collection Les océanides

BALTIC - ARCTIC
STRATEGIC PERSPECTIVE

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Sommaire

PARTIE 2 - Strategy & Perspective

PARTIE 3 - Human & Technology

Avant Propos

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En participant à la première conférence Baltic Seas tenue à Klaïpeda en Lituanie en mai 2018 sur le thème *The Baltic Sea : Gateway or cul-de-sac ?,* j'eus le plaisir d'intervenir pour expliquer en quoi les pays baltes, Lituanie, Lettonie et Estonie, demeuraient des territoires éminemment stratégiques. Enchâssés entre l'enclave russe de Kaliningrad et les débouchés maritimes russes du Golfe de Finlande, les pays baltes (en fait surtout les ports lituaniens et lettons) constituent une véritable fenêtre géostratégique majeure à l'interface entre l'espace maritime de la Baltique et l'immense arrière-pays oriental européen incluant évidemment la Biélorussie enclavée.

Le port de Klaïpeda est au cœur de concurrences intenses qui sont exacerbées par les opportunités économiques et logistiques insufflés par les investisseurs institutionnels et privés chinois. Il peut paraître incongru d'évoquer le rôle de la Chine dans l'avenir des ports baltes et plus largement dans l'attractivité (ou la désaffection) de la mer Baltique. Pourtant, dans sa vision quasi planétaire *Belt & Road Initiative* (BRI), Beijing inclut les débouchés maritimo-portuaires baltes comme de potentiels « gateways » qui serviraient de connecteurs stratégiques entre l'immense potentiel de l'Asie centrale et les marchés européens.

[1] L'auteur de cet article est seul responsable du contenu de cette mise en perspective, qui n'engage ni la direction générale du Trésor, ni l'ambassade de France en Lituanie.

Les travaux de la conférence *Baltic Seas* ont parfaitement reflété les problématiques récurrentes qui se posent sur la place la Mer Baltique dans ces circulations interrégionales et intercontinentales. Le volet géostratégique a été mainte fois illustré avec notamment les perspectives de nouvelles connectivités multimodales avec les actuels développements maritimo-portuaires de l'Arctique occidentale russe et norvégien.

Quelques incartades ont permis aussi de comprendre combien les chemins de fer et leurs connectivités avec les terminaisons portuaires étaient au cœur d'enjeux autant logistiques que politiques pour quasiment tous les pays du pourtour balte. Je me permettrais cependant de développer quelques éléments supplémentaires sur la place trop souvent méconnue de la Biélorussie dans le jeu économique, logistique et politique régional, car, de la relation des nations voisines de la Biélorussie et de leurs entreprises avec Minsk dépendent en partie les débouchés maritimes que les Chinois et leurs entreprises choisiront au sein de la BRI.

Ce pays d'un peu plus de 200 000 kilomètres carrés et peuplé de moins de 10 millions d'habitants fait l'objet d'une attention particulière de la part des dirigeants russes qui relancent à intervalles irréguliers sinon le projet d'une « confédération russo-biélorusse » qui prévoit une véritable fusion avec un seul président et un parlement unique, du moins une plus grande intégration des relations économiques entre les deux Etats souverains. Ces tensions politiques qui émaillent régulièrement les relations diplomatiques entre les deux Etats n'occultent pas le fait que l'économie biélorusse demeure tributaire des investissements russes qui représentent 38,3 % du stock total des IDE *(Investissements Directs Etrangers)*. A court termes les Russes pourraient exiger de la part des entreprises biélorusses qu'elles travaillent de plus en plus avec l'Oblast de Leningrad dont Saint Pétersbourg est le chef-lieu. Cette position dominante russe pourrait cependant être perturbée à moyen terme, dans la mesure où la Chine semble particulièrement intéressée par le pays enclavé.

L'Empire du Milieu ne représente aujourd'hui que 3,1% du stock total des IDE (7e place), mais il promet une implantation durable dans la région et a déjà accordé à la Biélorussie un prêt de 600 MUSD pour que le pays puisse rembourser ses emprunts à la Russie. Surtout, la Biélorussie semble être déjà incluse dans le cadre de l'initiative BRI. Cette coopération sino-biélorusse est symbolisée par l'implantation du parc industriel Great Stone, un dry port proche de Minsk. Ayant un emplacement stratégique – proche des liaisons ferroviaires, de l'aéroport international de Minsk et de l'autoroute transnationale Berlin-Moscou – ce site accueille aujourd'hui une quarantaine d'entreprises, qui profitent d'une niche fiscale les 10 premières années. C'est notamment le cas de l'entreprise lituanienne New Craft Technologies, qui investit à présent un capital de 7 MEUR afin de construire une usine d'emballages écologiques.

Cette première illustration met en perspective l'importance stratégique de la coopération historique entretenue entre la Biélorussie et la Lituanie (les deux pays actuels ayant constitué le noyau du Grand-duché de Lituanie du XIV^{e} au XVIII^{e} siècle) dans les secteurs vitaux des transports (que ce soit par voie ferroviaire ou routière) et de la logistique. Ainsi, les deux pays ont récemment préparé l'élaboration d'un plan pour créer quatre points supplémentaires de passage frontalier pour le transport international. Si cette entente leur permet de développer les flux de fret dans leur pays ; elle pourrait devenir demain au cœur des relations entre l'Europe et l'Asie puisqu'au-delà de Minsk, Beijing cherche à développer « ses » terminaisons portuaires sur la Baltique.

Dans le cadre de la politique BRI, les investissements chinois visent le port de Klaipeda, troisième ville de Lituanie. Le port lituanien est en plein essor comme il l'a été rappelé avec précision dans le cadre des échanges de la conférence. Cette croissance du premier port maritime et commercial de Lituanie tient en partie au transport de marchandises provenant de Biélorussie (notamment les engrais) qui représentait un tiers du fret, mais aussi à l'existence de la ligne Viking un « blocktrain » qui peut rejoindre le Caucase, mais dont 50% du trafic en valeur est effectué entre la Biélorussie et la Lituanie.

Ainsi, les Chinois semblent être intéressés par Klaipeda comme centre de transit dans leur chaîne de transport vers l'Europe et donc via les pays baltes. Les marchandises provenant d'Asie atteindraient Minsk pour être ensuite transportées à travers la Lituanie vers le port de Klaipeda – ce qui renforcerait considérablement les relations entre la Biélorussie et la Lituanie, compte tenu de l'importance pour les deux pays de cette coopération économique. Le développement du port de Klaipeda est un investissement lourd, estimé entre 800 et 1 milliard EUR. Déjà, des protocoles d'intention ont été signés entre le port de Klaipeda, la société ferroviaire Lietuvos Geležinkeliai et la zone économique franche de Kaunas avec le parc industriel Great Stone.

Néanmoins, la décision d'une implantation de la Chine à Klaipeda n'est toujours pas actée. Les investisseurs chinois peuvent toujours considérer d'autres ports, comme Ventspils et Riga en Lettonie, ou encore ceux situés dans l'oblast de Leningrad. Surtout, le port de Gdansk en Pologne ne cache pas son ambition de devenir un centre de transit majeur pour les marchandises en provenance ou à destination de l'Europe centrale et orientale et espère pouvoir attirer, au détriment de Klaipeda, les flux provenant du dry port de Minsk.

Selon Martin Osowski, responsable des infrastructures au port de Gdansk, le transport de marchandises provenant de Great Stone serait moins coûteux via Gdansk que par Klaipeda ; et pourrait être considérablement développé suite à la mise en place d'une liaison ferroviaire entre le port polonais et Minsk. L'accueil symbolique du plus grand porte-conteneurs, le *MSC Gülsün*, dans le port de Gdansk le 23 août 2019, manifeste combien le port polonais compte devenir la nouvelle plate-forme régionale de la Baltique au détriment de Hambourg et *a fortiori* Rotterdam.

Un des enjeux logistiques majeurs qui anime la compétition portuaire sur la rangée Gdansk-Saint-Pétersbourg est d'optimiser l'attractivité de connectivités ferroviaires et routières avec l'arrière-pays pour assurer un minimum de volumes de fret retour aux navires maritimes qui touchent directement les ports baltes. Le cas du *MSC Gülsün* pose la question des équilibres de flux import/export alors même que la plupart des ports de la Mer Baltique demeure « feederisés ».

Une lecture à deux variables s'impose quand il est interrogé le statut de gateway ou de cul-de-sac de la Mer Baltique :

- D'une part les connectivités terrestres (que ce soit vers l'Arctique occidentale, l'Europe orientale et l'Asie Centrale) pour permettre de développer des continuums logistiques à très grande échelle géographique et logistique ; et,
- D'autre part, les connectivités maritimes directes avec l'impérieuse nécessité de consolider des frets retours pour être suffisamment attractifs et ainsi déplacer le centre de gravité maritimo-portuaire de la Mer Baltique qui est actuellement ancré à Rotterdam et Hambourg.

La décision des investisseurs chinois de s'implanter à Klaipeda, si elle devait se concrétiser, dépasserait donc largement le seul développement – ou non – des relations économiques entre la Biélorussie et la Lituanie. Il pourrait être nettement plus structurant dans l'orchestration logistique d'une partie des flux de marchandises qui entrent et sortent de l'espace baltique, en provenance ou à destination de la Biélorussie, des Etats enclavés de l'Asie Centrale comme le Kazakhstan ou même de la Chine intérieure.

Cette illustration, parmi tant d'autres qui ne peuvent être développés dans cette courte contribution, a le mérite d'ouvrir les perspectives sur le rôle de gateway et non de cul-de-sac de la Mer Baltique. L'effort collectif contenu dans *Baltic-Arctic. Strategic Perspective* est d'autant plus à saluer qu'il met en lumière une région largement sous-documentée, notamment en matière de transport et de logistique. Dans notre monde nomade, il est impossible de dissocier les faits politiques des enjeux énergétiques et logistiques.

Avec son approche résolument pluridisciplinaire, le groupe de recherche appliquée *Baltic Seas* apporte des regards complémentaires et prospectifs qui s'avèrent indispensables pour nourrir les réflexions des décideurs publics. Puisse ce premier opus en appeler de nombreux autres ; avec un souhait pieux de voir la recherche appliquée francophone trouver une place de choix dans les réflexions actuelles et surtout à venir.

Chapitre Introductif

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Biographies

Depdepuis novembre 2010, **Yann Alix** *occupe le poste de Délégué Général de la Fondation SEFACIL, laboratoire d'idées prospectives sur les stratégies maritime, portuaire et logistique. Il a fondé et dirige la collection* Les Océanides *et co-dirige la collection* Afrique Atlantique.
Titulaire d'un PhD de Concordia University (1999) et d'un doctorat en géographie des transports de l'Université de Caen en France, Yann Alix fut consultant chez Innovation Maritime à Rimouski au Canada (2000-2004) avant de prendre un poste d'enseignant-chercheur à l'Ecole de Management de Normandie au Havre où il devient en 2007 le Directeur de l'IPER (Institut Portuaire d'Enseignement et de Recherche). De 2011 à 2019, Dr. Yann Alix travaille chez SOGET au développement international du Cargo Community System *avant de rejoindre depuis Avril 2019 le cabinet Abington Advisory en qualité de Senior Manager.*

Arnaud Serry *est Maître de Conférences en Géographie à l'Université du Havre, spécialisé en géographie des transports maritimes. Ayant occupé un poste de responsable logistique dans une entreprise d'import-export, ses différentes missions l'ont amené à travailler dans le domaine des transports sous des angles forts différents.*
Il est également responsable du projet DEVPORT (www.devport.fr) qui s'appuie sur la constitution d'un Système d'Information Géographique (SIG) dédié à l'Axe Seine et qui est plutôt orienté vers la géographie économique.
Ses thèmes de recherche actuels sont centrés sur trois axes principaux : le transport maritime en mer baltique, des travaux sur l'axe Seine via l'angle de l'adaptation des acteurs de l'économie maritime, portuaire et logistique aux aléas de la mondialisation et des travaux plus globaux consacrés au transport maritime notamment en lien avec l'utilisation de technologies modernes dans le monde maritime (AIS, GNL) et avec des publications à vocation pédagogique (préparation à l'agrégation).

Les Océanides… évoluer sans cesse !

7 ans : la collection *Les Océanides* célèbre ses 7 années de production et de diffusion. Porteur de symboles forts et de croyances ésotériques, le chiffre 7 signifie pour la Fondation Sefacil maturité et continuité avec un sixième tome qui s'écarte quelque peu du modèle inscrit dans les canons éditoriaux de la collection tout en conservant les fondements originaux qui font des *Océanides* un outil de diffusion de connaissance unique en son genre.

En premier lieu, rappelons que ce nouvel opus conserve l'idée fondatrice de la pluridisciplinarité avec une production qui se veut libre de ses propres choix, sans nécessairement se conformer aux standards scientifiques. Cette liberté s'assume pleinement dans la mission première de la fondation : établir des passerelles utiles entre un écosystème académique intéressé au terrain et des professionnels-praticiens séduits à l'idée de confronter leurs problématiques aux savoirs appliqués d'une recherche universitaire opérationnelle.

En second lieu, ce sixième tome incarne en quelque sorte une évolution naturelle de la production du réseau de la Fondation SEFACIL puisqu'il est le fruit d'un collectif international, nom de code *Baltic Seas*, soutenu par la fondation depuis 2017. Après une note stratégique et prospective sur l'évolution du système maritime et portuaire de la mer Baltique publiée fin 2017, le collectif *Baltic Seas* « auto-produisait » avec son partenaire scientifique la *Lithuanian Maritime Academy* la première conférence internationale du réseau en mai 2018 à Klaipeda en Lituanie (Figure 1).

Figure 1. Intervenants de la première conférence internationale du collectif Baltic Seas tenue à Klaipeda en Lituanie..

Source : Yann Alix 2018

Le double paradigme de la fondation ; à savoir promouvoir la culture d'une recherche appliquée en langue française et assurer une diffusion mondiale des productions par la gratuité des supports papier et électronique se trouve légèrement bousculé avec ce tome VI. Manifestant toute la diversité disciplinaire et toute la richesse des échanges qui se fécondèrent depuis la manifestation de Klaipeda, le tome VI se construit autour de miscellanées plus anglo-saxonnes que francophones du fait que plus de dix nationalités se sont retrouvées sous l'égide de la Fondation, utilisant trois langues officielles (anglais, français et lituanien). Cette incartade anglophile a permis de stimuler les discussions entre experts baltes, scandinaves et ouest-européens et ouvert encore un peu plus le réseau international *Baltic Seas* qui se trouve pour la tenue de la deuxième édition du colloque international à Turku en Finlande.

Baltic-Artic – Strategic Perspective constitue le premier ouvrage de la collection à dimension « régionaliste » et cela se justifie par l'intensité des réflexions académiques et stratégiques sur cette partie du monde qui se révèle sous le double effet du réchauffement climatique et de l'exploitation accélérée d'immenses ressources naturelles. En guise de prolégomènes, la conférence internationale de Klaipeda posait une question simple : est-ce que l'espace maritime et portuaire de la Mer Baltique demeure un cul-de-sac géographique ou devient une nouvelle porte d'entrée majeure de la circulation mondialisée des flux de marchandises ? Pas de réponse unique mais un ensemble de points de vue qui part d'un constat : l'espace Baltique et son foisonnement portuaire (Figure 2) s'appréhendent dans une triple dynamique géographique, économique et logistique.

Figure 2. Localisation géographique des principaux ports commerciaux de la Baltique

Source : Arnaud Serry 2019

La première est que la Mer Baltique, à l'instar de ce que l'on retrouve dans plusieurs espaces océaniques semi-fermés (Méditerranée, Mer de Chine, Caraïbe, etc.), demeure un territoire régionalisé où la mer constitue le substrat immatériel de sillons commerciaux. La connectivité maritime entre les ports de grandes, moyennes et petites tailles s'avère intense avec une kyrielle de services qui transportent avant tout des hydrocarbures et des marchandises roulières. La Mer Baltique constitue en ce sens un carrefour régional qui sert les intérêts économiques et logistiques de populations riveraines principalement concentrées sur les pourtours côtiers. Difficile d'ailleurs de différencier la mer de la terre tant les liaisons roulières matérialisent une forme de continuité de la mobilité et des échanges entre les pays riverains.

La deuxième tient au fait que la Mer Baltique constitue le début (ou la fin) géographique d'un système portuaire hanséatique largement dominé aujourd'hui par les ports allemands. Cela se traduit par une importante « feederisation » de l'espace maritime Baltique, rappelant de manière évidente que les plus grands établissements portuaires ne sont pas des têtes de pont des services massifiés des opérateurs maritimes. Cet espace maritime secondaire demeure néanmoins bien desservi et connecté au reste du monde via l'intensité des services de feedering qui s'orchestrent depuis les ports de Bremerhaven et surtout d'Hambourg. Et cela n'est guère nouveau puisque le géographe Guido G. Weigend parlait déjà en 1956 de *« wet transit »* pour qualifier l'intensité des transits maritimes entre le plus grand port allemand et les territoires économiques Baltes et Scandinaves. Aujourd'hui, le gigantisme naval et la consolidation stratégique en alliances favorisent un éclatement sous-régional à partir de hubs intercontinentaux comme Rotterdam, autre port majeur dans la connectivité maritime international de l'espace Baltique.

La troisième dynamique élargit le spectre avec l'inclusion de la Russie occidentale et surtout prend en considération l'impact des développements portuaires et maritimes de l'espace maritime Arctique. Avec 80 millions de tonnes de trafic maritime annoncés par les plus hautes autorités politiques de Moscou pour 2030, le pourtour Baltique regarde vers le Nord et l'Est et plus seulement vers l'Ouest européen. Les ports russes de l'ouest Arctique de Mourmansk et Arkhangelsk présentent des projets pharaoniques de développement, soutenus par des investisseurs internationaux aux premiers rangs desquels figure la Chine. Bien plus que des interfaces stratégiques de sortie des produits miniers de Kusbass, Mourmansk et Arkhangelsk pourraient devenir de véritables hubs et gateway de l'ouest arctique russe. Les transbordements stratégiques de LNG en Ship-to-Ship rapatriés depuis l'été 2019 dans les eaux russes après 7 mois d'exploitation et plus de 300 opérations dans le Fjord norvégien de Sarnesfjord constituent une illustration de la volonté politique de Moscou de favoriser ses propres établissements portuaires pour le traitement de ses marchandises.

Pour l'espace Baltique, cela peut autant représenter une menace et une opportunité. Une menace par le contournement opérationnel des acheminements par la Baltique de produits stratégiques comme le gaz naturel ou le pétrole russes. Une opportunité si les corridors de transport européens réussissent à connecter la toile infrastructurelle européenne avec ses terminaisons septentrionales *(Barents Euro-Arctic Transport Network & Arctic Corridor Railway)*. Le petit port norvégien de Kirkenes pourrait alors se muer en une nouvelle porte d'entrée et de sortie des espaces scandinaves et baltiques, conjuguant ainsi de manière opportune les potentiels de trafics russes (essentiellement miniers) avec ceux de la Scandinavie (essentiellement forestiers). Kirkenes espère devenir un « connecteur » comme jamais il en a existé dans l'histoire puisqu'il serait la terminaison portuaire d'un système intégré de transport qui ouvrirait la Baltique à l'ouest Arctique.

Ces trois dimensions très rapidement résumées s'inscrivent dans une géostratégie qui dépasse évidemment les seuls intérêts maritimes, portuaires et logistiques de l'espace Baltique. La Russie se replace sur l'échiquier énergétique international avec l'accélération des exploitations pétrolières, gazières et minières situées ou connectées à la côte Arctique. Pour ne prendre qu'un exemple et une seule zone, la Péninsule de Yamal où il n'y avait aucun développement industrialo-portuaire significatif avant 2014 pourrait exporter en 2024 l'impressionnant volume de 41,1 millions de tonnes métriques de LNG ! En une décennie s'orchestrera toute une chaîne de valeur énergétique avec le développement d'un port dédié (Sabetta) et la construction de nombreux trains de liquéfaction qui permettent une exportation continue du gaz via une flotte de 17 navires spécialisés de type ARC7.

L'espace Baltique, au-delà de sa propre raison d'être économique et politique, constitue un espace-tampon entre l'Europe d'une part et la Russie d'autre part. Dans une logique souveraine de contrôle de ses propres flux énergétiques d'exportation, une véritable dichotomie portuaire s'instaure en Baltique avec le développement accéléré des activités portuaires russes. Saint-Pétersbourg, Oust-Louga et Primorsk constituent un chapelet portuaire russe sur la Baltique qui profite clairement des orientations idéologiques et stratégiques insufflées par Moscou. Une politique d'aménagement stratégique du littoral russe de la Baltique soutient une logistique souveraine russe pour que les flux entrants et surtout sortants du territoire national empruntent en priorité des terminaux portuaires domestiques. De nouvelles intensités concurrentielles s'instaurent avec les ports « non-russes » de la Baltique qui ont perdu de nombreux trafics suite au « repositionnement » des flux. Le futur port à conteneurs de Bronka, au sud du Golfe de Finlande, devrait renforcer cette logique concurrentielle qui pour l'instant concernait essentiellement des flux énergétiques. Avec une capacité projetée de 1,9 million de conteneurs, Bronka viendra en complémentarité des solutions de manutention conteneurisée du grand port historique de Saint-Pétersbourg qui lui-même dispose de projets de modernisation et d'expansion. Le centre de gravité économique et logistique de la mer Baltique s'orientalise avec la croissance des tonnages de la côte russe du Golfe de Finlande, de Vyborg-Vysotsk au nord à Oust-Louga au sud.

Dans le même temps, ces flux orientés est-ouest avec les « intrants » en provenance de l'Europe et les « extrants » en sortie de Russie, pourraient être aussi impactés par les projections de développements portuaires arctiques russes. Une nouvelle cartographie s'installe progressivement avec en exergue la réorientation massive de la politique de Moscou à destination de la triade nord-asiatique Chine-Japon-Corée du sud. Selon les rapports de *Energy Strategy of Russia,* 22 à 25 % des exportations de pétrole et 19 à 20 % de gaz russes pourraient avoir pour destination finale l'Asie du Nord-Est dès 2030 ! Un véritable renversement stratégique pourrait se produire dans la prochaine décennie avec une recomposition des équilibres entre les flux « historiques » en sortie Baltique vers l'Europe et ceux « à croissance rapide » en sortie Arctique vers l'Asie du Nord-Est.

Toutes ces préoccupations prospectives sur les dimensions géostratégiques et géoénergétiques questionnent les futures relations que pourraient entretenir les espaces maritimes et portuaires Baltique et Arctique. Après la tenue de la conférence de Klaipeda, il devenait évident que nous allions relever le défi d'aborder ces deux espaces dans un même ouvrage, avec des regards appliqués et décalés sur quelques sujets non-exhaustifs. Ce sixième tome rejoint la philosophie des 5 premières productions, à savoir de promouvoir quelques idées neuves qui n'ont pas la prétention d'apporter toutes les réponses aux nombreuses problématiques maritimes qui animent les espaces Baltique et Arctique. Bien au contraire, par le truchement d'une vingtaine de chapitres répartis en trois grandes thématiques, l'ouvrage *Baltic – Arctic. Strategic Prospective* établit une synthèse de points de vue défendus par leurs auteurs, essentiellement d'obédience académique cette fois-ci.

