School of Maritime and Industrial Studies
Department of Maritime Studies

Concentration in the port industry: alliances, innovations and synergies for the development of door-to-door logistics

PhD Thesis

by Theodoros Styliadis

Doctoral Committee Members:

Prof. Chlomoudis Constantinos (Thesis Supervisor)

Prof. Papadimitriou Efstratios

Prof. Pardali Angeliki

Prof. Boile Maria

Prof. Pallis Athanasios

Prof. Theotokas Ioannis

Prof. Vaggelas George

MAY 2022, PIRAEUS

To Periklis, Olga & Zoe

Aknowledgements

As you set out for Ithaca

hope the voyage is a long one,

full of adventure, full of discovery.

Cavafy, C. (1911). Ithaca

Indeed, it has been a hell of a journey. A strenuous yet enlighting and fascinating journey which finally comes to an end. But every ending is also a new beginning, so I will let myself to what the future will bring. I would like to express my deepest gratitude for my Supervisor Professor Constantinos Chlomoudis, for his immense support, guidance, and patience throughout all these years. I feel quite lucky to have met him. Off course I owe this acquaintance to my dear Professor Hercules Haralambides, who suggested me to meet him back in 2010. I still remember how we met. Following Professor Haralambide's advice, I set one day to go to the University of Piraeus to find him. Once there, while entering the University's elevator a man shouts "can you hold the door please". Quite polite, after entering he thanked me and asked me in which floor I was going. "I am looking for Professor's Chlomoudis office, however I don't know in which floor it is", I replied. "No problem, I'll guide you to his office", he said. After exiting the elevator, I followed him to an office where he said, "sit here he'll be available in a minute". While I sat, anxious about the meeting organizing my thoughts, I see this man going behind the Professor's desk. Once he sat too, to my amazement he said "Professor Chlomoudis is now available, to what do I owe your visit my dear child". I was stunned! The rest is now history.

I am also grateful to Professor Haralambides, who ever since my adolescence has been always there caring for me, guiding and advising me as a teacher, as a mentor. He along with Professor Chlomoudis will always be in my heart.

Special thanks to my dear Professors at the University of Pireaus, Angeliki Pardali and Efstratios Papadimitriou for their support, constructive comments and help during all those years. Additionally, I would like to thank all those who added their bit for the realization of this dissertation, Professors' Costis Hadjimichalis, Thanos Pallis, Ernestos Tzanatos, Lois Labrianidis and Napoleon Maravegias.

Finally, and most importantly, I would like to thank my family, my parents Periklis and Olga and my wife Zoe, to whom this dissertation is dedicated, for believing and supporting me ceaselessly and unconditionally all these years. If it weren't for them, I wouldn't have made it.

Περίληψη

Το κύριο κίνητρο για την εκπόνηση της παρούσας διδακτορικής διατριβής αποτελεί η προσέγγιση του φαινομένου της συγκέντρωσης κεφαλαίου στη λιμενική βιομηχανία κατά τρόπο ολιστικό. Κατ' αυτόν τον τρόπο, στόχος της παρούσας εργασίας είναι η παροχή ενός ολοκληρωμένου πλαισίου για την κατανόηση του τρόπου αναπαραγωγής του κεφαλαίου, των κινητήριων δυνάμεων που πυροδοτούν την συγκέντρωση και συγκεντροποίησή του καθώς και την διαχρονική εξέλιξή του, στις αγορές των τακτικών γραμμών και της διαχείρισης τερματικών εμπορευματοκιβωτίων, καθώς και η διερεύνηση των επιπτώσεων που αυτή εγείρει τόσο σε επίπεδο ανταγωνισμού στους κλάδους αυτούς όσο και σε επίπεδο λιμενικής οργάνωσης και διακυβέρνησης.

Σε αυτό το πλαίσιο, σε πρώτο επίπεδο, αναλύεται ο ρόλος των αλυσίδων μεταφοράς εμπορευματοκιβωτίων στο ευρύτερο πλαίσιο της καπιταλιστικής ανάπτυξης και παρουσιάζεται μέσω μίας προσαρμοσμένης κυκλικής προσέγγισης ο μηχανισμός πραγμάτωσης της διευρυμένης και επιταχυνόμενης αναπαραγωγής του μεταφορικού κεφαλαίου. Έχοντας καταδείξει την τάση συσσώρευσης κεφαλαίου στον κλάδο των εμπορευματικών μεταφορών, εν συνεχεία υπολογίζεται ο βαθμός κεφαλαιακής συγκέντρωσης των παιχτών που δραστηριοποιούνται αντιστοίχως στην αγορά των τακτικών γραμμών και στην διαχείριση τερματικών εμπορευματοκιβωτίων, ενώ παράλληλα συζητώνται ζητήματα που σχετίζονται με την δομή και την οργάνωση των αγορών αυτών, με τις στρατηγικές συγκεντροποίησης που ακολουθούνται, με τις διεπιχειρησιακές σχέσεις που αναπτύσσονται και κατ' επέκταση με τις δυνητικές επιπτώσεις της αυξανόμενης συγκέντρωσης στην λειτουργία του ανταγωνισμού στους εν λόγω κλάδους. Παράλληλα, εξετάζονται και οι επιδράσεις της κεφαλαιακής συγκέντρωσης στην διεξαγωγή του διεθνούς εμπορίου μέσω των λιμένων, μέσα από δύο σχετικές εμπειρικές εφαρμογές.

Πιο συγκεκριμένα, η πρώτη μελέτη περίπτωσης διερευνά μέσω πρωτογενών δεδομένων το κατά πόσο στρατηγικές συγκεντροποίησης κεφαλαίου όπως η δημιουργία των συμμαχιών στην αγορά των τακτικών γραμμών μεταφοράς εμπορευματοκιβωτίων ευνοεί την συμπερίληψη συνδεδεμένων λιμενικών τερματικών στα δρομολόγια των θαλάσσιων μεταφορών. Αντιστοίχως, η δεύτερη μελέτη περίπτωσης αξιοποιεί δείκτες συγκέντρωσης (CR4, CR8, HHI) καθώς και επιπρόσθετα μεθοδολογικά εργαλεία (όπως ο συντελεστής Gini και η ανάλυση Shift Share) προκειμένου να διερευνήσει το κατά πόσο η ενίσχυση των τάσεων συγκέντρωσης κεφαλαίου στις αγορές των τακτικών γραμμών και της διαχείρισης τερματικών οδηγεί σε μία αντίστοιχη αύξηση της συγκέντρωσης των εμπορευματικών ροών σε έναν μειούμενο αριθμό λιμένων. Βάσει των αποτελεσμάτων, η διαχρονικά αυξανόμενη συγκέντρωση στους υπό μελέτη μεταφορικούς κλάδους, έχει οδηγήσει στη διαμόρφωση μίας ολιγοπωλιακής αγοράς στην ναυτιλία τακτικών γραμμών και αντιστοίχως μίας ολιγοψωνιστικής αγοράς στην διαχείριση τερματικών, στις οποίες έχουν αναδυθεί κυρίαρχοι παίχτες με παγκοσμιοποιημένα χαρακτηριστικά, σημαντικά μερίδια αγοράς και σημαντική ισχύ.

Ενώ η αύξηση της συγκέντρωσης κεφαλαίου στους εν λόγω κλάδους θα μπορούσε να αποτελέσει από μόνη της απειλή για την ανταγωνιστική λειτουργία των παγκόσμιων αλυσίδων μεταφοράς εμπορευματοκιβωτίων, η παρούσα διατριβή καταδεικνύει ότι η συσσώρευση κεφαλαίου συνεπικουρείται από την περαιτέρω συγκεντροποίηση κεφαλαίου, η οποία έχει επιτρέψει σε αμφότερους τους παίχτες της αγοράς τακτικών γραμμών και της διαχείρισης τερματικών να επεκταθούν κατά μήκος της εφοδιαστικής αλυσίδας μέσω

οριζόντιων και κάθετων ολοκληρώσεων ενοποιώντας τα πακέτα μεταφορικών υπηρεσιών που προσφέρουν αλλά και να διαμορφώσουν μεταξύ τους στενές διεπιχειρησιακές σχέσεις.

Ως εκ τούτου, η αύξηση της συσσώρευσης κεφαλαίου, ενισχύει δυνητικά την δυνατότητα των εταιρειών να υιοθετήσουν αντιανταγωνιστικές συμπεριφορές και πρακτικές προς ίδιον όφελος και κατ' επέκταση να επηρεάσουν την διεξαγωγή του διεθνούς εμπορίου στους λιμένες. Τα αποτελέσματα των δύο εμπειρικών εφαρμογών τα οποία πραγματώθηκαν στο πλαίσιο της παρούσας διατριβής επιβεβαιώνουν εν μέρει αυτούς τους ισχυρισμούς.

Επιπροσθέτως, το εν λόγω διδακτορικό, εξετάζει το κατά πόσο η καινοτομία και η δημιουργία νέας γνώσης λειτουργεί σαν μία πρόσθετη κινητήριος δύναμη για την αναβάθμιση των δυνατοτήτων συσσώρευσης κεφαλαίου και την περαιτέρω ενίσχυση της θέσης των κυρίαρχων παιχτών στις αλυσίδες μεταφορών. Ειδικότερα, για πρώτη φορά στην σχετική ναυτιλιακή και λιμενική βιβλιογραφία εξετάζεται η σχέση συγκέντρωσης κεφαλαίου και καινοτομίας, καθώς και της αποτύπωσης της καινοτόμου συμπεριφοράς των μεγαλύτερων παιχτών στις αγορές των τακτικών γραμμών και της διαχείρισης τερματικών εμπορευματοκιβωτίων, μέσα από την διερεύνηση, την καταγραφή και την κατηγοριοποίηση των πατεντών που κατέχουν. Τα αποτελέσματα της εμπειρικής αυτής μελέτης καταδεικνύουν ότι παρότι οι κυρίαρχες εταιρείες στους κλάδους της ναυτιλίας τακτικών γραμμών και της διαχείρισης τερματικών δεν παρουσιάζουν το ίδιο αυξημένο επίπεδο καινοτομίας, ένας σημαντικός αριθμός εξ αυτών στρέφονται στην ανάπτυξη νέων εφευρέσεων για να επιτύχουν ένα διαρκές ανταγωνιστικό πλεονέκτημα ή/και να ενισχύσουν περαιτέρω τη θέση τους στην αγορά. Κατ' αυτόν τον τρόπο, τα αποτελέσματα της μελέτης αυτής επιβεβαιώνουν, σε μεγάλο βαθμό ότι οι ολιγοπωλιακές και ολιγοψωνιστικές αγορές επιδεικνύουν αυξημένα επίπεδα καινοτομίας, ενώ υποδηλώνουν επίσης ότι ακόμα και οι εταιρείες (που δραστηριοποιούνται και στους δύο υπό εξέταση κλάδους) που δεν εστιάζουν στην ανάπτυξη νέων εφευρέσεων αλλά διαθέτουν επαρκή κεφάλαια και σημαντικά μερίδια στην παγκόσμια αγορά, δύνανται να αποκτούν και να αξιοποιούν νέες καινοτομίες και τεχνολογίες, μέσω τρίτων μερών αντί να τις εφευρίσκουν οι ίδιες.

Σε συνέχεια της παραπάνω ανάλυσης, εξετάζονται οι επιπτώσεις της καταγεγραμμένης συγκέντρωσης κεφαλαίου στην αγορά των διαχειριστών τερματικών εμπορευματοκιβωτίων στην οργάνωση και την διακυβέρνηση των λιμένων. Μέσω μίας ακόμα μελέτης περίπτωσης, καταδεικνύεται η αυξανόμενη διαπραγματευτική δύναμη των παγκοσμιοποιημένων αυτών παιχτών έναντι των δημόσιων λιμενικών αρχών, ενώ αποτυπώνεται και ο αυξανόμενος ρόλος που αυτοί επιζητούν στην οργάνωση και διαχείριση των λιμένων. Όπως υποδηλώνουν τα αποτελέσματα, η μετατόπιση της ισχύος προς την πλευρά των ολοκληρωμένων και παγκοσμιοποιημένων παιχτών της αγοράς, επιβάλλει ως αντίβαρο τον επαναπροσδιορισμό του ρόλου του δημοσίου στη διακυβέρνηση των λιμένων. Σε αυτό το πλαίσιο, η παρούσα διατριβή αναδεικνύει τον στρατηγικό ρόλο της οικονομικής λιμενικής ρύθμισης και της ανεξάρτητης διακυβέρνησής της ως το αντιστάθμισμα στις επεκτατικές τάσεις των παγκοσμιοποιημένων παιχτών που δραστηριοποιούνται στις ολοένα και πιο ολοκληρωμένες αλυσίδες μεταφοράς εμπορευματοκιβωτίων. Πιο συγκεκριμένα, προκρίνει την ανάθεση της ρυθμιστικής λειτουργίας των λιμένων σε εξειδικευμένες και ανεξάρτητες ρυθμιστικές αρχές, καθώς και την ενίσχυσή τους με κατάλληλα ρυθμιστικά εργαλεία, προκειμένου να διαφυλαχθεί αφενός η ανταγωνιστική λειτουργία της λιμενικής βιομηχανίας αλλά και το δημόσιο συμφέρον από αθέμιτες πρακτικές.

Επιπροσθέτως, δεδομένου ότι οι παίχτες των υπό εξέταση αγορών εκλαμβάνουν πλέον τις αλυσίδες μεταφορών εμπορευματοκιβωτίων ως ένα ενοποιημένο και ολοκληρωμένο δίκτυο,

προκρίνεται ότι και οι ρυθμιστικές αρχές αντιστοίχως θα πρέπει να το αναγνωρίσουν ως τέτοιο, επεκτείνοντας την εμβέλεια των ρυθμίσεων πέραν των στενών ορίων του λιμένα, κατά μήκος της εφοδιαστικής αλυσίδας. Για τον λόγο αυτό, προκειμένου να ενισχυθεί και να διευρυνθεί το πλαίσιο ρύθμισης των παγκοσμιοποιημένων παιχτών που δραστηριοποιούνται στις αλυσίδες μεταφοράς εμπορευματοκιβωτίων, προκρίνεται επίσης η αναδιαμόρφωση των δομών διακυβέρνησης της ρύθμισης σε περιφερειακό και παγκόσμιο επίπεδο, ούτως ώστε να ενισχυθεί η συνεργασία και ο συντονισμός μεταξύ των κατά τόπους αρμόδιων ρυθμιστικών αρχών σε ζητήματα που ξεπερνούν τα εθνικά όρια.

Εν κατακλείδι, βάσει της ανάλυσης που διεξάγεται και των εμπειρικών στοιχείων που παρέχονται και στα πλαίσια της εκτελεσθείσας έρευνας, το παρόν διδακτορικό συνεισφέρει και εμπλουτίζει την σχετική ναυτιλιακή και λιμενική βιβλιογραφία με διττό τρόπο. Αφενός παρέχεται ένα νέο ολιστικό πλαίσιο προσέγγισης του φαινομένου της συγκέντρωσης κεφαλαίου στη λιμενική βιομηχανία και προσφέρεται νέα γνώση αναφορικά με την κατανόηση του τρόπου μέσω του οποίου επιτυγχάνεται η διευρυμένη αναπαραγωγή του κεφαλαίου στις αλυσίδες μεταφορών εμπορευματοκιβωτίων, των μέσων και των κινητήριων δυνάμεων που ενισχύουν τις τάσεις συγκέντρωσης και συγκεντροποίησης των παιχτών που δραστηριοποιούνται στις εν λόγω αγορές. Αφετέρου ιδιαίτερη συνεισφορά αποτελεί η αποτύπωση της διαχρονικής εξέλιξης της συγκέντρωσης σε κομβικούς κλάδους της αλυσίδας μεταφορών όπως είναι η ναυτιλία τακτικών γραμμών και η διαχείριση τερματικών εμπορευματοκιβωτίων καθώς και η διαμόρφωση ενός πλαισίου για την ενίσχυση της διακυβέρνησης και των εργαλείων λιμενικής ρύθμισης για την αποτροπή αντιανταγωνιστικών και αθέμιτων πρακτικών που μπορούν να επηρεάσουν δυσμενώς την λειτουργία της λιμενικής βιομηχανίας αλλά και το παγκόσμιο οικονομικό σύστημα συνολικά.

Abstract

The main driver and motivation of this dissertation is to analyze issues pertaining to the concentration of capital within the port industry. More specifically, it aims to provide a robust and holistic understanding on the realization, motivating powers and evolution of the concentration phenomenon within the containerized transport segments of port terminal operations and liner shipping as well as on the effects it exerts on market competition, port organization and governance.

In this framework, this thesis analyzes the role of containerized transport chains within the context of capitalist development while through an adjusted circuitist approach unveils the reproduction mechanism through which transport or commercial capital achieves and accelerates its expanded reproduction. Having portrayed the tendency of commercial (transport) capital towards accumulation, the focus of attention is turned on investigating its evolution. In this vein, while measuring concentration amongst the major market actors in liner shipping and terminal operations, issues relating to market structure, centralization strategies pursued, inter-firm relationships arisen as well as the potential effects of the competitive functioning of the respective markets are discussed. In extension, the effects of market concentration exerted on the conduct of international trade in ports is empririically examined in two relevant case studies. More specifically, the first employs primary data to investigate the extend to which the formation of liner alliances favors the inclusion of affiliated port terminals in the formers itineraries, while the second utilizes concentration ratios namely, CR4, CR8, HHI, as well as methodological tools such as the Gini Coefficient and Shift-Share analysis to measure the level of concentration/consolidation of container flows in the port system.

As results indicate, the diachronic increase in concentration has led to the formulation of an oligopolistic and oligopsonistic market structure in the liner shipping and terminal operators' markets respectively and hence to the emergence of incumbent firms with significant market share and power. While by itself increased sectoral concentration would be a potential threat to the competitive functioning of the containerized transport market, it has been revealed that market actors, both in liner shipping as well as in container terminal operations, not only have expanded throughout the chain network through successive waves of vertical and horizontal integration, bundling services, but have established robust inter-firm relationships. These facts reinforce their capacity to adopt potentially anti-competitive behavior for their own gain as well as to influence the conduct of international trade (traffic flows) at ports. The empirical results of the two cases studies conducted partly affirm such a claim.

Additionally, this thesis examnines whether innovation and knowledge creation act as an underlying force in enhancing the capacity of transport actors to concentrate and solidify their market positions. Within the context of the dissertation, for the first time within maritime and port literature an examination of the relationship amongst concentration and innovation is undertaken while also the innovative behavior of major containerized liner shipping and terminal operating firms is captured through an investigation and classification of the patents they hold. In this case study, results indicate that while not all major liner shipping companies and terminal operators exhibit the same level of innovativeness, a considerable number of them has turned to the development of novel inventions to achieve a sustained competitive advantage and enhance their market positions. This examination similarly to other concentrated markets (i.e., pharmaceuticals) largely affirm that oligopolies and oligopsonies exhibit an increased degree of innovativeness, while also suggests that market actors from

both sectors under study, with sufficient market shares and deep pockets but with little or none, innovative activity, also have the option to acquire novel technologies through third parties instead of inventing them.

Further on, considering the above analysis, this dissertation examines the effects of the recorded concentration in the terminal operators' market in the organization and governance structure of the ports. Through another case study, which depicts the rising bargaining power of concentrated globalized market actors vis-à-vis public port authorities (even states), it portrays the increasing role these actors seek within the organization and management of ports, by recording the magnitude of change in the division of responsibilities amongst public and private bodies. As results suggest, the shift of power towards the side of consolidated market actors such as Global Terminal Operators (GTO's) and Mega Carriers, necessitates as a counterbalance the reconceptualization of the public's role in the governance of ports. In this context, this dissertation suggests that economic regulation emerges as a new strategic frontier, however not necessarily in the hands of port authorities. Similarly, to the case of network industries, this thesis suggests that the delegation of the regulatory function to specialized independent regulatory authorities for ports, provided they are handed the appropriate tools, can be a more adequate and effective solution to prevent anti-competitive behaviors and hence safeguard public interest.

In parallel, this dissertation calls for the reconsideration and extension of the regulatory reach, beyond the context of the port premises, throughout the supply chains denoting that as market actors aknowledge the latter as a unified and integrated network, regulators ought to do so too. In this regard, to achieve a robust and widened framework for the regulation of globalized and consolidated containerized transport actors, the reconformation of the regulatory governance structures also on a regional and global level is proposed, through the reinforcement of transnational cooperation and coordination amongst the competent national and peripheral port regulators, on eminent regulatory issues that surpass the national boundaries.

To this end, based on empirical evidence provided, this dissertation contributes to the maritime and port literature by providing a novel holistic and inclusive approach for analyzing the phenomenon of concentration within the port industry as well as some unique insights with regards to the realization, motivating powers and evolution of capital concentration within the containerized transport network. Finally, it promotes the reinforcement of ports' regulatory governance and substance in an effort to prevent potentially anticompetitive practices by incumbents, that may not only hinder the competitive functioning of the port sector but of the global economic system as a whole.

Contents

List of Tables

List of Figures

Chapter 1: Introduction

1.1 Overview

The global capitalist space-economy is highly dependent on ports for trade as within today's complex multimodal door-to-door chains, ports have evolved into critical nodes for the facilitation of commodity flows. Specifically, as more than 80% of the world cargo volumes are transported by sea, ports are the nervous system of global trade and key elements within the international logistics chains. Against this background, ports along with the other means of transport are significant engines of economic growth and source of prosperity.

Particularly in EU, the transport industry directly employs around 10 million people (of which 2.1 million are directly employed in the port industry) and accounts for about 5% of gross domestic product (GDP) (while ports contribute around 1% in EU GDP) (EU, 2020). For the U.S case, the total economic value that coastal ports provide has grown from $4.6trillion in 2014 to $5.4trillion in 2018, accounting for nearly 26% of the nation's $20.5trillion economy while the number of direct, indirect and induced jobs supported by America's deep-sea ports increased from 23.1 million to 30.8 million (AAPA, 2019). While, for the case of the world's largest trading nation, ports' contribution in the prosperity of China is colossal, with China's "blue GDP" representing 10% of the country's GDP (Duchâtel, 2019).

The port industry has experienced multiple changes over the last 30 years as a result of multi-faceted parameters. On the one hand, transport innovations and technological enhancements led progressively to the commodification of container trade, port regionalization and expansion of port hinterlands through the development of multimodality, amongst other, altering transport conduct while rendering port organization and management under the Fordist regime obsolete. On the other hand, the rise of neoliberalism as a novel model of development, led many governments around the world to reconsider the until then dominant role of the public sector in industries such as the port industry. Similarly, to network industries (telecommunications, energy, rail amongst other), the inefficiencies of the monopolistic or comprehensive model of port organization were counterweighted

against the advantages of competition which provided more incentives to achieve enhanced economic efficiencies than state ownership.

The liberalization of the port industry in the early 90's, altered the legal framework which sheltered ports from competition, enabling private companies especially in the segment of container terminals, not only to enter the port operators' market but also to expand their worldwide terminal portfolios through vertical and horizontal integration strategies as well as their reach across supply chains, thus establishing their own end-to-end transport networks. As such although the argument of policy makers in favor of port deregulation was that the net gains of competition would be transferred to final users, in essence deregulation led to the emergence of incumbent actors in terminal operations as well as in the upstream and downstream containerized transport markets with significant market shares. Despite this fact, aside from a few scholars, relevant maritime and port literature tends to accept this concentration as a fait accompli (Wilmsmeier & Monios, 2018).

In this vein this dissertation aspires to investigate the evolution of concentration as well as its multiple facets within the port sector and particularly on the container terminal segment, through a systematic approach which places ports and containerized transport chains as a whole within the wider context of capitalist development. Through the adaptation of Marx's capital circulation theory (M – C – M') and its adjustment to the containerized transport sector this thesis embarks in a journey which through the utilization of empirical data, ties for the first time within the port and maritime academic literature, phenomena that are customarily investigated separately, such as the accumulation of capital, the evolution of container port systems and structures as well as the role of innovation and economic regulation. Through such a multi-faceted analysis we opt to assess and depict the progression of capital's concentration and centralization as well as its effects on competition within the containerized sectors of liner shipping and terminal operations as well as throughout contemporary door-to-door supply chains. Finally, while the expansnion of incumbent market actors along the supply chain is investigated, a limitation of this research lies to fact that it does not expand its analysis on assessing

concentration or market structures on the terrestrial inland segments of the multimodal transport chain.

1.2 Research Framework & Stimuli of the Thesis

Containerized transport chains have evolved into an integral component of our increasingly globalized and highly integrated capitalist world. From the advent of containerization in the 60's to its commodification over the last 30 years, the containerized transport sector has experienced tremendous growth (UNCTAD, 2020), drastically reforming the way international trade is conducted. Undeniably, the inception of the box was a revolutionary invention which while at first disrupted the traditional and cumbersome transport structures and procedures, it eventually led to an increase in efficiency, rapidity and intensity of global trade on the one hand, while on the other accelerated the integration of the world economy. Increasing economic integration and interdependence amongst the world's national economies has materialized in a remarkable growth of international trade. Trade amongst nations has always been a major proponent of wealth and prosperity enhancement for the world's population (Smith, 1863).

In addition, containerization was accompanied by policies which liberalized the world economy and increased the mobility of financial, industrial and commodity capital, altering the until then dominant production – consumption patterns. The entrty of China in the World Trade Organization (WTO) in 2001 (WTO, 2001) as well as the rise of other export oriented South-East Asia countries as manufacturing hubs (mainly due to their low labor costs), reinforced this tendency while transformed western societies and altered the core – periphery dependencies and balances. While in the Fordist regime of accumulation western economies (core) were mainly export driven, the rise of "Factory Asia" as per Baldwin & Forslid (2014) (periphery) reversed the flows of international trade.

Nowadays, the majority of consumers are well aware that the products they buy or find in the shelves of retail stores originate from Asia as well as that most probably these commodities are transported within a container. After all, containerized transport has been increasingly integrated within the contemporary popular culture

with many movies and fiction books depicting scenes or taking place in container terminals or containerships.

Conversely, notwithstanding their positive link to economic growth as well as the nations' ever-increasing reliance on maritime transport and a fortiori upon liner shipping and ports, to carry out the physical movement of massive commodity flows over longer and more complex supply chains, container shipping or terminal news rarely hit the broadcast spotlight (as it happened with the grounding of the Ever-Given containership in the Suez Canal). As a result, the majority of consumers are not aware of the underlying forces which pull the strings within these increasingly complex containerized supply chains, undertaking the circulation of commodities in space and through time, in order for them to find the final products they desire in the shelves of retail stores. As such, most likely consumers are also not aware of the implications, market structure alterations in the containerized transport nodes might have on their welfare.

Respectively, relevant maritime and port academic literature acknowledges the role of liner shipping and in extension of container terminals in trade facilitation. However, while researchers analyze firms' expansive strategies (vertical and horizontal integration) through mergers, acquisitions and cooperation agreements such as global alliances, as well as their effects on efficiency, capacity utilization and service quality amongst others, they have rarely questioned their potential implications on concentration and in extension on competition. Some researchers such as Munari (2012), even accept the possibility of cartelization in sectors like liner shipping in order to avoid rate wars and destructive competition, which would undermine the reliability and stability of trade. Hirata (2017) based on Baumol's contestability theory, also suggests that an increase in market concentration does not necessarily diminish competition.

In theory, these arguments might be valid, however, reality suggests otherwise. Destructive competition already exists in both liner shipping as well as in terminal operations, as on the one hand the rally on newsbuildings' orders for containerships of greater capacity resembles an arms race and on the other the huge terminal investments in infrastructures and superstructures necessitated to serve efficiently

these mega-vessels, establish an environment where the “eat or be eaten” theory (Gorton et al., 2009) applies for firms.

Consequently, such capital barriers have established a handful of dominant firms in major trade routes on the one hand and on major ports’ terminals on the other minimizing the threat of new entrants. Even existing firms should either have “deep pockets” to undertake massive investments to increase their scale of operations, decrease unit costs and thus remain competitive, or opt for mergers or acquisitions to survive.

Additionally, from a societal perspective, the effects and the threats of bestowing global container trade on a handful of liner carriers and terminal operators respectively, have unraveled and have become clearer during the pandemic (Covid-19) crisis which besets the world the last couple of years. More specifically, while the world economy entered into recession in 2020 due to measures which limited economic activity in order to inhibit pandemic outbursts, liner carriers primarily recorded record profits while terminal operators, despite a drop in cargo volumes, proved to be resilient. The increasing demand for final products as well as the explosion of ecommerce led to imbalances between supply and demand, with shortages in ship and port capacities, as well as in containers, being observed amongst all trade routes (Drewry, 2021).

These unprecedented market conditions in turn, enabled incumbent liner carriers to exercise their market power, exacerbating further the limited capacity through capacity and cost management strategies (cancelation of spot bookings – blank sailings) while raising freight rates to record levels, unseen before (UNCTAD, 2021). Respectively, terminal operators, since the second half of 2020 and henceforth, benefited from port congestion and supply chain bottlenecks, raising their cargo-handling rates. Shippers, retailers, as well as forwarders for EU and US have openly accused liner carriers as well as some terminal operators for anticompetitive practices and abusive behavior[1] in such a period during which, while service levels and schedule

[1] See CLECAT’s press release: https://www.clecat.org/news/press-releases/shippers-and-forwarders-call-on-european-competiti

reliability have diminished considerably, carriers demand increased surcharges and operators have raised respectively demurrage and detention charges (xChange, 2021). Under these circumstances, liner carriers and terminal operators' practices have come under the microscope of US (Federal Maritime Commission – FMC[2]) and Chinese (Ministry of Transport and Communications[3]) regulatory authorities, while UNCTAD (2020) too calls for the continuous strengthening of national competition authorities in the area of maritime transport, in order to ensure that they are prepared to provide the requisite regulatory oversight.

In this context, the long-lasting debate between liberals and state intervention supporters concerning the implementation and further reinforcement of laissez-faire policies or the re-regulation of the markets, comes again at the forefront. However, considering the global nature of containerized transport as well as that liberalization unified transport nodes under a system's perspective, allowing thus market players to bundle services throughout these chains, a new holistic approach is necessary in order to lean toward the one or the other side of the above debate. That said, a more comprehensive understanding of the parameters that enable and trigger concentration in liner shipping and terminal operations as well as its effects on the port side is required to conclude which regulatory governance model as well as which regulatory tools are the most appropriate for containerized transport chains.

To this extend, provided the above research framework, this thesis is stimulated to investigate and provide insights over concentration within the port sector by:

- Placing liner shipping and terminal operations within the wider context of capitalist development and expanded reproduction;
- Assessing the industry structure of liner shipping and terminal operations along with the concentration and centralization practices (vertical – horizontal integration and alliances formation) undertaken by incumbent market actors;

[2] See FMC's press release: https://www.fmc.gov/commission-meeting-addresses-fact-finding-29-and-alliance-monitoring/
[3] See relevant article in press: https://theloadstar.com/china-set-to-step-in-and-hold-down-rates-with-ocean-freight-a-global-mess/

- Investigating the operational effects on the port side that emanate from the respective market structures of the above two supply chain segments;
- Addressing the role of innovation, as an essential component and a driver of concentration;
- Discussing the implications of market structure developments in the above containerized transport markets on port organization and port authority functions, as well as on the governance and substance of port (and in extension of supply chains) regulation.

It is plausible that since firms within the containerized transport sector operate within the context of the capitalist system of production, it should not be disregarded that these firms too, follow the laws and tendencies of capital motion towards concentration and accumulation which are enabled through the current mode of regulation and development. Hence, an investigation of concentration on transport nodes such as liner shipping and port terminals should have as its starting point an analysis of their role within the context of capitalism before turning its attention to the actual market structure of these segments, to the effects it exerts on the port side as well as to the parameters (innovations) that enhance their capacity to accumulate.

These fundamental elements which will be presented through a rigorous analysis will then allow us to evaluate the impact concentration has had so far on port organization and to determine whether port regulation (on a national and global level) under the current framework is an efficient and effective way to monitor and control the competitive behavior of global market actors or a more holistic regulatory regime of governance and substance which extends along the supply is more adequate in the era of meta-globalization. To this end this dissertation, to the best of our knowledge is the first industry-specific effort which addresses and treats holistically the multi-faceted issues of the roots and the effects of concentration within the containerized segment of the port industry.

1.3 Research Questions

In the light of the research framework outlined above, the research questions set by this dissertation aim to unveil the characteristics of concentration within the port

industry and by extension within the containerized supply chains, while also to empirically investigate the market structure and the competition effects of concentration in order to determine whether increased concentration in container terminals as well as in liner shipping, results in potentially anticompetitive behaviors on behalf of incumbent market actors and, hence, regulatory structures and tools at hand should be revisited, or as suggested by a stream of literature, does not diminish competition and hence the current regulatory regime is efficient and effective. According to the above, the aspiration of this thesis is to provide answers with regards to:

- R.Q 1: ***What is the role of containerized transport within the context of capitalist production and which framework can be utilized as a methodological tool to assess and analyze the parameters which enable the realization of concentration within the terminal operators and liner shipping markets?***
- R.Q 2: ***What is the level of concentration within the liner shipping and terminal operators' markets, and how concentration levels have influenced the respective market structures and in extension competition?***
- R.Q 3: ***What are the effects of these concentration and centralization tendencies of capital on the port side? Do they lead respectively to the concentration of container flows to fewer ports? Do inter-firm relationships amongst incumbent market actors (in liner shipping and terminal operations) influence the selection of port terminals for the handling of their cargo?***
- R.Q 4: ***Do innovations and technological advancements enhance the capacity of liner shipping and terminal operating companies to concentrate? Do incumbent firms in the above market segments pursue the development of novel innovations in their effort to sustain their competitive advantage and enhance further their market positions?***
- R.Q 5: ***What are the effects of capital concentration and centralization on the port organization, governance and regulation? Are port authroities the competent bodies to effectively regulate (in terms of governance and***

substance) globalized market actors or new specialized regulatory structures and tools that extend the reach of regulation beyond the port perimeter should be adopted?

For a better understanding of the constructed framework employed to answer the above research questions, *Chapter 2* discusses the relevant literature on concentration, competition and integration theories, while *Chapter 3* provides the methodological approach utilized in order to tie together the various research components of concentration under study.

1.4 Methodology

In the current section, the general research design and formulated methodological framework utilized throughout the dissertation is described, to shed light upon the steps and research activities undertaken to approach the research questions under study. The latter, despite being dialectically interwoven to comprehend, evaluate and measure the underlying forces, the realization and impacts of concentration within the port industry, is deemed necessary to utilize multiple types of research analysis tools, amongst which primary and secondary research, qualitative and quantitative analysis, as well as case studies for applying the selected research methodologies.

To depict the adopted research and methodological design, Figure 1. below presents the various activities undertaken as well as their relation to each other and to the outlined aims of this thesis.

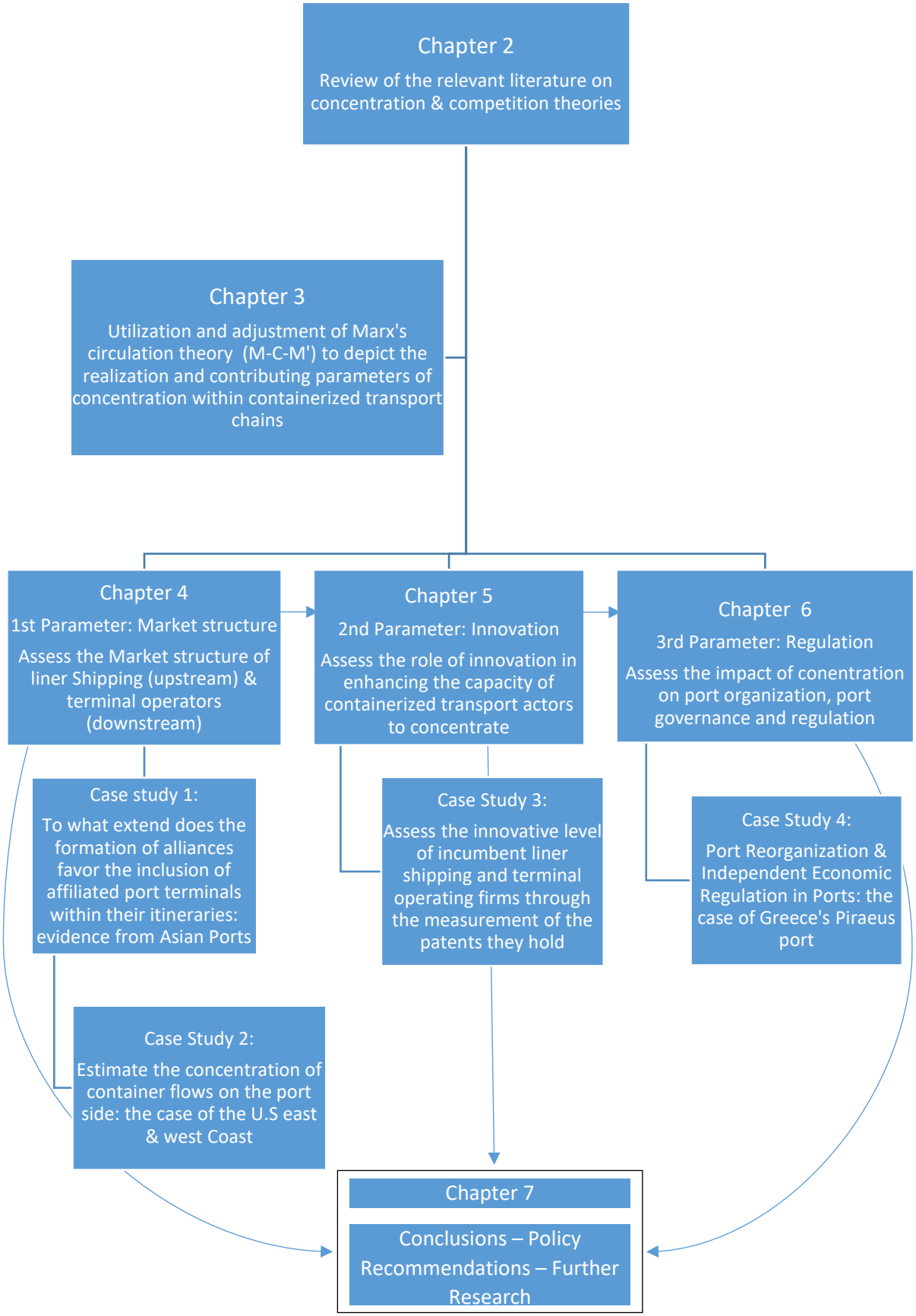


Figure 1. Research & Methodological Design of the Dissertation

As per Polit and Hungler (2004), methodology refers to the ways of obtaining, organising and analysing data, while for Kothari (2010) it is a way to systematically solve a research problem. Respectively, Henning et al. (2004), define methodology as a coherent group of methods that complement one another while having the ability to fit together, to deliver the data and findings that will reflect the research question(s). In this vein, utilizing a method of analysis which moves from the abstract to the concrete this thesis is comprised by two methodological components, namely a theoretical orientation and a number of empirical case studies.

As such, initially while seeking an analytical methodological framework to analyze and assess the evolution and effects of concentration within the port industry within relevant economic literature, one could not overpass the works of Karl Marx, which primarily focus on the issue of capital concentration and accumulation. Surprisingly, since the global financial crisis of 2008, a renewed interest in Marx's works is observed within literature (Holgersen, 2020). Marx's biggest achievement even for his critics, was the unveiling of the laws and motivating forces of the capitalist mode of production. Hence, his analysis provides the means not only to understand the evolution of contemporary capitalism but also apply his analytical framework to further comprehend and analyze the evolution, structure and organization of specific market segments.

Particularly, in the second volume of Das Capital, which is undoubtedly his most influential work, Marx describes the process of capital's self-expansion (enabling the process of accumulation and therefore of concentration) as a circulatory process at the end of which capital (through the absorption of surplus value) becomes valorized. This approach, referenced by subsequent researchers as the circulation or circuitist approach, is represented through the infamous formula of M – C – M', which is utilized to describe the forms that capital assumes and sheds during its sojourn towards valorization.

To this end, the adoption and utilization of a circuitist approach within the context of this dissertation, provides the means on the one hand to conceptualize the role of containerized supply chains within the spatially integrated global economy, while on the other hand to unveil the motivating forces which enable the expanded

reproduction of capital for the firms operating within the containerized transport segment. Such an approach, is considered a major milestone of this thesis as it does not only approach the subject matter of concentration within containerized transport through a novel perspective never utilized before within maritime and port literature, but also extends and contemporizes Marx's circulation theory.

Having illustrated that within the context of capitalist production, containerized transport companies also have a tendency towards the concentration of capital, the remaining of this dissertation utilizes and synthesizes multiple qualitative and quantitative methodologies in an effort to evaluate the evolution of concentration in the containerized transport segments of liner shipping and terminal operations, to analyze the contributing parameters which reinforce it, as well as to assess its impacts and effects on the port sector. Each applied methodology is analytically presented in the respective methodological sections of this dissertation. However, a bird's eye view on the methodologies utilized, is presented below.

In Chapter 4, based on data from the reports of Drewry Shipping Consultants on Global Terminal Operators as well as on data publicly available from the Alphaliner database on the largest liner carriers we calculated the global market shares of incumbent players in both respective markets. In addition, through data from the annual reports, financial information sources and the websites of liner shipping firms and terminal operators we investigated the interfirm relationships within each and amongst the two market segments of containerized transport.

Moreover, having portrayed the evolution of concentration, the research proceeds with two case studies which empirically test the impact of concentration on the port side. The first of the two, tests the extent to which ownership of a terminal by an alliance member or a specific Global Terminal Operator, leads to the former's inclusion as a port of call for that particular alliance's members. To carry out this exercise we utilized data spanning from the second (2nd) quarter of 2017 till the first (1st) quarter of 2018, which were collected from the Alphaliner Database between the 3rd and 20th of April 2018, for a sample of 11 Asian container ports and specifically for 32 container terminals within these ports. Once data were collected, organized and cleansed

appropriately, a comprehensive research framework was developed to support the statistical analysis undertaken to affirm or reject our hypothesis.

Accordingly, in the second case study, in order to examine the concentration/de-concentration tendencies of container volumes within the U.S East and West Coast port system, we utilized publicly available U.S Waterborne data sets of annual port container volumes for the 2005-2015 interval, withdrawn from the U.S Army Corp of Engineers (ACE). Having established our data sets, we used concentration measures such as CR4 and CR8 concentration ratios, the HHI as well as the Gini coefficient, the Lorenz Curve and a Shift Share Analysis, to test our research hypothesis.

Further on, having illustrated through the curcuitist approach adopted (Chapter 3) the importance of innovation in accelerating the turnover time and hence the expanded reproduction of capital, in Chapter 5 a deeper investigation of the relation between concentration and innovation is performed. More specifically, the goal of this case study is to examine whether innovation is considered by incumbent market players in liner shipping and terminal operations as a major firm resource for enhancing further their competitive position against their rivals. With our objective being to capture the innovative activity within the above containerized transport sectors, in the form of patents granted, we undertook a deep investigation through a Systematic Review on the EPO's (European Patent Office, 2021) comprehensive database for the 2008 – 2020 interval, in order to make a first record and a classification of the patents granted based on multiple attributes, to the ten (10) largest liner shipping companies and to the fourteen (14) major terminal operating companies, respectively. Through a strict research protocol, in the prototypes of a Systematic Literature Review (SRL), we established our final data sets which in turn were utilized to perform statistical analysis and test our research hypothesis.

Finally, in Chapter 6, while investigating the effects concentration exerts on port organization model as well as on the governance and substance of port regulation, the case of Greece and more particularly of its largest port of Piraeus is used as a case study in the light of its recent master concession through the sale of the majority of port authority's share, which deviates from the international best practice of port concessions. Utilizing Ibrahimi's (2015) port re-organization model along with country

specific legislative documents with regards to the responsibilities, powers and functions of the involved parties we sketch the magnitude of port re-organization within the port of Piraeus, along with resulting structure of port governance and regulation in Greece. Additionally, through an in-depth review of literature on the governance of regulation and on the economic regulatory tools at hand a novel contemporary approach to port economic regulation which extends beyond the port perimeter is proposed.

All the above methodologies are utilized to answer the outlined research questions while the results obtained are utilized to draw the dissertation's final conclusions and policy recommendations.

1.5 Original contribution of the thesis

This dissertation consists of the first attempt to estimate in a holistic manner the evolution and effects of concentration within the port sector through the investigation of multifaceted parameters and driving factors which are tied to this phenomenon, in two key segments of containerized transport chains, i.e., in terminal operations and liner shipping markets. While the majority of academic literature on port and maritime studies focuses more on operational issues, taking the phenomenon of concentration and the rise of incumbent market actors as granted, this thesis in the antipode tries to ask deeper structural questions over the issue of capital concentration in the port industry and place market developments into historical context as well as into future perspective.

More particularly following Hegel's suggestion in the Phenomenology of the Spirit (1979) in which he supports that:

"*Every era can be looked as a repository of a particular kind of wisdom. And while progress is never linear … there is wisdom at every stage of history … it is the task of the researcher to restore these ideas from the past that are most needed to compensate for the blind spots of the present*"

this dissertation brings back to the fore and contemporizes the circulation theory developed by Marx, in a manner adapted and adjusted to explain both the role of containerized transport as the media of industrial's capital circulation as well as an

independent branch of investment, which exhibits all the features of capital and hence it is prone to concentration and accumulation tendencies too.

In addition, it deals with multiple issues and parameters of concentration in terminal operations and liner shipping segments of the transport chain, providing thus a comprehensive view on how it has affected the respective market structures and competition not only in the port industry but across the entire supply chain.

Moreover, a unique contribution of this dissertation is the investigation conducted over the relationship between concentration and innovation. To the best of our knowledge this thesis is the first to embark an investigation on the innovative level of incumbent players, as expressed in patents granted, in order to evaluate the importance firms in terminal operations and liner shipping attach to the creation of novel knowledge as part of their effort to enhance their market position and hence their capacity to concentrate.

Finally, having assessed the evolution as well as the actual and potential effects of concentration within the port industry this study contributes to the re-establishment of a comprehensive and holistic model of port regulation, through the delegation of the governance of regulatory function to an independent regulatory authority for ports which however extends its reach beyond the port perimeter across the transport network and through the enrichment of the regulatory tools at hand through the adoption of uniform economic regulatory measures on a local, regional and global level.

1.6 Structure of the thesis

The thesis is divided in the following Chapters:

Chapter 2, approaches the subject matter of capital concentration and accumulation through an in depth –interdisciplinary review of academic literature. More particularly, it focuses on four thematic research domains relevant to the study of concentration: a) concept definition of capital accumulation and of the processes through which its realized - concentration and centralization b) monopolization of capital, c) integration strategies – horizontal and vertical integration, conglomerate formation and their effects on market competition – tools of measurement of

concentration (d) the circuit of capital (industrial – commercial – financial) and the creation of surplus value – including an analysis of the turnover time, of the costs and of the composition of capital – and of the role of innovation in the process of circulation.

Chapter 3, set the stage for the development of a framework for understanding the realization of concentration and its critical components, through a circuitist approach. It provides an overview of relevant academic literature and of the approach followed. Further on, it describes the function of transport capital as the media of industrial capital's circulation, before the circuit is adapted and adjusted to analyze the capital circuits as well as the media functions performed by a liner shipping and a terminal operating company. In parallel, the chapter, portrays the role played by specific sectoral innovations in accelerating turnover time of the commercial capital circuit (liner shipping & terminal operations) which enhance the processes of concentration in each respective market.

In **Chapter 4**, the effects of global supply chain developments on the evolution of concentration within the port and maritime transport industry are investigated. More particularly, the chapter provides a background analysis of the a) liberalization and re-orientation of the port industry towards market (unbundling) b) development and evolution of integrated transport networks c) the emergence of integrated global transport actors, namely the Global Terminal Operators and Mega-Carriers. Moreover, the chapter includes the estimation of market concentration in liner shipping (on a firm level and on an alliance level) as well as the estimation of market concentration in terminal operations (Top 10 Terminal operator's market shares) and the unveiling of the cooperation schemes-joint ventures amongst Global terminal operators and Mega Carriers. Additionally, the effects of concentration and centralization processes on ports are examined through two case studies. The first investigates whether the formation of liner alliances favors the inclusion of affiliated port terminals within their itineraries while the second examines the concentration of container flows in the U.S West & East Coast port ranges.

Chapter 5 discusses the role of innovation and commercialization of technology among containerized transport actors through patenting as an additional driver of

concentration. It provides a literature review on innovation within the maritime and port literature as well as of related innovation theories from the broader economic literature (RBV/KBV – Schumpeterian framework – network theory of inter-organizational relationships). The methodological framework adopted and the steps followed to perform a Systematic Review of the European Patent's Office database are thoroughly analyzed. The results obtained with regards to the patents granted (including Temporal Distribution, Classification of patents, forward/backward citation statistics, Avg/Max no of inventors, Avg/Max no of applicant, direct – indirect patents – joint patents) to the largest liner shipping and terminal operating companies are presented while the relationship of innovation and concentration are sketched.

Chapter 6 embarks an analysis to understand and conceptualize the effects of concentration on ports and particularly its effects on port re-organization and on port regulatory framework. In this respect the Chapter provides a review on the evolution of port governance, on the roles and functions of port authorities, while addressing the arising regulatory issues faced by the industry. In addition, it provides a contemporary framework for the Governance of Port Regulation & the utilization of Economic Regulatory Tools, which is then applied for the Case of Greece's, Piraeus Port, in an effort to redefine the model of port organization and management in the port through a GOV-AD-MAN approach as well as to analyze the governance of port regulation through the model of Independent Economic Regulation adopted. Finally, the chapters discuss other paradigms of novel port regulatory approaches and promotes the enhancement of regional and global cooperation and coordination amongst port regulators in order to enhance the efficiency of port economic regulation not only within the port premises but within the context of globalized containerized supply chains.

Finally, ***Chapter 7*** is the concluding chapter of the dissertation in which an overview of the findings and results is analyzed and discussed. The chapter also provides policy recommendations as well as new avenues for future research.

Chapter 2: Literature Review

2.1 Overview

The current chapter conducts a thorough review of literature on concentration and competition theories. This is a prerequisite for the establishment of a comprehensive theoretical background and of a robust research framework to address the outlined research questions with regards to the evolution, the triggering forces and the effects of concentration in containerized transport segments such as liner shipping and terminal operations in the port sector.

2.2 A primer on Capital concentration and accumulation

It has been widely acknowledged within literature, that one of the inherent characteristics of capitalism is capital's imperative to overcome time and space barriers that hinder its expanded reproduction (Brandão, 2008). In an era of globalized production and consumption, the world has shrunk into a "global village". On many accounts, the accelerated internationalization of capital during the 70s and 80s and the rise of a world market economy, facilitated by a universal yet progressive shift towards liberalization and deregulation of domestic markets, provided the necessary space for industrial capital to grow on a transnational scale, surpassing the spatial constrains of national states (Hymer, 1972). Transnational capital, shaped in the form of Multinational Corporations (MNC's), disaggregated and dispersed production to take advantage of global differential in labor as well as tax regimes, labor processes and industrial organizations to maximize profitability (Shi & Gregory, 1998, Wise & Martin, 2015, Hennart, 2011) and hence the intensity of the accumulation.

While however, production shifted away from major consumption centers dispersing in the global terrain, circulation processes had also to be re-organized to support the physical mobility of commodity-capital, in order to breach the increasing gap between production and consumption and thus ensure the expanded reproduction of the system (Harvey, 1985). According to Marxian theory (Marx, 1974), gains in productivity achieved in one branch of production due to technological or organizational advancements should eventually be coupled by equivalent ones in other affiliated branches so that gains achieved in the initial branch can be sustained. In Marx's words:

"The revolution in the modes of the production… made necessary a revolution in the general conditions of the social process of production, i.e. In the means of transport and communications" (Marx, 1976).

Indeed, radical changes in the transport conduct, brought about by the advent of containerization, revolutionized the way freight was transported and handled, becoming itself a primal force for accelerating globalization and international trade within the world economy (Bernhofen et al., 2016). Containerization coupled by the evolution of logistics, provided immense gains in productivity and efficiency through standardization, reductions in transport costs, as well as through possibilities of integration and interoperability amongst the since then fragmented transport modes and nodes, speeding up commodity capital's movements within the sphere of circulation, thus ensuring its smooth realization and expanded reproduction (Chua, 2019). Hence, innovations in transport and communications on the one hand facilitated further the accumulation process for various branches of capital, ascending the geographical scope of capital accumulation on a global scale, enabling the spatial disaggregation of its operations (Harvey, 1989) On the other, these innovations along with their accompanying prospects, established the conditions for accumulation opportunities within the sphere of circulation and particularly within the transport and logistics sector. For Marx, transport:

"*Is distinguished as a continuation of the production process within the circulation process and for the circulation process, forming an independent branch of production and hence a particular sphere for investment of productive capital. (Marx, 1973).*

With the immense increase in global containerized trade both in terms of volumes as well as destinations reached, transport expanded as an independent branch of production and hence as a sphere for investment of productive capital as well as a social need. On the one hand maritime shipping, due to the morphological landscape of earth, is inherently transnational and undertakes diachronically the vast majority of international trade, with its share ranging nowadays between 80 and 90 per cent (UNCTAD, 2018). On the other hand, ports as its fundamental infrastructure became the linchpins of the world's commodity chains and a "time compression" mechanism mediating to annihilate space by time (Harvey, 1989).

Capitalism is a mode of development founded in the production of commodities. Marx's (1976) introduction in the volume one of Capital is characteristic:

"The wealth of those societies in which the capitalist mode of production prevails, presents itself as "an immense accumulation of commodities," its unit being a single commodity".

The fetishism of capital on the commodity, and its relentless effort to commoditize every facet of modern life, is rather profound and lies in a fundamental element of capitalist relations of production (Pimenta, 2020) which aims to attain pecuniary gains through the creation and appropriation of surplus value. The commoditization of the transport sector and particularly of the containerized transport networks, also denoted their submission to the capitalist laws of motion. By "selling a change in location" (Marx, 1973), transport became itself a commodity and therefore a distinct source of productive surplus value.

In this respect, a critical point in the investigation of the law of capital accumulation within the transport sector, particularly on the container port sector and on the supply chains structured around it, which is the scope of the study, prerequisites also an analysis of the creation of surplus value as well as of the barriers that it encounters. To this end, moving from the abstract to the concrete, within the remains of the chapter we shall embark our journey by providing the theoretical framework, the concepts and their interrelations in the process of accumulation, which will be the basis of analysis and application in the chapters that follow.

2.2.1 Concentration & Centralization processes

As Sweezy (1990) observes, Marx's Capital, similarly to classical political economy from Adam Smith to John Stuart Mill, was based on the assumption of free competition i.e., that all commodities are produced by industries consisting of many firms, each accounting for an insignificant portion of total output and with no individual control over the price and profit signals generated by impersonal market forces. Contrary to the others though, who credited the increasing wealth of societies to a "building up of capital" or to a "virtuous accumulation circle", Marx according to Sweezy (1990) recognized that such an economy was unstable, contradicting the inner

laws of capital's imperative to cut costs and expand through a process of incessant accumulation, in ever new technological and organizational forms.

In this respect, acknowledging the expansive nature of capital, Marx described the process of capital accumulation as the engine that drives growth under the capitalist mode of production. In line with Marx, Harvey (1975) rendered the capitalist production process as highly dynamic and inevitably expansionary, forming a permanently revolutionary force which through accumulation, powers growth while continuously and constantly reshapes the world we live in. Essential to this process are the two distinct but complementary processes of concentration and centralization of capital.

On the one hand, concentration which grows directly out of accumulation, is a process of consolidation of individual capital accumulations which (through the capitalization of part of the surplus value) add productive capital to the previously invested one, and eventually increase the monetary value of the initial capital and hence of the total sum of capital (Lianos, 1984). In Marx's (1974) view every individual capital is a larger or smaller concentration of the means of production, with accumulation increasing further the concentration of wealth of individual capitalists while extending the basis of production on an ever-increasing scale.

On the other hand, centralization refers to the process by which already existing separate capitals come under the control of a single capitalist (Lianos, 1984). Thus, centralization presents itself not as the repulsion of many individual capitals from one another, but instead as their attraction. Thus, contrary to concentration, centralization tendencies, reshape the field of accumulation by redrawing the boundaries previously set between individual capitals either through the acquisition of certain firms by others or through the merger between two or more firms (Sanfelici, 2016). In Marx's words:

It is concentration of capitals already formed, destruction of their individual independence, expropriation of capitalist by capitalist, transformation of many small into few large capitals. The process of centralization differs from concentration in that it only presupposes a change in the distribution of capital already to hand, and functioning [….] the battle of competition is fought by cheapening of commodities. The

cheapness of commodities demands, ceteris paribus, on the productiveness of labor, and this again on the scale of production. Therefore, the larger capitals beat the smaller. It always ends in the ruin of many small capitalists, whose capitals partly pass into the hands of their conquerors and partly vanish… *'In addition, the credit system which* in its first stages furtively creeps in as the humble assistant of accumulation… *soon 'becomes a new and formidable weapon in the battle of competition, and finally it transforms itself into an enormous social mechanism for the centralization of capitals' (Marx, 1976).*

As such, for Marx, concentration and centralization are not perceived as a perversion of an ideally competitive state, but as the logical sequence of competition itself, in the process of expansion (Elliot, 1988). In the relentless process of accumulation; concentration and centralization are thus the two sides of the same coin. Whenever, concentration halts, necessitating an increase in the minimum amount of individual capital required to operate in specific sectors, centralization comes into full swing along with the help of the credit system, speeding up further accumulation, by reorganizing capital to enable production on an extended scale and hence to enable further concentration. To this end, capital accumulation presupposes both a growth in the size of individual firms (concentration) as well as the merging of many capitals into a "huge mass in a single hand" (centralization) (Foster & Burkett, 2018).

2.2.2 Towards the rise of the Monopoly Capital

Ultimately, according to Marx's (1973) analysis, in any given branch of industry, centralization would reach its extreme limit if all the individual capitals invested in it were fused into a single capital or a single company. In volume three of Capital (1981), edited by Engels, years later Marx's death, the former observes more clearly that owing to the emergence of joint stock companies, the old boasted freedom of competition had reached the end of its tether (Foster & Burkett, 2018). However, contrary to what Marx and Engels believed, the demise of the competitive era did not eventually lead to the overthrowing of capitalism, but contrary led progressively to the emergence of a new higher stage of capitalism, i.e., what Baran & Sweezy (2017) termed the era of Monopoly capitalism.

Prior to Sweezy's & Baran's analysis however, other researchers too observed the tendency towards the accumulation and monopolization of capital. Veblen, in his works the "Theory of Business Enterprise" (1904) was the first amongst those. In his multi-level and poly-thematic analysis, he noticed some of the rising monopolistic characteristics of the system. Pursuit of pecuniary gains, through large-scale organization of the industrial process, aided by the expansion of corporate finance, created according to Veblen (1904) an irresistible tendency towards further concentration, consolidation and restructuring towards more competent hands. In turn these processes would enable, the establishment of comprehensive coalitions to regulate prices and output, maintain excess capacities and basically override competition through the attainment of a monopolistic position[4].

Another early influential work in the direction of analyzing the evolution of the capitalist system was Hilferding's Finance Capital (1910). Many at the time, considered his analysis a pioneering evolution in Marxian thought and a major development in political economy, amongst which Otto Bauer and Karl Kautsky described it respectively as the continuation and the completion of Capital (King, 2010)[5]. Just like Veblen, Hilferding emphasizes the growing influence and power of the credit system, i.e. banks, attains, due to the corresponding increase in the importance of finance for industrial capital, in the latter's process of concentration and centralization. Amongst other, Hilferding (1910) denotes the increasing network of relations between finance and industrial capital, with the former becoming shareholder to the latter's companies. The creation of such bonds made banks concern for the long-term

[4] ***For additional analysis of Veblen's theory***:
Cornehls, J. V. (2004). Veblen's theory of finance capitalism and contemporary corporate America. Journal of Economic Issues, 38(1), 29-58.
Ford, K., & McColloch, W. (2012). Thorstein Veblen: A Marxist starting point. Journal of Economic Issues, 46(3), 765-778.
Davanzati, G. F., & Pacella, A. (2014). Thorstein Veblen on credit and economic crises. Cambridge journal of economics, 38(5), 1043-1061.

[5] ***For additional analysis of Hilferding's theory***:
Zoninsein, J. (2000). 'Rudolf Hilferding's theory of finance capitalism and today's world financial markets', in P. Koslowski (ed.), The Theory of Capitalism in the German Economic Tradition, Berlin and Heidelberg: Springer-Verlag, pp. 275-304.
Lapavitsas, C. (2004). 'Hilferding's theory of banking in the light of Stewart and Smith', Research in Political Economy 21, pp. 161-80.
Marchlewski, J. B. (2012). 28.'Rudolf Hilferding's Finance Capital: A Study of the Latest Phase of Capitalist Development' (27 August 1910). In Discovering Imperialism (pp. 425-439).

prospects of the enterprise and the future state of the market, with each bank having an interest in overriding competition among the firms it participates. This process of integration would eventually lead to a general cartel, characterized by the growth in export capital as well as by an increasing transnational competition amongst large corporate firms, which according to the author would render the monopolistic phase as the latest phase in the capitalist development.

An interesting fact, is that Lenin's (1916) concept of imperialism, developed in the homonym book of his Imperialism: the higher state of capitalism, in which he also analyzes the rise of monopolies, is essentially derived from Hilferding's analysis of finance capital. Some decades later, Baran and Sweezy[6] (2017), following the evolution in mainstream economic theory and particularly the conception of the theory of imperfect competition by Chamberlain[7] (1933) and the theory of crisis by Keyne's[8] (1936) as well as evolutions in Marxist theory mainly by Kalecki who incorporated in his analysis the above developments in economic theory, elaborated further Marx's model of competitive capitalism by adjusting it to the novel conditions of monopoly capitalism.

According to their analysis, monopoly capitalism is a system comprised of giant corporations (monopolistic or oligopolistic), which become the vehicle that dominate the modern process of accumulation (Baran & Sweezy, 2017). Amongst their arguments, they illustrate that the major contradiction of, at the time, system of accumulation was that the rising surplus accumulated by such corporations, which was appropriated due to the increasing pricing power gained as well as due to advertising and promotion of sales, exceeded the existing capacity for investment (underutilization of capacity leading to large amounts of unproductive capital) and consumption and hence it could not be profitably reinvested or absorbed by the economy, creating in turn a powerful tendency towards stagnation. According to this analysis, only an exogenous stimulus such as novel "epoch-making innovations" (such

[6]**Prior work of Baran & Sweezy on the subject of monopoly capitalism**:
Sweezy, P.M. (1942). The Theory of Capitalist Development (New York: Oxford University Press)
Baran, P. A., (1957). The Political Economy of Growth (New York: Monthly Review Press)
[7] Chamberlin, E. (1933). Theory of Monopolistic Competition. Cambridge, MA: Harvard University Press
[8] Keynes, J. M. (1936). The general theory of employment, interest, and money. Springer.

as the steam engine, the railroad development as well as the automobile) or state intervention (through an armed conflict which would lead to increases in military spending or through favorable regulations and policy formulation) could countervail stagnation by providing an expanding sphere for surplus absorption (expansion of export capital, growth of finance capital, transportation etc.). As long as, such a condition was met, capital accumulation and monopolization could be resumed through a new concentration and centralization wave.

For Aglietta (2000), as capitalism evolves and reorganizes, accumulation regimes do so too, to facilitate the further process of accumulation. Another major contribution to the understanding and the evolution of capitalism, are the works of the French Regulation School, and particularly of Aglietta who conceptualized and proposed a historical framework of capital accumulation, comprised in his so-called "Regulation Theory". In an effort to provide answers for the economic restructuring of the 70's, while also understand how the system could be stabilized for certain intervals in time, such as the post second World War "Fordist Golden Age" expansion period, Aglietta focused on the role of institutions in the regulation of the capitalist economy (Labrousse & Michel, 2017). For Aglietta (2000) regulation is not just a set of laws or rules, but rather a "study of the transformation of social relations" as it creates new forms that are both economic and noneconomic, that are organized in structures and themselves reproduce a determinant structure*, the "mode of production*". The four distinctive structural components of a regulation system as described in Jessop (1997) are:

- **An Industrial Paradigm**: a micro-economic model governing the technical and social division of labor such as mass production.
- **A Regime of Accumulation**: a macro-economic complementary pattern of production and consumption which is relatively stable and reproducible over a long period.
- **A Mode of Regulation**: an emergent ensemble of rules, norms, conventions, patterns of contact, organizational forms and institutions amongst other, which provide support and can stabilize an accumulation regime. It comprises of five dimensions: a) the wage relation; b) the enterprise structure (forms of

competition, ties among firms, links to finance capital; c) nature of money (predominant form, finance system, allocation of money capital to production); d) the state (intervention, policy formulation) and international regimes (trade, investment, nations, the world system)

- **A Mode of Development**: a holistic concept comprising of all the above components in a coherent way, complementing each other in order to enable the conditions for a long wave of expansion.

Within this framework, the mode of regulation is a set of mediations which ensure that the distortions brought about by the accumulation regime are manageable and within the limits of social cohesion (Aglietta, 1998). However, as capital does not have a self-limiting mechanism enabling the perpetual accumulation, regulation cannot absolve all the system's internal contradictory maladies, thus achieving only temporal equilibria amongst the above-described components. As such, at some point in the economic cycle, the disparities between the regime of accumulation and the mode of regulation prevail, undermining the coherence of the structure and eventually leading to a structural crisis. The crisis threatens the stability and sustainability of the capital accumulation which can be only restored through the emergence of a new mode of development (Heino, 2015).

Based on the above analysis, the Regulation School conceptualized the transition from an extensive to an intensive regime of accumulation, closely linked with the development of Fordist production techniques after the crisis of 1929, as well the latter's demise during the 70's crisis, leading in turn to a post-Fordist or as Harvey would later characterize it, a flexible accumulation regime (Harvey, 1989). The rigidities of Fordism in production resulting in diminishing productivity and profit rates, the lack of flexibility to allow the re-adjustment of mass producing fixed assets to the frequent alterations in product mix (Clarke, 1998, Schoenberger, 1988), as well as the rigidities of states to extend state expenditure and the rise of global Fordism[9] (Lipietz, 1986) which intensified international competition amongst many others,

[9] The spread/copying of Fordist production techniques in the periphery, primarily through foreign direct investments by MNC'S in search for low-cost labor

rigged the foundations of the Fordist regime of accumulation eventually leading to its structural limits.

Under conditions of recession and heightened competition, the drive towards rationalization, restructuring and innovation, surged to the fore of corporate strategies for survival (Harvey, 1989). As Harvey explains, the emergence of flexible accumulation confronted the rigidities of Fordism, by enhancing the flexibility and mobility capabilities of production, distribution and consumption patterns, through intensified rates of commercial, technological and organizational innovation as well as through capital's infiltration into new sectors of production, geographical dispersal and excessive centralization. While in order to enable capital to dismantle its "fordist" barriers of expanded reproduction, the new regime of accumulation was coupled by a novel system of political and social regulation.

The prevalence of liberalism and neoliberalism later on as a hegemonic (in the sense Gramsci as well as Aglietta utilize the term) political paradigm, ingrained institutions' regulatory stance favoring greater market deregulation, enhanced capital mobility and organization norms (Jessop & Stones, 1992). Reformation of the financial system, liberalization of former state natural monopolies and disintegration of network utility industries (such us electricity, telecommunications, railways, air transport, ports) through privatization schemes implemented on a world-wide scale during the late 80's (Braeutigam, 1989, Weiss & Klass, 1986) and especially since the beginning of the 90's (after the collapse of the Soviet Union) created fresh room for accumulation by providing the space capital needed to grow (Ashman & Callinicos, 2006). For Jones (2009) the disorganization and disintegration of core components of the until then state capital, undertaken on national level, should be understood as an outcome and as an effect of globalization, with the level of world order shifting from national to global and with capitalism becoming ever more tightly organized through financial, organizational and spatial integration. In the same vein, Lebowitz (2009) contends that the separation and disintegration of capitals comes in contrast to the capital's inherent tendency towards integration and unity. In the process of dismantling the barriers that hinder its expansion and growth, capital must cancel this fragmentation

and in order to do so, according to Lebowitz three separate but related centralization processes are required:

a) **Horizontal integration**: i.e. the integration of business entities at the same level of the production process;

b) **Vertical integration**: integration of business entities organically related, in upstream or downstream spheres of the production process;

c) **Conglomerate formation**: integration of business entities in differing spheres of production, independent of any organic relation.

Nitzan (2003) concocting and summing up Lebowitz's analysis, suggests that horizontal integration creates economies of scale, vertical integration leads to more roundabout production runs while conglomerate integration improves allocative efficiency through inter-sectoral capital mobility. All three types of integration, are inevitable as all increase productivity and efficiency, thus contributing to accumulation and further monopolization.

More recent monopoly theorists, like Foster & McChesney (2012) contend that the evolution of these processes especially from the 90's and forth through continuous concentration and centralization of capital on a global scale, have enabled fewer and fewer firms to control larger parts of both domestic and international economies. As illustrated in an empirical study (Foster et al.,2011) formerly competitive sectors have become the province of enormous monopolistic chains, massive economic fortunes have been assembled into the hands of a few mega-billionaires sitting atop of vast empires, and the new firms and industries spawned by the digital revolution have quickly gravitated to monopoly status.

More particularly, their findings suggest that during 2007 to 2009 (i.e., amidst of the Global Financial meltdown of 2008) the Top 200 corporations in U.S.A accounted for 30% of gross profits of the economy (in 1950 the equivalent percent was 13%) while respectively on a global scale the Top 500, attained around the 40% of global total revenue (doubled since the 60's).

Similarly, Vitali et al. (2011) unveil the structure of economic power of the modern corporate world. Out of 43.060 TNC's studied, the research team distinguished 1318, with interlocking ownerships which formed the core of the globalized economy. As their results illustrate nearly 4/10 of the control over the economic value of TNC's in the world is held, via a complicated web of ownership relations, by a sub-group of 147 economic super-entities in the core, which has almost total control over itself. Added to this, ¾ of the core were found to be financial intermediaries i.e., banks (such as, JPMorgan Chase & Co, Morgan Stanley, Barclay PLC, The Goldman Sachs Group etc.). Such global interlinkages, the authors suggest, may on the one hand threaten stability of the financial system, due to exposure to contagion, however on the other, place top holders in a position to exert considerable control either formally or via informal negotiations. In this direction, characteristic is also the fact that the last three centuries have been characterized by an extraordinary accumulation of capital, growing by a factor of 134 times between 1700 and 2008 (Bonneuil & Fressoz 2016). Hence, considering the above review, it can be supported that monopoly power is ascending as never before (Foster et al., 2011).

2.3. Integration strategies

The formation of the global market and thus of global competition, has been the progressive development and the result of capital's constant pursuit for expansion and growth. In the process of achieving so, firms have been implementing different types of growth strategies (Murray, 2003) while trying to align their corporate structure to their profit maximization goals. A lack of such strategy, drains the firm of potential opportunities, possibly leading to the loss of its enterprising managers as well as to technological obsolescence (Kotler & Keller, 2016).

Since the capacity for improvement within a firm is restricted by limited resources, competencies and capabilities, the importance of enhancing them through extending business functions beyond the firm's boundaries became a necessity to remain competitive and grow profitability. (Boyer & Lewis, 2002). According to Kudełko et. al. (2015), one of the most commonly utilized options of firm development is a strategy of integration i.e., a fusion of different business entities operating or capable of operating separately for the production of market products, which results from the

possibility of implementing common goals, processes and /or tasks. Integration is for Musso (2009) an effort to align and coordinate firm processes and activities in order to improve its overall performance, share lessons learned and best practices (Kapla & Norton, 2006). For Lebowitz (2009) integration destroys the individual independence of existing capitals, by transforming many small capitals into a few large ones, thus enabling the intensification and acceleration of accumulation through centralization. Within literature three types of integration are identified: horizontal integration, vertical integration & conglomerate formation (Federal Trade Commission, 1966, Elia et al, 2010).

Mergers and acquisitions (M & A's) as well as formation of strategic alliances, are the means to the realization of any integration strategy (in the same industry, in upstream or downstream industries, or in new industries respectively) (Toveda & Knoke, 2005). The former, increase the concentration within a sector directly while the latter indirectly (Chlomoudis, 2011). According to Roberts et. al (2016), a merger or an acquisition from the standpoint of a company, can be termed as the combination of two or more companies into one new company or corporation. Their distinction lies in that, in a potential merger there is usually a process of negotiation between the two parties, the favorable outcome of which would be a merger of the two, forming a new larger whole. Conversely, in a potential acquisition, such a phase may not take place. Acquisitions are basically the expropriation of smaller firms by larger ones, and in this sense, they may be friendly or well agreed, while they may also be hostile. Finally, Roberts et. al (2016) characterize M&A's as a strategic initiative to boost profitability by increasing market share, cost-savings, and optimizing production processes while it can also be done to expand a firm's global business portfolio through acquisition of another foreign-based firm. Respectively, for Brealey et al., (2016) M&A's are undertaken if senior management believes that it will promote a synergy to the firm, i.e. the value of business combination after the M&A process will be larger than the combines values of each of the firms, had they remained separate entities. As such through such synergies, firms can enhance their market share and their production capacity and hence increase their revenues and profitability (Wang & Wang, 2015).

2.3.1 Horizontal Integration

Horizontal integration, i.e., the expansion of capital within a particular sphere of production, is for Lebowitz (2009) a process of both success and failure which transubstantiates in the destruction on the one hand of the individual independence of existing capitals, while on the other in effectively causing their redistribution within that sphere, through their centralization. Instead of relying on their own resources to survive global competition, firms aim to achieve a competitive advantage by expanding their scale and by establishing their market presence through mergers and acquisitions (M&A) with/of their former rivals. For Adeleke et al. (2018), mergers and acquisitions simply refer to the coming together of two or more enterprises into a single entity.

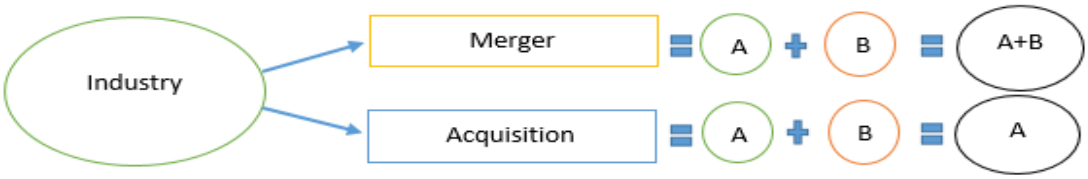


Figure 2. Horizontal integration through Merger or Acquisition. Author's Elaboration

As such, while a firm's horizontal boundaries determine also the varieties and quantities of the products it produces (Besanko et al., 2007), horizontal integration, allows firms to extend and expand their boundaries, replicate their operational and managerial expertise within the industry they operate, leading in turn to an increase in value creation through revenue enhancement, cost savings and new growth (Kumar, 2016). According to Kazmi & Kazmi (1986) as well as Hill & Jones (2012) there are many benefits for those pursuing a horizontal integration strategy, amongst which they distinct:

- **Economies of scale & scope**: especially in industries with high fixed costs, horizontal integration leads to cost reductions, increased efficiency and effectiveness, as the formation of a larger base reduces the per-unit costs, leading in turn to a lower cost structure and a better utilization of assets. In addition, the combination complementary skills may lead to enhanced ways of production.

- **Increased Product differentiation**: horizontal integration allows organizations to offer a wider range of product bundles and innovative new products at a single combined price, thus providing an advantage of increased product differentiation;
- **Reduced industry rivalry**: horizontal integration produces a measurable change in the industry's level of concentration (Betton, et al., 2008), eventually reducing competitors from the market and as such on the one hand helps to rationalize excess capacity which often triggers price wars, while on the other makes it easier to implement tacit price coordination between remaining rivals, thus reducing the intensity of competition. Taken to its extreme, horizontal integration could eventually lead in a monopoly;
- **Increased market/bargaining power**: the merger or acquisition amongst competitors, increases consolidation within the industry along with the size of the firms being merged, and as such due their larger scale, firms can exercise increased bargaining power against their suppliers and buyers (Chipty, 1995).

In addition to the above, for Kudelko et al. (2015) horizontal integration leads to the development of synergies which allow firms to adopt new technological/ innovational competences, transfer technology and know-how as well as to improve quality, through reduction of cost by mutualisation of functions and processes (such as joint marketing or R&D processes for example). For Oye (2008) too, horizontal integration is usually a scheme, cautiously planned to achieve a synergistic effect. Respectively, Cai & Obara (2009) suggest that horizontal integration in markets producing homogenous products, leads to a larger market base for the merged firm, thus helping reputation building while allowing for better effectiveness and monitoring by eliminating all the idiosyncratic shocks across the market. For Gorton et al., (2005), horizontal integration may be also motivated by a defensive strategy in order to prevent being taken over, leading to defensive mergers which decrease value generation for shareholders, however, allow to increase the private benefits of managers (Gorton, et al. 2005). Finally, Knapp (1950) suggests that horizontal integration is usually necessary as a basis for vertical integration (see section 2.3.2 below), as some of the more important gains of horizontal integration cannot be realized except by a certain amount of

vertical integration. In a much more recent study, Giustiziero (2013) also stresses the simultaneous interplay and the existing complementarities between vertical and horizontal corporate strategies.

Apart from the benefits for the integrated firms however, from the vantage point of the consumer or the regulator, horizontal integration especially in industries with few competitors and large market shares, may be a means of strategy to increase market power and lessen competition (CFA, 2017). According to the Federal Trade Commission in U.S, there are two ways that a horizontal integration can hamper competition; the first being the ability of the remaining firms in the market to act in a coordinated way on some competitive dimension (price, output, capacity) while the second is by permitting firms to raise prices profitably on its own. In either case, the Commission concludes that consumers might face higher prices, lower quality, reduced service or fewer choices (FTC, 2019).

Respectively, for European Commission (2020), there are two main ways in which horizontal mergers may significantly impede effective competition, in particular by creating or strengthening a dominant position: (a) by eliminating important competitive constraints on one or more firms, which consequently would have increased market power, without resorting to coordinated behavior (non-coordinated effects) and (b) by changing the nature of competition in such a way that firms that previously were not coordinating their behavior, are now significantly more likely to coordinate and raise prices or otherwise harm effective competition. A merger may also make coordination easier, more stable or more effective for firms which were coordinating prior to the merger (coordinated effects).

While though firms in a wide range of sectors such as banks, utility, electricity, oil and gas, automobiles, food and beverages, and the beauty market amongst other (see Figures below), increasingly engage in horizontal integration in recent years (Sudarsanam 2010), regulatory mechanisms and tools have been established to monitor the markets' competitiveness.

As a horizontal merger produces a measurable change in the industry's level of concentration and a change in the risk-adjusted present value of industry rents

(Kumar, 2016) both the FTC in U.S (FTC, 2010), as well as the EC in European Union (E.U, 2004) have established a specific set of merger guidelines and tools to assess the competitive implications of horizontal integration, based on which they can block those mergers and acquisitions that tend to either decrease competition, increase the likelihood of monopolization and coordination or raise prices for consumers. More specifically, the potential increase of market power due to a horizontal merger is analyzed based on the unilateral and coordinated effects of the merger. That being said, according to Motis (2007) while coordinated effects refer to the scope of collusion, facilitated by the lower number of competitors, unilateral effects refer to the risk that the merged firm, acting independently of any remaining rivals, finds it profitable to raise prices after the merger. Specifically, as the author confers, oligopoly models of competition regarding the merger unilateral effects predict that whenever the merging products are substitutes and the market is composed of symmetric firms, prices in whichever mode of competition (in quantities with homogeneous goods or in prices with differentiated markets) will increase. In turn, the factors that would impede such adverse effect on prices are free entry, efficiency gains and product repositioning.

The Herfindahl–Hirschmann Index (HHI), as well as Concentration Ratios (CR4, CR8) are commonly utilized in U.S and E.U, to measure industry concentration of the integrated parties (based on market shares relating to sales, capacity, units sold etc.). In this respect market shares and concentration levels may provide a useful first indication of the market structure and of the competitive importance of the merging parties and their competitors (E.C, 2004, Pilsbury & Meaney, 2009, FTC, 2019).

Figure 3.Top Beauty Empires: 8 Companies that own the Beauty Market

Source: (CBS Insights, 2018)

Figure 4. The 5 companies that control the beer market

Source: (Visual Capitalist, 2016)

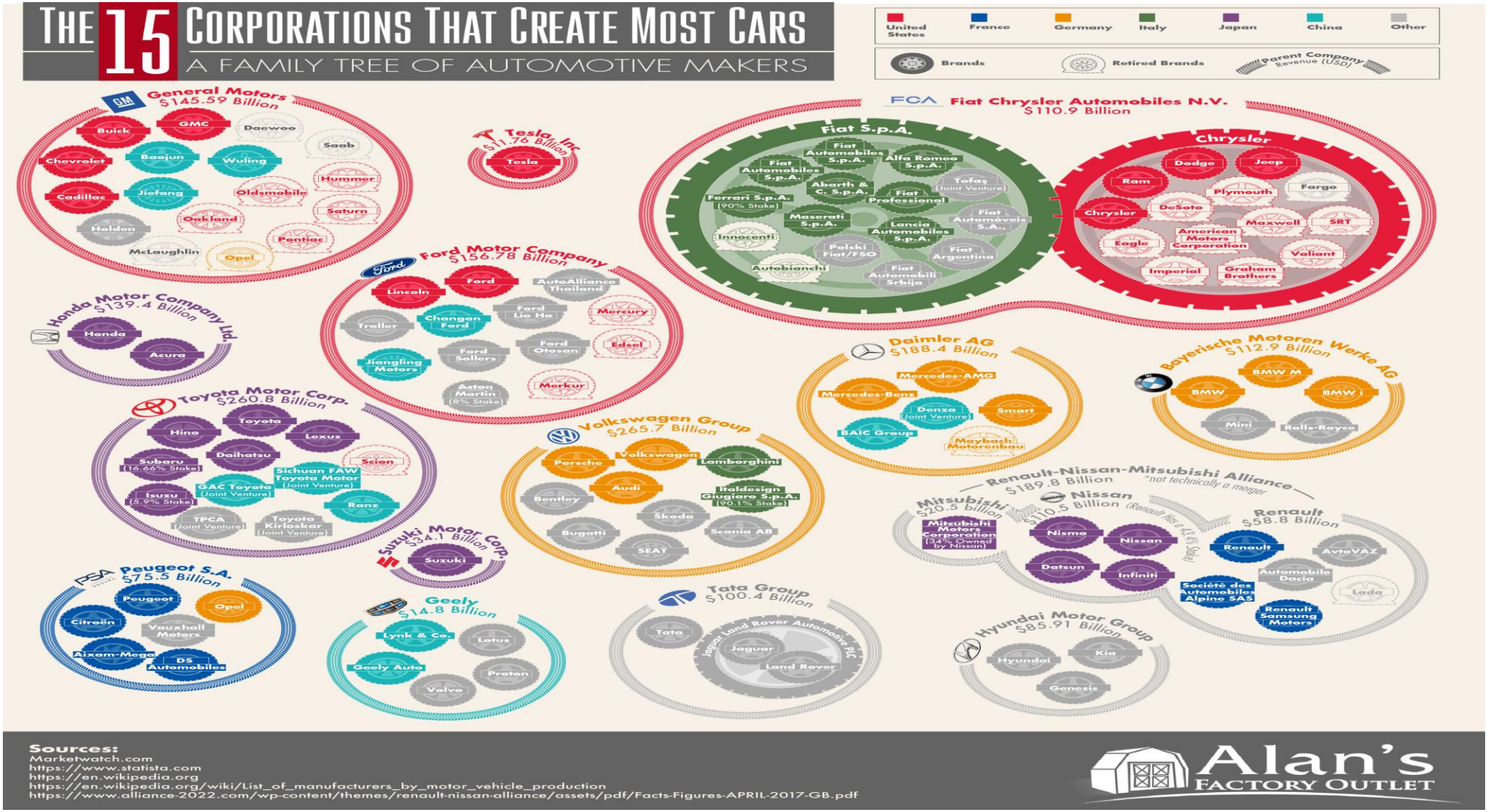


Figure 5. The 15 Corporations that control the car market

Source: (Visual Capitalist, 2018)

2.3.2 Vertical Integration

Ever since the rise of the contemporary industrial enterprise in the beginnings of the 20th century, vertical integration, i.e., the integration of business entities organically related, in upstream or downstream spheres of the production process, has been an important portion of corporate strategy, used to serve diverse strategic objectives (Zhang, 2013). Frank (1925) described vertical integration as an attempt of functional coordination amongst one or more units in each of the several successive stages of production, so that they are all operated as one unified industrial process under one management, while a plethora of other definitions have been provided ever since (Adelman, 1949, Bork, 1954). From a more contemporary viewpoint, according to Perry (1989) this type of integration, describes firms which encompass two single-output production processes in which either the entire output of the "upstream" process is employed as part of all the quantity of one intermediate output into the "downstream" process, or the entire quantity of one intermediate input into the "downstream" process is obtained from part or all of the output of the "upstream" process. Hence, vertical integration for Perry (1989) involves a variety of decisions concerning whether corporations should provide certain goods or services in-house or purchase them from outside firms. For this reason, it is often viewed as the extent to which a firm controls the production of its inputs or supplies and the distribution of its outputs (Gulbrandsen et al., 2009). From a Marxist point of view, Lebowitz (2009) argues that vertical integration is the process of dismantling the barriers of capital growth, by unifying capitals which are organically related in the production of use-values but separated by commodity exchange.

Apart from the variety of definitions, researchers have also distinguished amongst several types of vertical integration. Kessler & Stern (1959) argue that vertical integration can be based either on stock or asset acquisition, thus being an ownership integration, either on vertical contractual arrangements (output, franchise, agency agreements etc.) which enhance coordination and control, thus contractual, or it can be hybrid combining both ownership and contract (vertical joint-venture agreements). In addition, they make a further distinction amongst tapered and mixed integration. The latter differs from the former in that it involves the use of contracts for some

factors of production or distribution while ownership for others. Respectively, tapered integration involves the use of contracts for securing part of a firm's needs for some factor and ownership for the rest of that same factor (Kessler & Stern, 1959).

Davis & Duhaime (1992), distinguish among the between-stage vertical integration which occurs between stages in the value chain, such as between manufacturing and distribution and the within-stage vertical integration, which occurs in a single-stage of the value chain (usually expected in the manufacture of complex products and services). The majority of researchers, however, classify vertical integration either as forward or as backward (Fronmueller & Reed, 1996, Spiegel, 2013, Lin et al., 2014). Forward integration describes the process of expanding the firms' scope of activities towards the side of the buyer (from raw materials to production, or from production to distribution and sales), a process which is triggered by technological interrelationships involving economies of scale and scope, uncertainty and risk considerations amongst others (John & Weitz, 1988). Conversely, backward integration describes the expansion of firms' activities towards the side of the supplier (thus towards producing materials rather than purchasing the inputs of production) (Cousins & Menguc, 2006). Finally, vertical integration can be full, i.e., when a firm acquires in its totality the ownership of a downstream or upstream firm (full backward or forward integration) or partial, i.e., when a firm acquires just a share of the total ownership (partial backward or forward integration) (Quirmbach, 1986, Levy et al., 2018).

From a legal point of view, Hovenkamp (2010) suggests that vertical integration could occur by three different legal devices. The first, is an action of "de novo" integration, where a firm simply begins to do something that it used to purchase on the market. The second is to acquire a different firm in a vertically related market, while the third is achieved through a long-term or relational contract amongst two vertically related firms that maintain their legal independence, functioning as a kind of contractually controlled subsidiary to a parent firm.

Overall, according to Dreyer et al. (2001), the analysis of vertical integration within academic literature, is dominated by three distinct fields, namely transaction costs economics (TCE), strategic management (SM) and industrial organization (IO).

According to the author, each captures and justifies partly the different drivers of the vertical integration phenomenon and basically how firm boundaries are determined. Joskow (1988) in turn suggests, that one theory alone will seldom or never be able to provide an explanation of vertical integration, as according to Langlois & Robertson (1989) an examination of the whole history (of the automobile industry), suggests that no single theory always fits the facts perfectly and therefore a complete explanation must combine specific theories in a way that accounts and is attentive to numerous and diversified factors.

a) Transactional Cost Economics: Amongst the above streams of literature, TCE has been the most commonly utilized and the most widely accepted theory on how firms can gain competitive advantage through efficient organization of their economic transactions (Steenkamp, & Geyskens, 2012). Stemming initially from Coase's (1937) observation that significant transaction costs occur when obtaining a good or service through the market, TCE argues that producing internally what is more expensive to procure externally, reduces such transaction costs since inter-firm claims are eliminated (Mahoney, 1992).

Extending Coase's rationale by which contracts govern firms' relationships and thus transaction costs arise due to exchanges amongst them, Williamson (1985) develops the TC theory and examines the factors that affect the organization of production systems and observes that asset specificity in upstream or downstream markets, bounded rationality and opportunism result in increased transaction costs for firms. More specifically, he distinguishes amongst two types of transaction costs. The ex-ante costs which encompass the costs of drafting, negotiating and drafting an agreement and the ex-post costs of contracting such as costs of maladaptation, set up, operational and bonding costs. Matthews (1986) in line with Williamson (1985), holds that the fundamental idea of transaction costs is that they consist of the cost of arranging a contract ex ante while monitoring and enforcing it ex post, as opposed to production costs, which are the costs of executing a contract. Milgrom and Roberts (1987) provide a more detailed definition of transaction costs:

"Transact as an intransitive verb means to do business to negotiate. Transaction costs encompass the cost of deciding planning, arranging and negotiating the actions to be

taken and the terms of exchange when two or more parties do business; the cost of changing plans re-negotiating terms and resolving disputes as changing circumstances may require and the cost of ensuring that the parties perform as planned or agreed. Transaction costs also include any losses suffered on account of inefficient group decisions plans arrangements or agreements inefficient responses to changing circumstances and imperfect enforcement of agreements"

Within such a framework, Williamson (1985) supports that, especially in cases of increased levels of asset specificity, the organizational imperative that emerges for firms, is to organize transactions to economize on bounded rationality while simultaneously safeguarding them against the hazard of opportunism which raises transaction costs. According to Bresnahan & Levin (2012) as the transaction proceeds there is plenty of room for opportunistic and inefficient behavior, especially when complexity or uncertainty make it rather difficult to specify contractual safeguards, or when parties cannot walk away without incurring substantial costs. To this end Williamson (1975) suggests that vertical integration can aid in response in minimizing transaction costs in three ways. Firstly, by replacing the logic of profit maximization at individual stages of production with joint and aligned profit maximization, secondly through improving information exchange amongst these individual stages and thirdly by utilizing control instruments such as hierarchical control that aid in resolving market transaction problems. In this sense, through vertical integration and thus through the internalization of transactions, the buyer's firm will economize on transaction costs, by utilizing instead common codes and shared organizing principles, to control behavior (Arrow, 1974)

Several researchers have examined this make or buy decision, concluding that transaction costs are an important parameter triggering vertical integration. Amongst them, prominent authors such as Riordan & Sappington (1987), suggest that vertical integration will reduce transaction costs by decreasing uncertainty and asymmetric information, leading thus to the more efficient utilization of inputs. Ray et al. (2009) too, argue that vertical integration substitutes market transactions between firms through better planning and cost-coordination within the firm, leading to reduced

costs. While for Levy (1984), internal organization of transactions, will be profitable as long as transactional costs over market, outweigh internal cost of management.

For Marxists such as Lebowitz (2009) and Harvey (1989) too, vertical integration will lead to lower inputs and thus savings as a result of extending the sphere of controlled production at the expense of exchange. By unifying under a continuous process, what was previously separated with commodity exchange, firms will no longer have to pay for the surplus value of another capital. Smith (2001) schematizes this argument suggesting that when firms purchase inputs of capital their cost is c+v+s, while when they produce the inputs themselves the cost declines to c+v. Harvey (2006) also provides a graphic illustration of this claim, which we reproduce in the following figures.

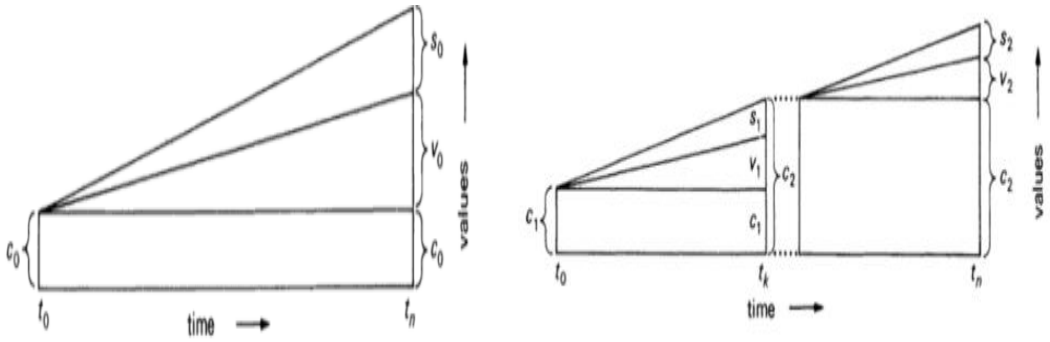


Figure 6. Effect of Vertical Integration in lowering the input costs of a firm

Source: (Harvey, 2006)

According to his analysis, under a unified process (Figure 6.), production commences at t_0, with an initial input of constant capital c_0, and which proceeds until time t_n by adding variable capital to the value of v_o and surplus value s_0. In such a case, thus the value composition of capital will be c_0/v_0. Conversely, when the same production is separated into two segments, at time t_k the total value of the first production process (c_1) becomes the constant capital input c_2, of the second phase of production. As such, in this case the value composition will be $(c_1 + c_2)/ (v_1 + v_2)$, which is much greater that the c_0/v_0 of the first case. Therefore, in order to avoid the profits and production costs of another firm and as long as c_0/v_0 is smaller than $(c_1 + c_2)/ (v_1 + v_2)$, vertical integration will be utilized as a strategy to lower firms' input costs.

The TCE approach, focuses on the efficiencies and benefits achieved thus motivating under circumstances the realization of a vertical integration strategy. Blignaut et al. (2010) summarize these efficiencies in:

- Eliminating the costs of negotiation and execution of contracts as well as the minimization of risk and uncertainty;
- Facilitating the internalization of externalities which amongst other lead to the elimination of double marginalization;
- Enabling the achievement of economies of scale and scope;
- Building up savings that in turn increase production and output;
- Promoting technical enhancements in the product quality;
- Aligning coordination and distribution of products; as well as in
- Promoting innovation.

b) Industrial Organization (IO): Conversely to the TCE and SM (RVB) perspectives, the primal determinant of vertical integration for IO economics theories, is the link between integration decisions and market structure, or more correctly asymmetric market structure (Chatterjee, 1991). More particularly, some of this research focuses on scale and scope economies as rationales for integration, while other streams highlight strategic motives, in a sense that integration can be a valuable tool to create competitive advantages through differentiation that will in turn enable the extension of market power and thus of concentration (Bresnahan & Levin 2012).

The former view on vertical integration, stems from Stigler's interpretation of Adam Smith's infamous theorem that the division of labour is limited by the extent of the market. Based on this assumption Stigler (1951) relates the extend of vertical integration amongst firms to the size and the volume of demand within the particular industry, suggesting that vertical integration is a characteristic of young industries who are often "strangers to the established economic system" and of declining industries experiencing contractions in demand. In such cases, firms pursue increasingly vertical integration, to strategically align production and allow the realization of economies of scale and scope in the constituent markets, to control the source of inputs (Kessler & Stern, 1959, Porter, 1980). According to Church (2008) potential efficiencies from

coordination in both design and production made possible by a vertical merger include amongst others, lower costs, higher quality, shorter lead times, improved quality control, reduced costs of inventory resulting from just in time production and distribution, optimized production runs, reduced costs of innovation. Contrariwise, Stigler (1951) argues, that vertical disintegration is the typical development for growing industries with increasing demand, as specialized companies which exploit economies of scale and scope emerge to undertake functions that since then were produced internally. Hence, according to his view, vertical integration decisions will be primarily influenced by the horizontal market structure (size) of the upstream and downstream markets.

While thus Mpoyi's (2003) and Katie's (2003) results along with Stigler's (1951) suggest that vertical integration declined over time in the manufacturing sector to allow them to become more competitive, Langlois and Robertson (1989) argue that while there are certainly industries in history that fit Stigler's pattern, counterexamples exist. According to their analysis, industries such as the automobile one, which were quite differentiated at an early stage of the industry's life, became increasingly more integrated as output expanded. Other researchers too, have reached similar conclusions which contradict Stigler's rationale.

Adelman (1955), was amongst the first to associate vertical integration with economic change, suggesting that in an increasingly growing industry, suppliers of intermediate products may not be capable of expanding output as rapidly as expected by the producers of the final goods, thus motivating the latter to integrate. As such he suggests contrary to Stigler (1951), that there is an apparent rough correlation between vertical integration and firm size. In the same vein, Tucker & Wilder (1977) also find a positive and significant relationship between industry concentration and vertical integration. Levy, (1984) in accordance with the above results, finds a positive and significant relationship between vertical integration and the tested variables of concentration and demand growth, suggesting that industries with larger firms, are more likely to be vertically integrated. In a more recent study, Elberfeld (2002) re-examined Sitgler's (1951) prediction within the context of oligopolistic suppliers at two successive stages of production. His obtained results suggest that vertical

integration should decrease with market size when entry into markets is free and firms compete but should increase when competition impediments exist (such as entry into the upstream market is restricted or upstream producers collude).

While thus contemporary business practice as well as conducted research in IO provide ambiguous results over Stigler's argument (over vertical disintegration or integration), an increasing body of literature within IO, focuses on the effects vertical integration has on competition and therefore study the effects the latter has on the market structure of the industries in which it is undertaken. Economic analysis demonstrates that numerous economic factors are potentially at play in a vertical merger which can work in opposite directions and in this respect, in order to evaluate the competitive effect of vertical integration it is necessary to weigh the pro-competitive and anti-competitive effects of the transaction given the specific economic circumstances of the case (Meyer & Wang, 2011).

Riordan (2005) in turn suggests that the competitive effects of vertical integration will depend on the structure of upstream and downstream market, as well as on the market power of firms in these markets. According to his analysis, market power is the profitable ability to raise price above marginal cost, and can be traced to conditions of industry concentration, product differentiation or cost advantages.Under this spectrum, many researchers as well as regulatory and competition authorities stress that vertical integration (depending on the market structure) can enhance market power and hence lower welfare, being harmful to competition, while in contrast others suggest that vertical mergers not only do not lead to increased market power but can often lead instead to a price reduction for the final good (Salinger, 1988).

Over this debate about the competition implication of vertical integration, OECD (2007) suggests that while most vertical mergers are efficiency enhancing, both outcomes are possible; however, the task of distinguishing amongst the anticompetitive and procompetitive ones is substantially more complicated than in the case of horizontal integration, making the effective enforcement of policy and the development of appropriate industry regulation a difficult and demanding challenge. To this end, investigating the consequences of vertical integration on competition has

become a task of paramount importance and scrutiny in the formulation of antitrust policy, gaining significant attention over the last decades.

In this respect, both the Department of Justice (DOJ) in U.S and the European Commission in E.U have issued the Non-Horizontal Merger Guidelines to assess the competitive effects of vertical mergers. The DOJ (1984) guidelines focus on four different potential anticompetitive implications, namely 1) the elimination of a potential entrant, 2) the creation of barriers to entry, 3) the facilitation of collusion as a result of increased information coordination and 4) the evasion of rate regulation due to post merger opacity to transfer prices (Meyer and Wang, 2011). Respectively, the E.C (2008) has a slightly more holistic approach, suggesting that there are two main ways in which non-horizontal mergers may significantly impede effective competition; non coordinated and coordinated effects. The former, may principally arise when vertical mergers give rise to foreclosure, while the latter arise where the vertical merger changes the nature of competition in such a way that firms that previously were not coordinating their behavior, are now significantly more likely to do so, to raise prices or otherwise harm effective competition (E.C, 2008).

As it can be observed, both U.S and E.C's Guidelines converge, with regards to the potential anti-competitive effects of coordination as a result of vertical integration, which may lead to the facilitation of tacit or express collusion. Market coordination may arise where competitors are able, without entering into an agreement or resorting to a concerted practice, to collectively exercise their market power by identifying and pursuing common objectives, avoiding thus the normal mutual competitive pressure by a coherent system of implicit threats (E.C, 2008).

Within the IO literature, numerous researchers have investigated the potential ways through which vertical integration can enable coordination as well as its effects on competition. King (1992) defines vertical coordination as the alignment of direction and control across segments of an integrated system, while Sporleder (1992) suggests that the factors that are aligned and controlled can possibly include price, quantity, and terms of exchange.

Blignaut et al. (2010), in line with EC's Guidelines suggest that vertical integration results in a reduction in the number of firms in a market, removing or weakening the pre-merger competitive constrains, thus facilitating or at least increasing the likelihood of easier coordination on matters that concern pricing, output or commercial decisions amongst the remaining firms in the market. Bain (1956 ,1959) suggests that increases in concentration facilitate collusion as an increase in concentration increases each individual firm's payoff from collusion. Conversely, as the number of firms in the industry increases, the value of each firm's share of collusive industry profits declines, as the same monopoly profits must be divided amongst more firms. Similarly, also firms with the same level of vertical integration are more likely to tactically collude (E.C, 2008).

Another possible way of facilitating coordination through a vertical merger is according to Salop & Culley (2014) by reducing the costs of the merger firm. If those lower costs could create more symmetry in costs and structure, the authors suggest that it may lead to the firms' having similar desired prices, while in addition obtaining lower costs also may place the merger firm in a stronger position to punish defectors, which can deter defection. According to Mendi (2009), vertical integration may also reduce cost asymmetries, or help to sustain collusion through cost asymmetry by enabling implicit side transfers between integrated and non-integrated firms. In another paper Mendi et al. (2011) suggest that also forward vertical integration occurs for strategic reasons, namely to create a mechanism that allows the upstream firm to discipline non-integrated downstream firms and thus sustain more profitable collusion, while refer specifically to Lamoreux (1985) and his study on US. Steel market which was able for a period of time to control independent manufacturers of finished products, by holding up prices on raw materials and forcing down prices on finished products. According to the author, the fact that US Steel was a vertically integrated firm meant that it was able to be an active actor in the downstream market while being a potential supplier of raw materials to competitors of its downstream divisions (Lamoreux, 1985). Additional cases of collusion in vertically integrated industries have been reported by Mendi & Vezsteg (2009) in the Basque iron and steel industry, by

Page (2011) in Standard Oil and U.S Steel, as well as by Webb (1980) in the German Steel industry and Levenstein (1996) in the bromine industry.

Nocke & White (2007) illustrate in a number of models that the net effect of vertical integration is to facilitate collusion. As suggested vertical mergers facilitate collusion through the operation of an outlets effect: where cheating unintegrated firms can no longer profitably sell to the downstream affiliates of their integrated rivals. In addition, vertical integration also gives rise to an opposing punishment effect: integrated firms are in a more advantageous position to punish defections of upstream competitors by swiftly increasing competition in the downstream market. As such, it is typically more difficult to punish an unintegrated structure, so that integrated firms are able to make more profits in the punishment phase than unintegrated upstream firms. In addition, the authors (2007) suggest that when downstream firms can condition their prices or output on upstream firms' contract offers, two additional effects arise, both of which further facilitate upstream collusion. In the first instance, an unintegrated upstream firm's deviation profits are reduced by the reaction effect which arises since the downstream unit of the integrated firm will react aggressively to upstream deviations, while in the second, an integrated firm's deviation profit is reduced by the lack of commitment effect as it cannot commit to its own downstream price when deviating upstream.

Similarly, Salop & Culley (2016) suggest that the likelihood of collusion can be also increased by the acquisition of a disruptive seller, who may then refuse to supply any non-integrated firms who diverge from the agreement. They also confer that a vertical merger can facilitate coordination in the downstream market by weakening maverick or other disruptive competitive behavior of a non-merging downstream firm. If a non-merging firm is a maverick or otherwise disruptive competitive influence in the premerger market, the upstream division of the merged firm might weaken the incentives for that behavior by raising the price it charges to the disruptive firm or by reducing its access to inputs (Salop and Culley, 2016).

Biancini & Ettinger (2017), while studying the effects of a vertical merger on downstream firms, illustrate that in a simple double oligopoly context vertical integration in general increases the feasibility of downstream collusion, as firms

through the utilization of maximal punishments enforce a collusive outcome more easily when vertical integration takes place. In addition, their constructed framework can identify instances in which a vertical merger, creating new collusion opportunities, has a welfare reducing effect, suggesting that the potential collusive impact of vertical integration on the downstream market should be taken into account when attempting to establish if a merger is likely to create or strengthen collusion.

Also, Piccolo & Miklos-Thal (2012) investigate downstream firms' ability to collude in a repeated game of competition between vertical chains. More particularly, they illustrate that downstream firms with buyer power can collude more easily in the output market if they also collude on their input supply contracts. As they specify, an implicit agreement on input supply contracts with above marginal cost prices and negative fixed fees (slotting fees) facilitates collusion on downstream prices. Chen & Riordan (2007) also show that vertical integration can aid an upstream firm in cartelizing the downstream market through exclusive contracts with other downstream providers, to restrict output as well as prices to final consumers. Such exclusive contracts essentially prevent downstream providers from absconding to other upstream suppliers.

Finally, vertical integration might also increase the ability as well as the incentive for tacit or express collusion through a change in the information structure of markets (Riordan, 2005). More specifically, Riordan & Salop (1994), suggest that vertical mergers can facilitate tacit or express coordinated conduct by facilitating the exchange of pricing and other competitively sensitive information in either the input or the output market. On such occasions, the vertically integrated firm, can utilize this information to monitor the compliance of the upstream rivals with a collusive agreement.

While thus U.S & EC's Guidelines, both emphasize on the potential harm for competition in cases of vertical coordination, the same consensus is not reached with regards to the non-coordinated effects of vertical integration. In particular the U.S Guidelines, at the time of their issuance reflect the influence of developments in the understanding of the economics of vertical integration from both the Chicago School literature that questioned the extent to which the share of the market foreclosed was

correlated with harm to consumers and increased market power, and TCE economics that recognized the potential for vertical integration to be efficiency enhancing (Church, 2008), they do not acknowledge (as is the case with EC's Guidelines) the possibility of foreclosure or raising rivals' costs' as the basis for a merger challenge (Langenfeld, 2016).

Kernel and basis of the Chicago school's contemplation against regulatory intervention have been the successive monopoly and the single profit models. The two models consider a monopolist upstream and determine the effects if it integrates in the downstream market; with their difference lying in that the single profit model assumes competition downstream premerger, while on the contrary the successive monopoly one assumes a monopolist premerger downstream (Church, 2008).

The former model considers whether a monopolist upstream is incentivized to monopolize the downstream market. On the basis of five restrictive assumptions: 1) the products are used in a fixed ratio; 2) Buyer demand for them has a strong positive correlation; 3) Each purchaser buys at most a single unit of the tying product; 4) the competitiveness of the tied market is fixed and 5) the competitiveness of the tying market is fixed; the theory showed that an upstream monopolist would continue to earn exactly the same monopoly profit, as it would be unable to leverage its monopoly power into the competitive downstream market, thus suggesting that integration reflected real efficiencies (Elhauge, 2009, Bork, 1978), such as lower per input costs, increase in sales by lowering the final price etc. and hence an increase in social welfare.

Respectively, in the successive monopoly model, the effect of integration between an upstream and downstream monopolist. As suggested, additional monopolies in the manufacturing and distribution chain lead to a world of "double marginalization" in which an upstream monopolist increases prices and restricts output compared to the competitive level, and the downstream monopolist then further raises prices and restricts output because of higher input costs (Langenfeld, 2016). In this sense, the effect of vertical integration is welfare enhancing, as it allows the upstream firm to supply inputs to the downstream firm at marginal cost without adding an extra mark-up upstream, thus leading to the elimination of double marginalization and the

generation of a downward pressure on prices in the downstream market (Meyer & Wang, 2011).

As suggested by post Chicago economic literature in IO however, the above models cannot interpret the effect of vertical integration in cases of imperfect competition in the upstream and downstream markets, thus disregarding the increasing potential for foreclosure along with the potential anticompetitive effects that come with it (Motta, 2004). According to EC's (2008) Guidelines, which by being issued much later than those of DOJ (1984) were able to incorporate newer research and thus the prospect of anticompetitive foreclosure, the term "foreclosure" describes any instance where actual or potential rival's access to supplies or market is hampered or eliminated as a result of the merger, thereby reducing these companies' ability and or incentive to compete. Foreclosure thus can be found even if the foreclosed rivals are not forced to exit the market: It is sufficient that the rivals are disadvantaged and consequently led to compete less effectively. Consequently, the Guidelines continue, the merging parties and possibly some of its competitors as well, may be capable of impeding effective competition by profitably increasing the final price charged to consumers (E.C, 2008).

As such, for EC's (2008) guidelines a merger apart from enhancing the likelihood of collusion at some point in the production chain, can erode competition and welfare concerns if the integrated parties are able to either foreclose their rivals' access to inputs thus raising rivals' costs or to foreclose upstream and/or downstream rivals by restricting their access to sufficient customer base thus reducing their revenues (Saggers, 2008, E.C, 2008).

While thus, vertical integration that fails to increase market power is unlikely to have adverse consequences for consumers according to Riordan (2005), Bain (1959) pinpoints an increased likelihood of foreclosure as a result of vertical integration and observes that the procompetitive rationales for vertical integration tended to diminish as market became more concentrated, suggesting that while such strategy may have been beneficial in highly competitive markets, in oligopolistic or monopolistic ones it is not.

According to Rey & Tirole (2007) foreclosure refers to a dominant firm's denial of proper access to an essential good it produces with the intent of extending monopoly power from that segment of the market (bottleneck segment) to an adjacent segment (the potentially competitive one). It can be complete, as in the case of a refusal to deal with potential competitor, or partial, as when the bottleneck owner favors some firms or products in the adjacent market to the detriment of other competitors, while it can happen in numerous other ways (Rey & Tirole, 2007):

- The bottleneck owner can integrate with one or several firms in the complementary segment creating thus a competitive disadvantage for the non-integrated firms.
- The integrated firm can refuse to deal with potential competitors. Relatedly, it may make the bottleneck good incompatible with competitors' products or technologies (see also Riordan (2005)), degrade the quality of the input supplied, or engage in tie-in and refuse to unbundle, thereby denying access to the essential facility. Similarly, Ordover et al. (1990) suggested in one of the first papers to analyze input foreclosure, that such a strategy allows the integrated firm to exercise market power over other suppliers by raising rival's costs. Salop & Scheffman (1983) also argued that cost increasing strategies are more credible than predatory pricing. As it is better to compete against high-cost rivals than low-cost ones, raising rivals' costs' would in turn force higher cost firms to quickly reduce output, allowing the would be-predator to immediately raise price or market share as well as to avoid expenditures that would otherwise require deep pockets or superior access to financial resources. In turn, for Kessler & Stern (1959) as well as for Allain et al., (2014) under such circumstances competitors may also be forced into integration in order to expand if not to exist, and as such an initial vertical merger may unravel subsequent mergers amongst the remaining firms.
- In the presence of economies of scope or scale calling for cooperation among firms in the same market, a dominant group of firms may put its competitors at a disadvantage by refusing to cooperate. Kessler & Stern (1959) based on literature suggest that in the presence of economies of scale, vertical

integration can be utilized to secure or strengthen power at another level of production, as only foreclosure from a market sufficient to prevent competitors from securing an efficient output level, will bar their entry.

- The bottleneck owner can grant exclusivity to a subset of firm or tie its essential product with selected products on the complementary segment, and thus de facto exclude their rivals. Again, according to Kessler & Stern (1959) the use of vertical integration by exclusive dealing contracts appears to bolster horizontal power, as well as to deteriorate the possibility of an efficient entry (Blair & Kaserman, 1983).
- Finally, a last instrument of foreclosure is second and third-degree price discrimination. Third-degree discrimination consists in charging different prices to different customers. It generalizes exclusivity or tying arrangements by favoring some customers over the others but gives the bottleneck owner some flexibility in serving discriminated against customers. Even if third price discrimination is prohibited, the bottleneck owner may be able to duplicate it in an apparently anonymous way that is through second-degree price discrimination. In the same vein, Salop and Culley (2014) also argue that a vertical merger may permit a firm with pre-existing market power to price discriminate more effectively in the downstream market and harm selected groups of consumers.

Characteristic is the fact that Salop & Culley (2016) by reviewing 48 challenges to vertical mergers between 1994 and 2015, found that 36 of them incorporated foreclosure allegations. Other empirical research investigating market foreclosure on selected industries, such as Cement & Concrete (Allen, 1971), Cable TV industry (Waterman & Weiss, 1996, Chipty, 2001) as well as in the gasoline and refining industry (Hastings & Gilbert, 2005) found evidence on foreclosure. In line with the above literature, Boehm and Sonntag's (2020) results suggest that vertical foreclosure along the extensive margin is occurring among large firms, across a range of sectors in the economy, and both for domestic and international mergers. More specifically they found that on average firms whose supplier vertically integrated with one of their competitors, experienced a temporary drop in sales, a drop which was greater for

firms that did not have relationships with other suppliers while lower for those firms who had.

On the contrary, Mullin & Mullin (1997), Hortacsu & Syverson (2007) and Asker (2016) researching the Iron Ore & Steel industry, the Cement and Concrete as well as the beer industry respectively, found no evidence of vertical foreclosure. In addition, Lafontaine and Slade (2007) by reviewing empirical literature suggest that in most cases the efficiency gains attained from vertical integration prevail over the likelihood of foreclosure.

Finally, Hart et al. (1990) in their seminal paper, develop a model based on a series of commitments and assumptions which examines the effects for market power and efficiency resulting from vertical mergers between successive duopolists and ultimately illustrates how vertical integration can be privately desirable yet socially undesirable. More particularly, the model shows three sources of social loss from mergers and two sources of social gain.

In the former case, social loss is the consequence of a) a vertical merger (of U1 & D1) which raises consumer prices to the extent that it allows them to monopolize the market ex post, leading to a reduction of the sum of consumer and producer surplus; b) a vertical merger (of U1 &D1) which may cause the exit of one or both of their respective competitors (U2 &D2), allowing thus U1-D1 to gain greater market power ex post, causing again consumer prices to rise and consumer plus producer surplus to fall; c) a vertical merger which involves incentives and legal costs.

In contrast, potential social gains arise as a result of a) a vertical merger (U1 &D1) that causes the exit of one or both of their respective competitors (U2 &D2), but leads this time to a saving in investment costs, to the extent that this merger-induced exit(s) leads to a reduction in rent seeking behavior; b) pure efficiency gains arising from a vertical merger (U1 &D1) which encourages investments in order to reduce hold-up problems (triggered mainly by upstream firms which in the absence of a perfectly competitive market for its products is unwilling to invest), leading thus to increased competition and reduced consumer prices.

Through the analysis of IO literature, we have illustrated how vertical mergers can on the one hand and under specific circumstances, enhance the efficiency and cut the costs with which the merged firms operate, while on the other the numerous ways through which such a merger can potentially harm competition. In this respect, both DOJ (1984) and EC's (2008) non-horizontal guidelines, acknowledging the possibility of competition distortions, have developed similarly as in the case of horizontal mergers, specific measures, tools and principles to assess the effects (both procompetitive and anticompetitive ones) of a vertical merger. While differences in their approaches exist (specifically with regards to foreclosure), with EC's (2008) guidelines formulating a more holistic framework, both regulators utilize market share and HHI thresholds, (specifically where the market share after the merger of the new entity in each of the respective markets is above 30 % and the post-merger HHI is above 2.000) as well as the overall likely impact on prices and choice, as indicators to assess vertical mergers (E.C, 2008).

While the use of safe harbours can aid to improve the allocation of the scarce resources of enforcers towards more problematic merger cases (OECD, 2017), authorities should be aware of the limitations of market shares and concentration measures as indicators of market power. According to Salop & Culley (2014 & 2016), agencies should be cautious about using such tools as summary measure of competitive concerns in vertical mergers, as such static measures fail to account for dynamic effects, namely the capacity of established firms to innovate and/or rapidly expand their market share.

c) Strategic Management and Resource Based View (SM-RBV): in complementarity to the transaction cost view, the strategy management literature provides an additional perspective to the utilization of vertical integration. Stemming also from Coase's (1937) theory of the firm and what determines firms' boundaries, a growing body of research within SM, collectively labeled the resource-based view theory of the firm, contended that the reason an activity is conducted within the firm is not market failure (i.e., the cost of transacting through the market) but rather firm success (Madhok, 2002).

In contrast to neoclassical economics which do not account resources as a differentiating factor between firms and therefore suppress and underestimate the role of the heterogeneity and of the differences in firms' productive capabilities (Demsetz,1988), the RBV theory focuses on the resource position of the firm. According to this approach, a firm abides by a strategy to generate rents based upon its resource capabilities. Resources yielding Ricardian rents, may include amongst other ownership of assets, locational advantages, competencies, organizational processes, knowledge and information, patents and copyrights etc. (Mahoney, 1992, Barney, 1991a). Organizations with the strategic capability to focus and coordinate human effort and the ability to effectively evaluate the resource position of the firm in terms of strengths and weaknesses have a strong basis for competitive advantage (Andrews, 1971). Based on this view Barney (1986) suggested that it is possible to develop a theory of persistent superior firm performance based on the attributes of resources a firm, controls. More particularly in a subsequent paper, Barney (1991a) specified the two fundamental components of the RBV.

The first component is resource heterogeneity; assuming firms as bundles of productive resources, with different firms possessing different bundles of resources. According to Penrose (1959) who set the foundations of the RBV, it is the heterogeneity (and not the homogeneity) of the productive services available or potentially available from its resources that gives each firm its unique character.

According to this view, the distinctive competencies of a firm are those attributes that enable firms select and pursue strategies more efficiently and effectively than others (Selznick 1957). In this sense, varying routines attained over time (Nelson & Winter, 1982a), the distinctive ways resources are managed and things are accomplished within the enterprise' (Teece et al., 1997), as well as the significant differences in strategies and capabilities amongst enterprises (Wernervelt, 1984) are important sources of heterogeneity which can result in enhanced performance and ultimately be the source of a sustained competitive advantage (Barney, 1991a).

The second component is resource immobility; assuming that some of these resources are either costly to copy or inelastic in supply. In order for an organization to have the

potential of sustainable advantage the resources should have four attributes (Barney, 1991a):

- must be valuable in the sense that it has the ability to reduce cost or increase the price of the product/service (Dess et al., 2007), and hence provides opportunities or neutralizes threats to the organization's environment;
- must be rare amongst the firm's current and potential competitors. If this bundle is not rare, then other firms are capable of conceiving and imitating the same strategies (Johnson et al., 2005);
- must be non-substitutable i.e., there cannot be strategically equivalent substitutes for this resource that are valuable but neither rare nor imperfectly imitable (Dess et al., 2007);
- must be imperfectly imitable. More particularly the term refers to the difficulty that competitors may face in imitating or substituting an identified resource that confers value in a successful organization (Taylor et. al, 2015). Resources can potentially be imperfectly imitable in cases of unique social conditions, casual ambiguity and social complexity in the nature of resources (Barney, 1991a).

Hence, RVB also concerns the valuable and rare combinations of resources whose internalization and exploitation potentially may also give rise to competitive advantages that are difficult and costly to imitate or substitute (Madhok, 2000, Barney, 2001).

As resources shape the scope and direction of the search for knowledge (Penrose, 1959), resource management and the capability portfolio are also key determinants of the configuration and boundaries of the firm. In the respect, the resource view of the firm emphasizes that vertical integration may be seen as an adaptive response to a to a product differentiation strategy, driven rapidly changing and volatile markets, new disruptive technologies and worldwide competition (Olmos et. al, 2016).

Barney (2001), denotes, at least, three explanations why firms should vertically integrate into business functions where they currently relish a competitive advantage. First, hierarchical governance can enhance the likelihood of being able to keep the

sources of their competitive advantage proprietary. Second, vertically integration gives rise to the firm´s chance to be able to appropriate the economic rents that a source of competitive advantage may generate. Third, a source of competitive advantage can be considered sustained if it is valuable, rare and costly to imitate; the resources and capabilities involved in this particular function have been built up over long periods of time and are socially complex. Therefore, in order to acquire competitive advantages from governance choices, it is necessary to introduce more heterogeneity to the application of these logics than have traditionally been introduced (Caldeira et. al, 2005).

As increased control over adjacent phases of production may enhance a firm's ability to differentiate its product (Porter, 1980), Rawley & Simcoe (2010) also underline the interdependence exhibited between value creating functions undertaken by firms and their selection of diversification strategies. To this end, a large corpus of SM literature suggests that firms seeking product differentiation are encouraged to vertically integrate, in order to allow for greater product and process quality enhancements through the control of the input quality and output distribution and service (Kumpe, & Bolwijn, 1988, Hill & Jones, 2008). In turn Olmos et. al (2016) and Olmos & Martinez (2013) suggest that firms seeking to have highly differentiated products are associated with a greater likelihood of internalizing production through vertical integration. Their empirical evidence indicate that firms vertically integrate to mitigate opportunism, to deal with unforeseen contingencies, to internally exploit their capabilities and to improve their success in vertically differentiating their products.

For Madhok (2002) however, since each firm has a basic area of competence, gradually accumulated through experience, this becomes the source of its competitive advantage as well as a competitive constrain. On the one hand, overextension of its activities into domains which are too diverse and dissimilar not only dilutes the strength of its competence, but also increases the costs of organizing in—house due to the lack of experience in these fields; and therefore such a behavior is ill-advised. On the other hand, closely related activities economize on costs since resources and routines can be leveraged across them.

Barney (1999) inclines that the attributes of the capabilities a firm is trying to gain access to, can have an important impact on the firm's boundary choices, suggesting that the firms which are highly skilled across multiple disciplines will be more likely to integrate than other less skilled firms. Argyres (1996) findings suggest that firms vertically integrate into those activities in which they have greater production experience and/or organizational capabilities than potential suppliers, while outsource activities in which they have inferior capabilities, except in cases where explicit long-run decisions are taken to incur the costs of developing in-house capabilities.

Arrow (1962) in turn suggests that production experience provides novel learning opportunities that expand a firm's capabilities. Lippman & Rumelt (2003) also perceive value creation as mainly driven by search for new uses of resources. Expansion of production capabilities through novel skill sets as well as through innovation, are also for Conner (1991) a fundamental driver for both performance and efficiency enhancements. Indeed, Bharadwaj (2000) who also examines the association between firm capabilities and performance, indicates that firms with high (IT in particular) capabilities tend to outperform a control sample of firms on a variety of profit and cost-based performance measures. Leiblein & Miller (2003) too, confer that production experience is likely to enhance the possibility that a firm will choose internal governance along a given technological trajectory. As a result, according to the authors, the greater a firm's production experience over the utilization of relevant process technology, the larger the likelihood to vertically integrate in order to expand the learning opportunities that enhance further its production capabilities.

Finally, another distinctive perspective within SM and RBV, which attempts to explore the determinants of vertical integration is the economics of property rights. According to Grossman & Hart, the inceptors of the property rights theory of the firm, ownership is defined as residual rights of control (Grossman & Hart, 1986). Property rights held to a firm's attributes consist of the right to consume, obtain income from and alienate these attributes (Alchian, 1977). According to this view, ownership and control over the firm's physical and intangible key assets/resources (i.e., intellectual property, know-how, etc.) is a way to distinguish between the governance of internal

organization and those of market transactions, where ownership confers the authority to determine how these assets will be utilized. More particularly, within this framework, integration matters because it determines who gets to control assets, make decisions, and allocate the profits that result from the production process. For Kim (2019) the choice between alternative governance mechanisms (internalization or outsourcing) is efficiency oriented, meaning that there are performance implications depending on the different types of governance mechanisms employed.

As such, property rights become an important strategy, as a resource owner's ability to create, appropriate and sustain value from resources partly depends on the property rights that he or she hold and how well they are protected (Foss & Foss, 2005). Protection efforts according to the authors, revolve around making and keeping resources costly to imitate or substitute while in addition property rights may also be protected by promoting particular governance structures (i.e., vertical integration) which restrict other firms from duplicating the benefits of the selected strategy, while enable their holder to release a sustained competitive advantage.

In conclusion, despite the numerous perspectives of integration provided by SM and particularly by RBV scholars, which encourage dialogue while enable to synthesize the rate, direction and performance implications of diversification strategies (Mahoney, 1992) in order to provide a rich and rigorous theory of the strategic firm (Rumelt, 1984), Balakrishan & Wernerfelt (1986) confer that simple-minded rules of thumb on how and when to apply vertical integration do not exist. Decisions on the integration levels will in contrast require and should be judged through an in-depth assessment and analysis of the particular context and market environment.

2.3.3 Conglomerate Integration

A final form of integration, is conglomerate integration which is often defined as a merger where the relationship between the involved firms is neither purely horizontal nor vertical (Schlossberg, 2004, E.C, 2008). OECD (2017) adds to the above definition, that the involved firms neither produce competing products nor are in an actual or potential buyer-seller relationship, while in addition suggests that conglomerate mergers do not involve the removal of an actual or potential competitor from the

market as in horizontal mergers, nor do they involve firms at different but complementary levels of production or distribution chains as in vertical merger.

Hurley (2006) classifies conglomerate mergers into three distinct categories; product extension mergers, market extension mergers and pure conglomerate mergers. More specifically, according to the author a product extension merger is one in which the products of the acquired company are complementary to those of the acquiring firm and may be produced with similar facilities, distributed through the same channels and in the same manner. A market extension merger in turn, occurs between two non-competing companies selling similar products in different geographical locations while finally, a pure conglomerate merger exists where the economic relationship or motives between the acquiring and the acquired firms is less clear.

As to the driving forces behind the conglomerate formation, proponents of conglomerate mergers have suggested that such mergers permit companies to increase efficiency in a number of ways. Dean (1969) stresses amongst other the operating efficiencies achieved, as a conglomerate firm is the ideal business vehicle to put excess capital to use. The combination of numerous distinct operations under the umbrella of a mother company, allows the conglomerate corporation to create a joint pool of assets that could be disbursed as desired throughout the company's different divisions (Hurley, 2006). As such, according to Dean (1969) funds can be rationed more knowledgeably and efficiently within the corporate fold on the basis of prospective returns, than across corporate boundaries by the cumbersome, costly and relatively ignorant allocation of funds by the impersonal capital markets, where leakages of personal income taxes on dividends additionally deter movement and add to its apparent cost. Motis (2007) also points that the alleged motive in these mergers is the creation of a new larger firm that relocates capital in a more efficient way to generate cost saving and thus larger profits. As result, according to a number of studies, conglomeration can enhance cash management and corporate liquidity (Sagner, 2007, Mooney & Shim, 2015) as well as can reduce the profitability of bankruptcy and lender's risk (Levy & Sarnat, 1970).

Due to better utilization of current assets and liabilities, Sagner (2007) also links conglomeration to opportunities that improve the efficiency of working capital

management. According to Dean (1969) the ability to appraise the performance and potentialities of executives so as to move and promote them to divisions where they will do the "most-good", while making them more accountable for their decisions consist of additional potential sources of superior economic performance for conglomerates. Wyatt & Spacek (1970), also suggest that in the conglomerate era the principal goal is to permit successful management to bring its expertise to bear in a broader business arena. In return the evolving professionalism of management would permit better management and increased efficiency in operation of the acquired businesses as well as higher profits.

Similarly, Kolasky (2001) confers that conglomeration provides increased possibilities for improving management efficiency either through replacement of mediocre executives or by reinforcement of good ones through superior financial control and management information systems, as well as transfer of technical and marketing know-how and best practices across traditional industry lines. Fuchs (1961) who examines the case of American Manufacturers demonstrates that conglomerates are more efficient or at least utilize their personnel more productively than single-industry firms. More specifically his results indicate that for 76 out of 83 industries examined, the value added per employee in conglomerates surpassed that of single industry companies by 18%.

In another recent study, Gill et al. (2016) found that conglomerate mergers play some role in the improvement of the efficiency of working capital management of American production firms. As their results indicate, while firm size increases accounts payables and cash conversion efficiency, it decreases inventory holding days, account receivable days and quick ratio, thus suggesting a co-relational association of conglomerate mergers and increased efficiency of working capital management.

For Lebowitz (2009) in turn, the movement of corporations into different spheres of production occurs as capitals compete to expand and diversify in order to maximize their individual rate of self-expansion. Diversification is thus for the author, the manifestation of conglomerate integration which is in turn the manifestation of the capitals' tendency to become One. Hurley (2006) from another point of view, confers that conglomerates value corporate diversification not only as a way to increase the

efficiency of their firms, but also as a way to reduce the risks associated with operating a business entity. For this reason, he suggests that by acquiring companies in multiple non-related markets, conglomerate firms can reduce the risk by eliminating the company's dependence on a single product line in a single market. Risk reduction through pooling is thus another justification often invoked to justify conglomerate mergers (Mueller, 1969). Amihud & Lev (1981) also stress risk reduction as a primal managerial motive for conglomerate mergers. The argument here is that a portfolio of unrelated activities allows a more predictable and certain level of profit and reduces the overall degree of risk experienced (Hill & Pickering, 1986). In contrast to a specialized firm which cannot divert income from other lines of business, conglomerates, apart from diverting can also borrow funds on the basis of their multiple operations and their large size more readily than single-industry ones, who must ask creditors to put their eggs into one basket (Edwards, 1970).

Diversification, in addition enables firm expansion without bearing the risk of having to pay transaction costs tied to the exploitation of synergies in a contractual fashion. More specifically, while diversification often occurs throughout related industries, conglomerates can at times claim substantial synergies from non-industry-specific economies of scale and scope (Pozzi & Vasilopoulos, 2007). In fact, many authors focus on the synergistic effects of the conglomerate mergers. Within this literature Seidman notes (in Hurley, 2006) that the rationale for the conglomerate movement has been the injection of an element of synergy while also Malkiel (1999) suggests that conglomerate growth has to be interwoven with synergism. In turn, Mueller (1969) suggests that three synergistic effects are put forth to justify conglomerate mergers within literature. First, comes the argument that management, which has an amorphous substance, can be applied with equal success across totally unrelated lines of business. Second in line comes the argument of finance. In his view giant conglomerates with large annual cash flows have access to outside funds at the lowest attainable rates and as such small firms can benefit from being absorbed by a larger firm by gaining access to cheaper capital. Closely related to the above, is the final argument which suggests that conglomeration leads to the reduction of risk through pooling. Finally, Williamson (1975), stresses that due to commonalities in technologies

or economies of scale, firms may profit from synergies through the allocation of internally generated cash flows across different businesses.

In contrast to the advocates of conglomerate mergers, the U.S Congress Committee on Small Business (1980) as well as academics as Mueller (1970, 1977) amongst others have questioned the net economic benefits for the firms involved. Mueller (1970) in particular, while researching on empirical literature, finds that some conglomeration drivers (such as the synergistic effects) lack strong empirical support while others generate the opposite results; to conclude that conglomerates on average have not generated extra profits for the acquiring firms nor have resulted in increased economic efficiency.

For Hill & Pickering (1986) the conglomeration wave during the 60's and henceforth was the result of heightened merger controls, in response to the increasingly concentrated structures of many industries, which severely restricted further opportunities for horizontal and vertical integration. Whereas horizontal and vertical mergers posed antitrust concerns, conglomerate ones did to a lesser extent because they did not necessarily have an impact on the product market and therefore on welfare (Motta, 2004). As antitrust and competition authorities conferred that conglomerate mergers do not involve an extension of market power in any market and hence do not raise any grounds for competition policy intervention, merger policies became more favorable to conglomerate mergers than to horizontal or vertical ones. Hence, conglomeration was utilized by firms as an alternative vehicle of expansion.

A Bundeskartellamt (2006) report suggests that from early 70's, courts in U.S increasingly began to set higher demands on the proof of anticompetitive effects in the case of conglomerate mergers, resulting in a significant drop in the success rate of plaintiffs' court proceedings against such mergers. The report specifically, refers to the untranslated work of Dreher (1987)[10] who recorded the success rate of court proceedings for the 1964-1974 decade to lay at 11 out of 21 cases, while for the

[10] Dreher, M. (1987): Konglomerate Zusammenschlüsse, Verbotsvermutungen und Widerlegungsgründe, Berlin.

proceeding decade (1974-1984) only to 5 out of 31. As of the enforcement of the U.S Non-Horizontal Merger Guidelines, which are still in force, the elimination of potential competition could be the only possible basis for intervention by the competition authorities. The mainspring idea behind this theory, is that competition in a market is impaired when a large firm that could have entered the market is eliminated as a potential entrant by merger (Posner, 1970)

Apart from the elimination of potential competition however, Bundeskartellamt (2006) report refers to three additional theories of harm, on the basis of which prohibitions and consent decrees on conglomerate mergers were issued prior to the to the enforcement of the U.S Non-Horizontal Merger Guidelines (1984). These theories of harm can be condensed into three groups, which do not preclude one another:

- **The Entrenchment Doctrine**: which occurs when a conglomerate enters in an oligopolistic market by acquiring a firm that holds a significant position in the target market (Lord, 1982) According to the author a number of factors have emerged as fundamental to identifying entrenchment. The acquiring firm is necessarily a large firm or "giant" with considerable economic power. The acquired firm is a substantial, but not necessarily the dominant factor in a target market, that is highly concentrated or oligopolistic. The target market, either because it is highly concentrated or because of the nature of the goods produced, exhibits high barriers to entry. The merger must provide opportunities for the acquiring firm to transfer substantial competitive advantages to the acquired firm. Finally, apart from the element of synergy, which is entailed in most entrenchment cases, the merger must also rigidify or increase market concentration (Lord, 1982).

  That being said, McKinney's (1969) suggests that conglomerate mergers might hinder competition not only by eliminating a direct competitor or foreclosing a market, but also by creating an increase in the relative size of the enterprise making the acquisition to such a point that its advantage over its competitors threatens to be decisive. As such, the allegedly entrenching merger, through the conjunction of a conglomerate and an oligopolistic market can be a

potential source for significant anticompetitive effects due to an increase in economic power, particularly in terms of financial power and its consolidation by the use of brand names (Bundeskartellamt, 2006).

According to McKinney (1969), at the time, several courts, have considered this theory and have used it to invalidate conglomerate mergers in certain market situations. Although these cases involved disparate circumstances, each contained certain common factors. In general, a large and powerful company acquired an incumbent firm in an oligopolistic market and the court found that the stronger company could transfer its financial power either directly or indirectly to its new line, thereby augmenting or entrenching the market position of the acquired company. In addition, courts indicated that the financial power could be utilized either to aid the smaller firm gain sectoral competitive advantages (in marketing or promotion) or to engage in predatory pricing (McKinney, 1969).

Owing to the conglomerate's big size and its diversification, the latter can achieve costs reductions in a number of ways; through economies of scale and predatory pricing as well as by having "deep pockets", and can thus deliberately undercut competitors' prices for the purpose of achieving the benefits of a dominant position thereafter, driving those competitors who cannot meet the lower prices, out of the market (Lord, 1982). Due to the enlarged disparity in financial resources between a conglomerate firm and its market rivals, smaller firms out of fear of retaliation measures on behalf of the newly enriched competitor against any company instituting a price move, could either be discouraged from engaging in a vigorous competition, or encouraged instead to obtain similar resources by seeking out a comparably sized merger partner (Congress U.S, 1980). Therefore, as a result of the size and diversity of the company, a conglomeration could impair competition in any of the markets it enters by raising barriers to entry, and dissuading other companies to enter the target's market, as well as by providing the smaller acquired firm with access to its arsenal of marketing, financial, and managerial advantages (Hurley, 2006).

In addition, Sullivan (2019) observes that especially in oligopolistic markets with few sellers and unattractive opportunities for entry, soft competition and conditions close to cooperation and mutual interdependence tends to prevail, which in turn enhance the ability of larger firms to tacitly collude. However, while antitrust enforcement under the non-horizontal Merger Guidelines, requires (DOJ, 1984, EC, 2008) the existence of an agreement to intervene, these anti-competitive patterns of integration can arise without any express agreement between competitors, though the results are the same as explicit collusion, if not worse. As such the author confers, that merger enforcement is currently poorly equipped to handle with cases in which tight oligopolistic coordination is already underway.

Respectively, for Sullivan (2019) failures to intervene in addressing issues of tacit collusion and/or of market power (in the form of scale and network effects as well as other similar barriers to entry) in this type of markets, are likely to result in the continued and presumably durable exercise of that power into the future. For this reason, the author proposes instead, a novel approach to antitrust enforcement, through the reenactment of the entrenchment theory as extension of the prophylactic potential of merger control and as a vehicle for addressing problematic markets in the modern antitrust framework.

- **The Reciprocity Argument:** which in a conglomerate merger context, involves the acquiring firm's utilization of purchasing power to induce its customers or suppliers to transact future business with the acquiring firm (Bundeskartellamt, 2006) has been also used to invalidate conglomerates mergers (McKinney, 1969). According to Doyle (1981) the term "reciprocity" embraces a variety of business relationships, which may be classified into three categories. Coercive reciprocity involves the use of a threat or of economic leverage by a purchaser to either withdraw purchase orders or withhold future purchases unless the disadvantaged supplier makes reciprocal purchases. Mutual or consensual reciprocity, which stems from the possibility of mutual benefit, is a voluntary arrangement between two companies of relatively equal bargaining power. Finally, unilateral reciprocity occurs when, absent of an

agreement between the parties, a supplier voluntarily purchases from a firm to which it hopes to sell its own products.

Although reciprocity is not unique to conglomerate corporations, the increase in the number and size of conglomerations, highlights the potential threat of reciprocal buying and selling as diversification enhanced the ability of a conglomerate firm to engage in this anticompetitive practice (Yale – Brozen, 1982). While this diversification from one spectrum can be seen as a potential benefit to economic efficiency of a conglomeration, a company that can purchase many of the products and services it needs from within its own divisions could damage the potential business partners in their respective markets (Hurley, 2006). For Burrus (1965) the vice of practicing reciprocity is that it distorts the focus of the purchaser by interposing between him and the traditional standards of price, quality and service, an irrelevant and alien factor which is destructive of fair and free competition on the basis of merit. OECD (2001a) too, while suggests that when complementary products are merged, there is a potential for considerable synergies that could benefit buyers, it also acknowledges that there is also an increased potential for forced tying, pure bundling or analogous practices that could restrict buyer choice. As such the report confers that under certain circumstances, consumers may gain in the short run but suffer long term harm from such practices, if they eventually result in a sufficient reduction of competitors and capacity in the market.

Doyle (1981) in turn, confers that the cost of such a distortion in the competitive market selection process may ultimately be borne by the consumer in the form of higher prices or inferior product while McKinney (1969) reports a case were the court found that there was substantial evidence both that reciprocity was practiced after the merger and that the practice led to an increased market share. In addition, amongst the congeries of anticompetitive practice made possible by reciprocal dealing and purchasing of conglomerates are according to Doyle (1981) the significant barriers to entry raised, making firms without reciprocity power reluctant to enter such a market as well as the creation of market foreclosure effects in a similar way as

in vertical mergers (Bundeskartellamt, 2006), where non-diversified firms which do not have reciprocity leverage will be foreclosed from the market.

As with the preceding theory of harm, McKinney (1969) suggests that reciprocity and reciprocity effects have significant limitations as methods of challenging conglomerate mergers, as in the most cases there is no guaranty that the merger will substantially increase opportunities for reciprocity; and even if it does, proof of probability may be difficult in many cases. Doyle (1981) in turn, views the revitalization of the reciprocity theory and/or the enactment of new legislation applicable to conglomerate mergers, as the only way to prevent further concentration control the anticompetitive effects of conglomerate mergers.

- **The Increase of Aggregate Concentration:** according to this theory of harm, which was advance by the U.S Department of Justice but was never embraced by any court, the anticompetitive effect already lies in the increase of the aggregate concentration (Bundeskartellamt, 2006). Aggregate concentration denotes the concentration of economic assets in general, without reference to concentration in any particular industrial sector. This approach, centering specifically on the economic, political, and social consequences of increased conglomeration and economic concentration suggests that as conglomerates prevail over competitors in the market, the mere increase of aggregate concentration in assets should in itself consist of a probable factor for lessening competition, and thus of a probable reason for preventing conglomerate mergers (McKinney,1969).

  The surge of conglomerate acquisitions has attracted widespread public attention to the problems[11] of conglomeration and aggregate concentration and has stimulated a re-examination of the viability of federal antitrust merger law to deal with these problems. In this context, several legislative proposals have been put forth, to prohibit conglomerate mergers on the basis of the size

[11] Doyle (1981) summarizes the political and social consequences attributed to increased conglomeration and aggregate concentration include: the emergence of business corporations as a pre-eminent lobbying force in the political (U.S) process; the upset of the balance of power between labor and management; the disappearance of small businesses; and limited opportunities for self-fulfillment through economic roles.

of the merging parties. Doyle (1981) specifically refers to two such proposals which could accomplish the goal of halting the conglomerate merger movement and the growing trend toward increased aggregate concentration. One in which mergers are prohibited, if the assets or sales of one of the merging entities exceed a specific amount, unless positive societal benefits from the merger can be demonstrated. A second proposal, advanced by the Federal Trade Commission which embodies a so called "cap and spin-off" approach, which allows acquisitions by large firm so long they are accompanied by the divesture of other viable entities equivalent in size to the acquired firm (Doyle, 1981).

The enactment of the U.S non-horizontal merger guidelines by the U.S Department of Justice, lead to a complete reversal[12] in U.S antitrust practice through the abandonment of the abovementioned theories of harm. Characteristic is the fact that since the abolishment of such weapons from the antitrust arsenal, no known case in U.S practice of conglomerate mergers have been prohibited (Bundeskartellamt, 2006). According to the novel view in U.S antitrust policy, instead of ex-ante measures, prohibiting mergers having potentially harmful effects, competition agencies should instead take a wait and see attitude, intervening only as long as the negative effects actually materialized (OECD, 2001). Instead, the enforcement of ex-post measures of abuse control, such as claims for damages and fines, were considered as an effective deterrent mechanism against possible abusive behavior (Bundeskartellamt, 2006).

A contrario, the approach adopted by the E.C, even before the formulation of the non-horizontal merger Guidelines issued in 2008, which led to the prohibition of two conglomerate mergers by E.U courts in early 2000 (General Electric/Honeywell & Tetra Laval/Sidel solely overruled in E.U), has triggered important changes by clarifying the standards of proof and review that apply in E.U merger control with respect to conglomerate mergers, making clear that what matters is the incentive rather than the ability to implement a strategy, as anti-competitive effects cannot be presumed

12 According to the author, a significant factor towards the liberalization of U.S antitrust policy was the prevalence of the neoliberal Chicago School, and the positioning of its representatives by the Reagan Administration as heads of the U.S competition Authorities.

(Neven, 2008). As such, in the EC's non-horizontal merger Guidelines (2008), the Commission while acknowledges that conglomerate mergers in the majority of circumstances will not lead to any competition problem, suggests that in certain specific cases there may be harm to competition. Unlike the U.S antitrust practice, in the E.C's Guidelines, which although do not directly incorporate or refer to any of the U.S theories of harm, elements and notions of these theories can be identified. Similarly, to the cases of horizontal and vertical integration, E.C categorizes the potential anti-competitive "conglomerate effects" into two categories; those of non-coordinated and coordinated effects.

As far as the non-coordinated effects are concerned the main anti-competitive effect of conglomerate mergers is that of foreclosure. As laid down in the E.C's Guidelines (2008), the combination of products in related markets may confer on the merged entity the ability and incentive to leverage a strong market position from one market to another by means of tying or bundling or other exclusionary practices. Under certain conditions, the Guidelines, continue, these practices may eventually lead to a reduction in actual or potential rival's ability or incentive to compete, reducing the competitive pressure on the merged entity and thus allowing it to increase prices.

Respectively, with regard to the coordinated conglomerate effects, conglomerate mergers according to E.C (2008) may in certain circumstances facilitate anti-competitive coordination in markets, even in the absence of an agreement or a concerted practice. In this respect, similarly to horizontal mergers, the framework applied suggests that tacit coordination may lead to the reduction of the number of effective competitors, and thus impede competition.

However, while recent decision and pending cases reveal an increased pursuit of conglomerate cases on anti-competitive effects by the Commission, enforcement of anti-competitive policy has been in most cases rather soft. With the exception of Essilor/Luxottica and Bayer/Monsanto, in all other cases examined and cleared by the EU, remedies were requested to address the conglomerate concerns, the majority of which were behavioral remedies in the form of assurances that the parties will not eliminate competition as opposed to structural remedies, which are preferred in cases of horizontal effects (Sakellariou & Jeram, 2018).

Thus, while the E.C's guidelines provide a more holistic framework to analyze and identify the potential anticompetitive effects of conglomerate mergers than the respective U.S ones, the belief that ex-ante measures such as prohibition or clearance, will diminish (in the majority of cases)the efficiencies of conglomerate mergers has become dominant in both sides of the Atlantic. To this end, on the one hand the favorable treatment of conglomerate mergers in U.S and the soft approach through the enforcement of remedies in E.U on the other, have so far led to the unconditional rise of several conglomerates on multi-service and multi-product sectors.

Figure 7. 10 Major Food & Beverages Conglomerates

Source: (Journal, 2016)

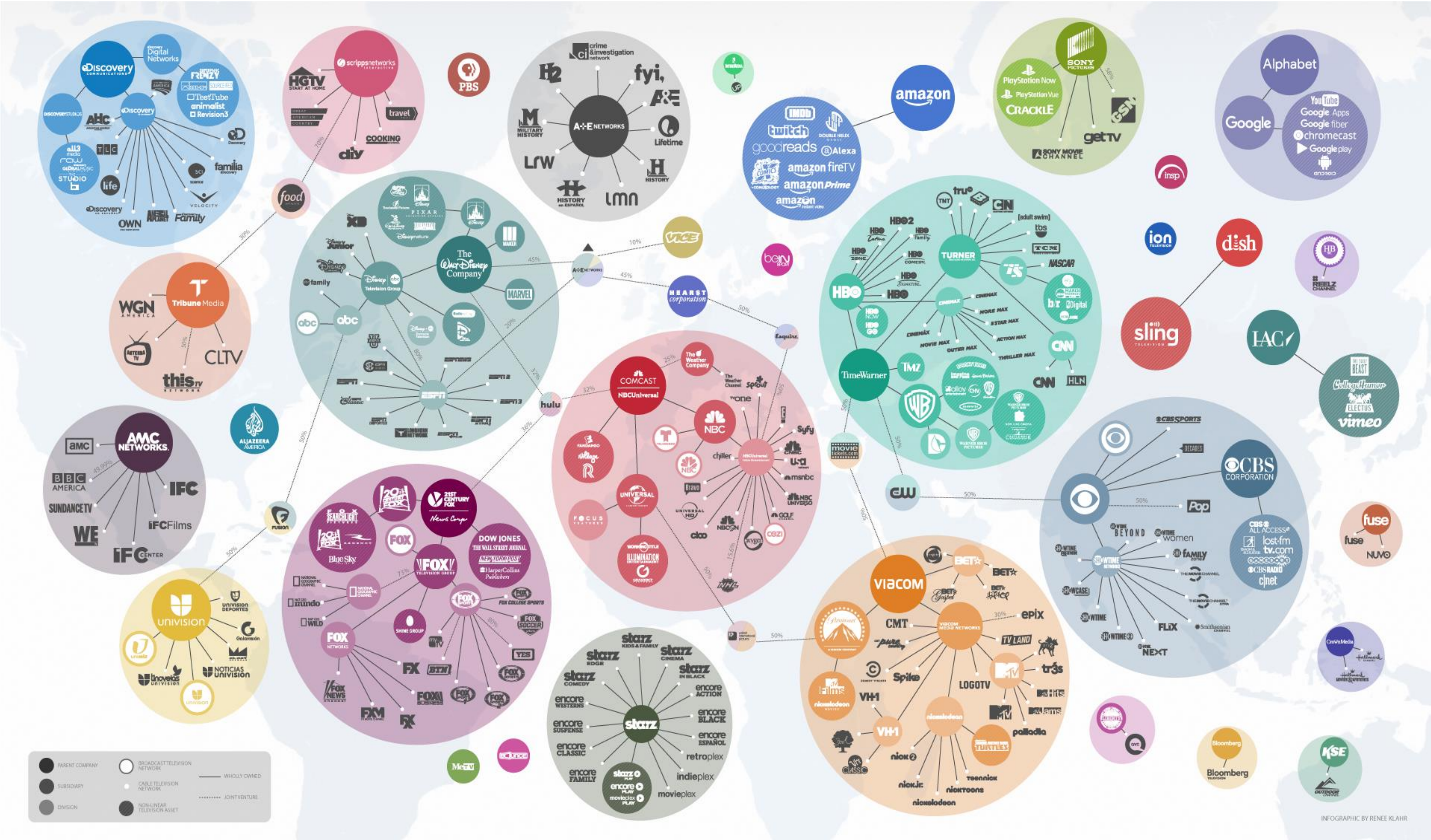


Figure 8. Major Media Conglomerates

Source: (Reneeklahr – wordpress, 2018)

2.4.1 The circuit of capital & the creation of surplus value

Now let us turn, into the process which is the locomotive force of accumulation; the expansion of capital's value, i.e. the production and appropriation of surplus value. Marx (1988) argues that capital accumulates through a perpetual circulatory process, through which capital's consequent metamorphoses in form, expand and valorise its initial value. He describes capital's movement as a circuit, within which capital assumes and sheds three forms, namely the money-capital, the productive-capital and the commodity-capital forms, that replace each other successively before returning to its initial form. Although each form has a distinct circuit, and hence a distinct point of departure and return, all have self-expansion of value as their common purpose, representing in their unity the self-valorising circuit of industrial capital, expressed in the **general formula of capital**: $M - C - M'$.

According to the inceptor, the circular movement of industrial capital takes place in three connected and mutually determined phases:

a) the initial phase $M - C(= Mp + Lp)$, where a quantity of money-capital (M) is advanced and exchanged for the purchase of the elements ("commodities") of production i.e. constant capital (C) or else means of production (Mp) and variable capital (V) or else labor power (Lp), so that the initial capital advanced is equal to the sum of Constant and Variable capital purchased, i.e. $M = C + V$. Constant capital is the part of money capital expended to purchase means of production, while variable capital the part respectively which is expended to purchase labour power (Mp). The sum of money capital (M) exchanged for the acquisition of commodities (C) of equal value, is in turn equal to the latter's constituent components, Mp + Lp, and hence a more detailed representation of this first phase of circulation of money capital would be: **M – $\boldsymbol{C_{Mp}^{Lp}}$.**

b) the productive phase of capital[13]. As soon and as long as Mp and Lp are acquired, money-capital transforms into productive-capital, functioning within the sphere of production. In the production phase $M - C(= Mp + Lp) \dots P$, circulation halts while money-capital (M) (purchased elements of production) transforms into productive-capital (P), functioning within the sphere of production for the purpose of creating a novel commodity of altered substance and of increased value, "as the new product is not just a commodity but a commodity impregnated with surplus-value (s) attained, by the expropriation of surplus-labour" (Marx, 1988). The new product embodies both the value attained by the functioning of Mp, as well as an additional increment of value attained by the expropriation of surplus-labour, the surplus-value (s). As such, the value of the output of production (P') is equal to the value of productive capital exhausted in production, plus the surplus value created by it, i.e., **P'= P+ s**.

c) the final phase $P \dots C'(= C + c) - M'(= M + m)$, where as a result of production $(..P..)$, capital assumes its new commodity form[14]. (C'), which embodies the capital originally advanced $(M = P = C)$ as well as a surplus-value (s) derived during production $(s = c)$. The new commodity of increased value $C'(= C + c)$, must then be sold in the market to be converted again into money-capital (M'). The reconverted money-capital, is also of greater value than the originally advanced $M'(= M + m) > M$, as it contains the surplus-value attained during production $(s = c = m)$.

However, to realize its inner value commodity capital must be sold in the market, and thus it should reenter circulation in order to be reconverted into money (C' – M').

[13] The circuit of productive capital has production (P) as the point of departure/return and hence its circuit is P...C'– M'. M – C... P.

[14] Respectively, the circuit of commodity capital has the new commodity (C') as the point of departure/return and hence its circuit is C' – M'. M – C …P….C'.

Circulation is, therefore, the antithesis of production; whereas value is created in the sphere of production, it is only realized and posited in its form(s) in the sphere of circulation (Kjosen, 2019).

M' is solely the outcome of the realization of C', as both represent different forms of self-expanded capital value (Marx, 1988). Capital value advanced continues to exist here along with the surplus value, resulting in an M' which is also greater than the M originally advanced (M' = M + m). The antithetical to the M – C process of C' – M', completes the circuit of capital by returning to the point of its arrival, only this time with an augmented capital value. The novel sum of money capital at hand, can initiate the industrial circuit once more, to perpetuate the further expansion of value (through the conversion of a portion of surplus value into additional capital that in turn will allow expansion in the scale production, investments in other sectors), the making of money and hence the process of accumulation.

In this sense, the embarkation of the M – C – M' cycle for industrial capital and its limitless repetition, according to Hean et. al. (2003) does not aim in procuring commodities with use-values but instead aims to sell them in order to generate a profit that can be diffused afresh within the circuit

By aggregating the above transformations, which industrial capital undergoes to augment its value, a complete capital circuit could be represented according to Marx (1988) in the following formulas:

$$M - C \dots P \dots C' - M'$$[15]., or in its expanded form as

$$M - C(= Mp + Lp) \dots P \dots C'(= C + c) - M'(= M + m) \text{ (1).}$$

In addition, Figure 9., depicts capital as a unity of the spheres of production and circulation, i.e., of the three successive phases of purchase (M – C), production (P) and

[15] Lines (- -) in the above formulas, indicate acts of exchange undertaken in the process of circulation while dot (…) signal the interruption of circulation for the operation of process of production.

sale (C'-M') as well as of the three forms it attains, i.e., money capital (M), productive capital (P) and commodity capital (C') (Kjosen, 2016).

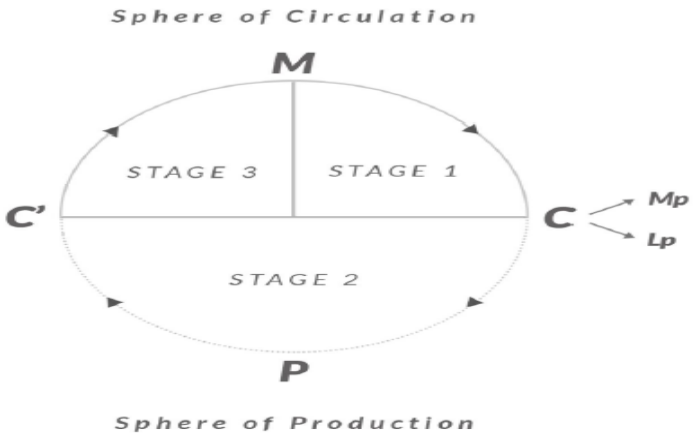


Figure 9. The circuit of industrial capital

Source: (Kjosen, 2016)

The perpetual repetition of industrial capital's circuit allows us to observe and distinguish in addition to the money capital circuit, the respective circuits of productive capital as well as of commodity capital, as illustrated in the Figure 10. For Passarela & Baron (2013) the perpetual repetition of industrial capital's circuit, insofar a constant share of the surplus-value is reinfused in the productive circuit, will eventually lead to the increase of capital accumulation and hence of industrial concentration.

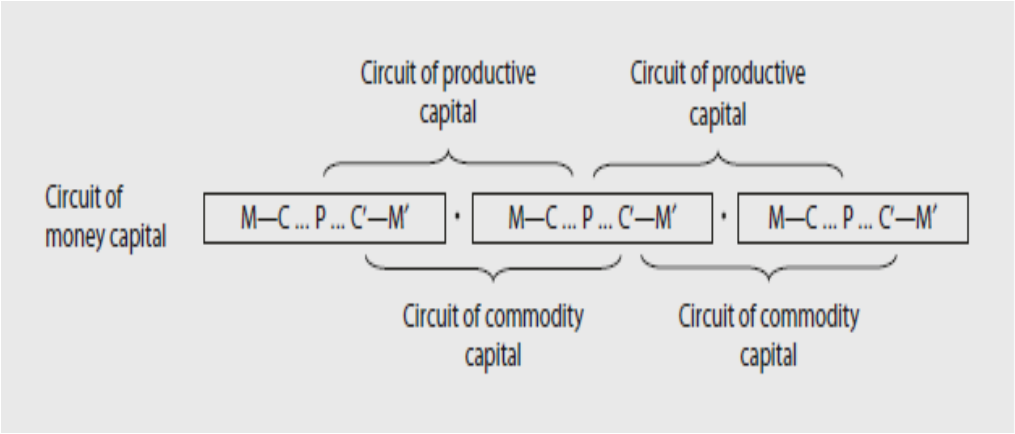


Figure 10. The circuit of capital in its three forms

Source: (Otani, 2018)

2.4.2 The turnover time of capital

As illustrated in the section above, the circuit of capital necessitates the locomotion of capital through the sphere of production (P) as well as through the two stages of circulation (M – C & C'- M'). Marx (1988) distinguishes, the duration of capital's sojourn in the former sphere as its time of production while that of its stay in the latter sphere as its time of circulation. Production time is the working period during which the processed product is subjected to the direct effect of labor, while circulation time consists of the time of buying and the time of selling, with the latter being one of the most critical periods, as capital in its commodity form awaits to be exchanged and sold in the market. The sum of time elapsing during production and circulation, in order for capital to be reproduced and perpetuate its expanding circuit, is thus its turnover time. As Marx (1988) puts it:

"Is the period of time from the moment of the advance of capital-value in a definite form to the return of the functioning capital-value in the same form".

This process, however, necessitates the passing of a series of time. The faster or slower pace with which capital transits from one form to another will also eventually determine the length of its turnover time and hence of the period of its expanded reproduction. For example, if the turnover time (n) of a specific capital is 4 months (t), then the number of its circuits in one year (T) will be: n= T/t = 12/4= 3 circuits per year, while if the turnover time is 24 months, then n=12/24 = 0,5 circuits per year, meaning that capital will go through half of its circuit.

In this respect, turnover time is one of the most critical factors in direct relation to profitability. For this reason, the imperative of capitalist production, is to minimize both the processes of production and circulation (Harvey, 1989). On the one hand production is subject to constrains and interruptions caused by subjective factors (such as the duration of the labor day, time to process materials and transform them into commodities, type of technology and machinery utilized), however, the major factor limiting its functioning is the duration of circulation (Kjosen, 2016). Time of production and time of circulation according to the Marxian analysis (Passarella & Baron, 2013) are mutually exclusive, meaning that time of circulation limits/interrupts

the functioning and therefore the efficiency of productive capital in direct proportion to its duration.

Hence, the contraction or expansion of the selling time, operates as a negative limit to the respective contraction or expansion of the time of production. Thus, the more the time of circulation is shortened, approximating to zero, the more productive capital functions and hence the more its productivity and augmentation increases (Marx, 1988).

On the other hand, circulation time is also subjected to constrains; the major of which is the distance needed to be travelled by the commodity capital to reach its destined market. According to Marx (1988), circulation may require the locomotion of products in space, i.e., their physical movement from one location to the other. This time interval, which depending on the distance expands or contracts also the time of selling, should be added to the time of circulation.

Especially, in a world of globalized production and consumption, where the majority of commodities produced migrate towards distant markets, the physical distribution of commodities necessitates a medium to carry out their circulation. As such, activities of transport and logistics become capital's indispensable media of circulation (Manzerolle & Kjosen, 2012, Kjosen, 2016). However, as production and reproduction of industrial capital is restricted by its time of circulation, transport and logistics sectors who act as a continuation of production, are also impregnated with capital's logic of shortening the former's duration.

From such a perspective, the immense evolutions and innovations in transport and telecommunications, led to productivity increases which in turn not only made circulation possible by enhancing its velocity and accelerating industrial capital's turnover time, but also enabled the expansion of the respective sectors, as distinct spheres of investment and of surplus-value creation, with distinct and independent to the industrial capital's, capital circuits. Thus, as Marx argues in Grundrisse, the duration of one capital's production time (in particular of transport) determines the velocity of the other's (industrial capital's) circulation time (Marx, 1973).

Hourwich (1984), was one of the first to attribute the rapidity of rotation of capital and its positive impact on surplus-value and profits as being an outcome of advanced machinery. Passarella & Baron (2013) also stress that a reduction of turnover-time leads to an increase in turnovers in a given period of time and hence in the rate of surplus-value absorbed. As they illustrate, every reduction in the turnover period involves a proportional increase in the rate of profit (calculated as the ratio between surplus-value and total capital employed in the production process). In the antipode, Harvey (2018), denotes the side-effects of capital's pauses within its circuit. As he notes:

"Capital is value in motion and any pause or even a slowdown in that motion for whatever reason means a loss of value, which may be resuscitated in part or in total only when the motion of capital is resumed. 'When capital takes on a particular form –as a production process, as a product waiting to be sold, as a commodity circulating in the hands of merchant capitalists, as money waiting to be transferred or reinvested – then capital is 'virtually devalued'. Capital lying 'at rest' in any of these states is variously termed 'negated', 'fallow', 'dormant' or fixated' (Harvey, 2018)"

Wani & Wani (2015), in line with Harvey's analysis, suggest that the more production halts on exchange, the more important the physical conditions of exchange become and as such increasing integration and innovation become in turn a necessity to overcome and shrink the relative distances to the minimum by enabling a "time space compression". With the mass of commodities in the contemporary world requiring physical distribution in order to overcome the barriers of space, time and perishability, transport necessarily intervenes between production and consumption, of each commodity circulating in space, producing the necessary accessibility to underwrite the circulation process (Sheppard, 1990). Therefore, since production time of transportation, can be directly translated into a component of circulation time of the industrial capitals whose commodities are transported, any productivity increase in the branch of transport can in turn lead to reduced circulation times for those capitals that are dependent on transport (Kjosen, 2019).

Having exhausted the potential to squeeze production time further through labor-substitution technologies and automation in manufacturing plants, the interest for

turnover cuts as well as profits was shifted in the sphere of circulation and particularly in increasing the velocity and efficiency of international commodity circulation (Chua, 2020). This evolution eventually is the key for understanding the rise of the importance of logistics: in managing a complex network system that transports, stores, distributes and secures the circulation of commodities around the world. The world of logistics has radically restructured the process of capital accumulation; highlighting as never before the imperative to realize surplus-value in a short time and in an extended geographic scale, in order to annihilate space by time and thus maximize profits (Hadjimichalis et al., 2015).

2.4.3 Costs of circulation and the establishment of commercial capital

According to Otani (2018), unlike production costs which are made up of the objectified and living labor expended in the production process, circulation costs respectively consist of the objectified and living labor expended in the circulation process. According to Marx's analysis, two types of circulation costs can be distinguished: pure circulation costs and physical distribution costs.

Pure circulation costs on the one hand, include activities both in the pre-production (time of buying) as well as in the post-production process (time of selling) which facilitate the metamorphoses of capital between its various forms and as such do not produce or add any use value to the commodity (Tregenna, 2009). Such costs, according to the Marx (1988), are just expenses incurred in the process of realization of the value impregnated in commodities and in this sense, the capital spent to cover these costs belongs among the faux frais of capitalist production and should be considered a deduction from the surplus-value generated by industrial capital.

Physical distribution costs on the other, include the logistical activities of transport and storage and therefore we can refer to them as logistical costs. Unlike pure circulation costs, transport is productive of value, with its product being the "change in location" (Marx, 1988). This locomotion constitutes the process of production and the "useful effect" of transport, with its produced value, transferred as an added value to the commodity transported itself. However, this useful effect as Marx (1988) explains, can be consumed solely during the process of production, as transport sector

does not produce a novel commodity and therefore it does not circulate as a commodity.

For this reason, its production time is identical to its circulation time. However, its exchange value is determined similarly to any other commodity by the value of the elements of production expended in it and the surplus value created by it. As a distinct sphere of investment, which however forms a stage in the production of commodities being transported, the circuit of transport as a branch of industry intercepts the circuit of industrial capital, and due to its distinctive characteristics Marx (1988) designates a separate formula for it. The formula representing the circuit of capital within the transport industry is:

$$\mathbf{M - C < ^{ML}_{MP} \ldots P - M' \ (2).}$$

As said, unlike the typical circuit of industrial capital, transport does not produce a novel commodity (C') and therefore, it is the process of production itself that is paid for and consumed, with M' representing the converted form of the useful effect augmented with surplus value created within the process of production.

On the contrary, storage (including also processes of packaging, sorting, loading and unloading) does not increase the value of commodities, however, it aids in maintaining their use values by preventing their deterioration (Otani, 2018). Thus, storage costs are included in the value of commodities, as they constitute a deduction of surplus value created elsewhere. To this extend, storage costs are deemed unproductive however, similarly to transport, storage is of productive character, generating surplus value while acting too as a continuation of industrial capital's production process.

Both transport and storage are thus activities which are augmented with surplus value within the circulation sphere of the industrial capital. Otani (2018), distinguishes such activities, as a distinct and independent branch of social capital, termed commercial capital. However, since demand for transport and storage is derived demand, in order to produce commercial profit, the latter should align and integrate their capital circuits with the respective ones of industrial capital.

2.4.4 Finance capital and the finance capital circuit

The rise of finance capital in the commanding heights of the economy as discussed in 2.2.1, lies in the ever-increasing role of financial motives, financial markets, financial actors and financial institutions in the functioning of both domestic and international economies (Epstein, 2005). The ability of the banking system on the one hand to mobilize through a complex set of mechanisms, hoards of idle money accumulated in the form of a spare reserve fund of surplus value (of reserves, deposits, savings) and then on the other, to transform it into a homogeneous commodity and redistribute it among several functioning capitals, by giving it the character of interest bearing (loanable) capital, consists the foundation of the credit system (Lapavitsas, 1997).

Money as capital, when provided by the lender (i.e., bank) goes therefore through a metamorphosis of M – M'. Value is valorized by just lending money for a period of time and then having it returned with an interest (Otani, 2018). Through such a function, credit acts as a powerful mechanism and a mediator between finance, industrial and commercial capital, enabling the latter to expand output with borrowed funds.

In turn, borrowed funds must be returned with an interest, an interest which is a deduction from their surplus value created in production, and which further expands the hoards of money accumulated by monetary credit. The expansion of credit in every facet of modern life, has thus led to the progressive subordination of industrial and commercial accumulation to the imperatives of finance (Lucarelli, 2011). To this extend, the interplay of credit with industrial capital could be depicted upon the formula of the industrial capital circuit, as illustrated below.

$$Mf - M - C(= Mp + Lp) \dots P \dots C'(= C + c) - M'(= M + m) - Mf' \ (3).$$

M_f symbolizes the interest-bearing capital of the creditor, who lends to industrial capital in the beginning of the latter's circuit while M_f' symbolizes its augmented reconversion at the end of the industrial circuit. As the formula illustrates M_f' should be considered for industrial capital, similarly to the case of the commercial capital, a deduction from its profit. As such, interest bearing capital not only utilizes the profits of industrial lying in the form of reserves in banks to provide credit, but in addition it

augments them by exploiting them. By providing credit to industrial capitalists (as well as to commercial ones), finance manages to control the investment cycle enabling the acceleration of accumulation for the former, while at the same time through the appropriation of surplus value it manages also to expand credit itself.

2.4.5 The composition of capital and innovation

As noted earlier, in the beginning of each circuit, money capital is advanced partly to acquire means of production and partly to purchase labour power, in other words, constant and variable capital. The proportion of capital expended in each of these distinct forms of advanced capital, is referred to as the composition of capital (Marx, 1988). Having appropriated a certain abundance of surplus value, capital of every kind (industrial, commercial, financial) in the struggle of competition amongst firms producing the same use values, is compelled to innovate introducing new ever more productive equipment as well as novel optimization techniques in order to sustain its competitive edge.

In the process of accumulation, Mandel (1992) along with Marx postulate that capital composition undergoes changes, with investment in constant capital increasing at a quicker pace than that invested in variable capital. Saad-Filho (1993) also draws on Marx to make clear that there are three distinct compositions of capital: Technical (TCC); Value (VCC); and Organic (OCC). He demonstrates that the distinction between them can be traced back to the relations between the spheres of production and circulation and argues that it is central for an analysis of capital accumulation and technical change.

To be more specific, for Marx the composition of capital is to be understood both in terms of value as well as in terms of material (Marx, 1988). More specifically:

- *Technical Capital Composition (or capital deepening)* is the expression of the relation between the mass of constant capital consumed in production, to the mass of variable capital required to operate it. This relation, however, is unmeasurable by a single according to Fine & Harris (1979) as it encompasses physical, material quantities.

- *Value Capital Composition* (*or capital widening*) expresses respectively the same relation only measured in terms of values, amongst the value of constant capital and the respective value of variable capital purchased. This relation can be schematically expressed as the ratio of constant to variable capital, i.e., C/V.

The interrelation of the two, as long as the value composition is determined by its technical composition and reflects the changes in the latter, forms according to Marx (1988) the *organic composition of capital*. It is most commonly expressed also as the ratio of constant to variable capital C/V[16], and although often confused with VCC, according to Saad-Filho (2001), OCC is a technological composition that synthesizes in value terms the technical relations of production and specifically the value of the means of production that absorb one hour of labour in a given firm, industry or economy.

The point is for Fine & Harris (1979) that the technical composition is always increasing as accumulation and more productive techniques that increase efficiency are employed. As they suggest, such productivity increases, change the values per unit of means of production and labour power, reducing them in differential rates. VCC is based on these ever-changing values while OCC abstracts from them, and in that sense changes in OCC mirror and are directly proportional to changes in the TCC, whereas changes in the VCC only show approximately the change in the composition of its constituent materials (Fine & Harris, 1979).