Le modèle éditorial de la collection *Les Océanides* s'est adapté puisque finalement les contributeurs de la conférence de Klaipeda furent invités à coucher sur le papier le fruit de leurs réflexions orales. Une grande partie des intervenants a manifesté son enthousiasme dès l'annonce de produire ensemble le sixième tome avec comme objectif de l'éditer pour la tenue de la deuxième édition de *Baltic Seas Conference*. Seul bémol, à quelques exceptions près, les praticiens n'ont pas répondu à l'invitation de production, ce qui empêche d'un point de vue méthodologique l'inclusion de capsules professionnelles qui auraient éclairé, dans un effet miroir, les apports scientifiques et académiques.

La collection *Les Océanides* paraît sous forme papier (1 000 exemplaires) et en format électronique téléchargeable sur le site de l'éditeur EMS Editions. Chaque contributeur reçoit 10 copies papier afin de l'encourager à diffuser les contenus dans son propre réseau de recherche. Ainsi, plus de la moitié des ouvrages papier sont diffusés gracieusement sur les 5 continents auprès des autorités portuaires, des ministères de tutelle, des universités, des écoles de commerce et des centres/laboratoires de recherche ainsi que des chercheurs experts du domaine couvert par la production. C'est le *modus operandi* retenu depuis la création de la Fondation SEFACIL pour consolider un réseau mondial de compétences, de connaissances et de diffusion sans aucune restriction technique ou financière. Cela n'est possible que par le soutien de tous les donateurs qui chaque année pérennisent leur confiance. Ces mêmes donateurs deviennent eux-mêmes les vecteurs de la diffusion puisqu'ils participent largement à la dissémination des savoirs et des savoir-faire de la fondation SEFACIL. Qu'ils soient tous ici chaleureusement remerciés pour leur audace à croire en la vivacité du mariage de la culture de la prospective et de la stratégie dans les secteurs maritime, portuaire et logistique.

Structure de l'ouvrage

Baltic – Arctic – Strategic Perspective décline 17 contributions impliquant 33 auteurs internationaux. La partie 1 intitulée *Policy & Energy* englobe 6 chapitres tout comme la partie 2 *Strategy & Perspective.* 24 auteurs de 10 pays différents sont concernés par ces deux premières parties qui se complètent d'une troisième intitulée *Human & Technology* et composée de 5 chapitres pour 9 auteurs. Une fois encore, force est de rappeler ici que cet ouvrage n'a aucune ambition d'exhaustivité scientifique puisqu'il ne fait que partager le fruit de réflexions qui ont le bénéfice et le défaut de leur pluridisciplinarité.

Dans son avant-propos, **Luc Boyer**, conseiller économique auprès de l'Ambassade de France en Lituanie, dresse un portrait de quelques enjeux géostratégiques qui animent les relations entre la plupart des Etats riverains de la Mer Baltique. Fin connaisseur des problématiques énergétiques internationales, Luc Boyer met toutefois l'emphase sur le secteur des transports et de la logistique avec en perspective l'importance des investissements chinois dans la concurrence des systèmes intégrés de transport sous-régionaux. Le spécialiste français confirme combien la Mer Baltique est tout sauf un cul-de-sac, en particulier pour les partenaires économiques et stratégiques de l'Europe Orientale et de l'Asie Centrale.

PARTIE 1 – Policy & Energy

Dr. Valters Bolevics ouvre cette première partie avec une analyse des cadres politiques et institutionnels qui concourent à façonner le réseau de transport européen. L'intégration des Etats Baltes dans la circulation européenne des flux de marchandises exige des infrastructures mais aussi une organisation politique. Le spécialiste letton dissèque le délicat sujet de la gouvernance des réseaux de transport transeuropéens avec une approche originale qui traite de la performance des cadres institutionnels et légaux au service des Etats Baltes. L'auteur travaille sur une optimisation des modèles de gouvernance dans l'objectif d'améliorer la gestion des autorités portuaires, en particulier des Etats riverains de l'espace maritime balte. Le travail du professeur Bolevics met en perspective combien les modèles actuels de gouvernance demeurent différents au sein des Etats Baltes avec des niveaux d'efficacité et de transparence très hétérogènes. Les préconisations de l'auteur visent à une forme d'uniformisation qualitative des pratiques de gouvernance dans des cadres légaux et institutionnels qui reflètent néanmoins les pratiques, notamment politiques, propres à chaque état et même chaque autorité portuaire.

Le cas du transport maritime à courte distance conteneurisé est abordé par le **Professeur Dr. Joachim R. Daduna** avec en premier lieu une analyse de l'environnement concurrentiel dans l'aire Baltique en incluant notamment les investissements sur les arrière-pays disputés par les principaux ports européens, baltes et scandinaves. Le professeur allemand rappelle le rôle fondamental des ports dominants d'Hambourg et de Rotterdam dans l'organisation et la compétition des services maritimes conteneurisés à courte distance de la Baltique. L'analyse inclut d'emblée l'importance cruciale et les effets directs des politiques de réglementation internationale en matière d'émissions atmosphériques sur l'espace maritime et portuaire de la Baltique. L'auteur conclut sur le fait que la complémentarité et la coopération interportuaire en Mer Baltique seraient probablement plus à même de développer le TMCD, particulièrement si l'on considère la promotion d'un transport maritime toujours plus écologique et durable.

Dans la continuité de la contribution précédente, le **Professeur Dr. Olli-Pekka Hilmola** propose un zoom sur les relations maritimes à courte distance entre les deux partenaires finlandais et suédois. L'auteur rappelle qu'historiquement, les liaisons maritimes ont considérablement participé au développement économique des deux nations riveraines mais constate les effets directs de la crise financière dans l'érosion des échanges mais avec des intensités différentes selon les ports et les régions connectés. Par ailleurs, selon le professeur finlandais, les réglementations environnementales n'ont pas aidé le transport maritime à courte distance dans le recouvrement des trafics puisqu'une partie se serait même détournée au profit des ports estoniens et allemands. La contribution met en perspective la dépendance des réseaux maritimes aux localisations manufacturières et aux stratégies logistiques des entreprises qui ont massivement redéployé leurs investissements en Allemagne ou en Pologne, profitant de l'amélioration significative des connectivités ferroviaires et routières ouest et centre-européennes.

Dans un autre registre, le **Dr. Vadim Volovoj** replace l'espace Baltique dans une lecture géopolitique mondiale, rappelant que ces territoires sont au cœur d'un délicat équilibre diplomatique et militaire entre la forte influence historique russe et les intérêts non-cachés des puissances américaine et ouest-européenne. L'auteur lituanien rappelle combien est complexe la lecture politique des jeux d'influence, ce qui selon l'analyse, rend compliqué les processus de coopération entre Etats riverains de la Baltique. Le professeur Volovoj met en exergue l'importance cruciale de l'énergie dans les processus de dépendance et d'indépendance vis-à-vis du voisin russe. La contribution se conclut sur l'impérieuse nécessité de mieux coordonner les relations politiques entre Etats riverains de la Mer Baltique pour faire face aux ambitions explicites de Moscou



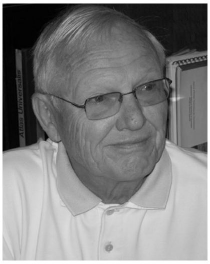



Un collectif d'enseignants-chercheurs de la *World Maritime University* (WMU) de Malmö en Suède propose une lecture en deux chapitres des potentiels de développement de la filière du gaz naturel liquéfié (GNL) en Mer Baltique. Les professeurs et chercheurs **Dimitrios Dalaklis, Momoko Kitada, Aykut I. Ölçer ; Alessandro Schönborn, Fabio Ballini et Monica Canepa** abordent en premier lieu le sujet de la formation professionnelle comme un élément indispensable de l'expansion de l'usage du GNL dans les activités maritimes et portuaires de l'espace Baltique. Les auteurs soulignent que les ambitions internationales portées par l'Organisation Maritime Internationale (OMI) pour réduire l'impact des pollutions atmosphériques du secteur maritime placent le LNG comme un carburant alternatif très promoteur. Dans cette perspective, la Mer Baltique est rapidement devenue un important terrain d'expérimentation qui a poussé WMU à penser des formations professionnelles adaptées aux besoins actuels et à venir. Le centre de compétence LNG de WMU s'inscrit comme un des ingrédients indispensables pour accompagner la croissance de l'usage du LNG dans les solutions de transport maritime et la capacité de terminaux portuaires de traiter la question du LNG en toute sécurité.

Aykut I. Ölçer, Alessandro Schönborn, Dimitrios Dalaklis, Momoko Kitada, Monica Canepa et **Fabio Ballini** concluent cette première partie avec une analyse sur les conséquences du changement réglementaire de la convention MARPOL de l'OMI sur la pollution maritime internationale. Les auteurs analysent les arguments techniques et scientifiques qui font du GNL un carburant de substitution intéressant dans un espace maritime baltique très fréquenté mais aussi très sensible aux questions sociétales et environnementales. Le collectif de WMU souligne le développement d'un réseau d'infrastructures portuaires indispensables pour soutenir l'évolution économique et logistique d'une vraie chaîne de valeur du LNG. Les auteurs questionnent in fine le modèle d'affaires et les rentabilités que peuvent espérer chacune des parties prenantes intégrées dans le développement de cette nouvelle filière énergético-maritime.

PARTIE 2 – Strategy & Prospective

Dr. Arnaud Serry, fondateur du réseau *Baltic Seas* et auteur de la note stratégique et prospective sur le transport maritime en mer Baltique, ouvre cette deuxième partie à dominante francophone. Géographe des transports et des réseaux, l'auteur présente une analyse des connectivités maritimes et portuaires baltiques. Espace en mutation politique, économique et logistique, la mer Baltique est au cœur d'enjeux notamment énergétiques qui animent de vives concurrences portuaires selon Dr. Serry. Les stratégies des Etats souverains, au premier rang desquels la Russie, impactent la typologie et l'organisation des principaux flux baltiques. Les projets ferroviaires, les investissements chinois, les nouveaux terminaux portuaires ou encore les revendications nationalistes russes engendrent une reconsidération permanente des conditions de connectivité de l'aire Baltique.



En continuité des réflexions d'Arnaud Serry, **Prof. Dr. Pierre Thorez** s'interroge sur la place que pourraient jouer les ports de la Baltique orientale dans les flux logistiques internationaux de demain. L'auteur replace par son analyse le fait que les ports de la Baltique orientale commercent en priorité avec les clients d'Europe orientale et d'Asie centrale. Les développements ferroviaires modernes relancent toutefois la possibilité d'étendre l'arrière-pays toujours plus loin vers l'Extrême-Orient pour faire de la Baltique orientale une extension septentrionale des nouvelles routes de la soie du XXI[e] siècle. Pierre Thorez conclut en argumentant sur plusieurs facteurs qui favoriseraient une saine complémentarité portuaire indispensable pour améliorer le rôle de transit et de passage stratégique de la Mer Baltique.






Quand il s'agit d'aborder le développement arctique, force est de constater l'importance du facteur risque et sa gestion dans un environnement naturel en pleine mutation. Un collectif d'enseignements-chercheurs internationaux et pluridisciplinaires emmené par le **Dr. Olivier Faury** travaille sur l'impact de la gestion du risque sur l'attractivité du passage maritime du nord-est. **Dr. Laurent Etienne, Dr. Laurent Fédi, Dr. Rigot-Muller, Dr. Cheaitou et Dr. Scott Stephenson** proposent une lecture des principales contraintes au développement des trafics sur la *Route Maritime du Nord* (RMN) pour ensuite développer toute une méthode d'analyse visant à évaluer les réponses techniques et législatives qui permettraient de garantir un maximum de contrôle des risques. Les auteurs concluent sur les dimensions économique et financière de l'équation complexe d'une navigabilité sécurisée sur la RMN avec en perspective la problématique récursive de la grande variabilité climatique sur le moyen terme.


L'intensification de la circulation maritime Arctique se conjugue inéluctablement avec les ambitions politiques du pouvoir de Moscou. **Dr. Yann Alix et Mikaa Mered** rappellent dans un premier temps combien la rangée portuaire arctique russe est devenue un enjeu stratégique de développement avec les immenses projets de valorisation des ressources naturelles. Les deux auteurs analysent les facteurs clés qui structurent le développement commercial et stratégique d'une nouvelle artère maritime qui pourrait devenir bien plus qu'un simple raccourci nautique entre l'Asie du Nord-Est et l'Europe du Nord-Ouest. Il est démontré combien la vision planifiée des aménagements prônés par le gouvernement central russe se réalise avec l'engagement massif d'investissements internationaux.

En guise de conclusion prospective, Yann Alix et Mikaa Mered élaborent le scénario de la croissance d'une future *TransArctic Russian Maritime Highway* qui serait alimentée par un système de plateformes portuaires de nouvelle génération localisées stratégiquement aux extrémités du nouveau sillon maritime.

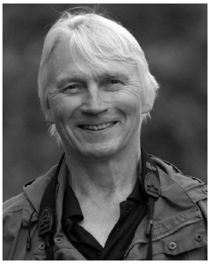


Les deux derniers chapitres reviennent à quatre contributrices travaillant sur des problématiques portuaires et maritimes de l'aire Baltique. **Dr. Jelena Belova** et les deux *lecturers* candidates au grade de **PhD Rima Mickiene et Elena Valioniene** abordent le sujet complexe des liens managériaux et stratégiques que l'on peut établir entre la compétitivité d'un système portuaire, celui d'un réseau maritime et enfin celui relevant des fonctions régaliennes de l'Etat. Au cœur de l'analyse proposée par les trois auteurs, une évaluation qualitative multicritères avec une modélisation des liens de causalité entre la performance effective de la politique d'attractivité d'un Etat et la compétitivité des autorités portuaires. Le travail de recherche s'applique aux systèmes portuaires des trois Etats baltes (Estonie-Lettonie-Lituanie) et tend à démontrer des trajectoires distinctes selon les cas via une analyse en 4D du management portuaire. Des réflexions théoriques et pratiques concluent le chapitre en vue d'améliorer la performance et l'attractivité générales du système portuaire Balte.

En illustration pratique du chapitre précédent, **Kristina Gontier**, directrice des relations internationales de l'autorité portuaire de Klaipeda, reprend l'historique de la création de l'autorité pour démontrer combien a évolué le rôle de l'Etat lituanien dans le fonctionnement et les opérations du port de Klaipeda. L'analyse des trafics et des filières illustre la polyfonctionnalité du premier port lituanien tout en explicitant le rôle éminemment stratégique des infrastructures pour l'économie nationale. Kristina Gontier retrace avec force de détails l'évolution des modalités de la gouvernance moderne du port pour être toujours plus en phase avec les intérêts de sa communauté d'affaires. Le plan de développement et les ambitions portuaires de Klaipeda s'inscrivent autant dans une logique nationale de croissance que dans l'enjeu de rester compétitif face aux nouvelles concurrences régionales.

PARTIE 3 – Human & Technology


La troisième et dernière partie de l'ouvrage constitue en quelque sorte une illustration de la diversité des analyses et points de vue qui a été partagée lors de la première conférence de Baltic Seas. Le premier chapitre s'ouvre avec le sujet d'actualité de la transformation digitale accélérée des secteurs maritime, portuaire et logistique. **Olli-Pekka Brunila et Vappu Kunnaala-Hyrkki** abordent le sujet en reprenant les fondements même de la digitalisation et ses réalités opérationnelles et mettent en perspective les différences de maturité rencontrées entre les différents secteurs (maritime, portuaire et logistique). Les auteurs rappellent les dividendes et désavantages déjà constatés avec la digitalisation, interrogeant l'efficacité et la productivité apportées par une dématérialisation intelligente du traitement de l'information. Les dimensions sécuritaires et environnementales sont également abordées avant de conclure sur une série de questionnements sur les contours de la digitalisation portuaire de demain. Les auteurs n'hésitent pas à mettre en garde sur le fait que les seules dimensions techniques et technologiques ne sont pas suffisantes pour engager une gestion digitale optimale.




Dr. Esa Hämäläinen et le **professeur Tommi Inkinen** prolongent la discussion sur la digitalisation par le prisme du Big Data et son usage prédictif dans l'optimisation des coûts de transport maritime dans l'espace Baltique. L'usage scientifique de masses considérables de données soutient le développement d'analyses prédictives pour accompagner les armements maritimes à optimiser le rapport entre la vitesse et la consommation de carburant. Cela s'avère d'autant plus pertinent depuis 2015 et l'impératif d'utiliser du diesel à très faible teneur en soufre (MDO) nettement plus cher que le traditionnel mais beaucoup plus polluant diesel lourd (HFO). Les deux spécialistes finlandais travaillent l'équation optimale pour optimiser la réduction des coûts d'exploitation des navires avec une vitesse commerciale qui soit aussi adaptée en fonction même du cours des matières premières pétrolières. Il est intéressant de constater que les deux auteurs concluent sur la perspective de considérer le LNG comme une autre alternative pour une navigation commerciale maritime toujours plus propre… et moins coûteuse.

Changement complet de perspective avec l'analyse présentée par le directeur exécutif de la *Lithuanian Shipowners Association* **Gintautas Kutka** et l'experte **Karolina Mickute**. Les deux auteurs s'interrogent à propos de l'impact sur le transport maritime des tensions politiques qui affectent les échanges internationaux depuis les premières mesures préconisées par l'administration américaine à l'encontre des intérêts économiques et industriels chinois et européens. Le cas particulier des barrières tarifaires sur le métal est pris comme référence par les deux experts qui démontrent que ce climat protectionniste obère le développement du transport maritime, principal vecteur de la mondialisation des échanges. Un focus sur la Baltique est proposé par Gintautas Kutka et Karolina Mickute en reprenant plusieurs macro-indicateurs pour aborder l'épineuse question du futur des activités maritimes internationales en mer Baltique avec l'exacerbation des tensions politiques et commerciales internationales.

Les deux derniers chapitres qui concluent l'ouvrage mettent l'humain au cœur de leurs réflexions, mais sous un angle radicalement différent du chapitre politique précédent. Les trois contributeurs, tous membres éminents du corps professoral de la *Lithuanian Maritime Academy*, rappelent par leurs réflexions le rôle incontournable de l'être humain dans le fonctionnement même des activités maritimes et portuaires. **Dr. Saulius Lileikis** aborde la question de la résistance psychologique des travailleurs du secteur portuaire mettant en perspective les mécanismes de défense dans leurs activités physiques et psychologiques quotidiennes. Cette problématique complexe s'intègre dans un modèle anthropomorphique de la psychologie particulière que l'on retrouve dans les interfaces portuaires. L'auteur travaille sur un plan théorique sur les facteurs de résistance et leurs implications en matière de réaction et de projection. L'originalité du papier tient dans son approche et son sujet alors même que les terminaux portuaires s'automatisent et que les tâches des travailleurs portuaires ne cessent d'évoluer avec la modernisation constante des mécanisations.

Les professeurs Viktoras Sencila et **Genute Kalvaitiene** partagent un retour d'expérience sur l'évolution de la formation des personnels navigants au sein de la *Lituanian Maritime Academy*. L'analyse concerne cette génération Y qui remet en cause par ses pratiques et ses aspirations l'essence même de la formation des futurs marins. Les deux auteurs ont mené une enquête qualitative et livrent ses principaux résultats pour mieux saisir comment les formations doivent évoluer en prenant en compte les aspirations des étudiants sans remettre en cause les fondements théoriques et pratiques indispensables dans une formation maritime de qualité. Le travail d'analyse prend autant en compte le devenir des futurs marins formés que les demandes exprimées par les compagnies maritimes et les entreprises spécialisées dans la gestion des personnels navigants.

Michel Donner, Associate au sein du cabinet londonien Drewry Maritime Advisors nous propose quelques mots sur la quatrième de couverture pour mettre en relief toute la complexité des enjeux qui marquent les développements de la Mer Baltique aux territoires côtiers Arctiques.
Les côtes de la Baltique ne lui sont pas étrangères, ayant en effet travaillé près de trois ans à Copenhague pour le Groupe AP Moller ; Ensuite, au cours de son affectation à la Banque Mondiale (2008-2009), il a eu l'occasion de mener des audits non-financiers sur divers projets portuaires de la Banque à Szczecin, Swinoujscie et Klaipeda.
Spécialiste des affaires portuaires internationales, Michel Donner valide par ses propos la pertinence de l'approche croisée proposée par la Fondation SEFACIL pour faire mieux comprendre les trajectoires logistiques et maritimes de demain dans cette partie du monde.

Partie I

Policy & Energy

Chapitre 1

The analysis of the baltic states ten-t port governance, institutional and legal framework

Valters Bolevics

Board member at Transport and Maritime Economics Research Corporation

Riga - Latvia

Biography

Dr.sc.administr. **Valters Bolevics**

Assistant Professor for Transport Management and Economics and management consultant within transport related matters geographically covering the areas of Europe and Middle East. Experienced within contract negotiations and large complex commercial deals, drafting, negotiating and closing concession agreements, evaluating investment plans and providing strategic direction, performance management and process improvement, public policy advisory. Received recognition diplomas from Cabinet of Ministers and Prime Minister of Latvia for successful contribution for the Latvian state and its people.

Abstract

The purpose of the present research is to evaluate port governance within the Baltic States European Union-level trans-European core network ports (TEN-T) and assess the institutional and legal framework of named ports managing entities or port authorities. The financial performance of the port's managing entity is of vital importance for port development, meanwhile this is the direct result of a port governance chosen model, whether the port is governed through a corporately governed port authority or a hybrid mechanism where political and local stakeholder interests are present. In the course of the research, port governance and port authority management models are discovered and comprehensive institutional and legal framework analysis conducted. The ultimate target of the research is to empirically test various port governance models between three geographically close countries within the TEN-T ports and discover the differences among those models and propose recommendations for better port governance according to good corporate governance discourse. The results of this research may be of value to port authorities, government representatives, policymakers and scholars.

Keywords: port, port authority, governance, Baltic States, performance

Introduction

The Baltic States seaports have played an essential role in the social and economic activities of the region since ancient times, as the inhabitants have been concentrated in coastal areas and ports formed the core trading centres. Harbours have served and strengthened their positions as focal points for the industrial, transportation, and distribution activities that support each country's economy. Ports are not only quays for loading and unloading cargo, but assets of national importance, enabling a range of other essential industries to operate. The industries ports make possible can be split into three broad types: first, those which use ships to access the sea or to service their facilities at sea; second, those which rely heavily on imports of bulky raw materials or exports of finished goods; and third, those which depend on the natural or historic heritage associated with the coastline, ports or shipping.

Today the shipping industry and ports within it, is a crucial part of the transportation infrastructure and delivers benefits to the economy by enhancing competition and raising productivity. There are 27 ports in Estonia, 10 in Latvia and only one in Lithuania (Butinge oil terminal is not considered as a sole port, but a single terminal with clear and dedicated objective of liquid cargo handling, namely oil and oil products). The sector is very diverse, ranging from TEN-T ports such as Tallinn, Riga, Ventspils, and Klaipeda to smaller ports that cater essentially to local traffic or to more specific sectors, such as fishing, export of pulp and wood products or leisure use, which consists mainly of sailing and tourism. The role of each port is influenced by many factors, including its physical attributes, especially size and nautical accessibility, ports management, infrastructure quality and availability. Ships continue to be built bigger and greater in transported volumes, particularly for long-distance routes, and increasing size eventually limits their manoeuvrability and increases port authorities and terminals investments in facilitating safe ships turnaround, mooring and cargo loading, unloading and storing. Another major influence is location relative to major shipping routes and consumption markets, to inland freight transportation networks, and to passenger destinations. Industries that rely heavily on imports of bulk raw materials or export markets also influence ports near major industrial or urban areas. For smaller ports focused on recreation, proximity to a piece of attractive coastline, flora or fauna, or a heritage site is also influential.

The port authorities of the TEN-T ports in the Baltic States are proprietary-type organisations (landlord ports). Port authorities functioning as landlords can be considered as the principal function of contemporary port authorities, also when seen from the value chain perspective (Dooms and Verbeke, 2007). In addition to building, maintaining, and managing port facilities, including navigation channels, breakwaters, quay walls and other basic facilities, the port authorities formulate policies for basic development plans in consideration of the development of the inland regions. The port's functional facilities are leased to the private sector under the management of the port authority, and actual operations – port transport, storage, transport on land, etc. are entrusted to the private sector in accordance with the relevant laws and regulations.

Port authorities levy charges in the form of port dues and fees for use of port facilities and services provided. These fees are determined on a cost-accounting basis and fixed by the port authorities in regulations. Port dues are levied on all vessels in exchange for the use of the port as a whole; the port authorities levy these dues in accordance with enacted law. Port dues may be calculated and assessed based on the expenses necessary for managing the water area, the port's land facilities, and port development facilities. Port dues vary both between the different Baltic States and between ports within a state.

Theories and concepts of the research

Governance is a historic term for the description, evaluation and comparison of state governance, and was often used as a synonym for government in the political literature. In the 1970's the concept of governance revived in American business language in the concept of "corporate governance" with the focus on corporate responsibility. The World Bank introduced the term "good governance" and thus coined this phrase (Wouters and Ryngaert, 2005). Today, corporate governance defines the regulatory framework for the management and supervision of companies whereas the corporate governance framework is largely determined by legislators and owners (Spira, 2002), whereas the actual corporate governance design falls to the supervisory board of the board of directors. The company specific corporate governance system consists of the totality of relevant laws, regulations, codes, letters of intent, mission statement, and habits of the management and monitoring (OECD, 2010), Bolevics (2018).

Academic literature discusses "good corporate governance" and the improvement of existing corporate governance. Good corporate governance should ensure and guide a responsible, professional and transparent business administration in the interests of owners, but also of external stakeholders such as creditors, debtors, society and employees (Felo, 2011; Rose, 2016). According to Passenheim (2010) characteristics of good corporate governance are: 1) risk management, 2) formal and transparent procedures for the proposal and election of board members, 3) a functional management organization, 4) management decisions focus on long term value creation, 5) transparency in internal and external corporate communications, 6) safeguarding mechanisms to secure the interests of different groups (stakeholders) and 7) a clearly defined management and control structure.

Within the scope of the research the term "port governance" can be distinguished in two levels: the governance of the port and the governance of the port authority. The governance of the port corresponds with the external cluster level whereas the governance of the port authority relates to the internal firm level or corporate governance of the port authority (De Langen, 2007), within the scope of this research the port governance through the port management entity which relates to the internal firm level of corporate governance is conducted. Seaports as such possess characteristics of public utilities on the one hand and of private enterprise on the other (Meersman et al., 2002). European Commission (2001) defined port authority as the entity, which whether or not in conjunction with other activities, has as its objective under national law or regulation the administration and management of the port infrastructures, and the co-ordination and control of the activities of the different operators present in the port.

The term "port authority" implies a specific, i.e. public, form of port management, but it is used generally as the generic term for the body with statutory responsibilities that manages a port's water and land side domain (De Monie, 2004). A port is a land area with maritime and hinterland access that has developed into a logistics and industrial centre and plays an important role in global industrial and logistics networks (Notteboom et al., 2009). Port authorities tend to function as landlords, regulators, or operators (Baird, 1995), depending on their respective legal status (Brooks, 2006). The landlord function of port authorities has been defined in keeping with the literature on port governance models (Brooks, 2007). Strategically, the major seaports in the Baltic States and their port authorities (PA) act as triggers for national infrastructure development plans, such as railway and road network expansion, giving due consideration to social responsibility and the environment (Bolevics, 2017).

Research methodology

The research presents the results of a synthesis of the literature on port governance models and port managing entities performance, management and a comprehensive three different European Union member States legal and institutional framework analysis, with the overall objective of making a comparative analysis of existing governance models applied for TEN-T network seaports within the Baltic States and assessment of those models applied according to good corporate governance guidelines. Research is based on bibliometric tools and publicly available quantitative and qualitative information on the governance models applied, legal framework analysis, yearly port and port authority performance statistics and an analysis of financial performance of a port authority. The main methods used to achieve the research goals include theoretical and literary analyses, empirical observation, and monographic or descriptive methods.

Analysis of the research results

The highest cargo-handling turnover in the Baltic States TEN-T seaports in 2017 was registered in Klaipeda, thus outpacing other three ports of Riga, Ventspils and the joint Port of Tallinn. Significance lies in the fact, that Klaipeda was the only port, which sealed the year with major turnover increase compared to other three neighbouring ports, who faced significant shifts in cargo volumes, the biggest of which happened in Riga. The Russian port, Ust- Luga, has become the biggest one in Baltic Sea, and the volumes achieved are already at the top European port level, thus future cargo volume decline in the Baltic States ports is expected to happen, namely for the ports of Estonia and Latvia, Lithuania has done tremendous work towards cargo diversification and transit corridor promotion for Belorussia and also Russia, despite geopolitical factors and other socio- economic reasons happening in Baltic area for the last two years, the cargo volumes in Lithuania are increasing and Klaipeda port is increasing its total market share in the eastern coast of the Baltic Sea (Table 1).

Table 1. Cargo turnover in the eastern coast Baltic Sea ports, in millions of tons, 2010-2017

	2010	2011	2012	2013	2014	2015	2016	2017
Ventspils	24,82	28,45	30,35	28,77	26,20	22,53	18,8	20,03
Riga	30,48	34,05	36,05	35,47	41,08	40,05	37,1	33,68
Klaipeda	31,28	36,60	35,24	33,40	36,41	38,51	40,00	43,17
Tallinn	36,65	36,47	29,48	28,25	28,32	22,43	20,12	19,20
Ust-Luga	11,78	22,70	46,79	62,64	75,69	87,87	93,37	103,3
Primorsk	77,64	75,12	74,77	63,82	53,66	59,6	64,42	57,60
St. Petersburg	58,06	59,99	57,81	57,97	61,18	51,52	48,6	53,60

Source: Statistics from corresponding port authorities' yearbooks. Author's research

Over the last decade, the Latvian ports and port of Klaipeda have benefited from a rapidly growing regional market, the regional traffic went from about 128.8 million tons to 307.8 million tons between 2000 and 2012 which created significant opportunities for the ports to grow and develop. Baltic ports are very dependent on outbound cargoes that are originating in Russia or transiting through Russia – and they have very little influence over transit tariffs and delays. Since the early 2000s, Russia made an effort to develop its own ports on the Baltic Sea – including substantial investment in St. Petersburg's container facilities, the construction of the port of Ust-Luga and the completion of crude oil pipelines to Primorsk and Ust-Luga.

This has had a significant impact on the Baltic States market, and has significantly affected Latvian as well as Lithuanian and Estonian ports. Primorsk, St. Petersburg, and Ust-Luga are now controlling more than 60 percent of the regional traffic (from 25 percent in 2000). According to Russian association of commercial seaports, in 2017, Russian seaports handled 786.97 million tons of cargo (+9%, year-on-year), the ports of the Baltic basin handled 247.49 million tons (+4.6%) including 105.06 million tons of dry cargo (+17.1%) and 142.43 million tons of liquid bulk cargo (-3%). The port of Ust-Luga handled 103.3 million tons (+10.6%), Primorsk 57.6 million tons (-10.6%), Big Port St. Petersburg 53.6 million tons (+10.3%), Vysotsk 17.5 million tons (+2.6%).

The container turnover in ports of Baltic basin increased by 10.6% to 2.23 million TEU, including loaded export of 740.27 thousand TEU (+8%), empty export of 362.23 thousand TEU (+20.1%), import of 1.13 million TEU (+9.6%). Container turnover of Big Port St. Petersburg up 9.9% to 1.92 million TEU, port of Ust-Luga 75.26 thousand TEU (-10.3%) and Kaliningrad 239.2 thousand TEU (+26.4%). The port of Riga and Klaipeda have managed to maintain and expand its market share for containerised goods in the region, these are the only non-Russian ports that have managed to do so, and this success should be credited to an active port management, including effective marketing as well as efforts to improve the quality of services.

Ports of the Baltic States are struggling in developing value- added services, thus all ports have containerised goods terminal or they are handling Ro-Ro cargo and different heavy machinery and electronics products, but the most successful in this business niche is the port of Klaipeda which has managed to develop high value- added services where containers accounted to 11.36% from total cargo handled in 2015 followed by port of Riga 9.1% from total cargo handled in 2015. Despite the throughput amount facts containerised cargo business compared to Western European ports remains relatively marginal in the region, which can be explained that ports of Baltic States haven’t been successful enough to position themselves as transit doors to or from Russian and Scandinavian market for containerised goods.

Port-cities benefit from part of the economic impacts of ports. Most of the direct port-related value added is still created in port-cities. Port-cities also benefit from the effects of clustering industries in a port area, and the possible economies of scale and knowledge transfer related to it. Several resource-intensive industries continue to be attracted by port areas, as location in a port limits their transportation costs. Major seaports not only affect the regional economy, but also significantly increase national GDP through three channels of economic impact: direct; indirect and induced.

According to (Hegeland, 1969) the direct impact measures the economic activity and jobs generated by the ports themselves. The direct impact of ports consists of the employment they create, their contribution to GDP, and the taxes their employees and constituent firms pay. These occur at the port. This activity causes a ripple effect in the rest of the economy, stimulating output and employment in other industries. The indirect impact captures the effect ports have on activity and jobs in their supply chain. These effects occur predominately through ports' purchases of goods and services from many parts of the national economy. This spending generates output, profits, and employment in the suppliers, whose own spending on inputs creates second-round effects. The induced impact of ports comprises the effects of salaries paid to staff at ports and in their supply chains on the rest of the economy through consumer spending: employees spend their salaries at retail and leisure outlets, purchasing imported and domestically produced goods. These effects typically occur close to where those employees live, but there are also second-round effects in the retailers' and leisure outlets' supply chains. To the extent that the ports sector increases employment and economic activity at other firms, both in its supply chain and from induced spending, it also increases tax contributions, locally and nationally (Bolevics et. al., 2013). Hegeland's (1969) economic contribution multiplier effects are available in Table 2.

Table 2. Economic Contribution Multiplier Effects

Indirect effects multiplier = (direct effect + indirect effect) / direct effect
Induced effects multiplier = (direct effect + indirect effect + induced effect) / direct effect

Source: Hegeland, Multiplier Theory (1969)

According to Hegeland (1969) theory of economic contribution multiplier effects, the indirect effects multiplier, which shows the impact on the supply chain as a result of the port sector's purchases of inputs, by adding the direct and indirect effects and dividing the sum by the direct effects. To evaluate the induced effects multiplier, which shows the additional impact of consumer spending by those who derive their incomes from the direct and indirect effects of the port sector, add the direct, indirect, and induced effects, and divide the sum by the direct effects (see Table 2).

The economic impact of any seaports is a widely researched topic in EU and significantly within the range of ports of Le Havre (France) to Hamburg (Germany), where numerous economic impact studies have been conducted on a yearly basis, thus the situation in the Baltic States is rather different, only few researches of ports economy, ports impact to the city, state or region have been taken place. It would be advised for all major seaports in Baltic's do an economic impact studies on a yearly basis, to monitor the ports actual KPI's and ports contribution to regional and national economy, at the same time, there is also gap within the general research and development field within Baltic's, and it would be advised for the governments of corresponding states to revise its policy towards investments and government expenditure within research and development, Bolevics (2017).

Klaipeda State seaport plays a significant role in the national economy of Lithuania, as it is the only seaport in the country, whereas more than 800 economic entities are directly related with the operations of Klaipeda port, economic activities directly related with Klaipeda port generated approximately 4.5 % of the country's GDP, 37 % of Klaipeda region (Klaipeda city included) and 44 % of GDP generated in Klaipeda city, and with its indirectly related business share it creates 16% of the country's GDP (KSSA, 2015). Klaipeda port and companies related with the port operations create over 23 thousand jobs. The port is a basis for welfare of Klaipeda region residents; the average monthly salary in companies related with Klaipeda port operations is higher than the average salary in the country.

The share of GDP deriving from Latvian major port activities has been variously estimated at 5 to 7 percent of GDP. Roughly 30 percent of exports of services are related to transit cargo. Ports also provide a significant number of jobs, directly and indirectly: Riga Port accounts for about 10 percent of the city's workforce (5,200 direct and 15,000 indirect jobs), and Ventspils port for about 20 percent of the city's workforce (4,000 direct and indirect jobs). Entrepreneurs revenue from each tonne moved through ports of Riga and Ventspils generates 13.45 euro per tonne, if the cargo is on transit route then 14.33 euro and if the cargo is simply exported from Latvia or imported to Latvia through major seaports then entrepreneurs receive 10.76 euro, from these amounts government budget receives 1.61 euro and municipality 0.83 euro per each tonne (ROP, 2013). The sustained performance and the competitiveness of the port sector are hence key to the country's economic prospects and of interest not only to port stakeholders but also to the society at large.

Transit cargo accounts for the largest part of the traffic (about 80 percent in Riga, and 90 percent in Ventspils). Most of the dry and liquid bulk cargoes are transit cargo shipped by rail from Russia and neighbouring countries and loaded into chartered vessels to Northern Europe and overseas. Outbound traffic represents about 90 percent of this transit, inbound 10 percent. The main countries of origin are Russia and other CIS countries, the main destinations are the UK, Germany, the Netherlands, and Scandinavia. In 2015, Estonia's gross domestic product (GDP) was € 19.96 billion at current prices, 51.9% of which was comprised of Tallinn's GDP, and 5.6% from total countries GDP was contributed from port of Tallinn. Estonian logistics sector involved directly 33 000 employees and indirectly 49 000 employees (accounts 7.84% of all employees), in Estonia the total estimated number of employees in 2015 was 625 000 (Statistics Estonia, 2015), and the transit sector employed 8000 employees.

Concluding, major seaports of the Baltic States have considerable presence in overhaul country's economy, whereas in Lithuania, port of Klaipeda generates to countries GDP 4.5%, in Latvia, ports of Ventspils and Riga generate in a range from 5 to 7% and in Estonia, port of Tallinn contributes 5.6% to countries GDP.

Port authority's responsibilities, ownership and legal form

The ongoing port governance discussion, taking place worldwide, has attracted the attention of both academics and practitioners, in the attempt to identify the most suitable and fitting options for restructuring the overall industry. In particular, port devolution represents a central paradigm when redesigning the port institutional framework in a number of countries. The institutional trajectory of the Baltic States port governance advances the risks associated to port reform processes in rigid institutional frameworks, typically reluctant to conjugate global challenges with local claims. Port reform implementation phase emerges as a risky momentum within the overall process, as local forces or stakeholders' groups embedded in disruptor ports may consciously produce severe conflicts in order to obstacle the concrete application of the reform in specific local contexts. In the Baltic States, port authorities share responsibility with national and municipal governments for the development of basic port and harbour infrastructure facilities: waterways, anchorages, breakwaters, quay walls and port traffic facilities for public use. Article 87(1) of the European Union treaty on seaports prohibits any aid by a Member State or through any form of state resources, which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods, insofar as it affects trade between Member States. However, the treaty permits state aid to public undertakings and undertakings charged with providing services of general economic interest. Member States generally consider they have a right and duty to facilitate and finance port development projects for reasons of economic strategy, as it is in the case of the port of Klaipeda, which is positioned as seaport of national strategic importance and receives state budget allotments. Port management and ownership structures varies between states, ranging from fully state-owned port authorities in Tallinn (EST) and Klaipeda (LT) to port authorities established by relevant municipality and jointly governed by the municipality and the state representatives in Ventspils and Riga (Latvia). The Baltic States port authorities' legal forms and ownership hierarchy is explained in following Table 3.

Table 3. **The Baltic States TEN-T port and port authorities' legal form and ownership**

Country	Port	Port authority owner	Port authority legal form
Estonia	Tallinn	State	State enterprise, JSC
Latvia	Riga and Ventspils	Self-owned	Established by the city council, under the supervision of the Ministry of Transportation
Lithuania	Klaipeda	State	State enterprise, LLC

Source: Authors' research

Within the scope of research Author analysis whether the governance models of the major port authorities in the Baltic States meet the objectives of good corporate governance guidelines and effective asset utilisation policy identifying the definition of the ownership structure of PA and its legal form, and legally binding governance structure, and define the port board decision makers as well as bottom down to operational and port management executive level. It is important for the Baltic States seaports to be governed well, as these ports do not possess inner specific advantages compared to Russian ports (large domestic market, less borders to cross for each CIS country, large volumes of export goods, close location to major shipping routes and internal market consumption limits), therefore efficient ports governance and management is of paramount importance to secure ports market share in the region and increase its operational and financial performance.

Ports are viewed as a core responsibility of the national and regional development. They are specifically planned as a strategic means of regional development, and constructed and administered accordingly. Ports function not only as mere marine transportation terminals, but also incorporate a multitude of other functions, including those related to industry, distribution, housing, and recreation. The Law on Ports, which governs the management and administration of ports, stipulates that ports are managed by port management bodies, i.e., port authorities. In addition, in accordance with the European Union treaty the Laws on Ports in the Baltic States forbid port authorities to interfere with private ventures or to conduct any business that competes with the private sector. In the course of managing and operating the port, they also forbid making any prejudicial distinctions in their treatment of persons or entities connected with the port. Systematic guarantees of operation by the private sector are thought to provide greater efficiency than direct operation by local governments.

Legal framework analysis of the Baltic States TEN-T port governance

In total there are 27 ports in Estonia handling commercial traffic, the most important port is the port of Tallinn which together with other ports is managed by the state enterprise AS “Tallinna Sadam”, which accounts for almost 80 percent of the total amount of cargo handled in Estonia. Besides port of Tallinn, there are two other important ports, the ports of Pärnu and Kunda, which have a market share of about 4 % each. Russia in particular is an important part of their hinterland, and large amounts of cargo consist only of transhipment. The Estonian Ports Act regulates the obligations of port authorities, concerning safety and procedures relating to State supervision of the ports. All ports in Estonia are operated as public limited companies based on corporate law. Some ports are a hundred percent state owned while other ports are privately owned. In certain cases there is a mixed ownership structure. In the port of Tallinn, all shares of the port company are in hands of the State. The port of Kunda and its facilities are entirely privately owned. In the port of Pärnu, the northern port of Paldiski and the Miiduranna port, municipal authorities together with private companies have shareholding interests. In Pärnu, for example, the port company of Pärnu Sadam AS, is partly owned by a private company, Transcom AS (50.6 % of the shares) and partly by the Municipality of Pärnu (41 % of the share). The Port of Tallinn operates according to the landlord port model, and since 1997 all superstructure and equipment are owned and operated by private companies, the supervisory board consists of six representatives selected, nominated and approved from two ministries: Ministry of Finance and Ministry of Transport and Communication, and management board of three professional members who at the same time are port authorities CEO, CFO and CCO. Supervisory board of port of Tallinn formed an audit committee which is an advisory body to the supervisory body about exercising of supervision, including the management of accounting function, the performance of the external auditors, the functioning of the internal audit system, the monitoring of the management of financial risks and the legality of activities, as well as budget preparation and approval of the annual report. The audit committee consists of three members of Supervisory Board, who are appointed for three years.

Klaipeda is the only seaport in Lithuania besides the dedicated oil terminal Butinge. The port is an important node in Lithuanian, European transportation network and international transportation systems. Its major traffics are oil and oil products, bulk products, fertilisers, RO-RO cargoes and containers. Butinge oil export and import marine terminal is located close to the Lithuanian border and owned by AB Mažeiki Nafta, a subsidiary of the Yukos Group, and was opened in 1999. It is connected to the Mažeiki refinery with a crude oil pipeline of an annual capacity of 13 million tons. The loading principle is an offshore loading buoy and the terminal's storage capacity is 254,000 cubic metres. Ports in Lithuania have gone through the same type of restructuring as in the ports of other Baltic countries. The reform process has been concluded with the Law on Klaipeda State Seaport of the Republic of Lithuania, issued in 1996 (last amendment 2002). The port of Klaipeda is managed by the Klaipeda State Seaport Authority (KSSA), a 100% owned government enterprise under the direct control of the Ministry of Transport and Communications of the Republic of Lithuania. The board of the KSSA is made up of representatives of the Ministry of Transport and Communications of the Republic of Lithuania, the Klaipeda county administration, the city of Klaipeda, the port authority, port users, and their associations and institutions, at present KSSA is governed as limited liability company with elected board members, without direct supervisory authority (supervisory board), and the board of the port is accountable for port performance achievements only to its shareholder (state).