To this extend, Marx's (1988) argument about the tendency of the OCC to rise continuously, could be interpreted as a result/effect of the constant struggle to increase the TCC through the introduction of ever more productive equipment and techniques, which on the one hand reduces the value of inputs while on the other increases the value of the output, through the appropriation of an increasing surplus value per unit of output (minimization of costs vs maximization of profits). The effect of this process leads progressively to an increase in the share of constant capital in

[16] Gillman (1957) expresses OCC as the ratio of constant capital to wages, Mage (1963) as the ratio of the stock of constant capital to new value added, expressing the OCC as c/ (v + s) while Sweezy (1968) as the ratio of constant capital to total capital expresses in the formula OCC = C/ (C+V).

proportion to the total capital outlay, and a parallel decline in that of variable capital. As Giammanco (2002) articulates, capital deepening or technical composition is a weapon of competition employed to reduce labor input per unit of product while capital widening or value composition is a weapon employed to increase the profit size, through an increased output at constant technique.

Within this framework, Saad-Filho (2001), distincts the process of growing output associated with the replication of current technologies to that of growing output through productivity increase, referring to the former as extended expanded reproduction and to the latter as intensified extended reproduction. For Shaikh (1990) this struggle is associated with the capitalist rationality which is expressed in the routinization of production, in the reduction of human activities to repetitive and automatic operations and in the eventual replacement of the machine like human labour by actual machines, where the tool from an instrument of labour, becomes the means of labour coordination.

Marx (1973), in a his less renowned passage of “Fragments on Machines”, provides one of his most futuristic insights on the evolution of capitalism, suggesting that the worker’s activity will be reduced to a mere abstraction of activity, determined and regulated on all sides by the movement of automated systems composed by numerous mechanical and intellectual organs. At a certain point of development, wealth creation and appropriation will be growingly dependent on technology and knowledge due to the increasing importance of constant-fixed capital in social organization (Dyer-Witheford, 1999). For Marx (1973), the machine is the power of knowledge objectified and to this extend the development of fixed capital according to his analysis indicates, the extent to which general social knowledge has become a direct force of production, and hence the extent to which the conditions of the process of social life itself have come under the control of the “general intellect” and been transformed in accordance with it.

In the battle of competition, accumulated wealth and knowledge are increasingly infused in the production of innovation. As capital cannot abide a limit to profitability, the perpetuation of expanded reproduction and of accumulation, necessitates on

behalf of the capital the frantic exploration of new forms of time-space compression through technological innovations in fixed assets of infrastructure (Harvey, 1995).

To this extend, capital accumulation is for Marx (1973), the result of an innovation – competition process with technology and knowledge being a by-product of this dipole. By incorporating new technologies and other sources of qualitative changes, entrepreneurial innovations create surpluses of revenues above cost, however competition tends to eliminate them. As Sheppard (1990) explains, innovations may decrease effort and thus reduce production costs by reducing inputs required, or may decrease time of production and therefore capital advanced, by increasing its speed and utilization. On both occasions however, the rate of profit for a firm that can implement them will rise. As long as it sustains such an advantage, it will also incur windfall profits, diminishing competition while enabling further accumulation through concentration.

However, other competitors too, especially in markets producing similar use values, will seek either to enhance their production techniques or to imitate their best competitors, and eventually some will establish or replicate cost-reduction methods (Sheppard, 1990). Meanwhile, the rest who are unable to meet either the technical and operational criteria or the increased investment funds required, get expropriated, reorganizing the market through centralization. In the long run, standardization of such technologies, will increase once again competition and in turn will deplete the windfall profits attained by the innovation sappers.

Eventually, according to Marx (1988), if the organic composition of capital C/V rises but the ratio of surplus value s/V does not sufficiently, the rate of profit s/ (C + V) will fall.

Jones (2016) argues along with Marx, that the rising organic composition of capital is the primal factor to explain the tendency of the rate of profit to fall, as the development of the forces of production under capitalism, eventually result in a growing TCC and hence a growing OCC. By accounting the turnover time of variable capital to estimate the evolution of VCC and OCC in the post WWII U.S.A till 2013, his results indicate strong tendencies for both to rise, while respectively a strong tendency for shortening the average turnover time (reduced by more than half). More

specifically, in periods of expansion when there is more investment in enhancing production and distribution techniques, such as the post war boom and particularly in the 80s and 90s there is a rapid increase in both VCC and OCC accompanied also by a sharp shortening of turnover time. Conversely, during crises, when rates of investment are low, both VCC and OCC were stagnant while a slight increase in the turnover time, attributed to the buildup of inventories, was observed. On the whole the author, suggests that OCC rises faster than VCC, due to the tendency of constant capital to be cheapened over time due to increased productivity, while as to the effect of the rising VCC and OCC exert on the rate of profit, he supports that a decline was counteracted by the tendency of turnover time to get shorter.

Sweezy (1968) describes the five countervailing causes that may impede that tendency of the rate of profit to fall, to be:

- The cheapening of the elements of constant capital
- The rise in productivity/ intensity of labour
- The squeeze of labour wages below the value of labour power
- Overpopulation – labour reserve army
- International trade

If none of the above sufficiently counteracts the tendency of the rate of profit to fall, stagnation, recession and crisis will ensue until a novel innovation increases once again the organic composition of capital and hence enhance further the circuits of capital and the process of accumulation. Inventions or according to Baran & Sweezy (2017) epoch-making innovation, are thus for capitalism a “Deus ex Machina” providing capital with a new lease of time. In its totality, this innovation-competition process of creative destruction, revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one (Schumpeter, 1976).

Chapter 3: Analyzing the evolution of concentration within containerized transport chains through a circuitist approach: the role of innovations in accelerating the circuits of liner and container terminal operators[17]

3.1 Overview

Within the context of a spatial capitalist economy, transport and logistics networks, act as the cogwheel of the global market, performing in real time and space the abstract concept of commodity circulation. Within this framework the more the world became globalized, increasingly dependent on the organization of commodity flows, the more transport and logistics gained importance, leading into what Tsing (2009) calls the development of "supply chain capitalism". On the one hand, transport and logistics became the media of circulation as well as a strategic and indispensable stage for industrial capital's expanded reproduction while on the other, an increasingly lucrative sector for investment and appropriation of surplus value, leading to the emergence of incumbent players in sectors such as, liner shipping and container terminal operations.

By convention, the majority of research conducted in the fields of maritime and port economics in recent decades, as Ng et al. (2014) observe, primarily focus on applied and operational aspects of the transport industry rather than trying to understand and analyse like Li, Haralambides and Zeng (2022) the evolution of integrated port and transport systems within the broader context of capitalist development. Scarce exceptions do exist (Wilsmeier and Monios, 2015), however, particularly for containerized transport chains the absence of such a critical approach restrains the analysis of the specific confluence of dynamics that on the one hand compelled industrial as well as transportation capital to switch their attention to the circulation

[17] Sections of this Chapter are part of the published paper: Styliadis, T., & Chlomoudis, C. (2021). Analyzing the evolution of concentration within containerized transport chains through a circuitist approach: The role of innovations in accelerating the circuits of liner and container terminal operators. The Asian Journal of Shipping and Logistics, 37(4), 321-328.

of commodities, while on the other extended and accelerated the process of accumulation in both capital sectors.

To this extend, in the absence of such an analysis this chapter develops a theoretical model which aims to grasp and display the evolution of the process of capital accumulation within containerized transport chains, as an interrelated evolution and as an outcome of industrial capital accumulation. In seeking an analytical framework to understand this dynamic nature of transport capital, we will adopt the circuitist approach as proposed in the Neue Marx-Lektüre (Backhaous, 1980), thus utilizing the general formula of capital expressed in the M-C-M' cycle, initially outlined in Das Capital (1867). The utilization of such a methodology will on the one hand allow us to understand the role of transport and logistics in contemporary capitalism, by analysing the formers' role within the circuit of industrial capital. On the other hand, by employing the M- C- M' formula and adjusting it to the container transport sector, we aim to illustrate how innovations such as the advent of container and the revolution of logistics not only expanded and accelerated the processes of accumulation for industrial capital but also for the commercia capital operating within the sphere of commodity circulation.

To this end, the contribution of this chapter lies in the innovative adaptation of Marx's particular methodology, which provides the means to tie together phenomena that are customarily studied separately, such as concentration and centralization of capital, innovation and turnaround time, in analysing and depicting the evolution of capital accumulation within containerized transport chains. Under this framework, the remaining of this chapter is structured as follows: in section 3.2 we undertake a literature review on the evolution of transport chains and the function of transport as a medium of circulation, in section 3.3 we provide an analysis of the industrial and commercial capital circuit respectively, while section 3.3.1 and 3.3.2 consists of the methodological adaptation of the circuit's formula and of the respective analysis of liner and terminal operators' circuits. Finally, in section 3.4 we conclude with a discussion and some meaningful conclusions.

3.2 The function of transport chains within the circulation of capital: a literature review

The maritime transport landscape in the second half of the 20th century, has little resemblance to the rigidities and cumbersome procedures characterizing the Fordist economic environment. The post-Fordism regime of flexible accumulation (Aglietta, 1976) was accompanied by a significant increase in financial, spatial and physical mobility and accessibility much attributed to the evolutions in transport and communication systems (Rodrigue et al., 2016). The introduction of the maritime container and the intertwining of computer software with logistics, swept away the assumption that transport carriage stopped at the port terminal gates, transforming nearly every aspect of the transportation industry.

A vast and growing stream of maritime and port related literature investigates the industry-specific effects of this technological progress, in enabling more efficient and more cost-effective transport through economies of scale (Hummels, 2007), enhancing port productivity and efficiency of landside operations through automation and smart operations (Saanen,2004, Kim & Haralambides, 2021), altering the spatial organization of ports and their connections with their expanding hinterlands (Notteboom & Rodrigue, 2005, Behdani et al., 2020). In addition, technology contributed to improving the coordination and integration among the since then fragmented transport actors (Rodrigue & Notteboom, 2013) through the enhancement and the seamless flow of information exchange (Song & Panayides, 2012). In the same vein, other scholars have focused on the broader consequences of such evolutions, quantifying their positive relation to the immense growth of international containerized trade (Cosar & Demir, 2018), as well as to the acceleration of globalization (Bernhofen et al, 2013).

Despite the growing research undertaken to typeset the transformation of transport conduct, such evolutions have been largely seen in isolation to economic, social or even political issues, as well as independently to the spatial re-organization and restructuring of the capitalist system itself. Conversely, another body of critical literature, stemming mainly but not solely from the research fields of economic geography and media studies, has put an increasing emphasis on the role evolutions

in transport and communications have, in shaping and extending contemporary accumulation. This stream of literature systematically tries to understand the role of the media of circulation in the expanded reproduction of capitalism. Moving from the abstract to the concrete, capital is Marxian literature not treated as something static but as a circulatory movement or a value in motion (Harvey, 1989) during which capital fulfils a double function in the process of its self-expansion. Capital, according to Marx's formula $M - C - M'$, must alter successively its value form, from money-capital to commodity-capital and again back to money-capital (with surplus-value). Hence, under the spectrum of capital's circuit, exchange or the final turning of commodities into money is the focal form of social production and reproduction, otherwise value is non-existent (Bellofiore,2009).

Kjosen (2016) following Marx's approach, highlights the double role of transport; being on the one hand an independent branch of production while on the other being distinguished by its appearance as the continuation of a production process within the circulation process and for the circulation process. As such the latter hold a critical role within the circuit as according to Marx (1988), surplus-value may be created in the sphere of production, however it is realized within the sphere of circulation and in this sense transport and logistics are the means of its realization. Therefore, since the realization of the surplus-value of the commodity is a condition of exchange, for as long as capital sustains its commodity form or as long as circulation lasts, it cannot transit back into the forms of money and productive capital, halting thus the completion and re-initiation of the circuit as well as the appropriation of profit. Marx (1988) had suggested that the rate of surplus-value appropriated may be increased by acceleration when speed contributes to reduce the costs of circulation.

To this end, the time it takes capital to fulfil its double function i.e., the pace with which it assumes and abandons its successive forms as well as the actual speed of circulation, directly influences the rate and extend of accumulation (Cowen, 2014a). Sheppard (1990) develops a framework to calculate the impact of circulation time on profits. His findings suggest that indeed circulation time taken in transportation is a deduction from capitalists' profits, and therefore, cost and time reducing technical

change in the transportation commodity is one of the few ways to ensure an increased rate of industrial profit.

Under the vantage point of capital's circuit and by acknowledging transport and communications as elements of circulation, critical scholars have explained the shift of firms' attention from the sphere of production to the sphere of circulation (Danyluk, 2018). According to Chua (2020), the evolution of transport and the logistics restructuring arose out of the tendency of capital to seek new ways to reduce its turnover time, prompting corporate experiments with speeding the realization of value. In the same vein, Manzerolle and Kjosen (2012) view the development and adoption of technologically advanced media that allow the binding of space and time, as the means to increase capital's velocity while decreasing the time of circulation.

Kjosen (2016) respectively, articulates that the general function of capital's media is to reduce circulation time by accelerating capitals movement through the sphere of circulation, viewing innovations such as the container and logistics revolution amongst the primal accelerators of circulation. According to his analysis, transport capital reduces its production time through the introduction of new technology that is productive in terms of speed, capacity and power, but effectively what media achieve is the reduction of circulation times for the circuits of commodity-capital being transported.

The phrase "time is money" (Loft, 1995) puts flesh and bones to the logic of shortening the time of economic activity as well as to the shrinkage of space, through the removal of the impediments which hinder the acceleration of productive and transportation activities. For Altvater (1989), this is precisely the imperative of capitalist valorisation. Harvey (1989), while suggests that technological innovations in transport and communication aid in accelerating industrial capitals' turnover time, acting as a time –space compression mechanism diminishing distances, he also argues that such innovations grant capitalism a new lease of time, as they provide capital with new spaces for accumulation. For Cowen (2014b) and Haralambides (2021) too, the revolution of the container which led to the revolution of global logistics was a prerequisite for the emergence of global supply chains and Just - in -Time production networks, which ultimately superseded and stretched the factory across a highly

uneven economic and political geography. For Chua (2019) in turn, logistics do not displace production at the site of surplus creation, however, reorganize the systems of production, distribution and consumption so that firms' ability to compete rests on their capacity to increase the volume and velocity of commodities in circulation.

By integrating transport and logistics into the production process, the until then separate phases of production and circulation could be unified under a systems perspective (Klose, 2015), allowing thus the multiple actors involved, to align their circuits even in complex supply chains across great distances. The development of supply chains became a crucial element for ensuring the viability of the total social circuit of capital, since the physical conditions of circulation have evolved to play a central role in ensuring the continued reproduction of capitalist relations (Chua, 2020). Containerization and logistics, along with the promoted deregulation of the transport and communications markets in the 80-90s, disrupted the labour-intensive structures of the Fordist transport industries (Chlomoudis, 2006), changing transport conduct as well as the performance and rapidity with which trade was carried out until then, creating a unified and commoditized space for investment within the sphere of circulation.

The outcome of these evolutions rendered the transport industry and particularly the container transport sectors comprising the supply chain, a lucrative sphere for investment. Many theorists have focused their attention both on the long-range macro-historical perspective of world systems theory as well as to a more industry and firm-centred model of organizational analysis (Werner & Bair, 2011). However, they have neglected that containerized transport chains apart from being capital's media of circulation, also form a distinct sphere of investment which ultimately opts, through innovations, to accelerate its own expanded reproduction. Although some fragments of this notion appear in Harvey's (1975) as well as in Chua's (2020) analysis, the fact that containerized transport actors have their own distinct capital circuits, which produce surplus-value, and therefore establish the terms and conditions for the evolution of accumulation in the transport sector, remain largely unaddressed.

3.3 An adaptation of the circuit of capital within containerized transport chains

Although Marx set the foundations for analysing the way capitalism evolves, he could not have imagined at the time of his writing, how a "box" as well as the revolution of logistics would ultimately aid capital to shift to a higher plane, establishing the world market. He had envisioned though that, "the revolution in the modes of the production… made necessary a revolution in the general conditions of the social process of production, i.e. in the means of transport and communications" (Marx, 1988). Contemporary critical researchers, in seeking an analytical model to assist in the understanding of the evolution of capital's media, have resorted to Marx's capital circuit (Kjosen 2015 & 2016, Fuchs & Mosco, 2015).

Based on the capital circuit analysis on Chapter 2, here we are going to integrate the capital circuit of transport capital within the industrial circuit to sketch the interdependencies of the latter on the former and vice versa. As said, Otani (2018), acknowledges transport activities, as a distinct and independent branch of social capital, termed commercial capital. According to this view, while commercial capital facilitates the completion of the industrial capital's circuit, in parallel it opts for the completion of its own circuit.

More particularly, commercial circuits intersect the industrial both in the beginning of the latter's circuit $(M - C)$ for the transport of raw materials and other production components as well as for the transport of finalized products after the completion of their production process $(C' - M')$. In turn, by undertaking the circulation of commodities, commercial capital ensures its own expanded reproduction. To represent these interdependencies amongst the two types of capital, we synthesize the designated formulas (1) and (2) presented in sections 2.4.1 and 2.4.3 respectively, to sketch a more complete formula of industrial capital's reproduction schema, through the integration of the commercial capital's circuits $\{M - C(= MP + LP) \dots P \dots - M'(= M + m)\}$ in it. Thus, by integrating the commercial circuit in-between of the two respective circulation spheres $(M - C \ \& \ C' - M')$ of the industrial circuit, the latter's representation becomes:

$$M - \{M - C(= Mp + Lp) \dots P \dots - M'(= M + m)\} - C(= Mp + Lp) \dots P \dots C'(= C + c) - \{M - C(= Mp + Lp) \dots P \dots - M'(= M + m)\} - M'(M + m) \textbf{ (4).}$$

The above formula (4) implies that the duration of circulation impacts the turnover time of the industrial as well as of the commercial capital circuit. Therefore, the process of their valorisation, depends heavily on the rapidity with which commercial capitals execute their part of circulation or their independent circuits. The fastest the circuit, the fastest the valorisation and the expanded reproduction of industrial as well as of the commercial transport capital. It could not be otherwise; transport's operation and organization under capitalistic terms instantly instils to the latter, all the features of capital. Hence, the logic of ever accelerating the circuit's turnaround time, through epoch-making innovations and technological advancements which increase efficiency and productivity, as well as the tendency towards accumulation, are also features of commercial transport capital.

Having portrayed the interdependencies amongst the two types of capital in the course of their self-expansion, we turn our attention on the final reconversion of industrial capital from C' to M', and particularly on the circulation sphere that intercepts it. Commodity circulation however, within the context of containerization and of globalization of production and consumption, is not a task carried out by a single mode, as containerized chains are rather complex and comprised of multiple actors and nodes, namely liner shipping and container terminal operators, port authorities, multimodal operators as well as freight forwarders, warehouses and inland distribution centres amongst others. All these actors who structure the door-to-door containerized supply chains and operate within the sphere of circulation and for the circulation of industrial capital, have thus their distinct and separate commercial capital circuits.

Circulation therefore becomes a network of interdependent circuits that must be aligned and coordinated in order to effectively mediate the commodity's movement to the market. The pace with which each transport actor fulfils the media functions within the context of his circuit as well as the level of synchronization achieved amongst them, will in turn determine the time of circulation and therefore the pace of industrial capital's expanded reproduction. As such, industrial capital's circulation in the final reconversion of $C'to\ M'$, would be composed by an equivalent to the number of transport actors, commercial circuits ($n \times \{M - C(= Mp + Lp) \dots P \dots -$

$M'(= M + m)\}$), with its circulation time (Ct) being equal to the sum of each of those circuits' turnover-time (tn).

$$C' - n \times \{M - C(= Mp + Lp) \dots P \dots - M'(= M + m)\} - M'(= M + m) \text{ (4)}.$$

$$Ct = t1 + t2 + t3 + t4 \dots . . tn \text{ (5)}.$$

In parallel however, the turnover time of each of those commercial circuits involved within a containerized transport chain also constitutes the time within which each of those capitals reproduces itself. While though nodes and modes involved are interlinked in a sequential order along the process of commodity circulation, their circuits are also intertwined. This means that where one's circuit ends, another's begins and therefore that the efficiency of the former's circuit will influence the efficiency of the latter's as well as of the whole supply chain.

In this context, as the logic of ever-accelerating the circuit's turnover-time is also a feature of commercial capital, we utilize Marx's formula (2) for the capital circuit of transport and assess the impact of innovations in the circuits of a liner carrier and of a terminal operator, involved in an end-to-end containerized transport chain that mediates the final metamorphoses of industrial capital. A circuitist approach is therefore the basis of our framework. Kjosen (2015) who due to the complementarity of the functions performed by media in general and by transport actors in particular, and their sequential order in the process of undertaking industrial's capital circulation, renders the latter process as rather logistical while attaches to these media actors three distinct and particular functions; namely those of transfer, storage and processing.

Kjosen (2016) adds another dimension, that of processing, to the functions performed by media. Following Kjosen (2015, 2016), we integrate all three functions within our circuit approach, assuming their fulfilment as a prerequisite for the completion of media's own circuit. In this respect, the rapidity with which they carry out these functions will determine industrial circulation but will also determine the duration of medias circuit and therefore the pace of their own reproduction. In this context, through the analysis of media's circuit along with their particular functions we intend to illustrate on the one hand, how containerization and logistics specifically disrupted

and eventually revolutionized the way transport actors perform their media functions, while also on the other, how in the process of doing so, expanded the capacity of containerized transport actors to concentrate.

3.3.1 A liner's capital circuit

As the seas have diachronically been the most efficient way to carry out global trade, shipping too has diachronically been its primal carrier. The containerization wave however, signaled a new era for both. Unitization heralded the proliferation of a new shipping market, improving the conduct and efficiency with which trade was carried out and eventually altering the market structure of shipping itself.

What would start as a niche market, would evolve into one of the largest shipping segments (UNCTAD, 2019) and the hegemon of containerized transport chains a few decades later. To prove our latter argument, we utilize the transport capital's circuit (formula 2) to illustrate the effects of containerization as well as of related innovations, on the liners circuit and therefore on the way liner shipping fulfills its media functions. For the purpose of this analysis, we break-down the circuit on the two phases that also signal the metamorphoses of liner's capital, that of $M - C(= Mp + Lp)$ and… $P - M'(= M + m)$:

a) $M - C(= Mp + Lp)$**:** Ship-owners from other market segments as well as accumulated and merged capitals infused from other sectors (industrial, financial), advanced their money-capital (M) in order to acquire the means of production, i.e ships (Mp) and labor power (Lp). First and foremost, containerization necessitated the building of a particular kind of vessel, i.e. the containership. New ship designs, substituting the hatches and dividers of break-bulk vessels with cargo holds in the form of cells for containers, were built, transforming containerships into huge floating warehouses.

According to reports and estimates of the 70's (Maritime Administration Authorization, 1969), containerships would be able to carry 60% more cargo in comparison to general cargo vessels. While though at that time, the first generation of containerships was constructed with a carrying capacity of around 1250 to 1.600 20-foot containers (TEUs) and an average service speed of 25.5 knots, related

technological innovations as well as economic and operational issues became catalysts for enhancing the design and the characteristics of containerships, in the years to come.

With container trade expanding both in volumes and destinations reached, evolutions in telecommunications and operational systems, aided in further enhancing the efficiency with which such vessels were built and operated. Satellite communications, digitization, remote monitoring and labor substitution systems amongst others, were incorporated in the vessel's design to provide further cost and performance efficiencies, while at sea. The most profound change, however, was the progressive yet immense increase in the size of container vessels, carrying nowadays up to 23.000 TEUS. With service speeds being reduced significantly lower than the maximum possible (from 25.5 to 14 to 18 knots), in order to increase operational efficiency in the face of rapidly increasing fuel costs, liner carriers opted to offset the loss of velocity at sea through an increase in the capacity carried by container vessels.

At first, such an evolution which extends rather than shortens both industrial capital's as well as liner's expanded reproduction, might seem quite an oxymoron and antithetical to transport capital's cause. However, Virilio (2010), who discusses specifically the massive increase in container ship capacity, argues that when further acceleration of the circuit is not possible (or not economically viable we would add) the only thing left to increase is capacity or the bandwidth of the volumes transported. By pursuing economies of scale, which in turn reduce unit cost of production and compensate in-part for slow steaming, liner carriers especially after Maersk's introduction of 18.000 Triple E, initiated a high-seas "arms race" over megaship construction. Nowadays, such vessels service the major trade routes almost exclusively, while smaller ones (even up to 9-10.000 TEUs) which can no longer compete, cascade for secondary markets.

Additionally, as containerships grew bigger, the manpower to operate them was reduced disproportionately. The introduction of advanced onboard technological systems, that enable remote monitoring on the one hand and of automation on the other, substituted a large part of laborers physical work routine, enabling in turn the radical reduction of containerships' manning requirements. Labor-saving machines

and systems increased the efficiency as well as the intensity of production and in turn the organic composition of capital, which enabled the radical reduction of capital expended for the purchase of labor (Lp). Characteristic is the fact that Maersk's Triple E containership operates with just 13 crew members[18]. Despite though that the labor factor has been subjugated to the efficiency of the "machine", it still is, for the time being at least, a necessary input of production.

As though, innovations and technological inventions become quickly standardized, copied or imitated amongst liner competitors, a temporal level playing field is established. For this reason, pursuing novel cost-effective solutions either in the means of production or in relation to the labor factor can become the differentiators that will enhance the implementer's competitive position. Thus, current experimentations with block-chain technology such as Maersk's and IBM's TradeLens Platform[19], digitization and robotization, as well as initiatives towards the development of unmanned vessels, should be seen as efforts of capital deepening which further increase the organic composition of capital in the struggle to gain a competitive edge against competitors.

b) $\dots P - M'(M + m)$**:** Having acquired the means of production, liner companies design their service schedules and deploy their vessels amongst major and secondary routes, based on a variety of decisions that ultimately opt to minimize the total transport costs, given the capacity and service constraints (Fagerholt, 2004). According to Fagerhol (2004), a liner ship route always starts and ends at the container depot or a hub, while visiting in between at least one intermediate port. From this perspective, the total time such a voyage takes will also equal the production and turnover time of a liner carrier.

Notteboom (2006a) highlights the importance of the time factor for liner carriers and argues that any delay faced, apart from extending the circuit of reproduction also incurs additional costs both for shippers (logistics and inventory costs) as well as for carriers themselves (operational costs). While thus liners' schedules are fixed and

[18] https://newatlas.com/triple-e-maersk-worlds-largest-ship/17938/
[19] https://www.maersk.com/apa-tradelens

transit times between ports as well as total turnover times are largely pre-determined, carriers' schedule reliability or their ability to perform punctually and according to schedule their media functions, will in turn determine both their own and industrial capital's expanded reproduction.

Table 1. below, summarizes the way innovations have aided in enhancing the efficiency, intensity and scale of liner shipping media functions and hence in accelerating liners' capital circuits.

Table 1. The media functions of liner shipping and the effect of innovations on their capital circuit

Media Functions	**Liner's Circuit**		
	Function Scope	Innovations	Effect on Circuit
Transfer	Annihilate space by time – overcome space and time barriers – mobilize commodities till their port of discharge	Evolution in containership design; Increase in vessel's size & hence of capacity; Introduction of automation - recyclable parts.	Increase the bandwidth of commodities transported per time Economies of scale –unit cost reduction / increase in the sum of surplus-value absorbed Minimization of labor input on board Increase in Operational efficiency
Storage	Storage of commodities till port of discharge	Container Box, Container Cell Guides, twist locks, cable power cells etc.	Secure Stacking Increase in the variety of goods transported (finished, bulk, perishable) Preservation of commodities' use values, protection from the perils of the seas
Processing	Material handling -organization & manipulation of commodities' movements in space and time	Development of software solutions Enhanced telecommunications;	Organization & optimization of internal & external processes; remote & real time monitoring/seamless exchange of information/enhanced visibility - flexibility Increased utilization - more efficient stowage planning, based on the characteristics of the containers transported (weight, perishability, hazard, destination) Enhanced synchronicity: coordination & alignment of commodities' movements amongst transport nodes

Source: Authors' representation (based on Kjosen, 2016)

3.3.2 A terminal operator's capital circuit

While shipping has been the primal carrier of global trade, ports respectively have been its key interchange node and handler. Under the Fordist regime of accumulation, ports were characterized by time-consuming and labour-intensive procedures, with vessels spending as much time in ports as they did afloat (Cudhay, 2006). Global changes however, in the conduct of trade, brought about by the advent of containerization and logistics, exerted significant influence in the radical reorganization of the port industry (Chlomoudis & Pallis, 1998).

Such developments in the post-Fordist economic environment, coupled by the liberalization of the industry, altered the source of port competitiveness from economies of scale based on basic production factors, to economies of scope based on advanced production factors (Wilmsmeier & Monios, 2015). In this context, similarly to the case of liner shipping, we analyse how innovations impacted the circuit of terminal operators, through the alterations incurred in the latter's means of production as well as in performing their media functions.

a) $M - C(= Mp + Lp)$**:** the advent of container led to the evolution of containerships and of intermodal transport chain, which in turn necessitated the restructuring of ports to enable their service, through the development of specialized container terminals as well as of shore and land-side equipment (Mp). Ports, thus, became more capital intensive as a consequence of the increased demand for container handling as well as due to the growth of specialized terminal facilities.

However, as in many cases (and many countries) port authorities could no longer provide all the capital required to develop the appropriate infrastructure and superstructure, the insertion of private money-capital (M) in container terminal operations was promoted (Suykens, 1992, Peters, 2001, Tongzon & Heng, 2005). Massive devolution of container terminals to the private sector in the 80's and 90's, aided in modernizing terminal designs and equipment, eventually reorganizing radically the lay-out and operations performed. Installation of mechanized equipment in every aspect of operations, substituted in part dock workers (Lp), increasing the productivity and efficiency with which containers were handled either in the quay side or at the land side.

Characteristic is the fact that break-bulk vessels could require up to 150 longshoremen working a minimum of four days to a week to unload and load a ship. In contrast, the handling process of a containership could be completed over a single eight-hour shift by a crew of just fourteen or less, allowing container vessels to reduce both port related costs as well as their port-stay to just 10 to 20% (Kjosen, 2016). Additionally, related evolutions in information and communications technologies, such as the development of terminal operating systems (TOS) fostered the more accurate and well-organized transportation within container terminals, through real-time planning, scheduling and coordination amongst all the handling equipment (Kanellopoulos, 2018).

In response to these evolutions, terminal operators similarly to liner carriers, opted for further increasing the organic composition of capital through the introduction of automation as a more cost-effective and efficient alternative to manually driven equipment (Saanen & Rijsenbrij, 2012). Characteristically, Saanen & Rijsenbrij (2012) estimate that automation reduces labour costs by up to 40% with the overall cost-reduction ranging between 15% and 25%. Although of all the container terminals globally, only 40 are partly or fully automated, this trend is expected to accelerate over the next years (McKinsey, 2018). In this way, the volition of terminal operators to increase intensity of production through capital deepening should be understood as an effort on the one hand to relieve the pressure imposed by liner carriers and on the other to expand their capacity to reproduce themselves, by optimizing their production phase within their circuit.

b) $\dots P - M'(= M + m)$**:** In Steenken et al. (2004) container terminals are described as open systems of flows with two external interfaces (i.e., quayside and landside). As soon traffic from either interface arrives, means of production are being transformed into productive-capital, and operate as a material handling system. For Tompkins and Schaffer (1996) a material handling system should provide the right amount of the right material in the right condition, at the right place at the right time, in the right position, in the right sequence and for the right cost by using the right methods. Considering that ports and specifically container terminals are an interchange node,

where multiple containers flow simultaneously from the direction of the hinterland and from the sea, material handling becomes a challenge for operators.

Terminal operators not only must coordinate and accelerate the mass of circulating commodities but also the circuits of the multiple transport actors involved. According to Cullinane & Haralambides (2021) operators are increasincly pressed to address amongst others: the minimization of gate congestion; the minimization of dwell times; the minimization of rehandles and container-moving equipment, aiming at the same time at the minimization of atmospheric emissions; the synchronization of appointment systems with port equipment availability; the allocation of berths such that equipment movements and emissions are minimized; and the incentivation of 'dual-transaction' truck movements inside the terminal.

While amongst those, inland operators are more geographically dependent and more tied to a specific port or terminal, liner carriers on the contrary are more footloose, being able to switch ports or terminals, if necessary. In addition, the increases in the firm size of liner carriers (and of the establishment of liner alliances) and in the size of their vessels respectively, gave rise to the latter's bargaining power against terminal operators, over the conditions and performance of handling.

Increased volumes to be handled within specific service times, obliges terminal operators, who do not want to lose traffic from major carriers, to increase their berth productivity, compromise the efficiency and utilization of their equipment, even though this is not to their own circuit's interest. As Haralambides (2019) highligts cargo handling time per TEU is higher after a certain ship size, and this is a distinct "port diseconomy of scale". Prioritizing however, the liners' circuits over theirs does not mean that terminal operators, even when facing increased costs, do not opt for an expanded reproduction through the absorption of surplus-value both from liner carriers and multimodal operators. Thus, similarly to the case of liner shipping we depict in the following Table 2. the effect innovations have on the circuit of a container terminal operator.

Table 2.The media functions of a terminal operator and the effect of innovations on its capital circuit

Media Functions	Terminal Operator's Circuit		
	Function Scope	Innovations	Effect on Circuit
Transfer	Transporting containers between terminal's interfaces & the stacking yard.	Horizontal terminal transport system evolution; Substitution of man-driven horizontal equipment with automated one (Automated Guided Vehicles)	Increase in Operational efficiency - synchronicity of terminal equipment Route optimization - Remote operation Accuracy - Flexibility -Rescheduling; Minimization of labor input
Storage	Buffer - Storage/ preservation of containers in terminal's yard till transit/ transshipment time	Automated & semi-automated yard stacking equipment - Rail Mounted Gantries) Yard Layout (new stacking strategies for denser operations)	Increased density of storage - Optimization of capacity utilization; Secure Stacking – Remote handling monitoring & enhanced visibility Preservation of commodities' use values, protection from damage/theft etc. Minimization of reshuffling – optimal sequencing; Increased terminal throughput & surplus-value appropriated
Processing	Material handling of containers arriving/ departing from/to quayside hinterland Organization of commodity flows & information processing	Development of specialized automated/semi-automated quayside & landside handling equipment (larger quay-cranes in terms of height, outreach & capacity- yard stacking equipment - Rail Mounted Gantries) Development of software solutions - Enhanced telecommunications;	Maximized productivity, efficiency and utilization (allocation) of equipment while minimizing costs & time of operations in either interface Minimization of labor input Organization & optimization of terminal's internal & external processes; Remote & real time monitoring/seamless exchange of information/ enhanced visibility – flexibility (stowage plans, yard positioning, processing requirements) Enhanced synchronicity: coordination & alignment of commodities' movements amongst transport nodes

Source: Authors' representation (based on Kjosen, 2016)

3.4 Discussion & Conclusions

This chapter has utilized the $M - C - M'$cycle proposed by Marx along with the designated formulas for the circuits of industrial and commercial capital, in an effort to gauge the role of transport within the context of contemporary capitalism. As transport operates within the sphere of circulation and for the circulation of industrial commodities through space and time, by integrating the commercial circuit of capital within the industrial circuit, our analysis has highlighted the critical role of transport in determining the pace of industrial capital's expanded reproduction. In parallel though, we have argued that while transport aids the reproduction of industrial capital, its ultimate purpose, as a distinct sphere of investment and of surplus-value generation, is its own reproduction.

Therefore, as the appropriation of surplus-value also in the transport sector is only realized after the completion of the capital circuit, the logic of ever-accelerating the circuit's turnaround time, is not only a feature exhibited by industrial capital but by the commercial transport capital as well. For this reason, as the introduction of innovations and technological advancements are amongst the few ways through which cost and time reduction is achieved, we have examined the effect transport innovations exerted in the performance of the media functions of commercial transport actors. By focusing on the circuits of containerized transport actors (liner carriers and terminal operators) involved within door-to-door supply chains, we have argued that the advent of containerization and logistics, coupled by relevant innovations in the means of production have been the catalysts in enhancing the intensity and the scale of the media functions performed by these actors within the context of their capital circuits. The increased capabilities provided by transport innovations for enhanced productivity, mobility, and efficiency amongst other, enabled a respective increase in the scale of capital in motion and in the speed of appropriating surplus-value, while in turn expanded and accelerated the capacity of containerized transport actors to accumulate capital and increase sectoral concentration.

Although we acknowledge the spatial dimension of capital accumulation, achieved through spatial fixes (fusion of surpluses absorbed to expand and reproduce fixed and

mobile structures in space through mergers, acquisitions and alliances) and the aid it provided as a complementary force to concentration, our aim has been to illustrate the significance of innovation in ever enhancing the circuit's rapidity and thus capital concentration amongst containerized transport actors. Hence, the use of the $M - C - M'$ model and particularly of its adaptation for the transport industry, provides a framework which can be utilized by researchers and policy makers to assess and conceptualize the impact of transport innovations on the co-evolution of industrial and commercial transport capital concentration.

As concentration is the result of an innovation – competition dipole (Schumpeter, 1976) under which capital cannot abide a limit to profitability, experimentation with new forms of time-space compression innovations which broaden the base and the scale of concentration should be awaited. However, under this process of creative destruction that revolutionizes the economic structure from within, policy makers both on a country and a global level should attempt to influence innovation activities through measures that promote a balance between the profit-maximizing incentives of market actors and social justice. As such, also within the context of the containerized transport industry, policies which catalyse innovations for the development of an equitable and sustainable transport system should be established and promoted.

Chapter 4: Effects of global supply chain developments on the evolution of concentration within the container terminal operators' and liner shipping markets

"If you think of Wall Street as capitalism's symbolic headquarters,
the sea is capitalism's trading floor writ large"
—Kalvin Henely, The Forgotten Space

4.1 Overview

In this chapter we focus on the recent -post '90s- market concentration developments on liner shipping and terminal operators. We follow the transition of the maritime and port industries from a dispersed to a gradually integrated state of the supply chain, and finally to the formation of mega carriers and global termial operators, concluding that the resulting state bears elements of potential market distortion. The establishment of an oligopolistic and oligopsonistic market structure in liner shipping and terminal operations respectively, may introduce risks related to market power and collusive behaviour, raising thus considerable competition concerns. In addition, as the emergence of global market actors in the above containerized markets segments and the development of inter and intra-industry relationships amongst them may exert significant impacts on the flows of containerized cargo at ports' terminals, we investigate the effects of concentration and centralization processes in the ports.

In this respect, the current chapter consists of three parts, of which the first revolves around the measurement of concentration in liner shipping and terminal operations as well as in recording the centralization processes these actors undertake to enhance their market position. The second part investigates the effects of inter-industry relationships on the selection of port terminals for the handling of liner shipping firms' cargo, while the third part examines whether increased market concentration leads respectively to an increase of concentration of containerized flows in specific ports.

4.2 A Primer on Recent Developments in containerized liner shipping and terminal operators

4.2.1 Liberalization and re-orientation of the port industry towards the market

Historically, ports, similarly to industries such as telecommunications, railways and energy, have been part of the public sector, due to their contribution to regional and

national economies. Due to the importance of their infrastructure, these state-controlled and monopolistic industries were characterized by the co-existence of competitive and regulated segments with natural monopolies, high fixed and sunk costs, as well as economies of scale (European Commission, 2013). For Sabracos (2001), such industries share common features which apart from the economies of scale also include externalities in production and consumption, provision of public interest services as well as complex technical, economic and political subsystems. For the port industry, which although it does not consist a network or a utility industry such as telecommunications or electricity but is rather a node within the broader supply chain netowrk, these characteristics as well as the nature of its product –the result of intermediate and complementary functions (which means that port users opt for the provision of a bundle of services rather than individual ones) (Chlomoudis, 2006) - were the main reasons to justify their state ownership.

However, unprecedented transformations aiming at introducing more competition into sectors traditionally considered as natural monopolies have been an important feature of public policy in the two last decades (Garcia et al., 2007). The end of the 80s marked the beginning of the transition to open markets for network and state-controlled industries, through structural reforms, both on a European and national level.

Exogenous attributes to the port industry exerted sizable impact on the ports' foreland and hinterland interfaces, forcing them to reposition themselves within the new competitive environment (Chomoudis et al., 2000). Technological advances and innovation in telecommunications and transport, coupled by commodification of container trade and universalization of standards, allowed for expansion of international trade, both in terms of volumes and destinations reached, thus intensifying globalization of production and consumption (Sekula et al, 2010). Maintaining ports as state monopollies and sheltering them from competition was, deemed inefficient, mainly due to the lack of flexibility to the evolving needs and requirements of port users (Brooks & Cullinane, 2006). The shift towards competition as per Newbery (1997) provided more efficiency incentives than regulation, since the net gains would be ultimately transferred to the final users (Newbery, 1997).

Over the last 20 years the responsibility of ports was transferred from the public to the private sector (Brooks & Baltazar, 2001). However, as per Ng and Pallis, the observed asymmetries of port governance and devolution processes across countries, were the result of variations of institutional frameworks in which restructuring strategies were nested, meaning that reforms responded to diverse challenges and produced diverse results (Ng & Pallis, 2010).

Despite these differences, in Derbie and Ruby (2009), it is verified that there is an increased convergence of the forms of port organization at least in Europe, through the division of responsibilities between a port infrastructure provider and one (or more) commercial operators. Apart from the case of U.K and some ports in Australia, where the aim of the reform was to sell the port assets to profit the government (Baird & Valentine, 2007) in the majority of other countries, reforms introduced private participation through unbundling. This unbundling policy which was similar to the set-up of other transport infrastructure and utilities sectors such as energy, rail and telecommunications introduced competition, new investments and innovation into formerly State-controlled, monopolistic and generally less efficient markets (Van Hooydonk, 2014). According to Hofbauer, (2009) privatization and unbundling are commonly closely interlinked.

Unbundling refers to the separation of the market functions traditionally provided by vertically integrated undertakings, into functionally independent components (Tanrisever et al., 2015). Different forms and degrees of unbundling are distinguished (Meletiou et. al, 2018):

- **Accounting unbundling**: is the least stringent form of unbundling and requires undertakings to keep separate internal accounts for each of their transmission and distribution activities, to prevent cross-subsidization. In addition, the internal accounts must include a balance sheet and a profit-and-loss statement for each activity;
- **Functional/Operational unbundling**: which refers to the separation of s operational activities and management activities;

- **Legal Unbundling**: which requires sequential operational activities to be operated through separate legal entities when a vertical integration undertaking exists. In essence, legal unbundling supposes that the essential input must be controlled by a separate legally entity. However, a firm that is active in the downstream market is still allowed to own this entity. Ownership under legal unbundling entitles the downstream firm to receive the entity's profits, but interference in the entity's operations is prohibited (Höffler and Kranz, 2011);
- **Ownership Unbundling**: which is the most stringent form of unbundling, sequential commercial operations/activities within the network must be controlled or owned by independent entities with these entities not allowed to hold shares in both activities. Thus, the same entity is not entitled to exercise control over an undertaking performing any of the operational functions and to exercise control or exercise any right over infrastructural provision.

To mention a number of paradigms, unbundling has been a foundation stone of E.U policy for other network and state-controlled industries:

- railways (with rules on, the separation of railway infrastructure managers and railway undertakings ('track and wheel') and on regulators acting as an appeal body (E.C, 2001);
- electricity and gas (rules on the unbundling of transmission system operators, distribution system operators and other providers, transparency of accounts, regulatory authorities (E.C,2009a & 2009b);
- airports (rules on the separation of accounts between airport managers and ground handling undertakings, a charging system and supervisory authorities (E.C, 1996).

Particularly for ports, which were sheltered from competition longer, the liberalization process adopted lessons and experiences from the other formerly regulated markets. The dominant model of a state-owned comprehensive service port was thus gradually abandoned (Brooks, 2004). The new set-up of the port industry promoted the

operational/functional unbundling which led to a new division of responsibilities amongst the provider of port infrastructure and of commercial operators, and thus amongst the public port authorities and the private enterprises (PwC, 2013). With the withdrawal of port authorities from terminal operations (and hence from the operator function), the landlord function became the primary function of contemporary port authorities (Verhoeven, 2010).

While such evolutions within ports led to the dominance of the landlord model across the majority of countries (Laxe et al., 2016), exogenous factors such as technology, globalization of international trade, creation of international supply chain networks and the increased importance of efficiency in operations, exerted tremendous impact on the operational and commercial environment of the port (Chlomoudis & Pallis, 1999). Operational unbundling may have led to the disintegration of the traditional port functions, however in parallel it has also enabled the integration of ports within the wider supply chain networks. Nowadays, the port product may be regarded as a chain of interconnected functions, while the port as a link in the global logistics chain (Suykens & Van de Voorde, 1998).

Through this process ports have become an attracting business, capturing the attention of large investment groups and equity fund managers, while concession policy is considered to have evolved in the most important tool for port managers to influence the prosperity of the port community and shape port development (Notteboom, 2007). Characteristic is the fact that in 2017, 85% to 90% of ports worldwide were landlord ports, accounting for 65% to 70% of the global container throughput (UNCTAD, 2017). The universalization of such a practice and the extent of the reform in the port industry, can be easily conceptualized if also we take into account that the control of container terminals on a global scale is now heavily biased in favour of private terminal operators. The extent of this reshaping is visible in container terminals, currently operated mostly by private operators: By the end of 2008, 494 (70%) of the container terminals and 78% of the global terminal throughput was controlled by the private sector (Farrell, 2012). Ports reassessed their role and scope within supply chains, incorporating a novel philosophy of port management, based on smart, agile and less concentrated forms of organization (Chlomoudis &

Pallis, 1999). In a nutshell, ports re-oriented themselves towards markets and competition (Notteboom & Winkelmans, 2001).

4.2.2 Development and evolution of integrated transport networks

The development of global markets bears a strong connection with the globalization of transportation systems (Rodrigue et al., 2013). Due to its inherent international nature, maritime transport is the backbone of international trade and ports are its core infrastructure (UNCTAD, 2017). The opening of the port industry, one of the last protected nodes of the transport chain, facilitated the penetration of private capital in container terminals and motivated investment risk assumption. International trade grew and ports became an increasingly profitable business, capturing the attention of large investment groups, financial firms and equity fund managers (Rodrigue, et al., 2011), leading to further integration and development of door-to-door competitive supply chains. Under this framework, ports were no longer considered bottlenecks (Heaver et al., 2000) or merely facilitators of imports and exports. Their role was expanded from a simple node to major intermodal distribution centres and critical coordinators of freight flows within supply chains (Rodrigue & Notteboom, 2009) and service providers for the entire supply chain (Vitsounis & Pallis, 2012)

Enhancing efficiency and integration within the supply chain could then be transformed into improvement in cost, quality of service and delivery times (Cousins & Menguc, 2006). Among the transport actors, the pursuit for efficiency eventually led to: a) growth of vessel size (Merk, 2015), b) further development of intermodalism (Monios & Wilmsmeier, 2013) and, c) development of integrated logistics (Panasyuk, et al., 2013). Specifically, for ports, efficiency led to a) utilization of hub & spoke system (Hsu & Hsieh, 2005), b) automation and, c) port valued added services including warehousing, barcoding and packaging (Grundey & Rimienė, 2007). In turn, these factors, allowed for more integration; competition was shifted from ports to terminals, and from terminals to the entire supply chain (Suykens & Van de Voorder, 1998).

4.2.3 Towards the emergence of integrated global transport actors, the rise of Global Terminal Operators and Mega-Carriers

Rising demand for transport services and international competition, forced transport actors to extend their scale of operations, through capital intensive investments as well as through the utilization of vertical and horizontal integration strategies (Van de Voorde & Vanelslander, 2008). On the one hand, horizontal integration allowed liner carriers and terminal operators to expand and replicate their operational and managerial expertise, through large-scale investments and M&A activities (Slack & Fremont, 2005). On the other hand, vertical integration, allowed market actors to expand their scale of operations in upstream and/or downstream supply chain segments, enabling them to enhance core business coordination (Fremont, 2009), services differentiation (Brooks, 2000). These developments led to (a) the emergence of mega carriers, comprised by either large transport conglomerates controlling the entire supply chain, and/or synergy-based door-to-door transportation networks (Chlomoudis, 2011) and (b) the reshaping and integration of the transportation industry (Heaver, 2002).

4.2.4 Hypotheses

Based on the above analysis, within the next sessions the study will focus in providing a quantification on the evolution of concentration and centralization processes within containerized supply chains and more specifically in the liner shipping and terminal operators' markets. While in extension of this investigation we will also look into the effects these processes exert on the ports.

As such within the next sections, we will investigate the evolution and the effects of concentration and centralization processes undergone in the liner shipping sector as well as in the container terminal sector, some 30 years, since the liberalization of the port industry. The main research questions here are:

Hypothesis 1*: concentration and centralization processes within the liner shipping and terminal operators' markets, have reinforced incumbent players in both respective market segments, allowing them to capture a significant market share and acquire significant market power*

In this respect our investigation will initiate from an analysis of the evolution of concentration and centralization in the liner shipping market, which as illustrated in the preceding chapter has evolved into the hegemon of global container supply chains, while thereinafter we will turn our focus on attention in the respective processes within the terminal operators' market. Such an analysis will allow us to also deepen our research into the effects these concentration and centralization processes exert on the port system. Thus, two sub-research questions that arise:

Hypothesis 2: *To what extend does the formation of liner alliances favour the inclusion of affiliated port terminals within their itineraries; and*

Hypothesis 3: *market evolutions such as the aforementioned consolidation of market actors, lead also to a new consolidation phase of container volumes to fewer ports*

To this end, in 4.3 section of this chapter we will investigate the evolution of concentration and centralization phenomena within the market segments under study, providing aggregate estimates about the market shares of the largest liner companies and terminal operators. Accordingly, in section 4.4 and section 4.5 we will deepen our research on the potential effects of these phenomena on the port system. More particularly in 4.4 we will investigate *Hypothesis 2*, for a sample of container ports in Asia. Respectively, in 4.5 we will investigate *Hypothesis 3* for the particular case of U.S West & East port ranges. Finally, in section 4.6 we will conclude the chapter with some concluding remarks.

4.3 Part I: Concentration in Container Liner Shipping and Terminal Operators

4.3.1 Concentration in Liner Shipping

Maritime transport represents 80% of the global trade volume (UNCTAD, 2017). Trade, mainly through container shipping rendered liner shipping the main pillar of international logistics chains. Liner-shipping companies experienced tremendous growth and high profitability (Grammenos, 2013). According to De Monie et al. (2011), between 1990 and 2008 container traffic grew almost 430% from 28.7 m. TEUs to 152.0 m. TEUs.

However, since transport demand is derived demand, the 2009 market reversal and unprecedented contraction of global trade, affected both maritime transport demand

and freight rates (Ng & Liu, 2010). Year 2009 was marked as the first time since the beginning of containerization with a sharp contraction: Volumes fell by 9%, slightly less than international trade, totalling 124 million TEUs (UNCTAD, 2010).

An aggravating factor for the container-ship market was the large number of new-built vessels to be delivered after 2008. Prior to the trade shock, liner companies had been heavily investing in additional capacity of modern, large vessels to reduce further unit costs (Kalgora & Christian, 2016). In 2010, with more than 600 ships laid up -12% of the global fleet-, 254 new vessels were delivered, the majority of which had more than 8,000 TEU capacity, increasing global capacity further by 1.3 m. TEUs (BIMCO,2010). Despite the fact that newly built ships continued to enter the market with the same rate up to 2016, even the most optimistic analysts did not expect (Sanders et al., 2015) that the capacity injected in the market would be able to hinder the reversal of freight rates, since excess capacity is an inherent industry feature.

However, even though trade volumes recovered the following years, albeit not to pre-crisis levels (UNCTAD, 2015), the imbalance between supply and demand were still perturbed by introduction of new built ships. Despite this overcapacity, industry leaders still lean towards further growth, through ever-larger capacity ships: 16 out of the 20 largest liner carriers expected new vessel deliveries in the upcoming years, extending further their capacity between 21.4% and 41.8% (Alphaliner, 2016). Maritime executives such as the president of OOCL find similarities of this tendency with an arms race[20]. A second important fact to be taken into consideration is that these large vessels are increasingly concentrated in the portfolio of the few largest firms[21].

This new generation of so-called mega-ships, when utilized appropriately are expected to reduce total vessel costs by four to six times (Merk, 2015). Notwithstanding, both

[20] See: (Shen, 2015 April 22nd). http://www.joc.com/maritime-news/no-escape-ship-ordering-arms-race-oocl-head-says_20150423.html

[21] According to the results of Drewry Maritime Research report, as published in the press (Morris, 2015), the three larger operators, namely Maersk, MSC and CMA-CGM include in their fleet 433, 696 and 363 ships above 10,000 TEUs. See: http://fortune.com/2015/02/02/biggest-container-shipping/

in the report of ITF (2015), as well as in other academic papers, such as Malchow's (2016), it is argued that the positive effects will be outweighed by current low demand and additional operating costs, leading to lower actual savings per container transported. Furthermore, the post-2008 poor economic performance of the majority of liner carriers (Yeo, 2013)[22], resulted in a novel wave of vertical and horizontal market integration, in order to differentiate and gain in competitiveness (Qi, 2013). As Haralambides (2019) argues, the weakening or banning of conferences, the low freight rates and service unreliability that have ensued because of the economic crisis, led liner carriers: a) to return back to core business (shipping) where they have comparative advantage, strengthening further horizontal integration through the establishment of alliances, b) to invest in the other components of the supply chain, such as container terminals, distribution centres, road, rail and air transport means, as well as in a miscellany of other value-adding services.

As a result of the above, market concentration in liner shipping is steadily increasing. More particularly, as it can be seen in Table 3 below, the concentration Ratios (CR) of the four, eight and ten largest liner shipping carriers has an upward trend over the 2012 -2021 interval. Characteristic is that the 10 largest liners totalled 37.3% of the

Table 3. Concentration Ratios (CR) of the four, eight and ten largest Liner Shipping Carriers

Index	***2021***	***2020***	***2016***	***2015***	***2012***
CR (4)	57,7%	55,9%	47,8%	42,9%	41,2%
CR (8)	80,3%	77,0%	62,8%	59,2%	56,2%
CR (10)	84,5%	81,0%	68,5%	65,4%	62,5%

Source: Alphaliner (2012, 2015, 2016, 2020, 2021). Authors' elaboration

the global capacity offered in 2001 (KPMG, 2015), 60.8% in 2009 (Alphaliner, 2009), 62,5% in 2012, 68,5% in 2016 (Alphaliner, 2016), 81% in 2020 (Alphaliner, 2020) and

[22] According to American Shipper (28 June, 2012), the top 15 lines lost collectively 11.3 billion in 2009. See: http://www.americanshipper.com/main/news/whos-making-money-a-seasick-industry-50323.aspx

84.5% in 2021 (Alphaliner, 2021). Respectively the CR (8) index has increased by 24,1% while the CR (4) index by 16,5%. The individual market shares of the 10 largest liner shipping companies for 2016, 2020 and 2021 are presented in the following figures (11, 12 and 13) below.

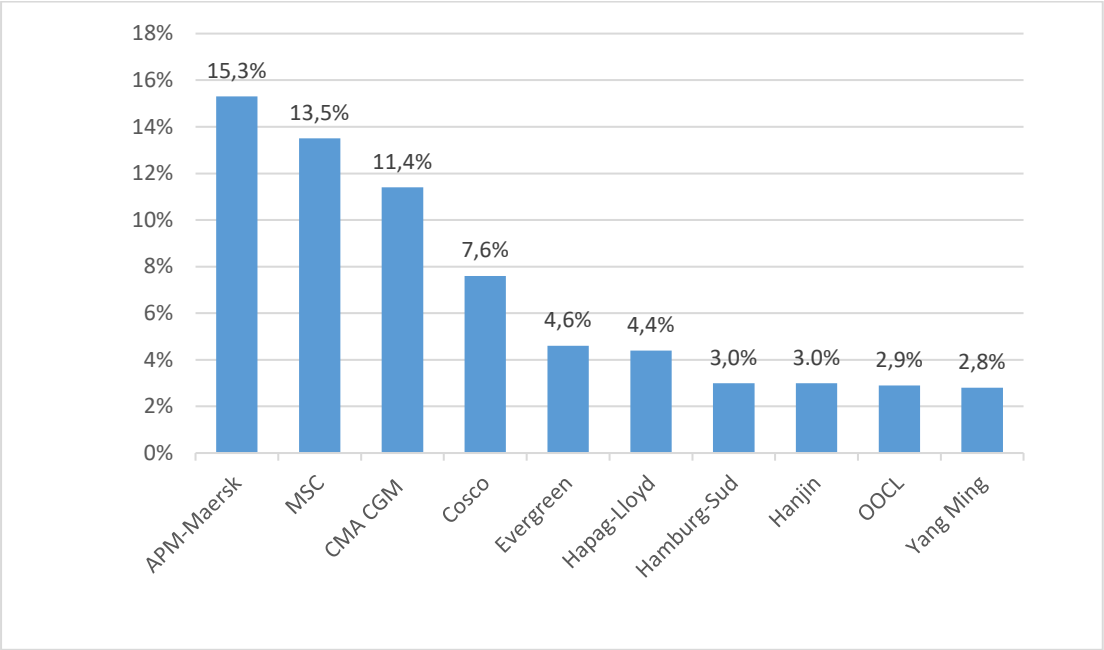


Figure 11. Market shares of the 10 largest liner shipping companies

Source: (Alphaliner, 2016), Author's Elaboration

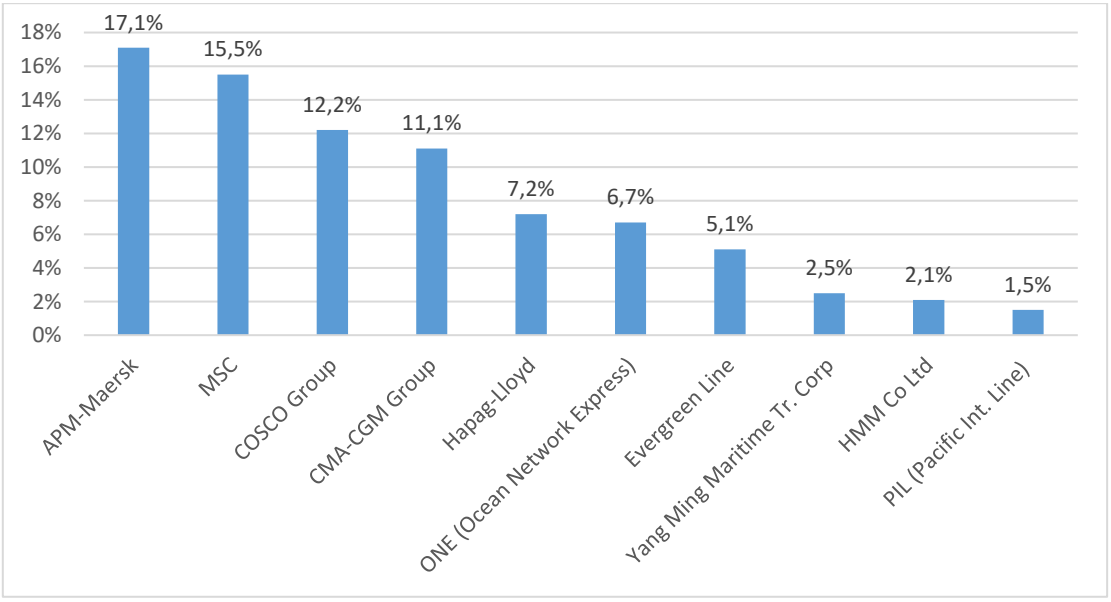


Figure 12. Market shares of the 10 largest liner shipping companies

Source: (Alphaliner, 2020), Author's Elaboration.

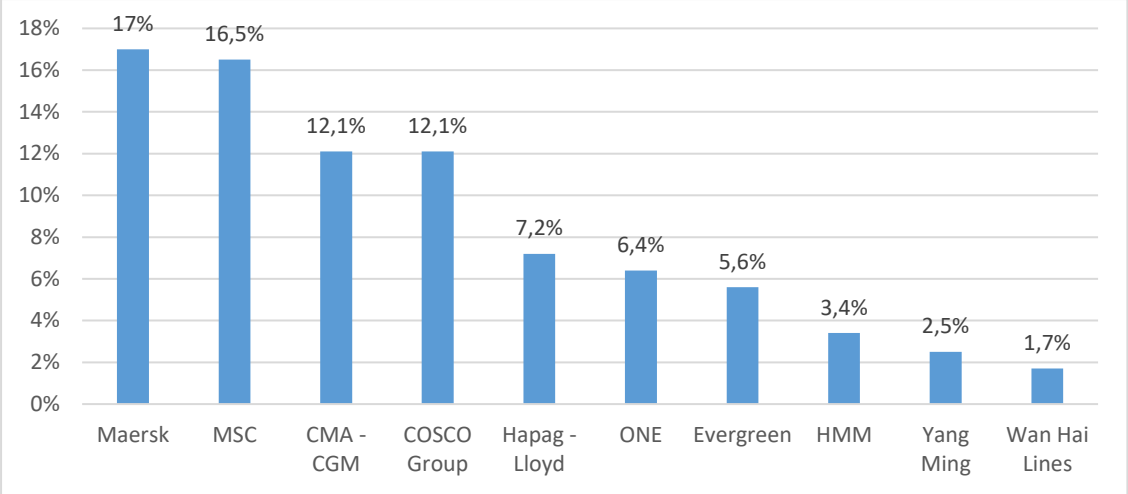


Figure 13. Market shares of the 10 largest liner shipping companies

Source: (Alphaliner, 2021), Author's elaboration

As it can be observed in the above figures, since 2016 the top four (4) positions are held by Maersk, which maintains for the time being the sceptres of the market, MSC which lately invests aggressively on newsbuilding and second-hand capacity[23], CMA – CGM and COSCO, which switch places for the third largest carrier over the years. It is worth noting that COSCO has recorded the most impressive increase in capacity since 2016 (from 7.6% to 12.1%), however all four major carriers have expanded their capacities considerably.

Amongst the remaining carriers, Hapag –Lloyd, Evergeen and Yang Ming, appear uninterruptedly in the ranking. The Hamburg-based, Hapag – Lloyd has managed to secure the fifth (5th) position (increasing by 2.8% its capacity since 2016), overtaking the Taiwanese Evergreen which although invested in new capacity (2% up from 2016) retreated to the seventh (7th) position of the ranking. The sixth (6th) position over 2020 and 2021 shield by the Singapore based ONE (Ocean Network Express) which is a joint venture amongst MOL, NYK and K-Line shipping companies.

As for Yang Ming, whose position varies since 2016 within the top 10 ranking, it is the sole carrier who has experienced a considerable decrease of its market share.

[23] As reveiled by the press, MSC will likely overtake Maersk in the leading position over the next couple of years. See (Financial Times, 7 July), 2021: https://www.ft.com/content/d06dff17-05f5-4698-aa7b-7cf7a919ebdc

Conversely, Hyundai Merchant Marine (HMM) and Wan Hai Lines have proliferated their capacities entering the ranking in 2020 and 2021 respectively.

Of the remaining carriers that appear only once in the ranking it is worth noting that Hanjin has gone bankrupt[24], Hamburg Süd and OOCL have been acquired by Maersk and Cosco respectively (Alphaliner, 2021), while Pacific International Lines (PIL) is currently under debt restructuring[25]. Overall, with seven out the ten carriers being amongst the ten largest carriers over the last six years, it can be said that the majority of the major liner shipping firms have strongly consolidated their positions in the market.

Such a consolidation and such a transition from a fragmented market in 2001 to a state of concentration in 2021 was made possible through large scale investments in additional capacity (organic growth) and consecutive consolidation waves (see Figure 14. below). In turn as far as mergers and acquisitions are concerned, Fusillo (2009) argues that containerization and technological advancements liner shipping raised the minimum efficient scale of operations, to a point where individual firms could not be able to achieve without horizontal integration. In addition, M&As were characterized as the fastest way (as it does not take time for them to purchase new ships, design marketing and operational networks; especially inheriting long-standing customers from acquired players) for global carriers to broaden their coverage in principal trade routes as well as enhance service quality (Nguyen, 2018).

Increasingly today, shippers seek more customized services through contract arrangements covering an array of shipping needs over a variety of shipping routes, for which carriers increasingly should incur customer-specific investments to ensure sufficient service quality (Reitzes & Sheran, 2002). Finally, price internalization, cost-cutting, pursuit of economies of scale and increases in productivity through investments in ever-increasing mega-vessels as well as market share preservation have been also drivers for the extensive M&A's and the transformation of the liner

[24] See : (Seatrade Maritime, 17 February, 2017) https://www.seatrade-maritime.com/americas/end-hanjin-shipping-officially-declared-bankrupt

[25] See: (Seatrade Maritime, 31 March, 2021) https://www.seatrade-maritime.com/finance-insurance/pil-completes-600m-restructuring

shipping market into an oligopolistic one (Haralambides, 2019, Khandelwal, 2000, Fusillo, 2009, Sys, 2009).

Apart though organic growth and M&A expansion, additional capital centralization processes have been put into play to enhance further the consolidation of the liner shipping market (Lee et al. 2012). Liner cooperation schemes have a long tradition in shipping (ever since the Calcutta conference in 1875) (Sjostrom, 2009), however their contemporary form of strategic (global) liner alliances dates back in the mid to late 1990s (Varbanova, 2017). Prior literature highlights the driving forces that lead to the formation of such alliances. More particularly, for Hoffmann (1999), the two main motives for companies to form alliances was the desire to reduce unit costs and gain greater market power. Evangelista and Morvillo (1999) denoted that by sharing an increasing number of activities through alliances, firms would opt for faster market expansion while gaining access to supplementary expertise and new capabilities without incurring high costs. Ryoo and Thanopoulou, (1999) related the establishment of alliances amongst Asian carriers to the economic crisis plaguing “tiger economies” (1997) while reasoned their emergence as a condition for their market survival. In addition, they investigated the differences between consortia and alliances, concluding that amongst the latter’s primal aims were the achievement of operational synergies, box utilization and economies of scale.

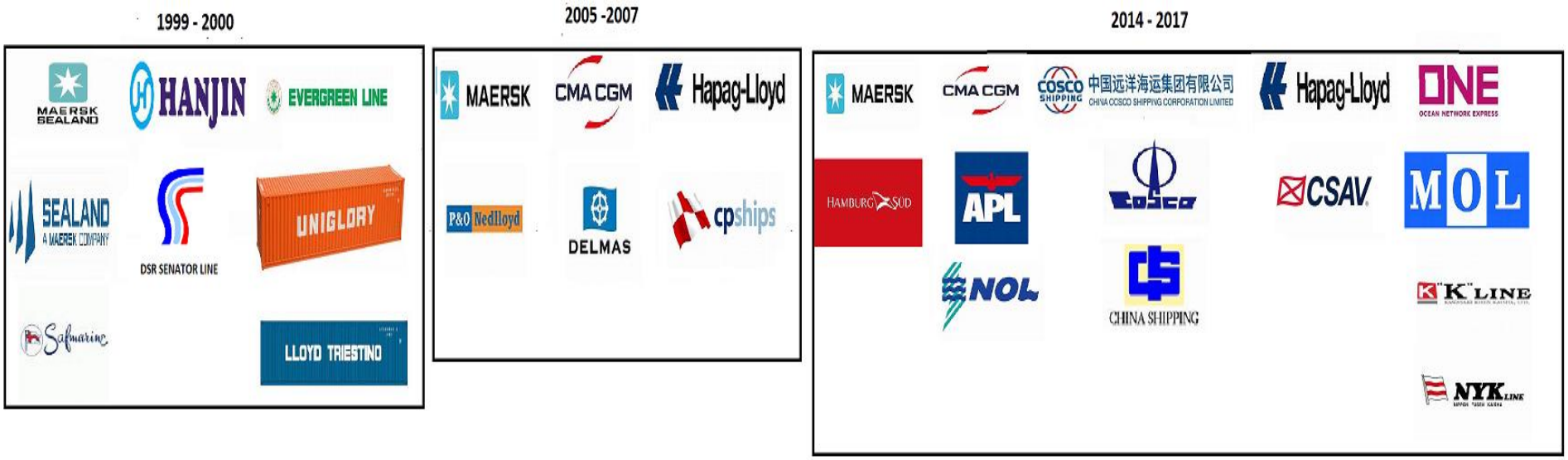


Figure 14. Evolution of Mergers & Acquisitions amongst liner shipping companies

Sources: Van de Voorde & Vanelslander (2008), China COSCO Shipping (2016), CMA-CGM (2015), CSAV (2014), Maersk (2016), FMC (2017), Author's elaboration

Midoro and Pitto (2000) also supported that alliances provided an opportunity to share risks and investments, achieve economies of scale and increase service frequencies while enhancing vessel utilization. For Cariou (2008) apart from capacity rationalization, alliances provided an opportunity to extend their geographical scope, and enhance network reach against their competitors. Ryan (2001) depicted the evolution of container shipping networks and the market restructuring within the 1989-1999 decade, also providing an explanation for their establishment and their influence. Slack et al. (2002) observed amongst other features, that alliances introduced in addition greater uniformity through the transformation of services, which became more alike, while also intensified operations in the industry, facilitating in turn greater service integration.

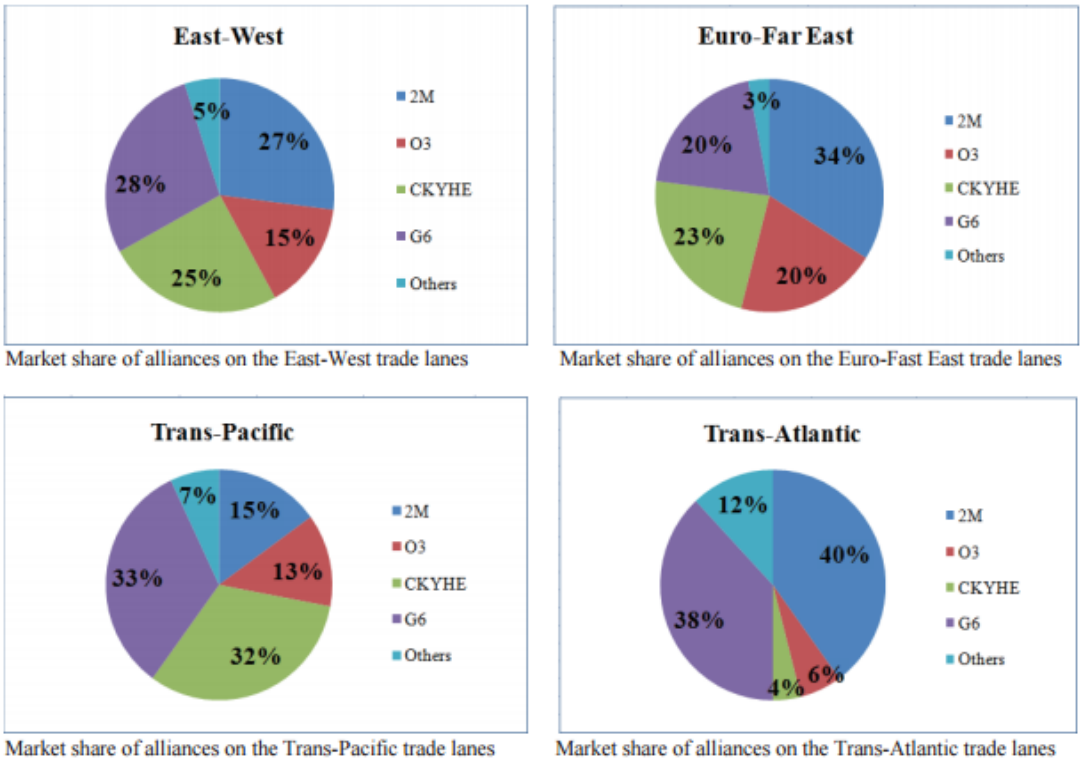
However, from a business cycle perspective periods of growth are commonly followed by recession, imposing stringent readjustment phases on the freight distribution systems and the global value chains they support (De Monie et al., 2011).The outbreak of the financial crisis in 2008, not only caused trade flows to plummet (by around 9%) (UNCTAD, 2010), but also brought to the surface endogenous to the industry characteristics which exacerbated the need for fundamental readjustments and restructuring. Low freight rates and poor profitability for the majority of carriers, in combination with the oversupply of ever-larger vessels which entered the market massively in the years following the crisis heightened competition while pressured carriers to re-consider their options (Huang, 2016).

Despite the fact that liner shipping is inherently characterized as an oligopolistic market (Sys, 2009), the above factors gave a new impetus for further centralization of capital within the industry, initially in the form of M&A's while on a second level through the re-establishment of alliances (Angelopoulos et al, 2017). Only this time, due to market conditions, even the largest companies were forced to create or join a reliable alliance to enhance their competitiveness.

After the abolition of conferences, the first cooperation scheme to emerge on a global level between ocean carriers was alliances (F.M.C, 2012). Alliances do not differ much from their predecessor (conferences) as to the gains achieved (Slack et. al, 2002), as

their aim is to further rationalize and manage excess capacities and costs, through the extension of their operational scope on a worldwide scale.

Despite the initial abolition of the alliance comprising the three largest at the time carriers (Maersk, MSC and CMA-CGM) by the Chinese Ministry of Commerce (MOFCOM) (Drenan, 2015), in 2014 four liner alliances were fully operational: 2M (Maersk & MSC), O3 (CMA-CGM, China Shipping & UASC), G6 (NYK Lines, APL, Mitsui OSK lines, Hapag-Lloyd, CSAV, Hyundai Merchant Marine, Orient Overseas Container Liner), and CKYHE (Cosco, K-Line, Yang Ming, Hanjin & Evergreen). Within a very short period of time the above alliances managed to dominate all major trade routes with cumulative market shares ranging between 88% and 97% (Maritime Insight, 2014).



Market share of alliances on the East-West trade lanes

Market share of alliances on the Euro-Fast East trade lanes

Market share of alliances on the Trans-Pacific trade lanes

Market share of alliances on the Trans-Atlantic trade lanes

Figure 15. Alliances' market shares on major trade lanes

Source: (Maritime Insight, 2014)

Despite their dominance however, a major reshuffle underwent between 2014 and 2017 as a consequence of the Hanjin bankruptcy and of consecutive M&A activity amongst carriers (such as the merging of K-Line, MOL & NYK into a newly established liner company, ONE) from different alliances (Yap & Zahraei, 2018).

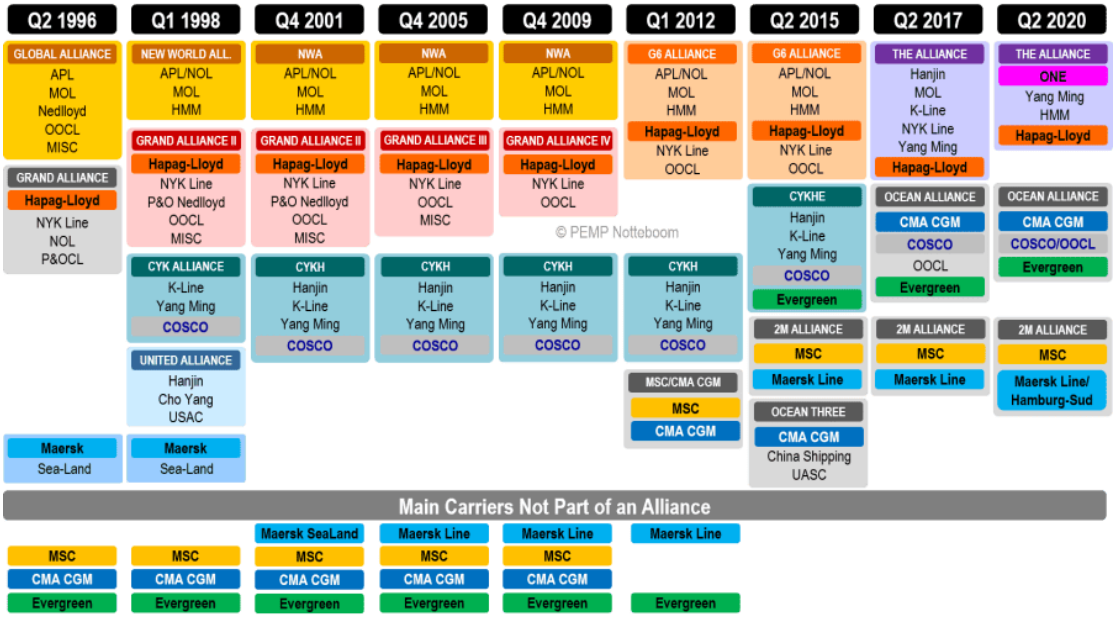


Figure 16. The evolution of liner shipping alliances

Source: Port Economics, Management & Policy (17 August, 2021), updated from Notteboom, T. (2012), Chapter 12: Container shipping, in: Talley, W. (ed.), The Blackwell Companion to Maritime Economics, Wiley-Blackwell Publishing, ISBN: 978-1-4443-3024-3, pp. 230-262.

The above reshuffling among the members of each alliance is not a new phenomenon, however. Midoro and Pitto (2000) identified instability factors even in the first formulation of alliances. According to their findings increased organizational complexity as well as intra alliance competition is likely to undermine the level of mutual trust and hence cause instabilities among partners. Lu et al. (2006) also confirmed the instability between alliance member while emphasized on the need for mutual trust, compatibility, and common managing culture to ensure the success of the alliance. In addition, Yoshida et al. (2005) focused on the effects of network economies on strategic alliances to find that Japanese companies achieved cost reductions through network extension achieved through participation in the alliances.

Ferrari et al. (2008) supported that a key factor for success for shipping alliances is the optimization of shipping networks while according to Mitsuhashi & Greve (2009) network and resource compatibility are important formation factor for carriers. More recently Yang et al. (2011) investigated, by applying the core theory, the influence of increasing ship size to the stability of shipping alliances, to find that the latter is significantly related to the structure of member's demands and joint ship's capacity when they decide to use a joint service strategy. Finally, Rau and Spinler (2017)

confirmed that competitive intensity, alliance complexity cost and freight rate volatility are decisive drivers for alterations in alliance member formations.

Since the beginning of 2017, the three existing liner alliances, are comprised of the nine out of ten largest liner carriers: 2M (comprising the same partners as well as Hamburg Sud, acquired by Maersk), with an aggregated market share of 34%, the OCEAN Alliance (comprised by CMA-CGM with APL, Cosco Group –with the acquisition of OOCL, and Evergreen) with a market share of 29.8%, and THE Alliance (comprised by Hapag Lloyd -with UASC-, ONE, HMM and Yang Ming) with 19.5% respectively (Alphaliner, 2021, FMC, 2017). While all three alliances have been approved by the three major global regulators, Haralambides (2019) estimated that in 2019, they carried around 80% of the world container throughput.

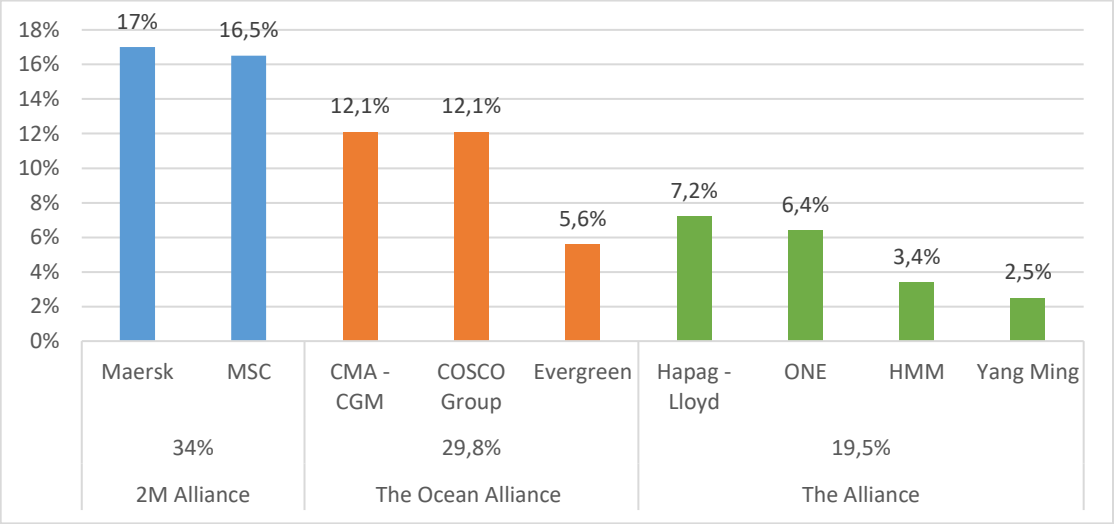


Figure 17. Liner Shipping Alliances' Capacity & Market Share

Source: (Alphaliner, 2021), Author's elaboration

Apart from the alliances however, carriers in the liner shipping industry utilize vastly another cooperation scheme, known as consortia. According to Merk & Teodoro (2022), carriers engage in cooperation with all of their major competitors in a system of consortia that is highly interlinked. According to his research, the number of consortia has increased substantially over 2006–2021, together with the capacity they operate. More specifically, in 2006, around 31% of the global containership capacity was operated in consortia; this was 49% in 2021. Over the same period, the share of capacity operated by shipping lines that are members of alliances increased from 22% in 2014 to 42% in 2021. Based on the above findings, Merk & Teodoro (2022) suggest

that in addition to mergers and acquisitions, further market consolidation has been occurring in the liner shipping industry through the formation of consortia amongst the biggest shipping lines (See Table 4. below). For this reason, the authors argue that an assessment of industry concentration in liner shipping is highly incomplete if it does not take consortia and alliances into account. In this vein, although consortia and alliances are utilized by carriers to enhance the utilization rate of their vessels, expand their service network amongst other, they nonetheless reduce the choice for shippers and result in an increased buying power for carriers and in extension of an oligopsony risk against ports and port service providers (Merk & Teodoro, 2022). To this end, the strengthening of consortia and of liner alliances' market shares raises concerns with respect to their market power, through collusive or abuse practices, that may hamper fair competition.

Table 4. Links between top 10 carriers via consortia in 2021

	2 M		Ocean alliance			THE Alliance					Total
	Maersk	MSC	CMA CGM	COSCO	Evergreen	Hapag Lloyd	HMM	ONE	Yang Ming	ZIM	
2 M											
Maersk		2	4	3		4		4		2	19
MSC	2		1	2		4	1	3		1	14
Ocean alliance											
CMA CGM	4	1		10	5	8		2	1	2	33
COSCO	3	2	10		12	6		10	5	3	51
Evergreen			5	12		3	1	5	3	2	31
THE Alliance											
Hapag Lloyd	4	4	8	6	3		5	11	6	1	48
HMM		1			1	5		6	4		17
ONE	4	3	2	10	5	11	6		7	3	51
Yang Ming			1	5	3	6	4	7			26
ZIM	2	1	2	3	2	1		3			14
Total	19	14	33	51	31	48	17	51	26	14	

(Source: Merk & Teodoro,2022)

Bockhart (2016) confirms for the first time that the new synergetic ventures among leading Ocean carriers may, in some cases, inhibit trade in major trade routes in a manner consistent with the definition of market power. Hence, market power acquired through participation in alliances, which according to Shepherd (1970) is

defined as the ability to influence directly or indirectly price, quality and the nature of products, appears to affect the competitive function of the market; therefore, reinforcing the arguments for the formulation of appropriate regulatory measures which will safeguard and facilitate competition.

4.3.2 Terminal Operators' Market Concentration

The deregulation of former port state-monopolies along with technological innovations and concentration in the liner shipping sector, also affected the terminal operating business (Rodrigue, 2010). Global (Terminal) Operators emerged and expanded through consecutive waves of consolidation, establishing multinational strategic portfolios (Peters, 2001). Slack & Fremont (2005) and Olivier, et al. (2007) were amongst the first to provide a typology for the internationalization and the rise of multinational firms in the port handling business. Notteboom & Rodrigue (2012) combined these approaches and categorized global terminal operators in three categories:

- *Stevedores or Global Terminal Operators*, whose core business is terminal operations, and through horizontal integration expand in new locations and diversify their revenue geographically. Examples include leading worldwide operators such as DP World, Port of Singapore Authority (PSA), Hutchison Port Holding (HPH), China Merchant Holdings International, and smaller ones such as Eurogate.
- *Container Carriers (or Mega Carriers)*, who expand vertically their scope of operations through subsidiaries or so-called sister companies, to secure capacity and favourable handling conditions (Chlomoudis, 2011) in order to enhance core business coordination (Fremont, 2009) as well as to achieve differentiation (Brooks, 2000). A litany of shipping liners entered the terminal business, including Maersk through APMT, COSCO through COSCO Shipping Ports, Mediterranean Shipping Company (MSC) through Terminal Investment Limited (TiL) and CMA-CGM through Terminal Link.
- *Financial holdings*. Despite their core business being asset management, financial holdings expanded in terminal operations for revenue generation - due to the consistent profitability-, and risk mitigation. Examples include

investment banks (Goldman Sachs-SSA Marine), and pension funds (Caisse de dépôt et placement du Québec).

Another classification can be made, distinguishing between privately and state-owned terminal companies (Drewry, 2014). Despite their heterogeneous background and alternative categorizations, it can be argued that the majority of global terminal operators have experienced significant growth, through (a) large-scale capital investments, (b) M&As, (c) establishment of joint ventures (Drewry, 2010).