By the Law on Ports (1994), Latvian TEN-T port authorities are "derived public persons" which imply certain limitations not only in their operations but also in governance and accountability systems. Under public law, the objective function of board members and management of Latvian ports is to minimise the risk of deviation from the letter of law, with the constraint of not generating losses to the government. In a corporate structure the incentives are different – the objective function is to maximise the long-term value for shareholders within the constraints of the law (in the case of a public enterprise this value can have a monetary of non-monetary sense). The Latvian Law on Ports is complemented by additional laws and regulations. The Law on Ports regulates the principles of port activities and the port's administrative procedures. Separate laws for each port regulate procedures and conditions for granting the status of a licensed capital company within the port territory. Complementary Cabinet Regulations (bylaws) spell out the responsibilities of the port authorities and of their boards, and regulate the appointment and removal of board members, their remuneration, and the duties of the Chief Executive Officer (CEO). In turn, each port has issued its own regulations on issues such as the structure of the port authority, the rights and obligations of the harbour master, the behaviour of vessels in the ports, the use of port areas, the dues and charges. The port authorities are governed by both, public and private law, depending on the nature of specific responsibilities. As regulators, the port authorities are responsible for applying conventions, laws, and regulations, (e.g., on public safety and security, environment, navigation, and health, or to collect taxes and fees). Under Private Law, they manage public infrastructure and public space, and provide security for the facilities. The private sector provides port operations and services and finances superstructure. Port authorities are comprised of the board and the executive body (or administration). The board is the highest decision-making body and is appointed for half by the government and for half by relevant municipalities. The executive is subordinated to the board and executes its decisions, it is headed by a CEO who is appointed by the board. Compared to practices in other ports, the Latvian ports' regulations provide little detail on some key internal processes. The 1994 Law provides a framework, which is overall consistent with international good practices. The Laws governing each port are sound, meanwhile such legal instruments are most effective when they are complemented by detailed regulations, which spell out specifics for their implementation. In this context, the Latvian ports' regulations are less developed than in most well-performing ports. For instance, these regulations do not cover important areas such as: (i) the establishment of board committees; (ii) the profile, expertise, and independence of board members; (iii) the election, terms of office, duties and responsibilities of the chairperson and deputy chairperson of the board; (iv) the conduct of board members during and outside board meetings; (v) conflicts of interest; (vi) the profile, expertise and independence of port authority chief executive officer; (vii) port authority chief executive officers tenure and terms of serviced etc. It is each port's internal regulations, not the law, that typically regulate those issues and provide more specifics on enforcement of the relevant provisions in the regulations (World Bank, 2013).

According to Law on ports (1994) port authorities as "derived public persons" are placed under the oversight of the Cabinet of Ministers. Moreover, the law established the Latvian Port, Transit and Logistics Council (The Council) to oversee the joint management of ports by municipal and state authorities. In practice, the government exercises its oversight through the Ministry of Transport (which, similar to three other ministries, is represented in the port authority boards). The Council provides a proper mechanism to address some port and transit sector issues by bringing together public and private sector stakeholders. The Council coordinates implementation of the national policy related to the development of ports and of their operations (the name of the Council also adequately reflects the fact that ports are just one node in longer supply chains). Meetings can be attended by the private sector, and the Council typically devotes a large share of its time to discussing concerns expressed by freight forwarders, road haulers, shipping agents, logistics companies, etc. The meetings are open to the media, hence ensuring a high degree of transparency (although formal minutes of the Council's meetings could also be disclosed to the general public on the website). According to World Bank (2013) policy research, the Council often appears to be a discussion platform rather than a decision-making authority, which could hold port authorities accountable. The Council's decisions are not binding and its composition is such, that the decision of the Prime Minister could theoretically be outvoted, especially by members representing the industry. Complaints about the Council's decision can be referred to local courts (World Bank, 2013).

Overall, the Council is not equipped to provide effective oversight of the port authorities, and lacks the ability to enforce its decisions over the boards or the CEOs. Neither the Cabinet of Ministers, nor the Council nor municipalities have an institutionalised process to assess performance by the boards, and hence to hold them accountable. There is no formal performance measurement process for the boards, even though they bear the ultimate responsibility for the ports' performance. Bylaws for each of the boards do not stipulate any mechanism to assess the way they discharge of their responsibilities and ensure effective supervision of the ports. Because the boards are not formally held accountable by any authority both the central government (through several ministries) and the municipal governments have always had their representatives on boards in order to remain posted on the work and decisions of the boards. However, these representatives are usually accountable only to their political constituencies or to the authorities, which appointed them. As a result, they are expected to reflect their constituency's position and provide information to their constituencies, and do not always have incentives to look first at the general interest of the ports. This is a key weakness of the current port status. Another consequence of this setting is that they change as frequently as the central government (which changes frequently) or municipal governments (which have been very stable). The performance of individual board members is presumably appraised by the authority which (s)he is representing, but this cannot substitute for an evaluation of the board as a whole (and of the outcomes of its decision-making process) – especially considering the nature of the relationships between the various appointing authorities.

The boards constitute the "highest decision-making body" in Latvian TEN-T port authorities. According to OECD (2004) guidelines, public entities boards, not management, are assigned the ultimate responsibility for the organisation's performance and are accountable to relevant public authorities. Boards are expected to follow the best practices adhered to in the private sector to effectively perform their responsibilities and functions. Specific responsibilities of the boards in Latvia include the review and approval of: 1) the port authority's regulations; 2) the structure of the port authority's executive; 3) the ports' borders; 4) the ports' development programs; 5) the port authority's marketing strategies; 6) the port authority's annual and five-year budgets (including revisions); 7) proposals for new leases (including fees) and issuance of permits for licensed commercial activities; 8) contracts of a value over EUR 70,000 or a duration of more than five years; etc. The boards of the Latvian port authorities perform only the function of the highest decision-making body but not the function of supervision in the ports. Several important features of the boards diverge from international good practices, including composition of the boards, the profile of board members, the duration of their tenure, and the role of committees. It is well understood that practices in each country need to reflect specific circumstances and arrangements, and that there is no "one size fit all" model for the functioning of ports boards. Meanwhile, some of the practices may have important implications on the boards' ability to ensure adequate supervision of the executive as well as possibly on the quality of some of their decisions (World Bank, 2013).

The composition of landlord port boards varies greatly across the world. Port authority board members are typically appointed by relevant public authorities. In most port authority boards, the number of members is odd, so as to facilitate decision-making in case of dissensions. Particular efforts are also made to ensure that boards include members of or people with strong experience in the private sector. An emerging trend is to ensure that board members are "independent" rather than "representatives" of an authority, i.e., that once appointed by a relevant authority they act and decide by themselves in the best interest of the ports rather than represent or defend the views and interests of an external party. By contrast, in accordance with the 1994 Law on Ports the boards of Riga and Ventspils port authorities are composed of eight members: four government representatives from four different ministries: Ministry of Transport and Communications, Ministry of Finance, Ministry of Economics and Ministry of Regional Development and Environment, and four representatives from the relevant municipality. Ministry representatives are appointed by the Cabinet, and municipal representatives by the city council. The boards of the port authorities do not have representatives from the business sector. Overall, the composition of the boards and the appointment system create a risk of political interference (while paradoxically there is limited accountability to the political oversight body, the Latvian Port, Transit and

Logistics Council) and do not guarantee the independence of board members. This weakens the board's ability to act as an effective supervision authority.

Port authority board composition varies across the world, most performing ports seek a large share of board members with a private rather than public sector background and mind-set, Bolevics (2017). This is aimed at encouraging a decision-making process based on an economic and financial rationale, rather than on politically driven considerations. It also reflects the fact that the port authorities are not government agencies and operate in a different environment thus requiring a different set of skills. In-depth technical experience in areas relevant to port management is also critical for board members to be able to adequately assess the CEO's reports and recommendations. The most common professional experience among port authority board members includes shipping, railways or other transport modes, logistics, industry, nautical-maritime, and financing (while each board member can only have limited professional expertise, the board as a whole should be able to cover all critical areas of port management). In Latvia, applicable regulations do not explicitly spell out qualifications requirements for port authority board members. In practice, a brief review of current port authority board members' backgrounds suggests that the level of experience and expertise may be variable, as well as the board members may fill these posts for unlimited amount of terms. There is also a perception that political affiliation may at times trump professional skills. This does not facilitate the functioning of the board as an effective supervision authority (World Bank, 2013).

Landlord ports in the world set term limits for their board members, typically between three and six years with the possibility of one re- appointment. This is aimed at ensuring stability and at providing enough time for board members to acquaint themselves in depth with the issues they are to decide on (by avoiding too rapid rotations) while at the same time bringing in “fresh blood” periodically and minimising the risks of co-optation between board members and the CEO or specific stakeholders (which could develop over long tenures). In Latvia, applicable regulations do not define such term limits for board members. In practice, representatives of ministries tend to be replaced with each change of government and current members have served from 9 months to two years. Municipality representatives, on the other hand, have been in the board for two to over 15 years (World Bank, 2013). This results in some unbalances and in a degree of instability. At times, boards may also end up being dominated by a group of members who have been in place for a long period, which may create little space for challenging established arrangements and fostering new ideas. This makes it difficult for the board to function as an effective supervisor, which can hold management accountable.

Most performing landlord ports have established an audit committee within their board. The audit committee is charged with oversight of financial reporting and disclosure. It is typically composed of three to four qualified members of the board (with a chairperson selected from these members). The audit committees are typically empowered to acquire the consulting resources and expertise deemed necessary to perform their responsibilities. Audit committees also oversee the internal audit function within the port authority, financial planning and reporting, the system of corporate controls, risk management, and develop recommendations to the full board for approval. From the empirically tested port authorities, the port authority of Tallinn has implemented audit committee according to good corporate governance guidelines, meanwhile the TEN-T port authorities of Riga, Ventspils and Klaipeda haven't gone the same path, which implies that boards of the port authorities may not be as well-equipped as comparators to ensure an effective supervision of the ports' financing and control systems. In general Latvian and Lithuanian ports, contrary to usual international practices, do not establish other committees for other purposes (World Bank, 2013).

Baltic TEN-T ports are operating in a very difficult competitive environment, performance by all institutional stakeholders, and especially by port authority's boards and management is critical. Accountability mechanisms make it possible to evaluate such performance on a regular basis and to act on the findings of the evaluation to correct observed deficiencies. Accountability is also an essential element for the management of public assets and public resources. It is a protection against the risks of corruption and it provides the general public with confidence that resources will be used effectively. This is especially important for public entities, which are managing large amounts of funds. A number of rules and recommendations have been developed, for example, by the OECD (2004), to translate general principles into actual and practical recommendations for public entities. These were essentially designed for public entities that are "corporatized" and that are either subject to the company law or specific laws applicable to public enterprises. Many of these OECD (2004) corporate governance principles can be applied to administrative bodies such as the Baltic States TEN-T port authorities. However, the usual practice for entities with status similar to Latvian port authority does not always correspond to the logic of OECD rules, which may make them difficult to apply, for example in the functioning and roles of boards. A switch of the governance structure of the ports to a system close to the laws applicable to public corporations may facilitate the implementation of OECD rules in the sector. The challenge is to build systems that will provide for effective accountability. Individual or institutional performance may be strong and financial practices may be sound, even in the absence of a clear accountability framework. Informal evaluation and feedback may provide for an appropriate degree of control and oversight. According to World Bank (2013), effective accountability requires the setting up of mechanisms that can ensure that performance is systemically managed, and not only the results of a combination of ad hoc factors. In the case of the Baltic States TEN-T ports, accountability systems need to encompass several features: the legal framework, the oversight function by the public authorities, the functioning of the boards, the relationship between boards and management, and finally the existence and full disclosure of independent external audits. Transparency in decisions is also critical to foster the accountability of the system to the general public, Bolevics (2018).

Functional environment of the Baltic States TEN-T network seaports

A port is a land area with maritime and hinterland access that has developed into a logistics and industrial centre and plays an important role in global industrial and logistics networks (Notteboom et al., 2009). Notteboom's definition focuses on the role of the port in logistics networks and the port's important role in global industrial networks. However, within the scope of this research, Author agrees that it is impossible to neglect the ports' contribution to the regional economy, in the Baltic States and other regions worldwide, where cargo is transferred between several nations, yet without representing a global economic zone or participating directly in the whole world's industrial and logistics networks (Bolevics et. al., 2013).

Following Notteboom's (2009) definition of the port and using Porter's five forces model (Porter, 2008) ideas of strategic management, Author has developed definition, that a port is a dedicated land area with maritime and hinterland access where a diverse set of economic activities occur, and which is managed by a port authority with the legal right to act as a land manager with corporate responsibility for the port's efficient, effective, and safe development (Bolevics et. al., 2013). Port authorities tend to function as one of landlord, regulator, or operator (Baird, 1995), depending on their respective legal status (Brooks, 2006).

Port authorities in the Baltic States analysed here perform the functions of landlords, which include the management and development of the port's land, with consideration for nautical access, international safety standards, and port infrastructure. The landlord port is a model characterised by a mixed public-private orientation, under this model, the port authority typically acts as landlord and as a regulatory body, while port operations, especially cargo handling, are carried out by private companies. This model is appropriate for ports with the characteristics of Riga, Ventspils, Tallinn and Klaipeda. Similar to other landlord ports, the port authorities of all four Baltic States main ports manage real estate, carry out port development and planning, undertake marketing of the location, provide maintenance and upkeep of port access and waterside. The port authorities have retained responsibility for dredging and ice breaking, meanwhile the ports are outsourcing some services, with regard to port security, safety of vessels and maintenance of infrastructure. A key responsibility of the landlord port is to manage the real estate, which includes economic exploitation/leasing out, long-term development, maintenance and improvement of basic infrastructure such as fairways, berths, access roads, tunnels and manage adjacent industrial areas, as free zones. The terminal operators provide and maintain their own superstructure including buildings (offices, sheds, warehouses, container freight stations, workshops). They acquire and install their own cranes and other equipment, and arrange for stevedoring. The landlord function of port authorities has been defined in keeping with the literature on port governance models (Brooks, 2007). Strategically, port authorities in Baltics act as triggers for national infrastructure development plans, such as railway, deepening of ports access channels and road network expansion, giving due consideration to social responsibility and the environment.

Notteboom et al. (2009) focuses on the logistics environment in ports and how port authorities should act in this challenging environment, stipulating that port authorities must be able to respond to fast-changing market needs, and see networking as a central prerequisite for PA competitiveness. Chlomoudis and Pallis (2002) on the other hand develop a “smart port authority” concept, in which the port authority takes responsibility for improving interconnectivity and interoperability in between port users.

Institutional framework of TEN-T port authorities in the Baltic States

Competition among ports in the Baltic States encompasses competition for hinterland access, competition for national infrastructure development projects, and is impacted by competition in the established markets, such as Scandinavia or Western Europe, by local governance constrains and new trends in transit cargo shipping in the areas of Far East, silk-way development programmes and opportunities along with these mega developments. Ports do not compete directly as individual entities: rather, it is the performance of a complete infrastructure chain that determines the user’s port of choice (Notteboom and Winkelmans, 2001a). The port’s performance is linked to nautical accessibility, cargo handling facilities, the efficiency of terminal operators, and the overall industrial and logistics chain. In recent decades, the logistics of the port chains and hinterland access have played a major role in port authorities’ allocation of resources to development projects, as well as in motivating port user companies to invest constantly in facilities and fundamental infrastructure projects to improve the terminals’ cargo throughput, improve ships turnaround times, safety and quality of services and relentlessly invest in any cargo value added activities, which would increase port users and port authorities revenues and increase port authorities efficiency ratios.

The institutional positions of port authorities in the Baltic States have changed as per port governance decentralisation methodology, often simply called as a port reform (World Bank, 2001). Reforms of the landlord and regulatory functions of ports is usually a matter of corporatization, commercialisation, or some degree of privatisation of operations – mainly cargo handling – while the actual management of the ports remains in public hands, whether through state, municipality or both combined legal entities. These models are aimed at making public port authorities act on commercial criteria and respond to changing market conditions (Heaver, 1995).

Corporatization introduces professional management structures and amounts to a shift from public administration organisations to autonomous companies owned by the public sector, but with accounting procedures and legal requirements similar to those of private-sector companies, and with very limited direct government control. In commercialisation, government retains control of the port organisation, but in a business-like environment with some management autonomy and accountability (Notteboom and Winkelmans, 2001b). The institutional frameworks of TEN-T port authorities within the Baltic States and corresponding legal differences among them are listed in details within Table 4, which also summarises the ownership structure of piers within the port, port land and water area, ownership of cargo handling operations and outlines whether the ports have followed commercialisation or corporatization path and evaluates port authority's compliance with good corporate governance guidelines.

Table 4. Institutional frameworks of TEN-T port authorities in the Baltic States

	Tallinn, Estonia	Riga, Latvia	Ventspils, Latvia	Klaipeda, Lithuania
Corporately governed PA	Yes	No	No	No
Supervisory board	Yes	No	No	No
PA board	Yes	Yes	Yes	Yes
Audit committee	Yes	No	No	No
PA CEO is board member of the PA	Yes	No	No	Yes
PA is financially independent	Yes	Yes	Yes	Yes
PA is an entity governed according to commercial laws	Yes	No	No	Yes
PA owner	State	Self	Self	State
PA legal form	JSC, state enterprise	Public body under municipal and national control	Public body under municipal and national control	LLC, state enterprise
PA port funds, state budget allotments	No	No	No	Yes

	Tallinn, Estonia	Riga, Latvia	Ventspils, Latvia	Klaipeda, Lithuania
Owner of port land area	State	National or local government, or other legal or natural person	National or local government, or other legal or natural person	State
Owner of port water	State	State	State	State
Quayside owner	State	National or local government, or other legal or natural person	National or local government, or other legal or natural person	State
Operations, cargo handling	Private	Private	Private	Private
Corporatized PA	Yes	No	No	No
Commercialized PA	No	No	No	Yes
Commercialized PA	No	No	No	Yes

Source: Authors research

Regarding the cargo handling operations, within this research the limitations are set, that these are the operations which do exclude any operations with passengers, as passengers terminals and equipment's along with it are fully or partly owned by the state through a port authority, an exception is the port of Riga, where the passenger terminal and piers along with it, as well as other infrastructure associated with it is owned by private entrepreneurs through the legal form of LLC, which has been established in Riga under equally the same principle as any other LLC within a country, meanwhile the port authority of Riga port, has financed construction of passengers gateway tunnel and other infrastructure within the private passenger terminal. The situation is opposite in ports of Tallinn, Klaipeda and Ventspils, where port authorities are the actual owners of passengers gateway tunnels, passenger terminals buildings, piers, mooring equipment and other infrastructure which includes "passenger handling and operation", port authority of Tallinn seaport is also the shareholder of ferry service business and one of the paramount facilitators for Helsinki- Tallinn sea route expansion, which today is one of the world's busiest passenger sea routes, handling in combined value between both ports of nearly 20 million passengers in 2016 (POT, 2016). The seaports of Tallinn, Estonia, and Klaipeda, Lithuania, where the port lands, port waters and port infrastructure are state property (see Table 4) and the port authority has the right to rent port lands for the purposes of port activities, which is more efficient in comparison with the port authorities of Riga and Ventspils, Latvia, where the dry portion of a port's territory may be the property of the state, the municipality, or another legal entity or natural person. Although the port authority is a state enterprise established by a decree of the government, its primary assets are its land, and the infrastructure is operated by the right of trusteeship, pursuant to the laws and by-laws regulating its operations. Because the port authorities' income flows come from land rents and port dues, a port authority that has more land in trust gains financially by accommodating more companies and maximising its rent.

TEN-T network ports in Latvia are governed following a hybrid governance methodology, the port authorities itself act as non- profit institutions established in relevant municipalities under Ministry of Transport and Communications control. The highest decision- making body of which are port authority boards, whose eight members include four officials from the local government and four from various ministries. The board members of these port authorities are nominated directly from represented municipalities and relevant ministries, the municipality board members are approved by the city major or his deputy, and the government representatives are approved by Cabinet of Ministers vote. It is common and frequently used that board members are at the same time members of the ruling political parties or persons directly nominated by the competent minister. This tends to limit financial autonomy and favour political influence, an imperfect situation that would appear to put port authorities in a weak and uncertain position (Verhoeven, 2006). Empirical evidence represents that the governance system in the two seaports follows neither the corporatization nor the commercialization path, and ports are subject to the direct influence of municipal and national politicians. National and municipal cooperation is no reason why the present system should be reassessed: it is rather a benefit than an obstacle. However, in comparison with the industry practice in port devolution, it makes the ports both financially and politically dependent. Everett (2002) comments that inadequate legislative frameworks frustrate statutory corporations such as ports by making them unable to operate as commercially oriented and market-driven businesses, and unable to operate independently of political and bureaucratic control.

Because port authorities increasingly need to develop their facilities to face the challenges of the dynamic market they operate in, governance reform or a retreat from direct government involvement is crucial for port authorities to obtain the strong and independent position necessary to meet the challenges of the logistics sector and the social environment. Port management reform is motivated by reasons of economic efficiency with the objective of reinforcing the port authority as an entity which reconciles private and public interests (Verhoeven, 2009). According to Brooks (2007), a port governance system which is fragmented between municipal and national political opponents does not allow ports to sustain long-term investment plans and does not allow port authorities to act as efficiently and effectively as possible.

Following Brooks (2007) and Verhoeven (2009) theory, there are grounds to open a debate that the degree of fragmentation in the governance model also makes a difference. A scenario of equal shares, i.e. a governance model in which municipal and national interests are equally represented, would definitely not lead to sustainable port development, especially if the municipal and national representatives on the port authority board would be equally numbered or these members would be politically nominated from different set of parties. The national and municipality level interests in equally represented (50/50) shareholding portfolio can only succeed if the parties agree that port authority is professionally governed according to transparent and accountable corporate governance model, in any other situation where there is space for doubts or unclear decisions made, such a governance model would not be feasible in long term. A good example is the port of Rotterdam, which has evolved from a traditional municipal port to one in which the city owns a 66.7% share and the Dutch state a 33.3% share (Winkelmans, 2006). Most port authorities in the European Union have gone through a process of devolution towards corporatization or commercialisation, and most of them are governed by specific legislation and have a separate legal form, or operate as limited liability companies. Corporatization is seen to prevail here over commercialisation. The official legal status of the port authority does not reveal its actual degree of autonomy: the fact that many port authorities declare that they enjoy only partial financial autonomy, and that several indicate that their board of directors includes political appointees, seems to suggest that the process of corporatization has not led to the desired degree of financial autonomy, while political influence deserves further investigation (Verhoeven, 2010).

Port authorities in the Baltic States have gone through a process of corporatisation, as in the Estonian port of Tallinn, or of commercialisation, as in the Lithuanian port of Klaipeda. These processes are not yet complete, and a high degree of direct government involvement is still visible. Port management reform is essential to obtain a strong and independent political and financial position. As a model of such financial independence, the Port of Tallinn, which consists of five harbours around Estonia – Muuga Harbour, Tallinn Old City Harbour, Paljassaare Harbour, Paldiski South Harbour, and Saaremaa Harbour – is a joint-stock company whose shares are owned entirely by the State of Estonia. A landlord-type port, the Port of Tallinn operates under the same business laws as any other private company in Estonia: it receives no subsidies from the State; on the contrary, the port pays yearly dividends to the state as its shareholder. From the point of view of financial independence, management reform here has achieved its goals. Empirical evidence shows, however, that the political sector still remains responsible for the port functions, as the company's supervisory board consists of eight members, of whom four are appointed by the Minister of Communications and Economic Affairs and the other four by the Minister of Finance. While this does not necessarily imply that all members of the supervisory board are ministry officials or politicians, the existing legislation offers enough influence over decision-making. The procedure for selecting supervisory board members should therefore be revised to meet the criteria of port authority independence and good corporate governance guidelines.

The Lithuanian port of Klaipeda has followed a commercialisation path, and its port authority functions as a landlord. Nevertheless, the present law governing the Klaipeda seaport stipulates that port funds may include of state budget allotments, which is in conflict with the relevant European Union treaties. Port authorities, whether they are in public or private ownership, are subject to the provisions of the EC Treaty, under which states may not grant aid, refuse access, discriminate between customers, or otherwise act unilaterally.

The Klaipeda port authority is owned by the state of Lithuania and governed according to state enterprise mandate. The board of the port of Klaipeda is made up of representatives of the Ministry of Transport and Communications of the Republic of Lithuania, the Klaipeda county administration, the city of Klaipeda, the port authority, port users, and their associations and institutions. The appointment process and board members direct affiliation with their political background limits the independence and transparency within this process, also it would be highly recommended to implement good corporate governance guidelines and establish a supervisory board and professional executive board.

In relation to global industry trends and empirical evidence on the governance of port authorities, the port authorities should improve their performance and proceed further to political and financial autonomy. Each port in this study has its own unique character and political heritage, Author has evaluated the present situation and analysed the existing port governance models and their compliance to good corporate governance guidelines, and compared gathered data with best industry practices within others TEN-T ports. The review of the port governance aspect reveals following factors which have affected governance practices currently being used in the port authorities:

- Lack of independence of port boards due to political appointment processes and emphasis on political accountability of each individual to its appointing authority;
- Uneven consideration of professionalism criteria in port authority board appointments and in the case of Latvia, no relevant criteria or guidelines are established for port authority board members, the current situation supports the political appointment process, whereas state representatives are chosen by corresponding ministers direct nomination for Cabinet of Ministers approval and municipality representatives are directly nominated by the city major or his deputy;
- Weak collective accountability of the port management and of the boards to the state and municipalities who entrusted them with management of public assets;
- Limited transparency in decision-making process and in activities of the ports affects the confidence of current and potential investors and operators;

- Limited implementation of good corporate governance guidelines. Port of Tallinn authority is governed according to good corporate governance guidelines and established supervisory board, audit committee and executive board, meanwhile other researched port authorities are governed following hybrid governance models with local interest representatives present at the board level.

Concluding, this research has analysed governance models of port authorities of TEN-T network seaports in the Baltic States, and the fundamental governance, institutional and legal differences among them, with the overall objective to guide port authorities towards good corporate governance guidelines, as the Author strongly believes that transparency, good governance and accountability are paramount factors to increase ports and port authorities' performance. Further to this, the empirical analysis highlights the legal and institutional differences among ports and discovers that TEN-T port authorities of the Baltic States have followed to some degree the good corporate governance guidelines, for the ports of Lithuania and Latvia there is still space for major improvements to be done towards the transparency, board selection and election process, establishing a supervisory board and appropriate changes in legal structure of the port authority. Meanwhile the Estonian government has followed and implemented almost all of the guidelines, hence lacking behind in the supervisory board selection and election process, as this is today controlled by two ministries directly, therefore appropriate amendments should be implemented to avoid ministry appointment process and follow the independence and professionalism criteria.

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Chapitre 2

Short sea shipping and hinterland container transport in the baltic sea area - Developments and competition

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Biography

Prof. Dr. Joachim R. Daduna *is teaching since 1997 as a professor and lecturer in business administration with the focus on logistics at the* Berlin School of Economics and Laws*. Before he worked at the* University of Applied Sciences for Technology, Business and Design *at Konstanz. 2016 and 2917 he also gave lectures at the* University of Applied Sciences for Technology, Business, and Design *at Wismar. Moreover, he has been a visiting professor in China, Colombia, Cuba, Estonia, Japan, Kazakhstan, and Russia in recent years.*
After studying Business Administration *at the* University of Hamburg *he worked at the* University of German Armed Forces *at Hamburg, where he received his Ph.D.. Occupations followed at* Hamburger Hochbahn Aktiengesellschaft and at Dornier GmbH / Consulting Group*, an affiliate of the* Daimler Benz Group *in Friedrichshafen, Berlin, and Athens. Within his research activities he published (also as a co-author) several books as well as numerous papers in national and international journals and in contributed works.*

Abstract

Designing efficient transport corridors for container transport in the Baltic Sea region, the importance of short sea shipping will continue to increase in the future and thus inevitably the associated seaport hinterland transport. The reasons for this are complex, with the focus on economic as well as ecological objectives. In general, in the Baltic Sea ports a further increase in container transport volume is expected for the next few years, but this must be scrutinized critically. In any case, the long-term effects of the designation of the Baltic Sea and large parts of the North Sea as a (Sulfur) Emission Control Area play a significant role. In addition, the development of the competition of international supply chains must be seen, especially in Northeastern Europe, which will become increasingly noticeable.

This concerns above all the competition for the port calls and the associated container turnover and the subsequent hinterland transport with the eastern North Range harbors, so for example Hamburg, Bremerhaven and Rotterdam, which can cover because of their geographical situation a wide hinterland. In addition, several ports in the northern Adriatic, as well as in the Ligurian and Tyrrhenian Seas, must be kept in mind, as these can potentially develop a high level of competition potential. In order to compete with these ports, it is, on the one hand, necessary to have an efficient technical terminal infrastructure and also to be able to offer efficient hinterland connections. On the other hand, instead of (internal) regional competition, coordination and, in a long-term view, cooperation in the Baltic Sea region must be sought.

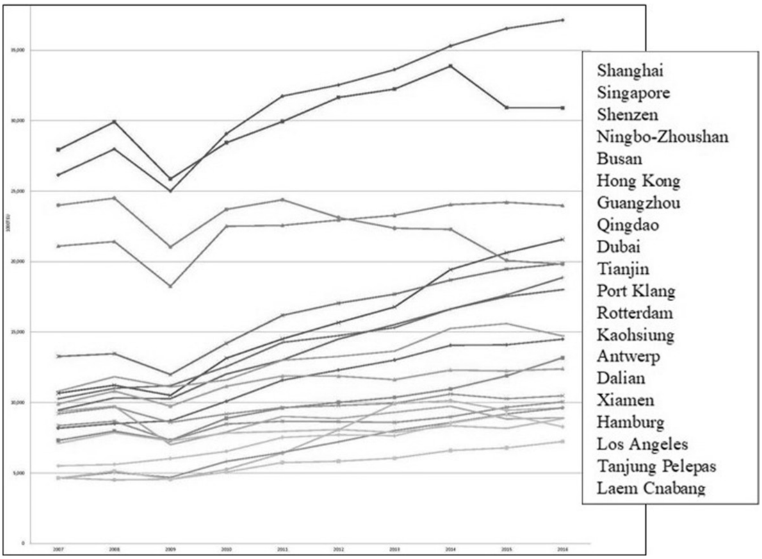
With increasing competition in international container transport, and possibly also a decreasing demand due to structural and technological change, it is only possible to survive in a long term with each other, but not against each other. Only those who succeed in adapting to the changed structures on time to a sufficient extent have enough potential to succeed in the international market in the future.

Keywords: Baltic Sea, Short sea shipping, Hinterland transport, Competition, Future developments

Developments in maritime container transport

Developments in maritime container transport have shown steady growth over more than 50 years, especially in the East Asian ports. After the worldwide collapse in transport demand during the global economic crisis in 2009, a significantly more differentiated view can be seen (see, AIPH 2017). Although growth can be seen again, but there is an increasing number of cases showing stagnation and decline (see, figure 1 and table 1). Growth rates of 9% per year, as predicted a few years ago for the period from 2008 to 2015 (see Heymann 2006), are far away from real developments. Nevertheless, Halim et al. (2017: 84) also assume based on their underlying scenario that a further significant growth will occur relating to the years 2030 and 2050. But this also raises the question whether such a long-term forecast can form a reliable basis for a discussion about future developments in international container transport, especially in the context of significant structural changes of recent years.

Figure 1. World top 20 ports 2007 - 2016 (1,000 TEU)



However, at the same time they point out that on the part of the shipping companies the total vessel capacities planned for 2030 for different market areas are very oversized, which means that the future expectations of these companies may be far too optimistic. In addition, they also see the traditional approaches to estimate future developments very critically (see Halim et al., 2017: 90). An important point here is the statement that disruptive influences, which are already recognizable, have not been included in the design of the scenarios, so that as a result the forecasted values may possibly have to be significantly corrected.

The problem here is that the operators of many *seaport container terminals* (SCT) take as the basis for their development plans of the port infrastructure such, possibly unrealistic data. Important points that need to be considered are the future *economic policy framework conditions* and the (international) *supply chain structures* arising from them. These can for example be influenced by (power) political decisions or supra-regional conflicts, as well as by disruptive innovations in the technological environment. Such influences on long-term decisions, which normally cannot be quantified, are often not adequately included in risk calculations.

Table 1. World top 20 ports ranking (2004, 2007, 2011, 2013, 2015 - 2017) (1,000 TEU)

	Harbor (Country)	2004	2007	2009	2011	2013	2015	2016	2017	
1	Shanghai (CN)	14,557	26,150	25,002	31,739	33,617	36,537	37,133	40,199	
2	Singapore (SG)	21,329	27,936	25,866	29,937	32,240	33,869	30,904	33,667	
3	Shenzen (CN)	13,615	21,099	18,250	22,570	23,278	24,204	23,979	25,031	
4	Ningbo-Zhoushan (CN)	4,006	10,653	10,502	14,510	16,774	20,620	21,560	24,421	
5	Busan (KR)	11,430	13,270	11,080	16,184	17,686	19,469	19,850	18,263	↓
6	Hong Kong (HK)	21,984	23,998	21,040	24,384	22,367	20,073	19,813	20,721	
7	Guangzhou (CN)	3,308	10.257	11,190	14,260	15,309	17,625	18,858	20,087	
8	Qindao (CN)	5,140	9,462	10,260	13,020	15,520	17,510	18,010	18,383	-
9	Dubai (AE)	6,429	10,791	11,100	13,000	13,641	15,592	14,722	15,400	
10	Tianjin (CN)	3,814	8,176	8,700	11,580	13,010	14,090	14,490	15,212	-
11	Port Klang (MY)	5,244	7,312	7,309	9,603	10,360	11,887	13,170	11,978	↓
12	Rotterdam (NL)	8,281	9,900	9,743	11,876	11,621	12,235	12,385	13,734	
13	Kaohsiung (TW)	9,714	9,200	8,581	8,636	8,838	10,264	10,465	10,271	↓
14	Antwerp (BE)	6,064	8,355	7,309	8,684	8,578	9,654	10,037	10,451	-
15	Dalian (CN)	2,211	4,642	4,552	5,400	9,912	9,450	9,614	9,861	-
16	Xiamen (CN)	2,872	4,627	4,680	6,450	8,008	9,183	9,614	10,358	
17	Hamburg (DE)	7,003	9,360	7,007	9,014	9,302	8,921	8,910	8,815	↓
18	Los Angeles (US)	7,321	7,103	7,261	7,940	7,869	8,161	8,857	9,343	
19	Tanjung Pelepas (MY)	4,020	5,500	6,016	7,520	7,628	8,120	8,281	8,261	↓
20	Laem Chabang (TH)	3,529	4,627	4,537	5,731	6,041	6,780	7,227	7,797	
	Sum (20 main ports 2016)	161,871	232,418	220,885	274,016	292,689	312,197	317,879	332,253	
	Share of world total (%)	---	53.6	43,4	50.7	46.9	---	---	---	
	World total	---	433,253	509,440	540,816	624,480	---	---	---	

Sources: 2017: DVZ (2018) / 2007 - 2016: IAPH (2017) / 2004: AAPA 2005

In order to be able to discuss and evaluate the future developments of container transport in *Short Sea Shipping* (SSS) and the connected hinterland transport in the Baltic Sea region, the specific competitive situation is first outlined. This is followed by looking at the existing hinterland connections and their possible developments, also with a view to the impact on international competition between ports concerned. Then considerations for the design of transnational cooperation's are made with the objective of sustainably improving the competitive position of the Baltic Sea region. Finally an outlook on possible (and in particular disruptive) developments is given that can extensively change the demand structures in international container traffic.

Specific conditions for competition in the baltic sea area

The Baltic Sea region has been affected by shipping for centuries as the dominant transport mode. Probably the greatest time of prosperity was the middle Ages, in which the *Hanseatic League* in the North Sea and Baltic Sea region, including wide hinterland areas, had a decisive influence on not only international trade but also on the necessary maritime transport. This association was a horizontal cooperating network of mainly harbor cities that were free and not integrated in hierarchical state structures (see, e.g., Liggio 2007). Main objective was to organize effectively and efficiently as well as to develop continuously trade and the necessary logistics for transport and warehousing (see, e,g., Pichierri 2000: 83 and 118). Although the cartel-like structures of the Hanseatic League may be assessed differently from today's perspective, it has been a major factor in economic and social developments in much of Europe. Even after the collapse of the Hanseatic League, the importance of maritime transport for the region continued.

Only after the Second World War did the division of Europe lead to a significant weakening of the importance of maritime transport in this area. For decades, this power-political situation has had far-reaching impacts for economic and social structures (see, e.g., Jann 1993). With the failure of the Soviet Union, however, there was a widespread re-emergence of maritime structures that had shaped the economy in the Baltic region for centuries. Collaboration in recent years has developed in different fields, mainly in decentralized networks with a fact-based orientation, independent of the not always quite simple state structures (see, e.g., Jann 1993). In this sense in the historical context, the environment should actually be in place to develop suitable cooperative structures with a view to future competitiveness in the international transport market.

For some years, however, developments have emerged that could possibly have long-term negative effects on the maritime sector of the Baltic Sea. In the foreground are here three fields: the definition of the Baltic Sea as a *Sulfur Emission Control Area* (SECA), the (external) competition with the Eastern North Range ports as well as the Mediterranean and Black Sea ports and the internal competition of the Baltic Sea ports. In particular, the first two fields influence (and will continue to do so) decisively the possibilities of future developments in maritime container traffic in the Baltic region. Only if it is possible to establish a *unique selling proposition* through attractive offers as well as with high operational performance and a strong customer orientation the necessary *competitive advantages* can be achieved for the region in the long term.

The introduction of Emission Control Areas (ECA), based on the *International Convention for the Prevention of Pollution from Ships* (MARPOL), is aimed at a (finally worldwide) significant reduction of the negative environmental impact of maritime transport. However, implementation of SECA regulation has been very limited in terms of spatial extent (see Fig. 2), but the North and Baltic Seas are included (see Fig. 2). As a result, the framework conditions for the various transport modes in multimodal transport have changed in the whole Baltic Sea region since January 2015 (see, e.g., Notteboom, 2011 ; Holmgren et al., 2014 ; Daduna / Prause 2016). In addition, there will be an expansion to *Nitrogen* (Nitrogen Emission Control Area (NECA)) in 2021, which will lead to further changes in the framework conditions (see Åström et al., 2018). It is clear, as the studies of Chang et al. (2018) show that regulatory measures have negative effects on productivity in the ports concerned, which ultimately leads to additional costs and thus to disadvantages in international location competition.

The focus is on the question of whether and to what extent a change results in the modal split resulting from a shift from maritime transport to the three terrestrial modes (road, rail, inland waterway). This not only applies to internal traffic in the region but also to conflicts with competing sailing areas, the North Sea, the Mediterranean and the Black Sea.

Figure 2. **Sulphur emission control areas**

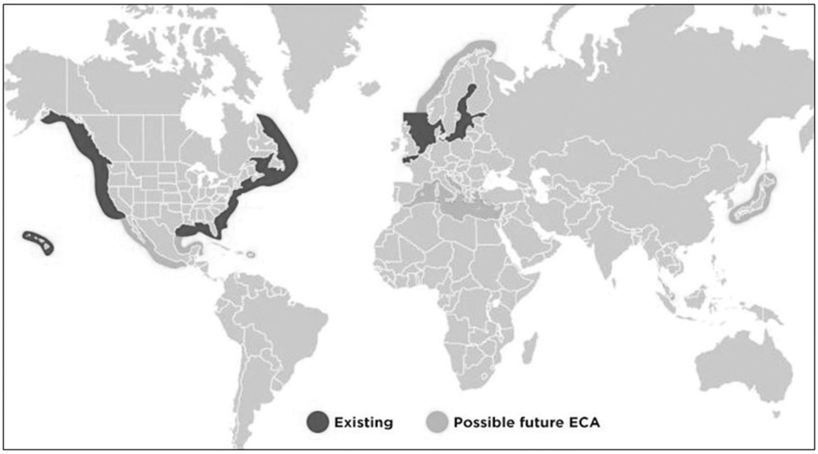
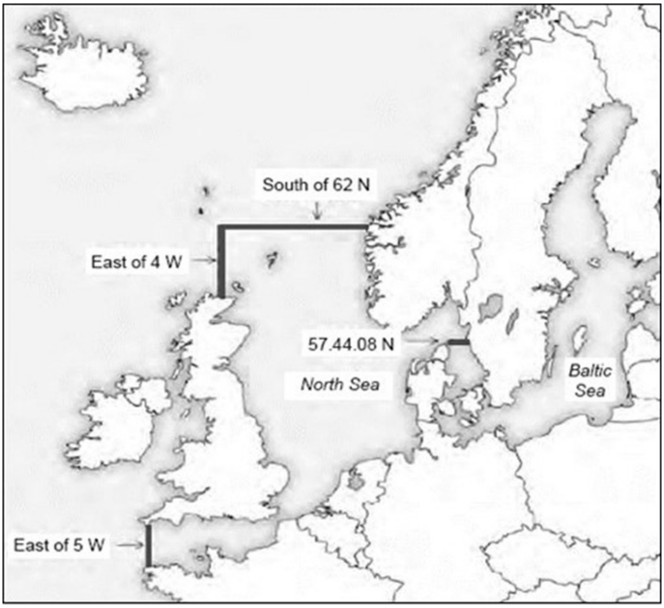


Figure 2. **Sulphur emission control in the North Sea and Baltic Sea**



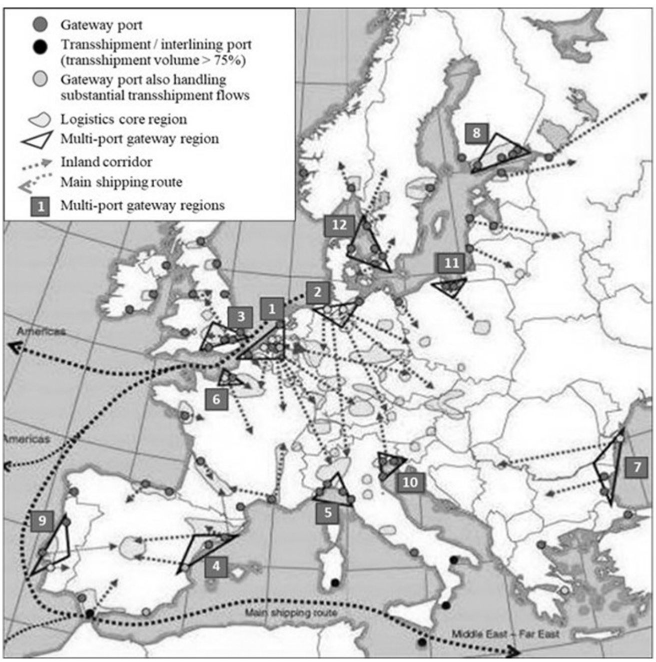
In the competition with the North Sea ports, primarily the two German harbors, Hamburg and Bremerhaven, as well as the Dutch harbor Rotterdam, it is essentially about the question of whether there is a reduction of the share of maritime transport in favor of a longer hinterland transport applying terrestrial transport modes. A decisive point here is the performance of the corresponding hinterland connections of these ports, primarily in terms of time and costs, but also increasingly taking into account ecological aspects. Regarding environmental impacts, however, it must be seen that the transport mode-related effects differ, that is, focusing on specific pollutants can lead to a misinterpretation (see, e.g. Svindland, 2018).

Ultimately, these are situation-dependent decisions, which, however, are also significantly influenced by the individual preferences of the decision makers (see, e.g. Talley / Ng 2018). In competition especially with the Baltic ports, the *Rail Freight Corridor* (RFC) 8 (North Sea - Baltic) (see BSL / UIC 2017: 28) is of considerable importance, since the use of this connection may involve a shift of SSS shares to rail traffic.

With regard to the Mediterranean and the Black Sea, however, there is a completely different situation. Although the Mediterranean is planned as a (possible) future SECA space, the probability of its realization seems rather low, especially with regard to the economic and political situation as well as the lower priority of ecological aspects in the neighboring states. In the case of the concerned member states of the *European Union* (EU) too, interest in this regard must be seen as rather low. In addition, no measures are currently under discussion for the Black Sea area. This results in clear competitive advantages for the ports in these two regions.

So far, the structures of container flows regarding European countries are dominated by the connection between East Asia and Europe via the *Suez Canal Route* (SCR), which also has the largest container transport volume in the world. In the past few years, the area of the North Range ports was the main destination for the routes coming from East Asia (see Fig. 4, based on Pastori, 2015: 40) (see also, Halim et al., 2016). The hinterland operation relating the Mediterranean ports of the northern Adriatic and the Ligurian Sea had, and has still partly today, largely a regional focus. The reason for this lies to a considerable extent in the topographical structures, since there is a natural barrier to the design of north-south transport links with the Alps. Although this also applies to the freight transport by road, despite its high flexibility, but especially rail freight transport is concerned.

Figure 4. Basic structures of hinterland transport structures of European seaports



1	Extended Rhine-Scheldt	5	Ligurian Range	9	Portuguese Range
2	Helgoland Bay	6	Seine Estuary	10	North Adriatic
3	UK SE Coast	7	Black Sea West	11	Gedansk Bay
4	Spanish Med	8	South Finland	12	Kattegat / The Sound

With the construction of new Alpine railway crossings in Switzerland with the two connections via the Lötschberg Base Tunnel / Simplon Tunnel and the Gotthard Base Tunnel as well as between Austria and Italy with the Brenner Base Tunnel (operations planned for 2026), new opportunities have emerged in recent years or will be available in the future. However, this transport mode still needs to take into account significant structural weaknesses as well as lower efficiency in planning and managing operations.

With the calling of some ports in the Mediterranean Sea, the shortening of the sea route compared to the North Range and the Baltic Sea ports can offer competitive advantages in the medium and long term (see, e.g. Zuchowski, 2014). This become more likely if the advantage of the more better hinterland connections, in particular those of the North Range, may no longer be available in the future as a result of the EU's efforts to extend and enlarge the road and rail infrastructure (see, e.g., BSL / UIC 2017: 24).