Similarly, to the consolidation waves experienced in the liner shipping market, De Souza et al. (2003), categorize the process of internationalization of the container operators' industry in three distinct but consecutive waves. According to their analysis the first wave initiated, with operators such as HPH and P&O amongst others which while seeking investment opportunities abroad (Peter, 2001), chose to expand the geographical scale of their operations, benefiting from the liberalization of the terminal operators' industry in many countries across the world. While these strategies proved to be successful, in the second wave a number of companies such as PSA and Eurogate, replicated such initiatives, opting too for their internationalization. Finally, in the third wave it was the turn of liner carriers such as Maersk and Cosco, to enter the market through vertical integration in order to extend their reach of operations across the supply chain, supporting in such a way their core business.

Particularly for the case of liner carriers, Parola & Musso (2007) suggest that the latter adopt a set of diversified strategies in order to obtain dedicated handling services. As such, some acquire terminal facilities and act as stevedoring companies, some others invest in terminals (minority shares, joint-ventures, majority shares) without being involved in the day-to-day operations, which they outsource to local or global pure stevedores, while finally a third category of liners just sign contracts with stevedoring companies for customized or semi-customized services. According to their analysis the degree of involvement of liners in terminal handling varies, and can be divided into four major categories (Parola & Musso, 2007):

- The first category involves a special agreement between the terminal and the carrier based on TEU throughput. The terminal operator agrees to provide

berthing and crane priority and, in some case, allows a cargo volume-based discount on port charges. Examples are PSA facilities in Singapore (terminal agreements with different carriers), ECT Delta terminal in Rotterdam (berthing agreements with main alliances) as well as Piraeus Port Authority (contractual throughput agreement with MSc).

- In the second category, the liner holds a minority share (usually less than 20%) in the terminal, but has not part in the revenue created, except through dividends. The carrier is involved in mid to long-term planning, but not in the short-term management and terminal operations. Examples are Cosco in some HPH terminals in China as well as MSC in its northern Europe terminals.
- In the third category, a 50/50 joint venture between the liner and the terminal operator is established. The terminal can be managed either by the terminal operator or by a third-party stevedore. Examples are at the Kwai Chung port in Hong Kong (Cosco- HPH), Bremerhaven (Eurogate-Maersk) and the then project for the Euromax terminal in Rotterdam (P&O Nedlloyd-HPH).
- Finally, in the fourth category, involved a dedicated terminal owned (51% or more) and operated by the liner, which can even attempt to cater for third-party traffic. Examples are the APM terminals in Algeiras, Los Angeles (Pier 400) and Rotterdam, and the Evergreen terminals in Taranto and Coco Solo.

Characteristic is that for 2012, liner shipping companies accounted for 21% of the investments in container terminals, while Global Terminal Operators such as PSA, HPH, DPW and ICTSI accounted for 33% (Farrell & Vanelslander, 2015). Thus, while liner carriers increasingly expanded through vertical integration within the container terminal sector in order to:

a) increase operational efficiencies and cut costs (Parola & Musso, 2017),
b) better manage their ever-increasing vessels while decreasing costs of handling (Midoro et al., 2005),
c) undertake the necessary investments to adequately service mega-vessels (Merk, 2015),
d) differentiate the services provided in order to exert enhanced control over the door-to-door supply chain (Haralambides, 2017) as well as to

e) incur profits (Alvarez-SanJaime et al., 2013)

pure terminal operators expanded too through horizontal integration to counterbalance the consolidation observed in the liner shipping market.

In parallel, the latter opt for vertical integration too, expanding in the upstream market (inland terminals and logistics services provision) to attain the advantages of vertical integration as well as to extend their reach within supply chains (De Borger & De Bruyne, 2011).

Notteboom (2004), with respect to expansion strategies of Mega Carriers and Global Terminal Operators, argues that they aim towards sustaining competitive advantage through development of market barriers. These barriers are strongly connected to the scale of operations, allowing global operators to create buffers of resources, to both withstand intense competition wars and enable them to financially outperform rival companies in bidding for additional terminals (Notteboom, 2004). Especially for the case of liner carriers, De Langen & Pallis (2007) as well as for Cariou (2008) and Parola et al. (2015) also suggest that pursued vertical integration might act as a barrier or may deter market entry.

According to Drewry's annual reports on global container operators (Drewry, 2009,2010,2014), over a period of seven years (2007 - 2013) only slight changes in the ranking of the top 10 global operators have taken place (Table 5) while during the same period, TEU volumes have grown (Figure 18.).

Table 5. Top 10 Global Operators Market Shares

Ranking.	***Top 10 Operators 2007***	***Market Share***	***Top 10 Operators 2009***	***Market Share***	***Top 10 Operators 2013***	***Market Share***
1	PSA International	9.6%	PSA International	9.5%	PSA International	8.2%
2	Hutchison Port Holdings (HPH)	6.8%	Hutchison Port Holdings (HPH)	6.8%	Hutchison Port Holdings (HPH)	7.0%
3	APM Terminals	6.4%	DP World	6.7%	APM Terminals	5.5%
4	DP World	5.8%	APM Terminals	6.6%	DP World	5.1%

Ranking.	***Top 10 Operators 2007***	***Market Share***	***Top 10 Operators 2009***	***Market Share***	***Top 10 Operators 2013***	***Market Share***
5	COSCO	2.0%	COSCO	2.3%	China Merchants International Holdings	3.6%
6	Evergreen	1.8%	MSC	1.7%	COSCO	2.9%
7	Eurogate	1.5%	Evergreen	1.5%	Terminal Investment Limited	2.4%
8	MSC	1.4%	SSA Marine	1.3%	China Shipping Terminal Dev.	1.3%
9	HHLA	1.4%	Eurogate	1.3%	Hanjin	1.2%
10	APL	1.0%	CMA-CGM	1.0%	Evergreen	1.2%
Total Top 6		32,4%		33,6%		32,3%
Total Top 10		37.7%		38.8%		38.4%
Total Top 22		44.5%		45.6%		47%

Source: Drewry, (2009,2010,2014). Author's Elaboration

Seven out of ten global operators (PSA, HPH, APMT, DPW, COSCO, MSC-TIL, Evergreen) have experienced only ranking shifts and the leading four have managed to sustain their positions. In 2013 the latter achieved a market share of 26%, when the share of the first ten sums to 38.4%. PSA (8.2%) retains the leading position, attributed to the global scale of its operations and to the ownership of 20% of the second largest terminal operator, HPH (7%).

Additionally, five out of ten global operators bear strong links with the liner shipping industry: APM Terminals (5.4%) sister company of Maersk Lines, remains the leading operator of this category (having also acquired a 30.75% in Global Ports Group – GPI) (APMT,2019), followed by COSCO (2.7%), Terminal Investment Limited (2.4%, MSC's terminal subsidiary), Hanjin and Evergreen (1.2% each). Notwithstanding, Hanjin's entrance in the top ten list can be considered rather temporary, as even before its bankruptcy in 2016, the company attempted massive terminal-related asset sales in order to reduce debts and losses stemming from its liner-shipping segment (Drewry, 2014).

With respect to the financial holdings category, DPW has enhanced its position in the terminal business following the acquisitions of CSX World Terminals and P&O in 2005 and 2006 respectively (DPW, 2008). On the other hand, SSA Marine (Goldman Sachs)

which made the top ten in 2009, retreated in the 13th position in 2013, leaving DPW as the only representative of this category in the top 10.

Other major developments for 2013 included the market entrance of China Merchants International Holdings in the fifth place (3.3%) through investments in a large number of terminals around the world as well as through the acquisition of interests in a range of other terminal operators such as Shanghai International Port Group (24.5%), Modern Terminals limited (27%) and Terminal Link (49%) the terminal leg of CMA-CGM (Notteboom & Yang, 2017).

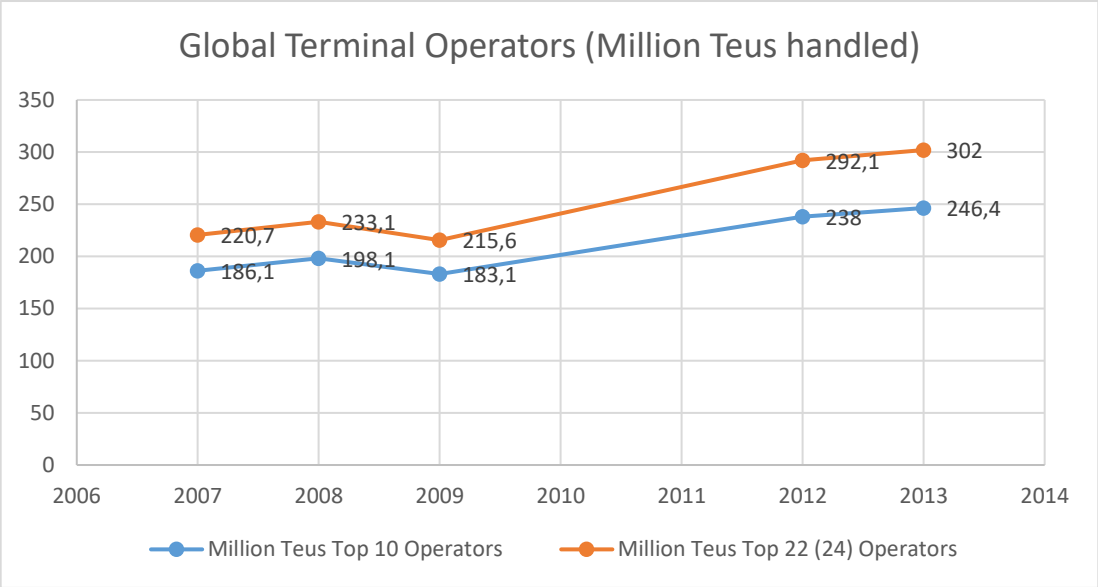


Figure 18. Top 10 vs top 24 Global Operators

Source: Drewry (2009, 2010, 2014), Author's Elaboration

Apart from the apparent and sustained consolidation of the sector by the various types of Global Operators that prevailed since the early 2000, two other aspects should be taken into account, in order to capture the extent and potential for concentration in terminal operations: (a) intra-industry relationships among global operators and (b) plans for terminal investments and expansion.

With respect to the first aspect, contemporary port literature including Van de Voorde & Vanelslander (2008) and Parola et al. (2014), apart from M&A activities, also unveil the hidden families of terminal operating groups. Through network analysis, in Parola et al. (2014) it is argued that global operators gradually resort to equity joint ventures in order to share financial resources, critical assets and risks. (Table 6).

Table 6. Preferred Partners & Number of Equity Joint Ventures among major Global Operators

Global Operator	*Preferred Partner(s) & Number of Equity Joint-Ventures*
PSA	HPH(49), COSCO Group (6), CSCL(2), YML(2), OOCL(1), Hyundai (1), K-Line(2), MSC (2)
HPH	PSA (49), Hyundai(1)
APMT	DPW (1), COSCO GROUP (6), Evergreen (2), Ballore Group (6), OOCL (1), TCB(6)
DPW	APMT(1), CMA-CGM (4), Dragados (1), APL(1)
COSCO Group	APMT (6), MSC (2), PSA(6), OOCL(1)
CMHI	MTL(Wharf Holdings)(5), SIPG(11)
MSC/TIL	COSCO Group(2), Eurogate(4), Noatum(JP Morgan)(2), PSA(2),
Hanjin	Hyundai(1), YML(2), Macquarie (6), K-Line(2)
Evergreen	APMT (2), Wan Hai (1)

Source: (Adjusted from Parola et al., 2014, Maersk, 2015, PSA,2015)

In addition to the recent evolution in inter-firm relationships, the rise of mega alliances in liner shipping is expected to further increase cooperation among terminal operators. Firstly, this stems from the fact that alliance members are authorized to discuss and agree on the ports to be called (FMC, 2014), therefore volumes will be shifted toward ports where their partners -many of which are global operators- have terminal investments.

A prime example is OCEAN alliance: Its members, COSCO and CMA-CGM, through their terminal arms signed an MOU for port operations and investments cooperation, at the ports where the alliance calls (CMA-CGM, 2017). Secondly, both independent stevedores and global terminal operators are expected to be forced to opt for more cooperation in order to increase leverage against liner alliances, due to the increase in the size and bargaining power of the latter (Martinho, 2008). This assertion is based on the strategic decisions terminal operators have taken after the formation of the

alliances which led to the establishment of an oligopsonistic terminal operations market [26].

With respect to the second aspect, i.e., plans for terminal investments and expansion, it is important to note that in 2013 the public sector still accounted for about 20% of global throughput. However, the public sector admittedly faced increasing challenges in financing additional large-scale investments required to accommodate the ever-increasing size of container vessels (Merk, 2015). Respectively, it has been reported (Drewry, 2014, 2010) that the majority of global operators have managed to retain profit levels and EBITDA margins (ranging 20% to 45%), albeit lower than pre-2008 levels. Therefore, this dichotomy between public and private operators created an opportunity for the latter to cover the investment gap. However, their strategies were not uniform, since in several cases terminal operators - mostly connected with liner companies- sold their assets to improve liquidity, rebalance their portfolio and optimize their network configuration (Notteboom & Rodrigue, 2011).

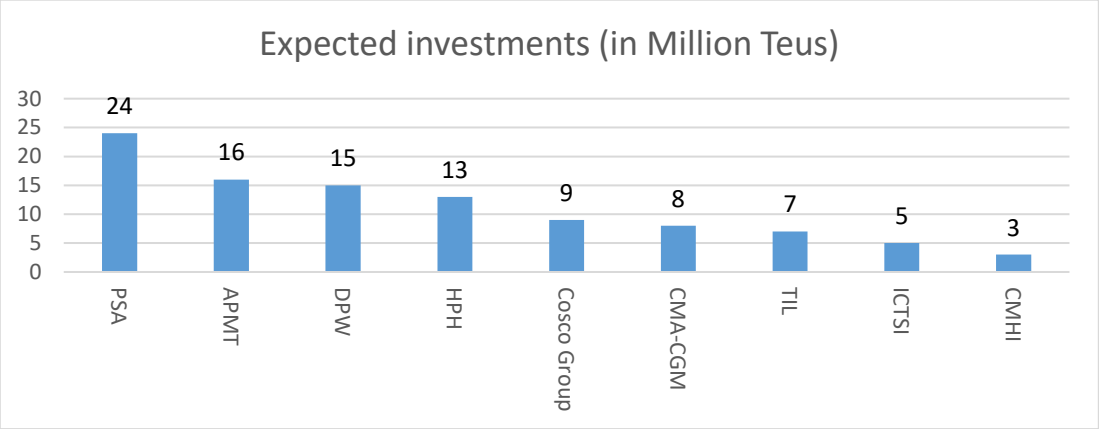


Figure 19. Investment plans of Global Operators in port capacity (m. TEUs)

Source: (Drewry, 2015)

According to Drewry estimates (2015), global operators (PSA, HPH, ICTSI and CMHI) were in the top of the list for future investments in terminal capacity, amounting to 45 m. TEUs. Mega carriers (Maersk/APMT, COSCO, CMA-CGM and MSC through TIL) followed, with estimated investments of 40 m. TEUs for the next four years. Nonetheless, mega carriers that continue to invest are the ones that invested in large

[26] See: http://www.supplychaindive.com/news/port-consolidation-alliance-shipping-negotiation/432775/

vessels. In essence they planned the necessary investments for evolving terminal portfolios in order to secure capacity, increase efficiency and provide favourable handling conditions for their vessels. However, a portion of mainly smaller terminal operators and other mega carriers, such as Hanjin, Yang Ming, K-line and Hyundai had either limited or no expansion plans at all (Drewry, 2015), due to either financial challenges or prioritizing in favour of their main shipping activities. Finally, from terminal operators connected to financial markets, DPW was the only company investing heavily -15 m. TEUs – in additional capacity.

Especially for Mega Carriers, the "scaling-up" wave in ships sizes, which followed the announcement of Maersk's Triple E in 2011 and the ever since growing demand for ever-larger containerships, rendered terminal operations increasingly important. To endure the benefits of economies of scale achieved while at sea, excessive investments on terminals' infrastructure and superstructure should be made to meet the new standards required to efficiently perform handling operations on such vessels; investments that are not always willingly undertaken by local terminal operators or the public sector (Merk, 2015).

As such, along with GTO's many of the shipping lines assumed a large proportion of the necessary investments while also expanded their presence in the terminal sector through M&A's, acquisition of stakes in terminals and joint ventures (Parola et al., 2014). Through this consolidation processes some of the largest liner carriers such as Maersk, China Cosco Shipping, CMA-CGM as well as MSC amongst others, through their terminal subsidiaries, emerged as market players with extensive networks of terminals around the globe.

In parallel, their involution in the formulation of strategic alliances – which incidentally was also, amongst others, a response to the exacerbation of overcapacity caused by the deployment of ever-larger vessels – provided these Mega Carriers with the sufficient scale to enhance further their negotiating power vis-a-vis, port authorities and stevedores (Heaver et al., 2000). Particularly for ports and terminals on major trade routes, the establishment of alliances and subsequently the rationalization of their networks reduced the number of direct port-to-port services (UNCTAD, 2017) as well as the number of potential clinets (oligopsony), increasing the competition among

the former and the dependency upon the latter. Yap and Zahraei (2018) considered the impact of alliances in port connectivity for 3 Southeast Asian container ports, to find that a significant service rationalization took place, with around 38% reduction in the shipping services calling at those ports. To this end, the authors assert that terminal operators and port authorities will increasingly need to cater the needs and be useful to alliances' key members to sustain them as clients. Respectively Merk et al. (2018) in their International Transport Forum publication on the impact of liner alliances, argue that the latter have led to a rationalisation of alliance networks which eventually reduced the number of direct port connections. In this respect, as most ports depend on one or two alliances the risk of losing alliance calls provides carriers with huge leverage over ports to reduce rates and invest in additional infrastructure.

Li, Haralambides & Zeng (2022), who study case of the container port system of China's Pearl River Delta, in the light of the above developments, also argue that the latter affect port market shares and the investment propensity of terminal operators, thus indirectly affecting competition among terminals. For this reason, as competition patterns of the container port system is becoming more complex, the propose as a countermeasure policy interventinos towards a rationalized, integrated port system development (Li et al., 2022).

Despite this diversity in expansion strategies and the novel challenges faced by ports and terminal operators, it was estimated that demand for port services would grow on average 4.5% annually until 2018, requiring another 168 m. TEUs capacity. Also, the global capacity was expected to grow from 670 m. TEUs in 2014 to 840 in 2018 (Drewry, 2015). As such, as inter-firm relationships amongst terminal operators continued to evolve and grow stronger over time (through new joint ventures as well as through the operation of alliances), demand for additional port capacity was met by a limited number of actors. As it can be observed in Figure 20. below the four (4) largest terminal operators control 45.1% of the global throughput while the six (6) largest the 60.1% and the ten (10) largest the 70.9% respectively.

Ranking	Operator	Throughput				Capacity	
		Total port handling (million TEUs)	Share of world throughput (percentage)	Growth or decline (million TEUs)	Growth or decline (percentage)	Total capacity (million TEUs)	Growth or decline (percentage)
1	COSCO	109.8	13.7	4.0	3.8	141.6	8.9
2	PSA International	84.8	10.6	4.8	5.9	117.0	3.9
3	APM Terminals	84.2	10.5	5.5	7.0	107.6	7.9
4	Hutchison Ports	82.6	10.3	0.1	0.1	113.0	0.9
5	DP World	69.4	8.7	-0.6	-0.9	91.0	1.5
6	Terminal Investment Limited	50.8	6.3	3.1	6.4	72.8	16.8
7	China Merchants Ports	35.6	4.4	1.1	3.1	44.2	3.1
8	CMA CGM	26.1	3.3	0.5	2.0	43.1	12.3
9	SSA Marine	13.0	1.6	0.4	3.3	20.5	1.4
10	ICTSI	11.8	1.5	2.0	20.9	20.0	11.7

Figure 20. Global terminal operators, throughput and capacity, 2019

Source: (UNCTAD, 2020, from Drewry, 2019, Global Container Terminal Operators Annual Review and Forecast: Annual Report 2020/21).

Respectively as far as throughput volumes and global market shares are concerned, Figure 21. below, suggests that in that respect too, the terminal operators market sustains a high level of consolidation,

Ranking			2019	
2019	2018	Operator	T'put (mteu)	share (%)
1	1	PSA International	60.4	7.5%
2	3	China Cosco Shipping	48.6	6.1%
3	5	APM Terminals	46.8	5.8%
4	2	Hutchison Ports	45.7	5.7%
5	4	DP World	44.3	5.5%
6	6	China Merchants Ports	41.5	5.2%
7	7	Terminal Investment Limited (TIL)	28.8	3.6%
8	8	ICTSI	10.1	1.3%
9	11	CMA CGM	8.3	1.0%
10	10	SSA Marine	8.3	1.0%

Figure 21. Top 10 Global Operators Throughput and Market Shares in 2019

Source: (Drwery, 2020)

As results suggests, the abovementioned factors, have directly and indirectly influenced the evolution of concentration in the terminal operators' market. More specifically, in comparison to 2013 data, the Total Market Share of the 6 largest Global Terminal Operators has increased from 32.3% to 35.8% in 2019. Apart from the per se increase in their aggregate market share, it is interesting to note that the terminal operators that comprised the Top 6 list in 2013 are exactly the same in the 2019 ranking. The sole difference is the rearrangement in the sequence between some of these operators. Other than that, apart from PSA and HPH who experienced a decrease in market share (in relation to that of 2013), all the other terminal operators (and specifically COSCO) have reinforced their market positions. Respectively, as far as the Top 10 Terminal Operators' aggregate market share in terms of throughput, has risen from 38.4% in 2013 to 42.7% in 2019 while finally, the aggregate market share of the 21 (22 in 2013) identified Global Terminal Operators also rose to 49.1% (47% in 2013).

Thus, overall, the terminal operators market similarly to the liner market segment continues to grow stronger, becoming more concentrated over the years. Although concentration levels in these markets are not equivalent, with the terminal market being significantly less concentrated, our analysis suggests that liner shipping strategies for expansion trigger and intensify to some extent the deepening of concentration also in the terminal operators' market. The increased investment costs to provide adequate infrastructure and superstructure as well as efficient handing operations to the ever-increasing container vessels, which in many cases the states cannot fund, has rendered Global Operators as the primal candidates to undertake such a task henceforth. In addition, the establishment of numerous joint ventures amongst incumbent players, across the world as well as the reformation of liner alliances (within which at least one liner carrier is also a Global Operator with an extensive terminal network) enhance the inter-firm and intra-firm relationships established in these interrelated markets as well as their bargaining power, diminishing the ability of independent operators to effectively compete.

4.3.3 Co-opetition within transport networks

The formation of oligopolistic and oligopsonistic market structures in liner shipping and terminal operations respectively, has given rise to the development of a co-dependent relationship through closer and stronger inter-firm as well as intra-firm relationships among them. Through alliances in liner shipping and multi-ownership schemes in terminals between mega carriers, global operators and amongst the two, the interplay of containerized transport actors has increased, creating progressively a case of horizontal and vertical interdependence. Thus, apart from competing with each other, these evolving ties also increased the level of collaboration among them; an oxymoron state known as co-opetition (Chen, 2008).

The term appeared first in Brandenburger & Nalebuff (1996) and describes a strategy which embodies both the concept of competition and cooperation, allowing co-opetitors to capitalize upon the benefits of both. Companies collaborate to increase the market size and at the same time compete to capture a larger market share, creating a so-called win-win situation (Brandenburger & Nalebuff, 1996). Within this framework, markets are not considered singular structures, but evolving into a system of interactive and continuous relationships in which firms progressively tighten their mutual commitments and create value (Dagnino & Padula, 2002).

Within the transport network, firms have to develop vertical and horizontal relationships in order to create value and provide bundles of services (Acciaro, 2010). Therefore, containerized transport actors of the same or of consecutive segments of the transport network, often act complementarily, co-developing routes, sharing capacity (both at terminals and vessels), know-how and cooperate to realize investment, optimize utilization and resources along the supply chain (Chlomoudis, 2011). In addition, such resource sharing practices according to Parola et al. (2015) may enhance efficiency and performance of cargo movement and handling without additional investments (see Haralambides (2002) concept of operational excess capacity), while also increasing profitability, sustainability and resilience to market fluctuations (Song, 2003).

In Tables 7 and 8 below, the containerized transport segments in which the largest Mega Carriers and Global Terminal Operators operate (either directly or indirectly –

through partnerships) are depicted in an effort to illustrate the control they exert over supply chain networks as well as the segments of potential cooperation amongst them.

Table 7. Expansion of Mega Carriers Across the containerized supply chains

Mega Carrier	Containerized Supply Chain Reach						
	Liner Shipping	Terminal Operations	Warehousing – Inland Depots	Logistics Services	Multimodal Transport	Air Freight	Other Sectors
APM Maersk	●	●	●	●	◐	◐	●
MSC	●	●	●	●	◐	○	●
COSCO Group	●	●	●	●	●	◕	●
CMA -CGM	●	●	●	●	◐	●	●
Hapag-Lloyd	●	◐	●	●	◐	◐	◐
Evergreen	●	●	●	●	◐	●	●
ONE	●	◕	◕	◕	◐	◕	◕
HMM	●	●	●	●	◐	○	●
Yang Ming	●	●	●	●	◐	○	●
Wan Hai Lines	●	●	●	●	◐	○	●

Degrees of competency legend: ● (direct provision), ◕ (provision by affiliated company) ◐ (indirect provision through partnerships), ○ (no provision). Source: (Company Sites, Annual Reports) Author's Elaboration.

As illustrated, liner Mega-carriers provide either directly or indirectly multiple services throughout the containerized supply chains. More specifically, all liner carriers apart from shipping services, are involved directly in warehousing/inland terminal

operations and in the provision of logistics services. Hapag Lloyd is the only liner without direct involvement in terminal operations (however, it still has a cooperation agreement with HHLA terminal operator) while ONE also may not own any container terminals however, its founding companies (MOL, NYK, K-Line) are all involved in the terminal business. Similarly, ONE's shareholding companies also own warehouses/inland depots and have logistics and airfreight divisions. As far as multimodal transport services are concerned all companies but COSCO (which also operates its own trains and trucks) have established partnerships with rail freight and trucking companies to ship containers.

Evergreen and CMA-CGM (also through partners) are the only carriers who offer directly airfreight services, while also COSCO is a shareholder in China Cargo Airline and has block space agreements and centralized purchasing agreements with many airlines. Respectively, Hapag – Lloyd cooperates with Lufthansa for its airfreight cargo and Maersk provides airfreight services through strategic partnerships. Finally, it is worth noting that all 10 largest carriers are involved in businesses outside the transport sector (cruises, real estate, supermarkets, hotels, oil and gas etc.) meaning that apart from mega transport groups they are also large conglomerates.

Respectively, for the case of Global Terminal Operators, results indicate that all major terminal operating companies also pursue vertical integration strategies in an effort to expand their reach throughout the door-to-door transport chain. Aside from the direct provision of liner shipping services (which all offer in partnerships with major liner carriers), the services offered by Global Terminal Operators are similar to the ones offered by Mega Carriers.

More specifically, all major operators are involved in port, dry-port and rail terminal operations, warehousing, logistics and inland (rail and truck through strategic partnerships) services provision, while PSA, HPH, China Merchants Ports and DPW also offer airfreight solutions established through partnerships. Similarly, to Mega Carriers, all Global Operators are also part of large conglomerates, a fact which reinforces their ability to expand and undertake investments throughout the supply chain network.

Table 8. Expansion of Global Terminal Operators Across the containerized supply chains

Global Terminal Operators	Containerized Supply Chain Reach						
	Liner Shipping	Terminal (port & rail) Operations	Warehousing – Inland Depots	Logistics Services	Multimodal Transport	Air Freight	Other Sectors
PSA	◐	●	●	●	◐	◐	●
HPH	◐	●	●	●	◐	◐	●
China Merchants Port	◐	●	●	●	◐	◐	●
DPW	◐	●	●	●	◐	◐	●
SSA Marine	◐	●	●	●	◐	○	●
ICTSI	◐	●	●	●	◐	○	●

Degrees of competency legend: ● (direct provision), ◐ (indirect provision through partnerships), ○ (no provision). Source: (Company Sites, Annual Reports) Author's Elaboration

Notwithstanding the above however, Acciaro (2010) as well as De Langen & Pallis (2007) argue that service bundling also tends to shrink competition as it provides companies, with greater opportunities to differentiate as well as to build barriers for newcomers through integration of consecutive stages of the chain. Vertical and horizontal integration for Cetin & Cerit (2010), especially of liner companies, can result in a power concentration of port users which can in turn lead to an increase in their bargaining power vis-à-vis port authorities, as well as terminal operators, as oligopolistic structures tend to lessen competition (Heaver et al., 2000). Respectively, however, as illustrated, the market power and reach of Global Terminal Operators is not negligent.

Therefore, when industry actors with significant market power engage in co-opetition, competition policy concerns arise, with respect to the potential for collusive or coordinated behaviour (Gnyawali, & Park, 2011). In Rey & Tirole (2013) it is suggested that co-opetition may lead both to coordination and tactical collusion, with the latter having significant social cost; while Junior et al. (2003) document the requirement for clearer policy towards terminal ownership and shipping capacity provision at a global level to ensure a reasonable level of fair competition (Junior et al., 2003).

Within such an intricate environment of consolidated as well as highly integrated and cooperative players in both liner and terminal operators' markets (Lee et al. 2014), our aim in the next sections will be to investigate the effects of these evolutions in the port system, through two particular case studies. More specifically, on the one hand we will investigate whether the formation of alliances in liner shipping as well as the establishment of joint ventures in terminal operations has favoured the inclusion of affiliated ports and specifically of terminals in the alliance's itineraries. On the other hand, we will investigate whether these concentration and centralization phenomena observed in the under-study markets extend also in port operations, with selected ports concentrating large shares of container volumes. In the first case study we will review the case of the Asian container market, while in the second case we will investigate the U.S west coast and east port ranges.

4.4 Part II: To what extend does the formation of liner alliances favor the inclusion of affiliated port terminals within their itineraries: evidence from Asian ports

4.4.1 Overview

The formulation of an oligopolistic and oligopsonistic market in liner shipping and terminal operations respectively, provided alliances with huge leverage over ports to reduce rates and invest in additional infrastructure (Merk et al., 2018). In any other case, alliances, have the flexibility as well as the means (since every alliance has at least one Mega Carrier, with an extensive and geographically dispersed terminal network) and the power to alter their itineraries and channel volumes accordingly either to ports that alliance members have stakes in term or to ports that suit best their clients' needs (De Souza et al, 2003).

Notteboom et al. (2017) investigated whether the above assertion applied in the largest north European ports. Their results demonstrated that although ports have a much higher chance of receiving calls of an alliance when the alliance members have a terminal stake in the port, only ports in which members of the then New World Alliance had a shareholding, received an increased number of alliance weekly calls, while for all the other alliances, the above condition was not met. In a similar exercise conducted by Vaggelas (2018) on the port of Piraeus, results indicated that although Cosco China Shipping is the owner and operator of the whole port, its largest client was MSC and hence the 2M alliance.

Despite the above results, the rise of mega alliances brings to the port industry a high level of uncertainty. As such, this evolution has given birth to an array of new theoretical and investigate efforts, which seek to assess the implications of this novel market structure and conduct, for ports. To this end, an increasing number of papers put forth the idea of collaboration amongst ports in close proximity (Haralambides, 2002, Kawasaki et al, 2018) or of their port authorities(Hitjens and Vaneslander, 2018), of port integration or port industry consolidation (Ma et al., 2001) as well as of the co-opetition amongst terminals within a port (Kavirathna et al., 2018) as a countermeasure to regain and strengthen their positions against the increasing scale of liner alliances.

4.4.2 Research Framework

As displayed in §4.4.1 although the two prior investigative efforts, to shed light upon the terminal inclusion patterns and criteria of liner shipping alliances services, provide some evidence on alliances' practices within the European port market, the issue for other port markets such as the Asian or the American, remains largely unaddressed. To this end, this paper attempts to fill a portion of this gap in a similar philosophy as Notteboom et al. (2017) and Vaggelas (2018), only this time for the Asian port market, by investigating the extent to which ownership of a terminal by an alliance member or a specific Global Terminal Operator, leads to the former's inclusion as a port of call for that particular alliance's members or not.

Thus, in order to test the above hypothesis, we utilized data collected from the Alphaliner Database between the 3rd and 20th of April 2018, for a sample of 11 Asian container ports and specifically for 32 container terminals within these ports. In more detail, these data cover an interval of one year spanning from the second (2nd) quarter of 2017 till the first (1st) quarter of 2018 while concerning the vessels' calls at each terminal, their size and usage rates (i.e., the duration of a ship's call). Our research framework is summarized in Figure 22.

More specifically, to approach our subject matter, we utilized the following five methodological steps: Firstly, we organized and categorized our sample in 3 major sub-regions according to each ports' geographical position, namely among the a) Arabic and Red Sea Port range b) Southeast Asia Port Range and c) Chinese Port range.

The second step was to identify, the operators of each terminal within our sample and classify them amongst the three distinguishable groups involved in terminal operation, namely GTO's, Mega Carriers and Financial Holdings plus two additional options for Joint-Ventures and Local terminal operators. On a third level, we distinguished whether the above operators have a direct relation with an alliance (i.e., operating as a subsidiary of a shipping line) or indirect (i.e., through a joint-venture or as a member of an alliance. Thereinafter, we proceeded with the statistical analysis (see Figure 22. below) of our data set, firstly on a shipping line basis and then on an alliance aggregate basis. Finally, we analysed the results for each of the three port regions and

constructed an inter-relationship matrix amongst alliances and terminal operators, taking into consideration all the above factors.

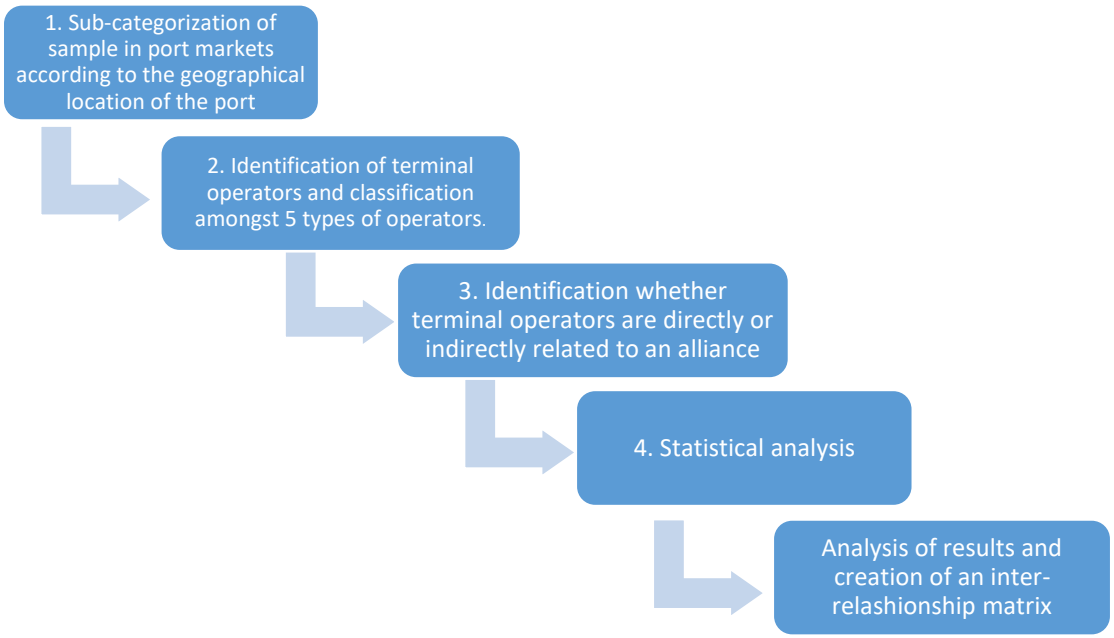


Figure 22. Framework of methodological analysis

4.4.3 The Arabic and Red Sea Port Range

The Arabic and Red Sea port region is a strategically located shipping hub amidst of the busiest Asia-Europe trade lane, with many of its ports evolving into major transhipment hubs with considerable vessel traffic and volumes handled. In this first port range under study, our sample extends from Red Sea's Jeddah Islamic port till the east coast of the Arabic Sea and the port of Pipavav in India, while including three additional ports of the Persian Gulf i.e., Jabel Ali and Khor Fakkan in Unites Arab Emirates and Salalah in Oman. Within these ports' terminals we identified two major terminal operators, namely Dubai Ports (DPW) which operates all container terminals in its home port Jabel Ali as well as one terminal in Jeddah Islamic port (South Container Terminal) and APMT, which holds stakes in two terminals, in the ports of Salalah and Pipavav respectively. Two of the three remaining terminals, one in Khorfakkan and the other in Jeddah (North Container terminal - NCT) are operated by the UAE's second largest operator, Gulftainer, while only the Red Sea Gateway terminal is operated by a local Saudi Arab operator, SISCO. As such, within this port region, the only terminal operator directly associated with an alliance, is APMT, which as the terminal leg of Maersk, is linked to the 2M alliance.

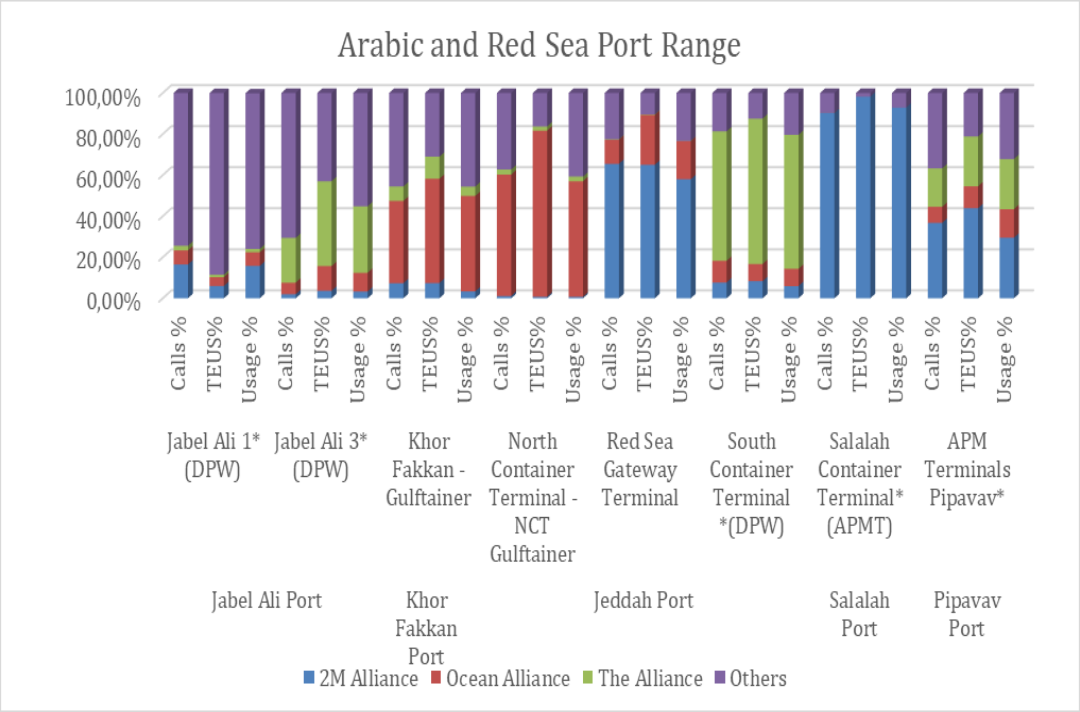


Figure 23. Alliances' Market Shares (in terms of calls, TEU's and Usage) in the Arabic and Red Sea Port Range

Source (Alphaliner Database, 2018) Author's Elaboration

Initiating our results' interpretation from the largest port of the region, Jabel Ali, we observe that in both terminals under study (Jabel Ali 1 and 3 terminals), independent liner operators have the majority of shares in terms of calls, TEU's and usage. Characteristically, from the 3372 calls received in Jabel Ali's terminal 1, between the second quarter of 2017 and the first of 2018, 2.509 or the 74.4% of the traffic is attributed to shipping lines which are not part of an alliance. On behalf of the alliances, 2M had 556 calls or the 16.5% of total traffic, the Ocean Alliance had 230 calls and 6.8% of the traffic, while The Alliance members' vessels called at the terminal 77 times capturing just a 2.3%. Also, in terms of aggregate vessel capacity handled and usage, independent shipping lines represent the 88.5% and the 75.8%, respectively. The picture is similar on Jabel Ali terminal 3, with independent lines capturing 70.6% of the traffic, 43% of the vessel capacity handled and 56.6% in terms of usage. However, in terms of vessel capacity handled and usage, The Alliance captures 41.3% and 32% respectively, percentages which are attributed to the large average capacities of the vessels calling the terminal.

Moreover, in Gulftainer's Khorfakkan terminal, it is observed that the Ocean Alliance prevails in all three attributes under study, representing 40% of the 888 calls, 51% of the vessel capacity handled and 46.5% of the total usage of the terminal. Independent shipping lines also have here a strong presence in comparison to the two remaining alliances, which aggregately represent just 14% of the calls, 18% of the vessels' capacity handled and 8% of total usage. As far as Jeddah's Islamic port is concerned, it is observed that each terminal is dominated by the presence of one of the three alliances. In this respect, in Gulftainer's NCT, similarly as in the case of Khorfakkan terminal, the Ocean Alliance has the largest share (59.1%) in terms of calls, as well as in terms of vessel capacity handled (80.9%) and usage (56.3%) while the other two alliances have a diminutive presence. Conversely, the 2M alliance seems to have a strong preference on the Red Sea Gateway terminal, representing 65.5% of the calls, 65% of vessel capacity handled and 58% of the terminal's total usage. The Ocean Alliance also calls at this terminal (11.7% of calls) however, its presence is less significant in comparison to that in the NCT terminal. The Alliance finally, which has little or no presence in the above terminals, dominates traffic (63%), capacity handled (71%) and usage (65.3%) in DPW's South Container terminal in Jeddah.

Finally, in the two remaining terminals in this region, operated by APMT, we observed the following differing results. On the one hand, Salalah's terminal, in which APMT holds 30%, operates as a dedicated terminal for the 2M alliance, with the latter's aggregate calls, capacity handled and usage being above the 90% threshold. On the other hand, in India's Pipavav terminal, in which APMT holds a 43% stake, traffic is more normally distributed amongst 2M and the other alliances. Once again, the 2M alliance is the largest terminal user with 36.7% in terms of calls, 44% in terms of capacity handled and 30% in terms of usage, however, also The Alliance and the Ocean Alliance represent aggregately around 26% of calls, 35% of capacity handled and 38% of the terminal's usage.

4.4.4 The South-East Asia Port Range

Container ports within the region of Southeast Asia, have experienced considerable growth over the last twenty years. More specifically, several of the ports within this range have evolved into significant transhipment hubs, with Singapore standing out,

as the number one and number two container port in the world for more than a decade now (Monroe, 2016). The rest of the ports, of course do not approach that size and scale of operations even by little, however, some have managed to ascent to the top 50 container ports in the world.

To this end, our sample of this region, apart from the port of Singapore is represented by five other container ports, namely the ports of Colombo in Sri Lanka, of Laem Chabang in Thailand, of Tan Cang Cei Mep in Vietnam as well as the port of Tanjun Pelepas in Malaysia; all included in the top 50 container port list. Amongst the operators within these ports' terminals, we identified two GTO's (PSA and HPH), six Mega Carriers with wholly owned or joint ventures in terminals (PIL, ONE, MSC, APMT, Evergreen and Cosco) as well as four local terminal operators. Apart from PIL which operates independently, all the other Mega Carriers identified, belong to one the three established liner alliances.

Amongst the nine terminals under study in the port of Singapore we observed that GTO PSA (the terminal operator of all Singapore's terminals) has established seven joint-ventures, namely two with the independent Pacific International Lines, two with partners of the newly formed ONE carrier (NYK and K-Line), two with Cosco and one with MSC.

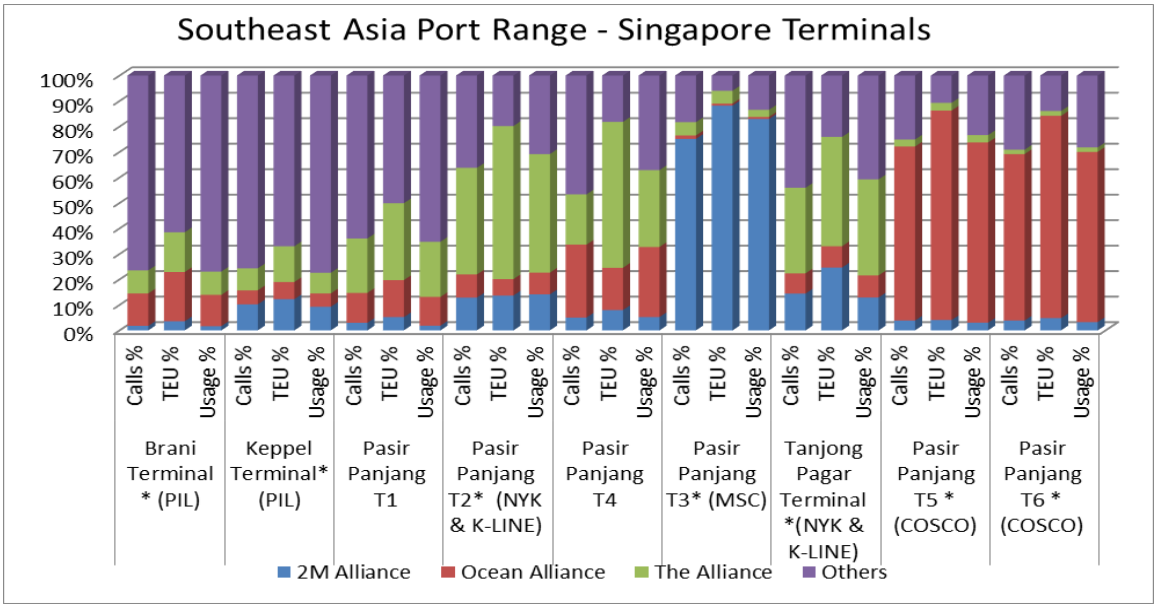


Figure24. Alliances' Market Shares (in terms of calls, TEU's and Usage) in Southeast Asia Port Range – Singapore Terminals

Source: (Alphaliner Database, 2018) Author's Elaboration

Having the above stakeholder formation in Singapore's terminals in mind, we proceed with a more detailed analysis of the traffic data for each of the nine terminals. In the Brani terminal, which is a joint venture with PIL, the latter accounts for about 46% of calls and usage of the terminal, as well as of around 36% of the vessels' capacity handled. This fact, renders PIL as the largest user of the terminal while explain the large percentages of the category Others which aggregately concentrate the 77% of calls, the 62% of vessel capacity handled and the 77% of total usage. Respectively, on behalf of the alliances, Ocean Alliance has the strongest presence with 515 calls (12.7%) corresponding to 19% of vessel capacity handled and to 12.3% of usage, with the rest two alliances aggregating 10% of the calls, 19% of vessel capacity handled and 10.8% of total usage. Similarly, in the second joint-venture amongst PSA and PIL (Keppel terminal), smaller independent carriers dominate traffic (75.6% in terms of calls, 67% in terms of traffic and 77.4% in terms of usage), only this time, PIL does not have such a large percent among them (4%, 2.4% and 4.3% respectively). On the alliances side, 2M represents 10% of calls, 12.3% of vessel capacity handled and 9.3% of usage, followed by The Alliance whose respective percentages are 8.6%, 14% and 8.1% accordingly.

Finally, the shares in the categories under study for the Ocean Alliance range between 5.5% (calls and usage) and 6.7% (vessel capacity handled). Further on, in the two-terminal joint-ventures between ONE and PSA (Pasir Panjang 2 and Tanjong Pajar), The Alliance prevails as the dominant user in both. More analytically, The Alliance is responsible for 42% and 33.6% of the calls in those two terminals while also for 60% and 43% of the vessel capacity handled and for 47% and 37.7% of their usage. The two other alliances have a fairly strong presence in these terminals (particularly for 2M), with their shares ranging between 8% and 15% in terms of calls, 6.5% to 25% in terms of vessel capacity handled, and 9% to 14% in terms of usage.

However, this picture of somehow equivalent presence of all alliances in the above two terminals, is not encountered, in the case of terminals joint-ventures amongst PSA and MSC as well as amongst PSA and Cosco. As such, in the first case of Pasir Panjang terminal 3, the 2M alliance is the dominant user, with 75% of the calls, 88% of the vessel capacity handled and of 83% of the terminal's usage, with the presence of the

other alliances being minimal. Similarly, in terminals Pasir Panjang 5 and 6, Cosco and consequently the Ocean Alliance is the larger and most accustomed user by far, responsible for 65% and 68% of the calls, for 82% and 79% of the vessel capacity as well as for 71% and 67% of total usage respectively. Finally, in the two remaining wholly owned terminals of PSA, Pasir Panjang 1 and 4, amongst the three alliances The Alliance has the strongest presence, followed by the Ocean Alliance. Characteristic is the fact that in Pasir Panjang terminal 4, the Ocean Alliance has the largest share of calls (28.6%) in comparison to The Alliance which has 20%. However, the latter surpasses the former in terms of vessel capacity handled and usage, representing 57% and 30% of these attributes, against the 16.6% and 27.5% attributed to the Ocean Alliance.

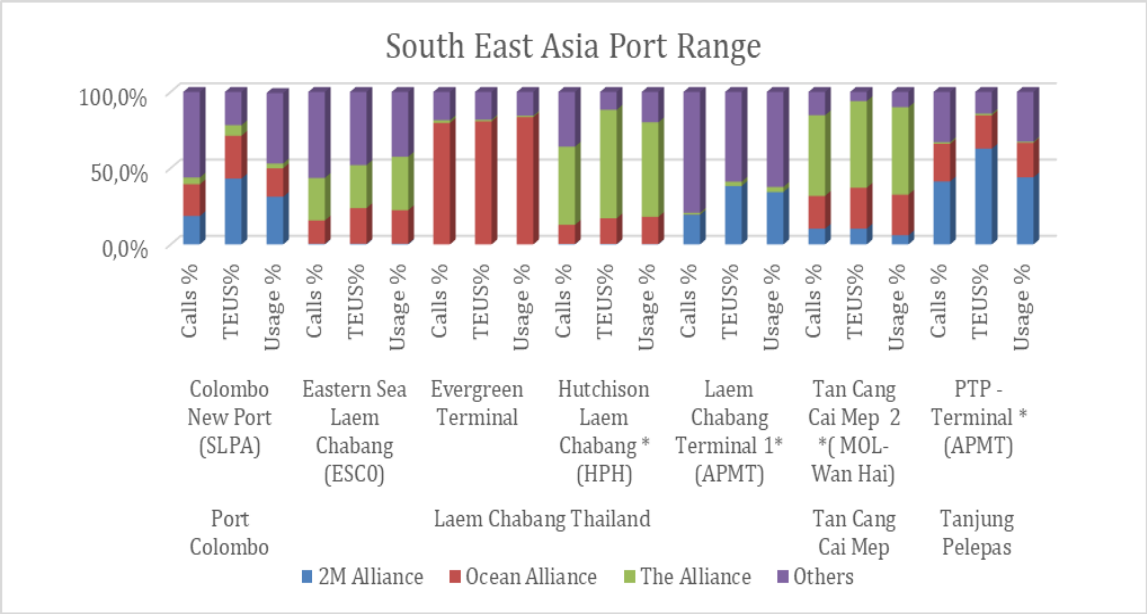


Figure 25. Alliances' Market Shares (in terms of calls, TEU's and Usage) in Southeast Asia Port Range

Source: (Alphaliner Database, 2018) Author's Elaboration

Moreover, regarding the other five ports of our sample, in the Southeast Asian Region we observed the following results. In the port of Colombo, the New Port terminal is operated by the Sri Lanka Port Authority, and more than half of its traffic is dominated by independent carriers (56%). Despite that fact however, the 2M and the Ocean Alliance, whose calls represent 18.5% and 21.8% of total traffic, have a considerably increased share in vessel capacity handled accounting to 43% and 31% respectively, as well as in terms of usage, representing the 28% and 18.6% of the terminal's usage,

mainly due to the larger vessels deployed by those alliances in comparison to independent carriers.

In Thailand's port Laem Chabang, all four terminals owned and operated by private terminal operators. The Eastern Sea terminal owned by ESCO, a local operator, has as its largest user small independent shipping lines which represent 56.5% of the calls received, as well as 48% and 43% of the capacity handled and usage. The Alliance, is the largest user of the three alliances, representing 28% of the call and vessel capacity handled and 35% of the total terminal's usage, followed by the Ocean Alliance (15% of calls, 23.4% of capacity handled and 22% of usage). In turn, the Ocean Alliance, dominates traffic in the Evergreen terminal of Laem Chabang, which due to the participation of Evergreen in it, acts as a dedicated terminal for that alliance. More particularly, the Ocean Alliance accounts for 79.6% of the calls, 80.7% of the vessel capacity handled and for 84% of the total usage of the terminal.

Further on, Hutchison Port Holding's terminal is preferred according to our results, by The Alliance, which accounts for 51.3% of the calls, 71% of the vessel capacity handled and for 62% of the terminals usage. The Ocean Alliance has also some small presence in the port, accounting for 12.5% of the call, and of around 16% to 17% in terms of vessel capacity and usage. Finally, the 2M alliance which in the above terminals had a diminutive presence, seems to channel its vessels and cargo in its own terminal in the port, operated by APMT. In spite of that fact however, in terms of calls as well as in terms of the other two attributes under study, 2M seems to have a relatively low percent representing 19.5% of the calls, 38% of the vessel capacity handled and 34% of the terminal's usage. As such, with no other alliance having frequent call on the terminal, independent carriers account as the largest users, representing 79% of the calls, 59% of the vessel capacity handled and 62.3% of the total terminal's usage.

Unlike the above, unexpected outcome, the 2M alliance has a clearer dominance in the Port of Tanjung Pelepas (which was built by Maersk) and specifically in the terminal operated by APMT. Although Ocean Alliance has also a strong presence with 1100 calls (24.7%), accounting for the 22% of capacity handled and usage, 2M has significantly higher shares, representing 41% of the calls, 63% of vessel capacity handled and 44% of the total terminal's usage. Finally, in Vietnam's Tan Cang Cei Mep

terminal 2, a terminal in which MOL (member of ONE) and Wan Hai have established a joint venture, we observe that although all alliances call at the terminal, The Alliance prevails as its largest port user. More analytically, The Alliance accounts for 53% of the calls, 57% of the vessel capacity handled as well as of the terminal's usage, while the Ocean Alliance and 2M respectively account for 21.5% and 10.3% of the calls, 28% and 10.4% of the vessel capacity handled as well as for 27% and 6% of the terminal's usage respectively.

4.4.5 The Chinese Shanghai Port Terminals

Despite the recent slowdown in China, which reflects the rebalancing of its economy away from a growth path focused on exports and investment, the country continues to dominate the container port sector, comprising seven out of the 10 largest container ports in the world (UNCTAD, 2017). Shanghai has been the largest among them, and for this reason presents in increasing interest to investigate the origins of the traffic received.

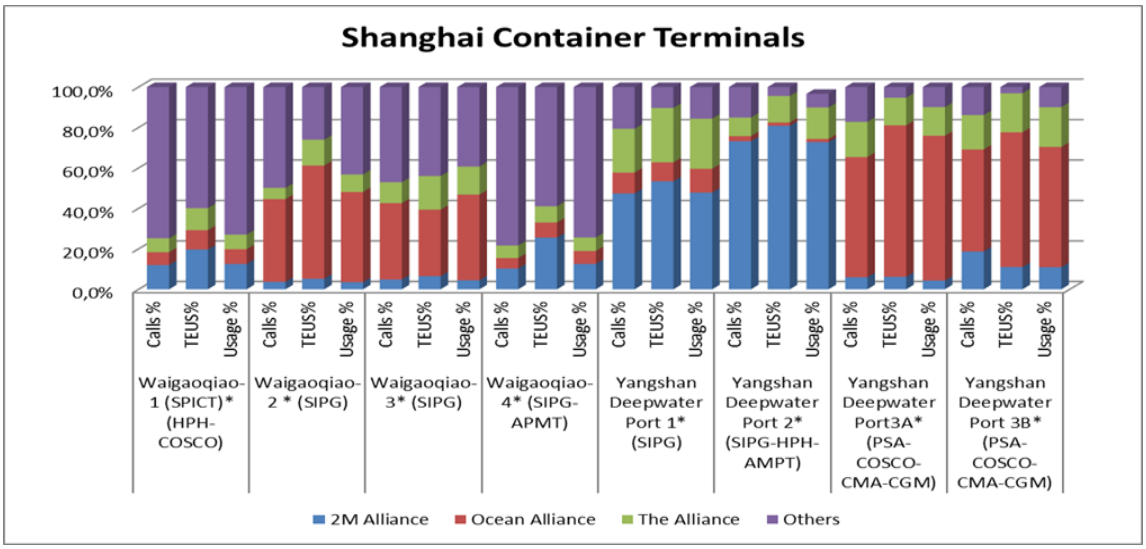


Figure 26. Alliances' Market Shares (in terms of calls, TEU's and Usage) in Shanghai terminals

Source: (Alphaliner Database, 2018) Author's Elaboration

As such, in Shanghai's terminals, we identify multiple inter-firm relations amongst Mega Carriers and GTO's through joint ventures in the port's terminals. In the first amongst the nine terminals, we have data on, HPH has established a joint venture with Cosco (30% stake). However, despite this fact, the Ocean Alliance has the smallest shares in terms of calls, vessel capacity handled and usage in comparison to the other

two alliances, accounting for 6.3%, 9.6% and 7.2% in each attribute respectively. Conversely, 2M and The Alliance capture 12% and 6.9% of the calls, 19.7% and 10.9% of the handled vessel capacity as well as 12.5% and 7.2% of total usage accordingly. Suffice to say that we the above percentages observed, the largest users of the port are independent carriers (74.7%).

Unlike this occasion, in the other two terminals (Yangshan Deepwater port 3A and 3B) in which Cosco has a joint-venture with its counterpart in the Ocean Alliance, CMA-CGM as well as with PSA, the dominance of the Ocean Alliance is clear. As such, in these two terminals, the Ocean Alliance accumulates 59.5% and 50.4% in terms of calls in each terminal, 75% and 66.6% in terms of vessel capacity handled as well as 71.6% and 59.5% in terms of total usage. Although, the other two alliances call on both ports, both 2M and The Alliance have a stronger presence in Yangshan Deepwater port 3B, accounting for 18% and 17% of the calls, 11% and 19.3% of vessel capacity handled as well as of 10.9% and 19.7% of the terminal's total usage. The 2M alliance, through APMT, has also two joint-ventures in the port of Shanghai, one with solely with SIPG (Shanghai International Port Group) and one with SIPG and PSA.

The former, despite of being in the terminal network of the 2M alliance, alliance members' traffic represents only 10% of the calls, 25% of the vessel capacity handled and 12.5% of total usage. Also, the other two alliances have a diminutive presence in the specific terminal, thus rendering the independent carrier group as it's the largest user. In the latter joint-venture terminal of APMT, however, the 2M alliance clearly prevails as the dominant user of the terminal. Specifically, it accounts for 73.2% of the calls, 80.8% of the vessel capacity handled as well as for 72.8% of the total usage of the terminal. The Alliance has some presence also, but obviously at a much lesser extent (9.2% of calls, 13.1% of vessel capacity handled and 15.6% of total usage).

Finally, in the two out of the three terminals operated solely by SIPG, we observe that the Ocean Alliance concentrates the largest shares as far as call, vessel capacity and usage are concerned. More specifically, in the Waigaoqiao Phase-2 terminal, it accounts for 38.9% of the calls, 57% of the vessel capacity handled and 44.6% of the usage of the terminal while respectively in the Waigaoqiao Phase-3 terminal, accumulates 37.7% of the calls, 33% and 42.4% of vessel capacity and usage. From the

other two alliances, The Alliance has a 10%, 16.6% and 14% in the above attributes in Waigaoqiao Phase-3 terminal while in Phase 2 terminal both The Alliance and 2M have very small shares of the traffic handled. Both of these alliances, as our results indicate prefer the third terminal of SIPG, the Yangshan terminal in which 2M and The Alliance account for 47.4% and 21.7% of the calls, 53.4% and 26.9% of the vessel capacity handled as well as of 47.8% and 27.7% of the terminal's utilization. Characteristic is the fact that 2M has significantly more calls in the particular terminal than in the one which is operated jointly by APMT and SIPG.

4.4.6 Discussion

As the above analysis indicated, liner alliances have a strong presence in all the above markets. More particularly, Figure 27. below, presents an aggregate picture of their patterns within the ports and terminals under study. As such, according to our results, the Ocean Alliance, has presence (larger than 5% of traffic) in 26 of the 32 terminals investigated, while The Alliance follows with calls in 19 terminals and 2M in 18. In addition, the Ocean Alliance has the largest share of traffic in 12 of those terminals called, while the other two alliances are the largest users in 10 of the 32 terminals.

With regards to the terminals preferred by the alliances, our results indicate that the 2M alliance calls in 3 terminals operated by GTO's (other than those with which it has joint-ventures), in 7 terminals operated by an alliance member (i.e. APMT or MSC solely or in joint-venture with other GTO's –Mega Carriers), in 2 terminals that are operated by a local operators and finally in 7 joint-venture terminals in which members of other alliances participate.

Accordingly, the Ocean Alliance shuffles volumes in 5 GTO's terminals, calls in 5 terminals in which a member of the alliance operates or has a stake, while has presence in 2 terminals owned by local operators as well as in 6 terminals owned or operated by members of other alliances. Finally, The Alliance, calls in 4 GTO's terminals, in 3 terminals linked with members of the alliance, while also in 3 terminals operated by local operators and in 7 terminals joint-ventures linked with other alliances or other carriers.

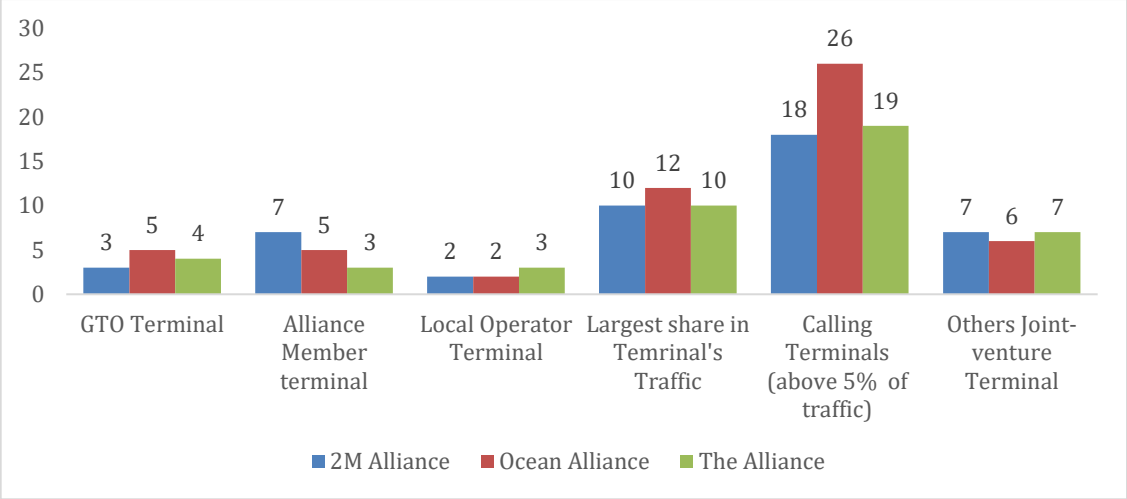


Figure 27. Results of aggregate analysis

Source: (Alphaliner Database, 2018) Author's Elaboration

Considering the above, we can infer that alliances whenever they have such an option, will prefer to call on terminals directly or indirectly affiliated to them (except of two instances, one in the case of 2M and one of the Ocean Alliance), however, this is not definitive. Some of those terminals, act at a large extend as dedicated terminals of that alliance, however, cases of terminals exist in which traffic is more evenly distributed amongst them.

Another outcome of the above analysis is that all alliances have established their terminals networks either through wholly owned terminals either by building bonds with GTOs through joint-ventures (a fact which probably allows them to have a preferential relationship on a wider scale) or by sustaining close relationships with local operators. Intra-firm relations amongst member of different alliances are also confirmed by the above analysis, depicting the high level of coopetition developed within the liner market.

4.5 Part III: Concentration of container flows in ports: the case of the U.S West & East Coast port ranges[27].

4.5.1 Overview

The pressure of competition along with the incentive to extent control over ever larger and more complex logistic chains have strongly encouraged players to expand their services and scale of operations through vertical and horizontal integration, alliances, and synergies. The effects of these processes have progressively led to the consolidation of both markets by few incumbent players (i.e., Mega-Carriers and Global Terminal Operators). Added to these, the deployment of ever-larger container vessels by Mega Carriers (Merk, 2015) and the increasing presence of Global Terminal Operators in hub-ports enhances the possibility of increased concentration of traffic flows in selected ports.

In the light of the above, it is our intention to investigate whether these evolutions, lead to increased concentration of container volumes in the port system. Concentration measures have been frequently utilized both by researchers and regulators in different sectors, such as liner shipping (Lam, et al., 2007), banking (Miljkovic, et al, 2013), energy markets (Borenstein, et. al, 1999) as well as in other industries (Rosenbluth, 1955). To this end, we adjust the concentration indexes for the port sector, and perform our analysis, on a US level and specifically on U.S West and East Coast port range, over the period of 2005 -2015. To examine our case, we utilize five concentration measures namely, CR4, CR8, HHI, Gini Coefficient and Shift-Share analysis. Previous studies, analysing traffic of the U.S Port system (on aggregate U.S and East-West Coast level) have revealed a structure of low concentration (Hayuth, 1988, Wang & Cullinane, 2004).

To this end our goal, is twofold. On a first level, to confirm whether this decentralized structure of the US Port system is maintained or altered by collateral market evolutions such as the aforementioned consolidation of market actors, while secondly, to provide an update on the U.S port system concentration. As such, results

[27]This section is part of the published paper: Chlomoudis, C., & Styliadis, Th. (2019). Concentration of container flows in the port phase: the case of the US West and East Coast port ranges. Bus. Manag. Econom., 7(1), 1-21.

are relevant for policy makers and port experts, as contrary to previous periods studied, they capture and depict an increase in concentration of container traffic flows in the U.S port ranges.

4.5.2 Literature Review

Several studies have investigated concentration and/or de-concentration tendencies within the container port markets. According to Hayuth (1981) concentration in the port system refers to the polarization of container traffic in few larger ports, at the expense of smaller ones. Respectively, de-concentration for Kitsos (2014) is the reverse process of shifting container flows in an increased number of ports, amongst which many are considered of medium to small scale.

Within literature, Hayuth's (1988) study on the degree of concentration in the structure of the U.S port system is one of the first efforts to systematically approach the particular subject matter. His analysis of container traffic in U.S ports between 1970 and 1985, utilizing the Lorenz Curve and the Gini Coefficient, illustrates an unexpected trend towards less concentration. In another early attempt to evaluate and assess load centre development, Marti (1988) implements a Shift-Share Analysis (SSA) focusing on the evolution of Pacific Basin ports with time specific data from 1974 to 1982. Results illustrate the prevalence of Oakland and Seattle as the primal U.S west coast port hubs and of Kaohsiung as the major foreign centre at the time.

In Notteboom (1997), an evaluation of concentration and de-concentration tendencies of container port traffic within the European continental port system is undertaken for the period between 1980 to 1994. By utilizing concentration ratios such as the Herfindahl-Hirshmann Index (HHI), the Gini Coefficient, and the Lorenz Curve as well as by implementing a SSA, the author concludes that developments in the European container port system resulted in a stagnation of the level of port concentration. In a repetition of this exercise on account of European Sea Ports Organization (ESPO), Notteboom (2009), investigated 78 ports within Europe and analysed concentration of cargo traffic (containers amongst other types of cargo) for a 23-year period (1985-2008), utilizing Annual Net Shifts, Market Shares and the normalized HHI. Results reveal that the European container market remains more concentrated in comparison to other handling segments. In addition, it is observed

that while the European container port system is becoming more diverse, growth of traffic has benefited slightly the largest ports, leading to an increased concentration of container flows in a limited number of ports.

Fageda (2000), attempts to investigate the evolution of concentration in the major Mediterranean container ports for the 1990-1998 interval, through the application of concentration ratios such as the Gini Coefficient, the Lorenz Curve and the HHI, in an effort to conceptualize the impact of technologic, economic and social transformations brought about by the advent of container in maritime transport. In addition, the author performs a SSA to depict the competitive positions of those port-hubs. Results confirm a highly competitive environment while advocate towards a tendency for container throughput concentration in a few dominant centres, namely Algeciras and Gioia Tauro in the West Mediterranean basin and Marsaxlokk in the East.

Contrary to the aforementioned results, Elsayeh (2015) through the application of K-CR, HHI, Gini Coefficient, Entropy Index and SSA for the period from 1998 to 2012 illustrated that the Mediterranean container market moves towards de-concentration. Elsayeh's (2015) results are attributed to the increased number of market players in the region as well as to the more evenly distributed container traffic caused by increased inter-port competition.

In another empirical study, Wang & Cullinane (2004) also employ alternative approaches, amongst which the HHI, the Gini Coefficient and SSA, for measuring concentration levels on the world's leading container ports in four regions, namely the Hamburg-Le Havre range, the U.S West and East coast and in Southern China. Findings for the period 1992 to 2002 indicate low concentration levels for the container port industry in the Hamburg –Le Havre range as well as in both of U.S coasts, while in respect to Southern China findings reveal a transformation of the port market structure, from one highly concentrated towards a deconcentrated one. De-concentration tendencies in all four regions are interpreted as the result of fierce competition among ports that either strive to maintain their role as regional hubs or aspire to become one.

Furthermore, in Le & Ieda (2010), a comparative examination of concentration tendencies of port systems in Japan, Korea and China is undertaken for a 30-year interval (1975-200528), through the application of HHI and of the Geo- Economic Concentration Index (GECI). The two indexes produce varied results, while illustrating the diversified evolution in concentration dynamics among the countries concerned. Japan based on HHI appears to be evolving to a more deconcentrated system while GECI suggests a fairly steady level of concentration throughout the years. Korea presents a concentration trend until 1990, captured by both indexes, followed by a moderate decline in concentration since then. Finally, China initially considering both indexes appear to have a deconcentrated port system, with the picture altering after the 90's and especially during the period 1995-2005, leading towards a strong growth pattern of concentration (although HHI underestimates the increase in comparison to GECI).

In a more recent study, Pham et al. (2016) investigate concentration developments in container terminals in the Northern Vietnam over 2005 to 2014 by employing several methodologies, including the HHI, the CR1 and CR3, the Gini coefficient, the Lorenz curve, and SSA. Their results demonstrate a tendency towards deconcentration and considerable shifting of container cargo among its terminals; justified by the fierce competition among new and existing terminals in an effort to capture a share of the increased demand. Two other topical contributions, which measure container port concentration through the application of HHI, CR3, CR5 concentration ratios and SSA, are the publications of Varan & Cerit (2014) and of Hanafy et al. (2017). The former focuses on Turkish container ports before and after the port privatization schemes (1996-2011 period) while the latter on the Eastern Mediterranean region (1995-2014 period). Both record deconcentration dynamics and increased competition.

Apart from the measurement of concentration specifically in container ports, there have been some publications focusing on other cargo segments or on the port industry as a whole. In this category we find De Lombaerde's and Verbeke's (1989), assessment on the evolution of international port competition in the North-West European range

[28] For China, the period under study concerns the years 1980 to 2005.

for the years 1970 to 1985, who apply the technique of SSA and compute a weighted diversification index for the different ports. Their results reveal the competitive structure of the North-West European range, characterized by high stability both in terms of market shares and of weighted diversification level. Another example is Kuby's and Reid's (1992) empirical research, which utilizes the Gini coefficient to measure concentration of general cargo port traffic in U.S, from 1970 to 1988. Their findings, illustrate that contrary to the results of Hayuth (1988) on containerized U.S traffic, general cargo traffic became more concentrated during the period under study, mainly due to technical change.

Finally, in Lee et al. (2014) an analysis of concentration ratios in bulk ports along the west coast of Korea is carried out for the 2005-2011 interval, with the intention to identify geographical patterns. Authors adopt a series of techniques such as HHI, Location Quotients (LQ), and Shift Effects (SE), to reach the conclusion that de-concentration has been gradually rising as a result of substantial shifting of cargo and of considerable overlapping of ports' functions.

4.5.3 Methodology

As illustrated also in the literature review in the previous section, numerous measures are available to estimate industry concentration. Within this section, we will further analyze, the concentration methodologies applied for the purposes of this paper, in order to reach our research objective, i.e., to examine concentration/de-concentration tendencies of container volumes within the U.S East and West Coast port system. Amongst them, we utilize the n-firm concentration ratio, the HHI as well as the Gini coefficient and the Lorenz curve. In addition, we perform an SSA, to gain an insight into the development of traffic flows in the two U.S port ranges under study.

According to Bikker & Haaf (2002) amongst the most frequently utilized ones, due to its simplicity and its limited data requirements, is the n-firm concentration ratio, which aggregates, the market share of the n largest firms (in the particular case, of the n largest ports). Hence, the formula for its calculation takes the form:

$$CR_n = \sum_{i=1}^{n} S_i \quad (6)$$

The ratio commonly used is the concentration ratio of four companies (CR4). The ratio is the sum of the market share (S) of the n largest companies in an industry. As the determination of the n number of firms taken into account is arbitrary, several indexes can be formed. The most commonly utilized ones are the CR4 and CR8 ratios, which measure the market share of the four and eight largest firms respectively, however CR5, CR10, CR20 and CR50 ratios can also be computed. Depending on the aggregate percentage, which can range from nearly 0% to 100%, conclusions on market structure and concentration can be made (Pavic, et. al, 2016). Hence, a value of the index close to zero represents a competitive market, while on the contrary a value close to unity indicates oligopolistic or monopolistic tendencies. However, as there is no consensus among economists regarding the use of CR4 and CR8 ratios, Gwin (2001) attempted, based on the rule of thumb, the following classification of CR4 values, is presented in Table 9.

Table 9. Interpretation of market concentration according to CR4 values

CR4	Interpretation of Market Concentration
CR4 = close to 0	Perfect Competition
0 < CR4 < 40	Effective Competition or Monopolistic Competition
40 ≤ CR4 < 60	Loose Oligopoly or Monopolistic Competition
60 ≤ CR4	Tight Oligopoly or Dominant Firm with a Competitive Fringe

Source: Gwin (2001) Author's Elaboration

However, apart from the simplicity and straightforwardness of calculating the n-firm concentration ratio, the latter has been under criticism within literature. Criticism focuses on the fact that it takes into account only a certain number (of the n largest) and not all firms operating in an industry (Pavic, et. al, 2016), thus often providing a misleading picture with regards to the market structure and its respective level of competition.

Unlike the n-firm ratio, the HHI, the other widely utilized measure to determine the concentration level within an industry, overcomes this handicap by taking into account the complete composition of the market. This index's calculation is also

straightforward, as it simply requires summing up the squares of the market shares of all firms in the market (Allardice & Erdevig, 1966), thus taking the following form:

$$HHI = \sum_{i=1}^{n} S_i^2 \quad (7)$$

Where Si is the market share of the ith firm within the market, while n is the number of firms. As indicated by the equation, the index stresses the importance of firms with larger market shares by assigning them proportionately a greater weight than smaller ones and thus increasing the HHI value (Calkins, 1983). The H-Index ranges between 0 and 1, or 0 and 10,000 depending on how market shares are expressed (i.e., 0.1 or 10%). As the number of industry firms increase, the value of the index falls from 1 to 0. The larger the value of the H-index, the fewer the number of companies competing in the industry. Often, an industry is considered concentrated if the HHI exceeds 1,800, corresponding to four to five equal-sized firms (Haralambides, 2019).

For more than three decades, antitrust regulators have utilized the HHI index to gauge whether prospective mergers would potentially result in a harmful increase in concentration, causing anticompetitive behaviour (Roberts, 2014). The U.S Department of Justice (DOJ) as well as the Federal Trade Commission (FMC), divide the spectrum of market concentration as measured by the HHI, into three regions as shown in the Table 10 below. As it takes into account the entirety of the market, HHI appears to be a more reliable method to measure concentration than the n-firm ratio, however Pehlivanoğlu & Tiftikçigil, (2013) support that they both show a mutually complementary structure.

Table 10. Interpretation of market structure based on HHI values

HHI	Interpretation of Market Concentration
HHI < 0,1	Un-concentrated
0,1 < HHI < 0,18	Moderately Concentrated Markets
0.18 < HHI	Highly Concentrated Markets

Source: Gwin (2001) Author's Elaboration

In addition to the above indices, the Gini coefficient derived from the Lorenz Curve is a popular statistical measure of income distribution and inequality however, as stated

in Sys (2009) it also serves for the measurement of market concentration. The Lorenz Curve compares the distribution of a selected variable (in our case port throughputs) with the uniform distribution that represents equality, shown by a diagonal line, the egalitarian line (Ameryoun, A., et al., 2011), while the Gini coefficient is equal to the area between the egalitarian line of equal distribution and of the observed Lorenz Curve. The further the Lorenz Curve deviates from this line of total equality, the greater the inequality and thus the concentration will be (Notteboom, 2006b). Although many calculation formulas exist, within the framework of this paper, we will utilize a variant Gini ratio, applied particularly to prior studies within the port sector (Wang & Cullinane, 2004) and its formula is depicted below.

$$G = 0.5 \sum_{i=1}^{N} |Xi - Yi| \text{ and } 0 < G < 1 \quad (8)$$

With G= Gini coefficient for a given firm, i.e., port, N= the number of firms, i.e., ports, Xi= the cumulative percentage of the number of firms, i.e., ports, while Yi= the cumulative percentage of market shares of all firms, i.e., cargo throughput of all ports. The value of Gini Coefficient ranges between zero and unity. When all firms, i.e., ports are of equal size, the value of Gini coefficient is 0, and the Lorenz curve coincides with the egalitarian line denoting that no concentration exists. On the opposite extreme of one firm domination, Gini's value reaches 1, denoting full concentration of container traffic within the market.

Finally, SSA unlike the above indices does not measure concentration, however it is a popular method for analyzing regional economic growth and decline within time by assessing the overall performance, development and importance of a region/firm in comparison to other regions/firms (Stejskal, & Matatkova, 2012). To this end, SSA can and has been utilized within port studies literature for analyzing the evolution and development of port complexes (Lombaerde & Verbeke, 1989, Wang & Cullinane, 2002).

For its application it is necessary to divide the observed change (growth or decline) in two separate components, namely the "share" and the "shift" effect. On the one hand, the first depicts the necessary growth in the output of a firm, in our case the growth in port throughput that would allow the latter to maintain its position within the market. While on the other hand, the "shift" effect, on a given level of output, depicts

the amount of output won or lost by a firm to its competitors, i.e. port traffic gained or lost to/from other ports. In that sense SSA is a zero-sum game where one's gains are somebody else's losses (Piezas-Jerbi & Nee, 2009). For the purposes of this study, we will employ the shift-share analysis formula presented by Notteboom (1997) which applies specifically for ports:

$$SHAREi = \left(\frac{\sum_{i=1}^{n} TEU_{it1}}{\sum_{i=1}^{n} TEU_{it0}} - 1\right) x\, TEU_{it0} \quad (9)$$

$$SHIFTi = TEU_{it1} - \frac{\sum_{i=1}^{n} TEU_{it1}}{\sum_{i=1}^{n} TEU_{it0}}\, x\, TEU_{it0} \quad (10)$$

$$ABSGR_i = TEU_{it1} - TEU_{it0} = SHARE_i + SHIFT_i \quad (11)$$

Where ABSGRi= the absolute growth of container traffic of a port i for the period t1-t0 (in TEU), SHAREi= share effect in TEU of a port i for the period t1-t0, SHIFTi= the shift effect in TEU of a port i for the t1-t0, TEU= the container throughput of a port i, while n= is the number of container ports within the port system (Notteboom, 1997)

4.5.4 Overview of the U.S East & West Coast container ports

The lifeblood of U.S economy passes through its ports, rendering them an engine of growth for the worlds' leading economic power (U.S Maritime Administration, 2009). Similarly, to all major waterborne ranges around the world, the forces of globalization, integration and containerization have also transformed the North American port ranges (Rodrigue & Guan, 2009). Amidst two major international container trade routes, i.e., the transpacific and transatlantic, the U.S port system can be categorized in two port ranges, namely the West & East Coast range. For the purposes of this exercise, the former consists of all coastal ports in the States of Washington, Oregon, California, Alaska and Hawaii while the latter consists of ports in the Eastern Coast shoreline, from Maine to Texas**.** The evolution of container traffic in both port ranges, as well as on an aggregate U.S level[29], for the decade 2005 to 2015 is shown in the following Figure 28. below.

[29] Container volumes on an aggregate U.S level include also inland and lake ports' container traffic.

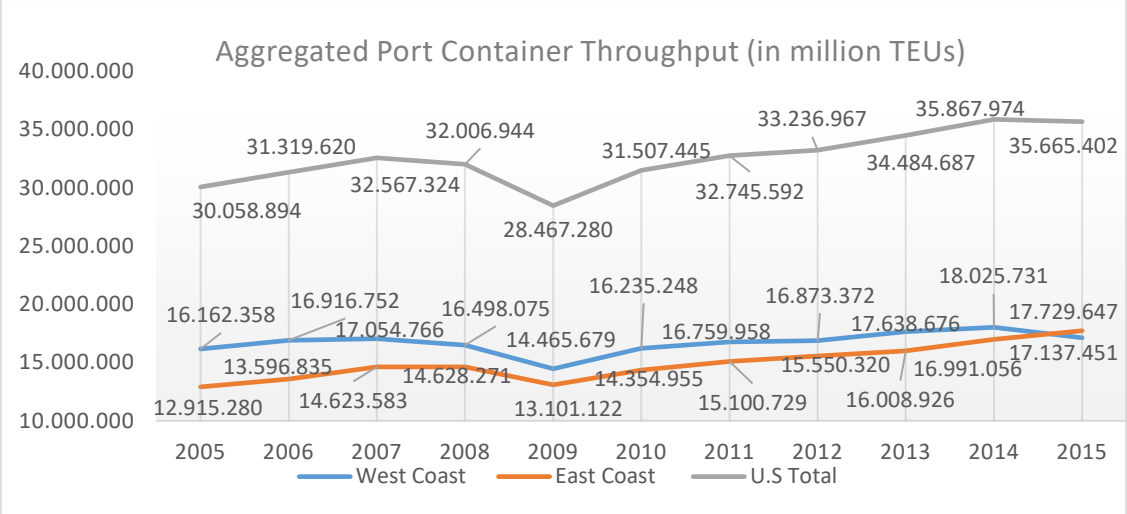


Figure 28. Port Container Volumes (million TEUs) on U.S aggregate level, West & East Coast level

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration.

As depicted, on an aggregate U.S basis, with the exception of the 2008-2009 interval and of a slight slump in 2015, container volumes have been steadily increasing within the time-period under study. More particularly, despite the observed decrease in container throughputs due to the global economic downturn of 2008, port volumes rebounded in 2010, while in the following year, overcame the pre-crisis throughput levels. Accordingly, the West and East coast port ranges, present more or less a similar fluctuation over the years. However, although East coast's container volumes had been diachronically lower than that of West coast's, due to the fact that the annual increases of the former were proportionately greater, on 2015 for the first time the East coast's port container volumes surpassed those of the West coast.

4.5.5 Assessment of concentration in U.S East & West Coast ports between 2005 & 2015

Within this section, we present the results of our calculations. U.S Waterborne data sets of annual port container volumes for the 2005-2015 interval, have been obtained from the U.S Army Corp of Engineers (ACE). As said in section 3, for the purposes of this study we will utilize the following concentration measures: CR4 and CR8 concentration ratios, the HHI as well as the Gini coefficient and the Lorenz Curve.

Table 11. CR4 & CR8 Concentration Ratios over U.S West Coast port range

U.S WEST COAST	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CR4(%)	78,46	80,24	79,87	81,04	81,19	83,10	82,68	80,08	80,44	81,80	81,70
CR8(%)	96,79	96,38	96,25	96,65	96,76	96,89	96,55	95,56	94,69	94,93	95,10

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

Table 11 above, illustrates the concentration ratios of the four and eight largest container ports of the west coast of the U.S. from 2005-2015. The results demonstrate that for the whole period under examination, both CR4 and CR8 values remain extremely high, denoting a very high level of concentration and an oligopoly in the West coast container port market respectively. More specifically, the concentration of the four largest container ports surpasses the 60% threshold while respectively the cumulative percent of the eight largest container ports is stabilized above 96%, with very small fluctuations from 2005 to 2011. From 2012 and forth, there is a slight decrease of 1-1.5% approximately, which is insignificant and not actual proof of a de-concentration tendency.