In the foreground relating rail transport are the RFC 1 (Rhine - Alpine), 3 (Scandinavian - Mediterranean), and 5 (Baltic - Adriatic), with which efficient north-south rail transport connections and also connections with the other corridors are available. However, this requires that the ports in question, in the Ligurian Sea of Genoa (RFC 1) and La Spezia (RFC 3), Gioia Tauro in the Tyrrhenian Sea (RFC 3) and in the northern Adriatic Sea of Koper and Trieste (RFC 5), have the necessary capacity and performance. The studies of Zuchowski (2014) regarding a developing competition between Koper (with a high share in the modal split in rail freight hinterland transport) and Odessa in the Black Sea with the Polish Baltic Sea ports (in particular Gedansk) and Hamburg as the easternmost North Range port, document very much clearly the present problem and the possibly associated economic disadvantages in the coming years. For example, the calculations of the catchment areas in SCT hinterland transport for Koper, Odessa, Gdansk and Hamburg show significant disadvantages for the Baltic port (as well as for Hamburg) (see Fig. 5) (see Zuchowski, 2014) which would increase if rail transport performance will be improved in the future. The Black Sea region, on the other hand, is of lesser importance, apart from the possibility of direct access to the main European inland waterway link, the Rhine-Danube axis, which allows a direct connection to the North Sea, with a total of ten countries on this path.

Figure 5. **Hinterland catchment areas in competition between Hamburg, Gdansk, Odessa and Koper taking into account the availability and costs of rail freight transport**

The impact of future use of the *Northern Sea Route* (NSR) on the competitive environment is currently difficult to predict, even if positive expectations exist (see, e.g., Zhao et al., 2016 ; Zhu et al., 2018). The fact is that the distance between the Northern-Chinese, Korean and Japanese ports is significantly shorter compared to the currently used route through the *Suez Canal* (SCR). Thus, Wan et al. (2018) stated for a loop Shanghai - Ningbo - Pusan - Felixstowe - Rotterdam - Hamburg - Pusan - Shanghai (NSR) 31.425 km, in comparison with 41.033 km for a loop on the SCR with Shanghai - Ningbo - Yantian - Felixstowe - Hamburg - Rotterdam - Hong Kong - Shanghai. This represents a 23.4% reduction of the sea-route on the NSR (costing $ 1.13 million compared to $ 1.5 million on the SCR). If the framework conditions develop accordingly and an adequate container volume for such a connection should be available in the source and destination areas, an economic basis for this route would exist. In this case, the disadvantage of the lack of demand along the Russian north coast can be compensated. In that regard, the competitive position of the Baltic Sea ports would be improved significantly in the long term compared to the Mediterranean ports mentioned above (see, e.g., Button et al., 2017).

On the other hand, with regard to the competitive situation, the trans-Eurasian railway connections, which are repeatedly brought up for discussion in connection with the *New Silk Road*, have no significance. Even in the case of a further expansion, the capacity that can be achieved to operate a larger number of container trains between Europe and China is much too small (see, e.g., Jakóbowski et al., 2018: 27 ; Vinokurov et al. 2018: 41) in order to gain a market share which is relevant to successfully compete. However, there are several market niches (see, e.g. Jakóbowski et al., 2018: 68) for some special connections between Central Europe and the Northwestern regions of China, as well as for time-related transport requirements, where air transport is too expensive and sea transport too slow.

Of considerable importance, however, is the problem of internal competition, on the one hand among the ports from the German Baltic Sea coast to the Baltic States and Russia, serving the southern hinterland, and on the other hand among the Scandinavian ports, which serve the Northern and North-eastern hinterland. An overview of the developments in container transport in the most important ports in this region for the period from 2004 to 2017 can be seen in table 2.

Table 2. Container throughput in the 20 main ports in the Baltic Sea area (2004, 2007, 2009, 2011, 2013, 2015, 2017) (1,000 TEU)

	Harbor (Country)	2004	2007	2009	2011	2013	2015	2016	2017
1	St. Petersburg (RU)	777	1,698	1,344	2.365	2,514	1,715	1,458	1,921
2	Gdansk (PL)	44	97	233	678	1,177	1,091	1,559	1,581
3	Gdynia (PL)	377	614	376	616	730	685	657	711
4	Hamina / Kotka (FI)	470	766	446	613	627	555	567	690
5	Gothenborg (SE)	713	841	824	914	868	805	795	644
6	Aarhus (DK)	341	504	385	431	406	444	455	511
7	Helsinki (FI)	500	431	361	392	406	430	427	491
8	Klaipeda (LT)	174	321	248	382	403	393	442	473
9	Riga (LV)	152	212	183	303	381	355	388	446
10	Helsingborg (SE)	99	189	112	175	188	193	204	280
11	Rauma (FI)	116	175	135	223	256	365	233	278
12	Kaliningrad (RU)	72	157	95	318	324	179	179	244
13	Gävle (SE)	47	67	112	119	125	135	160	236
14	Tallinn (EE)	113	181	131	198	254	209	202	215
15	Copenhagen / Malmö (DK/ SE)	144	192	156	171	159	164	165	167
16	Lübeck (DE)	69	140	172	117	102	144	157	139
17	Szczecin Swinoujscie (PL)	55	56	53	55	63	76	86	94
18	Fredericia (DK)	18	25	36	63	68	77	73	78
19	Ust-Luga (RU)	Operations start 2011			2	64	90	84	75
20	Aalborg (DK)	52	64	58	109	101	59	63	64
	Sum (20 main ports 2017)	4,333	6,730	5,460	8,244	9,215	8,088	8,348	9,338
	Share of total (%)	--	--	--	--	95.53	93.74	--	94.85
	Other ports	--	--	--	--	431	540	--	507
	Total	--	--	--	--	9,646	8.628	--	9,845

see: IHK Lübeck 2011, 2014, 2016, 2018; Matczak 2008, 2010; ISL Bremen
Remark: The number of container handling ports in 2012 in the Baltic Sea area was 54 (see: Baltic Container Yearbook 2013)

The development of container throughput from 2004 to 2007 shows a considerable increase, which was abruptly stopped by the global economic crisis of 2008 / 2009. Already in 2011, there was a significant increase, caused by the recovery in the global economy. On the other hand, looking at the period from 2013 to 2017, the ports show a differentiated development. In some cases, growth continues, but in various cases only to a lesser extent or even a recognizable decline can be seen. Above all, the development of the total volume in the ports of the Baltic Sea region is interesting. For the period from 2013 to 2017, overall growth is only 2.1%, well below the trends of most of the forecasts. Taking into account special effects from the economic sanctions against Russia, the picture is somewhat better. If the Russian ports are not included in the calculations, the increase is 12.8%, which results in an annual increase of 1.9%. However, this (approximately) correlates with the general positive economic development in the Baltic Sea area in the years under consideration. But these trends are obviously weakening in the meantime. If there is a slowdown in growth of container transport in the longer term, growth at certain ports will mainly result from reallocation at the expense of other locations which ultimately illustrates the problem of internal competition.

For some years container traffic is dominated by the ports of St. Petersburg (but with a downward trend) and Gdansk (with an upward trend) with together 35.57% (based on 2017). Including the following three largest ports, Gdynia, Hamina / Kotka, and Gothenborg, the total is 56.30% and taking the ten largest container ports, this results in a share of 78.65%. This means that the container throughput of the remaining more than 40 ports (with container traffic) in the Baltic Sea region has a total throughput of 2,097 thousand TEU, which represents a share of 21.35%. This results in an average utilization of only (maximal) 52,425 TEU in all the other ports. Starting from the largest 20 ports with a share of 94.85% for the more than 30 remaining ports (with 507,000 TEU) results in an average container handling of (maximal) 16,900 TEU. Because of this largely atomistic structure, this means that in many ports, as far as they cannot serve other market segments, the economic efficiency can hardly be guaranteed unless the technical infrastructure and equipment in the terminals is adapted to vessels of smaller size. In addition, there may be developments (see below) that negatively impact the global container transport volume, so that the economic problems in many cases can be significantly intensified.

Taking into account the currently known expansion plans in individual ports, the relation between capacity supply and actual demand for transshipment capacity will be negative, with relating effects on the economic situation in most of the ports. If misallocations occur due to false estimates of future developments, there is a risk that it may possibly lead to ruinous competition, with relating thereto negative consequences for the ports concerned as well as for the economies of their countries.

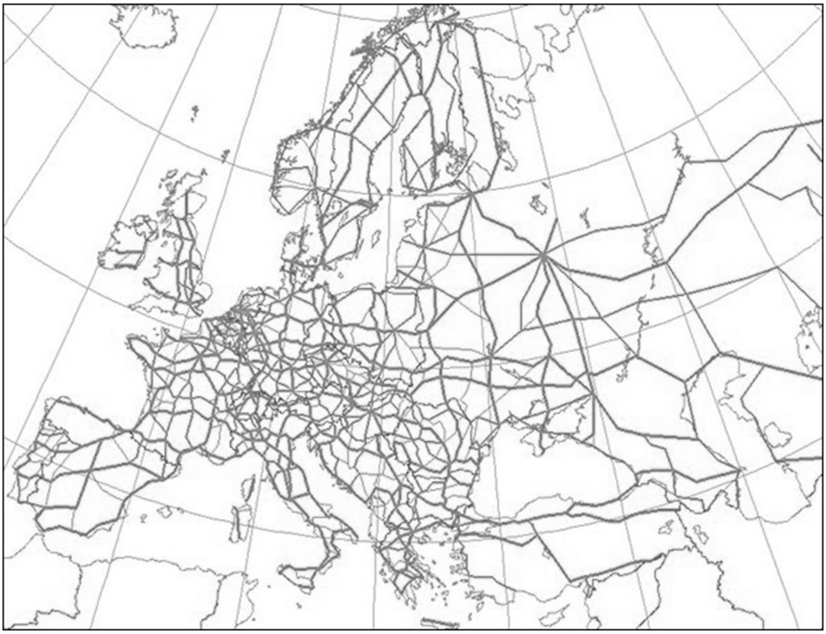
In addition to the *internal* competition, the above-mentioned external competition must also be seen, which may result in a shift of transport volume (and the related income) at the cost of the Baltic Sea region. Furthermore, there are structural changes due to technological developments, by means of which it is foreseeable that the necessary worldwide transport demand will decrease in the future, among others based on the impacts of *Additive Manufacturing* (AM) (see below). In order to avoid such negative developments for the region, it seems imperative to establish a transnational cooperation of harbor cities, even if this is not unproblematic, especially from the point of view of domestic policy of the states concerned.

Hinterland connections of seaport container terminals in the baltic sea area

SCT hinterland connections are the available network infrastructure of the three existing terrestrial transport modes (see, e.g. Pastori 2015: 39ff). However, due to geographic constraints, transport on inland waterways is not relevant in the considered region, apart from a few local exceptions, so only the available road and rail network is under discussion.

The available road network (essentially depending on the existing settlement structures) has a relatively dense structure (see Fig. 6). However, in some cases there are capacitive bottlenecks and the constructional condition does not always correspond to the actual requirements (s. u.a. Halim et al., 2016). Despite these deficiencies, road transport clearly dominates in hinterland transports in the Baltic Sea region (see also BSL / UIC 2917: 38).

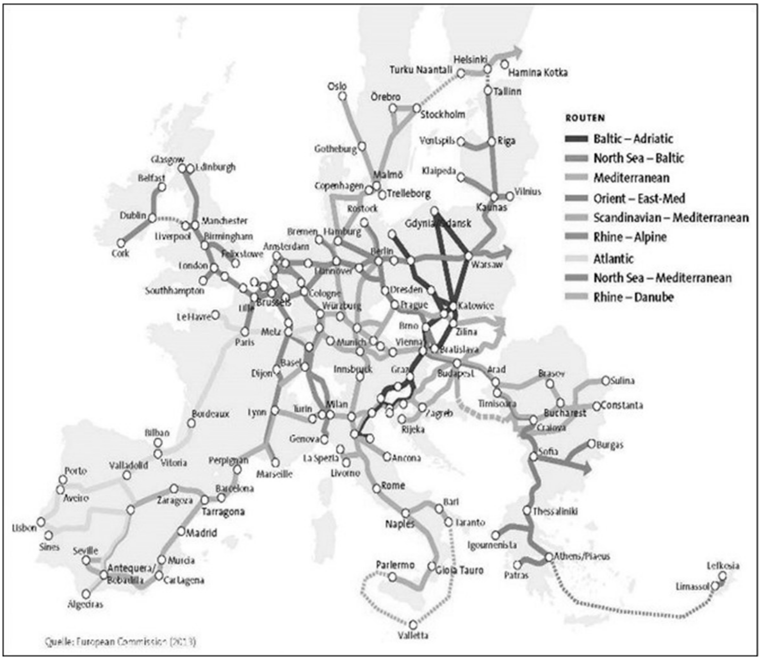
Figure 6. **European road transport core network**



In rail freight transport, not only is the network density a problematic aspect, even though the EU's cohesion policy gives the development of a Europe-wide core network a high priority (see BSL / UIC 2017: 24). In the foreground here is the shift of transport volume from road to rail, because this transport mode actually has the main potential in long-distance transport. An overview of the network structure currently planned for completion is given in Fig. 7. In addition to this mainly EU-focused network, different approaches exist for several years to improve rail transport connections from the Baltic Countries to Southeastern Europe and Russia (see, e.g., Daduna et al., 2012). These include, for example, the *Viking Line Project* (towards the Black Sea region) and the *Mercury Line Project* (towards Moscow).

Added to this is the problem of inefficient processes in the rail network capacity management, especially in the case of existing state-owned companies, as well as of successor companies in private-sector legal form, which have already emerged in the meantime. On the one hand there are technical incompatibilities due to historically grown national rail network structures (including signaling and control systems, power supply systems, and track gauge sizes) (see, e.g., Nijkamp / Vleuge, 1993; Marti-Henneberg, 2013). On the other hand, there are also considerable problems at the organizational level, in particular in cross-border traffic, based for example on deviating operational and labor law framework.

Figure 7. **Planned European rail network (TEN-T)**



In order to influence the modal split in freight transport in favor of rail traffic as far as possible, the legal framework conditions must therefore be adjusted (at least at EU level). In connection with this in the entire area of the EU, there must also be a consequent separation into network infrastructure in state responsibility in the context of public services of general interest and the operations to be organized according to economic criteria in the framework of private enterprises (s ee, e.g., Cantos et al., 2010; Beria et al., 2012; Zimmer et al., 2015; Wambach et al. 2017; Bassanini / Nastasi, 2018; Smith et al., 2018). Only in this way a functioning competition in rail freight transport can be ensured in the long term and thus the necessary efficiency enhancement can be achieved.

Cooperation approaches

A meaningful collaboration must be spatially based on two levels: an *external* (vertical) and an *internal* (horizontal) cooperation. Both can in principle be considered independently of each other, even if there are inevitably certain interdependencies. The first level deals with the competition of SSS links between the North and Baltic Seas and the terrestrial hinterland connections between the eastern North Range ports and the southern and eastern Baltic Sea hinterland. The second level concerns the transnational cooperation of harbor cities in the Baltic Sea region. If it succeeds in finding a meaningful and economically sustainable solution for the horizontal cooperation, this would have a positive impact on the prioritization of a SSS solution on the first level.

A cooperation with selected North Range ports, which have a hub function, is the main objective at the first level. This is based on the fact that on the container route from East Asia to Northern Europe, which is currently the most important, primarily vessel sizes are operated that are normally far away from the existing sea side accessibility and the handling facilities of the Baltic Sea ports. Moreover, an expansion of these ports for appropriate ship sizes is in most cases not possible at all and a necessary dimensioning of the technical equipment is usually difficult to justify from an economic point of view (see the data in Tab. 2). Apart from that, the question also arises for the shipping companies whether the integration of Baltic Sea ports into the worldwide oriented loops with larger container vessels can actually be economically viable.

It therefore makes sense to aim for vertical cooperation's with two or three of the large North Range ports and to serve as far as possible the Baltic Sea ports in the SSS mode via feeder connections. In this case, the feeder vessels can be matched to the respective capacitive conditions of the individual SCTs and potentially non-economic infrastructure measures can be avoided. Possible hubs here are primarily Hamburg with its immediate neighborhood to the Baltic Sea region, possibly Bremerhaven, and Rotterdam as the dominant European container port. In all three cases, access to the Baltic Sea with smaller vessel units can be made via the Kiel Canal, which significantly reduces travel time compared to the route through the Skagerrak. The longer sea transport in the SSS with its economic and ecological advantages is the basis for the advantageousness of this solution in comparison to a complete terrestrial hinterland transport, which connects the ports of the North Range and the Baltic Sea hinterland.

The fundamental problem lies on the second level, the internal (horizontal) cooperation of the local ports in the different destination areas of the Baltic Sea region. As already mentioned above, two areas are to be differentiated, the northern Baltic region with the Scandinavian ports and the southern Baltic region with the German Baltic Sea ports and going on to the Baltic States and Russia.

Due to the geographical structures, the hinterland connections of the Scandinavian ports have a comparatively small depth, so that the spatial allocation of hinterland territory to these ports is largely spatially restricted and thus there is less competition. In the southern region the situation is different. Here a very deep hinterland exists, on the one hand to the East European and also in the Southeastern European region and on the other hand into the European area of Russia. A possible structure with the relevant ports is shown in Fig. 8, which assumes a comparatively small number of regional SCTs. With a view to efficient structuring of hinterland transpot, the existing rail network and also the planned development and extension measures (see Fig. 7) must be included as key influencing factors in these location decisions.

Figure 8. **Basic structure of a hub and feeder network structure**

Although this will be a very problematic decision, it is mandatory. It leads to a prioritization of certain port locations and thus to their positive economic development, while at the same time the other ports must go into the background, possibly associated with economic disadvantages. However, this does not necessarily mean that these smaller SCTs have to be closed, as local markets they will continue to be serviced, based on appropriate vessel sizes and cargo handling volumes. Due to the permanent increase of container vessel sizes (see Monios 2017), which will make more and more smaller appropriate vessels available on the market, the necessary conditions are met.

Since the upcoming tasks are the development of cooperation's aimed at the development of transnational network structures, national (and therefore also often uncooperative) interests of the participants play a significant role (see also Daduna / Hanisch 2015). In the end these can lead to the problem that objectively reasonable solutions will be counteracted by diverging political interests. As a result, this sometimes leads to considerable competitive disadvantages, in particular in competition with the above-mentioned Mediterranean ports, if they can adapt their capacities and operational performance to the changed requirements. In addition, a strategy of hindrance and prevention, at least in the medium and long term, can lead to a lack of economic efficiency in many SCTs in the Baltic Sea region.

In addition to container transport, the cooperation concepts also can include the Ro/Ro transport in the Baltic Sea region, which has a not inconsiderable volume (see, e.g., IHK Lübeck, 2018: 10). This affects not only north-south but also east-west traffic within the Baltic Sea. However, this is not primarily about container transport and it is not the hinterland connection over the rail network in the foreground, but the connection to the much denser (regional) road network, e.g. operating semitrailer. Since the capital expenditure for Ro/Ro terminals is significantly lower in comparison to that for SCTs, they can be operated economically even with a lower volume of transshipment. In addition, this market segment has mainly an overall regional significance, so that there is essentially an internal competition in the Baltic Sea region with a strong polypolistic market structure.

Influences on developments in international container traffic

When forecasting developments in international container traffic, the existing data series are normally updated (see, e.g., Halim et al., 2017). This approach has time and time again led to misjudgments in recent years (see, e.g., the forecasts at Heymann, 2006), which also resulted in incorrect decisions regarding the further development of the port infrastructure. The main problem arises from the fact that the influence of disruptive effects are not taken into account, which are initially unpredictable or only partially predictable and often difficult to calculate in detail even after their occurrence. At present, there are developments in three areas, which may have significant effects on international container transport, or are already beginning to emerge (see, e.g., Daduna / Stahlbock, 2019).

First of all, it has to be considered that there are some changes in global economic structures. An essential aspect is the growing trend of *unilateralism*, as has been evident in recent years, especially in the United States of America. With a strong focus on national economic interests and associated protectionism, there is a hindrance or restriction in global economic relations. This has a negative impact on international trade, ultimately leading to a decline in global flows of goods.

In addition, there are prosperity developments, for example in important Chinese industrial centers, which are increasingly leading to rising labor costs there, so that the originally existing labor cost advantages in international competition no longer exist there. This results in a shift of value added shares to other regions (Africa, South America) with currently low labor costs or to re-shoring (see below). At the same time, in China there is a stronger orientation towards the domestic market, so that the volume of container transport on the currently dominant container route from East Asia to Northern Europe will probably decrease recognizably.

Due to the increasing occurrence of re-shoring measures (or inshoring or re-inshoring) in the area of industrial production (see. e.g., Ashby, 2016; Moradlou / Backhouse, 2016; Wiesmann et al., 2017), further (worldwide) changes are taking place. This shows a reduction of external value added components in the operational processes, which includes a partial, comprehensive shift of production shares with a corresponding reduction in the transport volume. The essential basis for this is the further development of industrial production and, to a considerable extent, the increasing replacement of previously manual work by automated processes, which among others based on humanoid, semi-humanoid and mobile robots (see, e.g., Pinedo et al., 2015 ; Wong et al., 218, Stasse / Flayols, 2019). With this outlined development, as, for example, formulated by Hammes (2016), there is an increasing de-globalization with far-reaching effects, not only in terms of economic structures and the need for mobility, but also in politics and society.

A further area is the increased application of AM, which will open up new design opportunities in industry and commerce that will change global logistics structures sustainably. The technical and economic benefits of the AM are so obvious that it is expected that the roll-out will become more widespread and multifaceted over the next few years (see, e.g., Mohr / Khan, 2015; Baumers et al., 2016; Chen et al. 2017). Essential point is the possibility of a decentralization of the manufacturing structures in connection with a customer-oriented and demand-dependent production (see, e.g. Mohr / Khan, 2015; Weller et al., 2015; Sassons / Johnson, 2016; Chen et al., 2017; Jiang et al., 2017).

In conjunction with a decline in many areas of traditional industrial manufacturing, structural changes in the supply chains inevitably occur. In this context Christopher and Ryals (2014) talk about a transition to demand chains. For example, many production steps no longer have to be carried out at external suppliers on centralized large-scale plants at locations that are sometimes far off, to be able to keep costs low. These can, for example, be integrated directly into the final assembly. Such modified manufacturing structures lead to a significant reduction of the logistics effort (and thus the costs), on the one hand by a drastic decrease of the required transport services, while on the other hand the demand-oriented production leads to a substantial elimination of storage (see, e.g., Ben-Ner / Siemsen, 2017).

Even more clearly, the AM will affect the spare part market (see, e.g., Khajavi et al. 2014; Savastano et al., 2016; Wits et al., 2016; Li et al., 2017). Here, instead of a centralized, a spatially dislocated and demand-depended manufacturing can take place, because in many cases the demand of the volume as well as the spatial and temporal distribution is only partially calculable. In the final consequence, the production of spare parts can be directly relocated to the field of maintenance and repair, that means, these are manufactured (possibly only on site) and in the case of an existing demand.

Probably even more extreme may be the impact of AM in various sectors of the consumer goods industry (see, e.g. Bogers et al., 2016 / Ben-Ner / Siemsen, 2017; Petersen et al., 2017). Here, in the medium and long term, the production of goods can be relocated to the level of retail trade to a considerable extent, for example in regional warehouses or directly in their own sales facilities. At a final stage, however, the production can also be made on demand by the customer himself *(home fabrication)* (see, e.g. Bogers et al., 2016; Rayna / Striukova 2016; Attaran, 2017; Petersen et al., 2017). This can finally lead, at least in some areas, to a *de-industrialization*, (see, e.g. Ben-Ner / Siemsen, 2017; Petersen et al., / Attaran, 2017), in connection with a return to partial self-supply from pre-industrial times. Attaran (2017) speaks in this context of micro-producers, which underlines the future possibilities of using small-scale manufacturing structures, with the corresponding negative impact on the volume of logistics demand.

Overall, in industry and retail trade with the use of AM new design options, which at least in part, the economies can be far-reaching changed and, associated therewith, the global flow of goods. Key points are the reduction of market entry barriers for new innovative companies, since the required capital expenditure is comparatively low, as well as a higher volatility of the location structures results. In addition, there is a largely demand-driven *scalability* of such companies, by means of which potential investment risks can be clearly limited.

Summary and outlook

The use of the SSS in the Baltic Sea is not only essential from a transport point of view due to the relief of the infrastructure of terrestrial transport modes, but also from an ecological point of view. Apart from the positive effects of maritime transport which mainly results from volume effects, SECA regulation also plays a key role in this regard. However, the reduction of emissions is associated with an increase in bunker costs, which, however, are basically not for discussion due to the prevailing legal conditions. However, in terms of cost-effectiveness, this cost factor can have a negative impact on competitiveness with the ports in question of the Mediterranean region.

When deciding on the design of the transport processes, a multi-criteria objective structure must be assumed (see, e.g., Halim et al., 2016; Meers et al., 2017), with the essential components of *costs, transportation time, punctuality* and *safety* as well as *emission reduction*. The crucial question here is which technically feasible and appropriate combination of the available transport modes represents a suitable and also possibly cost-effective multimodal solution for a defined corridor in order to be able to cope with the necessary transport requirements under the given objectives. However, there can be no standard solutions here, as decision-making can only be made on a case related basis for a specific transport order. Due to the complexity of this problem as well as the limited availability of appropriate evaluation bases and concrete market data, no suitable software tools are available so far (see, for example, Daduna et al., 2012).

For the international container transport, which ends or starts in the hinterland of the Baltic Sea, not only the East Asia route must be considered but also the routes from and to North and South America, Africa and Southwest Europe, as they are all aggregated passing the English Channel from West to East and disaggregated when going from East to West. In the Mediterranean Sea two directions must be differentiated, to the east (East Asia and East Africa) through the Suez Canal and to the west (North and South America, West Africa and Western Europe) through the Street of Gibraltar. For the transport on the so-called «last miles», that is, on the legs that are not carried by maritime transport, there are three competing basic models:

- Model 1: Maritime transport to the eastern harbors of the North-range with an onward transport to the respective hinterland destinations with terrestrial transport modes (mainly in road and rail freight transport) (and vice versa).
- Model 2: Maritime transport to the eastern harbors of the North-range with an onward transport to the Baltic Sea by SSS, with a distribution into the hinterland using terrestrial transport modes, starting from appropriate SCTs (and vice versa).
- Model 3: Maritime transport to the harbors to the northern Adriatic as well as the Ligurian and Tyrrhenian Seas, with a distribution into the hinterland using terrestrial transport modes, in this case mainly using rail freight transport (and vice versa).

From the point of view of the responsible management of the Baltic Sea harbors and the political decision-makers of the respective countries, only model 2 can be of interest. If the solutions from the other two models come to the foreground, this would lead to an extreme loss of importance for the Baltic Sea region and would also result in considerable economic disadvantages.

However, for this model to succeed, it is essential to develop a *horizontal cooperation* for the Baltic Sea container ports in order to increase their competitiveness as a whole over the other two models. The focus here must be on qualifying the terminal infrastructure of those container ports that have or will have a capable linking to the main European rail network, in particular to the defined RFCs (see Fig. 7). In view of the importance of using longer transport distances in seaport hinterland traffic, it is actually mandatory to give rail freight transport in the slot allocation process situationally a higher priority than passenger transport to improve its competitive position. In addition, however, sufficiently efficient road transport connections must be available, primarily for servicing the surrounding region and those areas not covered by the rail network (see, e.g., Meers et al., 2017).

In view of the changeover of *liquid natural gas* (LNG) ship propulsion systems discussed as part of the introduction of SECA regulations, a fast equipment of the cooperating ports with an appropriate ship refueling facility would also be an essential aspect, which is also important to enforce an ecological development. The prerequisite for implementation of such service, however, is that a demand-oriented and reliable LNG supply can be guaranteed.

Even if details can certainly be discussed, it is crucial which tendencies are recognizable or at least appear possible. Thus, as described above, there are increasing changes in worldwide economic structures and also in technological developments, so that it is necessary to accept these challenges. Waiting for the developments first of all usually makes little sense. In most cases, waiting and hoping for positive influences in the future and associated inaction does not provide a viable alternative, but in most cases ultimately leads to the most costly solution. The present remarks, however, can only give a framework for intensive discussions, they do not replace the responsibility of the decision-makers in charge to design future developments reasonably. Perhaps a look back in history can be helpful here.

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Chapitre 3

Unitized short sea shipping between Finland and Sweden: reasons of sluggish growth

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Biography

PhD Olli-Pekka Hilmola *is working as a Professor in LUT University, in Kouvola, Finland. He is affiliated with numerous int. journals through editorial boards, including Industrial Management and Data Systems, Decision Support Systems, and Expert Systems with Applications. Dr. Hilmola has published more than 160 refereed journal manuscripts. He has been part of numerous international research projects. In recent year he has served as Visiting Prof. in Beijing Jiaotong University (Beijing, China), and Tallinn Univ. of Technology / Estonian Maritime Academy (Tall).*

Abstract

For centuries, economies of Finland and Sweden have had significant trade and economic ties with each other, and maritime transport has been the key driver to serve and foster this relationship. Two countries do share common border in up north with each other, but as economic activity is in south in both of the countries, hinterland transports have played smaller role. However, in previous two decades time period sea port handling of unitized cargo between these countries have barely grown. This research work analyses reasons for this sluggish growth in long-term. In economic terms, both countries developed well before 2008-2009 Global Financial Crisis (GFC). Thereafter, Finnish economy entered approximately decade long "nearly no growth" development in GDP, and foreign trade was having significant challenges. Swedish economy was able to recover much better, however, overall trade between countries did not grow clearly above pre-crisis levels. Another reason for low growth in unitized cargo could be argued to belong in changed environmental regulation, that of sulphur cap (implemented in 2010 and 2015). It could be identified that number of longer distance flows between countries just disappeared, and traditionally strong routes significantly weakened. It could be assumed that some of the flows were redirected to Estonian and/or German routes as factories and supply chain locations changed, and Eastern Europe continued to provide cost advantage in manufacturing and logistics.

Keywords: Unitized cargo, Finland, Sweden, economic development, sulphur regulation

Introduction

In Northern Europe, trade has long tradition, and since Hanseatic times, it has been active between all Baltic Sea countries. It truly has been so that with closer proximity countries particular country has been trading more intensively. At modern times within European Union, border formalities and constraints in trade are minimal, and companies in Europe have integrated their supply chains in significant manner (like illustrated in case study of Cardoso et al., 2015). It is not anymore about countries trading with each other, but also seamless and low inventory corporate supply chains play important role (Holweg & Helo, 2014). For example, between Finland and Sweden there have been numerous mergers and acquisitions to form in world scale important corporations (like Stora-Enso, ABB, Nordea, Telia, HKScan, SSAB, Cargotec, Ahlstrom-Munksjö etc.). In long-term statistics, direct investments between these two countries reach 66 bill. EUR (Ali-

Yrkkö et al., 2017). So, cargo flows ought to be intensive and substantial between these two countries. This was the situation until Global Financial Crisis (GFC), however, thereafter unitized cargo volumes have levelled off and even declined. This latter has been the case especially in unitized cargo volume in maritime traffic between these two countries.

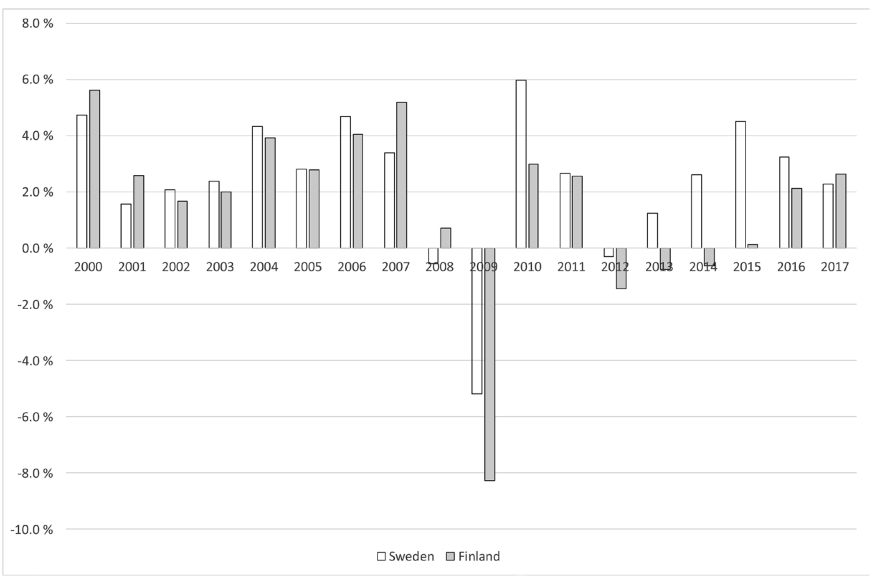
Rearrangement of unitized cargo flows is not only due to GFC and seeking the lowest cost supply chain for manufacturing operations. Also other decisions have affected the situation. For example, in years 2010 and 2015 sulphur regulation was implemented at Baltic Sea in demanding fashion, where after January of 2015 maritime diesel was allowed to contain only 0.1 % of sulphur (IMO, 2018; Hilmola, 2015). This of course resulted on higher maritime transport costs, especially in longer routes. Also other environmental restrictions have been on the agenda such as banning nitrogen emissions (from 2021 onwards in new ships; Ministry of Transport and Communications, 2016), and limiting CO2 emissions of transports (particularly in economically advanced economies in Europe; European Commission, 2018). These have and will affect supply chains in Europe, and particularly those operating between Finland and Sweden. As one option, companies have favoured more hinterland transports and very short-distance sea routes (Hilmola, 2019). Another popular alternative (Prontera, 2017; Hilmola, 2019) has been to invest on Liquefied Natural Gas (LNG) ships as low emission maritime transports option (controversy exist still on its environmental favourability; Anderson et al., 2015; Baresic et al., 2018). Third one has been to use low sulphur maritime diesel and/or to invest in scrubbers to be used in ships (Lindstad et al., 2017). Of course, there is some level of demand for cargo transports between nearby countries, however, corporations and logistics service providers make sudden decisions concerning supply chains as overall costs are important part of competitiveness. One of such decision has been to use less e.g. Swedish route to reach Central Europe from Finland (also other direction). As an alternative, there has been direct maritime route to Germany or using mostly hinterland option through Baltic States and Poland. Many new factories in Europe nowadays exist in eastern parts, which favours the use of latter further. Also emerging markets such as Turkey, Northern Africa and Middle-East could be reached using direct hinterland route rather than going through Western Europe to eventually get to the east.

In this research work interest is on the changes of unitized maritime cargo transports between Finland and Sweden. Under interest is the period of roughly last two decades. Changes are first analyzed in Section 2 through macro-economic indicators. In Section 3 follows detailed sea port unitized cargo flow analysis. Section 4 concludes this research work, and provides further research avenues.

Macro-economic background of Finland and Sweden

Based on World Bank (2018) annual statistics (Figure 1), GDP development in Sweden and Finland was rather similar and favourable from 2000 until 2007. During these years' both of the high GDP countries were able to show growth of more than 3 % on the average (Finland doing somewhat better than Sweden). Global financial crisis of course was reducing demand and was creating downwards pressure everywhere. This was the case in these two countries too – in 2008 annual growth rates were around 0 %, but in 2009 GDPs of both two countries substantially declined. Due to inflexible currency (euro), Finnish decline was much deeper and recovery much lower in 2010 as what was the case in Sweden (using still own national currency of krona). In period of 2010-2017 Swedish economy on the average was able to grow nearly three percent. However, growth in Finland was rather low or nearly non-existing. During these years on the average Finnish annual growth was well below one percent. Reasons for such low growth are numerous. One of them was the loss of big exporter volume (Nokia and its supply network), low competitiveness in cost basis (high salaries with strong euro), and lowering consumption of forest industry products (particularly paper). In addition, population ageing and retirements lowered the consumption, but that is the case in both of these advanced European economies.

Figure 1. Annual change (%) of GDP within Sweden and Finland during the period of 2000-2017 (GDP values in USD)

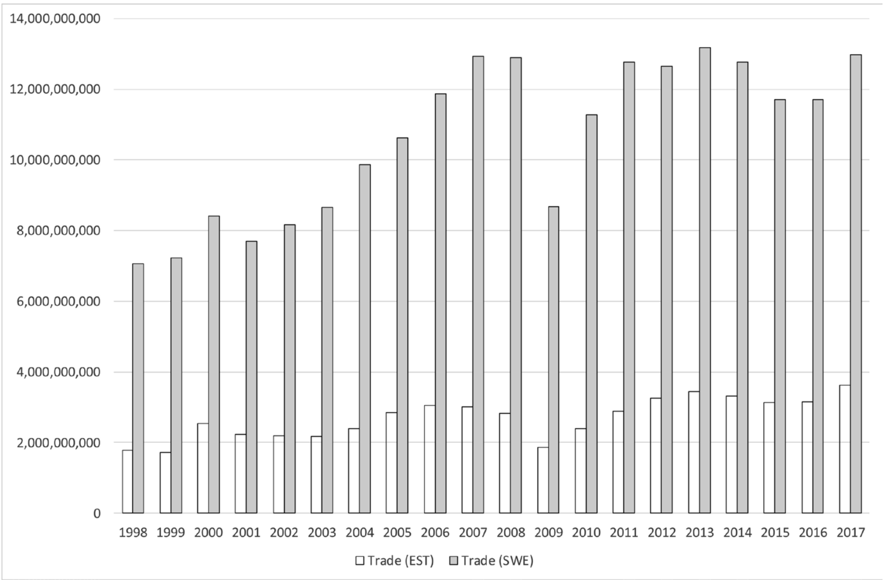


Source (data): World Bank (2018)

As mentioned earlier, export and foreign trade performance in general has been troublesome for Finnish economy since Global Financial Crisis (GFC). Trade in currency amounts was still in year 2017 lower than in the top year of 2008. Situation is similar with most important trading partners, like Sweden (being second or third most important partner in overall trade for more than decade, and holding similar importance earlier). In long-term perspective (Figure 2) Swedish trade is still growing with Finland (from 1998 to 2017 growth has been 83.7 %). However, after year 2008 this growth has been miniscule (0.7 % growth in 2008-2017). So, development has been on sideways in this period. However, situation is not necessarily the same with all neighbours of Finland. For example, trade grows still with Estonia – it shows somewhat better growth in 1998-2017 (102.3 %), and more importantly it has grown since 2008 too (28.5 %). Before GFC Finnish foreign trade was constantly showing impressive surpluses, however, since 2011 it has been on constant deficit. This is clearly present in trade account of Sweden too – in 2012 it was showing small deficit, which has thereafter only widened. With Estonia, which is less advanced economy as compared to Sweden, trade account has hovered around zero.

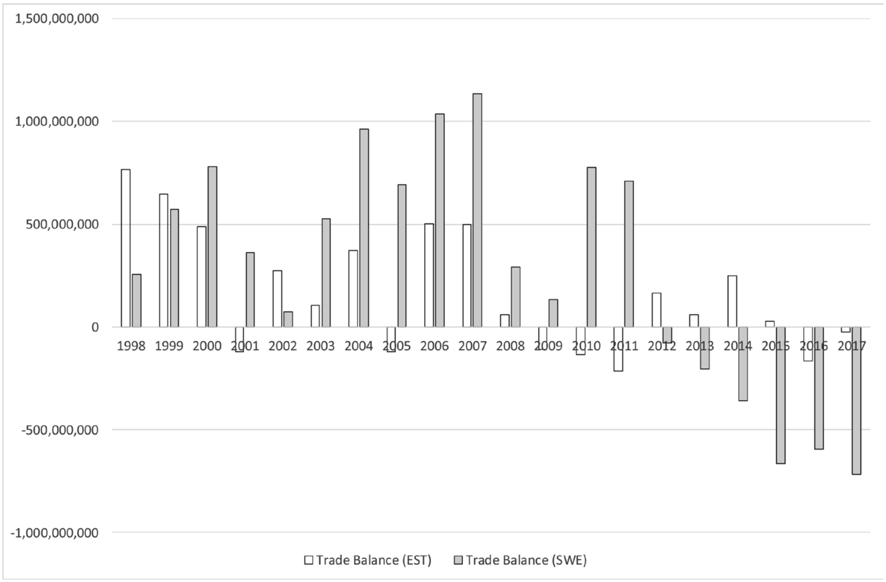
Even if trade performance and GDP could indicade that freight flows of unitized cargo could have sustained between Finland and Sweden well in recent decades, it is not so. This could be explained with time value of money (inflation). Trade statistics are based on nominal values, and having e.g. 0.7 % growth in 2008-2017 means that trade in volume (tons) terms have probably declined in unitized cargo (which is more valuable freight class, not being bulk). If inflation was in 2008-2017 somewhat around 2 % in these countries, then it means that every year volumes of unitized cargo must have decreased by more than one percent. In the case of three percent inflation, it means decline of more than two percents. If countries are also in the track of losing competitiveness and export performance, like Finland did in last decade, unitized cargo could be hurt even more.

Figure 2. **Overall trade of Finland with two neighbours (in EUR) Estonia (EST) and Sweden (SWE) during the period of 1998-2017**



Source (data): Finnish Customs (2018)

Figure 3. **Finnish balance of trade with two neighbours Estonia (EST) and Sweden (SWE) during the period of 1998-2017**



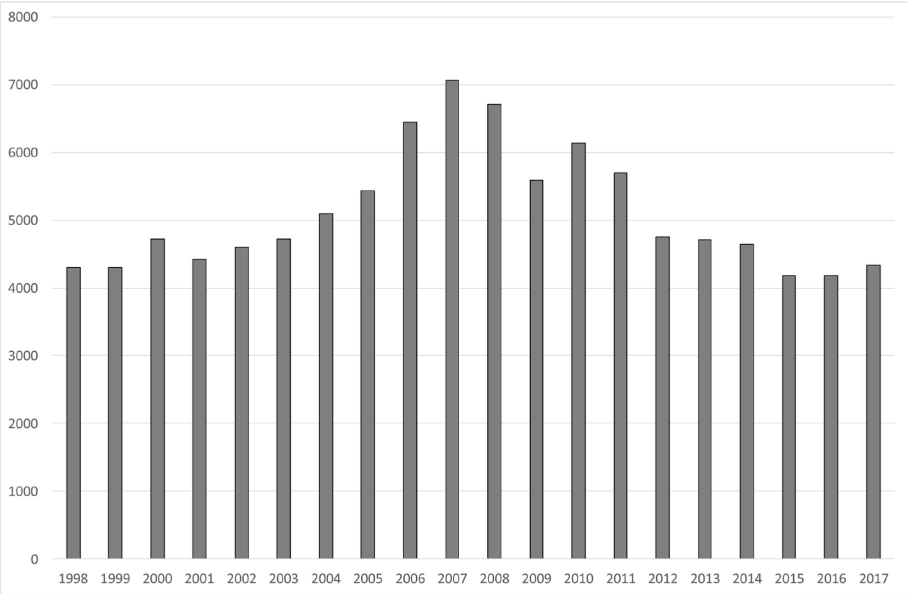
Source (data): Finnish Customs (2018)

Unitized maritime flows between Finland and Sweden

Figure 4 illustrates unitized maritime cargo volume development between Finland and Sweden. Although, trade volume has sustained in euros (Figure 2), but in unitized tons it has only grown until the beginning of GFC. In years 1998-2007 unitized cargo volume growth was 64 %. However, in period of 2007-2017 this volume reversed back, and completed cycle. Nearly 39 % of volume was lost in the period ending to year 2017, even if volumes somewhat started to recover from the bottom of 2015 in the last two observation years.

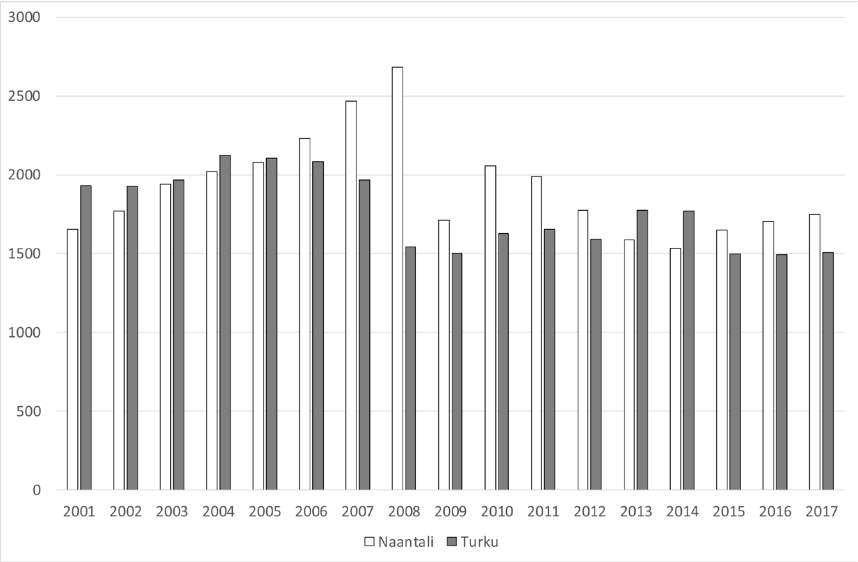
During the beginning of the observation period in Figures 5-7 (year 2001) share of two largest sea ports (Naantali and Turku) in unitized Swedish freight flows was around 80 %. At the end of the period (2015-2017) this share of two leading sea ports was in rather same neighbourhood, 75 %. These two sea ports have of course experienced diffulties in 2001-2017, however, they are not as high as what overall market has done. Port of Turku is down in unitized cargo handling by 22 % in 2017 as compared to base year. From best performing year 2004, Turku volumes are down in 2017 by 29.1 %. Naantali in turn can show in long observation period of 2001-2017 minor growth of 5.7 %. However, from best performing year 2008, Naantali's volumes are significantly lower by 34.8 %. Connections are provided to Sweden by the same companies as decade earlier (only Silja Line was sold to Tallink in 2006) – from Turku Tallink-Silja has connection to Stockholm through Åland (currently operated with two ropax ships), and Viking Line operating in the same route with two ropax ships too. From Naantali to Kapellskär there is currently only two roro ships, which are operated by Finnlines. Earlier this route was having presense from roro ship of Tallink-Silja (ship called Sea Wind), but this vessel was taken away from this route at the end of 2014, and started to operate daily between Helsinki (Vuosaari) and Tallinn (Muuga).