As far as the ports included in the CR4 and CR8 ratios are concerned, little variation from year to year has been observed. Amongst the top four West coast container ports, Los Angeles, Long Beach and Oakland steadily withhold the first three positions, while Tacoma and Seattle alternate in the fourth. Respectively, the rest of the largest ports that complete the top 8 (with container volumes, considerably lower than those of the top 4) include those of Honolulu, Anchorage and Portland (with an exception in 2015, where port of Juneau reached the 8th place).

Similarly, Table 12 below, illustrates the CR4 & CR8 ratios of ports in U.S East coast from 2005-2015. In comparison to those of the West coast, both CR4 and CR8, have significantly lower values, indicating lesser concentration and more competition between the container ports.

Table 12. CR4 & CR8 Concentration Ratios over U.S East Coast port range

U.S EAST COAST	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CR4(%)	62,06	61,49	61,90	62,92	63,62	63,94	63,96	63,76	62,42	60,68	63,13
CR8(%)	88,06	85,03	84,44	84,75	84,44	85,15	85,17	84,98	83,97	82,25	84,51

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

More particularly, CR4 values are stable within the examination period, ranging between 61,9% and 63%, surpassing however, the 60% threshold. CR8 values respectively, range between 88% and 82%, presenting a consistent decline over 2005-2015, with an overall decrease of approximately 3,5%. This, however, is not interpreted necessarily as a sign of de-concentration in the East Coast port range, as the decrease is relatively small, in relation to the exhibited levels of concentration. In addition to this argument, container ports of the East Coast range included in the two indexes, might present some variation on a year-to-year basis, however this is also small, as in the case of the West Coast range. Indicatively, the top 4 container ports for the majority of years are New York –New Jersey (NYNJ), Savannah, Norfolk Harbor and Houston. Respectively, the ports that conclude the top 8 include Miami, Port Everglades, Jacksonville, Charleston, Port of Virginia and Elizabeth River.

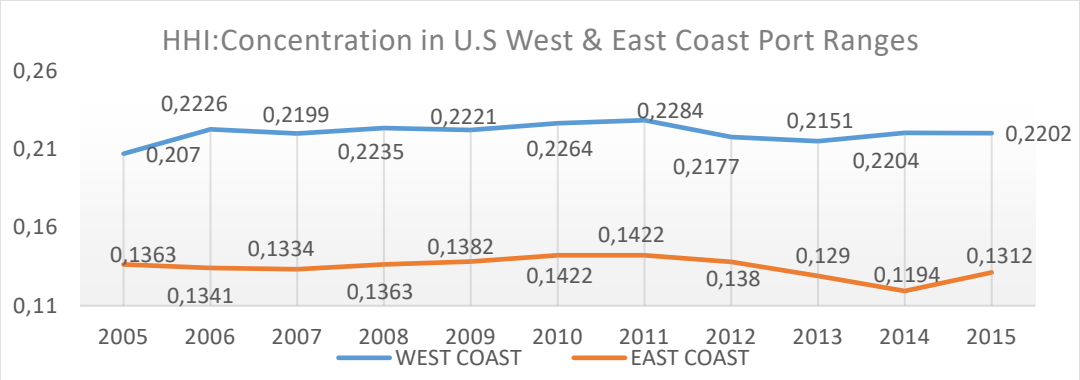


Figure 29. Concentration Measurement with HHI, over U.S West & East Coast port ranges

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

Figure 29. above, depicts the results of HHI both for the West & East Coast. As illustrated, results are in line with those of CR4 & CR8 ratios; with the West Coast range presenting a higher degree of concentration of container flows in comparison to the East Coast range. More analytically, the West Coast port range, records a 6% increase in the HHI over the decade under study, while being consistently high (despite some

small slumps in some years) and well beyond the upper region of 0.18, thus signifying a high degree of market concentration. Conversely, the Eastern Coast range, presents a decline of about 4% in the HHI over the same period. However, the latter's values have been steadily within the medium region between 0.1 and 0.18, hence indicating a moderate level of concentration.

Furthermore, as far as the Gini Coefficient is concerned, the results for both West & East Coast port ranges are shown in Figure 30., below. With respect to the West Coast range, results illustrate a slight increase in the Gini values over 2005-2015 and minor fluctuations, reaching its peak in 2011.

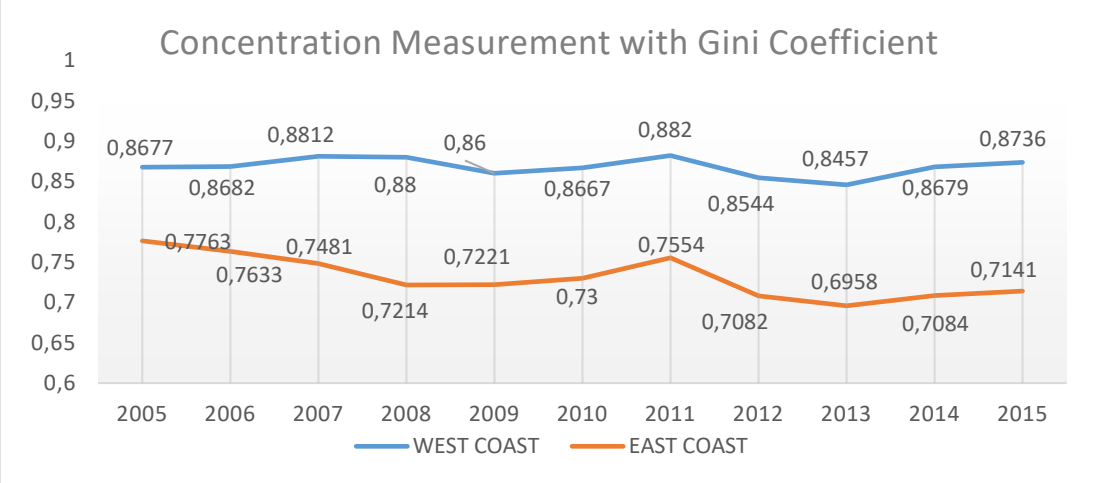


Figure 30. Concentration Measurement with Gini Coefficient, over U.S West & East Coast port ranges

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

As observed, yearly results approximate to the maximum value, indicating in line with the above observations a highly concentrated western port system, with increased inequality among the participating container ports. Consistent with the other indexes' results, are also those concerning the Eastern range. Gini values, illustrate a declining trend (with an exception in 2011 and 2014-2015) while also being significantly lower than those observed in the West Coast. Despite the decline however, Gini values are considered relatively high, indicating moderate concentration and inequality and hence, greater competition within the range.

Moreover, Figures 31. & 32. illustrate the Lorenz curves for the West Coast port range in 2005 and 2015 respectively, both reflecting the increased inequality among volumes handled in the western range ports. While, similarly in the Eastern Coast,

Lorenz Curves depicted in Figures 33. present analogous though more moderate results, while it can be seen that in comparison to 2005, 2015 results depict a slight decrease in inequality among Eastern range ports.

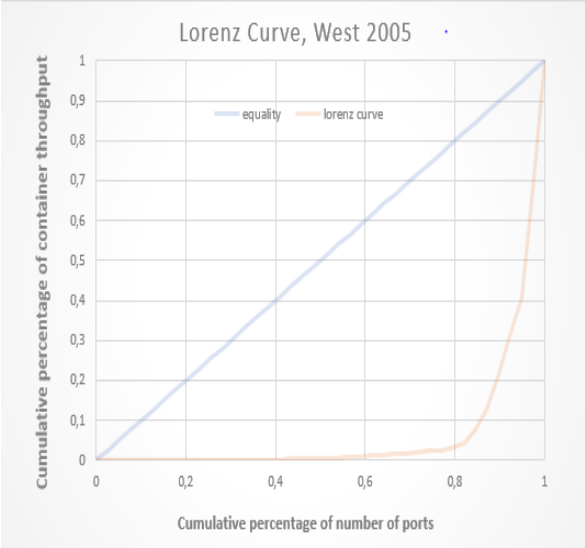


Figure 31. Lorenz Concentration Curves U.S West Coast port (2015). Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

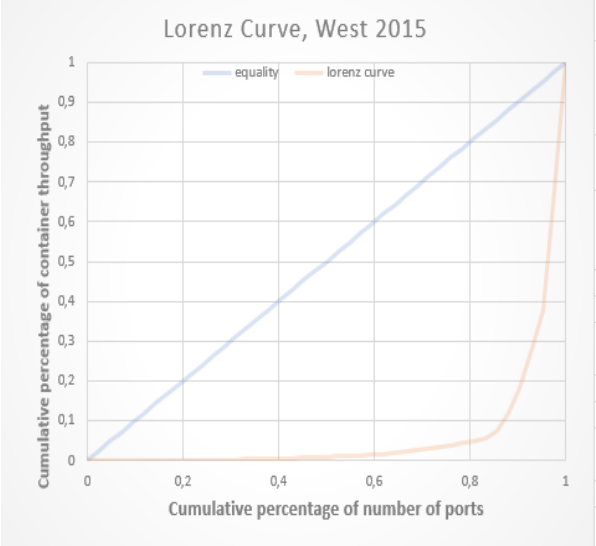
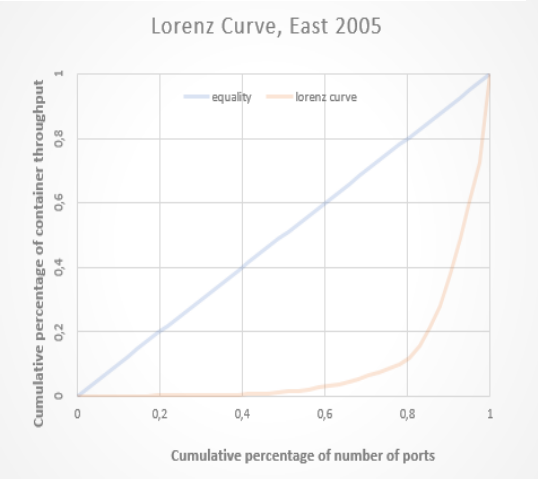


Figure 32. Lorenz Concentration Curves U.S West Coast port (2015). Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration



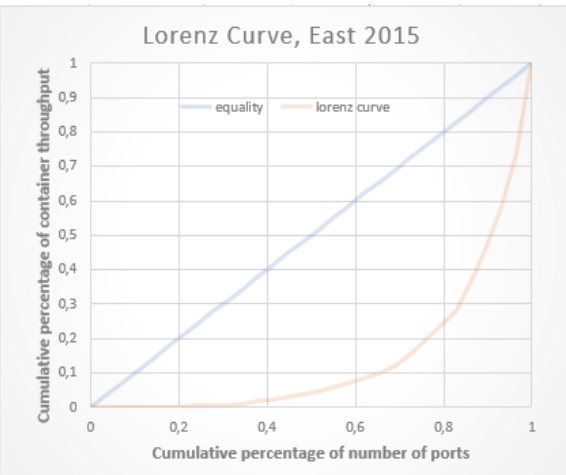


Figure 33. Lorenz Concentration Curves U.S East Coast port range (2005 & 2015)

Source: (U.S Army Corp. Of Engineers, 2018). Author's Elaboration

Table 13 below, illustrates the results of SSA on West Coast range (for a sample of Top 8 Ports) for three consecutive time periods namely for 2005 to 2008, 2008 to 2012 and 2012 to 2015 intervals. More specifically, in the interval 2005-2008, Los Angeles port is the big winner, gaining more than 1.1 million TEUs, followed by Anchorage and Portland ports, which also gain some market volume. On the losers' side, Long Beach

and Seattle lost potential volumes of more than 350 thousand and 218 thousand TEUs respectively. In the 2008-2012 interval, however, Seattle recuperates most of its losses with an increase in volumes around 210 thousand TEUs, followed by smaller volume gains recorded in Los Angeles and Oakland. Again, amongst those which record bigger losses, are the ports of Long Beach, Honolulu, Tacoma and Portland. Finally, during the last interval, Long Beach and Tacoma are the major winners with significant gains in volumes while on the contrary Seattle, Los Angeles and Portland lose the greatest market volumes.

Table 13. SSA on West Coast port range between 2005-2008, 2008 – 2012 & 2012-2015 (Top 8 Ports)

SSA WEST COAST: PORT	*STATE*	*2005-2008*	*2008-2012*	*2012-2015*
Los Angeles	CA	1.146.077	151.127	-146.275
Long Beach	CA	-357.092	-129.023	458.533
Oakland	CA	-12.979	143.032	-34.172
Tacoma	WA	-86.900	-70.717	258.956
Seattle	WA	-218.551	210.984	-362.456
Honolulu	HI	81.437	-71.666	10.625
Anchorage	AK	128.262	-6.173	38.262
Portland	OR	111.979	-48.172	-139.461

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

Similarly, Table 14. below shows the results of SSA for the same intervals for a sample of Top 8 port in the Eastern Coast. Contrary to the large shifts of volumes observed in the West Coast, the majority of the largest Eastern Coast ports appear to gain volumes over the three intervals under examination. Amongst the winners, the ports of New York and New Jersey, Savannah, Norfolk Harbour and Huston, gain significant volumes in all three intervals. These gains are of course in the expense of small and medium size ports, which lost considerable amounts of traffic. Exception to the above is the port of Charleston, which in the first two intervals lost around 206.000 and 97.000 TEUs respectively. However, also Charleston in 2012-2015 recorded massive volume gains of more than 341.000 TEUs.

Table 14. SSA on East Coast port range between 2005-2008, 2008 – 2012 & 2012-2015 (Top 8 Ports)

SSA EAST COAST: PORT	STATE	2005-2008	2008-2012	2012-2015
New York (NY & NJ)	NY	521.949	304.397	206.145
Charleston	SC	-206.231	-97.585	341.766
Savannah	GA	600.347	202.917	535.435
Norfolk Harbour	VA	208.730	82.287	276.508
Houston	TX	80.773	121.329	261.127
Miami	FL	-60.550	70.650	30.087
Port Everglades	FL	190.542	-38.794	77.636
Jacksonville	FL	250.356	172.213	39.565

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration

Finally, in the two Figures below (34. and 35.) a SSA over the 2005-2015 period is undertaken. As it can be observed, ports of the West Coast range experienced greater shifts of volumes in comparison to those of the East. Specifically, ports of Long Beach, Seattle and Portland lost considerable amount of volumes to their rivals, while on the contrary Los Angeles, and Anchorage where among the ones that increased their market shares.

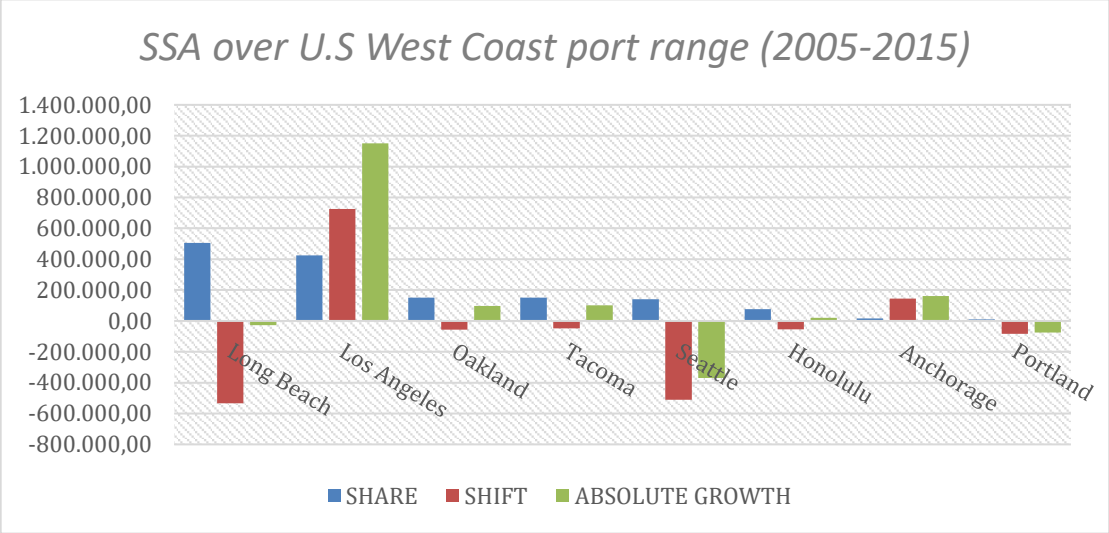


Figure 34. SSA over U.S West Coast port range during 2005 to 2015 interval (sample of top 8 ports)

(Source: U.S Army Corp. Of Engineers, 2018) Author's Elaboration.

Respectively, as indicated above, the majority ports in the East Coast range illustrated an increase in market share over the 2005-2015 period. Amongst the winners are the

ports of Savannah, which recorded the biggest growth followed by NYNJ, Norfolk Harbor, Houston, Jacksonville and Port Everglades. Ports of Charleston and Miami are the only exceptions in the East Coast, recording insignificant gains.

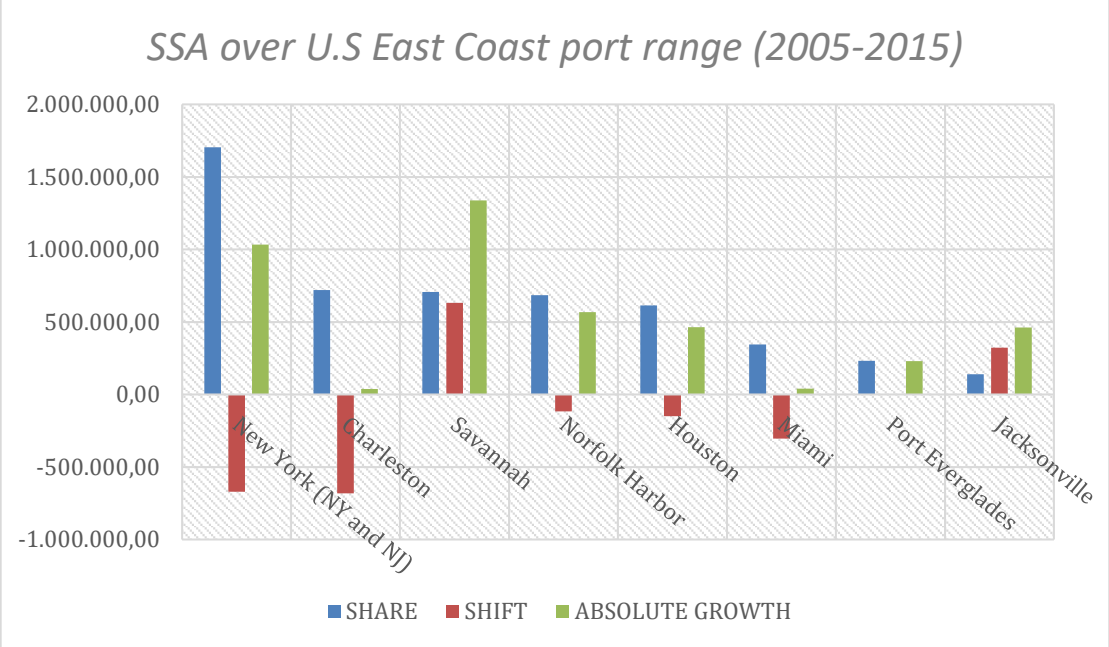


Figure 35. SSA over U.S East Coast port range during 2005 to 2015interval (sample of top 8 ports)

Source: (U.S Army Corp. Of Engineers, 2018) Author's Elaboration.

4.5.6 Discussion

Our findings suggest that a decreasing number of container ports, both in the U.S West and East Coast range, in a differing extend however, concentrate for the decade 2005-2015, the majority of container volumes handled within each respective port range. All three concentration measures applied, depict in a consistent way a highly concentrated West coast port market illustrating tendencies of further concentration, while also an East Coast port system which despite the greater dispersion of container volumes, is still characterized as moderately concentrated. Added to these, our SSA results also indicate, a considerable shift of volumes amongst rival hub-ports in West Coast (from Long Beach and Seattle to Los Angeles mostly) while on the Eastern port range, shifts of volumes have benefited the major hub-ports (such as port of Savannah, NYNJ), increasing their market shares.

As such, our results contradict those of previous studies on the U.S port system such as Hayuth's (1988) and Wang & Cullinane's (2004), denoting a progression from a decentralized port system into a concentrated one, in which a few major ports on both

ranges increase their share of container volumes handled in the expense of smaller ones. However, this evolution does not come as a surprise considering collateral market factors such as the deployment of ever-larger container vessels as well as the emergence of liner alliances amongst Mega Carriers and the increasing presence of Global Operators terminal in operations.

Although it is not within the scope of this study to analyze extensively those factors, which led to the observed port volume concentration, the concentration of container vessel and terminal capacity in the hands of few incumbent market players has surely affected the distribution of container volumes among the U.S West and East Coast ports. Both major liner shipping companies and terminal operators with their increasing firm size and scale of operations have the means and power to channel container volumes accordingly to the ports that suit best their door-to-door supply chains. To this end, on the one hand major load-centres on both coasts should fortify their relations with incumbent players to sustain their container volumes while on the other hand smaller ones should realign their competitive strategies to attract those players and increase their share of volumes handled.

4.6 Concluding Remarks

The above analysis has signified the changing market conditions undergone both in the liner shipping as well as in the terminal operators' markets. More specifically, we have analyzed how the emergence of Mega Carriers and Global Terminal Operators in liner shipping and terminal operations respectively, has led to the establishment of an oligopolistic liner market as well as to an oligopsonistic terminal operators' market in which powerful players withhold significant market shares on a global scale.

As illustrated both markets experience an increase in concentration over the years, as a result of the expansion strategies (concentration and centralization processes) followed by respective participants. More specifically, concentration in liner market has risen on the one hand due to the expansion of liners' vessel capacity through investments in ever-larger vessels while on the other as a result of centralization processes such as M&A's and the formation of liner alliances, which have been put into play to enhance further the markets' consolidation.

Respectively, in the terminal operators' market, the liberalization process through unbundling policies, signaled a new era for ports. Horizontal integration strategies followed by stevedores, who pursued replication of their expertise through investment opportunities abroad, were complemented by the vertical integration strategies on behalf of liner carriers which opted to extend their control over the supply chain. As a result, the port industry experienced an increase in the inflow of private capital, which progressively led to the rise of concentration in the since then fragmented container terminal market. Thirty years after the liberalization of the port industry, the container terminal market similarly to the liner segment is dominated by powerful Global Operators and Mega Carriers with significant market shares.

However, although the concentration of terminal operators was significantly lower than that in liner shipping market a decade ago, it has been observed that tendencies to further accrue consolidation have taken place. Volatile market conditions, after the 2008 economic meltdown followed by the introduction of mega-vessels and the greater consolidation brought forth through M&A's and the formation of alliances in the liner sector - who as the hegemon within supply chains impose their modus operandi - provided a novel impetus for the intensification of concentration in the container terminal sector. Global Terminal Operators too, engaged in responsive actions, to counterbalance the increase in the bargaining power of Mega Carriers, through novel waves of expansion in new terminals sites as well as through centralization processes such as joint ventures (with other Global Terminal Operators as well as Mega Carriers) which in turn led gradually but steadily to a further increase in the concentration of the terminal market.

Apart from market consolidation however, these processes led to a situation where every major participant in both respective markets is cooperating to some extend with the rest ones. As a result, the greater concentration and market power on the one hand as well as the formulation of strong inter-firm relationships amongst Mega Carriers and Global Operators on the other, have established an intricate market environment were the boundaries of competition and cooperation are very often blurred. While these facts denote and confirm the tendencies of commercial transport capital towards even further consolidation through the dismantlement of the barriers

that restrain its further expansion, they also raise some more actual and imminent concerns with regards to the market power and control these inter-connected market players exert over other "capitals" and finally consumers. This said, these robust inter-industry relationships may potentially enable them to distort competition through collusive, and abusive behavior.

While the issues relating to the regulation and safeguarding of competition within ports and in extension within the containerized transport network, will be in the epicenter of our focus and analysis in the proceeding Chapter 6 of this dissertation, in the current Chapter, after investigating the evolution of concentration in liner shipping and terminal operators' markets, we set out to explore the potential effects of these concentration and centralization processes in the conduct of container trade at ports.

As such, on our first case, our results on the Asian container terminal market revealed, that the revamping or re-establishment of mega alliances, has reshaped not only the market structure and the conduct of the liner industry but has also initiated chain reactions in the port system. Liner Alliances, through their member subsidiaries on terminal operations, as well as through collaborations with GTO's, joint-ventures and inter-firm connections with members of other alliances, have been able to create extensive networks, a fact that has given them a range of options on how to channel their cargo volumes.

As such, our results indicate that whenever it is possible liner alliance members will prefer to call on affiliated terminals, however, the increased bargaining power over local terminal operators as well as the inter-firm relations established with members of other alliances allows them to be more flexible. Conversely, local terminal operators, despite being included in the itineraries of alliances, are the ones who face the most pressure, as in case of an itinerary configuration, their position is much more insecure as their ties with alliance members is not as strong. Especially if consolidation in both market ensues, local operators, will possibly be the ones who will not stand this destructive competition as they will either have to succumb to the requirements of alliances or else they will risk losing a large share of their traffic and volumes.

Respectively, on our second case study, we examined whether such concentration and centralization processes in the liner and terminal operators' markets, translated into

more consolidation of port container volumes in fewer ports. Our obtained results for the particular under examination case of the U.S West and East Coast port system, revealed that both port ranges are experiencing too, a phase of consolidation, with major ports increasing their share of the volumes handled in expense of smaller ones.

Globalization of production and consumption have surely been a driving force over the aforementioned evolution. This process of concentration, extending over the port system, has led to the domination of a handful of load-centres in both the West and East Coast port ranges. Utilizing multiple concentration methodologies and analytical tools, our empirical results illustrate, contrary to previous studies that denoted de-concentration tendencies, that container volumes on the West Coast appear highly concentrated, while those of the East Coast also do, although in a lesser extent. To this end, it can be argued that both U.S West and East Coast port ranges have evolved from being deconcentrated towards high and moderate concentration levels respectively, over the 2005-2015 period under study. To this end, the contribution of this study within literature lies in the fact that it depicts the evolved and altered market structure of the U.S port ranges.

Overall, this chapter's aim was to depict the evolution of concentration of commercial capital within the containerized transport segments of liner shipping and terminal operations, as well as to investigate the effects of their rising market power in the trade conduct at ports. After the above analysis, it becomes clear that within network industries such as containerized transport chains, concentration has a tendency to expand from the most consolidated node to the upstream and downstream markets of the network respectively. However, the rapidity with which consolidation on a global scale was fortified in liner shipping and was accelerated within the container terminal sector, denotes that the existing regulatory regime enabled this evolution. To this end, it is believed that the effects of this rising market power, which enables these incumbent actors to control and affect the global flows of international trade, as illustrated in the two case studies, have only started to unravel.

Chapter 5: Innovation and patenting in liner shipping and terminal operations: an alternative way to enhance concentration[30]

5.1 Overview

Increasingly, in many industry sectors, companies, commercialize their technology and innovations through patenting to gain an edge over competition. Within the maritime and port sectors while the literature on innovation is expanding rapidly, issues related to the importance of intangible assets such the patenting for the participant firms of the industry remain unaddressed. Although patenting is not something novel even in transport chains, a deeper investigation of the subject matter has not yet been undertaken within literature. Utilizing the insights of innovational frameworks from the broader economic literature as well as patent data withdrawn from EPO's database (2021), the aim of this chapter is to investigate whether the concentrated structure of the liner shipping and terminal operator's markets, also renders incumbent firms in these markets more innovative, as suggested in literature. In this framework, this paper sets the stage for a discussion over innovation and patenting within the containerized transport segments of liner shipping and terminal operations, attempting to investigate and classify for the first time the patenting activity of the incumbent players participating in each of these markets. To this end, while results indicate a varying degree of utilization of the patenting system amongst firms, they nonetheless affirm that patenting is one of the various means utilized by incumbent companies in liner shipping and terminal operations, in their effort to enhance their market positions and achieve a sustained competitive advantage.

5.2 An introduction to innovation

McLean's (1958) Patent US2853968A, under the title "Apparatus for shipping freight", is to remain in history not only as the innovation that had profound implications in transport conduct, signalling the era of containerization in freight transport but also as one of the critical driving forces in the surge towards global integration. According to Schumpeter's (1982) view on innovation, McLean would be considered the

[30] Sections of this Chapter are part of the published paper: Chlomoudis, C., & Styliadis, T. (2022). Innovation and Patenting within Containerized Liner Shipping. Sustainability, 14(2), 892.

charismatic personality, the entrepreneur who by “doing things differently in the realm of economic life”, pushed capitalist development forth. The radical innovation of the standard shipping container which nowadays carries vast amounts of global commerce, brought along since its inception major disruptive changes which revolutionized the whole transport sector, as well as myriad other incremental innovations in order to enable the process of change (Levinson, 2006).

More than 60 years since McLean’s innovation, the containerized transport market has little resemblance to what started off as a niche market. Exploration of new innovation possibilities to further enhance operational performance, reduce costs and minimize commodities “fallow time” have led to leapfrogs in efficiency and increased speeds of commodity circulation, enabling in turn the exponential growth of container trade. After all, effective utilization of technological capabilities has been related to a firm’s capacity to develop and sustain a competitive advantage (Eisenhardt and Martin, 2000) as well as to an increase its market share (Mentzer et al., 2001). Particularly for the containerized transport segments of liner shipping and terminal operations, utilization of technological capabilities through the application of superior knowledge and skills in developing new and better ways of conducting business (Neil et al, 2014) along with the rising (derived) demand for carriage and handling respectively have been accompanied by the progressive rise in concentration through the proliferation of incumbent players in both respective markets (Luo & Wilson, 2014, Notteboom, & Rodrigue, 2012).

However, despite the formulation of an oligopolistic market structure in liner shipping and an oligopsonistic one in terminal operations, established through organic growth (addition of capacity) as well as through excessive vertical and horizontal integration strategies (Angelopoulos et al., 2017), pursuing innovation has become incessant and of paramount importance in the competitive struggle. In the Schumpeterian view of innovation “the prospect of market power and large-scale spurs innovation” and that is why larger firms and firms in concentrated industries, with greater market power and deep pockets to finance R&D (Research & Development) have better incentives to innovate (Shapiro, 2011). Especially as the potential cost savings in maritime transport as well as in the port dimension are getting narrower, while also

international rivalry is exacerbated, the pressure to utilize resources more effectively through novel innovations is growing (Rodrigue, 2010). In this respect, developing new innovations and technologies to enhance further efficiency and improve operations is a key resource in sustaining competitiveness. For Dičevska et al. (2016), firms operating within such an intense competitive fight, no matter what their field is, have rendered innovativeness as one of the most important enterprises' characteristics not only for development but for survival itself.

Increasingly, in many industry sectors, companies, commercialize their technology and innovations through patenting to gain an edge over competition. However, although patenting and intellectual property protection is not something novel even in transport chains, a deeper investigation of the subject matter and more specifically of the patents granted to containerized transport actors has not yet been undertaken within maritime and port literature. In this respect, this paper sets the stage for a discussion over innovation and a quantification of patenting within containerized transport chains. To this end, the chapter aims to investigate and record the innovative level of firms, expressed in patents, in the markets of liner shipping and terminal operations while also to unveil the sectors and the specific fields, in which these transport actors are pursuing novel innovations, based on a fist classification of their patent applications. Ultimately, through the above analysis the current chapter aspires to empirically revisit the Schumpeterian hypothesis which suggests that that the larger firms (in the sectors under study) are also the most innovative ones.

The rest of the chapter is structured as follows. In Section 5.3, a review of innovation literature both outside and within the maritime and port studies is undertaken. This is followed by an analysis of the methodology utilized in Section 5.4, while Section 5.5, presents the results obtained by the analysis of the patenting activity of both liner shipping and terminal operating companies, along with the fields of their application. Finally, Section 5.6 discusses the results obtained while attempts to draw some more general conclusions on the relation between innovative performance, firm size and competitiveness.

5.3 Literature Review

Over the past 20 years, the maritime and port industries have often been regarded as inadaptable to change and less prone to innovate. Many of the technologies utilized and the operational processes implemented to date, are characterized as almost archaic. In the relevant academic literature, scholars have until recently exhibited little interest how innovation is accounted for in the transport firm's strategic processes, or in how the innovation process as such is assessed, drawing broader conclusions with regards to the factors that favour or disfavour the successful adoption of innovative ideas (Acciaro & Sys, 2020, Arduino et al., 2013).

Notable early exceptions are those of Sahal (1980) who by examining three transport systems presents a theory of technological development, which suggests that accumulated experience and scale of operations are the two important factors which complementarily play a crucial role in the process of innovation and technological change; Sheppard (1990), who illustrates how cost-reducing and time-reducing technical change in transport is one of the few ways ensuring an increased rate of profit for industrial capital, and of Garrison (2000) who focuses on the workings of innovation processes in transport systems, to conclude that transport improvements become the mother of necessity in enabling social and economic advances. Finally, with particular reference to the maritime sector, Jenssen & Randøy (2002, 2006) and Jenssen (2003) were the first to scrutinize the parameters which render the shipping industry innovative and can lead to the development of distinctive competitive advantages that are difficult to imitate, the ones who investigated the organizational and inter-organizational factors that have a significant positive effect on the degree of innovation exhibited, as well as those who gauged the positive impact of product-process innovation on shipping firms' performance in terms of financial results, market position and bargaining power.

Against this backdrop, of limited theoretical and empirical studies on innovation within the field of maritime and port studies, a new stream of literature on the subject emerged shortly after the global economic meltdown of 2008. Arguably economic recession and crisis conditions has been the springboard to accelerate the efforts to systematize innovation and to explore novel innovational approaches and trajectories. (Guellec & Wunsch, 2009). As such while the maritime and port industries face

numerous challenges as well as numerous opportunities especially with the rise of new digital industrial technologies, within the context of the 4rth Industrial Revolution (Shin et al., 2018), a surge in literature towards the underpinning of the processes to promote sectoral innovation, its possible applications and effects has been observed. Within this context Fruth & Teuteberg (2017) as well as Sanchez-Gonzales et al. (2019) undertake a Systematic Literature Review (SLR) and sub-categorize in specific domains the emerging literature on digitization in the maritime sector. Similarly, Lambrou et al. (2019) conduct a literature review on digitization in shipping to formulate a theoretical model which systematizes the technological components, the prevalent strategic drivers and the determinant factors of shipping digitalization. Despite some typological differences, all three studies identify similar trending topics in maritime literature some of which are: automation, Big Data, Internet of Things (IoT) and Artificial Intelligence (AI) amongst others.

The advent and operational utilization of Autonomous Ships (AS) or Unmanned Vessels (UV) is undoubtedly a big forthcoming challenge for the maritime industry, possibly capable of significantly reconfiguring the industry's structure (Poulis et al. 2020). While several research programs are under development (Burmeister et al. 2014, Munim, 2019), researchers increasingly focus on identifying the important criteria for establishing a viable transport system with AS (Rodseth 2017); the potential hazards, safety, navigational and risk aversion issues faced (Ter Brake et al. 2015, Wróbel et al. 2017, Zhang et al. 2019) as well as on estimating the potential benefits of AS from an economic, societal and environmental perspective (Rodseth & Mo, 2016, Kretschmann et al. 2017, Munim, 2019).

Furthermore, the comprehensive studies of Yang et al. (2019) and Munim et al. (2020) which review the literature on Big Data and Automatic Identification Systems (AIS) and Big Data and AI respectively, reveal the effervescence within the maritime research community about their potential applications within the industry. Brouer et al. (2016) suggest that big data withdrawn from operational processes can be utilized to establish predictive and prescriptive models which in turn can increase the efficiency of decision making with regards to large scale planning problems faced within the liner shipping industry such as network design, empty container repositioning, vessels stowage plans and bunker purchasing. Dominguez (2014) supports that Big Data on

marine traffic can be used to predict with greater accuracy ships' arrival times in ports, thus increasing dock utilization and the port – vessel synchronization while reducing waiting times and operational costs. Similarly, Watson et al. (2015) document a reproducible method utilizing nautical charts and AIS data from ships, to determine the potential savings on carbon emissions when vessels, green steam to minimize anchoring times.

Tian et al. (2017) while acknowledge the magnitude of science and technological advancements in the fields of telecommunications, computers, information, automation and smart control in the support and realization of intelligent shipping, introduce the concept of the Internet of Vessels (IoV) which integrates all the above technologies into a platform that interconnects ship and shore facilities and allows them to exchange re-al time information through the internet. According to the authors, IoV enhances the ability to navigate and communicate while offering security protection and a more efficient, intelligent and safer shipping transport environment. Bai et al. (2010) in turn, propose a Cyber-Physical System (CPS) model with integrated RFID, sensors, etc., which collects and transmits data on the status and location of containers transported thus enabling their remote monitoring throughout their voyage. Finally, Yang et al. (2009) combined innovation capability with logistics service capability to develop a dynamic model to assess the relationships amongst resource, logistics service capability, innovation capability and firm performance in the context of Taiwanese container shipping services firms. Amongst the other hypotheses tested, the results obtained imply that a container shipping service firm with a high degree of information equipment resources and corporate image will have better innovation capabilities while in turn those firms with better innovation capabilities, will also have better logistics capabilities.

On the port side, while time lags in incorporating innovation advancements have been observed (Vanelslander et al. 2019), academic port literature and the port organizations themselves are increasingly involved in a process to fill this gap. In this vein, Vanenslander et. al (2015, 2019) propose a typology to support the management of port-related innovations, which then is applied to classify innovation initiatives undertaken within the sector. Another stream of literature within the port studies domain investigate the innovation path, the processes as well as the barriers and

enablers that turn a seaport related innovation concept into a success (Arduino et al. 2013, Acciaro et al., 2018, Carlan et. al, 2017) while others propose novel approaches to enhance the innovation strategy of port administration (Keceli, 2011) and to better align innovation strategy and innovation success (Acciaro & Sys, 2020). For Sys et al. (2015) and Carlan et al. (2017) the way forward for successful implementation, lies beyond individual innovation, as novel digital technologies will also urge the port sector towards co-innovation - a joint effort to knowledge creation.

Apart from the processes and strategies to be followed to develop and implement innovation initiatives, several authors have suggested that innovations and utilization of new technologies can eventually increase port sustainability while decreasing environmental problems (Wiegmans & Geerling, 2010, Di Vaio & Varriale, 2018, Bjerkan & Seter, 2019). However, as illustrated in Acciaro et al., (2014) green innovations aimed at improving the environmental sustainability of seaports do not always succeed in achieving their preset objectives. Others in turn, have investigated the effects of terminal innovations in increasing employment in the nearby port regions (Salas-Perez, 2018) as well as the impact innovation initiatives in port terminals have in enhancing dock labour productivity and performance (Notteboom & Vitellaro, 2019).

Finally, an additional dimension of the innovation literature in ports, focuses its attention on the development of web services, the utilization of emerging technologies such as cloud computing and the switch to the usage of E-business services to increase seaport capabilities, develop a higher level of cooperation through long-term partnerships within the port community (Čišić et al. 2009), as well as to enhance information exchange and interoperability within the transport network (Kawa & Mrozek, 2014). Gharehgozli et al. (2016), focus on highlighting recent developments and innovative container terminal technologies which aid in improving container handling as well as enhancing the operational efficiency of container terminals.In turm Heilig & Voβ (2017) while acknowledging the ever-increasing importance of IT/IS solutions in enhancing visibility, efficiency, reliability, and security in ports and the growing interest displayed in both academia and industry, about the current and future role of such applications, undertake an extensive review of literature and of applied industry solutions in order to classify the current state-of-the

enabling technologies and information systems being applied to seaports, in 10 distinct groups (national single window, port community systems, vessel traffic services, terminal operating systems, gate appointment systems, automated gate systems, automated yard systems, port road and traffic, control information systems, intelligent transport systems, and port hinterland intermodal information systems).

5.4 Research Framework, Data Sources and Methodology

5.4.1 Research Framework

Despite the ever-expanding literature that addresses and revolves around the various facets of innovation within the maritime and port industry especially over the last decade, still numerous aspects and frameworks of the innovation theory, analyzed in the context of the broader economic literature, remain largely unaddressed. These frameworks, which have originally been developed outside the scope of maritime and port innovation, include amongst others a) the resource/knowledge-based view of the firm, b) the Schumpeterian innovation framework as well as the c) network theory of inter-organizational relationships.

The first of these theories, the resource-based view (RBV) of the firm, contends that each firm is heterogeneous and consists of a unique set of tangible and intangible resources and capabilities (Wernerfelt,1984). In an ever evolving and highly competitive global environment however, firms have to constantly acquire, expand and develop their resources and capabilities in order to achieve a sustained competitive advantage (Barney, 1991b, Fahy, 2000). Within this line of reasoning, a growing body in literature regards knowledge as the most fundamental resource in the effort to develop a sustained competitive advantage (Grant, 1996). Based on this view, the knowledge-based view of the firm (KBV) as it is often regarded, knowledge is a unique intangible firm resource (Curado & Bontis, 2006) which holds the potential to be at the same time valuable, rare, difficult to imitate and substitute and hence fulfil the four attributes required as per Barney (1991b), to achieve a sustained competitive advantage. According to Toner (2011) and McGuirk & Hart (2015) the existence within the firm of human capital with higher levels of education, training and skills, increases the propensity of the firm to produce technical and organizational innovation. For Moulier-Boutang (2001) this shift towards knowledge, describes the

current system of accumulation which he terms “cognitive capitalism”, where the resources originally outside of the economic sphere are integrated into the economic sphere, rendering knowledge the principal resource in the process of creating innovative value (Christensen, 2012).

In turn, Schumpeter’s innovation framework as developed in his phenomenal work “Capitalism, Socialism, and Democracy” (1976) in which he also coined the term of creative destruction which “incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one”, suggested that a market structure involving large firms with a considerable degree of market power is the price that society must pay for rapid technological progress (Nelson & Winter, 1982b). Baumol (2004) was of the same opinion, indicating that vigorous oligopolistic competition, particularly in high-tech industries, forced firms to keep innovating in order to survive, internalizing innovative activities rather than leaving them to independent inventors. In other words, firms in concentrated markets and with greater market power are amongst other, more competent to finance R&D activities and appropriate the returns and hence have better incentives to innovate (Symeonidis, 1996). While innovations are also triggered by garage tinkerers and public funding (Mazzucato, 2013), we illustrated in Chapter 3 that firms in concentrated markets, have a greater capacity to diffuse the surplus value appropriated, to develop novel innovations which further decrease the turnover time of their capital circuit by either increasing its veloci-ty or its scale and intensity.

In the antipode, the network theory of inter-organizational relationships suggests that when the base of an industry is both complex and expanding and the sources of expertise are widely dispersed, the locus of innovation will be found in networks of learning, rather than in individual firms (Powell et al., 1996). While inter-firm networks such as partnerships, strategic alliances, coalitions and collaborative agreements (Provan et al., 2007) can enhance market access (Nueno & Oosterveld, 1988), access to finance (Scalera & Zazzaro, 2009) and diversified resources (Dyer et al., 2001), as well as increase the market power of the partnering firms (Morrish & Hamilton, 2002), it is also increasingly supported within literature that inter-organizational relationships are an important factor in increasing access to knowledge and thus

creating the conditions which enhance firms' innovative performance (Pittaway, 2004, Dagnino et al., 2015). In parallel, increased market access, also through the buildup of inter-organizational relationships, has been recognized as an additional factor which can accelerate innovation (Bustos, 2011), as firms are more likely to invest additional resources to investigate potentially useful discoveries in response to the increase in the expected return (Sokoloff, 1988).

The above brief analysis of these three innovation frameworks, has been undertaken in order to utilize their insights in the formulation of our hypothesis, which will be tested in the remainder of this chapter. More specifically, as the container industry (liner shipping and terminal operating companies) displays increased degrees of concentration attained through organic growth and consecutive merger and acquisition waves as well as high levels of inter-organizational relationships through the establishment of joint ventures and of strategic alliances. Apart from the joint ventures established and the formulation of alliances a number of liner companies, amongst others CMA-CGM, MSC, ZIM and PIL as well as terminals around the world have joined the Tradelens electronic platform which was developed by MAERSK & IBM (Tradelens, 2020). In addition, ocean carriers like CMA-CGM, MSC and NYK collaborate with other market stakeholders in the context of the Hydrogen Council to accelerate hydrogen deployment around the world (Hydrogen Council, 2021). Finally, in the Digital Container Shipping Association (DCSA) which has been formed by MSC and partners, MAERSK, CMA-CGM, Evergreen Line, Hyundai Merchant Marine, Yang Ming, ZIM, Hapag-Lloyd and ONE are also members (DCSA, 2020). Based on the above our aim is to investigate whether the largest firms in both respective markets also display increased levels of innovative activity.

To this end, we ultimately aim to understand whether knowledge, is considered as a primal resource for incumbent firms in liner shipping and terminal operations in their effort to further increase their market power and to achieve a sustained competitive advantage. More specifically, since knowledge is an intangible company asset, our intention is to gauge the outcomes of knowledge in the form of innovative activity and one possible way to measure that is through the investigation of the patents granted to the liner shipping and terminal operating companies.

5.4.2 Data Sources & Methodology

In essence a patent along with other types of intangible assets such as copyrights, trademarks and trade secrets, is a form of Intellectual Property (IP) granting the holder legal protection for an invention in all fields of technology which might be a novel product or a process that provides a new way of doing something or offers a new technical solution to a problem (WIPO, 2021). Patents provide their owners an exclusive right to an invention, preventing third parties from commercially exploiting their invention for a 20-year period from the date of the application submission (WIPO, 2021).

According to the World's Intellectual Property Office (WIPO), the principle behind the modern patent is that an inventor is allowed a limited amount of time to exclude others from supplying or using an invention in order to encourage inventive activity by preventing immediate imitation. In return, the inventor is obliged to make the description and implementation of the novel invention public rather than keeping it secret, allowing others to build more easily on the knowledge contained in his invention (WIPO, 2015). In this sense, while on the one hand patents grant protection to their holders, on the other hand they disclose important information about state-of-the-art inventions, thus aiding the process for future innovations. As recorded in WIPO's annual report (2020), characteristic of the increasing importance of patents is the long-term trend which shows patent applications growing worldwide every year since 1995, apart from 2002, 2009 and 2019, when they decreased by 0.9%, 3.8% and 3%, respectively.

The observed growth in patenting has also stimulated the interest of researchers from various academic fields, who are increasingly interested in assessing the effectiveness of the patent system in promoting innovative activity among private firms (Hall, 2007) as well as the implications patents have in market structure and competition (Schmidt, 2014, Yelderman, 2016). While thus patents' importance varies greatly across industries, they are the typical output of application-oriented types of R&D, and despite their weaknesses they provide a good measure of innovativeness as they reflect the technological capabilities of firms (Katila, 2000, Kürtössy, 2004). In addition, apart from having a direct effect in the performance of firms, patents, especially when

an increased number of them is granted in a particular market, can indirectly act as an entry barrier, deterring new firms from entering the market (Heger & Zaby, 2018) as well as a mechanism to block competition (Gubby, 2020). In this vein, in order to fulfil our research aim, we will undertake a systematic review of granted patents, based on Tranfield et al.'s (2003) three-stage procedure, comprised of the planning, execution and reporting stages.

In the primal planning stage, we set the objectives of this exercise. As our objective is to capture the innovative activity within the liner shipping and terminal operators' sectors, in the form of patents granted, we intend to make a deep investigation on the EPO's (2021) comprehensive database, in order to make a first record and a classification of the patents granted to the ten (10) largest liner shipping and respectively to fourteen (14) major terminal operating companies (Alphaliner, 2020, Drewry, 2020). Such a venture, to the best of our knowledge has never been undertaken before within the maritime and port literature.

As a comprehensive search distinguishes a systematic review from a traditional narrative review (Tranfield et al., 2003), in the following stage of execution we defined the initial selection criteria and the keywords to be searched in EPO's database. Following, Bessen & Hunt (2007), we used a search algorithm based on keywords, Company names & subsidiaries rather than, the EPO's classification system to identify the patent documents related to containerized transport actors. As such, three levels of research, utilizing multiple alternative keywords were undertaken, based on:

- the name of the Company included in the top10 liner shipping, e.g. Maersk, Mediterranean Shipping Company (MSC), COSCO Shipping, CMA-CGM, Hapag-Lloyd, ONE, Evergreen, Hyundai Merchant Marine (HMM), Yang Ming, ZIM and the top15 terminal operators' companies e.g. Port of Singapore Authority (PSA), Cosco Pacific Ports, APMT, Hutchison Ports Holdings (HPH), Dubai Ports World (DPW), China Merchants International Holdings (CMIH), MSC/Terminal Investment Limited, ICTSI, CMA-CGM/Terminal Link, SSA Marine, plus HMM, ONE, Ports America, Evergreen and Shanghai International Ports Group (SIPG)

- the name of affiliated companies, subsidiaries, start-ups of the above-mentioned companies (e.g., Safmarine, TCB Grup, APL, NOL, China International Marine Containers, COSCO Logistics, etc.)
- the name of the container terminals within the network of the abovementioned terminal operators (e.g., Tianjin Port Euroasia International Container Terminal, Guangzhou South China Oceangate Container Terminal, Qingdao New Qianwan Container Terminal etc.)

The results of the more than 140 queries performed in EPO's patent database, allowed us to compile an initial sample of more than 1750 relevant patents, dating from the 70's till 2021. The surprisingly high number of patents granted to liner shipping and terminal operating companies (while some however, are more innovative than others) and the wide range of their applicability (from ship design and cargo handling to logistics and AI technologies amongst others) reveals that the utilization of patents in an effort to protect their intellectual property rights and/or block competition has been a standard practice within the liner shipping and terminal operating sectors, for a sufficient period of time.

Furthermore, the patents of the initial sample were screened according to their relevance and their publication date. As far as the first additional parameter is concerned, whenever it was unclear whether the patent was related to the container segments of liner shipping and terminal operations, we downloaded the full patent application containing information such as mosaics and details of the invention to be patented, to study the application area further. Respectively, as regards to the timeframe of our research, due to the increase in the number of applications observed from 2008 onwards, we excluded from our sample all patents granted prior to 2008 as well as those granted in 2021, thus narrowing down the period under research from 2008 to 2020. After the above sorting, the final sample included 1636 relevant patents, granted within the 2008 and 2020 interval.

Having finalized our sample, we proceeded by classifying the selected patents according to: a) applicant's name / number of applicants, b) inventor's name / number of inventors, c) publication date, d) patent's field of application, e) patent's backward

citations31, f) patent's forward citations32 and finally g) whether the patent is directly or indirectly related to the companies included in our sample. Finally, after the collection and organization of the data on patents granted, we proceeded in the third stage of execution, where data were processed and analyzed. The results of this analysis are presented in the section below.

5.5 Patents granted to major liner shipping and terminal operating companies over the 2008-2020 period

5.5.1 Temporal Distribution of Patents

This study as outlined in the methodology section above reviewed the patents granted to the major companies operating in the containerized segments of liner shipping and terminal operations over the 2008-2020 period. In this context, 1636 granted patents were published in EPO's database over the last 13 years, the yearly distribution of which is presented in the following Figure 36.

The number of patents granted each year, despite some fluctuations observed, overall follows an upward trend. More specifically, the patent output over the 2008-2011 interval numbered 249 publications with the average number of patents granted on an annual base being 62.25. From 2012 to 2017 the patent output increased to 742, with the per year average publications surpassing the 100 threshold, being 123,6. While in 2016 a major decrease in the number of patents awarded was recorded (below 100) the output rebounded the following year. Finally, more than 39.4% of the patents included in the sample (645) were published over the last 3 years, during which the annual patent average ascended even higher, at 215. Thus, the progressive growth in patents granted over the years, reveals that liner shipping and terminal operating companies alike increasingly utilize the patent system to safeguard their innovative efforts from competition.

[31] Prior Patents cited in the patent application process
[32] Subsequent patents citing the particular patent

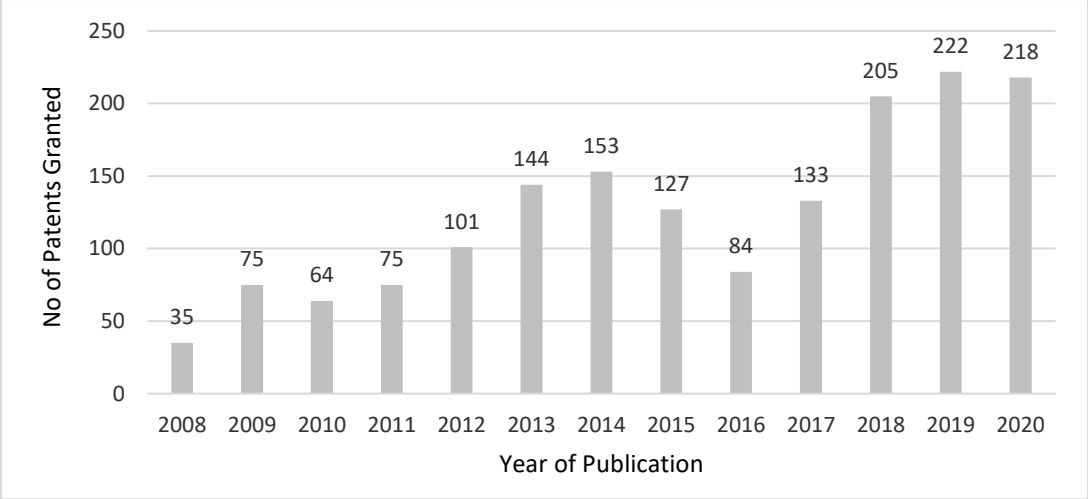


Figure 36. Number of Patents Granted per year over the 2008 – 2020 interval

Source: (EPO, 2021) Author's Elaboration

Moving forth from the overall picture to the distinct innovative activity expressed in patents, of liner shipping (Table 15) and terminal operating companies (Table 16), it appears that a number of companies in both containerized segments under study are highly innovative, considering the high number of patents in their portfolios, others are moderately innovative while a final group of companies exhibit little or none innovative activity.

As far as liner shipping companies are concerned, Table 15. below portrays the patents granted on a yearly basis to each firm as well as the aggregate number of patents of all firms within a year. On a firm level, ONE which comprises 'K' Line; Mitsui O.S.K. Lines and NYK Line stands out as the most innovative liner shipping company with numerous yearly publications (except 2008) and a total of 180 patents (32.7% of the sample) throughout the 2008-2020 interval. However, Maersk, Cosco and HMM are also highly innovative with 148 (26.9%), 112 (20.4%) and 108 (19.6%) patents respectively. While variations in the yearly patent output are observed, the results indicate that each of these companies rely heavily on and utilize increasingly, especially over the last years, the patent system to protect their intellectual property rights. On a yearly basis, 2020 has been the most productive year on a collective level with 81 patents granted, while on a firm level the highest output is recorded by HMM in 2014, when the company published 45 patents within just one year. Conversely, CMA-CGM's patent output over the 12-year period is rather poor, with just 2 (0.4%)

patents while MSC, Hapag-Lloyd, Evergreen, Yang Ming and Zim do not have any patents at all. At this point it is worth noting that of these liners CMA-CGM (U.S District Court Western District, 2021) Hapag-Lloyd (JUSTIA, 2020), MSC (Tradewings, 2021) and ZIM (U.S District Court Eastern District, 2021) have been also facing lately claims of patent infringement.

Table 15. Patents Granted to Liner Shipping Companies.

		Liner Shipping Companies					
		AP MOELLER MAERSK	COSCO SHIPPING	HMM	ONE	CMA-CGM	*Sum*
Year	2008	7	1	4	2	0	**14**
	2009	14	9	4	8	1	**36**
	2010	11	1	2	11	0	**25**
	2011	12	4	2	8	0	**26**
	2012	9	1	0	11	0	**21**
	2013	20	3	2	9	0	**34**
	2014	5	13	45	12	0	**75**
	2015	5	10	18	8	0	**41**
	2016	10	3	1	16	0	**30**
	2017	13	12	2	16	0	**43**
	2018	10	14	6	20	0	**50**
	2019	10	27	9	27	1	**74**
	2020	22	14	13	32	0	**81**
	Sum	***148***	***112***	***108***	***180***	***2***	***550***

Source: (EPO, 2021) Author's Elaboration

Respectively, in the terminal operations segment unlike the concentration of the overwhelming majority of patents amongst just four liner shipping companies, fourteen out of the fifteen companies (with the exception of ICTSI) researched, have at least one patent in their portfolio (Table 16.). In addition, in terms of aggregate yearly numbers, the patents granted in the field of terminal operations are almost double than those granted in the field of liner shipping. Nonetheless, a varying degree of patents granted amongst companies is also observed in this case.

Table 16. Patents Granted to Terminal Operating Companies

Year	Terminal Operating Companies														
	PSA	HPH	APMT	COSCO Ports	CMIH	SIPG	DPW	HMM	ONE	CMA-CGM	MSC	EVERGREEN	SSA Marine	Ports America	Sum
2008	0	0	2	3	2	6	0	2	6	0	0	0	0	0	***21***
2009	8	0	2	4	3	2	0	3	17	0	0	0	0	0	***39***
2010	7	0	0	2	1	11	0	1	15	0	0	2	0	0	***39***
2011	8	0	2	4	8	12	0	0	15	0	0	0	0	0	***49***
2012	14	2	5	15	11	11	0	1	20	1	0	0	0	0	***80***
2013	14	5	14	23	30	6	6	4	7	0	0	0	1	0	***110***
2014	9	3	5	16	17	5	0	6	17	0	0	0	0	0	***78***
2015	17	1	6	15	23	0	0	7	14	0	0	0	1	2	***86***
2016	7	0	3	2	4	14	0	11	13	0	0	0	0	0	***54***
2017	10	7	5	21	24	11	0	2	10	0	0	0	0	0	***90***
2018	8	28	3	50	32	13	0	3	10	2	2	1	0	3	***155***
2019	7	19	6	53	31	7	1	6	16	1	1	0	0	0	***148***
2020	16	11	4	24	27	10	1	20	13	4	4	3	0	0	***137***
Sum	**125**	**76**	**57**	**232**	**213**	**108**	**8**	**66**	**173**	**8**	**7**	**6**	**2**	**5**	**1086**

Source: (EPO, 2021) Author's Elaboration

As such, operators like SSA Marine (0.2% of the sample), Ports America (0.5%), Evergreen (0.55%), MSC (0.6%), CMA-CGM (0.7%) and DPW (0.7%) exhibit some innovative activity over the years, yet it is rather inferior to that of the other companies' patent output.

In addition, we observe, that in contrast to the case of liner shipping where there was an extreme antithesis amongst innovators and non-innovators, in the terminal operators' segment there is a group of moderately innovative companies which includes the APMT, HMM and HPH firms with each having a considerable number of patents, 57 (5.2%), 66 (6.1%) and 76 (7%) respectively. Interestingly, for the case of APMT and HMM, results indicate that the liner shipping arm of their Groups is far more innovative than the terminal one.

Finally, there is a group of highly innovative terminal operators, consisting of SIPG (9.9%), PSA (11.5%), ONE (16%), CMIH (19.6%) and COSCO (21.4%), each of which has more than 100 granted over 2008-2020. Particularly Cosco which stands out at the top and CMIH which follows, even surpass the 200 hundred patent threshold while ONE, taking also into account the patents it has in liner shipping, is rendered as the most innovative company of all.

5.5.2 Patent Classification

In addition to the yearly distribution, patents of our sample were further surveyed based on their description and information included in EPO's database, to distinguish the main fields of their applicability. Therefore, we established a set of ad-hoc categories to group patents granted to the liner shipping and terminal operating companies.

As far as the former are concerned, six (6) major categories were distinguished namely: 1) Ship design, which includes patents related to the design of containerships; 2) Ship's accessories, referring to patents related to ship's devices and units such as valves, cylinders, clamps etc. or equipment aimed at enhancing for example anchoring, wind resistance etc.; 3) Ship's Operational Systems & Devices for patents aimed at enhancing the ship's operational performance such as navigation support devices, voyage plan design assistance, ballast water treatment arrangement, stowage

system etc.; 4) Information Exchange - Monitoring & Control Systems & Devices for patents related to data processing and measurement systems, information management and transmission systems as well as devices for monitoring and controlling the various ship segments (engine room, propeller etc.); 5) Container Design referring to patents related to the design of container boxes (including reefer ones) and 6) Container's Accessories - Monitoring Systems & Devices for patents that comprise devices such as holds, connectors, batteries etc. and systems for monitoring the air flow, the temperature, the freshness and condition of products carried etc.

Accordingly, for the case of terminal operating companies another six (6) major categories are identified: namely: 1) Cargo Handling Equipment & Devices for patents relating to the design of quay cranes and other handling equipment (yard cranes, rubber tired gantries etc.) as well as to featured systems and devices embodied to that equipment (for power supply, hoisting, lashing etc.); 2) Terminal's Ancillary Equipment for patents related to a terminal's additional equipment such as lighting, charging, weighing systems, shore power and water supply equipment etc.; 3) Information Exchange, Monitoring & Control Systems and Devices which includes patents related to data processing and transmission systems for intermodal logistics management, gate traffic management, inspections, remote control of equipment and position detection etc.; 4) Cargo Management Systems for patents related to the management of cargo flows within the premises of the terminal such as, vehicle rooting optimization, storage yard allocation, stacking and positioning systems etc.; 5) Terminal Design which refers to patents related to the design and layout of container terminals and 6) Container Design referring to patents related to the design of container boxes (including reefer ones).

Based on the above categorization, Table 17. and Table 18. below present the results of the undertaken patent classification for the case of liner shipping and terminal operating companies respectively.

Obtained results in the case of liner shipping companies indicate that the majority of patents granted relate to Ship Operational Systems and Devices (30.5%) with all companies but CMA-CGM, holding a sufficient number of patents in this specific field.

Also, in relation to the other areas of application this field represents the 35%, 44.4%, 23% and 20.5% of all patents granted to ONE, HMM, MAERSK and COSCO respectively.

Table 17. Liner Shipping Companies' Patent Classification

		Liner Shipping Company				
		AP MOELLER MAERSK	COSCO SHIPPING	HMM	ONE	CMA-CGM
Patent Classification	Ship Design	18	7	13	11	0
	Ship's Accessories	23	31	27	18	1
	Ship's Operational Systems & Devices	34	23	48	63	0
	Information Exchange - Monitoring & Control Systems & Devices	4	19	16	24	0
	Container Design	33	12	2	26	1
	Container Accessories - Monitoring Systems & Devices	36	20	2	38	0

Source: (EPO, 2021) Author's Elaboration

Inventions in the Ship's Accessories category is the second most prominent field in which patents are granted to the liner shipping companies, representing the 18% of the aggregate total. COSCO and HMM in particular, have the most patents in this category (31 and 27 patents respectively), while MAERSK and ONE follow closely with 23 and 18 patents. In addition, one of the just two patents of CMA-CGM falls within this category, while the other is on the Container Design category which aggregates a total of 74 patents. MAERSK stands out in this field holding the 45% of the relevant patents, with ONE holding another 35%.

These two companies also lead the Container Accessories, Monitoring Systems & Devices category. Interestingly, more patents are granted in relation to unique characteristics and features containers embody (in total 96 patents) than in relation to their design. ONE, MAERSK and COSCO have more patents in this category than in the design category while HMM, according to the results is not particularly active in either.

In contrast, HMM holds 16 patents related to Information Exchange - Monitoring & Control Systems & Devices, closely behind COSCO and ONE which have 19 and 24 respectively. In total this category represents the 11.5% of the patents granted to liner shipping companies with MAERSK being the least innovative, in this field. Finally, in the Ship Design category which is the field with the lowest number of granted patents, counting 49 (8.9%) in total, from 2008 to 2020, MAERSK holds 18 patents related to the design of containerships, with HMM, ONE and COSCO having 13, 11 and 7 patents respectively.

Respectively, as far as the patents of terminal operators are concerned, the results depicted below illustrate that operators have been most actively engaged in the development of innovations related to the operational enhancement of the cargo handling equipment in their terminals. Characteristic of this fact, is that almost 35% of all patents granted to terminal operators fall within this particular category. Particularly, COSCO and ONE stand out as the most innovative operators in this field as each hold 82 (21.6%) patents. Amongst the rest all operators but MSC, CMA-CGM, EVERGREEN and Ports America have at least one patent granted related to cargo handling equipment, with the vast majority of companies holding 19 or more patents.

The second largest category, in terms of patents granted is Information Exchange, Monitoring & Control Systems/Devices which aggregates a total number of 290 patents (26.7% of the sample). The above high number of patents granted in aggregate terms as well as on an individual company level in this field reveals that most of the terminal operators are particularly eager to adapt and adopt new emerging technologies in order to enhance data exchange, visibility and communications and hence achieve better efficiencies and coordination not only in the terminal phase but also beyond the port perimeter.

Table 18.Terminal Operating Companies' Patent Classification

		Terminal Operating Companies													
		PSA	HPH	APMT	COSCO Ports	CMIH	SIPG	DPW	HMM	ONE	CMA-CGM	MSC	EVERGREEN	SSA Marine	Ports America
Patent Classification	Cargo Handling Equipment & Devices	41	21	19	82	61	34	3	36	82	0	0	0	1	0
	Terminal Ancillary Equipment	34	23	17	64	58	23	4	2	10	0	0	3	0	1
	Information Exchange, Monitoring & Control Systems/Devices	35	24	9	56	63	40	0	19	26	8	7	2	1	0
	Cargo Management Systems	12	8	11	30	25	10	1	9	37	0	0	1	0	4
	Terminal Design	3	0	1	0	0	1	0	0	18	0	0	0	0	0
	Container Design	0	0	0	0	6	0	0	0	0	0	0	0	0	0

Source: (EPO, 2021) Author's Elaboration

Moreover, a large proportion of the patents, accounting for the 22% of all patents granted to terminal operators is related to the ancillary equipment of terminals. All apart from three terminal operators hold patents in this category, with COSCO and CMIH being distinguished for their inventive activity in the field. Considerably less patents but still sufficient in number are held by PSA, HPH, SIPG and APMT.

With 148 patents, corresponding to the 13.6% of the total number of patents granted, the Cargo Management Systems category is the fourth largest field of inventions. Almost two thirds of the aggregate total of patents in this category are held by just three operators, namely ONE (25%), COSCO (20.2%) and CMIH (16.8%). Amongst the rest, five operators (PSA, HPH, APMT, SIPG, HMM) have on average 10 patents, two operators have just one (DPW, Evergreen) while for Ports America 4 out of its 5 patents granted, are in this field.

Finally, in the two remaining categories, those of Terminal and Container (2.1%) Design respectively (0.6%), results indicate that the vast majority of terminal operators do not pursue to obtain patent grants in these fields. More specifically, CMIH is the sole terminal operator with patents in Container Design (the patents of Mega Carriers in container design have been counted as part of their liner shipping segment) while in Terminal Design with the exception of ONE which has a sufficient number of patents (18) in the design of container terminals, the other terminal operators have little inventive activity or none at all in the field.

5.5.3 Patent Citations and other Patent Statistics

Moving forth on a third level of analysis, we investigate the backward and forward citations of the patents granted to liner shipping and terminal operating companies as well as some additional features of those patents, related to the number of inventors and applicants as well as to whether they are directly or indirectly related to the companies included in our sample. More specifically, we investigate patent citations as on the one hand backward citations depict the level of knowledge of the applicant(s) in relevant research available at the time of publication, while on the other hand forward citations, just like in academic literature, provide a good measure about the significance of the patent. In addition, we investigate the average number of inventors and applicants of the granted patents in an effort to understand whether

the development of inventions is a collective or solitary process while also gauge whether the process of applying for a patent is a field which favours the collaborative behaviour amongst distinct companies. Finally, since the vast majority of companies in both markets researched have numerous wholly owned subsidiaries as well as stakes in terminals and other related companies, we investigate whether patents granted are directly related to a company of the Group or to a joint-venture company, thus being indirect patents.

In this vein, Table 19. and Table 20. below, depict the results attained for the case of liner shipping companies. More specifically, Table 19. where patent citation data are presented, is divided in two sections, those of backward and forward citations, which in turn consistinfi of four additional sub-sections. As anticipated, results indicate that both in terms of average citations per patent as well as in terms of cumulative citations, backward citations are significantly higher than forward ones.

Although the comparison between the two is just numerical, as for a patent to attain forward citations is much more difficult and relates to its importance and its value, the high percentage of non-zero backward patent citations (with the exception of COSCO) indicates that in a sufficient degree, patent applications contain at least one reference of relevant prior state of the art thinking and knowledge. As depicted in the results, patents granted have on average multiple references in previous inventions, the maximum of which for each company ranges between 10 and 50 backward citations.

Table 19. Liner Shipping Companies' Patent Citation Data

		Liner Shipping Companies				
		AP MOELLER MAERSK	COSCO SHIPPING	HMM	ONE	CMA-CGM
Backward Citation Statistics	Average	3.41	4.5	1.82	3.09	5.5
	Non Zero%	43.24%	23.21%	40.7%	50.55%	50%
	Max.	43	10	50	22	11
	Cumulative Backward Citations	505	140	197	553	11
Forward Citation Statistics	Average	0.96	1	0.67	0.99	2.5
	Non Zero%	29.05%	38.4%	36.11%	30.55%	100%
	Max.	29	9	6	19	4
	Cumulative Forward Citations	142	112	72	179	5

Source: (EPO, 2021) Author's Elaboration

As far as forward citations are concerned, results indicate that around a third of the patents granted, have received at least one citation. Interestingly, while the percent of forward cited non-zero patents is lower than that of non-zero backward ones for the cases of MAERSK, HMM and ONE, COSCO's and CMA-CGM's non-zero forward citations are considerably higher. While for CMA-CGM the results are not indicative as the company holds just two patents, in the case of COSCO it denotes that a considerable percent (38.4%) of its inventions have some significance and some value. ONE may have the highest number of cumulative forward citations amongst all liner shipping companies and along with MAERSK (142) might outperform COSCO (112), however the Chinese company's patents receive on average one citation per patent when for the others (excluding CMA-CGM), the average citations attained per patent, range between 0.67 (HMM) and 0.99 (ONE). Yet, the most cited patent belongs to MAERSK and counts 29, citations, in comparison to the 19, 9 and 6 forward citations received by the most prominent patents of ONE, COSCO and HMM respectively.

Table 20. Liner Shipping Companies' Patent Features

	Line Shipping Companies				
	AP MOELLER MAERSK	COSCO SHIPPING	HMM	ONE	CMA-CGM
Average Number of Inventors	1.7	5.6	2.3	3.6	1.5
Max.	6	20	9	17	2
Average Number of Applicants	1.2	1.3	1.1	1.8	1.5
Max.	5	4	3	12	2
Direct Patents %	100%	100%	100%	100%	100%

Source: (EPO, 2021) Author's Elaboration

Similarly, in Table 20. results indicate that the process of developing a novel invention is mostly a collaborative one, as on average more than one inventors are involved. Characteristic of this fact is that, for the creation of just a sole invention, as many as 20 (COSCO) or 17 (ONE) inventors may participate. Conversely, findings suggest that patent applications are on average applied solely by liner shipping companies themselves or through one of their subsidiaries. However, patents involving more than

one applicants also exist. More specifically, apart from the occasions where more than one companies of the liner shipping Group jointly apply for a patent, additional applicants include, inventors themselves as well as specialized high-tech companies. As such, while some patents may be shared with other applicants, overall all of the patents granted involve either the liner shipping companies themselves or a wholly owned subsidiary of their portfolios, and hence are directly related to them.

Respectively, for the case of terminal operators, Table 21. presents the results regarding their patents' backward and forward citations while Table 22. reports the findings on the additional features of those patents. As such, as far as patents' citations are concerned larger deviations are observed amongst the terminal operating companies with respect to both the cited and the citing patents, in comparison to those of liner shipping companies.

More specifically, in terms of backward citations apart from terminal operators such as SSA Marine and Ports America which have proportionally to the patents they hold an increased number of backward references, the companies that stand out in this respect are the ones holding an increased number of patents namely, ONE (33.9%), COSCO Ports (14.8%)) and CMIH (12.1%).

Excluding SSA Marine and Ports America, ONE has also the highest number of average citations per patent as well as the highest percent of cited patents. In contrast, COSCO's and CMIH's average citations per patent as well as the percent of their cited patents are lower than those of APMT, HMM and SIPG which hold less patents, indicating that their backward references are concentrated in a fewer number of patents. Finally, as results on the maximum number of citations on a single patent indicate, several of the most inventive operators (ONE, APMT, SIPG, PSA) include in their applications a significant number of references on related inventions.

Table 21. Terminal Operating Companies' Patent Citation Data

		Backward Patent Citations				Forward Patent Citations			
		Average	Non Zero%	Max.	Cumulative Backward Citations	Average	Non Zero%	Max.	Cumulative Forward Citations
Terminal Operators	PSA	1.15	17.07%	19	141	0.82	38.21%	10	101
	HPH	0.84	17.1%	10	64	0.17	13.15%	4	13
	APMT	2.4	29.82%	36	137	0.56	31.58%	6	32
	COSCO Ports	1.34	21.1%	13	312	0.68	31.89%	14	159
	CMIH	1.2	23.94%	10	256	0.95	37.55%	15	213
	SIPG	1.5	25.92%	22	162	1.33	49.07%	16	144
	DPW	3.13	50%	8	25	1.8	62.5%	3	9
	HMM	1.7	49.96%	8	100	0.56	27.27%	4	37
	ONE	4.1	69.36%	34	714	1.54	47.39%	16	267
	CMA-CGM	1.13	25%	6	9	0.13	12.5%	1	1
	MSC	1.29	28.57%	6	9	0	0%	0	0
	EVERGREEN	0	0%	0	0	1.17	33.33%	5	7
	SSA Marine	34.5	100%	45	69	1.5	50%	3	3
	Ports America	21.8	40%	64	109	0.8	80%	1	4

Source: (EPO, 2021) Author's Elaboration

Turning to the forward citations of the patents held by terminal operators, overall results suggest that a significant proportion of them is cited in subsequent inventions. Indeed, judging from the percentage of patents receiving at least one citation, it is observed that apart from MSC, CMA-CGM and HPH whose inventions seem to have no or negligible impact and operators with just a few patents such as Ports America, SSA Marine, DPW and EVERGREEN, companies' cited patents represent a portion of their portfolios which ranges between 27.7% (HMM) to 49% (SIPG).

APMT and HMM might not be as inventive as their liner segment is, however, their patents manage to receive 32 and 37 citations, respectively. In contrast, ONE and COSCO are amongst the so-called Mega Carriers who not only exhibit more innovativeness in the terminal phase but are amongst the terminal operators whose patents have the most significant impact. More specifically, ONE has both the highest number of average and cumulative citations, while COSCO might lack on average citations received per patent, on an overall level it manages to attain a significant number of forward citations.

Accordingly, from the pure terminal operators, CMIH, SIPG and PSA stand out. The Shanghai-based operator's patents might receive on average more citations than those of CMIH and might hold the most impactful patent in terms of citations (along with ONE), however the latter's inventions are the ones which aggregate the most forward citations of the three.

Table 22. Terminal Operating Companies' Patent Features

		Average Number of Inventors	Max.	Average Number of Applicants	Max.	Direct Patents %
Terminal Operators	PSA	7,1	15	1,3	9	9.6%
	HPH	3,5	10	2,3	3	0%
	APMT	3,7	11	1,2	5	40.3%
	COSCO Ports	5,6	27	1,6	5	30.2%
	CMIH	8,0	26	1,7	6	30.1%
	SIPG	5,7	13	1,5	4	91.7%
	DPW	8,9	11	1,1	2	12.5%
	HMM	1,8	8	1,2	4	100%
	ONE	2,5	11	1,2	4	87.9%
	CMA-CGM	3.5	4	1,6	3	12.5%
	MSC	3.9	4	1,4	2	0%
	EVERGREEN	1,7	2	1	1	100%
	SSA Marine	1,5	2	2,5	3	100%
	Ports America	8,4	11	1	1	100%

Source: (EPO, 2021) Author's Elaboration

Finally, results on inventions' development depicted in Table 22. above, suggest that in most cases, just like in the occasion of liner shipping, patents necessitate the collaboration of a sufficient number of highly skilled personnel. Characteristic of this fact, is that the development of a single invention might require the involvement of up to 27 (COSCO) scientists. Unlike though, the collaborative effort pertaining the development of inventions, its outcome is in a large extent enshrined solely by the terminal operators. While most operators have joint or collaborative patents with other institutions (on a bigger or lesser extent) in their majority they are held by a single applicant.

However, while the above results correspond to those observed in the case of liner shipping, the striking difference amongst the two containerized segments lies in the percentage of patents that are directly linked to a particular terminal operator. There

are companies such as HMM, EVERGREEN, SSA Marine and Ports America whose patents are all held directly, however in most other occasions this is not the case. The particularly high percent of indirect patents in the case of terminal operators is attributed to two major reasons. First of which, is that a number of companies have invested and hold stakes in start-ups (like Shore-tension by HPH or TRAXENS by CMA-CGM and MSC) while secondly, a large number of patents have been granted to individual container terminals, in which terminal operators have stakes or joint-ventures. As such, by looking into the shareholder base of those start-ups and terminals, hidden patent collaborations which are not spotted in EPO's applications, amongst terminal operators are revealed.

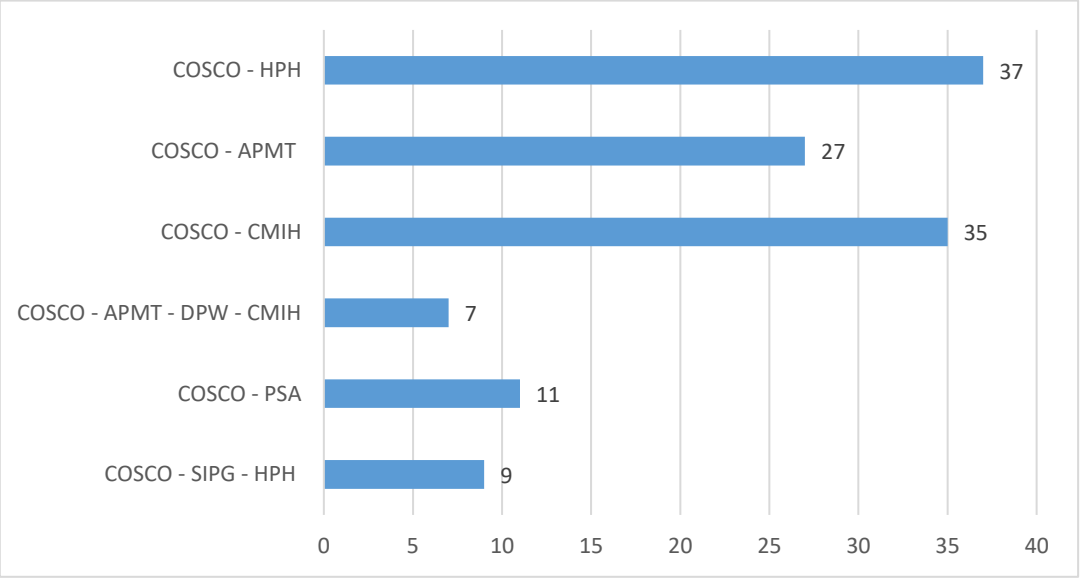


Figure 37. Indirect collaborative patents amongst terminal operators, granted to individual container terminals

Source: (EPO, 2021) Author's Elaboration

As depicted in the Figure 37. above, multiple collaborative patents initially granted to eight individual container terminals, have been unveiled. All of which involve COSCO and six other terminal operators. More particularly, it is found that COSCO and APMT, through the Guangzhou South China Oceangate Container Terminal and the Tianjin Port Euroasia International Container Terminal, share the 27 patents held by these terminals. Similarly, another 37 collaborative patents are found between COSCO and HPH on the Yantian Phase 3 International Container Terminals, 35 amongst COSCO and CMIH on the Tianjin Five Continents International Container Terminal and 11

amongst COSCO and PSA on the Lianyungang New Oriental International Container Terminal. Finally, in three additional terminals, those of Shanghai's Mingdong and Pudong Container Terminals owned jointly by COSCO, HPH and SIPG and the Qingdao Qianwan United Container Terminal in which COSCO, APMT, DPW and CMIH have stakes, 7 and 9 patents have been found respectively.

5.6 Concluding Remarks

The chapter through an initial review of relevant literature within the maritime and port industry affirms the ever-expanding interest of academia in the various aspects of innovation. While though existing papers revolve around a diverse set of mostly broader innovation issues related to the process of applying innovative ideas, the utilization of novel technologies, the development and implementation of innovation strategies as well as its effects in enhancing productivity and efficiency of operations amongst others, issues related to the importance of intangible assets such as innovation to the participant firms of the industry remain unaddressed.

In this vein, utilizing the insights of innovation frameworks proposed within the broader economic literature, which suggest that companies in concentrated markets, with increased market access and inter-organizational relationships, value knowledge creation and are more prone to the development of innovations to achieve a sustained competitive advantage; this paper sheds some light on the propensity towards innovation of the major firms within the containerized transport segments of liner shipping and terminal operations which feature the above characteristics. To do so, as data on R&D budgets were not available, we performed an in-depth investigation of the EPO's database and recorded their patenting activity over the 2008-2020 interval.

Results indicated, a varying degree of patenting activity in both sectors. On the one hand, amongst the liner shipping companies only half of those investigated have at least one patent while just four (COSCO, MAERSK, HMM and ONE) have a sufficient patent portfolio, denoting an active and durable engagement in the development of novel inventions. Surprisingly, companies such as CMA-CGM, MSC and Hapag-Lloyd which are classified amongst the five largest carriers have little or no patenting activity at all. On the other hand, judging from both the aggregate patent counts and the number of companies with patenting activity, terminal operators appear to be more

innovative. However, a distinction amongst highly, moderately and slightly innovative operators can be made. COSCO and ONE are amongst the Mega Carriers which stand out with their innovativeness also in the terminal phase segment, while from the pure operators CMIH, PSA and SIPG are ones with the majority of patents granted. APMT and HMM are not as inventive as in their liner shipping segment, however along with HPH form a group of moderately innovative operators. Finally, CMA-CGM, MSC and Evergreen from the Mega Carriers and SSA Marine and Ports America from the pure operators, display some patenting activity, none the less it is considerably inferior to that of the other companies above.

Apart from the temporal distribution and the counts of patents provided, the paper suggests a first classification of the fields these patents are applied, in both respective markets under study. More particularly as results demonstrate, within the liner shipping segment the category which concentrates the majority of patents is that of Ship Operational Systems and Devices. Respectively in terminal operations, Cargo handling equipment and devices category is identified as the main field of patent applications.

The number of patents granted relating to the enhancement of cargo handling equipment, might be justified by the increasing pressure terminal operators face in handling cargo from ever-larger containerships. As such granted patents might on the one hand aid in enhancing productivity and efficiency of operations while on the other shield the property rights of operators, thus providing them an edge over competition. Conversely, liner carriers are more concerned with the operational efficiency of their vessels, in an effort to further minimize the key service route cost components.

Finally, the third stage of patent analysis demonstrated on the one hand that the process of developing novel inventions is in the majority of cases, in both containerized segments, a cooperative process, involving numerous human capital units. On the other hand, while collaborative applications exist, most patents are granted solely to the companies that filled them. However, particularly for the case of terminal operators, the analysis revealed numerous hidden collaborative patents amongst the operators under study. More specifically, as many of the patents are granted to specific terminals, investigation of their ownership has shown that eight of

these terminals are joint ventures amongst two or more operators. As such all the patents which are held by these terminals are also indirectly related to the operators which have a stake in these terminals.

Overall, results indicated a varying degree of inventiveness amongst both liner shipping and terminal operating companies. As such, a number of companies from both containerized transport segments seem to increasingly resort to the patent system to protect their innovative technologies from competition, while others utilize it moderately or not at all. To this end, the outlined hypothesis, which suggests that firms in concentrated markets, with an increased number of collaborations, value more the significance of intangible assets such as knowledge creation and innovation investing additional resources to investigate potentially useful discoveries, is partly affirmed. However, although the findings support only partially the research hypothesis, they do contribute to our understanding of the behaviour and propensity towards innovation of liner shipping and terminal operating companies.

Indeed, as depicted market leaders such as Maersk, COSCO and PSA, as well as liner carriers and terminal operators with significant market shares (HMM, ONE, CMHI), seem to acknowledge knowledge as an important intangible company asset and display a highly innovative activity in the context of the patent system. More particularly it can be argued that through the diffusion of funds and resources for the development of novel inventions on the one hand market leaders (Maersk, COSCO, PSA) opt to sustain their market positions while companies in lower ranks but nonetheless with a strong presence in the global market and sufficient capital amongst other resources (HMM, ONE, CMHI) opt to enhance their competitiveness and hence their market positions. However, as results indicate this stance is not em-braced by the rest of market leaders and incumbent actors in the liner market who display little or no patent activity at all.

While the patent system, may not reflect all the innovative efforts of companies, the number of patents found both on an individual firm level as well as on an aggregate level, suggest that the latter are one of the various means utilized by companies in liner shipping and terminal operations to enhance operational performance and achieve a sustained competitive advantage. Conversely, to those companies with a

sufficient number of patents, those with an increased market share but with little or no use of the patent system should either utilize other innovative paths or should have deep pockets to acquire innovative technologies from third parties, to stay competitive. In either case, the direct or indirect investment of additional resources to develop or acquire enhanced technological capabilities, may constitute an additional barrier for new entrants in the oligopolistic and oligopsonistic markets of liner shipping and terminal operations respectively.

Chapter 6: Towards a new approach to ports' regulatory framework: the pursuit for a new paradigm and the case of the Piraeus[33]

6.1 Overview

In this Chapter, we argue that within the current environment of globalized and highly concentrated and interconnected containerized transport actors, port economic regulation, has been confined within the port context, losing its centre-stage position and effectiveness. Typically, the key objectives of economic regulation within a port are to ensure fair competition among competing operators within the port; to control monopolies and mergers; to counter and prevent anticompetitive practices by dominant playerssuch as (World Bank, 2001):

- Use of a dominant position to prevent or lessen competition;
- Cross-subsidization by the provider of monopoly services of contestable services, thereby threatening fair competition;
- Price fixing among competitors;
- Use of other practices that are intended to restrict, distort, or prevent competition.

Based on the above, the purpose of economic port regulation is to ensure the efficient and competitive functioning of a port in a context of limited or weak competition involving the intervention in the functioning of markets in terms of setting or controlling tariffs, revenues, or profits; controlling market entry or exit; and overseeing that fair and competitive behavior and practices are maintained within the sector (World Bank, 2007). Economic regulation of ports should be distinguished from types of port regulation which serve other public interests such as security, safety, environmental protection, maintenance of port infrastructure, protection of workers and privacy. The latter types of regulation may be assigned to specialised national or regional agencies or, as far as technical and operational aspects are concerned, to the port authority.

[33] Sections of this Chapter are part of: Angelopoulos, J., Chlomoudis, C. and Styliadis Th. (2017). Effect of global supply chain developments on the governance of port regulation. In Pettit, S. & Beresford, A. (Eds.). Port Management: Cases in Port Geography, Operations and Policy (pp. 62-93). Kogan Page Publishers

In this context, while reviewing the evolution of port governance and the port authority roles and functions, as well as investigating alternatives to the existing structures responsible for the governance of economic regulation and the regulatory tools at hand, we argue that: (a) a gap exists between the current state of evolution of containerized transport networks and the emerging regulation requirements, and consequently, (b) Port Authorities may no longer be the most appropriate entities to enact and enforce regulations.

Despite the fact that literature related to general governance and the substance of regulation in former state-monopoly industries has been expanding, research on regulatory governance and substance within the framework of the integrated transport network is still scarce. Notwithstanding, the growing complexity of the supply chain networks, a comprehensive market assessment is required, since the effects of possible distortions and anticompetitive practices can extend to economy in terms of development, competitiveness and growth. We develop a rationale for the segregation of the ports' regulatory function from Port Authorities and formulate a proposal for its delegation to a specialized independent regulatory authority, following the example of other network industries. Finally, we classify economic regulatory tools that can be utilized to enforce and strengthen regulation of the integrated transport network.

Our aim is twofold. Firstly, to understand and depict the changing dynamics of port governance in which Global Terminal Operators and Mega Carriers are seeking an increasing role. Secondly, to contribute to re-establishing appropriate and effective structures for the governance of regulation as well as to propose an economic regulation toolkit based on a holistic perspective for containerized transport, within the context of the port system. To fulfil our research aims, we investigate the particular case of Piraeus Port in Greece, in which a master-concession privatization model through the sale of the majority of shares in the Piraeus Port Authority, as well as the delegation of the regulatory function to an Independent Regulatory Authority for ports was adopted.

To this end, through the implementation of the GOV-AD-MAN conceptual model, as well as through the investigation of relevant national legislation we depict the changes

underwent in the roles amongst the public and private actors as well as in the governance structures and responsibilities undertaken by the newly established regulatory bodies. Ultimately, through the above analysis we want to investigate the extend to which the newly established regulatory model of independend port regulation in the Piraeus port, provides the means and the tools to a) enforce more effectively economic regulations, b)exert better oversight and monitoring over the port's master concession agreement and c) potentially extend the regulatory reach beyond the port's perimeter.

The remaining of this chapter is organized as follows. Section 6.2 provides an overview of the evolutions in port governance in the roles of port authorities. Section 6.3 and 6.4 focus on theories of regulation, structures of regulatory governance and economic regulation tools. Section 6.5 investigates the effects of privatization in Greece's largest port of Piraeus, focusing on the one hand in depicting the redistribution of port resources amongst the public and private bodies and on the other hand in evaluating the novel regulatory governance model of ports adopted (through an independent regulatory authority) as well as its capacity to enforce effective economic regulations both within and beyond the port's premises. Finally, section 6.6 proposes a holistic approach for the economic regulation of the containerized transport network, through the reinforcement of national, regional and global regulatory cooperation schemes while section 6.7 aggregates the conclusions of the present chapter.

6.2 Port governance: Roles, functions of port authorities

As depicted and discussed in the previous chapters, the liberalization of the port industry on a global level and its transition from the Keynesian regime of state monopoly, which fulfilled and provided in its totality all the functions and port services (Pardali, 2008), led to the adoption of mixed forms of coexistence between the public and the private sector as well as of purely privatized port forms (Baltazar & Brooks, 2001). Such schemes incorporated a modern port management philosophy based on smart (Chlomoudis & Pallis, 1999), flexible (Paixao & Marlow, 2003) and less centralized forms of port organization.

However, this transition was not uniform or linear, as private sector participation in a port can take place through a number of alternative ways, the most important of which are financial leasing, the direct sale of fixed assets of the port, or through the creation of consortia as well as through numerous variations of concession agreements (UNCTAD, 2006). According to the work of Ng & Pallis (2010), asymmetries in port governance and in the restructuring processes followed were the result of variations in institutional frameworks and aspirations among states (in terms of the derised end result of the ports' privatization).

Port restructuring, as it was promoted by governments, led to the redistribution of roles (Psaraftis & Pallis, 2012) as well as the redistribution of responsibilities between the public and private sectors (Juhel, 1998). In Baird (1999), three main operational activities are identified: a) the port regulation, b) the function of granting concessions (as the owner of the port's infrastructure and superstructures) or most commonly known the landlord function and c) the functions of the production of port services (cargo handling, towage etc.). The main result of the port restructuring and reorganization of port operations was the removal of port authorities from the direct port product production, as the former state responsibility for the operation of terminals was granted to private operators (Beresford et al., 2004).

However, Baird (1999) also argues that all three of the aforementioned port functions consist of the three essential elements that can be privatized in a port, either individually or collectively. Consequently, according to this view the degree of privatization of a port is determined by the division of the above functions between the public and the private sector. According to World Bank (2001) and Baird (1999), four main types of port organization and management are recognized and presented in Table 23. below:

Table 23. Ports Organization & Management Models

	Regulation	Infrastructure	Superstructure & Equipment	Operations	Examples
Public (Public Service Port)	Public	Public	Public	Public	Singapore & Dubai, Israel ports Colombo (Sri Lanka)
Private I (Tool port)	Public	Public	Public	Private	Antwerp (some terminals), Chittagong (Bangladesh)
Private II (Landlord port)	Public	Public	Private	Private	Rotterdam, Hamburg, New York/New Jersey etc.
Private III (Private Service Port)	Private	Private	Private	Private	Felixstowe (UK), Hong Kong

Source: (Wold Bank, 2001), Baird (1999) Author's Elaboration

The above classification facilitates the distinction between the categories of participation and the degree of penetration of the private sector in the port industry, although it is not always possible to classify all ports, exactly into one of the above categories. However, it serves as an international classification model based on the port services provided (Stevens, 1999). According to the World Bank's (2001) report and the work of Baird (1999) in the cases of partial privatization, there is usually a transfer of some (Private I category) or even of all the functions relating to port operations and/or to the ownership of a port's infrastructure and superstructure to the private sector. (Private II category). On the contrary, in the case of full privatization (category Private III), the responsibility of regulation is also transferred to the private sector.

The latter case involves the risk, that private managers might take advantage or even abuse the monopoly position granted to them: Baltazar & Brooks (2001) point to this risk and suggest that in the event of assigning or privatizing the function of port regulation, a body different from the privatized port authority, should undertake the responsibility of this function. Empirical data on the cases of Great Britain, New Zealand and Australia, where such a model was promoted, largely indicate that such privatized actors, failed to self-regulate (Thomas, 1994). Especially for the UK, the complete privatization of ports not only did not improve the quality of port services provided to port users but has also led to a significant increase in price levels and consequently to an increase in the profitability of port managers in certain ports (Saundry & Turnbull, 1997). As a result, the complete privatization of port functions in the UK has been deemed uneconomical and ultimately ill-advised for both the market and transportation, as well as for the economy and the public sector (Chlomoudis, 2011). For this reason, the author suggests that the absence of convincing arguments over time about the results of these actions and such choices, have greatly reduced the replication and adoption of such a model by the global port industry.

Apart from the various forms that private sector participation can take within the port industry, the managerial and organizational structure of a port usually consists of a public port authority and of port operators, most of which originate from the private sector. Thus, such coexistence, structures a port largely based on Public-Private Partnerships (World Bank, 2003). Such an organizational and management structure, expressed through the labelled *Landlord model*, is the dominant port model for organizing and managing the largest ports in the world (Van Reeven, 2010). In this version, the Port Authority, usually a public body, constitutes the grantor of the land under national law or regulation, and at the same time the entity responsible for the management and administration of port infrastructure as well as for the supervision, coordination, and the regulation of all private operators within the port zone, which offer among other things, cargo handling and other value-added services (European Parliament, 2016). Accordingly, private entities, on their behalf, lease premises or terminals from the Port Authority through concession agreements, with investments

and operational activities being distributed between them and the respective Port Authorities.

The implementation of a public-private partnership through a concession agreement in a port, is a complex activity, taking into account regulatory, economic, environmental and technical factors (Notteboom, et al., 2012a), However individualized solutions are required, tailored to the specific port authority's objectives, as well as to the specific local conditions and national and supranational legislation, as in the case of the EU. Concession agreements have therefore emerged as a powerful port management tool for Port Authorities and, among other things, include the exclusive assignment of a specific location for a specific period of time to the contractor, who in turn will then provide or further develop a port service (Notteboom, 2006a).

At EU level, despite differences observed in port characteristics, increased convergence of port organization forms, is being verified (Derbie & Ruby, 2009). Almost all major ports in the EU, with the exception of the UK, where the port is managed and operated by private companies, belong to the category of Landlord ports. The Landlord function and the adoption and utilization of concession agreements as noted in the work of Notteboom et al. (2012b) for the larger European ports, is the most prevalent method of private sector participation in the production and provision of port services, and the key tool in the hand of port authorities to influence the future development of the port (Notteboom, 2007).

The withdrawal of port authorities from the production of port product and from the business activities of their tenants (Chlomoudis, 2011) coupled by the increasing tendency for greater private participation in cargo handling processes and the promoted (in many cases) corporatization (operation with private economic criteria and greater autonomy from the public) of many port authorities in various countries, exerted a significant influence on the latter's strategy formulation and on the scope of their activities (Van der Lught et al. 2013).

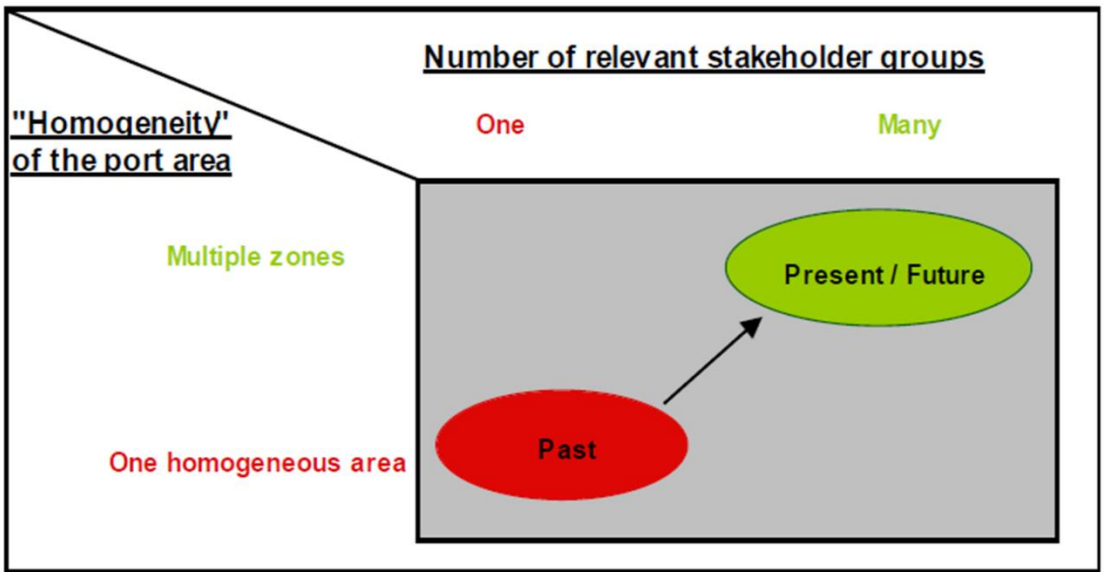


Figure 38. The evolution of the port environment

Source: (Dooms et al., 2004)

Within this evolving port environment, where the homogeneous port area of the Fordist era has given its place to a multi-stakeholder one, concentrating within and around the port, private port and port-related companies (logistics providers, warehouses, forwarders etc.) the so-called port-cluster (De Langen, 2004) was formed, with the Port Authority not only being in its epicenter but also called upon to manage it. Hence, the management and administration of the port cluster came to be added to the existing functions of port authorities. Among other things, this function prefixed that port authorities should undertake initiatives to develop partnerships and synergies (Van der Horst & De Langen, 2008), aid in solving collective problems of the port community as well as resolve conflicting interests among its cluster members, with its ultimate goal being the optimization of coordination, efficiency and overall performance. After all, according to Haezendonck (2001) and De Langen (2004), who were the first to introduce the *port-cluster* term, the effective management and overall efficiency of the cluster could significantly affect a port's competitive position. For this reason, this particular function, together with the Landlord one, gained significant importance for the Port Authorities, replacing cargo handling which until then had been their primal activity.

In addition, it is noted (Notteboom and Winkelmans, 2001) that due to the development of the port cluster and the emergence of global supply chains, the

strategy of the Port Authorities, necessitated an extension of their role beyond the exclusive role of mediator within the port cluster. Ports, as the authors characteristically point out, had to expand their networking, build up their partnerships and corporate relations with neighboring ports as well as with ports abroad. In the same vein, Notteboom & Rodrigue (2005), refer to the *port regionalization* and argue that Port Authorities should seek and develop an expanded role in the hinterland of their ports (Notteboom & Rodrigue, 2005). While according to Verhoeven's (2010) work, a renaissance of the Port Authorities was necessitated, a renaissance which would allow each port authority to cultivate its development path, based on the culture and the geographical scope, its functions extended. More specifically, in his article Verhoeven (2010) distinguishes three types of Port Authorities and argues that the reborn Port Authority should focus a) on its facilitator role, b) on the coordination of port community and c) on the development of entrepreneurial activities that extend beyond the port perimeter.

Nevertheless, under such circumstances and although all the other traditional functions of the port authority have undergone change while also new functional roles and elements have been incorporated to fit the new complex environment (Chlomoudis et al., 2000), it has become increasingly profound that the function of port regulation and respectively the institutionalized regulatory tools in the hand of port authorities, seem to be the ones which cannot cope with market evolutions and developments.

A characteristic example of the ineffectiveness of port economic regulation tools has been and continues to be the awarding methodology itself that is followed for the assignment of contaienr terminals. Although in Europe port concessions have opted for “competition for the market” instead of “competition in the market”, as pointed out in Pallis et al. (2008), concessions, and in particular the procedure for assigning them to private operators, had and has an impact on the entry of players into the port market. More specifically, it is argued that the existing awarding process and the prerequisite conditions which are necessitated to participate and assign the concession, such as the increased handling requirements as well as the proven experience of the operators, constitute significant barriers to entry. In relation to entry

barriers, Farrell's (2012) work also adds the growing investment requirements in times of recession, related to the assignment of container terminals. Such requirements and conditions significantly limit the number of candidates and most importantly of new entrants in international contaienr terminal awarding procedures, as only incumbent firms with global characteristics can meet these criteria.

Thus, while the practice of concessions has been a uniform methodology for the liberalization of the port market, having global scope and universal characteristics, it has also enabled port industry players and especially terminal operators to expand on an extended scale, acquiring shares in terminals around the world (Evangelista & Morvillo, 1999). The globalization of players within the port industry and the concentration of more and more terminals in the investment portfolios of a handful of operators, as well as the interconnection of the latter through subsidiaries and joint ventures, both with liner carriers as well as with companies providing hinterland and value-added services as seen in Chapter 4, brought about a reorganization of the port services market while also reshaped the relations between the members of the supply chain.

These developments, however, did not initiate the necessary changes to upgrade and extend the regulatory framework (such as measures to lower entry barriers, reduce the assymetries of power, abuse of market dominance etc.) within which ports operate, rendering it ineffective and outdated. Characteristic of this fact, is that while market actors have expanded their portfolios and their presence across the supply chain (in upstream and downstream markets), offering bundles of door-to-door services, ports' economic regulation is still confined within the context of port premises. In this sence, it has been increasingly challenging and difficult for Port Authorities to implement and enforce effective tools (for effective price gauging, service bundling, raising rival's costs in upstream and downstream markets monitoring) to regulate global and vertically integrated players solely at a local port level. As a result, the continuous expansion and gigantism of the latter has limited the negotiating power of the Port Authorities (Chao, 2006), making them more vulnerable to the dispositions of such powerful interest groups (Farrell, 2012).

In Baird (2000a) it is concluded that the regulatory function would be the least under pressure as it was less likely to be undertaken by the private sector (Baird, 2000a). This along with the emergence of concessions as a “dominant design” (Geroski, 2003) for the implementation of privatization schemes actually gave room for complacency to the port authorities who used competition as a substitute to regulation and chose to focus on their more profitable roles of cluster managers, facilitators and/or entrepreneurs, instead of developing and enforcing effective economic regulations (i.e. discourage price discrimintation - operator billings being subjected to audits, periodic submittals of tariff, financial, operational, and any other data necessary to support monitoring responsibilities; receive and issue complaints about alleged anticompetitive behaviour etc.) (Van Hooydonk, 2014).

Consequently, the liberalization of the port industry, which was the last sheltered link in the supply chain that remained under the exclusive control of the state, without the corresponding configuration of a regulatory framework, compatible and adapted to the developments and expansionary tendencies of market actors, enabled the latter to claim a greater role in post deregulated and fully competitive door-to-door transport chain, through the extension of their activities and control along the supply chain (for example impose ownership ubundling in upstream and downstream markets).

Thus, as analyzed in Chapter 4, through excessive horizontal and vertical integration, private and corporatized state-owned companies (liner shipping, terminal operators and stock market capitalists) were now able to offer integrated service packages, or service bundles. In Chen (1997) it has been argued that the formulation of such service packages tends to diminish competition, although such packages may have been more convenient for shippers in relation to the time/duration and cost of transport. Similarly, more than ten years later, Acciaro (2010) reaches the same conclusion, observing that the provided bundles of services lead to a reduction in competition through pricing policies which provide increased opportunities for companies to diversify their product. In addition, he affirms that competitive distortions can also occur if companies operating in successive stages of the supply chain try to exclude/ foreclose others, from accessing one of these activities (Acciaro, 2010).

For the above reasons, the integration in the transport chains and the inter-firm relations that have been developed between the market actors through M&A's as well as through the formation of alliances (Parola et al., 2013) raises both at the port level and at the level of the supply chain as a whole, issues for the re-examination of the role and effectiveness of the regulatory function. Hence it is considered that there is an eminent need to utilize effective tools to prevent anti-competitive practices (among carriers and/or carriers & terminal operators and or terminal and inland operators/ logistics providers) that otherwise would negatively affect investment decisions, price levels and the performance of market players while could ultimately harm the overall supply chains' competitiveness. As such, the shifting of market balance in favor of the integrated transport actors necessitates as a countermeasure the existence of an effective economic regulator with responsibilities that extend beyond the port premises and pertain to all the actors that comprise the supply chain.

Apart though from the ineffectiveness of port regulation, and the need to re-examine the institution and the means through which it is conducted, there is also an eminent need (due to market trends and challenges faced) to re-examine the role of the state as a port governance body. As observed by Verhoeven (2010), in many cases, the public sector in ports was unable to adapt to the dynamic emerging market conditions. The confusion of roles (regulator / entrepreneur), the substitution of functions (public goods vs. private goods) as well as the inability to integrate and adjust organizational and administrative port models to the novel trends and developments of the industry, contributed to this pathogeny. As such, the various forms of privatization schemes (as depicted in Table 23. above) promoted and adopted to date, make traditional models of port organization less relevant for today's port reality.

Similar conclusions are reached in the work of Ibrahimi (2015), who proposes a novel framework for the institutional and functional reorganization of the port, in order to delimit more accurately and according to the emerging environment within the port industry, the division of roles and responsibilities amongst the Public and Private Sector. According to his viewpoint, port functions are considered property rights and are categorized into three levels of analysis: a) Port *Gov*ernance, b) Port

*Ad*ministration and c) Port *Man*agement, on the basis of which a new model of port organization and management titled Gov-Ad-Man is formed.

In particular, for Ibrahimi (2015) the Administrative function includes all administrative responsibilities stemming from the rights of representation and the proper organization of port resources. In accordance, the Management function, includes all the operational responsibilities arising from the exploitation rights as well as the organization of production of port products/services that create value for the port. Finally, the Governance function includes all the institutional functions deriving from the rights of reorganizing the Administrative and Management functions both at the port operational level as well as on a broader cluster, supply chain and network level, in order to structure and in parallel ensure the operation of the various approved players within the port community.

Then, based on this approach, called Gov-Ad-Man, the port functions intersect with each of the three types of tangible port resources distinguished: a) infrastructure, b) superstructure and c) human resources. Hence, such a framework forms a dynamic three-dimensional table for the distribution of port functions amongst the public and private sector, on the basis of who is responsible for each of the three above-listed port resources. From this intersection, eight (8) models of port reorganization emerge, which are listed below in Figure 39.

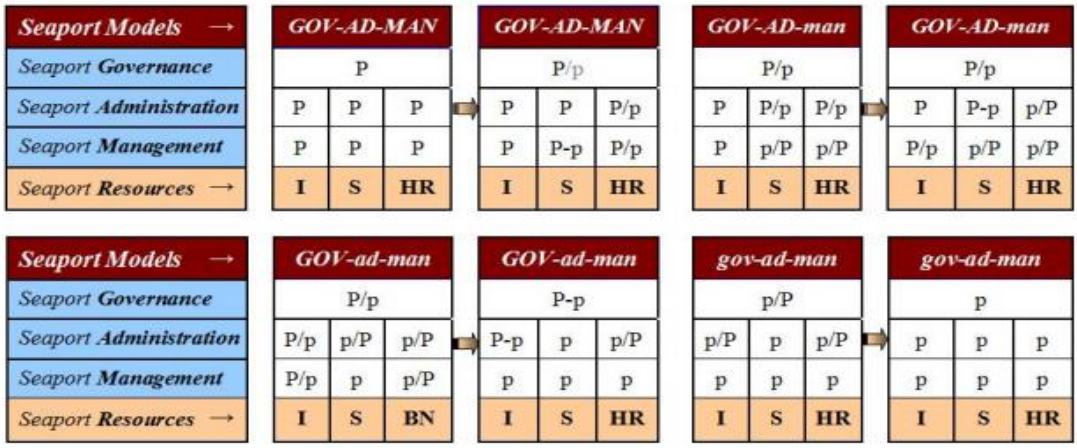


Figure 39. Port organization and Management models according to the distribution of port functions and port resources amongst the Public & the private sector

Source: (Ibrahimi, 2015)

The above schemes, signal the different outcomes derived from the distribution of functions, based on the ownership of port resources (infrastructure, superstructures and human resources), amongst the private and public sector. In particular, depending on the ownership of the port resources, each separate function is characterized as Public (P), Private (p) or mixed. For the latter case, there are occasions where the Public sector prevails over the Private one (P/p), occasions where the Private sector prevails (p/P) while also occasions where the ownership is joint and equal (P-p). According to Ibrahimi, only 4 out of 8 theoretical models are applicable in practice, however, all describe the dynamic penetration of the private sector in the port industry as well as the balance of power in each case between the two sectors. Thus, according to the first model (GOV-AD-MAN), a purely public port is described, while respectively at the other extreme (gov-ad-man), a fully privatized port. Amongst them, intermediate forms are depicted, in which sometimes the private sector (GOV-ad-man) and sometimes the public sector (GOV-AD-man) predominate.

Respectively in Heaver et. al., (2000) it is stated that due to the inability of port organization models to adapt to the modern port reality, three paths that can be followed by Port Authorities: a) to be fully integrated into supply chains, b) to be limited in providing secondary supporting activities, or c) be completely vanished. Although the majority of the relevant research leans towards the first two options, the question regarding the utility of Port Authorities returns to the forefront, this time by the market players themselves.

For reasons related to the macroeconomic situation of the market, the efficient and effective management of both the port and of the supply chain, but also due to the balance of power amongst global players (Mega Carriers, Global Operators) and Port Authorities, in certain cases, such as the case of Greece and its largest port, Piraeus (H.R.A.D.F, 2014) that we will examine in depth in the proceeding sections, a complete deregulation of the port industry was promoted; a deregulation which presents many similarities to the case of UK ports, applied from 1983 onwards (Chlomoudis, 2011).

While though, there is an abundance of literature among port policy studies about the contemporary role of port authorities (Verhoeven, Van der Lught et al, 2015), very few researchers have dealt specifically with the requirements of regulation in the context

of this new globalized era of port operators and port users. However, potential anti-competitive and collusive behavior among coopetitors (Liner Carriers, GTOs) has a direct relationship with regulation, or the lack of. Thus, under such an intricate environment of inter-connected functions within supply chains - increasingly handled by globalized and cooperating actors - there is an eminent need for the existence of multi-level, effective regulator as well as of transparent and holistic regulatory measures. On the one hand the entity entrusted with the capacity to regulate should be able to intervene when deemed necessary to defend public interest as well prevent competition distortions, while on the other regulatory measures should provide the tools to monitor the level of competition and the nature of cooperation, preventing potential collusion or cartelization among incumbents, and at the same time securing the provision of high-quality services in reasonable prices.

For liner alliances and vessel sharing agreements specifically, three global regulators have emerged, having the authority to oversee the approval and monitor such agreements; these are the U.S Federal Maritime Commission (FMC), the European Union's European Commission (EC) and China's Ministry of Commerce (MOFCOM) (Drenan, 2015). Drenan (2015) reports that global regulators utilize criteria such as relevant market shares, market power and concentration, market entry as well as the impact on consumers and business operators, before finally approving or rejecting an alliance.

However, from a holistic regulatory transport chain perspective, maritime transport is just one mode among the many within the integrated transport networks (Notteboom & Rodrigue, 2008). Therefore, excluding the case of liner alliances regulators, from a port or transport network perspective, neither similar bodies, nor regulatory procedures exist to ensure anti-collusive behavior and fair competition. Despite the fact that transport chains are widely acknowledged as networks (Chopra, 2003, Tseng, et al., 2005), the majority of existing national, regional or supranational regulators do not yet regard them as such.

Nonetheless, within the global framework described, effective multi-level regulation becomes an emerging requirement. Due to this fact, we will be questioning the competency of the existing form of port authorities as effective regulators. Within the

context of the evolution and integration of transport networks, in the following section we will display also an antithetical view on the necessity of regulations while next, we will assess a wider scoped alternative body for the institutional governance of regulation and highlight several categories of port economic regulatory tools.

6.3 Theory of Contestable Markets

Antithetical to regulationist claims, that market concentration may eventually lead to increased monopoly power, and very likely to market abuse, Baumol et al. (1986) in his "rebellious" theory of contestable markets argues that as long as markets are perfectly contestable i.e market entry and exit is easy and relatively costless (no sunk costs) while all firms have access to the same level of technology, "a history of absence of entry in an industry and a high concentration index may be signs of virtue, not of vice". Originally formulated, to provide a framework for regulation of natural monopoly; it also outlines an allocative ideal in which a laissez faire policy is most efficient (Bratland, 2004). As it is suggested, in perfectly contestable markets (irrespective of their structure and the number of companies in them), the "threat of new competition" (Hanlon, 1996) and the possibility of a costless reversible entry is enough to restrain incumbents from abusing their market power. According to Baumol et al. (1982), three welfare properties of the theory support that claim:

i. Perfectly contestable markets, even an oligopolistic or monopolistic ones, never offer more than a normal rate of profit; economic profits must be zero or negative. Or else any positive earnings would lure new entrants to set up business, replicate a profit-making incumbent's output at the same cost as his, undercut the incumbent's prices slightly and still earn a profit. As such, profits in the long run should equal to zero.
ii. Perfectly contestable markets, permit no operational or organizational inefficiency. Any unnecessary cost attributed to inefficiency, would be an invitation to more efficient entrants and an opportunity for profit. As such, potential and current competition, in the long run will influence incumbents' performance and eliminate any sort of inefficiency.
iii. Given free entry and competitive pricing, cross subsidization is not possible in perfectly contestable markets, and therefore no predatory pricing can

> be utilized as a weapon of unfair competition. Where a product is sold by two or more firms, any charged price below or above marginal cost, would be a profit-making opportunity to new entrants. As such, similarly to a competitive market, perfect contestability will eventually lead to a marginal cost pricing equilibrium, thereby incurring only normal profits to incumbents.

As such, as long as firms abide to these properties, the theory suggests that even monopolistic or oligopolistic markets, can endure the benefits of competition provided they are perfectly contestable. Early studies, on the airline industry (Bailey, 1981, Bailey & Panzar 1981, Baumol et al., 1982) provided evidence confronting the assumptions of contestability, reinforcing the applicability of the theory while rendering "temporarily "airline transport as the ideal example of a naturally contestable market. In addition, considering their date they provided an extra argument to justify policy decisions, promoting deregulation (Martin, 2000). Shortly after, a stream of literature on the airline industry, contradicted previous studies, finding results inconsistent with the contestability hypothesis (see Graham et al, (1983), Call & Keeler (1986) Butler & Huston, (1989), and later on Kim & Signal, (1993)). Even Baumol (1986) in Baumol & Willing (1986) reconsiders his initial position, conceding that several elements of the airline industry conflict significantly with the conditions necessary for the theory to apply. In addition, with much less than his initial enthusiasm, he also repositions his stand, that the theory is not basically an extension of the invisible hand, with a pervasive laissez-faire position on regulation and antitrust but rather a centered position in-between interventionists and noninterventionists, providing the tools to identify where regulatory intervention is needed and where is not. Despite such claims, Martin (2000) indicates that the history of deregulation of the U.S airline market proves the regulatory incompetence's of the theory. In addition, his broader critique focuses on the importance of sunk costs in influencing market structure and performance while also suggesting that performance of imperfectly contestable markets depends on actual rather than potential competition.

However, despite the serious criticism and the mixed results of the various studies testing contestability assumptions, over the years the theory has evoked a stream of

research in various branches of the industry (see Molyneux et al. (1996) and Yildirim & Philippatos (2007) for an analysis on banking sector, Brewer (1996) on the rail freight markets, Beato (1999) on electricity markets). Particular sector of interest in applying the contestability theory, due to the similarities, regarding the mobility of assets observed in the airline market (a parallelism of capital on wings with capital afloat), has been the liner shipping market. In Davies (1986) and (1988) as well as in Zerby (1988) and Shashikumar (1995) it is argued that liner shipping markets confront the assumptions of contestability. More particularly, it is supported that on the one hand the mobility of vessels which can be diverted form one trade to another, as well as the existence of a secondhand market to sell or charter assets if necessary, on the other, guarantee low sunk costs, access to technology and hence a freedom of entry and exit. Thus, based on observations of frequent entries and exits as well as of low profitability, authors conclude that contestability may practically be applicable in liner shipping. In Haralambides (2004) however, it is argued that, although, the acquisition of the ships themselves may not pose problems of entry or exit, however, network costs as well as economies of scope and economies of rationalization often do. To that extend, such costs as well as liners' global networks, EDI and logistic systems amongst others (in essence excessive horizontal and vertical integration), and not the ships themselves constitute sunk and entry deterring costs. Pearson (1987) and Jankowski & Davies (1989) also express their doubts with regard to Davies' (1986) and Zerby's (1988) findings, suggesting that the observance of entries and exits in liner trade routes, is an indication of a lack of contestability, rather of its existence. As they support it is the threat of entry and not the actual entry that is relevant and thus conclude that incumbents, when cartelized, possess considerable power to deter potential competitors from entering the market. In the same vein, Haralambides (2019) eloquently phrases it: "he who has honey at his fingertips is bound to lick them in the end"; in our case, sooner or later, concentration is bound to lead to monopoly power and rent-seeking by carriers".

6.4 Contemporary Governance of Port Regulation & Economic Regulatory Tools: Towards a Holistic Approach for ports

Every regulatory system is comprised by two core dimensions, (a) the "who" of regulatory governance i.e., which entity assumes the role of the regulator, and (b) the "what" i.e., the essence and content of regulation (World Bank, 2006). However, these dimensions appear to be increasingly at odds with the architecture and evolution of network industries, resulting to an emerging requirement for re-conceptualizing a regulatory framework (Finger & Varone, 2006).

In the current era of meta-globalization, port regulations in the form of international conventions, work rules and practices pertaining to health, safety and dock-work conditions (Angelopoulos et al., 2014), or regulatory framework for port governance are omnipresent. Regarded as an intrinsic part of the port system, their enactment and enforcement is a global common practice (PORTIUS, 2013). However, despite the abundance of relevant literature in other network industries, research focusing on the regulation of natural monopolies, port institutional governance and regulation are scarce. Even on a European Union level, no such regulatory framework exists. These facts demonstrate the lack of both a standardized regulatory governance regime and experience in formulating regulatory policies in the port sector. The proposal described in E.C (2016) for the establishment of a regulatory framework for port market entry and financial transparency is considered to be an initial step in establishing common principles with respect to port industry supervision.

Since ports were the ultimate managers and coordinators of transport flows between foreland and hinterland, port authorities – most of them public- were granted the responsibility of regulating the port system (Baird, 1995). The regulatory function, due to its nature as public good, was the least expected to be transferred to the private sector (Baird, 1999). However, port authorities gradually became more market oriented, and utilized competition as a substitute to regulation, focusing more on their newly established and more profitable roles as cluster managers, facilitators and/or entrepreneurs (Verhoeven, 2010). Although the majority of the traditional functions of port authorities have undergone change and new elements and roles have been developed to fit the new complex environment (Chlomoudis et al., 2000), the

regulatory function appears to be unable to keep up with the evolution of the market. Currently, despite the fact that the majority of port authorities are still port regulators, their power to enforce regulations is challenged and their ability to act as an economic regulator within multi-level, complex and highly globalized environment is limited. Ports did not adjust to the evolving market conditions (Verhoeven, 2010), rendering their regulatory functions on a large extent obsolete, since emerging global transport actors increased their bargaining power (Chao, 2006) and the negotiating position of ports was challenged (Farrell, 2012). In the following sections we develop the rationale for the delegation of the regulatory function to an independent regulatory entity, which will nonetheless operate in cooperation and interaction with port authorities; we also investigate potential forms and tools for economic regulation.

6.4.1 Governance of Regulation: Towards an Independent, Effective & Efficient Port Regulator

Regulation through independent bodies has been a long tradition in the U.S. (Jordana et al, 2011); it is also becoming an instrument of public policy in Europe (Ünay, 2011). Independent bodies having the power to develop and implement rules and regulations (Majone, 1996) are usually established by law as independent regulating authorities (IRA), in the sense that they are allowed to operate outside the line of hierarchical control and supervision by the central governments (Majone, 2010). This institutional transformation within EU, can be attributed to the liberalization process that many network industries went through the last 25 years (Martin et al., 2005). The risk of liberalization without restructuring is that the incumbents may have the ability to discriminate against entrants and make competition less effective (Al-Sunaidy & Green, 2006). An effective, fair and competitive operational framework was a requirement (Newbery, 2002), in order to explore new national and supranational institutional means to regulate the formerly state-owned monopolies. This novel vehicle for regulating private and public, replaced the traditional means for public intervention in many industries (Coen, 2008).

European Union legislation obliged member states to establish national independent authorities for network industries such as electricity, gas and telecommunications, irrespective of their organization or institutional tradition (Trillas, 2010). On an EU

level, the Council of European Energy Regulators (CEER) and the Body of European Regulators for Electronic Communications (BEREC) are the voice of Europe's national network industry regulators. This multi-level independent regulation is seen as part of a broader initiative towards a model of "network governance regulation" in Europe (Coen & Thatcher, 2008) in order to achieve greater co-ordination and harmonization among the member states with regard to the regulatory framework adopted

The rationale behind the aspect of independence is manifold. The first argument lies in the fact that task specialization results in efficiency gains (Hood, 1991). Gains in terms of credibility and efficiency are highlighted by in Maggetti (2010); performance-oriented management and innovative behavior is assessed in Verhoest et al., 2007. Thatcher (2005) argues that independent authorities are considered less bureaucratic, more independent of political influences, and able to safeguard interests of customers.

The concept of a regulatory state was introduced more than two decades in Majone (1994). More recent, similar concepts include the regulated capitalism of Levi-Faur (2005) and the port-specific era of post-globalization in Angelopoulos et al. (2014). Therefore, delegation of regulation to independent bodies could also be conceived as part of a broader trend towards the establishment of a network oriented regulatory model in Europe (Coen & Thatcher, 2008). Established independent regulatory authorities can exercise control and implement regulations in every network segment to the network as a whole (Uukkivi, et al., 2012), rather than defend the interests of the operators (Thatcher, 2005).

Finally, in Capros it is argued, that a sense of continuity, rationalization and business trust is embedded towards independent authorities because potential market participants realize that the transition to the free competition is achieved under the auspices of third independent institution, without personal interest or participation in the market, as in the case of the state, where the incumbent might be partially or fully owned by the former public monopolist (Capros, 2003).

Although ports are just nodes within the broader supply chain network, ports' economic regulation should not be seen solely and restrictively within the port context, as contemporary container ports simultaneously co-exist in multiple

networks; namely the port itself or else the port cluster, the operators' network and finally the supply chain network. Thus, it could further be argued that ports operate within multi-level networks; the hyper-networks such as the supply chains which surpass the port perimeter and extend over the door-to-door transport as well as the sub-networks (port network, operators' network) within the hyper-networks, which function complementary to the processes and for the processes of the hyper-networks in order to ensure the latter's efficiency and effectiveness (Chlomoudis & Styliadis, 2015). Under this spectrum, the established independent regulatory authorities can exercise control and implement regulations both in every segment of the network (through economic regulation) and in the network as a whole (by assessing market power, deciding on blockage or approval of mergers, preventing anti-competitive practices) while the existence of EU regulatory agencies guarantees a common comparable framework and a level playing field among member states.

In contrast to network industries, the port regulatory function has been, in most cases, retained by port authorities (Baird, 1995, Verhoeven, 2010). However, also regulation of ports should not be examined in isolation, since container ports are segments of more than one network; namely the network of the (a) port / port cluster, (b) port operator and (c) supply chain network. It could also be argued that ports operate within two multi-level network types: the hyper-networks and the sub-networks. The former extends beyond the port zone, capturing door-to-door transport, and the latter exist complementary and within hyper-networks.

The same arguments and incentives for the establishment of independent regulating authorities in network industries can be applied to the port industry and the supply chain network. However, only minimal steps have been taken towards this direction both on national and EU level. As a consequence of this regulatory inertia, combined with the globalized and deregulated environment of supply chains, the act of retaining the regulator role under port authorities impedes the national regulatory capacity instead of empowering it. Thus, by confusing the roles of manager and regulator and effectively subordinating the latter to the former (Majone, 2003), port authorities have impeded the development of specialized regulatory bodies. Also, as the degree of port reform increases, port authorities tend to concentrate more on activities that

generate revenues, than regulatory ones. As a result, the role of the port authorities as regulators within both port and supply chain network diminishes. Ports remain confined to supervision and monitoring of concession agreements.

However, the situation in the port industry calls for enhancing and reinforcing economic regulatory competencies both within ports and throughout the supply chain network. Since market actors acknowledge supply chains as a singular network of integrated services (Chlomoudis, 2011), regulations ought to be scoped accordingly. Regulators from their side should be aware of the benefits and risks of individual supply chain steps, in order to regulate any potential anti-competitive behavior. Van Niekerk (2014) also argues that regulators should assess local, national and international implications introduced by these market actors within the development framework of ports. Therefore, the competency and the suitability of the average port authority to implement and enforce regulations within the supply chain network is questionable; alternative modes of regulatory governance should be assessed.

Paradigms from network industries (CEER, 2015) could be creatively utilized, with respect to their institutional governance of regulation and provide a base for institutional reform within the port sector. Following the examples of electricity and telecommunications (Abbott & Ma, 2013), separation of the regulatory function from the port authorities and formation of independent regulatory authorities both on a national and EU level, is of cardinal importance.

This proposition is in line with recommendations of the World Bank's Port Reform Toolkit: Economic regulation requires expert-based knowledge and therefore should emanate from an independent regulator (World Bank, 2007). We argue that an institutional restructuring based on the delegation of regulatory function to independent authorities can restore the center-stage position of economic regulation in the port and supply chain network, allowing for policy convergence and, consequently, for the creation of a common network-wide regulation framework, whose epicenter will be the port node.

6.4.2 The substance of regulations: Effective regulatory tools at hand

Regulatory bodies ought to be provided with appropriate authority and the necessary tools to exercise their authority when deem necessary. In Litan (2015) three types of regulation are distinguished; economic, social and information regulation[34]. However, within the context of the port system and of door-to-door supply chains, the principal task of the regulator should be the economic regulation. Their challenge is to ensure that regulations and instruments utilized to achieve their predetermined objectives are both effective and efficient. Effective, in order to resolve the issues, they were created for; efficient in order to maximize benefits while minimizing both direct and indirect compliance costs of by those subject to regulation (OECD, 2006). However, it is not always easy to assess the actual costs and benefits of each regulatory tool, making less clear which is the most effective.

The Port Reform Toolkit of the World Bank defines the role of the economic regulator as the entity that ensures the efficient and competitive functioning of the port in a context of limited or weak competition. At the same time, the entity is involved in the market functions including setting or controlling tariffs, revenues or profits, controlling market entry or exit and overseeing that fair and competitive behavior practices are maintained within the sector (World Bank, 2007).

Thus, the objective of economic regulation is to address any market distortions and monopolistic tendencies through the creation of a robust regulatory framework which shields the interests of ports. At the same time, it exerts competitive pressure on incumbent operators through the imposition of regulatory requirements. In order to do so, economic regulators ought to be given the tools to and act proactively in order to prevent non-competitive market behavior and safeguard seamless operations within the port and transport networks. These regulatory tools include access, price and performance regulatory instruments, which based on literature, incorporate specific functions, tools and responsibilities, as illustrated in the Table 24. below.

[34] While we will analyze in detail the context of economic regulation, social regulation for Litan (2015) refers to the regulations which account the externalities exerted, while information regulation refers to information disclosure requirements.

Table 24. Functions, Tools and Responsibilities of Economic Regulators

Regulatory Functions	Regulatory Tools	Responsibilities
Regulation of Access	Setting Minimum Requirements for market entry	Issue Licenses, Leases, subleases to downstream services providers, concessions
	Unbundling/ Vertical Separation	Forbid owners of non-competitive segments to participate in potentially competitive ones
		Alternatively: Regulate the terms and conditions under which participants in competitive markets acquire access to non-competitive segments of the industry
	Set awarding procedures measures/ criteria for port service providers who want to access port facilities	Competitive tendering: supervision of pre-bidding, pre-qualification, selection and post bidding phases
		Negotiated Concessions
Price Monitoring	Direct Tariff Setting	Issuing of tariffs for port services by the regulator
	Rate of Return	Set maximum operator rate of return. Adjust the rate depending on operator performance
	Price Caps	Allow service providers to set prices within the price cap index.
		Monitor providers to set prices within the limits of price cap Index
		Compliance-based bonus-malus scheme
	Price Monitoring	Define performance measurement metrics
		Allow operators to set prices
		Perform regular reviews on service providers performance
		In case of misuse of market power, enact stricter regulations
Performance Regulation	Set performance and productivity indicators	Goal Setting. Periodic review of performance indicators. Performance Benchmarking.
	Monitor Performance of service providers	Supervise general compliance of operators with terms and conditions of concession agreements
		Performance-based bonus-malus scheme
	Monitor compliance with Minimum Service Level Agreements	Issue warnings and non-compliance notices.

Source: (Compiled through various sources) Author's Elaboration

6.4.2.1 Access regulation

Access regulation may encompass the setting the minimum requirements for issuing and enforcing licenses, vertical separation (when deemed necessary) as well as procedural measures for port service providers who want to access port facilities. Port access regulation can encourage entry and greater competition to upstream and downstream markets, helping to ensure more efficient use of resources, better service quality and lower prices, as long as regulations combine the right balance of incentives for investment and fair, transparent and non-discriminatory regulatory requirements (Samuel, 1997).

The recent regulation of the European parliament and of the Council establishes the minimum requirements with which operators should comply in order to perform the corresponding service within the port. These include (E.C, 2016) among others:

- the professional qualifications of the provider of port services and its personnel,
- the financial capacity of the provider of port services,
- the equipment needed to provide the relevant port service in normal and safe conditions
- the capacity to maintain this equipment at the required levels,
- the compliance with maritime safety and environmental requirements,
- the availability of the port service to all port users without interruption or discrimination.

While according to the supplementary announcement of the EU, restrictions to the freedom to provide service are acceptable only when justified by objective reasons, such as the lack of space or for public service reasons and as long as they do not lead to abuses of market power (E.C, 2017). In such an occasion, economic regulators should investigate whether the firm that files for access in port services also participates in the provision of complementary services in the upstream or downstream segments the transportation chain. If this is the case, some form of regulatory intervention should be warranted as vertically integrated firms may have incentives to abuse their monopolistic position in order to recuperate profits forgone by regulation. Such anti-competitive practices like price gouging, service bundling, entry barriers, predatory pricing and price discrimination, drive out potential competitors while increase the costs for port users and the economy on the whole (World Bank, 2007). In Defilippi (2010) there are two main regulatory approaches to confront this problem (Defilippi, 2010):

- Either to forbid owners of non-competitive segments to participate in potentially competitive ones; i.e. to enforce vertical separation of the industry;
- Or to regulate the terms and conditions under which participant in competitive markets acquire access to non-competitive segments of the industry.

Among these two regulatory options, OECD favors vertical separation, as the latter is argued to decrease regulatory burdens while enhancing both the quality of regulation and the level of competition in the market (OECD, 2001b). Thus, unbundling constitutes another weapon in the hands of regulating authorities in order to grant access to port services. In any other case, economic regulators should grant access and designate port areas according to well defined and transparent competitive or negotiated procedures. This is yet another type of access regulation, in which the definition of the characteristics of the port area to be awarded along with the steps and procedures for its assignment (economic proposition, duration, criteria to evaluate bids, labour issues), play a fundamental role in the success of a port and thus in its contribution to the general economic welfare (Parola et al., 2012). Several authors have investigated the procedures/phases and the current practices to grant terminal concessions (De Langen et al., 2012).

However, Farrell (2012) is in line with the view that EU imposed requirements along with the terms and conditions included in the process of granting concessions constitute formidable barriers for new entrants while favor the further concentration and centralization of incumbent firms who can switch equipment and management resources around the world in case of short-term glitches easier and in a way that smaller operators cannot (Farrell, 2012). Thus, further research on this respect is required in order to remove the existing/identified barriers and formulate a pragmatically free access framework for port services.

6.4.2.2 Price regulation

A second set of port regulations includes rules and regulations that determine the pricing methodology and tariff policy of port service providers. As of today, economic regulators may choose from a wide variety of price regulatory tools which range from heavier methods of regulation such as direct tariff setting, rate of return and price or revenue caps regulation to softer methods such as price monitoring (CCRED, 2014).

With regard to the heavier forms of price regulation two are the main approaches to prevent operators from monopolistic practices such as charging excessively high prices; namely the rate of return regulation and price cap regulation. The former is the

traditional cost of service regulation, where the regulatory authorities set the rate of return that the operator can earn annually. According to Jamison (2005), when applying this regulatory methodology, the regulator determines the rate of return, based on specific factors such as the company's interest rate[35], capital costs, operating costs and depreciation. The regulated price can be adjusted upward if the operator starts making a lower rate of return while it can also be adjusted downwards if the operator makes a higher rate (Alexander & Irwin, 1996). Pricing with a specific rate of return is considered fair and reasonable according to the work of Bonbright et al. (1988) as, on the one hand, it enables the company to recover the costs it has spent for the provision of port services, while on the other hand it also protects port users from paying prices that would give monopoly profits to the company. Jamison (2005) argues that rate of return is a viable regulatory methodology, appropriate in cases where there is no competition, as prices can be adjusted to changing conditions as well as depending to the environment in which the company operates.

Although this approach is simple and straightforward, there has been sufficient criticism. Its main disadvantage, according to Sappington & Weisman (1996), is the lack of adequate incentives for companies to operate efficiently, due to the inability of regulators to monitor and evaluate the effectiveness of companies operating within the port community. In addition, according to Ondrej & Jiri (2012) it creates asymmetries in the information between regulator and regulator, which can lead to a) mutual lack of trust, b) data manipulation phenomena and c) periodic tariff level reviews, as well as added expenses and delays (Machek et al.,2011). Added to these, rate of return may encourage the regulated operator to over-invest in network capacity which in turn may lead to allocative inefficiency (OECD, 2009).

Whereas the price cap regulation, gives incentives to reduce the negative impacts of the above method by allowing operators to change price levels according to an index that is comprised of an inflation measure and productivity offset; the regulator groups services into price baskets and establishes a price cap index within which the operator is allowed to change the price (Jamison, 2007). The main benefit of this form of price regulation is that it allows producers and consumers to share the risks and rewards by

[35] Interest rate, is the gross value of the company's assets, minus its accumulated depreciation

providing incentives for cost-cutting and enhanced productive efficiency, while the shortcomings include distortion of investments, cross-subsidization among regions as well as entry deterrence (Defilippi, 2010).

Moving to the light-touch approach and price monitoring regulation, operators are subject to regular reviews of performance, with the threat of full regulation in cases where misuse of market power can be demonstrated (CCRED, 2014). In Forsyth (2002) it is indicated that this method involves less day-to-day oversight for the regulator, in the price setting decisions of the regulated operators, however the regulatory authority is responsible to determine at the beginning of the probationary period which variables will require to be reported while also what constitutes a satisfactory performance and what an unsatisfactory one. The monitoring price regime is a system of flexible regulation which adjusts to market behavior evolutions however this flexibility is not costless, as it involves more discretion on the part of the monitoring authority (Forsyth, 2002).

6.4.2.3 Performance regulation

Added to access and price regulation, economic regulators may also enforce performance regulations. The notion that regulations should be based on achievement of specified results rather on prescribed means has been widely accepted as a basis for improving the impact of regulation (May, 2003). Within the port context, a performance measure enables economic regulators to numerically monitor and quantify many attributes with regard to the performance of the regulated operators in order to allow the comparison and evaluation of goal vis-à-vis benchmarks. (Bichou, 2007). Regulatory authorities can incorporate through terms and conditions in concession agreements, minimum performance requirements and standards to which operators will be obliged to comply along the duration of the agreement. Such requirements and guarantees may relate to throughput, berth occupancy and utilization measures, service quality indicators, customer satisfaction as well as health and safety standards. In order to reach the targets, set, regulators should also tempt operators with rewards and incentives to sustain operational efficiency.

The regulatory authority should set the performance and productivity indicators and should determine the application of sanctions and rewards, however it is not mandatory also to perform their monitoring and enforcement. Since the latter are not among the primal functions of economic operators, the task of monitoring concessions' terms and conditions can be undertaken by port authorities themselves. Port authorities may even have greater visibility and knowledge over operators' performance, a fact which makes them also more responsive in issuing warnings and compliance notices. In such a way, potential informational asymmetries between the regulator and the regulated operators will also diminish while the implementation of benchmarking schemes based on the comparison of operators' performance will be more efficient and thus more accurate.

6.5 Port Reorganization and Independent Economic Regulation in ports: The Case of Greece's, Piraeus Port

With the emergence of private sector's participation in the port industry becoming the global rule (Vagellas, 2007), existing port governance models, as well as the distribution of functions amongst the private and public sector, need to be redefined. The results of the inherent expansionary strategies of private sector players, which aim to increase their participation in the organization and management of ports, as well as the subsequent reform of the global competitive framework in which they operate, urges port authorities to redefine their responsibilities and priorities.

More specifically, with the globalization of players in both terminal operations and liner shipping and the integration of supply chains, the role of the Port Authorities is primarily focused on the effective management of commodity flows, acting as mediators and facilitators in developing partnerships and synergies between users and producers of port services (Verhoeven, 2010). In many cases, Port Authorities themselves become entrepreneurs (e.g real estate agents, investors in start-ups etc.) in the context of their corporate structure. Thus, by focusing on such roles which are more profitable both for themselves and for the members of the port community - utilizing competition as a substitute for regulation - Port Authorities as regulators, have not been able to respond accordingly to the regulatory demands and to the challenges of this novel environment. On the contrary we would argue that their

regulatory effectiveness has been significantly reduced, as while the players in the containerized transport chain have grown globally to form integrated transport networks, the responsibility for regulation still remains within the narrow confines of the ports.

However, precisely because of the above market conditions and characteristics, the importance of an upgraded and effective port regulation seems imperative. As supply chains have evolved into a single, fully competitive network dominated by global players with strong bargaining power, the regulatory function should be extended to the entire length of this network. By keeping it under the jurisdiction of the Port Authorities, as demonstrated above, the regulation could not be effective. For this reason, its independence could introduce new innovative methods of monitoring and regulation (Den Hertog, 2010). However, although the independence of the port regulator and the expansion of its role from the port level to a broader framework for the regulation of transport chains, provided of course the appropriate means and tools to enforce regulations, could be an effort in the direction of enhancing the importance and effectiveness of regulation, such a radical restructuring has not been promoted except in a few cases.

One such case is that of Greece. In this light, the institutional reform that has been promoted, through the assignment of port economic regulation to an Independent Regulatory Authority for port as well as of the task of port administration to a so-called intermediate Public Port Authority, is not the rule but an exception for study and evaluation. Characteristic is the fact, that such a model of ports' independent economic regulation is adopted so far by very few countries worldwide. Such cases, include South Africa, Portugal, Peru and India. However, no standard approach to economic regulation of ports exists, with significant differences even amongst those countries which have implemented them. This variance is mainly attributed to the novelty of such a venture, which as it seems to rely primarily on an experimental process of trial-and-error (Van Hooydonk, 2014).

In the particular the case of Greece, it can be argued that the establishment of an Independent Port Regulator was the result of the privatization model (master concession) promoted in Piraeus and Thessaloniki - the country's two largest

commercial ports - and not due to the acknowledgment for more efficient and comprehensive economic regulation framework. In this context, it is of great interest to record both the changes in the distribution of port functions between public and the private sector, as well as to investigate whether the new independent regulatory authorities can, with the tools and control mechanisms provided to them, upgrade and expand the possibilities of port economic regulation beyond the port premises and hence defend and promote the public interest.

Specifically, the model of master concession adopted in the case of the port of Piraeus (which was then replicated for the privatization of the port of Thessaloniki), through the sale of the majority shares of the state-controlled Port Authority, the Piraeus Port Authority (hereinafter OLP) (H.R.A.D.F., 2014), deviates from the traditional port organization models observed both at European and global level. The particularity of this choice, lies in that it rendered the private concessionaire the sole provider of port services in all port segments and activities (container terminals, car terminal, cruise, coastal shipping, shipbuilding), effectively excluding any intra-port competition and hence, essentially establishing a private monopoly within the port of Piraeus (Van Hooydonk, 2014).

Additionally, apart from the withdrawal of the state from the production of port product, the sale of the public port authority, i.e. of OLP, also resulted in the transfer of the responsibilities for the management and operation of the port to the private contractor. Finally, as the OLP prior to the privatization, was also in charge of regulating the port system, the methodology of master concession utilized, created a void regarding the institution which would undertake, enforce and supervise the implementation of port regulations and the administration of the port.

With the privatization of the OLP, these latter functions could also have been undertaken by the private contractor. However, as noted in international literature, such a possibility would be risky, as the contractor could easily abuse the monopoly position granted (Baltazar & Brooks, 2001). The likelihood of taking advantage or abusing such a monopolistic position as well as the inability of the contractor to self-regulate, could have a direct impact on the final port product, adversely affecting investment and innovation, productivity and the quality of the port services provided.

The case of the privatization of Great Britain's ports is an indicative example, illustrating the inability of private operators to self-regulate (Thomas, 1994). Therefore, in order to prevent such an outcome, the regulation and administration of the port system has in the majority of instances remained under public control, exercised by public bodies.

The Greek State, realizing the risks involved in granting the regulation and administration of the Piraeus port to the sole private contractor within the port, promoted an institutional restructuring of the regulatory and administrative framework in order to retain these latter functions under public control. The result of the institutional reform was the creation of two new public bodies, the Regulatory Authority for Ports (hereinafter RAP) and the Public Port Authority (hereinafter PPA) (Law 4389, 2016), to which the regulation and management of the port system, respectively. Through this legislative initiative, the Greek state has tried to ensure the exercise of public power over the sole private contractor and the implementation of a port management and regulation framework for the benefit of the public interest.

In this vein, Greece was the first among EU members to establishe a Regulatory Authority for Ports (RAP). Although the RAP was originally set up as an autonomous branch within the Ministry of Shipping, it was converted (Law 4389, 2016) into an Independent Regulatory Authority in 2016, i.e., in the year that the first Master Concession Agreement (Port of Piraeus) was concluded, with the mandate – among others - to monitor the implementation of the master concession and the application of national and European competition laws in the sector.

As such, on the one hand the uncommon methodology followed in the case of the privatization of the port of Piraeus, while on the other the parallel institutional actions of the Greek State to safeguard the public character of port regulation, form a field of research of multidimensional interest. More specifically, this interest lies primarily in the need to investigate the novel distribution of responsibilities and functions amongst the public and the private sector, in order to sketch the port's new governance model for the first time. At the second level, it also interesting to investigate the adequacy of the relevant legislative initiatives concerning the establishment of new public bodies, as well as their capacity to formulate a robust

framework for the enforcement of economic regulations both within the port and beyond the port premises.

In particular, next in this section, we refer to and describe the context and the process leading to the master concession of the port of Piraeus. On the second level, we explore the recent laws and the legal provisions concerning the newly established bodies (RAP & PPA.) as well as the responsibilities / functions that each undertakes. Our aim is to investigate whether the responsibilities, roles and tools assigned to these newly established institutions, can form a novel paradigm of economic regulation which secures and ensures the public interest, both on a port level as well as on a supply chain network level.

Finally, according to the above analysis and based on an adaptation of the port reorganization model Gov-Ad-Man proposed in Ibrahimi (2015) we attempt its adjustment to the Greek case of the port of Piraeus. Ibrahimi's model, as analyzed in 6.2, captures in a dynamic way the penetration of the private sector within the port industry through the distribution of responsibilities as well as of the rights of use and exploitation. In contrast to the pre-existing port organization models that simply categorize port functions (regulations, infrastructure ownership and operations) between private and public sector (Baird, 1999, World Bank, 2003), a customized version of Gov-Ad-Man offers the possibility of a more precise and more complete distribution of port functions, based on characteristics and resources such as: a) Infrastructure, b) Superstructure, c) Human Resources, d) Port Development and e) Cooperation Development. To this end, the above model is considered the most appropriate methodological tool, for recording the exhibited changes in the case of the port of Piraeus.

6.5.1 The chronicle from the first concession to the Master concession of the Port of Piraeus.

In 2002, the Greek government, through a master concession agreement, granted to the OLP, the autonomous entity managing the Port Authority of Piraeus, the exclusive right to use and exploit the land, infrastructure and superstructures, as well as the terrestrial zone of the port along with the competence to exercise administrative and regulatory functions within its perimeter, for a period of 50 years (ISL, 2006). This

evolution, in combination with the transformation of the Organization into a Societe Anonyme (SA) three years earlier and its introduction on the Athens Stock Exchange in 2003 (25.1% of the shares), shaped the conditions for a restructuring and modernization similar to the European paradigm. However, despite the corporatization of OLP, the Greek government continued to exert full control over the ownership, management and production of port services throughout its range of activities (coastal shipping, cruise, shipbuilding, car & container terminal) (Hadjimichalis et al., 2015).

After many unsuccessful attempts to liberalize the market of container terminal operations, which began as early as 2004, as described in the works of Pallis (2006), Pallis et al. (2007) and Vaggelas (2007), the first sub-concession in Greece, and in particular in the port of Piraeus took place in 2007 through an international tender (Psaraftis & Pallis, 2012). Finally, in 2009, the operation of the first privatized container terminal commenced.

Against this backdrop, Huliaras & Petropoulos (2013) highlight the crucial role of specific Greek business (shipowner) interests in mediating and strengthening the bilateral relations amongst the two countries (China-Greece); the turning point of which was the concession of the Piraeus port container terminal piers II & III in 2008, by the Piraeus Port Authority (OLP) to the Chinese state-owned company, China Ocean Shipping Company (COSCO). While though, the Greek Government advertised the deal, as the largest foreign direct investment ever made in Greece, estimating the financial return for OLP over the 35-year concession at €4.3 billion, Psaraftis & Pallis (2012) illustrated that due to the effects of the discount rate and time durations on NPVs, the above amount was in reality significantly lower, around €830 million. The agreement also obliged COSCO to refurbish pier II and construct pier III, in order to enhance the port's capacity. In parallel, COSCO invested in improving transit capacity, by constructing a railway link between its terminals and the national railway system as well as in establishing a distribution center in proximity (Van der Putten, 2016).

In turn OLP maintained handling operations in Pier I, however, according to the data provided by the Port's Authority, until 2009 the latter's economic dependence from container handling operations was almost exclusive (OLP, 2014). Thus, the completion

of the concession agreement in conjunction with the deteriorating economic crisis of 2008, had a negative impact on the economic and management operations of the Organization. The novel setting within the port of Piraeus and particularly in the container terminal sector, created the need to adapt the Organization's development strategy, through additional activities that would on the one hand provide more flexibility and more dispersion on the revenues attained, while on the other would enable the Organization to maintain its short-term and long-term profitability (OLP, 2015).

As such, the strategic plan of OLP (OLP, 2014) included two main long-term goals: a) the gradual detachment of the Organization's almost exclusive economic dependence from the container handling sector, and b) the drastic development of other as well as of new commercial sectors of activity. In this context, in an environment that cultivated and promoted the intra-port competition between the two operators, the port of Piraeus became an important transshipment and transit container hub for the Eastern Mediterranean, the Balkans and the Black Sea. Piraeus mainly due to Cosco, was for 2012 the fastest growing container terminal in the world, recording a growth rate of 100% (Cosco Pacific Ltd, 2014), while being ranked in the 4th place of Europe's largest commercial ports and the largest among the Mediterranean ports (Porteconomics, 2020).

For 2014, the total container traffic in the port of Piraeus (Piers I, II, III) exceeded the 3.6 million TEUs (Cosco: 2,986 million OLP: 0.66 million), while for 2015 the total traffic reached 4.7 million (of which 1 million were handled in pier I, while the remaining 3.7 million in the piers II & III) (OLP, 2015). This development has led to an increase in the market share of Greek ports in global container operations from 0.15% (2008-2010) to over 0.5% as early as 2012 (N.B.G, 2013).

During this period and in parallel with the traffic growth in the container terminal sector, OLP according to its strategic plan, initiated the development and exploitation of other areas of activity, which remained under public control (OLP, 2015). Specifically, significant growth was recorded in the car terminal segment, which is also located within the premises of the commercial port of Piraeus and is the largest in the Eastern Mediterranean. A contributing factor in becoming an international vehicle hub

for the Black Sea, the Balkans and Central Europe was on the one hand the completion, in July 2013, of the new port railway and its connection to the car terminal, and on the other the introduction and utilization of integrated information systems for the management of flows. Regarding the traffic handled in the car terminal, in 2014 the total cargo shrank by about 20% (359,655 vs. 448,682 in 2013) with significant losses in transshipment volumes of -28.7% (275,648, compared to 386,865 in 2013); a decline mainly attributed to the political instability of the wider East Mediterranean region (Syria, North Africa –Arab Spring, Ukraine) (OLP, 2015). Despite the reduction in car traffic handled, OLP's car terminal maintained its leading position in the eastern Mediterranean both due to its geostrategic position and due to the possibilities and prospects for an increase in transit traffic, formed by the new railway connection. Finally, as far as the other market segments of activity of OLP are concerned, in the field of coastal shipping, Piraeus is ranked among the largest passenger ports not only of Europe but of the world with a passenger traffic of about 17 million passengers for 2014 (including the Perama Strait). While respectively in its cruise segment, Piraeus has also become an important home port/port of call, recording for the decade 2002-2012 an increase in cruise traffic, of around 151% (OLP, 2015).

However, notwithstanding the Organization's profitable growth and development in all areas of activity, the dire economic situation of Greece from 2008 onwards (I.M.F, 2015), combined with the lack of liquidity, accelerated the further liberalization of strategic sectors maintained under public control. As in other sectors, the "state of exception" as described in Agamben (2003)[36] led to the promotion and finally in the adoption of uncommon liberalization policies, also within the port industry.

As such, in an environment of financial suffocation and strict institutional oversight (EU, European Central Bank, International Monetary Fund & European Stability Mechanism thereafter) the Greek governments established the Hellenic Republic Asset Development Fund (H.R.A.D.F) for the management and utilization of public property. The OLP's shares along with the shares of other Greek ports were also transferred to this Fund, in order to generate significant international capital flows

[36] Where a state of emergency (economic, political, natural disaster etc) turns the exception into a rule

from their sale that would in turn contribute to the so-called restart of the Greek economy by fueling economic growth (H.R.A.D.F., 2016). In this context and with the main criterion being the inflow of revenues and not the formulation of a viable model of port organization, the proposal for the master concession up to the year 2052 alongside with the sale of 67% of the shares of Piraeus Port Authority was promoted (Hadjimichalis et al., 2015). Taking into account the above historical background, but also the extent of the activities developed by the OLP, it is understood that with the advanced proposal for a master concession, all the activities of the port were transferred to the private contractor, who would obtain the exclusive control over the OLP, as well as the right to exercise the management and operations within the port of Piraeus.

The above sketched privatization plan of the port of Piraeus was considered by H.R.A.D.F. executives as the best solution for the Greek State (Vythoulkas, 2014), as through this scheme it was ensured that the contractor would have the incentive to develop all port activities. In addition, the sale of a sufficient majority package would stimulate the competitive interest of the tender process and would substantially improve the expected return for the State.

However, despite the initial high expectation of government officials, only one company (COSCO) participated in the final phase of tender process. The Chinese sought to further increase their presence in the port. Piraeus' strategic location (the first major container port after the Suez-Canal) as well as the prospects of increasing transshipment and transit volumes to the Black Sea and to the Balkans and Central Europe respectively (through the TEN-T European freight corridors) were the primal reasons why China desired Piraeus to be a crucial node within the BRI (Hadjimichalis, 2016).

In 2016, COSCO won the bid for a 67% stake in OLP, with the total value of the agreement reaching the amount of 1.5 billion Euros (IOBE, 2016). This amount included an initial bid (368.5 million euros), binding investments of 350 million euros for the next decade (see Figure 40. below for the investment breakdown), as well as 410 million euros in revenues up to 2052, for the Greek State in the form of a

concession fee (around a 3.5% of the OLP's turnover) (IOBE, 2016). The contract consists of two stages: in the first stage, the concessionaire COSCO Group (Hong Kong) Limited would pay 280.5 million euros to HRADF and would become the majority shareholder of OLP (with 51%). In the second phase, after five years (2021), on the condition that the terms described in the Share Purchase Agreement (SPA) had been met (including the planned € 300 million investments) the COSCO Group (Hong Kong) Limited will pay H.R.A.D.F the remaining 88 million euros, while it would also commit on additional investments of 50 million euros in order to increase its share in OLP from 51% to 67% (IOBE, 2016).

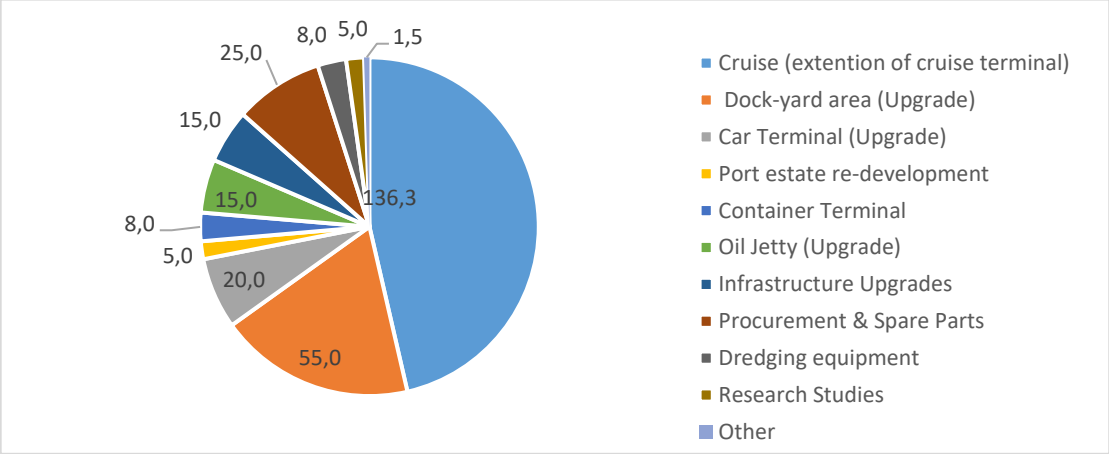


Figure 40. COSCO's mandatory investments in the Piraeus Port, within the first investment period (2016-2020), in million €

Source: (IOBE, 2016), Author's Elaboration

However, aside from the tangible investments that the Chinese have made and are willing to make, Hadjimichalis (2016) suggests that it is the well-known intangible characteristics of Piraeus, that comprise the port's value, rendering it one of China's flagship infrastructural projects. Its geostrategic importance aside, Piraeus is a vibrant multipurpose urban-port, in functional contact with the country's largest metropolitan area, the largest passenger port in Europe connecting the mainland to the Aegean islands (with an annual traffic of more than 15.5 million passengers) and an important cruise port. This diversification of services which allows the port system to be more flexible and agile both to changes in demand and in external environments has been a strong incentive for the Chinese investors (Hadjimichalis, 2016).

The Court of Audit and the Hellenic Competition Commission approved the sale of the OLP to the Chinese company. In fact, the Competition Commission, rejected the revocation applications submitted by workers' bodies (OMYLE & Union of Permanent and Probationary OLP Workers), approving the acquisition of the port's exclusive control by COSCO Group Ltd. According to the Press Release, the Competition Commission (H.C.C., 2016):

"After considering the conditions, but also the prospects of development of the relevant market, the improvements in efficiency, as well as the commitments made, concludes that the expected concentration does not raise serious doubts as to its compatibility with the operating requirements of competition in the individual markets, it concerns"

However, in order to avoid monopolistic and anti-competitive practices on the part of the concessionaire, the Commission (2016) demanded and succeeded in having accepted certain terms. Among them: a) To remove the terms of exclusivity and to refrain in the future from agreeing to or imposing any exclusivity terms in the provision of cargo handling and storage of domestic containers and, b) to maintain the current OLP's tariffs for cargo handling and storage services of domestic containers that will be provided at Pier I by OLP SA until the end of 2017, with the possibility of announcing any increases before the 2nd half of 2017.

In addition to these conditions, in order to ensure and safeguard the level of competition, as well as to cover the gaps created with regards to the functions that would be maintained under public control; the master concession agreement (which has already been accepted by the concessionaire and ratified by the Greek Parliament), incorporated clear and unambiguous terms and provisions:

"The Greek State has the right to enact, revoke or amend the laws governing or affecting aspects of the operation of the Port of Piraeus, including, indicatively, the establishment and appointment at any point in time of any legal entity under public law, supervisory body or organizational structure in order to undertake in whole or in part the duties of the port authority and/or of the harbor master and/or the responsibility of the whole or part of the public administrative functions and duties in relation to the operation of the Port of Piraeus" (M.M.A.I.P, 2016).

6.5.2 Port governing bodies and regulatory instruments: The Piraeus case

In the case of Piraeus port, the redistribution of the port's functions as a result of the increased role undertaken by the private sector have had a catalytic effect on the goals, strategies and scope of activities, the public sector retained within the port. As such, with the public sector in control of the regulatory and administrative functions in the port, specific responsibilities and roles had to be redefined and assigned to the new public institutional structures, so that the latter could adequately respond and perform their role in the new port's environment, established after privatization.

As early as 2013, in the context of the procedures described above in relation to the privatization of the port of Piraeus, as well as in order the supervise the national port system, the Regulatory Authority for Ports (RAP) was established by law as an independent public entity with administrative and financial autonomy, under the supervision of the Minister of Shipping (Law 4150/2013, Government Gazette A' 102/29-04-2013). However, with the finalization of the agreement for the master concession of the port to COSCO, it was deemed necessary by the Greek state to further reform and strengthen the regulatory authority with substantial and effective responsibilities for monitoring the implementation of the concession as well as the commercial methods and practices followed by port service providers. For this reason, with the Law 4389/2016, RAP was reconstituted as an Independent Administrative Authority, entrusted with the mission of supervising and ensuring the legality of relations between public and private bodies of the national port system. In addition, RAP was assigned to supervise the abidance to the agreement and the implementation of the Law on free competition (Law 4389/2016, Government Gazette A '94 / 27-05-2016).

In addition, given the above conditions, it was deemed necessary to set up an additional structure, the Public Port Authority of Piraeus (PAPP), which would undertake supervisory and administrative responsibilities related to the public interest, that were excluded by in the master concession agreement. This Authority was established by Law 4389/2016 as a decentralized and independent service unit of the Ministry of Maritime Affairs and Insular Policy with administrative and financial autonomy. More specifically, PAPP was assigned to exercise the administrative

responsibilities, which were deducted from OLP under the provisions of the Concession Agreement, and which are exercised in cooperation with RAP and the General Secretariat of Ports, Port Policy and Maritime Affairs (G.S.P). (Law 4389/2016, Government Gazette A '94 / 27-05-2016, M.M.A.I.P, 2016). Along with the Hellenic Competition Commission, which may intervene and co-operate with public authorities on matters relating to the competitive operation of the port, the organizational structure for the governance of port regulation is hierarchically formulated as depicted in the Figure 41. below:

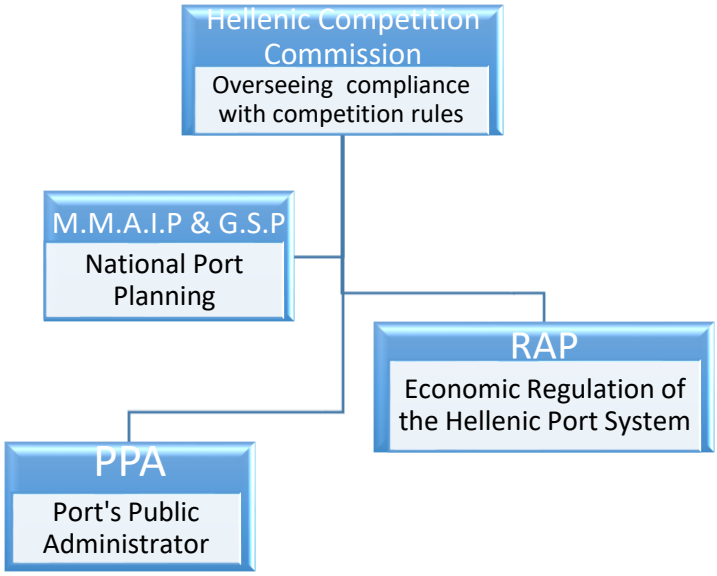


Figure 41. Hierachy of port regulation in Greece

Source: (Law, 4389/2016 & Law 4404 / 2016) Author's Elaboration

In this way, with the establishment of the two aforementioned bodies, on the one hand, RAP emerges as an upgraded independent authority which oversees commercial practices and regulates port service providers. As an independent entity, it may, in accordance with E.U legislation, national law and in cooperation with the Hellenic Competition Commission, take regulatory measures that ensure a) the uninterrupted provision of port services to users, b) the unimpeded access to port services and c) the smooth operation of the relevant port market service. On the other hand, PPAP is an intermediary public body that assumes the role of the State's observer in the port, monitoring the application of terms and clauses stipulated within the master concession agreement of the Piraeus port. In addition, it exercises

administrative and supervisory responsibilities that remain under public control, without interfering or intervening in the conduct of business or in business decision-making (Law, 4389, 2016).

Finally, the Ministry of Shipping and Insular Policy through the General Secretariat of Ports, Port Policy and Shipping Investments remains the competent body for developing the national port policy. However, the latter is not involved in any action related to the supervision of the implemented commercial methods or to the monitoring of compliance of port service providers regarding their obligations arising from the concession agreements (M.M.A.I.P., 2016). Thus, the protection of public interest, the supervision and monitoring of concession agreements as well as the implementation and enforcement of ports' economic regulation on the port private providers, is ensured by the triptych: Ministry of Maritime Affairs and Insular Policy - RAP - PPAP.

Based on the above sketched framework, a key step was to determine the specific responsibilities and functions attributed to the newly established bodies. As clarified in the Explanatory Memorandum of the Ministry of Shipping and Insular Policy (2016) the first step for the clarification of the institutional framework for the supervision of the henceforth privatized port organizations was Law 4336/2015, which explicitly stipulated the obligation of the government to determine the responsibilities of both the independent RAP and of the local OLP's which replace Port Authorities (M.M.A.I.P., 2016). As such, under Law 4389/2016, the regulatory, supervisory and other normative functions of both RAP and PPAP are determined. However, although this law explicitly defines and distributes regulatory and administrative powers and responsibilities amongst the two bodies, no specific regulatory tools are foreseen or proposed to be utilized by the newly established institutions. For this reason, the approach proposed below in Table 25. (based on our analysis in section 6.4.2 and on the Table 24.) covers this gap, as we synthesize under Law 4389/2016 the main regulatory functions of each body, with specialized and specific regulatory tools and with the regulatory responsibilities / duties that arise for each regulatory entity.

Table 25. Distribution of Regulatory Functions between RAP and PPAP, Regulatory Tools and Responsibilities

Regulatory Functions	Regulatory Tools	Responsibilities	Responsibility of:
Access Regulation	Setting Minimum Requirements for market entry	Issue Licenses, Leases, subleases to downstream services providers, structuring/renewal of clauses and terms in concession agreements	RAP
	Unbundling/ Vertical Separation	Forbid owners of non-competitive segments to participate in potentially competitive ones	RAP
		Alternatively: Regulate the terms and conditions under which participants in competitive markets acquire access to non-competitive segments of the industry	RAP
	Set awarding procedures measures/ criteria for port service providers who want to access port facilities	Competitive tendering: supervision of pre-bidding, pre-qualification, selection and post bidding phases	RAP
		Negotiated Concessions (terms & conditions)	RAP
		Direct Assignment (negotiating terms & conditions)	RAP
Price Regulation & Monitoring	Direct Tariff Setting	Issuing of tariffs for port services by the regulator	RAP
	Rate of Return	Set maximum operator rate of return. Adjust the rate depending on operator performance	RAP
	Price Caps	Allow service providers to set prices within the price cap index.	RAP
		Monitor providers to set prices within the limits of price cap Index	RAP
		Compliance-based bonus-malus scheme	RAP
	Price Monitoring	Define performance measurement metrics	RAP
		Allow operators to set prices	RAP
		Perform regular reviews on service providers performance	RAP in cooperation with PPAP
		In case of misuse of market power, enact stricter regulations	RAP
Performance Regulation	Set performance and productivity indicators	Goal Setting. Periodic review of performance indicators. Performance Benchmarking.	RAP in cooperation with PPAP
	Monitor Performance of service providers	Supervise general compliance of operators with terms and conditions of concession agreements	PPAP- data disclosure to RAP for additional action/non action
		Performance-based bonus-malus scheme (issuance of rewards, sanctions, penalties)	RAP
	Monitor compliance with Minimum Service Level Agreements	Issue warnings and non-compliance notices.	PPAP in cooperation with RAP
		Environmental protection and application of existing legislation within ports	PPAP
		Securing & controlling labor rights & trade union freedoms	PPAP

Source: (Law. 4389/2016, Table: 21) Author's Elaboration

The above table is a first record and a proposal for the assignment and division of tools and responsibilities amongst the two new entities. As such, it serves as an indicative

set of regulatory tools that aims to ensure the development and application of a comprehensive port regulation framework. With the proposed division, it is possible for the newly established public bodies to determine their priorities and goals, but also to defend the public interest in the new privatized environment of the port of Piraeus. However, it is the duty of both RAP and PPAP, off course depending on the priorities and goals that they will set, to further investigate and quantify the results and effects of each of the above regulatory tool, in order to select the most appropriate one depending on the issues arising.

In conclusion, it is considered that the establishment of both RAP and PPAP, structurally forms the conditions for an effective regulation primarily within the context of the port cluster. However, it is not enough just to create these structures, if they are not provided at the same time, with the appropriate regulatory tools to achieve a holistic economic regulation. At this level, especially in the case of the privatization of the Piraeus Port Authority, the clarification of a regulatory framework for RAP and PPAP, as specified above, may contribute to the formation of measures and safeguards, for the shielding of the public interest by monopolies, counterproductive and collusive practices.

6.5.3 Redefining the model of port organization and management of the Port of Piraeus

The privatization of the Piraeus Port Authority, as defined under the 2016 master concession agreement, did not solely affect and alter the entities in charge of port governance within the port, but rather led to a more radical reorganization of the port's organization and management model as a whole. As analyzed in Ibrahimi (2015), port governance is only one of the three main pillars of port functions, with the other two relating to the management and administration of the port's operations.

As such in the case under study, a necessary component for the complete adjustment of the novel model of port organization and management of Piraeus, necessitates also an examination over the redistribution of the latter two functions amongst the public and the private operator in order to depict the new balance of power and the extend of control, each of these two actors exerts.

As already described above, the private operator assumes part of the administrative duties/responsibilities as well as the exclusive management and operation of the port's distinct market segments (container terminal, car terminal, cruise, etc.). Thus, while the public sector withdraws from any provision of port services, it still continues to retain part of administrative and supervisory responsibilities which are directly related to the safeguarding of public interest. More particularly, as stipulated in the concession agreement, ratified by Law 4404/2016, the newly established regulatory entities, RAP and PPAP, are entrusted with those regulatory, administrative and normative responsibilities that the private operator does not undertake within the port (Law 4404, 2016).

As such under Law 4404/2016 the mixed nature of the administrative function is stipulated, with the private sector on the one hand undertaking the lions share over the day-to-day tasks of port administration and the public sector on the other, maintaining the ability to exercise certain administrative/ facilitative functions over the majority of port's resources. Furthermore, with regards to commercial port operations, as said the private sector might be rendered the sole manager and operator within the port's premises, however, the public sector continues to withhold

its right to intervene, negotiate and monitor port operations as well as the proper implementation of both the concession agreement and of the existing E.U and domestic legislation.

In more detail, the dynamic depiction of the shifting balance of power amongst the public and private sector, before and after the completion of the privatization is summarized in Table 26. below. In this table, the three main port functions (Governance - Administration - Management) intersect with the three types of port tangible resources as identified in Ibrahimi (2015), namely the port's a) Infrastructure, b) Superstructure and c) Human Resources as well as with two types of intangible port resources, relating to the responsibility for d) Port Planning and e) Cooperation/ Synergy development.

The addition of these intangible resources and the advancement of Ibrahimi's (2015) empirical model are considered appropriate as these two intangible port resources add value to both the port cluster and the producers of port services directly as well as to society indirectly. Therefore, their inclusion in the process of sculpturing the novel port organization and management model of the Piraeus port, becomes an additional component in the effort to depict more accurately the configured model and the magnitude of change, resulting from the redistribution of responsibilities amongst the public and the private sector.

As such, in the Table 26. below, we distinct the bodies that undertake the port functions for each of the three main tangible port resources, but also for the two intangible ones, according to their participation: in purely PUBLIC, purely PRIVATE and finally in a combination of PUBLIC / Private or PRIVATE / Public depending on which sector undertakes the majority of functions' responsibilities/duties. Based on this distinction, the configured model of port organization and management, of the Piraeus port is composed, depicting the balance of power prior to (left) and after (right) the redistribution of roles, resulting from privatization.

Table 26. Adaptation of the Port Organization Model GOV-AD-MAN, and distribution of responsibilities between public and private bodies, before and after the completion of privatization of the port of Piraeus

Port Organization and Management Model Prior to the Privatization of Piraeus Port					
Port Governance (Gov)	PUBLIC				
Port Administration (Ad)	PUBLIC	PUBLIC	PUBLIC	PUBLIC	PUBLIC
Commercial Operation and Management (Man)	PUBLIC	PUBLIC / Private	PUBLIC / Private	PUBLIC / Private	PUBLIC/ Private
Port Resources	Infrastructure	Superstructure	Human Resources	**Port Planning**	**Cooperation Development**

Port Organization and Management Model After the Privatization of Piraeus Port					
Port Governance (Gov)	PUBLIC				
Port Administration (Ad)	PRIVATE/ Public	PRIVATE	PRIVATE/ Public	PRIVATE/ Public	PRIVATE/ Public
Commercial Operation and Management (Man)	PRIVATE/ Public	PRIVATE	PRIVATE/ Public	PRIVATE/ Public	PRIVATE
Port Resources	Infrastructure	Superstructure	Human Resources	**Port Planning**	**Cooperation Development**

Source: (Ibrahimi, 2015), Author's Additions and Elaboration

To this end, as depicted above, prior to privatization, the public sector held the primary role, undertaking the majority of functions for all port resources, tangible and intangible. The private sector, respectively, was limited in performing certain commercial operations within the port, relating to the superstructures granted by the state, the management of the personnel employed in them, and the development of partnerships and synergies with companies within and outside the port cluster.

However, while moving to the right table (after the privatization), the balance of power between the public and private sector is at large extent, reversed. The private operator extends its role within the port, undertaking the primary role in performing the administrative and managerial functions over all the designated port resources.

This fact, however, does not render the private sector the sole and absolute ruler within the port, as despite the transformation of the port of Piraeus into a private monopoly with regards to commercial operations, the public maintains the function of governance over the entirety of the port's resources.

As such, the latter retains its ability to draw up and enforce rules and regulations, monitor the operator's compliance as well as intervene with the tools provided to the newly formed public entity of independent regulation, when deemed necessary. Also with regards to the Administration function, although the balance of power is unquestionably leaning towards the private sector, this function it is still at some extent, exercised jointly, with the public through the PPAP acting as a mediator, between the regulator and the operator as well as the supervisor of the latter.

Closely connected with the novel model of organization and management of the port of Piraeus and the new distribution of roles and functions, resulting from the agreement ratified by Law 44404/2016, and the Explanatory Memorandum of the draft Law 4389/2016 submitted to the Greek Parliament, is the need to review and clarify the responsibilities that come along with each of the above functions. Thus, while the above depicted model of port reorganization for the port of Piraeus does not capture those responsibilities, such a specialization would be of great interest and of great value. As such, by utilizing the list of regulatory tools identified in Table 24., as well as the stipulations incorporated in Law 4389/2016, a first approach for defining the responsibilities that come along with each port function can be sketched:

Table 27. Description of Responsibilities & Roles per Port Function in the case of the Port of Piraeus

Responsibilities of Port Governance & of Port Economic Regulation (RAP)	**Responsibilities of Port Administration** **Distribution of responsibilities amongst the Public Administrator (PPAP) & the Private Operator**		**Private Operator's Managerial & Operational Responsibilities**
- Exercise of Economic Regulation (access, price and performance regulation) - Monitoring and supervision of port cluster (in cooperation with OLP) - Ratification of License to Operate - Cooperation with Competition Commission and monitoring the enforcement of Competition legislation - Cooperation with Ministry of Shipping and Insular Policy for co-developing national port strategy - Enforcement of port rules and regulations - Issuance of Rewards, sanctions and penalties - Dispute resolution (Stakeholder management and negotiation) - Issuance of Annual Reports - Participation in International Conferences, Forums as the representative of the Hellenic State	- Monitoring and securing the operator's compliance to the stipulations and clauses of the concession agreement - Supervision of the port cluster, administration and utilization of port spaces which are not concessioned - Mediation for developing cooperation and synergies (amongst ports, businesses, foundations) - Handling Port-City Relations - Cluster Management with an emphasis on diffusing positive/ mitigating or minimizing negative externalities - Monitoring Performance of port operator - Carrying out regular scheduled and unscheduled inspections - Reorganization of public port resources - Monitoring the enforcement of Environmental regulations - Securing & controlling labor rights & trade union freedoms - Issue reports for Repairs and Maintenance of public infrastructures (roads, railways etc.) - Supervise customs clearance - Other non-profit services	- Sub-leases/ sub-concession issuance - Handle day to day administration requirements - Administration of piers, vessels, hinterland transport operators (vessel, truck, rail scheduling, gate control, gantries assigned etc.) - Supervise and monitor all market segments - Cluster Management - Marketing (purchases, sales, promotional activities, public relations, social media) - Legal Representation - Human Resources (abide by labour legislation, training, motives, dispute resolution) - Reorganization of the operator's port resources - Secure Quality of Port Service provision (Effective and efficient port operations) and compliance to concession agreements stipulations - Issue reports for Repairs and Maintenance of port's infrastructure and superstructure - Report to senior Management and Board of Directors - Implement safety regulations within port premises (ISPS) - Issue Grants and Scholarships	- Cargo handling Loading/ Unloading (containers, cars,) and passenger control (cruise, coastal shipping) - Cargo storage and other port-centric logistics services - Shipbuilding and repair activities - Traffic management - Cargo Inspections - Design of port terminals (quayside, yards, landside) operations and of future investments - Corporate Affairs - Master Plan development and strategic analysis - Secure port's accessibility - Plan, finance and undertake port investments (of port infra/ super structures) - Agency services - Stakeholder management with an emphasis on cooperation, collaboration synergies development amongst with port service provides and port users - Environmental Management - Research & Development (R&D), innovation, digitization – digital business solutions development - Provision of other value-added services - Other entrepreneurial, (commercial and touristic) services (hotel management, asset management real estate)

Source: (Law 4389, 2016) Author's Additions & Elaboration

The above Table forms a first indicative categorization of the responsibilities/duties that accompany each function (Governance – Administration – Management), thus also indicating the actions performed by the respective public and private bodies. In the above categorization, the public sector, after withdrawing from the production of a port product, strengthens its institutional role as a regulator and as an administrator, developing activities whose main goal is to safeguard the port system from competition distortions while promoting and defending the public interest within it. Especially for the function of port administration, in which both sectors are involved, the public sector basically assumes the role and responsibilities of a supervisor who monitors the operator's compliance to the concession agreement over performance, hygiene, safety and working conditions, among other things. In addition, the public sector through its administrative role can aid and mediate in developing synergies and collaborations amongst the port's and the city's stakeholders.

Respectively, the private operator undertakes the day-to-day administrative responsibilities within the port, being active in issues related to issuing subleases, planning and scheduling port operations, issuing reports for maintenance and repairs of the port's infrastructures / superstructures, amongst other. Finally, the private sector, gaining a monopoly position in the operation and management of the port, focuses on the planning/development of commercial business activities aimed at creating value for itself and its users.

However, it should be noted that the above analysis and division of responsibilities cannot be considered de facto, as their final distribution between the public and private sector will depend on both the bargaining power of each actor as well as to the degree of readiness of the public sector to undertake and exercise them. The absence of a strategy and a comprehensive plan for the regulation and administration of the port by the public sector can create opportunities for the private operator, who at any time can declare that he is ready to take on any additional responsibility granted, as long as it supports and benefits his strategic plan.

6.6 Beyond the port of Piraeus and the port perimeter: Towards the emergence of regional and global regulatory cooperation schemes

Moving from the local and national to the regional and global context it must be acknowledged that while the challenges of managing competition, in an era of Mega Carriers and Global Operators and of complex containerized supply chain networks, are intensified, the introduction of economic regulation is a first step in enhancing the arsenal of tools, port regulators possess. In addition, the delegation of the regulatory port function to an independent regulatory entity, can potentially (provided that such an entity is entrusted with the appropriate competencies) expand the scope and reach of regulatory enforcement beyond the port perimeter.

Especially in cases such as that of the Piraeus port described above, where a private landlord enjoys a natural monopoly position - levering market power as well as opportunities for acquiring/foreclosing upstream and downstream market players – such measures and structures reinforce the ability of the public sector to safeguard, intervene and mitigate on a non-discriminatory basis potential competition threats and abusive behaviors both on a port level and on the subsequent upstream and downstream markets.

As international practice has shown (Angelopoulos et al., 2019), apart from the Greek RAP, other countries have turned to the establishment of similar agencies with explicit port economic regulatory competencies (Table 28 below). According to the authors, while differences in the organizational and institutional approaches as well as in the scope, regulatory reach (tools) and efficiency of those agencies exist, port economic regulation, provides a more coherent and holistic framework in the process of enhancing the credibility and the quality of regulatory results, and hence of competition.

Table 28. Port Economic Regulators Worldwide

Country / State	**Authority**	**Regulatory Competency**					
		Tariffs	Port Access	Conflict Res./ Tribunal	Service Levels & Conditions	Manage or Award Concessions	Licensing
India	TAMP	●	-	-	-	○	-
Australia (S. Aust.)	ESCOSA	●	●	●	●	–	●
Australia (QSL)	QCA	●	-	●	-	-	-
Australia (NSW)	IPRT	●	●	●	-	-	-
Australia (Victoria)	ESC	●	●	◕	●	-	●
Australia (N. Ter.)	NTUC	●	●	N/A	-	-	-
South Africa	PRSA	●	●	●	-	-	-
Greece	RAP	●	●	●	●	●	-
Peru	OSITRAN	●	●	●	●	◐	-
Philippines	PPA / MARINA	○	○	N/A	●	●	●
Portugal	AMT	●	●	●	●	●	●
Canada	CTA	●	◐	●	●	-	-
Netherlands	ACM	◔	-	●	◔	-	-
Brazil	ANTAQ	●	-	-	●	●	-

Degrees of competency legend: ● (full), ◐ (partial), ◔ (minimal). Source: (Angelopoulos et al., 2019)

Despite the fact that port economic regulation is gaining ground internationally, the establishment of such regulatory structures/agencies, as well as their reinforcement with (a varying degree of) regulatory tools, still resides on national or regional initiatives which for a wide range of reasons opt to enhance and strengthen their national/regional ports' regulatory framework (Portius, 2019). Characteristic is the case of EU's Regulation 2017/352 (E.P., 2017) which while promotes the establishment of a Pan-European framework for the provision of port services and common rules on the financial transparency of ports, leaves the decision regarding the competent entity that will supervise its enforcement in the discretion of the Member States.

As such, the EU Seaports Regulation, apart from allowing a great diversity on the body that will regulate the port system, it does not extend its reach throughout the supply chain network, nor does it establish some form of coordination and cooperation amongst EU's port regulators. In this respect, while the EC, seems to comprehend the necessity of establishing a regulatory level playing field in the port sector as well of advancing amongst member states (since the first European Port Regulation 4057/86) (E.C, 1986) the regulated aspects which govern the industry, there is still a long way to be covered in order to establish a holistic European Port Regulatory framework.

On the one hand, the integration of ports within the context of global containerized supply chain networks, and on the other the emergence of powerful global players such as the Global Terminal Operators and Mega Carriers in container trades, demonstrates that the need for economic regulation and cooperation surpasses national borders and specific nodes such as ports, within the supply chain network. As illustrated in the beginning of the Chapter 6, the unbundling of the port sector enabled the creation of a seamless transport network and of a space where transport actors can through vertical and horizontal integration expand and bundle services across the chain, increasing concentration and centralization of capital in each distinct supply chain node, in the process of establishing their own door-to-door transport networks. In this vein, our assessment indicates that rethinking and readjusting port regulation solely on a port level is not sufficient enough, considering today's complex supply chain networks, to regulate powerful and globalized transport actors.

Characteristic of this fact is the emergence of the three regulatory watchdogs (USA's Federal Maritime Commission – FMC, EU's European Commission – EC and China's Ministry of Commerce – MOFCOM) which in the absence of any authorized international regulatory body, were informally entrusted to review and by extension to approve or reject Mergers & Acquisitions undertaken as well as the formation of each of the liner shipping alliances established (Drenan, 2015). Initially the FMC invited its counterparts in EU and China to participate on a world summit to review the potential effects of liner carrier cooperation on international trade. According to Nair (2016) the FMC Chairman Cordero stated:

"*I called for this Global Regulatory Summit given the rapidly changing face of the international maritime sector demands 'out of the box' thinking. The scope and size of the changes taking place provides an opportunity for our respective governments to dialogue and share our views on global regulatory challenges, and the impacts to international trade. …. From this Summit, I believe we all have a better understanding and appreciation for our respective legal regimes and views on global implications of the international maritime sector that we regulate*."

The Chinese delegate Mr. Li responded that (Nair, 2016):

"*We are very glad to have been invited by the FMC to attend the Summit. The United States, EU, and China are important economies in the world, and maritime transport plays a very important role. Ninety percent of China's foreign trade is carried by sea. The sustainable growth of the maritime sector is of great importance to China and globally, and it is our common duty to protect the sound development of maritime transport. Through this summit we exchanged ideas about the maritime regulatory policies and rules and continue to strengthen our partnership*."

Finally, the E.C participant at the meeting, Mr. de Broca stated (Nair, 2016):

"*We welcome the opportunity to discuss our comparative regulatory regimes. Discussion is the best vehicle we have to share our collective expertise given that we each have different tools. We thank the FMC for initiating this summit and inviting us to participate what has been an informative dialogue*."

While the above statements reinforce the argument for the need for enhanced international cooperation and regulatory supervision, the participating parties did not decide or propose any actions towards this direction. In this vein, apart from their informal delegation as the watchdogs of the containerized transport world, also the means and rationale based on which each reaches a decision are not unified or even transparent. For Drenan (2015), the rejection of P3 Liner Alliance (Maersk, MSC and CMA – CGM) by the Chinese MOFCOM (unlike EC and FMC which approved it) although grounded on (concise and unsurprisingly vague in rationale) competition related factors, the true reason for its rejection was that the specific alliance did not include any Chinese controlled carriers (such as COSCO or China Shipping at the time).

Respectively, Braakman (2017) argues that the EC has turned a blind eye with respect to the possible anti-competitive effects of these mega alliances on the EU market. As Mega Carriers participating in the three mega- alliances also participate in one or more of the roughly 65 conferences agreements that exist worldwide, he suggests that, the latter serve as vehicles for exchanging strategically sensitive information including pricing data relating to routes that fall under the Singapore Competition Order of 2006 (Block Exemption for Liner Shipping Agreements), which allows cooperation and exchange of sensitive information in the Intra-Asian leg of the routes. According to Braakman (2017) this fact enables lines to foresee, with a sufficient degree of probability, the strategically sensitive data that determine business on the second leg of the route to Northern Europe, where this behavior is prohibited under EU anti-trust law. Because they share capacity, commonality of costs may lead to alignment of prices, thus making it easier for the parties in an alliance to tacitly collude. Thus, with regards to liner alliances, he concludes that this lack of legal certainty is aggravated by the fact that cooperation between lines within an alliance is increasingly based on business intelligence and analytics (BI&A) systems and that there is no guidance on when BI&A, transforms arrangements that are explicitly permitted under the consortia block exemption, into forms of tacit collusion prohibited under EU anti-trust law.

Finally, concerns about the potential competition effects posed by collaborative ventures between the largest carriers, terminal operators and amongst the two have

been raised also within the FMC (Dupin, 2015). The FMC commissioner Richard Lidinsky who was the only one to cast a vote against the P3 alliance, commented in an interview with the JOC (Szakonyi, 2014) that in his view the particular alliance would foster monopolistic practices, reduce service via increased use of transshipment hubs and push out smaller carriers, while also suggested that even internal review arrangements and monitoring requirements for Vessel Sharing Agreements (VSA) put forth by the FMC, were not as rigorous and strict as should have been. While raising the issue of the overall increase in concentration caused by the formation of such a mega-alliance, he characterized P3 as "very structured, very robotic and massive" while likening it to allowing Ford, General Motors and Toyota to team-up.

In his view, the alliance would likely produce an unreasonable increase in transportation costs and an unreasonable decrease in service; measures which according to the Shipping Act of 1984, are how commissioners determine whether to allow a VSA to proceed or to seek an injunction in federal court to block it. His proposition for an increase in licensing requirements and financial responsibility levels, was widely criticized in the industry for needlessly adding costs, with his idea never gaining traction within the FMC, which with a majority vote, approved the alliance (Szakonyi, 2014).

The above facts, are characteristic to illustrate how the three emerging regulatory watchdogs have been either politically biased, or have chosen to turn a blind eye on actual concentration and competition issues raised by the formation of such liner alliances. Despite however, the diversified approaches on dealing with the proliferation of liner alliances, the established dialogue amongst the world's largest trade and peripheral powers, is undoubtedly a first step towards a universal cooperation on the regulatory issues and challenges faced by the containerized transport industry. However, as these watchdogs operate in a regulatory vacuum a further step towards this direction would be the reinforcement of transnational cooperation among port regulatory authorities on matters that surpass national boundaries. Such cooperative schemes could evolve into a formal International Regulatory Network that convenes at regular intervals enabling participating bodies to exchange information on their decision-making principles, best practices and

actions in order to promote a uniformity on the common regulatory issues and challenges faced. Some indicative areas of cooperation could be the establishment of a set of methodologies to assess the type of price and performance regulation needed as well as a basket of approved economic regulatory tools to monitor compliance and quality of service of terminal operators. In addition, cooperation could extend into parameters and issues relating to the level of desired transparency (financial disclosure, information availability, pricing strategies) of liner carriers and terminal operators, to the formulation of a common methodological framework for the evaluation of market power of incumbent (vertically integrated) actors both in the port industry and in upstream and downstream markets, as well as to the establishment of the necessary conditions under which ownership unbundling (vertical disintegration in two consequative segments of the supply chain) should be promoted and enforced.

We acknowledge that the creation of a universal regulatory framework for the door-to-door containerized supply chains centered around ports, as universal as unbundling was, is an ambitious if not a utopic goal. It would require consensus, convergence and consultations to agree on common principles while it would necessitate the cooperation among many countries, that toady does not appear to exist. In this respect, actions that strengthen cooperation and the dialogue among regulatory authorities, could instead aid in enhancing the collaboration and coordintation in a bidirectional context, both on national as well on supranational level.

Particularly now, that the ongoing COVID-19 pandemic has brought into the surface the potential threats and effects, market concentration in liner shipping and terminal operations may exert on the conduct of global trade, the need to reconsider the regulatory regime (both on a national, regional and global level) governing containerized supply chains is more eminent than ever. More particularly, while market conditions such as the increasing demand for final products and the explosion of e-commerce during the pandemic, led to imbalances between supply and demand creating shortages in vessels' capacities as well as to congestion and bottlenecks throughout the global chains (Drewry, 2021), market actors such as liner carriers and

terminal operators have turned this pandemic crisis into an opportunity for their own benefit.

Through capacity and cost management strategies (cancelation of spot bookings – blank sailings) the majority of liner carriers exacerbated further the available market capacity, raising freight rates to unprecedented record levels (UNCTAD, 2021) (on specific trades, such as the Far East – North America, container prices have soared, with the benchmark cost of shipping a container being up more than 220% over the past year (Deaux et al., 2021)). Respectively, terminal operators, since the second half of 2020 and henceforth, benefited from port congestion and supply chain bottlenecks, raising their cargo-handling rates (xChange, 2021). As a result, while shippers and retailers have incurred significantly increased costs for shipping their commodities, all major liner carriers and terminal operators, have recorded abnormal profits. Characteristic of this fact is that Hapag-Lloyd (the 5th largest carrier worldwide) earned more in the first half of 2021 than in the previous 10 years collectively (Financial Times, 2021). Similarly, amongst other Global Terminal Operators, DPW (the 5th largest terminal operator worldwide), recorded too, an increase of about 52% in its profitability in the first half of 2021 (DPW, 2021).

As Haralambides (2019) had warned "he who has honey at his fingertips is bound to lick them in the end". As such the pandemic crisis proved to be an excellent opportunity for carriers and operators to exercise their monopoly power and rent-seeking behavior. Under these circumstances, while forwarders in the EU have accused liner carriers of violating existing contracts, establishing unreasonable container booking conditions, and unilaterally setting rates "far in excess of those agreed in contracts" (CLECAT, 2021), the EU competition authorities have been unable to investigate these issues and take immediate action.

Respectively, the pricing ploys of liner carriers are increasingly under the spotlight of other countries' regulatory authorities. Initially, the practices of carriers and terminal operators came under the microscope of the FMC (Federal Maritime Commission) and of the Department of Justice in U.S. as well as of the Ministry of Transport and Communications in China (Chambers, 2021). It is worth noting that the House of Representatives as well as the U.S Senate also passed the Ocean Shipping Reform Act

which opts to strengthen the investigatory and enforcement authority of the FMC and give the agency a new rule-making authority and greater powers to pursue liner carriers (Biggar, 2022). Apart from U.S and China however, liner pricing investigations are spreading around the globe, with regulatory authorities in Vietnam, Taiwan, South Korea, Philippines and Nigeria also investigating amidst of surging freight rates, the potential engagement of liner carriers in anti-competitive agreements or collusion practices such as price-fixing (Chambers, 2021).

Finally, on a regional and peripheral level too, initiatives from national regulatory authorities to strengthen international cooperation in order to develop and share intelligence to detect and investigate suspected anti-competitive behaviour and collusion, are taking place. More particularly, the Common Market for Eastern and Southern Africa (COMESA) Competition Commission, comprising 21 African member states, initiated investigations over three liner carriers (Maersk, CMA-CGM and Africa Feeder Line) for allegedly coordinating in raising freights (Chambers, 2022). Additionally, a new working group made up by the competition authorities from the "Five Eyes" nations: the UK Competition and Markets Authority (CMA), the United States Department of Justice, the Australian Competition and Consumer Commission, the Canadian Competition Bureau and the New Zealand Commerce Commission opts to increase inter-agency cooperation to address potential anti-competitive and colluding activities in global supply chains (GOV.UK, 2022).

Within this context, the difficulties of the national and regional regulatory systems to proactively investigate, monitor and respond to the challenges faced in containerized trade which in turn threat the worldwide economic stability, highlight their inherent deficiencies and inadequacies. Characteristic is that UNCTAD (2020) too calls for the continuous strengthening of national competition authorities in the area of maritime transport, in order to ensure that they are prepared to provide the requisite regulatory oversight. As such, the ongoing pandemic crisis, apart from the dramatic effects it had on multiple levels, it is a chance to reconsider through a global lense the potential effects of global concentration on the competitive operation of the port and liner shipping markets. As the world becomes more globalized and integrated, regulatory frameworks should adapt and expand their reach on a global scale too. The agreement

and adoption by Members of the Organization for Economic Co-operation and Development (OECD) of a global minimum effective tax rate of at least 15%, for multinational companies can be considered as a move to this direction (E.C, 2021).

However, additional measures are necessitated to strengthen further the ability of regulators to intervene both on specific (local, regional) occasions as well as in cases such as in liner shipping and terminal operations, where market concentration may lead to anticompetitive and abusive behaviors. To this end, the proposition of this dissertation for the establishment of national, regional and global independent regulatory authorities responsible for the regulation of the door-to-door containerized supply chain networks through the extension of their regulatory reach and their empowerment with an arsenal of economic regulatory tools, is timelier than ever in order to make a leap forward towards the establishment of a formal international regulatory framework of cooperation for addressing the market power challenges faced in the highly concentrated containerized transport market.

6.7 Concluding Remarks

Globalization and technological advancements in the means of transport and telecommunications have been two of the most important factors that changed the structure of international trade, acting as catalysts in the integration of ports within the global supply chains. These evolutions coupled by a world scale liberalization wave of the port services market, established the conditions for the further penetration of private companies in the provision and management of port services, gradually but steadily transforming the traditional roles and functions of the until then state-owned port organizations. As such, the restructuring process initiated resulted in a major shift in the balance of power amongst the public and the private sector.

Through the process of unbundling, port authorities (or the respective port managing bodies) could withdraw from the production of port product by conceding the port's terminals to private operators. While becoming themselves corporatized, port authorities embraced new functional roles, assuming the landlord and stakeholder functions in the process of adjusting in the increasingly multi-stakeholder port environment which replaced the former Fordist homogeneity of the port area.

Within this context, the emerging port governance and management model that the largest ports worldwide adopted, through the concessioning of their terminals allowed them to reorient towards the market, becoming themselves entrepreneurs as well as facilitators of the global commodity flows. However, apart from the restructuring caused within the port industry by the liberalization processes adopted, the unbundling of the port sector had much broader effects in the structure of the different supply chain segments. More particularly, as ports were the last node within supply chains sheltered from competition, the unbundling process enabled the unification of the supply chain under a system or network perspective. In turn this evolution gave the opportunity to market actors such as liner carriers and terminal operators to bundle their services and develop their own seamless door-to-door networks through expansion strategies (of vertical and horizontal integration) and the channeling of huge capital funds in the port system for the acquisition of container terminals.

As port authorities though, focused more on activities and functions that generated revenues for themselves, substituting regulation with competition, market actors continued to grow organically through investments in port capacity as well as through centralization processes (M&As) which increased progressively their market and bargaining power vis-a-vis their landlords. In combination with other market related evolutions such as the economic crisis of 2008 and the lack of state funds (forbiddance of any state aid) available to undertake the excessive investments in container terminals' infrastructure and superstructure needed, to upgrade the service requirements of the ever-increasing container vessels, gave the opportunity to Global Operators and Mega Carriers to seek and bargain for augmented responsibilities and roles in ports' organization and management.

Under such circumstances, the formation of an oligopsonistic and oligopolistic market structure in terminal operations and liner shipping respectively, has undermined the capacity of port authorities to efficiently regulate global players within the context of the port system. As our analysis indicates, in order to regulate the globalized and powerful port actors, rethinking and repositioning the port system in today's complex supply chains will not be enough. If ports want to regain control over such global

actors, they must enhance, adapt and invent new tools to face today's challenges. To do so, appropriate updating of the regulatory function should be coupled with re-invention of the role of the regulator on a national and international level.

A crucial step in adapting ports to the modern global conditions can be the development of robust and holistic regulatory governance system, as well as the enactment and enforcement of specialized economic regulatory tools that will extend the regulatory reach beyond the port context and throughout the supply chain network. To this end, we identify an imminent need to redefine regulation schemes in two levels: (a) governance of regulation and (b) regulatory substance. Such a redefinition renders the economic regulation of port activities the new strategic frontier, however not necessarily in the hands of port authorities.

In this context, we have studied the case of Greece and specifically of its largest port, Piraeus, in the light of the changes that reshaped both the model of organization and management of the port as well as the division of port functions and responsibilities between public and private sector. While reviewing the chronicle of the port's first concession till its final master concession, we have examined the institutional restructuring which has led to the establishment of an independent regulatory authority for ports as well as of a local Public Port Authority which will oversee the regulation and administration of the port cluster and of the implementation of the master concession. While the delegation of the regulatory port function to an independent authority will be tested over the course of time, we have argued that such an innovative action can become an opportunity for the public sector and the state consequently, to regain the power to efficiently and effectively shield and safeguard public interest as well as regulate the concessionaire and the incumbent market actors in the liner shipping sector that utilize Piraeus as a node in their door-to-door supply chain networks.

For this to happen however, apart from the delegation of the governance of regulation to an independent regulatory authority and an administrative local port authority, issues of regulatory substance should as well had been resolved; as effective regulation is not meant without effective economic regulatory tools. For this reason, the present work fills this gap in legislation, by proposing and distributing amongst the

two public bodies, specific economic regulatory tools that can be utilized and exercised in the process of safeguarding the port system from competition distortions.

Moving our analysis one step further, we have adapted and expanded the approach of Ibrahimi (2015) and of his GOV-AD-MAN model in the new operating framework of the port of Piraeus, in order to formulate the framework for the assumption of roles and the distribution of functions between the public and private sector. This model allowed us to grasp and display the magnitude of change (from the public to the private sector) over the ports' tangible (Infrastructure, Superstructure & Human Resources) and intangible resources (Port Planning & Cooperation Development).

Thus, while the private operator undoubtingly becomes the dominant actor in the management and organization of the port of Piraeus, we sketch the roles and responsibilities of the public regulatory authorities that can counterbalance the monopolistic position of the private operator within the port. In our view, the enforcement of independent economic regulation within the port sector can become the vehicle that will allow ports to face the challenges posed in the increasingly integrated and concentrated by powerful players, global supply chains.

Finally, going beyond the case of the Piraeus port, we have observed that port economic regulation is gaining ground internationally, with several countries/ regions establishing agencies with a varying degree of economic regulatory competencies. In this sense, it seems to be increasingly acknowledged that the establishment of a clear regulatory framework that enables the transparent, fair and non-discriminatory provision of port services, plays a fundamental role in ensuring and sustaining competition rules, while preventing market distortions within the port system.

However, as today's ports apart from the port sub-network (port cluster) simultaneously co-exist in multiple hyper-networks (terminal operators' global network and the door-to-door supply network), economic regulation's reach too, should extend beyond the port's perimeter. While thus, supply chains extend across the globe and transport actors become more integrated and concentrated in the process of establishing a global transport market, regulations too cannot be confined solely within the port perimeter. As stressed out, it is difficult if not impossible to

effectively regulate global players exclusively on a national context or within the context of a port. The utilization of the pandemic crisis by the major liner carriers and a portion of terminal operators to exercise their market power (through capacity control, decreased reliability combined with increase freight rates and surcharges) in order to increase their profitability only reinforces the above argument.

To this end, we argue that as the battle of competition is shifted from the local to the global level, the need for transnational economic regulations that extend throughout the entire supply chain network emerges. Following the slow but steady steps, made by EC towards the establishment and enforcement of transnational regulations within the port sector, as well as the emergence of the three regulatory watchdogs which have sprung up as a response to the increasing challenges faced within the containerized transport industry, we have proposed the formulation of transnational and regional regulatory bodies which will be entrusted to stipulate and enforce regulations across the entire supply chains. Following the paradigm of other network industries which are governed by national, regional and transnational regulatory bodies, such an initiative would lead to perceive supply chains not as a sum of distinct nodes, but rather as a coherent and integrated network. While in addition, the existence of different levels of regulatory governance will also allow the formulation of a "*glorecal*" (global, regional and local) regulatory framework, which based on common general principles can also be specialized ad hoc.

Chapter 7: Conclusions

7.1 Overview

The purpose of this dissertation was to provide novel knowledge over the evolution, motivating powers and effects of concentration that pertain into the port industry. In this respect, having examined the academic economic literature over the issues and processes of concentration, centralization and capital accumulation as well as of the potential effects they might exert on the competitive functioning of the market (Chapter 2), Marx's circuitist methodological framework (Chapter 3) was utilized and adjusted to the case of the containerized transport networks in order to unveil the role of transport within the context of capitalist development as well as the underlying forces that trigger and enable the realization of concentration within the containerized segments of liner shipping and terminal operations. Having described the commercial's capital mechanism towards expanded reproduction, affirming that transport capital exhibits also a propensity towards concentration, we proceeded (Chapter 4) into examining the diachronic evolution of concentration in the two aforementioned containerized sectors, through an in-depth analysis of the expansive strategies followed by incumbent market actors as well as through the measurement of concentration in each respective market. In parallel, a mixture of qualitative and quantitative methodologies was utilized and applied to examine the effects this rising capital concentration has on the conduct of containerized trade at ports of specific geographical regions.

Moreover, as the commercial capital's circuitist analysis indicated that innovation is a primal force which enhances the capacity of firm to concentrate, the importance and significance of innovation and (in extension) of novel knowledge as a resource, for the case of the largest liner shipping and terminal operating firms was examined (Chapter 5). More particularly, for the first time the innovative behavior of these market actors was unveiled through the investigation and classification, amongst other, of the patents these companies withhold. Finally, having analyzed the regulatory regime and the motivating powers that enable the reinforcement of market power of incumbent containerized transport actors, we turn our attention on the effects this concentration had on the role, functions and bargaining power of public port authorities (Chapter 6).

With a particular focus on capacity of the latter to effectively regulate and monitor the practices followed by the globalized market actors in liner shipping and terminal operations, the particular case of Greece and its largest port, Piraeus, where an extreme port privatization model was adopted, was selected in order to examine through the utilization of the GOV-AD-MAN conceptual model the magnitude of the re-organization of port resources amongst the public and private sector as well as to investigate whether the regulatory structures and mechanisms established are competent and adequately equipped to undertake the challenging task of port economic regulation. To this end, this final chapter aggregates the findings of all the above undertaken exercises in order to provide an overall conclusive picture. In addition, it also provides an array of suggestions regarding future research paths.

7.2 Conclusions

The advent of containerization coupled by technological revolutions in telecommunications and logistics, transformed radically over the course of years the conduct of international trade. Ports respectively, experienced tremendous changes, in the era of containerization. The initially disruptive innovation brought forth both technical changes as it necessitated the development of novel port infrastructures and superstructures, as well as functional changes as containerization and hence standardization enabled ports to handle not only domestic but also transit and transshipment traffic, through their integration with other terrestrial and marine modes of transport (rail, barges, etc.), thus expanding their catchment areas. As such, the development of specialized port container terminals, dismantled the rigidities and cumbersome procedures characterizing the Fordist era of port operations, enabling a tremendous increase in productivity and efficiency of cargo handling as well as enhancing coordination amongst the transport actors of the increasingly unified transport network.

In parallel, on the port organization terrain, the segmentation of port terminals as well as the commodification of container trades in combination with the diseconomies of scale experienced and the lack of public funds, enabled the idea of deregulating the port industry to bloom. While since the late 80's, the majority of port around the world were state monopolies, organized under a comprehensive port model in which public

port authorities were responsible for undertaking all intermediate and complimentary functions within the port network, the liberalization of ports initiated a massive worldwide wave of devolution which according to its effects in the organizational structure of ports on a global scale, was an equally defining milestone and parameter in reshaping the port industry into what it is today.

More particularly, the disintegration of the port through the process of unbundling not only enabled the entry of private capital into terminal operations but also triggered its global expansion through the strategies of horizontal (Global Terminal Operators) and vertical (Mega Carriers) integration. As such, by dismantling the barriers which halted the expansion and the rise of commercial capital, liberalization of ports (the last sheltered node from competition within the transport network) a) enabled the bundling of services across containerized supply chains and most importantly b) paved the way for the proliferation of incumbent globalized transport actors.

Within this context, while most academic researchers within maritime and port studies have treated the of capital accumulation and of concentration within containerized transport segments as a fait accompli focusing on more operational, organizational and technical aspects of containerized transport, limited analysis has been undertaken to understand in a holistic manner the realization, evolution and the effects of commercial capital's concentration. For this reason, as the issues of capital concentration, centralization and hence accumulation in combination with the potential effects of these processes on the structure and competitive functioning of containerized transport segments (such as liner shipping and terminal operations) have been generally overlooked, this dissertation initially resorted to purely economic streams of literature, to sufficiently evaluate, report and adapt these finding within the transport sector.

While initially giving context to the above terms of capital concentration (organic growth of capital) and centralization (appropriation of existing capitals through vertical and horizontal integration) following their evolution within the different regimes of accumulation of the contemporary capitalist mode of production, we highlighted the capital's tendency to surpass, also with the aid from state regulations,

the barriers that restrain its expansion in order to form oligopolistic and monopolistic market structures which are dominated by powerful multinational corporations. Particular attention has been given to the means of centralization which enable the shift of concentration into a higher plane i.e., of horizontal, vertical and conglomerate integration. While all three processes enhance the competitive position of capital undertaking who pursue them, through gains in efficiency, economies of scale and scope, differentiation, diversification, synergies, internalize input costs and minimize double marginalization amongst other, their final result is an increase in market concentration which may potentially pose significant threats to the competitive functioning of the market(s). As such, especially in highly consolidated industries, integration strategies may be a means to increase market power, reduce rivalry and lessen competition through coordinated (colluding with the remaining market actor on prices, output, capacity) and uncoordinated practices (foreclosure by preventing competitors from securing an efficient output, raising rival's costs, price discrimination) as well as through entrenchment and reciprocity.

Apart from the drivers and the potential theories of harm which are raised by integration strategies, a study of concentration could not have omitted a Marxist analysis of the subject under study as, his works economic works and particularly The Capital's three volumes and Grundrisse focus on examining the laws of capital's motion and capitalist development. As such, the Marxist analysis and especially that relating to the industrial capital's circuit to self-expansion (M – C – M') proved to be a useful methodological tool to analyze a) the role of transport and particularly of containerized transport chains within the context of capitalist development, and b) to the process as well as the motivating forces which drive and accelerate transport (commercial) capital's self-expansion. More specifically, as transport operates within the sphere of circulation and for the circulation of industrial commodities (becoming through space and time the media of its circulation), the integration of the commercial capital circuit attempted for the first time within the scope of this dissertation, in the industrial circuit, highlighted the critical role transport plays in determining the pace of industrial capital's expanded reproduction. The faster the circulation, the faster the latter's appropriation of surplus value.

At the same time, as transport forms a distinct sphere of investment which also operates and abides by the laws of capitalism, its ultimate purpose is also the expanded reproduction achieved through the appropriation of surplus value created in the sphere of circulation. However, as the appropriation of surplus-value and hence the capacity to accumulate and concentrate capital also in the transport sector is only realized after the completion of the capital circuit, the logic of ever-accelerating the circuit's turnaround time, is not only a feature exhibited by industrial capital but by the commercial transport capital as well.

For this reason, we have argued that the introduction of innovations and technological advancements is amongst the few ways to increase the scale of capital in motion and the speed of appropriating surplus-value, in order to expand and accelerate the capacity of containerized transport actors to accumulate capital and increase sectoral concentration. By focusing on the circuits of containerized transport actors (liner carriers and terminal operators) involved within door-to-door supply chain we have illustrated how transport innovations are intensifying the performance of their media functions within the context of their capital circuit. To this end, as (commercial) capital cannot abide a limit to profitability, further increases in the scale as well as in the speed and intensity of performing their media functions, as it occurred in liner shipping with the introduction of ever larger vessels, or with the substitution of man driven equipment with automated machinery in container terminals, broaden further the base and the scale of concentration. In that sense capital concentration also with respect to containerized transport chains is therefore a result of an innovation – competition dipole; a dipole process of creative destruction that revolutionizes the structure, conduct and efficiency from within, incessantly destroying the old one, incessantly creating the new one (Shumpeter, 1942).

Having unveiled the mechanism of capital reproduction as well as the means and triggering forces for enhancing the capacity of containerized transport actors to accumulate capital, the analysis of the evolution of concentration within the containerized segments of liner shipping and terminal operations, reaffirms the tendency of commercial capital towards concentration. As illustrated, both markets experience an increase in concentration over the years, as a result of the expansion

strategies (concentration and centralization processes) pursued, by incumbent participants. More specifically, we have analyzed how the proliferation of such players such as Mega Carriers and Global operators in both respective containerized segments has led to the emergence of an oligopolistic liner market as well as to an oligopsonistic terminal operators' market in which powerful players withhold significant market shares on a global scale.

On the one hand, concentration in liner market has been steadily rising through organic growth (investments ever-larger vessels) as well as through excessive consolidation waves (in the form of M&A' and liner alliances). Such practices which necessitate "deep pockets", have raised the minimum efficient scale of production and hence the barriers to entry for new entrants, enabling major carriers in alliances to dominate the world's main trade routes. Characteristic is the fact that the liner companies comprising the ranking of the 10 largest carriers has remained largely unchanged for the last five years.

Respectively, in the terminal operators' market, horizontal integration strategies followed by pure terminal operators, who pursued replication of their expertise through investment opportunities abroad, were complemented by the vertical integration strategies on behalf of liner carriers which opted to extend their control over the supply chain. The diachronic analysis of the market shares of the largest terminal operators, demonstrates that similarly to the liner segment, concentration and consolidation are progressing.

Said that, it must be acknowledged that increasing consolidation in the liner market as well as excessive expansion in the terminal business Mega Carriers pursued, had a significant effect in the acceleration of concentration in the terminal market. Global Terminal Operators too, engaged in responsive actions, to counterbalance the increase in the bargaining power of Mega Carriers, through novel waves of expansion in new terminals sites and upstream markets as well as through centralization processes such as joint ventures (with other Global Operators as well as Mega Carriers). The end result of these processes, has given rise to a group of terminal operators which have over the course of years reinforced their market power, solidifying their positions in the container terminal market.

While however, apart from the reinforcement of their position in the liner and terminal, the examination of their undertakings and services offered in upstream and downstream containerized segments reveals that the ultimate goal of incumbent actors in both respective markets is to exert increased control over the door-to-door supply chain. As analysis indicates, either directly (through subsidiaries they own) or indirectly (through strategic partnerships), all major liner and terminal operating companies have expanded throughout the containerized transport network offering a holistic package of integrated and bundled services which include (apart from shipping and handling) logistics and storage, intermodal as well as airfreight transport solutions amongst other. Despite the fact that, these upstream and downstream markets are still at large fragmented, the evolution of concentration in liner shipping and terminal operations signifies that also these markets will experience waves of consolidation in the upcoming years as they provide fresh space for capital accumulation.

Apart from market consolidation, a striking fact is that the expansion strategies of major liner and terminal operating firms have led subsequently to a situation where every major participant in both respective markets is cooperating to some extend with the rest. Liner alliances on the one hand as well as numerous established joint ventures amongst Mega Carriers and Global Terminal Operators in terminals across the globe, have formulated an intricate market environment of robust inter-firm relationships were the boundaries of competition and cooperation are very often blurred. In this context, we have argued that market concentration coupled by growing inter-industry relationships amongst consolidated transport actors, not only poses a potential threat to the competitive functioning of the supply chains' markets but may also affect the conduct of international trade.

Particularly for the case of ports, the case studies conducted for the Asian container terminal market (exploring whether members of liner alliances prefer to call on affiliated terminal or not), as well as for the U. S's West and East Coast port ranges (exploring respectively the level of concentration of container flows at ports), reinforce the above belief. More specifically, Liner Alliances, through their members' subsidiaries on terminal operations, as well as through collaborations with GTO's, joint-ventures and inter-firm connections with members of other alliances, have been

able to create extensive networks, a fact that has given them a range of options on how to channel their cargo volumes. As such, whenever it is possible liner alliance members will prefer to call on affiliated terminals, however, the increased bargaining power over local terminal operators as well as the inter-firm relations with members of other alliances, allows them to be more flexible. Respectively, on our second case study, results revealed that both port ranges are experiencing, a phase of consolidation, with major ports increasing their share of the volumes handled in expense of smaller ones. To this end, it is believed that the effects of this rising concentration and market power, which enables incumbent actors in liner shipping and terminal operations to control and affect the global flows of international trade, as illustrated in the two case studies, have only started to unravel.

Meanwhile, apart from organic growth and expansion strategies pursued, liner carriers and terminal operators in their effort to sustain and excel their competitive position, utilize additional centralization means. Such a weapon in their arsenal, as depicted within the context of their capital circuit, is innovation. Academic literature on innovation also suggests that concentrated markets are more prone to innovation.

Patent investigation on EPO's database, partly reaffirmed this fact while revealed that only a proportion of incumbent market actors in the above segments, consider innovations and novel knowledge creation a major resource for their companies' competitiveness. Overall, results indicated a varying degree of inventiveness amongst both liner shipping and terminal operating companies. As such, a number of companies from both containerized transport segments seem to increasingly resort to the patent system to protect their innovative technologies from competition, while others utilize it moderately or not at all. Terminal operators appear to be more innovative than liner shipping companies with the majority of their patents relating to inventions in Cargo handling equipment and devices. Respectively, within the liner shipping segment most patents revolve around Ship Operational Systems and Devices. Interestingly, particularly for the case of terminal operators, the analysis undertaken revealed numerous hidden collaborative patents amongst the operators under study. More specifically, as many of the patents are granted to specific terminals, investigation of their ownership has shown that eight of these terminals are joint

ventures amongst two or more operators. As such, all the patents which are held by these terminals, reinforce even further the inter-industry relations established within the sector.

Finally, while the patent system, may not reflect all the innovative efforts of companies, the number of patents found both on an individual firm level as well as on an aggregate level, suggests that patents are yet another of the various means utilized by companies in liner shipping and terminal operations to enhance operational performance and achieve a sustained competitive advantage. Conversely, companies with increased market share but with little or no use of the patent system, should either utilize other innovative paths or should have deep pockets to acquire innovative technologies from third parties, to stay competitive. In either case, the direct or indirect investment of additional resources to develop or acquire enhanced technological capabilities, may constitute an additional barrier for new entrants in the oligopolistic and oligopsonistic markets of liner shipping and terminal operations respectively.

Considering all the above it has become evident that the unregulated growth of concentration in liner shipping and terminal operators' market has enabled incumbent actors of both markets to attain a significant market and bargaining power over the other nodes within supply chains but also over port authorities. While port liberalization altered the role, functions and priorities of port authorities, the latter focused more on activities that generated revenues for the port, than on their regulatory responsibilities. Added to this, the formation of a global oligopsonistic and oligopolistic market structure in terminal operations and liner shipping respectively, further undermined the capacity of port authorities to efficiently regulate global players within the context of the port system. As a result, the role of the port authorities as regulators within the port and supply chain network diminished.

By confusing the roles of manager and regulator and effectively subordinating the latter to the former (Majone, 2003), port authorities' complacency and inertia enabled Mega Carriers and Global Terminal Operators to exercise their market power and impose their modus operandi while paved the way for them to seek an increased role within the management and administration of ports. This evolution, in turn affected

once more the port industry and the role of the public sector in them, rendering deterministically necessary the need to reconsider their organizational structures and governance models. If ports want to regain control over such global actors, they must enhance, adapt and invent new tools to face today's challenges. To do so, appropriate updating of the regulatory function should be coupled with re-invention of the role of the regulator on a national and international level.

As such, in this emerging environment where the functions and the bargaining power of the public port authorities are being curtailed, we argue that port economic regulation emerges as a new strategic frontier not necessarily in the hands of port authorities. As identified in our analysis, a crucial step for the reposition of ports within the contemporary global market conditions can be the establishment of independent regulatory governance systems, as well as the adoption of robust and holistic economic regulatory tools, which will enable the adequate regulation of global powerful and highly inter-connected containerized transport actors both within and beyond the port premises.

Within this context, we studied the case of Greece's largest port, Piraeus, under the prism of the latter's master concession to the Chinese Mega Carrier Cosco, which led to the reformulation of the port's organization model as well as to a novel division of port resources, functions and responsibilities amongst the private and the public sector. As the role of the public sector, under the particular privatization scheme is confined in undertaking the role of port's regulator and mediator, we describe the institutional reorganization which took place through the establishment of RAP and PPAP. These public entities were assigned with the task of safeguarding and shielding public interest in the novel privatized port environment. As our analysis indicated, while the establishment of these two novel entities reinforces the regulatory and supervisory power of the public sector within the port, specific regulatory tools in their disposition had not been defined. However, effective regulation without effective regulatory tools is a "dead letter". For this purpose, within the context of this dissertation we fill this gap in legislation, by recording and distributing between the two public entities (RAP & PPAP), specific economic regulatory tools that can be utilized in order to empower their task of shielding the port cluster from anti-

competitive and abusive behaviors through adequate and effective regulatory measures.

Moving our analysis one step further, we adapted and expanded the approach of Ibrahimi (2015) and of his GOV-AD-MAN model in the new operating framework of the port of Piraeus, in order to formulate the framework for the assumption of roles and the distribution of functions between the public and private sector. This model allowed us to grasp and display the magnitude of change (from the public to the private sector) over the ports' tangible (Infrastructure, Superstructure & Human Resources) and intangible resources (Port Planning & Synergy Development).

As illustrated, while the private operator undoubtingly becomes the dominant actor in the management and organization of the port of Piraeus, we sketch the roles and responsibilities of the public regulatory authorities that can counterbalance the monopolistic position of the private operator within the port. In our view, the enforcement of independent economic regulation within the port sector can become the vehicle that will allow ports to face the challenges posed in the increasingly integrated and concentrated by powerful players, global supply chains.

However, the situation in the port industry calls for enhancing and reinforcing regulatory competencies both within ports and in the upstream and downstram segments of the supply chains. Since market actors acknowledge supply chains as a singular network of integrated services, economic regulations ought to be scoped accordingly. Regulators from their side should be aware of the benefits and risks of individual supply chain steps, in order to regulate any potential anti-competitive behavior. Our assessment indicates that solely rethinking and repositioning the port system in today's complex supply chains is not sufficient in order to regulate powerful and globalized transport actors. For this reason, the establishment of a formal International Regulatory Netowrk through which regulatory institutions would reinforce their cooperation and align their regulatory strategy, plans and actions would aid in addressing the challenges of our era. Initiatives towards such a direction will signal a new era, the era of the regulated governance of globalization.

7.3 Suggestions for further research

Overall, this thesis provides some unique insights with regards to the issues and challenges the port industry faces as a result of the increasing concentration within the containerized segments of liner carriers and terminal operators. However, acknowledging the limitations of this research in terms of scope, it is believed there is still a long way to fully examine and investigate the effects of concentration within the containerized transport sector. As such, during the writing of this dissertation novel research topics for further investigation have been brought into surface.

More specifically, this study focuses on the examination of the motivating powers, the realization and evolution of capital concentration in the liner shipping and terminal operators' market segments as well as on the effects the latter has on the port industry. As such further research, could be undertaken (utilizing also the adjusted methodological framework of M-C-M' capital's circuit developed here) to examine the evolution and effects of concentration on the containerized segments of multimodal inland transportation as well as of freight forwarders, to investigate whether they are also experiencing analogous tendencies towards consolidation.

Additionally, plenty of room for further research on the role of innovation within containerized supply chains is exhibited. As illustrated, technological advancements and innovations within the transport industry act as time and space compression mechanisms which enable the faster circulation of commodity capital as well as of commercial capital. As such, it is of particular interest to investigate how the advanced prospects of automation as well as of novel technologies like block chain will reform and affect containerized transport chains. Within this context, issues relating to the effects of innovation in reinforcing time-based competition illustrate particular interest.

Moreover, this study has a number of case studies which relate to the effects of concentration (in liner shipping and terminal operations) on the conduct of containerized trade at ports as well as to the necessary restructuring of the port regulatory establishments in order to enhance the regulatory control and oversight over globalized transport actors. As such, an extension and replication of these exercises for other port regions and other country specific cases, in order to compare

and cross-check findings with other geographic markets could also be an interesting field of further research.

Further on, as containerized transport chains have evolved into a core component of modern capitalism, influencing significantly all the sectors of the global economy, a deeper investigation of the effects, the (anti-competitive) practices followed by major liner carriers and terminal operators during the outburst of the COVID-19 pandemic on particular industries is necessitated.

Conclusively, as the port industry is undergoing changes as a result of technological advancements as well as of the increasing market power of incumbent market players, novel research approaches on ways that increase the bargaining power of port authorities vis-à-vis powerful market actors are required. Particularly, as terminal concessions are amongst the most significant tools port authorities possess in order to shape and influence future port development, an ideal type of port concession (adjustable to the new technological advancements and the particular characteristics of each port) should be envisioned.

References

AAPA, (2019). 2018 National Economic Impact of the U.S. Coastal Port System: Executive Summary. Conducted by Martin Associates, March, 2019. Available at: https://aapa.files.cmsplus.com/Martin%20study_executive%20summary%202018%20US%20coastal%20port%20impacts%20final.docx

Abbott, M., & Ma, X. (2013). The regulatory governance of the telecommunication and electricity industries in small, island nations. Utilities Policy, 26, 7-16.

Acciaro, M. (2010). Bundling Strategies in Global Supply Chains. Rotterdam, The Netherlands: Erasmus University Rotterdam.

Acciaro, M., Vanelslander, T., Sys, C., Ferrari, C., Roumboutsos, A., Giuliano, G., ... & Kapros, S. (2014). Environmental sustainability in seaports: a framework for successful innovation. Maritime Policy & Management, 41(5), 480-500.

Acciaro, M., Ferrari, C., Lam, J. S., Macario, R., Roumboutsos, A., Sys, C., ... & Vanelslander, T. (2018). Are the innovation processes in seaport terminal operations successful? Maritime Policy & Management, 45(6), 787-802.

Acciaro, M., & Sys, C. (2020). Innovation in the maritime sector: aligning strategy with outcomes. Maritime Policy & Management, 47(8), 1045-1063.

Adeleke, B. S., Onodugo, V. A., & Akanji, O. J. (2018). Does Horizontally Integrated Firms Enjoy Competitive Advantage in The Value-Chain? Evidence from The Nigerian financial sector.

Adelman, M. A. (1949). Integration and antitrust policy. Harv. L. Rev., 63, 27.

Adelman, M. A. (1955). Concept and statistical measurement of vertical integration. In Business concentration and price policy (pp. 281-330). Princeton University Press.

Agamben, G., & Borrás, M. R. (2003). El estado de excepción. Mientras tanto, (86), 57-66.

Aglietta, M. (1998). Capitalism at the turn of the century: regulation theory and the challenge of social change. New left review, 41-90.

Aglietta, M. (2000). A theory of capitalist regulation: The US experience (Vol. 28). Verso.

Alchian, A. A. (1977). Some economics of property rights, economic forces at work. Liberty Fund: Indianapolis, 127-149.

Alexander, I., & Irwin, T. (1996). Price Caps, Rate-of-Return Regulation, and the Cost of Capital. Public Policy for the Private sector (Note No. 87). Washington: World Bank Group.

Allain, M. L., Chambolle, C., & Rey, P. (2016). Vertical Integration as a Source of Hold-up. The Review of Economic Studies, 83(1), 1-25.

Allardice, D.R., & Erdevig, E. (1966). The significance and measurement of concentration. Southern Economic Journal. 32: 429-39.

Allen, B. T. (1971). Vertical integration and market foreclosure: The case of cement and concrete. The Journal of Law and Economics, 14(1), 251-274.

Alphaliner, (2009). Top 100: Operated fleets. Alphaliner Weekly Newsletter 2009-Week 16.

Alphaliner, (2012). Top 100: Operated fleets as per 7 December. Available from: www.alphaliner.com

Alphaliner, (2015). Top 100: Operated fleets as per 9 January 2015. Available from: www.alphaliner.com

Alphaliner, (2016). Top 100: Operated fleets as per 14July 2016. Available from: www.alphaliner.com

Alphaliner, (2020). Top 100: Operated fleets as per 3 March 2020. Available from: www.alphaliner.com

Alphaliner, (2021). Top 100: Operated fleets as per 15August 2021. Available from: www.alphaliner.com

Al-Sunaidy, A., & Green, R. (2006). Electricity deregulation in OECD (Organization for Economic Cooperation and Development) countries. Energy, 31(6), 769-787.

Altvater, E. (1989). Ecological and economic modalities of time and space. Capitalism Nature Socialism, 1(3), 59-70.

Alvarez-SanJaime, Ó., Cantos-Sánchez, P., Moner-Colonques, R., & Sempere-Monerris, J. J. (2013). Vertical integration and exclusivities in maritime freight transport. Transportation Research Part E: Logistics and Transportation Review, 51, 50-61.

Ameryoun, A., Meskarpour-Amiri, M., Dezfuli-Nejad, M. L., Khoddami-Vishteh, H. R., & Tofighi, S. (2011). The assessment of inequality on geographical distribution of non-cardiac intensive care beds in Iran. Iranian journal of public health, 40(2), 25.

Amihud, Y., & Lev, B. (1981). Risk reduction as a managerial motive for conglomerate mergers. The bell journal of economics, 605-617.

Andrews, K. R. (1971). Concept of corporate strategy. Dow Jones-Irwin, Homewood, IL.

Angelopoulos, J., Leonardou, P., & Vrysagotis, V. (2019). Uncharted Waters: Independent Regulation for Port Concessions. IAME 2019, Athens, Greece.

Angelopoulos, J., Chlomoudis, C., & Dalvadani, E. (2014). International Dock Work Conventions in the era of Post-Globalization. SPOUDAI Journal of Economics and Business, 64(1), 5-15.

Angelopoulos, J., Chlomoudis, C. & Styliadis T. (2017). Effect of global supply chain developments on the governance of port regulation. In Pettit, S. & Beresford, A. (Eds.). Port Management: Cases in Port Geography, Operations and Policy (pp. 62-93). Kogan Page Publishers.

Arduino, G., Aronietis, R., Crozet, Y., Frouws, K., Ferrari, C., Guihéry, L., ... & Lloyd, M. (2013). How to turn an innovative concept into a success? An application to seaport-related innovation. Research in Transportation Economics, 42(1), 97-107.

Argyres, N. (1996). Evidence on the role of firm capabilities in vertical integration decisions. Strategic Management Journal, 17(2), 129-150.

Arrow, K. J. (1974). The limits of organization. WW Norton & Company.

Arrow, K. J. (1962). Economic welfare and the allocation of resources for invention (pp. 609-626). Princeton University Press.

Ashman, S., & Callinicos, A. (2006). Capital accumulation and the state system: assessing David Harvey's The New Imperialism. Historical Materialism, 14(4), 107-131.

Asker, J. (2016). Diagnosing foreclosure due to exclusive dealing. The Journal of Industrial Economics, 64(3), 375-410.

Backhaus, H. G. (1980). 'On the Dialectics of the Value-Form', Thesis Eleven, 1: 99–120.

Baldwin, R., & Forslid, R. (2014). The development and future of factory Asia. In Asia and Global Production Networks. Edward Elgar Publishing.

Baran, P. A., & Sweezy, P. M. (2017). The Age of Monopoly Capital: Selected Correspondence of Paul M. Sweezy and Paul A. Baran, 1949-1964. NYU Press.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: an empirical investigation. MIS quarterly, 169-196.

Bai, Y., Zhang, Y., & Shen, C. (2010). Remote container monitoring with wireless networking and cyber-physical system. Mobile Congress (GMC) Global (pp. 1–5).

Bailey, E., E. (1981). Contestability and the design of regulatory and antitrust policy. American Economic Review, 71(2), pp. 179—183

Bailey, E. E. & Panzar J. C. (1981). The contestability of airline markets during the transition to deregulation, Law and Contemporary Problems, 44, pp. 125—145

Bain, J. S. (1956). Advantages of the large firm: production, distribution, and sales promotion. Journal of marketing, 20(4), 336-346.

Bain, J. S. (1959). Industrial Organization (New York, USA: Wiley).

Baird, A. J. (1995). Privatisation of trust ports in the United Kingdom: Review and analysis of the first sales. Transport Policy, 2(2), 135-143.

Baird, A., (1999). “Privatization defined: Is it the universal panacea?”. Napier University, Edinburgh, United Kingdom.

Baird, A. (2000a). Port privatisation: Objectives, extent, process and the UK experience. International Journal of Maritime Economics, 2(3), 177-194.

Baird, A. (2000b). Privatisation and deregulation in seaports. In B. A. in Bradshaw, Privatization and Deregulation in Transport (pp. 397-412). London: MacMillan Press.

Balakrishnan, S., & Wernerfelt, B. (1986). Technical change, competition and vertical integration. Strategic management journal, 7(4), 347-359.

Baltazar, R., & Brooks, M. R. (2001). The governance of port devolution: A tale of two countries. In World conference on transport research (pp. 22-27).

Barney, J. (1986). Strategic factor markets: expectations, luck, and business strategy, Management Science 32: 1231–1241. http://dx.doi.org/10.1287/mnsc.32.10.1231

Barney, J. (1991a). Competitive Advantage. Journal of management, 17(1), 99-120.

Barney, J. (1991b). Firm resources and sustained competitive advantage. Journal of management, 17(1), 99-120

Barney, J. (1999). How a firm´s capabilities affect boundary decisions, Sloan Management Review Spring: 137–145.

Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. Journal of management, 27(6), 643-650.

Bartland, J. (2004). Contestable Market Theory as a Regulatory framework: An Austrian Post-Mortem. The Quarterly Journal of Austrian Economics Vol. 7, No. 3 (Fall 2004), pp. 3–28.

Baumol, W. J. (1982). Contestable markets: an uprising in the theory of industry structure. The American Economic Review, Vol. 72, No. 1, pp. 1-15. http://www.jstor.org/stable/1808571?origin=JSTOR-pdf

Baumol, W. J. (1986). Productivity growth, convergence, and welfare: what the long-run data show. The American economic review, 1072-1085.

Baumol, W. J., Panzar, J., & Willig, R. (1986). Contestable Markets and the Theory of lndustry Structure. New York: Harcoutt Brace Jovanovich.

Baumol, W. J. (2004). Entrepreneurial enterprises, large established firms and other components of the free-market growth machine. Small business economics, 23(1), 9-21.

Beato, P. (1999). Retail competition in electricity. Inter-American Development Bank.

Behdani, B., Wiegmans, B., Roso, V., & Haralambides, H. (2020). Port-hinterland transport and logistics: emerging trends and frontier research. Maritime Economics & Logistics, 22(1), 1-25.

Bellofiore, R. (2009). The monetary circuit of capital in the 0. In Rosa Luxemburg and the Critique of Political Economy (pp. 69-79). Routledge.

Beresford. A.K.C., Gardner, B. M., Pettit, S.J., Naniopoulos, A., Wooldridge, C.F. (2004). The UNCTAD and WORKPORT Models of Port Development: Evolution or Revolutions?., Maritime Policy and Management, volume 31, number 2, pp.93-107

Bernhofen, D. M., El-Sahli, Z., & Kneller, R. (2016). Estimating the effects of the container revolution on world trade. Journal of International Economics, 98, 36-50.

Besanko, D. Dranove, D. Shanley, M. & Schaefer, S. (2007). Economics of Strategy (4th Ed.) USA: McGraw-Hill

Bessen, J., & Hunt, R. M. (2007). An empirical look at software patents. Journal of Economics & Management Strategy, 16(1), 157-189.

Betton, S., Eckbo, B. E., & Thorburn, K. S. (2008). Corporate takeovers. In Handbook of empirical corporate finance (pp. 291-429). Elsevier.

Biancini, S., & Ettinger, D. (2017). Vertical integration and downstream collusion. International Journal of Industrial Organization, 53, 99-113.

Bichou, K. (2007). Review of Port Performance Approaches and a Supply Chain Framework to Port Performance Benchmarking. Research in Transportation Economics, Vol. 17, pp.567-598.

Biggar, K. (2022, 1st of April). US Senate passes Ocean Shipping Reform Act. Splash 24/7. Available at: https://splash247.com/us-senate-passes-ocean-shipping-reform-act/

Bikker, J. A., & Haaf, K. (2002). Measures of competition and concentration in the banking industry: a review of the literature. Economic & Financial Modelling, 9(2): 53-98.

B.I.M.C.O. (2010). “Container shipping - markets are over the hill of the rebound”. Available from: https://www.bimco.org/Reports/Market_Analysis/2010/1210_Box.aspx

Bjerkan, K. Y., & Seter, H. (2019). Reviewing tools and technologies for sustainable ports: Does research enable decision making in ports?. Transportation Research Part D: Transport and Environment, 72, 243-260.

Blair, R. D., & Kaserman, D. L. (2014). Law and economics of vertical integration and control. Academic Press.

Blignaut, L., Plessis, L., and Lurie, J. (20100 Vertical Integration and the refusal to supply scarce goods: a legal and economic framework for analysis of prohibited practices. Edward Nathan Sonnenbergs Inc.

Bockrath, J. (2016). Alliances and concentration: the economic consequences of market structure in the liner shipping industry (Doctoral dissertation, University of Delaware).

Boehm, J., & Sonntag, J. (2020). Vertical integration and foreclosure: evidence from production network data.

Bonbright, J. C., Danielsen, A.L., and Kamerschen, D.R. (1988). Principles of Public Utility Rates. Arlington: Public Utilities Reports

Borenstein, S., Bushnell J., & Knittel, C.R. (1999). Market power in electricity markets: Beyond concentration measures. The Energy Journal, 65-88

Bork, R. (1954). Vertical integration and the Sherman Act: The legal history of an economic misconception. U. Chi. L. Rev., 22, 157.

Bork, R. (1978). The Antitrust Paradox: A Policy at War with Itself (New York, USA: The Free Press).

Bonneuil, C., & Fressoz, J. B. (2016). The shock of the Anthropocene: The earth, history and us. Verso Books.

Boyer, K.K., & Lewis, M.W. (2002). Competitive priorities: Investigating the need for supply chain trade-offs in operations strategy. Journal of Operations Management, 11(1), 9-20.

Braakman, A. J. (2017). Brexit and its consequences for containerised liner shipping services. The Journal of International Maritime Law, 23(4), 254-265.

Ibrahimi, K. (2015). “On the institutional and operational (re)organization of seaports: The Gov-Ad-Man approach”. Proceedings of the 2015 International Association of Maritime Economists Conference, 24-26 August 2015, Kuala Lumpur, Malaysia pp. 1-30.

Brandao, T. G. D. (2008). Essays on international capital flows (Doctoral dissertation, Massachusetts Institute of Technology).

Brandenburger, A.M., Nalebuff, B.J. (1996). Co-opetition. Doubleday, New York

Bratland, J. (2004). Contestable market theory as a regulatory framework: An Austrian postmortem. The Quarterly Journal of Austrian Economics, 7(3), 3-28.

Brealey, R. A., Myers, S. C., & Allen, F. (2017). Principles of Corporate Finance (12th ed.). New York: McGraw-Hill Education.

Bresnahan, T. F., & Levin, J. D. (2012). Vertical integration and market structure (No. w17889). National Bureau of Economic Research.

Brewer, P. R. (1996). Contestability in UK rail freight markets: The economics of open access. Transport Policy, 3(3), 91-98.

Brooks, M. R. (2000). Restructuring in the liner shipping industry: A case study in evolution. Centre for International Business Studies, Dalhousie University.

Brooks, M. R. (2004). The governance structure of ports. Review of network economics, 3(2).

Brooks, M. R. & Cullinane, K. eds. (2007), Devolution, Port Performance and Port Governance. Oxford: Elsevier.

Brouer, B. D., Karsten, C. V., & Pisinger, D. (2016). Big data optimization in maritime logistics. In A. Emrouznejad (Ed.), Big data optimization: Recent developments and challenges (Vol. 18, pp. 319–344). New York City, NY: Springer International Publishing

Bundeskartellamt, (2006). Conglomerate Mergers in Merger Control -Review and Prospects.

Burmeister, H. C., Bruhn, W., Rødseth, Ø. J., & Porathe, T. (2014). Autonomous unmanned merchant vessel and its contribution towards the e-Navigation implementation: The MUNIN perspective. International Journal of e-Navigation and Maritime Economy, 1, 1–13.

Burrus, B. R. (1965). Tying Arrangements and Reciprocity: A Lawyer's Comment on Professor Ferguson's Analysis. Law and Contemporary Problems, 30(3), 581-589.

Bustos, P. (2011). Trade liberalization, exports, and technology upgrading: Evidence on the impact of MERCOSUR on Argentinian firms. American economic review, 101(1), 304-40.

Butler, R. V., & Huston, J. H. (1989). How contestable are airline markets? Atlantic Economic Journal, 17(2), 27-35.

Cai, H., & Obara, I. (2009). Firm reputation and horizontal integration. The RAND Journal of Economics, 40(2), 340-363.

Caldeira, A., Moysés, G.L., Costantin, P.D., Lex, S., Sílvio, & Bertoncello, L.T. (2005). Vertical Integration and Corporate Diversification Strategies – Study Based on Brazilian Industries.

Calkins, S. (1983). The new merger guidelines and the Herfindahl-Hirschman Index, California Law Review. 71 (6): 402-429.

Call, G., & Keeler, T. (1986). Airline deregulation, fares, and market behavior: Some empirical evidence. In A. Daughety (Ed.), Analytical Studies in Transport Economics (pp. 221-248). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511895913.010

Capros, P. (2003). Independence of Energy Regulators: New Challenges. Rome: World Forum on Energy Regulation.

Cariou, P. (2008). Liner shipping strategies: an overview. International Journal of Ocean Systems Management, 1(1), 2-13.

Carlan, V., Sys, C., Vanelslander, T., & Roumboutsos, A. (2017). Digital innovation in the port sector: Barriers and facilitators. Competition and regulation in network industries, 18(1-2), 71-93.

CBS Insights, (2018). 8 Companies That Own the Beauty Aisle. Available at: https://www.cbinsights.com/research/top-beauty-brands/

CCRED. (2014). Review of regulation in the Ports Sector. Johannesburg: By Trade and Industrial Policy Strategies (TIPS).

CEER. (2015). Council of European Energy Regulators. Retrieved 02 02, 2015, from http://www.ceer.eu/portal/page/portal/EER_HOME

Cetin, C. K., & Cerit, A. G. (2010). Organizational effectiveness at seaports: a systems approach. Maritime Policy & Management, 37(3), 195-219.

CFA, (2017). CFA Program Curriculum 2017 Level II, Volumes 1 – 6. Wiley Publications.

Chambers, S. (2021, 16th of August). Philippine authorities suspect collusion among container carriers. SIpash 24/7. Available at: https://splash247.com/philippine-authorities-suspect-collusion-among-container-carriers/

Chambers, S. (2022, 1st of April). Liner Shipping Investigations multiply across the globe. Splash 24/7. Available at: https://splash247.com/liner-pricing-investigations-multiply-across-the-globe/

Chandler, A. D. (1990). Scale and scope. Cambridge, MA: The Belknap Press.

Chao, C. M. C. (2006). Study of the possibility of container port alliance. Hong-Kong University, M.A in transport policy and planning dissertation

Chatterjee, S. (1991). Gains in vertical acquisitions and market power: Theory and evidence. Academy of Management Journal, 34(2), 436-448.

Chen, Y. (1997). Equilibrium Product Bundling. Journal of Business, Vol.70 no.1, pp. 85-103.

Chen, M.J. (2008). Reconceptualizing the competition-cooperation relationship: a transparadox perspective. Journal of Management Inquiry 17 (4), 288–305.

Chen, Y., & Riordan, M. H. (2007). Vertical integration, exclusive dealing, and ex post cartelization. The RAND Journal of economics, 38(1), 1-21.

China COSCO Shipping, (2016). "Group Profile". Available from: http://en.coscocs.com/col/col6915/index.html

Chipty, T. (1995). Horizontal integration for bargaining power: Evidence from the cable television industry. Journal of Economics & Management Strategy, 4(2), 375-397.

Chipty, T. (2001). Vertical integration, market foreclosure, and consumer welfare in the cable television industry. American Economic Review, 91(3), 428-453.

Chlomoudis, C. I., & Pallis, A. A. (1998). Ports, Flexible Specialization, and Employment Patterns. In 8th World Conference on Transport research.

Chlomoudis, C., & Pallis, A. (1999). The Need for a New Philosophy or Port Management and Organization: Effective Responses to Contemporary Challenges. European Research Studies, Vol. 2, No 2, pp. 91-103

Chlomoudis, C.I, Karalis, A.V., Pallis, A.A. (2000). "Transition to a new reality: Theorising the organisational restructuring of ports". Paper presented at the Special Interest Group on Ports and Maritime Transport International Workshop, Genoa - Italy, 8-10 June 2000. (Internet Publication: http://www.informare.it/news /forum/2000/sig2/chlomoudis.asp). Special Interest Group on Port and Maritime Transport International Workshop

Chlomoudis, C. I. (2006). Port Planning in the Modern Port Industry, (in Greek), J&J Hellas, ISBN: 960-8461-49-9, Piraeus Greece 2006

Chlomoudis C. I. (2011). "Trends and Developments in the port industry. Port business and systems in the era of the organization and operation of competitive ports", Chlomoudis Konstantinos, Papazisis Publications, 2011, ISBN 978-960-02-2613-3

Chlomoudis, C. I., & Styliadis, T. (2015). A framework for the institutional governance of regulation and the regulatory tool at hand, in port services. In Econship Conference (pp. 1-20).

Christensen, B. A. (2012). On the Road to Nowhere? Some thoughts on the ideas of innovation and ideology. International Journal of Žižek Studies, 6(1).

Chopra, S. (2003). Designing the distribution network in a supply chain. Transportation Research Part E: Logistics and Transportation Review, 39(2), 123-140.

Chua, C. (2019). State, Capital, Logistics - a reading guide in Période journal (published in French). Période.

Chua, C. (2020). Logistics. In The SAGE Handbook of Marxism, by Farris S, Toscano, A. and Skeggs B (eds.) Sage Publications Ltd.

Church, J. (2008). Vertical mergers. Issues in competition law and policy, 2, 1455.

Čišić, D., Hadžić, A. P., & Tijan, E. (2009). The economic impact of e-Business in seaport systems. MIPRO 2009–32nd.

Clarke, S. (1988). Overaccumulation, class struggle and the regulation approach. Capital & Class, 12(3), 59-92.

CLECAT (2021, 4th January). Shippers and forwarders call on European Competition Authorities to act. Press Release. Available at: https://www.clecat.org/news/press-releases/shippers-and-forwarders-call-on-european-competiti

CMA-CGM, (2015). “CMA CGM to acquire NOL, reinforcing its position in global shipping”. Available from:https://www.cma-cgm.com/news/1011/cma-cgm-to-acquire-nol-reinforcing-its-position-in-global-shipping

CMA-CGM, (2017, January 26th). Signing of MOU between COSCO SHIPPING Ports and CMA Terminals Holding, the CMA CGM port subsidiary, to reinforce their strategic cooperation on port operations and investments. Available from: https://www.cma-cgm.com/news/1464/signing-of-mou-between-cosco-shipping-ports-and-cma-terminals-holding-the-cma-cgm-port-subsidiary-to-reinforce-their-strategic-cooperation-on-port-operations-and-investments

Coase, R. H. (1937). “The Nature of the Firm.” Economica, 4(16): 386–405.

Coen, D. (2008). EU Lobbying: Theoretical and Empirical Developments in EU lobbying. London: Routledge.

Coen, D., & Thatcher, M. (2008). "Network Governance and Multi-level Delegation, European Networks of Regulatory Agencies". Journal of Public Policy, Vol.28 No.1, pp. 49-71.

Congress, U. S. (1980). House of Representatives Subcommittee on General Oversight and Minority Enterprise on Committee on Small Business. Hearings on Minority Truckers Participation in Federal Procurement Contracts. Washington: US Government Printing Office.

Conner, K. R. (1991). A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of the firm?. Journal of management, 17(1), 121-154.

Coşar, A. K., & Demir, B. (2018). Shipping inside the box: Containerization and trade. Journal of International Economics, 114, 331-345.

Cosco Pacific Ltd. (2009). “Commencement of 35-year Concession in relation to Piers 2 and 3 of Piraeus Port”. Press Release. Available from: http://www.coscopac.com.hk/eng/media/p091001.php

Cosco Pacific Ltd. (2014). Annual Report 2014, China.

Cousins, P. D., & Menguc, B. (2006). The implications of socialization and integration in supply chain management. Journal of operations management, 24(5), 604-620.

Cowen D. (2014a). The Deadly Life of Logistics: Mapping Violence in Global Trade, University of Minnesota Press, Minneapolis.

Cowen, D. (2014b). Disrupting distribution: Subversion, the social factory, and the “state” of supply chains. Viewpoint Magazine, 4, 1-12.

C.S.A.V., (2014). "CSAV and HAPAG-LLOYD Complete the Merger and Become the Fourth Largest Container Liner Shipping Company in the World”.

Cudhay, B. J. (2006). Box Boats: How Container Ships Changed the World. New York, NY: Fordham University Press.

Cullinane, K., & Haralambides, H. (2021). Global trends in maritime and port economics: the COVID-19 pandemic and beyond. Maritime Economics & Logistics, 23(3), 369-380.

Curado, C., & Bontis, N. (2006). The knowledge-based view of the firm and its theoretical precursor. International Journal of Learning and Intellectual Capital, 3(4), 367-381

Dagnino, G. B., & Padula, G. (2002, May). Coopetition strategy: a new kind of interfirm dynamics for value creation. In Innovative research in management, European Academy of Management (EURAM), second annual conference, Stockholm, May (Vol. 9).

Dagnino, G.B., Levanti, G., Minà, A. and Picone, P.M. (2015), "Interorganizational network and innovation: a bibliometric study and proposed research agenda", Journal of Business & Industrial Marketing, Vol. 30 No. 3/4, pp. 354-377. https://doi.org/10.1108/JBIM-02-2013-0032

Danyluk, M., 2018, Capital's logistical fix: Accumulation, globalization, and the survival of capitalism. Environment and Planning D: Society and Space, 36(4), 630-647.

Davies, J. E. (1986). Competition, contestability and the liner shipping industry. Journal of Transport Economics and Policy, 299-312.

Davies, J. E. (1989). Competition, Contestability, and the Liner Shipping Industry (Comment and Rejoinder), Journal of Transport Economics and Policy, 23(2), pp.199-208.

Davis, R., & Duhaime, I. M. (1992). Diversification, vertical integration, and industry analysis: New perspectives and measurement. Strategic Management Journal, 13(7), 511-524.

DCSA, (2020). Our Members. Available Online: https://dcsa.org/about/members/ (Accessed 22/11/2021).

Dean, J. (1969). Causes and consequences of growth by conglomerate merger: an introduction. John's L. Rev., 44, 15.

Deaux, J., Li, Y.Y., & Koh, A. (2021, 13th August). China's Port Shutdown Raises Fears of Closures Worldwide. Bloomberg. Available at: https://www.bloomberg.com/news/articles/2021-08-12/massive-china-port-shutdown-raises-fears-of-closures-worldwide

De Borger, B., & De Bruyne, D. (2011). Port activities, hinterland congestion, and optimal government policies the role of vertical integration in logistic operations. Journal of Transport Economics and Policy (JTEP), 45(2), 247-275.

Defilippi, E. A. (2010). Access Regulation for Naturally Monopolistic Port Terminals: Lessons from Regulated Network Industries. Rotterdam, The Netherlands: Erasmus University Rotterdam.

De Langen, P. (2004). "The performance of seaport clusters - A framework to analyze cluster performance and an application to the seaport clusters of Durban, Rotterdam and the Lower Mississippi". PhD thesis, Erasmus Universiteit Rotterdam, Netherlands.

De Langen, P. W., & Pallis, A. A. (2007). Entry barriers in seaports. Maritime Policy & Management, 34(5), 427-440.

De Langen, P., Van den Berg, R., & Willeumier, A. (2012). A new approach to granting terminal concessions: the case of the Rotterdam World Gateway terminal. Maritime Policy and Management: the flagship journal of international shipping and port research, Vol.39 No.1,pp. 79-90.

De Lombaerde, P. and Verbeke, A. (1989). Assessing International Seaport Competition: A Tool for Strategic Decision Making. International Journal of Transport Economics. 16(2): 175-192.

De Monie, G., Rodrigue, J. P., & Notteboom, T. (2011). Economic cycles in maritime shipping and ports: The path to the crisis of 2008. Integrating Seaports and Trade Corridors, 13-30.

Demsetz, H. (1988). The theory of the firm revisited. Journal of Law, Economics, and Organization 4(1): 141–162.

Den Hertog, J. A. (2010). Review of economic theories of regulation. Discussion Paper Series/Tjalling C. Koopmans Research Institute, 10(18).

Derbie, J., & Ruby, C. (2009). Approche des reformes portuaires europeenes et nord americaines (Canada): Elements de reflexion pour la politique portuaire francaise. Paris, France: Institut National de Recherche sur les Transports et leur Sécurité (INRETS)

De Souza, G. A., Beresford, A. K., & Pettit, S. J. (2003). Liner shipping companies and terminal operators: Internationalisation or globalisation?. Maritime Economics & Logistics, 5(4).

Dess, G.G, Lumpkin, G.T, Eisner, A.B. (2007). Strategic management creating competitive advantage. 3rd. Edition, New York: McGraw-Hill. Co., Inc

Dicevska, S., Nikolovski, P., Karadjova, V., Zdravkoski, I., & Menkinoski, G. (2016). Strategic alliances and innovations in the international business. International Journal of Sciences: Basic and Applied Research (IJSBAR), 27(1), 57-64.

Di Vaio, A., & Varriale, L. (2018). Management innovation for environmental sustainability in seaports: Managerial accounting instruments and training for competitive green ports beyond the regulations. Sustainability, 10(3), 783.

DOJ, (1984). Non-Horizontal Merger Guidelines. U.S Department of Justice (DOJ) and the Federal Trade Commission (FTC).

Domínguez, A. G. (2014). "'Smart Ships': Smart Mobile Applications, Cloud and Bigdata on Marine Traffic for Increased Safety and Optimized Costs Operations", 2014 2nd International Conference on Artificial Intelligence, Modelling and Simulation, pp. 303-308. IEEE.

Dooms, M., Macharis, C., & Verbeke, A. (2004). Proactive stakeholder management in the port planning process: empirical evidence from the Port of Brussels.

Doyle, C. A. (1981). Reciprocity as a Basis for Challenging Conglomerate Mergers Under the Clayton Act. Loy. U. Chi. LJ, 12, 481.

Drenan, M. T. (2015). Watchdogs of the World: Global Linear Conference Regulators in the Modern Shipping Market and Why the P3 Agreement Failed. Mich. St. Int'l L. Rev., 24, 79.

Drewry, (2009). Global Container Terminal Operator - Annual Review and Forecast, London: Drewry.

Drewry, (2010). Global Container Terminal Operator - Annual Review and Forecast, London: Drewry.

Drewry, (2014). Global Container Terminal Operator - Annual Review and Forecast, London: Drewry.

Drewry, (2015). Global Container Terminal Operator - Annual Review and Forecast, London: Drewry.

Drewry, (2020). Global Container Terminal Operator - Annual Review and Forecast, London: Drewry

Drewry, (2021, October). Container Forecaster Newsletter. London: Drewry.

Dreyer, B., Isaksen, J.R., and Grønhaug, K. (2001) The art of vertical integration - profitability considerations. In: G. Stefanusson and B. Tilanus (Eds), Collaboration in Logistics - Connecting Islands using Information Technology. Gøteborg, Chalmers University of Technology

DPW (Dubai Port World), (2008). Annual Review. Available at: http://web.dpworld.com/wpcontent/uploads/2014/05/2008DPWorldAnnualReport.pdf.

DPW (Dubai Port World), (2021, 19th August). DP World reports strong 1H2021 financial results. Available at: https://www.dpworld.com/news/releases/dp-world-reports-strong-1h2021-financial-results/

Duchâtel, M. (2019). China's Port Investment: The Flag Behind The Trade. In Institut Montaigne's Asia Program, China Trends, Institute Montagne Publication, Paris, 1-2.

Dupin, C. (2015). FMC's Lidinsky worries about shipping alliances become supra national forces. American Shipper. http://www.americanshipper.com/main/news/b3903a30-e97c-41e6-9fdc-db38d7de6088.aspx.

Dyer, J. H., Kale, P., & Singh, H. (2001). How to make strategic alliances work. MIT Sloan management review, 42(4), 37-37.

Dyer-Witheford, N. (1999). Cyber-Marx: Cycles and circuits of struggle in high-technology capitalism. University of Illinois Press.

Edwards, C.D (1970) The Changing Dimensions of Business Power, 44 ST. JOHN's L. REV. 416, 431

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they?. Strategic management journal, 21(10-11), 1105-1121.

Elberfeld, W. (2002). Market size and vertical integration: Stigler's hypothesis reconsidered. The Journal of Industrial Economics, 50(1), 23-42.

Elia, S., Maggi, E., & Mariotti, I. (2010). Horizontal, vertical and conglomerate investments in the Italian logistics industry: drivers and strategies. European Regional Science Association.

Elhauge, E. (2009). Tying, bundled discounts, and the death of the single monopoly profit theory. Harv. L. Rev., 123, 397.

Elliott, J. E. (1980). Marx and Schumpeter on capitalism's creative destruction: A comparative restatement. The Quarterly Journal of Economics, 95(1), 45-68.

Elsayeh, M.E. (2015). The Impact of Port Technical Efficiency on Mediterranean Container Port Competitiveness (Doctoral dissertation, University of Huddersfield).

Epstein, G. A. (2005). Introduction. In: Epstein, G. A. (Ed.). Financialization and the World Economy. Cheltenham, UK: Edward Elgar, p. 3-16.

EPO, (2021). Espacentet Database. Available Online: https://worldwide.espacenet.com/?locale=en_EP (Accessed 12/1/2021)

E.C (European Commission), (1996). Council Directive 96/67/EC of 15 October 1996 on access to the ground handling market at Community airports OJ L 272, 25.10.1996, p. 36–45.

E.C. (European Commission), (2001). Council Directive 95/18/EC on the licensing of railway undertakings. Official Journal L 075, 15/03/2001 P. 0026 - 0028

E.C. (European Commission), (2004). Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings. Official Journal of the European Union, C 031, 05/02/2004 P. 0005 – 0018.

E.C. (European Commission), (2008). Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings, Official Journal of the European Union, C 265/6,(2008/C 265/07).

E.C. (European Commission), (2009a). Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.

E.C. (European Commission), (2009b). Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.

E.C. (European Commission), (2013). Market Functioning in Network Industries - Electronic Communications, Energy and Transport, Occasional Papers 129. Brussels: Directorate-General for Economic and Financial Affairs Publications

E.C. (European Commission), (2021, 10th July). Global Agreement on Corporate Taxation. Press Release. Available at: https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_3564

E.C (European Council), (1986). Council Regulation (EEC) No 4057/86 of 22 December 1986 on unfair pricing practices in maritime transport, Official Journal of the European Communities, L 378/14.

E.P. (European Parliament), (2016). Market access to port services and financial transparency of ports: Amendments adopted by the European Parliament on 8 March 2016 on the proposal for a regulation of the European Parliament and of the Council.

E.P. (European Parliament), (2017). Regulation (EU) 2017/352 of the European Parliament and of The Council of 15 February 2017, establishing a framework for the provision of port services and common rules on the financial transparency of ports, Official Journal of the European Union, L 57/1.

E.U. (European Union), (2020). Transport sector economic analysis. Available at: https://ec.europa.eu/jrc/en/research-topic/transport-sector-economic-analysis

Evangelista P. & Morvillo A. (1999). Alliances in Liner Shipping: an Instrument to GainOperational Efficiency or Supply Chain Integration?, International Journal of Logistics Research and Applications: A LeadingJournal of Supply Chain Management, 2:1, 21-38

Fageda, X. (2000). Load centres in the Mediterranean port range: ports hub and ports gateway.

Fagerholt, K. (2004). Designing optimal routes in a liner shipping problem. Maritime Policy & Management, 31(4), 259-268.

Fahy, J. (2000). The resource-based view of the firm: some stumbling-blocks on the road to understanding sustainable competitive advantage. Journal of European industrial training.

Farrell, S. (2012). The ownership and management structure of container terminal concessions. Maritime Policy and Management: The flagship journal of international shipping and port research, Vol. 39 No.1, pp. 7-26.

Farrell, S., & Vanelslander, T. (2015). Comparison of public–private partnerships in airports and seaports in low-and middle-income countries. Transport Reviews, 35(3), 329-351.

F.T.C, (Federal Trade Commission), (1966). Economic report on mergers and vertical integration in the cement industry. Washington: U.S. Government Printing Office.

F.M.C. (Federal Maritime Commission), (2012). Study of the 2008 Repeal of the Liner Conference Exemption from European Union Competition Law. Bureau of Trade Analysis. Washington, D.C.

F.M.C. (Federal Maritime Commission), (2014). Maersk/MSC Vessel Sharing Agreement FMC Agreement No. 012293 A Cooperative Working Agreement. Available from: http://www2.fmc.gov/agreement_lib/012293-000-P.pdf

F.M.C. (Federal Maritime Commission), (2017). Ocean Carrier Alliances. Available from: http://www.fmc.gov/doyle_prepared_remarks_national_retail_federation/

F.T.C, (Federal Trade Commission), (2019). Guides to Anti-Trust Laws; Mergers: Competitive Effects. Available at: https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/mergers/competitive-effects Accessed: 16/12/2019

F.T.C, (Federal Trade Commission) (2010). Horizontal Merger Guidelines. U.S. Department of Justice and the Federal Trade Commission.

Ferrari, C., Parola, F., Benacchio, M., 2008. Network economies in liner shipping: the role of home markets. Maritime Policy and Management, 35 (2), 127–143.

Financial Times, (2021, 12th August). Shipping group Hapag-Lloyd earns more in 6 months than in previous 10 years. Available at: https://www.ft.com/content/6145121c-7069-4ca5-bd8f-429461617d37

Fine, B., & Harris, L. (1979). The Law of the Tendency of the Rate of Profit to Fall. In Rereading Capital (pp. 58-75). Palgrave, London.

Finger, M., & Varone, F. (2006, September). Governance of network industries: towards European regulators, differentiated regulations, or self-regulation?. In European Consortium for Political Research Standing Group on Regulatory Governance Conference, University of Bath, Bath (pp. 7-8).

Forsyth, P. (2002). Replacing Regulation: Airport Price Monitoring in Australia. Paper presented at the German Aviation Research Seminar, The Economic Regulation of Airports: Recent Developments in Australia, North America and Europe (pp. 1-21). Department of Economics, Monash University.

Foss, K., & Foss, N. J. (2005). Resources and transaction costs: how property rights economics furthers the resource-based view. Strategic Management Journal, 26(6), 541-553.

Foster, J. B., & Burkett, P. (2018). Value isn't everything. Monthly Review, 70(6), 1-17.

Foster, J. B., McChesney, R. W., & Jonna, R. J. (2011). Monopoly and competition in twenty-first century capitalism. Monthly Review, 62(11), 1.

Foster, J. B. & McChesney, R. W (2012). The Endless Crisis (New York: Monthly Review Press).

Franck, B. & Bunel, J. C. (1991), "Contestability, competition and regulation: The case of liner shipping," International Journal of Industrial Organization, Vol. 9, No.1, pp. 141-159.

Frank, L.K. (1925). "The Significance of Industrial Integration." Journal of Political Economy 33(2):179-195.

Frémont, A. (2009). Shipping lines and logistics. Transport Reviews, 29(4), 537-554.

Fronmueller, M. P., & Reed, R. (1996). The competitive advantage potential of vertical integration. Omega, 24(6), 715-726.

Fruth, M., & F. Teuteberg. (2017). "Digitization in Maritime logistics—What Is There and What Is Missing?" Cogent Business & Management 4 (1): 1411066.

Fuchs, C., & Mosco, V. (2015). Marx in the age of digital capitalism. Brill

Fuchs, V. R. (1961). Integration, concentration, and profits in manufacturing industries. The Quarterly Journal of Economics, 75(2), 278-291.

Fusillo, M. (2009). Structural factors underlying mergers and acquisitions in liner shipping. Maritime Economics & Logistics, 11(2), 209-226.

Garcia, S., Moreaux, M., & Reynaud, A. (2007). Measuring economies of vertical integration in network industries: An application to the water sector. International Journal of Industrial Organization, 25(4), 791-820.

Garrison, W. L. (2000). Innovation and transportation's technologies. Journal of Advanced Transportation, 34(1), 31e63.

Geroski, P. A. (2003). Competition in markets and competition for markets. Journal of Industry, Competition and Trade, 3(3), 151-166.

Gharehgozli, A. H., Roy, D., & De Koster, R. (2016). Sea container terminals: New technologies and OR models. Maritime Economics & Logistics, 18(2), 103-140.

Giammanco, M. D. (2002). Competition and technical progress in Marx: two different perspectives. History of Economic Ideas, 69-95.

Gill, A., Biger, N., Tibrewala, R., Prabhakar, P. (2016). The impact of merger on working capital management efficiency of American production firms. Corporate Ownership & Control, 13(3), 100-109. http://dx.doi.org/10.22495/cocv13i3p9

Gillman, J. (1957) The Falling Rate of Profit: Marx's Law and its Significance to Twentieth Century Capitalism. Oxford University Press, Oxford.

Giustiziero, G. (2013). Vertical and Horizontal Expansions in Value-based Models. Paper presented at the 35th DRUID Celebration Conference 2013, Barcelona, Spain, June 17-19.

Gnyawali, D. R., & Park, B. J. R. (2011). Co-opetition between giants: Collaboration with competitors for technological innovation. Research Policy, 40(5), 650-663.

Gorton, G., Kahl, M., & Rosen, R. (2005). Eat or be eaten: A theory of mergers and merger waves (No. w11364). National Bureau of Economic Research.

Gorton, G., Kahl, M., & Rosen, R. J. (2009). Eat or be eaten: A theory of mergers and firm size. The Journal of Finance, 64(3), 1291-1344.

GOV.UK (2022). International agencies put supply chains on notice against collusion. Press release. Available at: https://www.gov.uk/government/news/international-agencies-put-supply-chains-on-notice-against-collusion

Graham, D. R., Kaplan, D. P., & Sibley, D. S. (1983). Efficiency and competition in the airline industry. The Bell Journal of Economics, 118-138.

Grammenos, C. (2013). “The handbook of maritime economics and business”. Taylor & Francis.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. Strategic management journal, 17(S2), 109-122.

Grossman, S. J., & Hart, O. D. (1986). The costs and benefits of ownership: A theory of vertical and lateral integration. Journal of political economy, 94(4), 691-719.

Grundey, D., & Rimienė, K. (2007). Logistics centre concept through evolution and definition. Engineering economics, (4 (54)), 87-95

Gubby, H. (2020). Is the patent system a barrier to inclusive prosperity? The biomedical perspective. Global Policy, 11(1), 46-55.

Guellec, D. and S. Wunsch, V. (2009). “Policy Responses to the Economic Crisis: Investing in Innovation for Long-Term Growth”, OECD Digital Economy Papers, No. 159, OECD Publishing, Paris.

Gulbrandsen, B., Sandvik, K., & Haugland, S. A. (2009). Antecedents of vertical integration: Transaction cost economics and resource-based explanations. Journal of Purchasing and Supply Management, 15(2), 89-102.

Gwin, C.R. (2001). A guide for industry study and the analysis of firms and competitive strategy. http://faculty.babson.edu/gwin/indstudy/index.htm

Hadjimichalis, C., Samarinis, P. & Styliadis, Th. (2015). The port-logistic cluster of Piraeus and Thriasio. Hellenic Republic, Vice Presidency of the Hellenic Government, Athens, Greece.

Hadjimichalis, C. (February 1, 2016). The intangible value of Piraeus. Avgi (also accessible in English through: Places – A critical Geographical Blog, https://placemanagementandbranding.wordpress.com/2016/02/07/the-intangible-value-of-piraeus/).

Haezendonck, E. (2001). "Essays on Strategy Analysis for Seaports" (Leuven, B: Garant).

Hall, B. H. (2007). Patents and patent policy. Oxford Review of Economic Policy, 23(4), 568-587.

Hanafy, N.A., Labib, A., El-Haddad, E.F., & Abd-El-Salam, E.M. (2017). Analytical approach to the market of the container ports in the east mediterranean region using the concentration ratio, HHI, shift–share analysis. The Business and Management Review. 8(5): 192-199.

Hanlon, P. (1996). Global Airlines, Competition in a Transnational Industry. Great Britain: Butterworth-Heinemann.

Haralambides, H. E. (2002). Competition, excess capacity, and the pricing of port infrastructure. International journal of maritime economics, 4(4), 323-347.

Haralambides, H. E. (2004, March). Determinants of price and price stability in liner shipping. In Workshop on the Industrial Organization of Shipping and Ports, National University of Singapore (pp. 5-6).

Haralambides, H. E., & Thanopoulou, H. (2014). The economic crisis of 2008 and world shipping: unheeded warnings. SPOUDAI-Journal of Economics and Business, 64(2), 5-13.

Haralambides, H. E. (2017). Globalization, Public Sector Reform, and the Role of Ports in International Supply Chains. Maritime Economics & Logistics, 19(1).

Haralambides, H. E. (2019). Gigantism in container shipping, ports and global logistics: a time-lapse into the future. Maritime Economics & Logistics, 21(1), 1-60.

Haralambides, H. E. (2021). Containerization and the port industry.

Hart, O., Tirole, J., Carlton, D. W., & Williamson, O. E. (1990). Vertical integration and market foreclosure. Brookings papers on economic activity. Microeconomics, 1990, 205-286.

Harvey, D. (1975). The geography of capitalist accumulation: a reconstruction of the Marxian theory. Antipode, 7(2), 9-21.

Harvey, D. (1985). The geopolitics of capitalism. In Social relations and spatial structures (pp. 128-163). Palgrave, London.

Harvey, D. (1989). The condition of postmodernity Basil Blackwell. Oxford.

Harvey, D. (2006). Spaces of global capitalism. Verso.

Harvey, D. (2018). Marx and the Madness of Economic Reason. Oxford University Press

Hastings, J. S., & Gilbert, R. J. (2005). Market power, vertical integration and the wholesale price of gasoline. The Journal of Industrial Economics, 53(4), 469-492.

Hayuth Y (1981). Containerisation and the Load Centre Concept. Economic Geography. 57: 160-176.

Hayuth Y (1988). Rationalization and Deconcentration of the US Container Port System. The Professional Geographer. 40: 279-288.

Hean, S., Cowley, S., Forbes, A., Griffiths, P., & Maben, J. (2003). The M–C–M' cycle and social capital. Social Science & Medicine, 56(5), 1061-1072.

Heaver, T.D., Meersman, H., Moglia, F. & Van de Voorde, E. (2000). Do mergers and alliances influence European shipping and port competition?, Maritime Policy and Management, 27(4): 363-373.

Heaver, T. D. (2002). The evolving roles of shipping lines in international logistics. International Journal of Maritime Economics, 4(3), 210-230.

Hegel, G. W. F. (1979). Phenomenology of spirit (A. V. Miller, Trans.). Oxford University Press.

Heger, D., & Zaby, A. K. (2018). Patent breadth as effective barrier to market entry. Economics of Innovation and New Technology, 27(2), 174-188.

Heino, B. (2015). Capitalism, regulation theory and Australian labour law: Towards a new theoretical model. Capital & Class, 39(3), 453-472.

Heilig, L., & Voß, S. (2017). Information systems in seaports: a categorization and overview. Information Technology and Management, 18(3), 179-201.

H.C.C. (Hellenic Competition Commission), (2016). Press Release 22-06-2016. Available at: http://www.epant.gr/img/x2/news/news871_1_1466674195.pdf

H.R.A.D.F (Hellenic Republic Asset Development Fund), (2014). Invitation for the expression of interest regarding the acquisition of a majority stake in the share capital of "Piraeus Port Authority SA".

H.R.A.D.F (Hellenic Republic Asset Development Fund), (2016). Vision. Available at: http://www.hradf.com/el/the-fund/vision

Hennart, J. F. (2011). A theoretical assessment of the empirical literature on the impact of multinationality on performance. Global Strategy Journal, 1(1-2), 135-151.

Henning, E., Van Rensburg, W. & Smit, B. (2004). Finding your way in qualitative research. Pretoria: Van Schaik.

Hill, C. W., & Pickering, J. F. (1986). Conglomerate mergers, internal organization and competition policy. international Review of Law and Economics, 6(1), 59-75.

Hill, C.W.L., and Jones, G.R. (2012) Strategic Management: An Integrated Approach (10th Edition). Mason, OH: South-Western Cengage Learning.

Hintjens, J. & Vaneslander, T. (2018) Cooperation between port authorities from a port user perspective: the case of the Flanders Port Area, IAME conference, 11-14 September, Mombasa, Kenya.

Hirata, E. (2017). Contestability of Container Liner Shipping Market in Alliance Era. The Asian Journal of Shipping and Logistics, 33(1), 27 – 32.

Hofbauer, I. (2009). Liberalisation, Privatisation and Regulation in the Austrian Electricity Sector.

Hoffmann, J., Talley, W., & Sanchez, R. (1998). Concentration in Liner Shipping. Santiago de Chile: ECLAC LC/G, 2027.

Höffler, F., Kranz, S. (2011). Legal unbundling can be a golden mean between vertical integration and ownership separation. Int. J. Ind. Organ. 29, 576–588. http://dx.doi.org/10.1016/j.ijindorg.2011.01.001.

Holgersen, S. (2020). On spatial planning and Marxism: Looking back, going forward. Antipode, 52(3), 800-824

Hood, C. (1991) A Public Management for All Seasons. Public Administration 69(1): 3-19.

Hortaçsu, A., & Syverson, C. (2007). Cementing relationships: Vertical integration, foreclosure, productivity, and prices. Journal of political economy, 115(2), 250-301.

Hourwich I. A. (1894), The rate of Profits Under the Law of Labour-Value, Journal of Political Economy, 2(2): 235-250.

Hovenkamp, H. (2009). The Law of Vertical Integration and the Business Firm: 1880-1960. Iowa L. Rev., 95, 863.

Hsu, C. I., & Hsieh, Y. P. (2005). Direct versus terminal routing on a maritime hub-and-spoke container network. Journal of Marine Science and Technology,13(3), 209-217.

Huang, S. T., (2016), Key factors analysis of strategic alliances in container liner shipping industry. Transport & Logistics: the International Journal, Volume 16, Issue 39.

Huang, S. T., & Yoshida, S. (2013). Analysis of key factors for formation of strategic alliances in liner shipping company: service quality perspective on Asia/Europe route

after global economic crisis. International Journal of Economics and Management Engineering, 7(6), 1414-1418.

Huliaras, A., & Petropoulos, S. (2014). Shipowners, ports and diplomats: the political economy of Greece's relations with China. Asia Europe Journal, 12(3), 215-230.

Hummels, D. (2007). Transportation costs and international trade in the second era of globalization, Journal of Economic Perspectives 21, 3:131-154

Hurley, T. M. (2006). The Urge to Merge: Contemporary Theories on the Rise of Conglomerate Mergers in the 1960s. J. Bus. & Tech. L., 1, 185.

Hydrogen Council, (2021). Hydrogen Council Adds Fourteen New Members Including Bankers, Engineers, Industrials and Energy Companies, Confirming Wide-Ranging Interest in Hydrogen. Available Online: https://hydrogencouncil.com/en/newmembers-newcochair-july2021/ (Accessed 22/11/2021).

Hymer, S. H. (1972). The Multinational Corporation and the Law of Uneven Development, in Bhagwati, J. N. (ed.), Economics and World Order, London: Macmillan.

I.M.F. (International Monetary Fund), (2015). Greece: An update of IMF's preliminary public debt sustainability analysis. IMF Country Report No. 15/186. Washington D.C

IOBE, (2016). Economic effects of the Piraeus Port Authority Privatization. Foundation for Economic & Industrial Research (In Greek).

Isaías, P. T., & Macedo, F. M. D. (2007). Web services as a solution for maritime port information interoperability. In Symposium on Human Interface and the Management of Information (pp. 1029-1038). Springer, Berlin, Heidelberg.

ISL (2006), "Public Financing and Charging Practices of Sea Ports in the E.U.", study by international consortium led by the Institute of Shipping Economics and Logistics, Bremen, Germany, prepared for the European Commission, DG-TREN, June. Study publicly
available:http://ec.europa.eu/transport/maritime/infrastructure/doc/2006_06_eu_seaports_study_en.pdf

Jamison, M. A. (2005). Rate of return regulation. Public Utility Research Center, University of Florida.

Jamison, M. A. (2007). Regulation: price cap and revenue cap. Encyclopedia of energy engineering and technology, 3, 1245-51.

Jankowski, W. B., & Davies, J. E. (1989). Competition, Contestability, and the Liner Shipping Industry (Comment and Rejoinder). Journal of Transport Economics and Policy, 23(2), 199-208.

Jenssen, J. I. (2003). Innovation, capabilities and competitive advantage in Norwegian shipping. Maritime Policy & Management, 30(2), 93-106.

Jenssen, J. I., & Randøy, T. (2002). Factors that promote innovation in shipping companies. Maritime Policy & Management, 29(2), 119-133.

Jenssen, J. I., & Randø y, T. (2006). The performance effect of innovation in shipping companies. Maritime Policy & Management, 33(4), 327-343.

Jessop, B. (1997). Survey article: the regulation approach. Journal of Political Philosophy, 5(3), 287-326.

Jessop, B., & Stones, R. (1992). Economic and political aspects of deregulation. Global Finance and Urban Living: A Study of Metropolitan Change, 167.

John, G., & Weitz, B. A. (1988). Forward integration into distribution: an empirical test of transaction cost analysis. JL Econ. & Org., 4, 337.

Johnson G., Scholes, K., Whittington, R. (2005). Exploring Corporate Strategy. Gerry Johnson Kevan Scholes Richard Whittington. Text and Cases, 7th Ed. Prentice Hall.

Jones, T. M. (2009). Globalization and the Organization(s) of inclusion in advanced capitalism. In Debating organization: Point-counterpoint in organization studies. Edited by Westwood, R., & Clegg, S. John Wiley & Sons.

Jones, P. (2016). Turnover time and the organic composition of capital. Cambridge Journal of Economics, 41(1), 81-103.

Jordana, J., Levi-Faur, D., Marin, X.F. (2011). "The Global Diffusion of Regulatory Agencies: Channels of Transfer and Stages of Diffusion." Comparative Political Studies.

Joskow, P. L. (1988). Asset specificity and the structure of vertical relationships: empirical evidence. Journal of Law, Economics, & Organization, 4(1), 95-117.

Journal, (2016). Companies That Control the Food Industry. Available at: https://vocal.media/journal/companies-that-control-the-food-industry

Joyce, P., & Winch, G. (2004). A framework for codifying business models and process models in e-Business design. In Value creation from e-business models (pp. 35-64). Butterworth-Heinemann.

Juhel, M. (1998). Globalisation, privatisation and restructuring of ports. Port, shipping and waterfront reform, 10th Annual Australasian Summit.

Junior, G. A. D. S., Beresford, A. K., & Pettit, S. J. (2003). Liner shipping companies and terminal operators: Internationalisation or globalisation?. Maritime Economics & Logistics, 5 (4), 393-412.

JUSTIA (2021). Transcend Shipping Systems, LLC v. Hapag-Lloyd (America) LLC et al. Available Online:

https://dockets.justia.com/docket/texas/txwdce/6:2020cv01195/1118732 (Accessed 22/11/2021).

Kalgora, B., & Christian, T. M. (2016). The financial and economic crisis, its impacts on the shipping industry, lessons to learn: the container-ships market analysis. Open Journal of Social Sciences, 4(01), 38.

Kanellopoulos, N. (2018). Port of the future challenges, enablers and barriers. In COREALIS report: Capacity with a positive environmental and societal footprint: ports in the future era. Published by European Commission.

Kaplan, R. S., & Norton, D. P. (2006). How to implement a new strategy without disrupting your organization?. Harvard business review, 84(3), 100.

Katie, M. (2003). Say Goodbye to Vertical Integration. Direct, 15, 85, Primedia Business Magazines & Media Inc.

Katila, R. (2000). Using patent data to measure innovation performance. International Journal of Business Performance Management, 2(1-3), 180-193.

Kavirathna, C., Kawasaki, T., Hanaoka, S., & Matsuda, T. (2018). Transshipment hub port selection criteria by shipping lines: the case of hub ports around the bay of Bengal. Journal of Shipping and Trade, 3(1), 1-25.

Kawa, A., & Ratajczak-Mrozek, M. (2014, April). Cloud community in logistics e-cluster. In Asian Conference on Intelligent Information and Database Systems (pp. 495-503). Springer, Cham.

Kawasaki, T., Watanabe, T., Tagawa, H., & Hanaoka, S. (2018). The effect of consolidation and privatization of ports in proximity: Case study in Kobe and Osaka ports. IAME conference, 11-14 September, Mombasa, Kenya.

Kazmi, A., & Kazmi, A. (1986). Strategic management. McGraw-Hill Education.

Keceli, Y. (2011). A proposed innovation strategy for Turkish port administration policy via information technology. Maritime Policy & Management, 38(2), 151-167.

Kessler, F., & Stern, R. H. (1959). Competition, contract, and vertical integration. The Yale Law Journal, 69(1), 1-129.

Khandelwal, R. (2000). Mergers in liner shipping: strategic options available to Indian shipping. World Maritime University Dissertations. 306.

Kim, J. (2019). Vertical Integration and the Theory of the Firm. In Oxford Research Encyclopedia of Business and Management.

Kim, K. H., & Haralambides, H. (2021). Smart operations planning in container terminals: integrating algorithms with our practical knowledge base. Maritime Economics & Logistics, 23(1), 1-3.

King, R. P. (1992). Management and financing of vertical coordination in agriculture: An overview. American Journal of Agricultural Economics, 74(5), 1217-1218.

King, J. E. (2010). Hilferding's Finance Capital in the Development of Marxist Thought, History of Economics Review, 52:1, 52-62, DOI: 10.1080/18386318.2010.11682164

Kitsos, V. (2014). Changes of concentration patterns in European container ports during and after the crisis. (Doctoral dissertation, Msc thesis, Host University: Erasmus Universities of Rotterdam, Rotterdam).

Kjosen, A.M. (2019). Circulation. In Diamanti, J., Pendakis, A., & Szeman, I. (Eds.). (2019). The Bloomsbury Companion to Marx. Bloomsbury Academic.

Kjosen, A. M. (2016). Capital's Media: The Physical Conditions of Circulation (Doctoral dissertation, The University of Western Ontario).

Klose, A., (2015). The Container Principle: How a Box Changes the Way We Think. Cambridge, MA: The MIT Press.

Knapp, J. G. (1950). Cooperative expansion through horizontal integration. Journal of Farm Economics, 32(4), 1031-1047.

Kolasky, W. J. (2001). Conglomerate Mergers and Range Effects: It's a Long Way from Chicago to Brussels. Geo. Mason L. Rev., 10, 533.

Kothari, C.R., (2010). Research Methodology, Methods and Techniques, Jaippur India: New Age International Publishers.

Kotler, P., & Keller, K. L. (2016). A framework for marketing management (p. 352). Boston, MA: Pearson.

KPMG, (2015). M&A trends in the maritime sector. Shipping Insights Briefing Issue 3.

Kretschmann, L., Burmeister, H. C., & Jahn, C. (2017). Analyzing the economic benefit of unmanned autonomous ships: An exploratory cost-comparison between an autonomous and a conventional bulk carrier. Research in transportation business & management, 25, 76-86.

Kuby, M. & Reid, N. (1992). Technological change and the concentration of the U.S. General Cargo Port System: 1970-1988, Economic Geography, 68 (3): 272-289.

Kudełko, J., Wirth, H., Bachowski, C., & Gacek, J. (2015). Horizontal integration in the development strategy of mining companies. Mining Science, 22.

Kumar, R. (2016). Valuation Theories & Concepts: Mergers & Acquisition valuation; pp 205-225. Published by Academic Press, UK, London.

Kumpe, T. & Bolwijn, P. T. (1988). Manufacturing: the new case for vertical integration, Harvard Business Review 66(2): 75–81.

Kürtössy, J. (2004). Innovation indicators derived from patent data. Periodica Polytechnica Social and Management Sciences, 12(1), 91-101.

Labrousse, A., & Michel, S. (2017). Accumulation regimes. In The Routledge Handbook of Heterodox Economics (pp. 54-69). Routledge.

Lafontaine, F., & Slade, M. (2007). Vertical integration and firm boundaries: The evidence. Journal of Economic literature, 45(3), 629-685.

Lam, J.S., Yap, W. Y, & Cullinane, K. (2007). Structure, conduct and performance on the major liner shipping routes. Maritime Policy & Management, 34(4): 359-381.

Lambrou, M., Watanabe, D., & Iida, J. (2019). Shipping digitalization management: conceptualization, typology and antecedents. Journal of Shipping and Trade, 4(1), 11

Lamoreux, N. (1985). The great merger movement in American history, 1895–1904. Cambridge University Press, New York

Langenfeld, J. (2016). The need to revise the US non-horizontal merger guidelines. Concurrences, 4, 51-58.

Langlois, R. N., & Robertson, P. L. (1989). Explaining vertical integration: Lessons from the American automobile industry. The Journal of Economic History, 49(2), 361-375.

Lapavitsas, C. (1997). Two approaches to the concept of interest-bearing capital. International Journal of Political Economy, 27(1), 85-106.

Law 4150, (2013). "Reconstruction of the Ministry of Shipping and the Aegean and other provisions, Government Gazette A' 102/29-04-2013, National Printing Office, Hellenic Republic.

Law 4389, (2016). Urgent provisions for the implementation of the Fiscal Objectives and Structural Reform Agreement and other provisions, Government Gazette A '94 27-05-2016, National Printing Office, Hellenic Republic.

Law 4404, (2016). "For the ratification of the amendment and codification from 24 June 2016 in a single text of the Concession Agreement from 13 February 2002 between the Greek State and the Piraeus Port Authority SA and other provisions", Government Gazette A 126 / 8- 7-2016, National Printing Office, Hellenic Republic.

Laxe, F. G., Sánchez, R. J., & Garcia-Alonso, L. (2016). The adaptation process in port governance: the case of the Latin countries in South America and Europe. Journal of Shipping and Trade, 1(1), 1-20.

Le, Y., & Ieda, H. (2010). Evolution Dynamics of Container Port Systems with a Geo-Economic Concentration Index. Asian Transport Studies, 1(1): 46-61.

Lebowitz, M. A. (2009). Following Marx: Method, critique and crisis (Vol. 20). Brill.

Lee, H., Boile, M., Theofanis, S., & Choo, S. (2012). Modeling the oligopolistic and competitive behavior of carriers in maritime freight transportation networks. Procedia-Social and Behavioral Sciences, 54, 1080-1094.

Lee, H., Boile, M., Theofanis, S., & Choo, S. (2014). Game theoretical models of the cooperative carrier behavior. KSCE Journal of Civil Engineering, 18(5), 1528-1538.

Lee, T., Yeo, G.T, & Thai, V.V. (2014). Changing concentration ratios and geographical patterns of bulk ports: the case of the Korean west coast. The Asian Journal of Shipping and Logistics. 30(2): 155-173.

Leiblein, M. J., & Miller, D. J. (2003). An empirical examination of transaction-and firm-level influences on the vertical boundaries of the firm. Strategic management journal, 24(9), 839-859.

Lenin, V. I. 1916. Imperialism, the Highest Stage of Capitalism. Moscow: Progress Publishers, 1968.

Levenstein, M. C. (1996). Do price wars facilitate collusion? A study of the bromine cartel before World War I. Explorations in Economic History, 33(1), 107-137.

Levi-Faur, D. (2005). The political economy of legal globalization: Juridification, adversarial legalism, and responsive regulation. A comment. International Organization, 59(02), 451-462.

Levinson, M. (2006). The Box: How the shipping container made the world smaller and the world economy bigger Princeton University Press. Princeton NJ.

Levy, H. & Sarnat, M. (1970). Diversification, portfolio analysis and the uneasy case for conglomerate mergers, Journal of Finance 25, 795-802, September.

Levy, D. (1984). Testing Stigler's Interpretation of "The Division of Labor is Limited by the Extent of the Market". The Journal of Industrial Economics, 377-389.

Levy, N., Spiegel, Y., & Gilo, D. (2018). Partial vertical integration, ownership structure, and foreclosure. American Economic Journal: Microeconomics, 10(1), 132-80.

Li, S., Haralambides, H., & Zeng, Q. (2022). Economic forces shaping the evolution of integrated port systems-The case of the container port system of China's Pearl River Delta. Research in Transportation Economics, 101183.

Lianos, T. P. (1984). Concentration and Centralization of Capital in Agriculture. Studies in Political Economy, 14(1), 99–116.

Lin, Y. T., Parlaktürk, A. K., & Swaminathan, J. M. (2014). Vertical integration under competition: forward, backward, or no integration?. Production and Operations Management, 23(1), 19-35.

Lipietz, A. (1986). Behind the Crisis: The Exhaustion of a Regime of Accumulation. A" regulation school" perspective on some French empirical works. Review of Radical Political Economics, 18(1-2), 13-32.

Lippman, S.A. & Rumelt, R.P. (2003). The payments perspective: micro-foundations of resource analysis. Strategic Management Journal, Special Issue 24: 903–927.

Litan, R. (2015). The Concise Encyclopedia of Economics. Retrieved from Regulation: http://www.econlib.org/library/Enc/Regulation.html

Lloyd's List, (2020). One hundred Ports 2020. Available at: https://lloydslist.maritimeintelligence.informa.com/one-hundred-container-ports-2020

Lloyd's List, (2019). One hundred Ports 2018. Available at: https://lloydslist.maritimeintelligence.informa.com/one-hundred-container-ports-2018

Loft, A. (1995). Time is money. Culture and Organization, 1(1), 127-145.

Lord, C. E. (1982). Entrenchment challenges to conglomerate mergers. Wash. ULQ, 60, 537.

Lu, C. S. (2007). Evaluating key resources and capabilities for liner shipping services. Transport Reviews, 27(3), 285-310.

Lu, H. A., Cheng, J., & Lee, T. S. (2006). An evaluation of strategic alliances in liner shipping-an empirical study of CKYH. Journal of Marine Science and Technology, 14(4), 202-212.

Lucarelli, B. (2011). The economics of financial turbulence: alternative theories of money and finance. Edward Elgar Publishing.

Luo, M., Fan, L., & Wilson, W. W. (2014). Firm growth and market concentration in liner shipping. Journal of Transport Economics and Policy (JTEP), 48(1), 171-187.

Ma, Q., Jia, P., She, X., Haralambides, H., & Kuang, H. (2021). Port integration and regional economic development: Lessons from China. Transport Policy, 110, 430-439.

Machek, O., Nowak, O., & Hnilica, J. (2011). Tariff Setting in TFP Based Regulation of Network Industries under Uncertainty.

Madhok, A. (2000). Transaction (in) efficiency, value (in) efficiency, and inter-firm collaboration. DO Faulkner and M. De Rond, Cooperative strategy—economic, business and organizational Issues (Oxford University Press Inc., New York), 74-95.

Madhok, A. (2002). Reassessing the fundamentals and beyond: Ronald Coase, the transaction cost and resource-based theories of the firm and the institutional structure of production. Strategic management journal, 23(6), 535-550.

Maersk, (2015, September 11th). Maersk fuels growth through terminal acquisitions. Available from: http://www.maersk.com/en/markets/2015/09/maersk-fuels-growth-with-terminals-acquisition

Maersk Line (2016, December 1st). Maersk Line to acquire Hamburg Süd. Copenhagen. Available from: http://www.maerskline.com/en-us/countries/int/news/news-articles/2016/12/maersk-line-to-acquire-hamburg-sud

Mage, S. (1963). The 'law of the falling tendency of the rate of profit': its place in the Marxian theoretical system and relevance to the US economy, PhD thesis, Columbia University, retrieved from https://archive.org/stream/MagesDissertation/Shane_Mage_djvu.txt

Maggetti, M. (2010). Legitimacy and Accountability of Independent Regulatory Agencies: A Critical Review. Living Revires in Democracy, Vol.2 , n.p.

Mahoney, J. T. (1992). The choice of organizational form: vertical financial ownership versus other methods of vertical integration. Strategic Management Journal, 13(8), 559-584.

Majone, G. (1994). The rise of the regulatory state in Europe. West European Politics, 17(3), 77-101.

Majone, G. (1996). A European regulatory state. European Union: power and policy-making, 263, 277.

Majone, G. (2003). Regulation and its modes. In G. Majone, Regulating Europe (pp. pp. 9-28). New York, U.S.A: Routledge.

Majone, G. (2010). The transformations of the regulatory State. Osservatorio sull'Analisi d'Impatto della Regolazione.

Malchow, U. (2016). Growth in containership sizes to be stopped? Presented in IAME Conference, Hamburg, Germany.

Malkiel, B. G. (1999). A random walk down Wall Street: including a life-cycle guide to personal investing. WW Norton & Company.

Mandel, E. (1992). Partially Independent Variables and Internal Logic in Classical Marxist Economic Analysis. Interfaces in Economic and Social Analysis, London/New York, 33-50.

Manzerolle, V. & Kjosen, A. M. (2012). The Communication of Capital: Digital Media and the Logic of Acceleration. triple C 10(2), 214-229.

Maritime Administration Authorization (1969). Hearings Before the Subcommittee on Merchant Marine...90-2, on H.R. 15189, February 17-19; March 4-6, 11, 12, 27, 1968. U.S Government Printing.

Maritime Insight, (2014, Autumn). Strategic Alliance in Container Liner Shipping After P3 Failure. Volume 2, Issue 3.

Marti, B. (1988). The Evolution of Pacific Basin Load Centres, Maritime Policy and management. 15(1):57-66.

Martin, S. (2000). The theory of contestable markets. Bulletin of Economic Research, 37(1), 65-68.

Martin, R., Roma, M., & Vansteenkiste, I. (2005). Reforms in Selected EU Network Industries. ECB Occasional paper, (28).

Martinho, M. (2008). Port Competition and Hinterland Connections (No. 2008/19). OECD Publishing.

Marx, K. (1973). Grundrisse. London: Penguin Classics.

Marx, K. ([1867] 1976). Capital Volume 1. New York: Vintage Books.

Marx, K. (1988). Capital, vol. 2: The Process of Circulation of Capital. Buccaneer Books

Marx, K. (1981). Capital. Vol. 3. Harmondsworth, UK: Penguin.

Matthews, R. C. O. (1986). "The Economics of Institutions and the Sources of Growth." Economic Journal 96 (December): 903-910.

May, P. J. (2003). Performance-Based Regulation and Regulatory Regimes: The Saga of Leaky Buildings. Law & Policy, 25(4), 381-401.

Mazzucato, M. (2013). The entrepreneurial state: Debunking public vs. Private sector myths. Anthem Press, London, UK, pp. 1-202.

McKinney, L. C. (1969). Section 7 of the Clayton Act as Applied to Conglomerate Mergers: Incipient Antitrust Doctrine. John's L. Rev., 44, 635.

MCKINSEY (2018). The future of Automated Ports. Available at: https://www.mckinsey.com/industries/travel-transport-and-logistics/our-insights/the-future-of-automated-ports

McGuirk, H., Lenihan, H., & Hart, M. (2015). Measuring the impact of innovative human capital on small firms' propensity to innovate. Research Policy, 44(4), 965-976.

Meletiou, A., Cambini, C., & Masera, M. (2018). Regulatory and ownership determinants of unbundling regime choice for European electricity transmission utilities. Utilities Policy, 50, 13-25.

Mendi, P. (2009). Backward integration and collusion in a duopoly model with asymmetric costs. Journal of Economics, 96(2), 95-112.

Mendi, P., & Veszteg, R. F. (2009). Sustainability of collusion: Evidence from the late 19th century basque iron and steel industry. investigaciones económicas, 33(3), 385-405.

Mendi, P., Moner-Colonques, R., & Sempere-Monerris, J. J. (2011). Vertical integration, collusion, and tariffs. SERIEs, 2(3), 359-378.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. Journal of Business logistics, 22(2), 1-25.

Merk, O. (2015). The Impact of Mega-Ships. Published for SRM Maritime-Economy. Available at:http://www.srm-maritimeconomy.com/wp-content/uploads/2015/09/sr-megaships-eng.pdf

Merk, O., Kirstein, L., & Salamitov, F. (2018). The impact of alliances in container shipping. An International Transport Forum Publication.

Merk, O., & Teodoro, A. (2022). Alternative approaches to measuring concentration in liner shipping. Maritime Economics & Logistics, 1-24.

Meyer, C. S., & Wang, Y. (2011). Determining the competitive effects of vertical integration in mergers. Econ. Comm. Newsl., 11, 7.

Midoro, R., Pitto, A. (2000). A critical evaluation of strategic alliances in liner shipping. Maritime Policy Management. 27 (1), 31–40.

Midoro, R., Musso, E., & Parola*, F. (2005). Maritime liner shipping and the stevedoring industry: market structure and competition strategies. Maritime Policy & Management, 32(2), 89-106.

Milgrom, P., & Roberts, J. (1987). Bargaining and influence costs and the organization of economic activity', research paper no. 934, Graduate School of Business.

Miljković, M., Filipović, S., & Tanasković, S. (2013). Market concentration in the banking sector: Evidence from Serbia. Industrija. 41(2): 7-25.

M.M.A.I.P. (Ministry of Maritime Affairs & Insular Policy), (2016). Explanatory Memorandum Draft Law of the Ministry of Maritime Affairs and Island Policy "Reform of the Supervision and Control System of the Greek Port System", Athens.

Mitsuhashi, H., & Greve, H.R. (2009). A Matching Theory of Alliance Formation and Organization Success: Complementarities and Compatibilities, Academy of Management Journal, Vol.52, pp. 975-995.

Molyneux, P., Thornton, J., & Llyod-Williams, D. M. (1996). Competition and market contestability in Japanese commercial banking. Journal of Economics and Business, 48(1), 33-45.

Monios, J., & Wilmsmeier, G. (2013). The role of intermodal transport in port Regionalisation. Transport Policy, 30, 161-172

Monroe, R. (2006). Analysis of Hub Ports in Southeast Asia and Northeast Asia, INFORMS Annual Meeting, Nashville, TN

Mooney, T. and Shim, H. (2015), “Does Financial Synergy Provide a Rationale for Conglomerate Mergers?”, Asia-Pacific Journal of Financial Studies, Vol. 44, No. 4, pp. 537-586.

Morrish, S. C., & Hamilton, R. T. (2002). Airline alliances—who benefits?. Journal of air transport management, 8(6), 401-407.

Motis, J. (2007). Mergers and acquisitions motives. Toulouse School of Economics EHESS (GREMAQ) and University of Crete. Retrieved from economics. soc. uoc. gr/wpa/docs/paper2mottis. pdf.

Motta, M. (2004). Competition Policy Theory and Practice, (Cambridge, UK: Cambridge University Press).

Moulier-Boutang, Y. Cognitive Capitalism. Polity Press, Cambridge, UK, 2011, pp. 1-240.

Mpoyi, R. (2003). Vertical Integration: Strategic Characteristics & Competitive Implications, Competitiveness Review, Vol. 13 No. 1, pp. 44-55. https://doi.org/10.1108/eb046451

Mueller, D. C. (1969). A theory of conglomerate mergers. The Quarterly Journal of Economics, 83(4), 643-659.

Mueller, D. C. (1970). A theory of conglomerate mergers: reply. The Quarterly Journal of Economics, 84(4), 674-679.

Mueller, D. C. (1977). The effects of conglomerate mergers: A survey of the empirical evidence. Journal of Banking & Finance, 1(4), 315-347.

Mullin, J. C., & Mullin, W. P. (1997). United States Steel's acquisition of the Great Northern ore properties: Vertical foreclosure or efficient contractual governance?. The Journal of Law, Economics, and Organization, 13(1), 74-100.

Munari, F. (2012). Competition in liner shipping. In Basedow, J. Magnus, U., Wolfrum R. (eds). The Hamburg Lectures on Maritime Affairs 2009 & 2010. Hamburg Studies on Maritime Affairs, XVII, Springer, Berlin- Heidelberg, 3-27

Munim, Z. H. (2019). Autonomous ships: a review, innovative applications and future maritime business models. In Supply Chain Forum: An International Journal, Vol. 20, No. 4, pp. 266-279.

Munim, Z. H., Dushenko, M., Jimenez, V. J., Shakil, M. H., & Imset, M. (2020). Big data and artificial intelligence in the maritime industry: a bibliometric review and future research directions. Maritime Policy & Management, 47(5), 577-597.

Murray, B. (2003). The succession transition process: a longitudinal perspective. Family Business Review, 1, 17.

Musso, F. (2009) Relational Dynamics within Vertical Business Networks: The Need for A Transdisciplinary Approach. International Journal of Business and Economics, 12(3), 17-28.

Nair, R. (2016). Study on Economic Regulation of Collaborative Strategies among Container Shipping Companies Following Repeal of European Union Regulation 4056/86. The Asian Journal of Shipping and Logistics, 32(2), 89-97.

N.B.G. (National Bank of Greece), (2013). “Container Ports: an engine for growth” Sectoral Report.

Nelson, R.R. & Winter, S.G. (1982a). An Evolutionary Theory of Economic Change. Cambridge: Belknap Press.

Nelson, R. R. & Winter, S.G. (1982b), “The Schumpeterian Trade-off Revisited”, American Economic Review, Volume 72, Number 1, pp.114-132.

Neven, D. (2008). The analysis of conglomerate effects in EU merger control. Handbook of Antitrust Economics, MIT Press, Cambridge, MA.

Newbery, D. M. (2002). Regulatory challenges to European electricity liberalisation. Swedish Economic Policy Review, 9(2), 9-44

Ng, A. K., Ducruet, C., Jacobs, W., Monios, J., Notteboom, T., Rodrigue, J. P. & Wilmsmeier, G. (2014). Port geography at the crossroads with human geography: between flows and spaces. Journal of Transport Geography, 41, 84-96.

Ng, A.K.Y., and Liu, J.J., (2010), The port and maritime industries in the post-2008 world: Challenges and opportunities, Research in Transportation Economics, 27 (1), pp. 1-3

Ng, A. K., & Pallis, A. A. (2010). Port governance reforms in diversified institutional frameworks: generic solutions, implementation asymmetries. Environment and Planning A, 42(9), 2147-2167.

Nguyen, K. T. (2018). Horizontal integration in container liner shipping. In Nachhaltige Impulse für Produktion und Logistikmanagement (pp. 51-62). Springer Gabler, Wiesbaden.

Nitzan, J. (2003): Mergers, Stagflation and the Logic of Globalization, In: Tétreault, Mary Ann Denemark, Robert A. Thomas, Kenneth P. Burch, Kurt (Ed.): Rethinking Political Global Economy. Emerging Issues, Unfolding Odysseys, Routledge,New York, NY, pp. 109-146, http://bnarchives.yorku.ca/166/

Nocke, V., & White, L. (2007). Do vertical mergers facilitate upstream collusion? American Economic Review, 97(4), 1321-1339.

Notteboom, T.E. (1997). Concentration and Load Centre Development in the European Container Port System. Journal of Transport Geography. 5(2): 99-115.

Notteboom, T. E. (2002), Consolidation and contestability in the European container handling industry, Maritime Policy & Management, 29:3, 257-269, DOI:10.1080/03088830210132614

Notteboom, T. E. (2004). Container shipping and ports: an overview. Review of network economics, 3(2).

Notteboom, T. E. (2006a) The time factor in liner shipping services. Maritime Economics & Logistics, 8(1), 19-39.

Notteboom, T. E. (2006b). Traffic inequality in seaport systems revisited. Journal of transport geography. 14(2): 95-108.

Notteboom, T.E. (2007). The changing face of the terminal operator business: lessons for the regulator. Gold Coast, Australia. Available at: http://www. accc. gov. au/content/item. phtml.

Notteboom, T. E. (2009). Economic analysis of the European seaport system. Report for the European Sea Ports Organization, Antwerp: ITMMA, University of Antwerp.

Notteboom, T. E., Parola, F., Satta, G., & Pallis, A. A. (2017). The relationship between port choice and terminal involvement of alliance members in container shipping. Journal of Transport Geography, 64, 158-173.

Notteboom, T. E., & Rodrigue, J. P. (2005). Port regionalization: towards a new phase in port development. Maritime Policy & Management, 32(3), 297-313.

Notteboom, T. & Rodrigue, J. P. (2011) "Emerging Global Networks in the Container Terminal Operating Industry", in T. Notteboom (ed) Current Issues in Shipping, Ports and Logistics, Brussels: Academic & Scientific Publishers. pp. 243-270.

Notteboom, T., & Rodrigue, J. P. (2012). The corporate geography of global container terminal operators. Maritime Policy & Management, 39(3), 249-279.

Notteboom T. E, Pallis, A. A., & Farrell, S. (2012a) Terminal concessions in seaports revisited, Maritime Policy & Management: The flagship journal of international shipping and port research, 39:1, 1-5

Notteboom, T.E, Verhoeven, P. & Fontanet, M. (2012b). “Current practices in European ports on the awarding of seaport terminals to private operators: towards an industry good practice guide”. Maritime Policy & Management: The flagship journal of international shipping and port research, 39:1, 107-123

Notteboom, T., & Vitellaro, F. (2019). The impact of innovation on dock labour: evidence from European ports. IMPRESA PROGETTO, (3), 1-22.

Notteboom, T. E., & Winkelmans, W. (2001). Reassessing public sector involvement in European seaports. International Journal of Maritime Economics, 3(2), 242-259

Notteboom, T., & Yang, Z. (2017). Port governance in China since 2004: Institutional layering and the growing impact of broader policies. Research in transportation business & management, 22, 184-200.

Nueno, P., & Oosterveld, J. (1988). Managing technology alliances. Long Range Planning, 21(3), 11-17.

OECD, (2001a). Portfolio Effects in Conglomerate Mergers. Policy Roundtables, Directorate for Financial, Fiscal and Enterprise Affairs Competition Committee, DAFFE/COMP (2001)5.

OECD, (2001b). Restructuring Public Utilities for Competition. Paris: OECD Publications.

OECD, (2006). Alternatives to Traditional Regulation. OECD Regulatory Policy Division.

OECD, (2007). Vertical Integration, Policy Roundtables, DAF/COMP (2007)21

OECD, (2017). Safe Harbours and Legal Presumptions in Competition Law. Directorate for Financial and Enterprise Affairs Competition Committee. DAF/COMP/WD(2017)82

Ollivier, D., Parola, F., Slack, B., Wang, J. (2007). The time scale of internationalisation: the case of the container port industry. Maritime Economics and Logistics, 9, 1–34 10

Olmos, M. F., & Martínez, J. R. (2013). Differentiation Strategies, Transaction Costs and Capabilities as Determinants of Vertical Integration. Proceedings of European Business Research Conference Sheraton Roma, Rome, Italy, 5 - 6 September 2013

Olmos, M. F, Oricain, N.D, & Martínez, J.R (2016). Product differentiation strategy and vertical integration: an application to the DOC Rioja wine industry. Journal of Business Economics and Management, 17(5), 796-809.

Ondrej, M., & Jiri, H. (2012). Total factor productivity approach in competitive and regulated world. Procedia-Social and Behavioral Sciences, 57, 223-230.

OLP, (Piraeus Port Authority), (2011). Annual Financial Report for The Year Ended December 31, 2011. Piraeus.

OLP, (Piraeus Port Authority), (2014): 2014-2018 Strategic Plan PPA S.A. Piraeus.

OLP, (Piraeus Port Authority), (2015). Annual Financial Report for The Year Ended December 31, 2015. Piraeus.

Ordover, J. A., Saloner, G., & Salop, S. C. (1990). Equilibrium vertical foreclosure. The American Economic Review, 127-142.

Otani, T. (2018). Reproduction and Circulation of the Total Social Capital. In A Guide to Marxian Political Economy (pp. 305-341). Springer, Cham.

Oye, A. (2008). Financial Management. Lagos: Ceemol Nigeria Ltd

Page, W. H. (2011). Standard Oil and US Steel: predation and collusion in the law of monopolization and mergers. S. Cal. L. Rev., 85, 657.

Paixao, A. C., & Marlow, P. B. (2003). Fourth generation ports–a question of agility?. International Journal of Physical Distribution & Logistics Management.

Pallis, A. A. (2006). Port governance in Greece. Research in Transportation Economics, 17, 155-169.

Pallis, A. A., & Syriopoulos, T. (2007). Port governance models: Financial evaluation of Greek port restructuring. Transport Policy, 14(3), 232-246.

Pallis, A. A., Notteboom, T. E., & De Langen, P. W. (2008). Concession agreements and market entry in the container terminal industry. Maritime Economics & Logistics, 10(3), 209-228.

Panasyuk, M. V., Gafurov, I. R., & Novenkova, A. Z. (2013). Influence of international transport and logistics systems on economic development of the region. World Applied Sciences Journal, 27(13), 135-139

Panayides, P. M., & Cullinane, K. (2002). Competitive Advantage in Liner Shipping: A Review and Research Agenda. Maritime Economics & Logistics, 4(3), 189-209.

Pardali, A. (2008). Keynesian and Neoliberal Approach in the Port Industry: The Port's Involvement in the Regional Development: The Case of Piraeus. Keynesian and Neoliberal Approach in the Port Industry, 1000-1026.

Parola, F., & Musso, E. (2007). Market structures and competitive strategies: the carrier–stevedore arm-wrestling in northern European ports. Maritime Policy & Management, 34(3), 259-278.

Parola, F., Tei, A., & Ferrari, C. (2012). Managing Port Concessions: evidence from Italy. Maritime Policy and Management: The flagship journal of international shipping and port research, Vol. 39 No.1, pp. 45-61.

Parola, F., Satta, G., & Caschili, S. (2014). Unveiling co-operative networks and 'hidden families' in the container port industry. Maritime Policy & Management, 41(4), 384-404.

Parola, F., Satta, G., & Panayides, P. M. (2015). Corporate strategies and profitability of maritime logistics firms. Maritime Economics & Logistics, 17(1), 52-78.

Passarella, M. and Baron, H. 2013. 'Capital's Pons Asinorum: The Rate of Turnover in Karl Marx's Analysis of Capitalist Valorisation', MPRA Paper No. 48306, retrieved from http://mpra.ub.unimuenchen. de/48306/1/MPRA_paper_48306.pdf

Pavic, I., Galetic, F., & Piplica, D. (2016). Similarities and differences between the CR and HHI as an indicator of market concentration and market power. British Journal of Economics, Management and Trade. 13(1): 1-8.

Pearson, R. (1987), "Some doubts on the contestability of liner shipping markets," Maritime Policy and Management, 14(1), pp. 71-78.

Pehlivanoğlu F, & Tiftikçigil B Y (2013). A concentration analysis in the turkish iron-steel and metal industry. International Journal of Economic Practices and Theories. 3(3): 152-167.

Penrose, E., & Penrose, E. T. (2009). The Theory of the Growth of the Firm. Oxford university press.

Perry, M. K. (1989). Vertical integration: determinants and effects. Handbook of industrial organization, 1, 183-255.

Perunovic, Z., & Vidic–Perunovic, J. (2011). Innovation in the Maritime Industry. Innovation, Proceedings of POMS 22nd Annual Conference, Reno, Nevada, U.S.A, 0355, pp. 1-25.

Peters, H. J. (2001). Developments in global seatrade and container shipping markets: their effects on the port industry and private sector involvement. International Journal of Maritime Economics, 3(1), 3-26.

Pham, T.Y., Jeon, J.W., Dang, V.L, Cha, Y.D., & Yeo, G.T. (2016). A Longitudinal Analysis of Concentration Developments for Container Terminals in Northern Vietnam. The Asian Journal of Shipping and Logistics 32(3): 157-164.

Piccolo, S., & Miklós-Thal, J. (2012). Colluding through suppliers. The RAND Journal of Economics, 43(3), 492-513.

Piezas-Jerbi, N., & Nee, C. (2009). Market shares in the post-Uruguay round era: A closer look using shift-share analysis. Prepared for World Trade Organization: Economic Research and Statistics Division, Geneva.

Pilsbury, S., & Meaney, A. (2009). Are horizontal mergers and vertical integration a problem? (No. 2009-4). OECD/ITF Joint Transport Research Centre Discussion Paper

Pimenta, T. L. (2020). Alienation and fetishism in Karl Marx's critique of political economy. Nova Economia, 30, 605-628.

Pittaway, L., Robertson, M., Munir, K., Denyer, D., & Neely, A. (2004). Networking and innovation: a systematic review of the evidence. International Journal of Management Reviews, 5(3-4), 137-168.

Polit, D. and Hungler., B (2004). Nursing Research, Principles, and Methods. Philadelphia: Lippincourt.

Port Economics, Management & Policy (17 August, 2021). Alliances in Container Shipping. Available at:

https://porteconomicsmanagement.org/pemp/contents/part1/ports-and-container-shipping/alliances-container-shipping/

Porter, M. (1980). Competitive Strategy: Techniques for Analyzing Industries and Competitors. New York, Free Press.

PortEconomics, (2020). Top 15 container ports in Europe in 2020. Available at: https://www.porteconomics.eu/top-15-containers-ports-in-europe-in-2020/ (Accessed 11/12/2021).

PORTIUS, (2013). Draft Chapter on Port Regulations for the IAPH Introduction to Maritime Law for Port Officials . Rotterdam, The Netherlands: PORTIUS.

Posner, R. A. (1970). Conglomerate Mergers and Antitrust Policy: An Introduction, 44 ST. JOHN's L. REV. 529, 530-31.

Poulis, K., Galanakis, G. C., Triantafillou, G. T., & Poulis, E. (2020). Value migration: digitalization of shipping as a mechanism of industry dethronement. Journal of Shipping and Trade, 5, 1-18.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. Administrative science quarterly, 116-145.

Pozzi, C., & Vassilopoulos, P. (2007). The Impact of Vertical Integration and Horizontal Diversification on the Value of Energy Firms. In The Econometrics of Energy Systems (pp. 225-253). Palgrave Macmillan, London.

Provan, K. G., Fish, A., & Sydow, J. (2007). Interorganizational networks at the network level: A review of the empirical literature on whole networks. Journal of management, 33(3), 479-516

PSA, (2015). Annual Report 2015. Available from: https://www.globalpsa.com/assets/uploads/AR2015.pdf

Psaraftis, H. N. & Pallis, A.A. (2012): "Concession of the Piraeus container terminal: turbulent times and the quest for competitiveness", Maritime Policy & Management: The flagship journal of international shipping and port research, 39:1, 27-43

PwC, (2013). Impact assessment on: "Measures to enhance the efficiency and quality of port services in the EU". Submitted to: European Commission Directorate-General for Mobility and Transport Unit B3 Ports & Inland Navigation.Version: 1.3

Qi, C. (2013). Market Power, Mergers and Concentratıon Of Logıstıcs Chaıns: A Revısıt Of The Impact Of Economıc Recessıon On Marıtıme Transport. Proceedings of IAMU, 26-28 October.

Quirmbach, H. C. (1986). Vertical integration: scale distortions, partial integration, and the direction of price change. The Quarterly Journal of Economics, 101(1), 131-147.

Rau, P., & Spinler, S. (2017). Alliance formation in a cooperative container shipping game: Performance of a real options investment approach. Transportation Research Part E: Logistics and Transportation Review, 101, 155-175.

Ray, G., Wu, D., & Konana, P. (2009). Competitive environment and the relationship between IT and vertical integration. Information Systems Research, 20(4), 585-603.

Rawley, E., & Simcoe, T. S. (2010). Diversification, diseconomies of scope, and vertical contracting: Evidence from the taxicab industry. Management Science, 56(9), 1534-1550.

Reitzes, J. D., & Sheran, K. L. (2002). Rolling seas in liner shipping. Review of Industrial Organization, 20(1), 51-59.

Reneeklhar Wordpress, (2018). Major Media Conglomerates. Available at: https://reneeklahr.files.wordpress.com/2015/11/media_conglomerates-master-file.png

Rey, P., & Tirole, J. (2007). A primer on foreclosure. Handbook of industrial organization, 3, 2145-2220.

Riordan, M. H. (2005). Competitive effects of vertical integration. Preliminary Draft Prepared for LEAR Conference on "Advances in the Economics of Competition Law", Rome, June 23-25.

Riordan, M. H., & Salop, S. C. (1994). Evaluating vertical mergers: A post-Chicago approach. Antitrust LJ, 63, 513.

Riordan, M. H., & Sappington, D. E. (1987). Information, incentives, and organizational mode. The Quarterly Journal of Economics, 102(2), 243-263.

Roberts, A., Wallace, W., & Moles, P. (2016). Mergers and Acquisitions. Edinburgh: Heriot- Watt University.

Roberts, T. (2014). When Bigger Is Better: A Critique of the Herfindahl-Hirschman Index's Use to Evaluate Mergers in Network Industries. Pace Law Review. 34(2): 894.

Rodrigue, J. P., & Guan, C. H. (2009). Port hinterland divergence along the North American Eastern seaboard. Notteboom, T., De langen, P., Ducruet, C., Ports in Proximity: Essays on Competition and Coordination among Adjacent Seaports, Londres, Ashgate: 131-160.

Rodrigue, J. P. (2010, May). Maritime transportation: drivers for the shipping and port industries. In International Transport Forum.

Rodrigue, J. P., & Notteboom, T. (2009). The terminalization of supply chains: reassessing the role of terminals in port/hinterland logistical relationships. Maritime Policy & Management, 36(2), 165-183.

Rodrigue, J. P., Notteboom, T., & Pallis, A. A. (2011). The financialization of the port and terminal industry: revisiting risk and embeddedness. Maritime Policy & Management, 38(2), 191-213.

Rodrigue, J. P., Comtois, C., & Slack, B. (2013). The geography of transport systems. Routledge.

Rodrigue, J. P. & Notteboom, T. E. (2013). Containerization, Box Logistics and Global Supply Chains: The Integration of Ports and Liner Shipping Networks. In Port management (pp. 5-28). Palgrave Macmillan, London.

Rodrigue, J. P., Comtois, C., & Slack, B. (2016). The geography of transport systems. Routledge. Fifth Edition.

Rodseth, H., & Mo, B. (2016). Integrated Planning in Autonomous Shipping—Application of Maintenance Management and KPIs. In Proceedings of the 10th World

Congress on Engineering Asset Management (WCEAM 2015). Lecture Notes in Mechanical Engineering, Koskinen K. et al. Eds; Springer, Cham, 2016, pp. 7-48

Rodseth, O. J. (2017). From Concept to Reality: Unmanned Merchant Ship Research in Norway. IEEE Underwater Technology. doi:10.1109/UT.2017.7890328.

Rosenbluth, G. (1955). Measures of concentration. In Business concentration and price policy. Princeton University Press. 57-99.

Ryan, D. A. J. (2001). Strategic alliances and their impacts on the container shipping industry (Doctoral dissertation, Concordia University).

Ryoo, D.K., Thanopoulou, H.A. (1999) Liner alliances in the globalization era: a strategic tool for Asian container carriers. Marit. Policy Manag. 26 (4), 349–367

Rumelt, R. P. (1984). Towards a strategic theory of the firm. In B. Lamb (Ed.), Competitive strategic management (pp. 556–570). Englewood Cliffs, NJ: Prentice-Hall.

Saad-Filho, A. (1993). A Note on Marx's Analysis of the Composition of Capital. Capital & Class, 17(2), 127-146.

Saad-Filho, A. (2001). Capital accumulation and the composition of capital. In Marx's Capital and Capitalism; Markets in a Socialist Alternative (pp. 69-85). Emerald Group Publishing Limited.O

Saanen, Y. A. (2004). An approach for designing robotized marine container terminals. TU Delft. Delft University of Technology.

Saanen, Y. A. & Rijsenbrij, J.C. (2012). Design of Systems and Operations in Container Terminals. Maritime Economics & Logistics Handbook, MEL, 2012

Sabrakos, E. (2001). Introduction to Transport Economics. Athens: Stamoulis Publications

Saggers, G. (2008). Vertical mergers-the European guidelines on non-horizontal mergers and their relevance for South Africa. South African Journal of Economic and Management Sciences, 11(3), 249-263.

Sagner, J.S. (2007), “Why working capital drives M&A today”, Journal of Corporate Accounting & Finance, Vol. 18, No. 2, pp. 41-45.

Sahal, D. (1980). Models of technological development and their relevance to advances in transportation. Technological Forecasting and Social Change, 16(3), 209-227.

Sakellariou, S. & Jeram J. (2018). The EU approach to conglomerate effects. White & Case LLP. Available at: https://www.whitecase.com/publications/insight/eu-approach-conglomerate-effects

Salas-Perez, R. (2018). Innovation and Port Logistics: Evidence on How Public Marine Terminals Prompt Unemployment Reductions in the Coast of Bolivar. Available at SSRN 3390449.

Salinger, M. A. (1988). Vertical mergers and market foreclosure. The Quarterly Journal of Economics, 103(2), 345-356.

Salop, S. C., & Culley, D. P. (2014). Potential competitive effects of vertical mergers: A how-to guide for practitioners. Available at SSRN 2522179.

Salop, S. C & D. Culley D.P. (2016), "Revising the US Vertical Merger Guidelines: Policy Issues and an Interim Guide for Practitioners", Journal of Antitrust Enforcement, Vol. 4/1, pp. 1-41,

Salop, S. C., & Scheffman, D. T. (1983). Raising rivals' costs. The American Economic Review, 73(2), 267-271.

Samuel, G. (1997). Competition reform and infrastructure. Melbourne, Australia: Australian Competition and Consumer Commission.

Sanchez-Gonzalez, P.-L., D. Díaz-Gutiérrez, T. J. Leo, and Núñez-Rivas, L. R. (2019). "Toward Digitalization of Maritime Transport?" Sensors 19 (4): 926. doi:10.3390/s19040926.

Sanders, U., Fæste, L., Riedl J., Egloff, C., Lee D., Kloppsteck L., Kolind J., and Italiano J. (2015). The Transformation Imperative in Container Shipping: Continued Overcapacity with No Market Recovery.

Sanfelici, D. (2016). The Centralization of Capital In The Property Sector And The Restructuring Of Metropolitan Areas. Mercator (Fortaleza), 15(2), 7-21.

Sappington, D. E., & Weisman, D. L. (1996). Designing incentive regulation for the telecommunications industry. American Enterprise Institute.

Saundry, R. & P. Turnbull (1997). "Private Profit, Public Loss: The Financial and Economic Performance of U.K. Ports". Maritime Policy and Management, 24, 4, 319-334.

Scalera, D., & Zazzaro, A. (2009). Do inter-firm networks make access to finance easier? Issues and empirical evidence. CONTRACTUAL NETWORKS, INTER-FIRM COOPERATION AND THE SMALL BUSINESS ACT, Fabrizio Cafaggi, Cheltenam, Edward Elgar, eds., Forthcoming.

Schlossberg, R. S. (2004). Mergers and acquisitions: Understanding the antitrust issues. American Bar Association.

Schmidt, K. M. (2014). Complementary patents and market structure. Journal of Economics & Management Strategy, 23(1), 68-88.

Schoenberger, E. (1988). From Fordism to flexible accumulation: Technology, competitive strategies, and international location. Environment and Planning D: Society and Space, 6(3), 245-262.

Schumpeter, J. A. (1976). Capitalism, socialism and democracy (1942). J. Econ. Literature, 20, 14-63.

Schumpeter, J. A. (1983). The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle (1912/1934). Transaction Publishers.–1982.–January, 1, 244.

Sekula, A., Burch, N., & Tessi, R. (2010). The forgotten space. Amsterdam: Doc. Eye Film.

Selznick, P. (1957). Leadership in Administration: A Sociological Perspective, Harper & Row, USA: New York)

Shaikh, A. (1990). Capital as a social relation. In Marxian economics (pp. 72-78). Palgrave Macmillan, London.

Shapiro, C. (2011). Competition and innovation: did arrow hit the Bull's eye?. In The rate and direction of inventive activity revisited (pp. 361-404). University of Chicago Press.

Shashikumar, N. (1995) Competition and models of market structure in liner shipping, Transport Reviews 15, 3–26

Shepherd, W.G. (1970). “Market power and economic welfare” Random House, New York (1970).

Sheppard, E. (1990). Transportation in a capitalist space-economy: transportation demand, circulation time, and transportation innovations. Environment and Planning A, 22(8), 1007-1024.

Shi, Y., & Gregory, M. (1998). International manufacturing networks—to develop global competitive capabilities. Journal of operations management, 16(2-3), 195-214.

Shin, Y. J., Oh, J. S., Shin, S. H., & Jang, H. L. (2018). A study on the countermeasures of shipping and port logistics industry in responding to the progression of fourth industrial revolution. Journal of Navigation and Port Research, 42(5), 347-356.

Sjostrom, W. (2010). Competition and cooperation in liner shipping. The Handbook of maritime economics and business, 433-456

Slack, B., Comtois, C., Mccalla, R. (2002). Strategic alliances in the container shippingindustry: a global perspective. Marit. Policy Manag. 29 (1), 65–76.

Slack, B., & Frémont, A. (2005). Transformation of port terminal operations: from the local to the global. Transport Reviews, 25(1), 117-130.

Smith, A. (1863). An Inquiry into the nature and causes of the Wealth of Nations... New edition, revised, corrected and improved.

Smith, D. N. (2001). The spectral reality of value: Sieber, Marx, and commodity fetishism. In Marx's Capital and Capitalism; Markets in a Socialist Alternative. Emerald Group Publishing Limited.

Sokoloff, K. L. (1988). Inventive activity in early industrial America: evidence from patent records, 1790–1846. The Journal of Economic History, 48(4), 813-850.

Song, D. W. (2003). Port co-opetition in concept and practice. Maritime Policy & Management, 30(1), 29-44.

Song, D. W., & Panayides, P. (Eds.) (2012). Maritime logistics: contemporary issues. Emerald Group Publishing.

Spiegel, Y. (2013). Backward integration, forward integration, and vertical foreclosure. Centre for Economic Policy Research.

Sporleder, T. L. (1992). Managerial economics of vertically coordinated agricultural firms. American Journal of Agricultural Economics, 74(5), 1226-1231.

Steenkamp, J. B. E., & Geyskens, I. (2012). Transaction cost economics and the roles of national culture: A test of hypotheses based on Inglehart and Hofstede. Journal of the Academy of Marketing Science, 40(2), 252-270.

Steenken, D., Voss, S., & Stahlbock, R. (2004). Container terminal operation and operations research-a classification and literature review. OR spectrum, 26(1), 3-49.

Stejskal, J., & Matatkova, K. (2012). Assessment of shift-share analysis suitable for identification of industrial cluster establishing in regions. Ekonomicky casopis 60(9): 935-948.

Stevens, H. (1999). “The Institutional Position of Seaports: An International Comparison”. (Dordrecht, Netherlands: The GeoJournal Library, Vol. 51, Kluwer Academic Publishers).

Stigler, G. J. (1951). The Division of Labor is Limited by the Extent of the Market. Journal of political economy, 59(3), 185-193.

Sudarsanam, S. (2010). Creating Value from Mergers and Acquisitions: The Challenges. (2nd Ed.) New York, USA: The Free Press

Sullivan, S. P. (2019). Anticompetitive Entrenchment. U. Kan. L. Rev., 68, 1133.

Suykens, F. (1992) Ports as nodal points. In Dolman A.J., van Ettinger J. (Eds). Ports as nodal points in a Global Transport System: Proceedings of Pacem in Maribus XVIII August 1990, 77-82

Suykens, F., & Van de Voorde, E. (1998). A quarter a century of port management in Europe: objectives and tools. Maritime Policy and Management, 25(3), 251-261

Sweezy, P. M. (1968). The Theory of Capitalist Development. Monthly Review Press, New York.

Sweezy, P. M. (1990). Monopoly capitalism. In Marxian Economics (pp. 297-303). Palgrave Macmillan, London.

Symeonidis, G. (1996). Innovation, firm size and market structure: Schumpeterian hypotheses and some new themes. OECD Economics Department Working Papers No. 161

Sys, C. (2009). Is the container liner shipping industry an oligopoly? Transport policy, 16(5), 259-270.

Sys, C., Vanelslander, T., & Carlan, V. (2015). Innovative concepts in the maritime supply chain.

Szakonyi, M. (2014, March, 24th). Sole FMC Commissioner Against P3 Calls It 'Alliance in Name Only', The Journal of Commerce (JOC). Available at: https://www.joc.com/maritime-news/container-lines/p3-network/sole-fmc-commissioner-against-p3-calls-it-alliance-name-only_20140324.html

Szűcs, I., & Szőllősi, L. (2014). Potential of vertical and horizontal integration in the Hungarian fish Product chain. APSTRACT: Applied Studies in Agribusiness and Commerce, 8(1033-2016-84245), 5-15.

Tanrisever, F., Derinkuyu, K., Jongen, G. (2015). Organization and functioning of liberalized electricity markets: an overview of the Dutch market. Renew. Sustain. Energy Rev. 51, 1363–1374. http://dx.doi.org/10.1016/j.rser.2015.07.019.

Taylor, T., Doherty, A., & McGraw, P. (2015). Managing people in sport organizations: A strategic human resource management perspective. Routledge.

Thomas, B. J. (1994). The Privatization of United Kingdom Seaports. Maritime Policy and Management, 21, 2, 135-148.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. Strategic management journal, 18(7), 509-533.

Ter Brake, M. C., Iperen, E., Looije, D., & Koldenhof, Y. (2015). Unmanned ship simulation with real-time dynamic risk index. Zeszyty Naukowe Akademii Morskiej w Szczecinie.

Thatcher, M. (2005). The third force? Independent regulatory agencies and elected politicians in Europe. Governance, Vol. 18 No.3, pp. 347-373.

Tian, Z., F. Liu, L. Zhixiong, R. Malekian, and Y. Xie (2017). “The Development of Key Technologies in Applications of Vessels Connected to the Internet.” Symmetry 9 (10): 211.

Todeva, E., & Knoke, D. (2005). Strategic alliances and models of collaboration. Management decision.

Tompkins, J. A., & Schaffer, B. (1996). High-performance material handling trends: preparing for the next century. IIE Solutions, 28(4), 16-20.

Tongzon, J., & Heng, W. (2005). Port privatization, efficiency and competitiveness: Some empirical evidence from container ports (terminals). Transportation Research Part A: Policy and Practice, 39(5), 405-424.

Toner, P. (2011). Workforce skills and innovation: An overview of major themes in the literature. OECD Directorate for Science, Technology and Industry (STI), Centre for Educational Research and Innovation (CERI)

Tradelens, (2020). Ecosystem. Available Online: https://www.tradelens.com/ecosystem (Accessed 22/11/2021).

TradeWings (2021). MSC latest to be hit with patent infringement lawsuit. Available Online: https://www.tradewindsnews.com/law/msc-latest-to-be-hit-with-patent-infringement-lawsuit/2-1-948608 (Accessed 22/11/2021)

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British journal of management, 14(3), 207-222.

Tregenna, F. (2009). 'Services' in Marxian Economic Thought. Faculty of Economics, University of Cambridge.

Trillas, F. (2010). “Independent Regulators: Theory, Evidence and Reform Proposals”. Barcelona, Spain: IESE Business Scholl - University of Navarra.

Tsing, A. (2009). Supply chains and the human condition. Rethinking Marxism, 21(2), 148-176.

Tseng, Y. Y., Yue, W. L., & Taylor, M. A. (2005). The role of transportation in logistics chain. Eastern Asia Society for Transportation Studies.

Tucker, I. B., & Wilder, R. P. (1977). Trends in vertical integration in the US manufacturing sector. The Journal of Industrial Economics, 81-94.

Ünay, S. (2011). The Rise of the Regulatory State in Europe. Turkish Journal of Politics, Vol.2, No.1, pp. 21-31

UNCTAD (2006). Review of Maritime Transport 2006, Geneva, United Nations Publications.

UNCTAD (2010). Review of Maritime Transport 2010, Geneva, United Nations Publications.

UNCTAD (2015). Review of Maritime Transport 2015, Geneva, United Nations Publications.

UNCTAD (2017). Review of Maritime Transport 2017, Geneva, United Nations Publications.

UNCTAD, (2018). 50 Years of Review of Maritime Transport, 1968-2018: Reflecting on the past, exploring the future. Transport And Trade Facilitation, Series No.11, United Nations Publications.

UNCTAD, (2019). Review of Maritime Transport 2019, Geneva, United Nations Publications.

UNCTAD, (2020). Review of Maritime Transport 2020, Geneva, United Nations Publications.

UNCTAD, (2021). Container Shipping in times of COVID-19: Why freight rates have surged and implications for policy makers, Policy Brief, No. 84, April 2021.

United States District Court for the Western District of Texas Waco Division (2021). Original complaint for patent infringement: TRANSCEND SHIPPING SYSTEMS, LLC, vs CMA CGM (AMERICA) LLC AND CMA CGM S.A. Case 6:21-cv-00018-ADA, pp. 1-61.

United States District Court for The Eastern District of Texas Marshall Division (2021). Original complaint for patent infringe-ment: TRANSCEND SHIPPING SYSTEMS, LLC, vs ZIM INTEGRATED SHIPPING SERVICES LTD. Case 2:21-cv-00108. pp. 1-45.93.95.

U.S Army Corp. Of Engineers (2018). U.S. Waterborne Container Traffic in 2015 – 2005. Available: http://www.navigationdatacenter.us/wcsc/containers.htm

U.S Maritime Administration (2009). America's Ports and Intermodal Transportation System. Available: http://www.glmri.org/downloads/Ports&IntermodalTransport.pdf

Uukkivi, R., Ots, M., & Koppel, O. (2014). Systematic approach to economic regulation of network industries in Estonia. Trames: A Journal of the Humanities and Social Sciences, 18(3), 221.

Vaggelas, G. K. (2007, June). Greek ports: Structural challenges and forms of adjustment. In 3rd Hellenic Observatory PhD Symposium (pp. 14-15).

Vaggelas, G. (2018). Shipping strategies: The rise of global liner alliances in the port of Piraeus, Jean Monnet Symposium on the "Future of European Port Policy",28-29 June, Chios, Greece

Vaio, D.A., & Varriale, L. (2018). Management innovation for environmental sustainability in seaports: Managerial accounting instruments and training for competitive green ports beyond the regulations. Sustainability, 10(3), 783.

Van Der Horst, M. R. & De Langen, P.W. (2008) "Coordination in Hinterland Transport Chains: A Major Challenge for the Seaport Community", Maritime Economics and Logistics 10, pp. 108-129.

Van Der Lugt, L., Dooms, M., & Parola, F. (2013). Strategy making by hybrid organizations: The case of the port authority. Research in Transportation Business & Management, 8, 103-113.

Van der Lugt, L., Langen, P. D., & Hagdorn, L. (2015). Beyond the landlord: Worldwide empirical analysis of port authority strategies. International Journal of Shipping and Transport Logistics, 7(5), 570–596.

Van Hooydonk, E. (2014). Recommendations on the Setting Up of the Greek Ports Regulator. Commissioned by the European Commission DG Employment, Social Affairs and Inclusion.

Van Reeven, P. (2010). The effect of competition on economic rents in seaports. Journal of Transport Economics and Policy (JTEP), 44(1), 79-92.

Van der Putten, F. P. (2016). Infrastructure and geopolitics: China's emerging presence in the eastern Mediterranean. Journal of Balkan and Near Eastern Studies, 18(4), 337-351.

Vanelslander, T., Sys, C., Acciaro, M., Ferrari, C., Giuliano, G., Kapros, S., ... & Roumboutsos, A. (2015). Port Innovation: definition and typology. In BNPPF Innovation Event 2015, University of Antwerp, 23 April 2015 (pp. 1-15).

Vanelslander, T., Sys, C., Lam, J. S. L., Ferrari, C., Roumboutsos, A., Acciaro, M., ... & Giuliano, G. (2019). A serving innovation typology: mapping port-related innovations. Transport Reviews, 39(5), 611-629.

Van De Voorde, E., & Vanelslander, T. (2008). Market power and vertical and horizontal integration in the maritime shipping and port industry (No. 2009-2). OECD/ITF Joint Transport Research Centre Discussion Paper.

Van Niekerk, H. C. (2014). Ports restructuring, policy and regulation: The South African case. Unpublished paper. University of Stellenbosch. www. cepal. org/transporte/perfil/iame_papers/…/Van_Niekerk. doc

Varan, S., & Cerit, A.G. (2014). Concentration and competition of container ports in Turkey: A statistical analysis. Dokuz Eylül Üniversitesi Denizcilik Fakültesi Dergisi, 6(1).

Varbanova, A. (2017). Concentration in Liner Shipping and Alliances Formation: Issues and Challenges, Scientific Proceedings Xiv International Congress "Machines. Technologies. Materials." - Summer Session

Veblen, T. (1904). Theory of business enterprise. McMaster University Archive for the History of Economic Thought. Available at: https://EconPapers.repec.org/RePEc:hay:hetboo:veblen1904

Verhoest, K., Verschuere, B., & Bouckaert, G. (2007). Pressure, Legitimacy and Innovative Behavior by Public Organizations. Governance: An International Journal of Policy, Administration, and Institutions, Vol.20, No.3, pp. 469-496.

Verhoeven, P. (2010). "A review of port authority functions: towards a renaissance?". Maritime Policy & Management, 37(3), 247-270.

Virilio, P. (2010). The Futurism of the Instant. Malden, MA: Polity Press.

Visual Capitalist (2016). These 5 Big Companies Control the World's Beer. Available at: https://www.visualcapitalist.com/5-big-companies-control-worlds-beer/

Visual Capitalist (2018). The 15 Corporations That Make the Most Cars. Available at: https://www.visualcapitalist.com/15-corporations-make-most-cars/

Vitali S, Glattfelder JB, Battiston S (2011) The Network of Global Corporate Control. PLoS ONE 6(10): e25995. doi:10.1371/journal.pone.0025995

Vitsounis, T. K., & Pallis, A. A. (2012). "Port value chains and the role of interdependencies". Maritime Logistics: Contemporary Issues, 155-173

Vythoulkas, D. (2014). Storms in the Port of Piraeus, for the Privatization of OLP. To Vima, Available at: http://www.tovima.gr/society/article/?aid=571025

Wang, T. F, & Cullinane, K. P. B. (2004). Industrial concentration in container ports. In International Association of Maritime Economists Annual Conference, Izmir (Vol. 30).

Wang, J., & Wang, X. (2015). Benefits of Foreign Ownership: Evidence from Foreign Direct Investment in China. Journal of International Economics, 97(2), 325-338.

Wani, A.A & Wani, M.R (2015). Time, space and capitalism. International Journal of Multidisciplinary Research and Development. Volume: 2, Issue: 9, 306-309

Waterman, D., & Weiss, A. A. (1996). The effects of vertical integration between cable television systems and pay cable networks. Journal of Econometrics, 72(1-2), 357-395.

Watson, R. T., Holm, H., & Lind, M. (2015). Green steaming: A methodology for estimating carbon emissions avoided. Thirty Sixth International Conference on Information Systems, Fort Worth, the U.S.A.

Webb, S. B. (1980). Tariffs, cartels, technology, and growth in the German steel industry, 1879 to 1914. The Journal of Economic History, 40(2), 309-330.

Weiss, L.W. and Klass, M.W. (1986) Regulatory reform: What actually happened. Boston: Little, Brown.

Werner, M., & Bair, J. (2011). Losing our chains: Rethinking commodities through disarticulations. Environment and Planning A, 43(5), 998-1015.

Wernerfelt, B. (1984). A resource-based view of the firm. Strategic management journal, 5(2), 171-180.

Wiegmans, B. W., & Geerlings, H. (2010). Sustainable port innovations: barriers and enablers for successful implementation. World Review of Intermodal Transportation Research, 3(3), 230-250.

Williamson, O.E. (1975). Markets and Hierarchies: Analysis and Antitrust Implications, (New York: USA: Free Press)

Williamson, O. E. (1985). Transaction cost economics. The economic institutions of capitalism, (New York: USA: Free Press)

Wilmsmeier, G., & Monios, J. (2015) The production of capitalist “smooth” space in global port operations. Journal of Transport Geography, 47, 59-69.

WIPO, (2021). Patents Available online: https://www.wipo.int/patents/en/ (accessed 16/2/2021)

WIPO, (2015). WIPO guide to using patent information. WIPO publication No. L434/3E, Geneva, Switzerland, 2015, pp. 1-44.

WIPO, (2020). World intellectual property indicators 2020. WIPO publication No. 941E/20, Geneva, Switzerland, pp. 1-237.

Wise, R. D., & Martin, D. T. (2015). The political economy of global labour arbitrage. In Handbook of the international political economy of production. Edward Elgar Publishing.

World Bank (2001). Port Reform Toolkit: Alternative port management structures and ownership models. Module 3. Washington, U.S.A: World Bank Publications.

World Bank. (2006). Handbook for Evaluating Infrastructure Regulatory Systems. Washington: International Bank for Reconstruction and Development / The World Bank.

World Bank. (2007). Port Reform Toolkit: Module 6. Washington, U.S.A: World Bank Publications.

Wróbel, K., Krata, P., Montewka, J., & Hinz, T. (2016). Towards the development of a risk model for unmanned vessels design and operations. TransNav, International Journal on Marine Navigation and Safety of Sea Transportation, 10(2).

Wróbel, K., Montewka, J., & Kujala, P. (2017). Towards the assessment of potential impact of unmanned vessels on maritime transportation safety. Reliability Engineering & System Safety, 165, 155-169.

WTO (World Trade Organization), (2021). China and the WTO. Available at: https://www.wto.org/english/thewto_e/countries_e/china_e.htm

Wyatt, A. R & Spacek, L, (1970). Accounting Principles and Conglomerate Growth, Sk John’s Law Review, pp. 805-828.

xChange, (2021). Demurrage & Detention Benchmark 2021, Globalink.

Yaghmaian, B. (1998). Globalization and the state: The political economy of global accumulation and its emerging mode of regulation. Science & Society, 241-265.

Yale-Brozen, Y. B. (1982). Mergers in perspective. American Enterprise Institute.

Yang, C. C., Marlow, P. B. & Lu, C. S. (2009). Assessing Resources, Logistics Service Capabilities, Innovation Capabilities and the Performance of Container Shipping Services in Taiwan. International Journal of Production Economics 122 (1): 4–20

Yang, D., Liu, M., & Shi, X. (2011). Verifying liner shipping alliance's stability by applying core theory. Res. Transp. Econ. 32 (1), 15–24.

Yang, D., Wu, L., Wang, S., Jia, H., & Li, K. X. (2019). How big data enriches maritime research–a critical review of automatic identification system (AIS) data applications. Transport Reviews, 39(6), 755-773.

Yap, W.Y., & Zahraei, S.M. (2018). Liner shipping alliances and their impact on shipping connectivity in Southeast Asia, Maritime Business Review, Vol. 3 Issue: 3, pp.243-255, https://doi.org/10.1108/MABR-05-2018-0018

Yasar, M., & Kiraci, K. (2017). Market Share, the Number of Competitors and Concentration: An Empirical Application on the Airline Industry. In Anadolu International Conference in Economics Proceedings.

Yelderman, S. (2016). Do Patent Challenges Increase Competition? The University of Chicago Law Review, 1943-2026.

Yeo, H. J. (2013). Geography of mergers and acquisitions in the container shipping industry. The Asian Journal of Shipping and Logistics, 29(3), 291-314.

Yoshida, S., Yang, J.H., Kim, K.H., Lee, T., Cullinane, K. (2005). 'Network economies of global alliances in liner shipping: the case of Japanese liner shipping companies'. World Shipping and Port Development. London: Palgrave , 36-49

Yildirim, H. S, & Philippatos, G. C. (2007). Competition and contestability in Central and Eastern European banking markets. Managerial Finance, 33(3), 195-209.

Zhang, D. (2013). The revival of vertical integration: strategic choice and performance influences. Journal of Management and Strategy, 4(1), 1.

Zhang, X., Zhang, Q., Yang, J., Cong, Z., Luo, J., & Chen, H. (2019). Safety risk analysis of unmanned ships in inland rivers based on a fuzzy Bayesian network. Journal of Advanced Transportation, 2019.

Zerby, J. A. (1988), "Clarifying some issues relating to contestability in liner shipping (and perhaps also eliminating some doubts)," Maritime Policy & Management, 15(1), PP/ 5-14.