Figure 4. **Unitized maritime freight volume ('000 tons) between Finland and Sweden during the years 1998-2017**



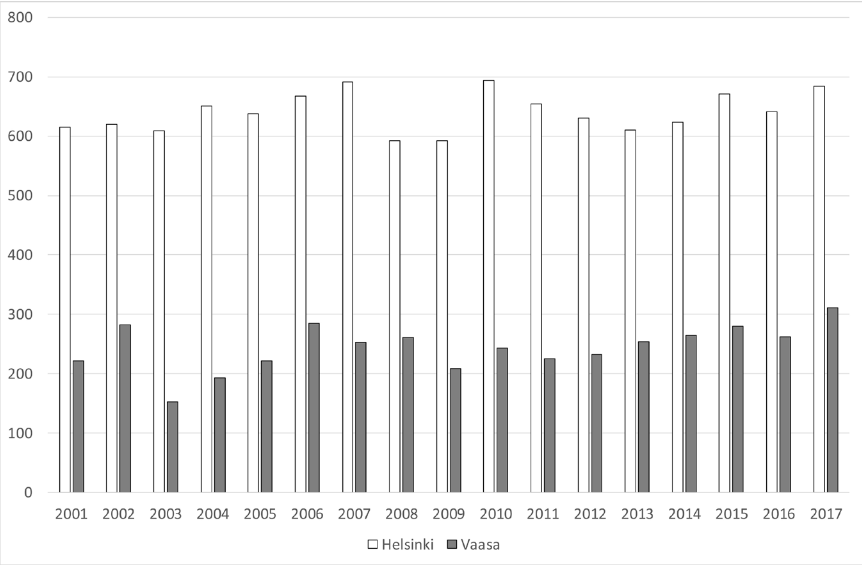
Source (data): Eurostat (2018), Finnish Transport Agency (2018)

Figure 5. **Unitized maritime freight volume ('000 tons) of two major Finnish sea ports with Sweden during the period of 2001-2017**



Source (data): Eurostat (2018), Finnish Transport Agency (2018)

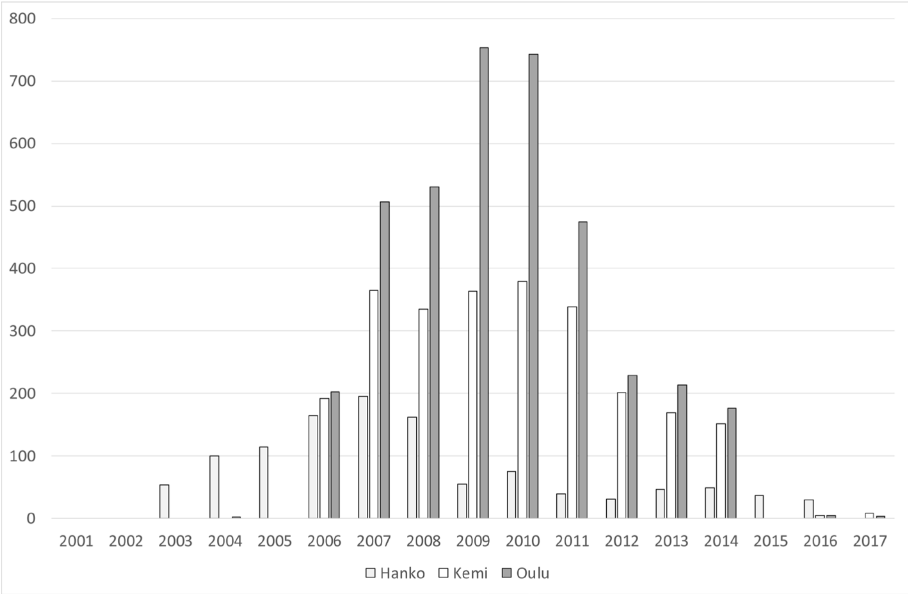
Figure 6. Unitized maritime freight volume ('000 tons) of two mid to small sized Finnish sea ports with Sweden during the period of 2001-2017



Source (data): Eurostat (2018), Finnish Transport Agency (2018)

It is interesting that medium volume, and in some ways, niche routes of Helsinki-Stockholm and Vaasa-Umeå have not experienced that great declines in their freight volumes (Figure 6). Actually, port of Helsinki has been able to sustain in volumes as in 2017 unitized freight volume was only 1.5 % below best year of 2010 (similar performance also in 2007). From base year of 2001 Helsinki's Swedish volumes are up 11.2 %. This sustaining performance could be explained with the end points of this route – both are capitals and there is always freight flows through capital cities. However, port of Vaasa has done more than just sustaining. Actually its performance is clearly growing. From year 2001 to the end of the observation period it has grown by 40.3 %. However, starting level is so low that this higher level of performance has been seen also during years 2002 and 2006. Current level is only 9-10 % higher of these earlier higher volume years. Reason for this route to exist and also grow is the very short sea distance between Vaasa and Umeå as well as the lack of local level competition within near proximity (actually it is the only alternative in hundreds of km).

Figure 7. **Unitized maritime freight volume ('000 tons) of three mid to smaller sized Finnish sea ports with Sweden during the period of 2001-2017**



Source (data): Eurostat (2018), Finnish Transport Agency (2018)

Most significant loss in unitized maritime freight flows between Finland and Sweden was experienced in the very northern sea ports, and their connectivity with Göteborg. Kemi and Oulu (Figure 7) were both growing significantly until 2010, and thereafter volumes started suddenly to decline. Both sea ports lost sea vessel operator serving Göteborg (unitized cargo) at the end of 2014. So, at the end of the period in Figure 7 both of these sea ports had very low unitized cargo volumes to Sweden. Sea route to Göteborg is long from Northern Finland, and sulphur regulation implemented in 2010 and 2015 must have affected these withdrawal decisions. As alternative, shipping company offered in both sea port cases connectivity to the ports of Germany at Baltic Sea (Lübeck; having couple of hundred km shorter distance).

Hanko in turn is southest sea port of Finland, and it is located between Helsinki and Turku. Hanko has lost also considerable amount of Swedish unitized cargo volume since 2007, and currently it is as insignificant as Kemi and Oulu (Figure 7). Hanko has developed more on serving German and Estonian routes, where it holds considerable competitive advantage due to shorter sea distance and less congested routes at hinterlands.

Conclusions

It could be stated that in the time period of this study, unitized cargo flows between Finland and Sweden experienced difficulties. Reasons for declining volumes after 2007 are numerous, but GFC is one major factor as is also the weak recovery of trade between countries. Trade figures are always troublesome to analyze as they are nominal value – they have tendency to increase. Even if trade slightly grew between years 2008-2017, in reality this growth was not experienced in unitized maritime cargo transport. Of course, many other issues affected the flows during the years. One of them is the implemented sulphur regulation programme, which led to situation where in 2015 sulphur content in used diesel oils was 0.1 % (it could be earlier high content, but in that case scrubbers are needed to be used). This legislation eventually hurt cost competitiveness of maritime transports, and it is not that surprising to find out that volumes in longer short-sea shipping routes declined to close to zero. Similarly as experiencing sluggish growth, some shorter distance sea ports lost volumes considerably. It could be concluded that well established and traditional sea ports with their decades long routes were able to somehow sustain volumes. However, after year 2015 growth (as compared to 2013-2014) could only be detected in the very short-sea shipping routes those of offered by Naantali and Vaasa. Sulphur regulation implementation favours shorter distance as cost competitiveness is then higher.

In Europe after GFC, it has been rather consistent development that companies are trying to save from every possible cost item and functions to gain lost competitiveness back. This is especially the case of Finnish and Swedish larger corporations. Eastern Europe and east in general has been favoured destination for supply chain operations, and for this reason Sweden must have lost considerable amount of transit traffic through its territory to reach Central Europe. For example, Finnish-Estonian unitized maritime cargo traffic has grown for two decades nearly 10 % p.a. This resulted to situation in 2015 and 2016 that Estonian flows became larger than Swedish ones. Structural change and competitive forces play very important role. Future does not look that good for economically advanced European economies in logistics and supply chains, as environmental regulation is very tight in the following decades.

As a further research, it would be tempting to analyze all possible unitized maritime cargo flows to and from Finland during the same time period. It is known a priori that German direction has also experienced difficulties, while Estonian direction has grown impressively. Knowing details would reveal further, how flows have really changed.

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Chapitre 4

Influence of the geopolitical situation on baltic sea region development

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Biography

Vadim Volovoj *got a PhD in political science in the Institute of International Relations and Political Science at Vilnius University. Former Senior expert at the Center for Geopolitical Studies (Lithuania) and Docent at Mykolas Romeris University (Lithuania). Author of many academic and journalistic articles in the sphere of international relations. Now independent political analyst and permanent author at the road transport website Cargonews.lt.*

Keywords: Baltic region, Lithuania, Latvia, Estonia, Poland, Russia, Belarus, NATO, the United States, the EU, military conflict, energy security, Gazprom, electricity, Nuclear power plant, LNG terminal in Klaipeda, transport, transit, OBOR.

Introduction

Today situation in the Baltic region is stressful (for example, air incidents over the Baltic Sea and large scale military exercises of Russia “Zapad”). The main question for business, which prefers long-term stability: “Will there be a war between NATO and Russia?”

If the answer is positive, economic potential of the Baltic region is in danger, because nobody wants to invest in such countries as Syria or Ukraine, which suffer from unfinished war. If the answer is negative, business perspective in Baltics looks rather bright – also because Baltic region has a great transit potential, which could bring a big profit to its states and their neighbors.

However, this opportunity requires constructive relations of Lithuania, Latvia, Estonia and Poland with Belarus, Russia and China, which initiated the “One Belt, One Road” (OBOR) project, to be realized. Unfortunately, relations of Baltic countries with Minsk and Moscow are confrontational (especially with Moscow). The question is: “Whether space for mutual understanding can be broadened?”

Finally, meaningful policy in the field of energy security is necessary for economic success of the Baltic states. Today they try to strengthen their independence from Russian gas and electricity, but the question is about price of decisions, related to this sphere. These decisions usually are more politically than economically based, what seriously threatens a competitiveness of Baltic business. Therefore, it is worth thinking about the possibility to find some balance between reducing Russian threat and using cheap Russian energy resources.

Further detailed analysis of the formulated issues reveals the essence of the influence of geopolitical factors on the development of Baltic Sea region.

Highly likely - No war

Facts are not in favor of those, who think that war in the Baltic region is not going to happen. Today we have actually permanent NATO military bases in Lithuania, Latvia and Estonia; Poland actively develops military cooperation with the United States, and the Alliance goes on developing military infrastructure in these states, being afraid of possible Russian aggression. After the annexation of Crimea and Russian actions in Donbas political elites in Vilnius, Riga, Tallinn and Warsaw say that it may happen tomorrow or the day after tomorrow.

At the same time Russia militarizes Kaliningrad oblast, and the appearance of missile systems “Iskander” and air defense systems S-400 there (not to speak about the modernization of Baltic Fleet) shows that Moscow deploys in the Baltic region the most advanced weaponry, expecting possible attack of NATO.

All these steps of both sides are the reflection of very bad relations between Russia and the West, when they do not hear (or even do not want to hear) each other and do not trust each other. Sometimes it seems that despite open flow of information opponents live in parallel realities, and the same facts are interpreted in a different way. In such situation of total mutual misunderstanding in principle any spark may ignite the fire of the World War III, and Baltic region is one of the places, where it may happen.

Of course, it can be said that there was something similar during the Cold War, and its main participants were clever and responsible enough to avoid nuclear apocalypse. But there are experts, who think that today the level of confrontation is higher, and we live in a more dangerous and unpredictable world.

Nevertheless, there is a broad background for optimism. First, despite sharp rhetoric and sometimes too provocative actions politicians and generals in Moscow and Washington are still clever and responsible enough so save each other and the planet from global catastrophe. For example, in Syria American and Russian armies face each other in the context of demonstrative political disagreement between the Kremlin and the White House on the future of this country. Still, Moscow and Washington are able to keep the situation under control, and it is worth noting that with Americans Russians have not had such military incidents like with Turkey and Israel.

Back to the Baltic region, it is much more stable than the Middle East, and the acceptability of war in Baltics is much more lower for all sides involved than in Syria. Those demonstrations of power and military "games", played by Russia, America, Baltic states and other EU countries near the Baltic Sea, are more about competition for political and economic influence in Europe between Moscow and Washington.

In other words, after the end of the Cold War it became more difficult for the United States to stay in Europe in terms of their geopolitical interest and justify the existence of NATO, because common enemy (the USSR) just collapsed. Russian actions in Ukraine in 2014 gave Americans a good chance to dominate in the EU once again, because "Moscow is back as a threat, and you need us, if you want to be secure". In fact, Russia, despite its aggressive policy in Donbas, is not as dangerous for Europe as some politicians in Washington and in the Baltic capitals (which together with Warsaw are its most devoted allies in the EU and strongly support bigger role of the U.S. in the European affairs) want to present it. And Vladimir Putin is too rational to attack NATO countries.

Of course, there is always a chance that the war may begin even when nobody is ready for it and does not want it. But it is highly likely that in the Baltic region it will not start, and we should concentrate our attention on political and economic issues.

"Independence" from cheaper energy resources

"Energy security" means several things, which are equally important. First, importer of the energy resources must be sure that the country, which sells it oil, gas and/or electricity will not stop export one day because of political or technical reasons. Second, the prices of the energy resources, which are imported, must be competitive, because such prices ensure the competitiveness of the national business. Of course, sometimes the state can propose cheap energy, but potential importer cannot trust it at all, and therefore must buy resources from other partners. However, energy trade should not be politicized too much. For example, during the Cold War relations between the USSR and Western Europe were not friendly, but Western Germany was buying Soviet gas anyway at that time.

Baltic states treat Russia as a country, which can use its energy resources and its huge state-owned energy corporations like "Gazprom", "Rosneft" or "Rosatom" as an instrument of political and economic influence. Therefore, they try to diversify their energy import. But there are two problems. The first one is that there is a lack of clear and common energy security strategy in the Baltic region. Second problem – energy security strategy of the Baltic countries is too much politicized, and their business together with ordinary people has to pay political price for different energy resources, what reduces its competitiveness and impoverishes big segment of society. Thus, energy security policy of the Baltic states could and should be more economically based.

At least two examples can be provided in this case. First, Baltic states could not make a deal on a regional liquefied natural gas (LNG) terminal and build it together in Latvia. Finally Lithuania built its own LNG terminal in Klaipeda "Independence", hoping to strengthen its independence from "Gazprom" and export LNG to neighbor countries. However, the project became a burden for Lithuanian budget, people and national business, which is obliged to buy expensive LNG to make terminal cost-effective. At the same time neighbor countries are not interested in Lithuanian LNG because of its high price and the alternatives they have.

Besides, Lithuania and Poland plan to build a gas pipeline, and the economic perspective of LNG terminal in Klaipeda becomes even more vague in this context (not to speak about the factor of bio fuel in Lithuanian energy balance). The most interesting thing is that Lithuania still buys a lot of gas from "bad Gazprom" (1,407 billion cubic metres of gas in 2017, what is 37 percent more than in 2016). So, the result is sad: reckless political decisions did not lead to significant independence from "Gazprom", but lead to painful longterm costs for Lithuanian state, business and citizens.

Second example relates to electricity sector. When nuclear power plant (NPP) in Ignalina (Lithuania) was closed, Lithuanian government after some time decided to build a new NPP in Visaginas together with Latvia, Estonia and Poland. But again countries could not make a deal on a project, and it „died“, succesfully not becoming another huge longterm burden for Lithuanian budget, people and business.

At the same time Lithuania built electricity power link to Sweden “NordBalt”, is going to build similar power link to Poland “LitPol Link” and wants to escape from Russian “electric prison” – BRELL system. These actions and goals are menaingful, but it is not understandable, why Lithuania passed a special law, which forbidens to buy electricity from the Astravets NPP, which is being built in Belarus by “Rosatom” (Russia). Diversification in the electricity sector is a good thing, but it should not mean the refusal of cheap electricity just because it is of Belorussian (Russian) origin – especially keeping in mind the fact that “NordBalt” link usually does not work properly, what regularly makes electricity prices in Lithuania higher.

To sum up, the strategic goal of energetic independence or at least diversification of energy import of the Baltic states looks logical, but the way it is realized is not acceptable, because it is too politicized, what brings their business and people unnecessary costs, and therefore should be more pragmatic.

When it is better to work together

Baltic region has a great transit potential, and it becomes especially important in the context of Chinese OBOR initiative. However, to be realized it needs constructive dialogue both with Western and Eastern partners, and the relations of the Baltic states with the latter (in particular with Russia and Belarus) are complicated.

In this case it is crucial to understand that important business decisions in the East depend on political position of the elite, which does not like being politically attacked (called “dictatorship regime”, etc.). Baltic countries usually are not careful enough about their rhetoric and political actions, what leads to unnecessary costs for their transit-related sectors of economy, and if their approach does not change, it will be more difficult for them to find their place in and get additional economic benefit from the economic communication between East and West.

First, today companies and states all over the world compete for Chinese investments. For China profit is as much important as a trust and respect. Lithuania is not very sensitive to the position of Beijing on Tibet (for example, president of Lithuania Dalia Grybauskaite had a meeting with Dalai Lama in 2013), and this definitely may negatively affect Chinese view on economic cooperation between two countries. Besides, there are talks in Lithuania about possible danger of Chinese investments (also in port of Klaipeda), what may only reduce further interest of Beijing.

Second, Chinese cargo has to appear in Lithuania somehow, and Russia and Belarus are on its way. Therefore, it is logical for Vilnius to have good relations with Moscow and Minsk, what would bring big profit to Lithuanian railways, hauliers, logistics sector, port of Klaipeda, etc. However, with Moscow these relations are very bad, and Minsk already started to talk about redirection of Belorussian cargo from Klaipeda to Russia, what is a sign of serious tension in bilateral dialogue. At the same time in Belarus China opened a huge industrial park "Great Stone".

Of course, China and Russia are tough bargain partners, but they are not a threat a priori – much depends on the ability of the partner to negotiate with them. In 2018 Lithuanian Prime Minister Saulius Skvernelis described Lithuania as a unique EU state without absolutely any contact with the Russian state, although other countries are very active in working with Russia on economic issues. The mainstream political and journalistic reaction to that position was extremely negative, and Skvernelis was described as a "Kremlin agent"…

Conclusion

Baltic region has a great economic potential and must be a place of multilateral cooperation, not war.

Fortunately, military conflict is not going to happen in it, because all military "games" there are about geopolitical competition between Russia and America for political and economic influence in Europe. However, this competition complicates cooperation process in the region, because Baltic states, being the close allies of the United States, politicize relations with Eastern neighbors too much.

Diversification of energy import, which is a strategic background of any economy, is a logical goal of Lithuania, Latvia, Estonia and Poland. However, the way it is realized is not acceptable, because it brings their business and ordinary people unnecessary costs, and therefore should be more pragmatic.

Baltic transit potential becomes especially important in the context of Chinese OBOR initiative, but to be realized it needs constructive regional dialogue. However, relations of the Baltic states with Russia and Belarus are bad and do not seem to get better, what limits business perspectives of Baltic railways, ports and hauliers.

To sum up, today (geo)politics plays significant role in the Baltic region, and its influence on the regional development is more negative than positive for the moment. To change that, the essence of this development should be more economic, more pragmatic and less politically motivated.

Chapitre 5

Expanding the use of liquified natural gas in the baltic sea region via tailor-made training activities

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Momoko Kitada
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Biography

Dr Dimitrios Dalaklis *joined the World Maritime University (WMU) in the summer of 2014, upon completion of a twenty-six years distinguished career with the Hellenic Navy (HN). He is serving as an Associate Professor (Safety and Security) in the Maritime Safety and Environmental Administration specialization and is also very familiar with Maritime Education and Training (MET) issues.*

Dr. Dalaklis, an Associate Fellow of the Nautical Institute (NI) and a Member of the International Association of Maritime Economists (IAME), holds a Bachelor in Maritime Sciences from the Hellenic Naval Academy (HNA). His postgraduate studies took place in the Naval Postgraduate School of the United States, during which he was awarded with two different Masters' degrees (MSc in Information Technology Management, with distinction & Defence Analysis). He then conducted his PhD research at the University of the Aegean, Department of Shipping, Trade and Transport. From the year 2005 until honourably discharged from service, he has been lecturing in the HNA in many aspects of Navigation; during the years 2013 and 2014, he has served as an adjunct lecturer in the Hellenic National Defence College (HNDC) in the domains of Geopolitics and Maritime Security.

Based upon his expertise, he has performed, coordinated and supervised many series of training involving the use of simulators, as well as on-board practical workout programs. The same applies to various educational and/or professional development activities. He is the author/co-author of many articles & studies in both Greek and English languages. His academic work also includes the books (2008) «Electronic Navigation Equipment" and its new updated version (2016) «Electronic Navigation Equipment and Electronic Chart Display and Information Systems (ECDIS)", as well as (2011) «Contemporary Sea Transport System and Piracy» and (2014) "GLOBAL GEOGRAPHY: The Key role of the Mediterranean in energy, maritime transport and environmental protection", currently in use in various Greek higher education institutions. His latest work (2018) «Trends and Challenges in Maritime Energy Management» is available by Springer International Publishing AG.

Dr Momoko Kitada *joined WMU in 2011 and serves as an Associate Professor (Gender, Culture, and Human Element) in the Maritime Education and Training (MET) specialization as well as in the Secretariat of the WMU Women's Association (WMUWA). She leads WMU's collaboration efforts with the International Maritime Organisation (IMO) in terms of women's integration in the maritime sector and assists WMUWA in connection with other IMO regional support networks.*

Momoko Kitada is a former seafarer and her research interests lie in gender and diversity issues in shipping, in particular, women seafarers and seafarers' families in terms of identities and welfare issues. She teaches subjects in Maritime Education and Training (MET), including cultural issues, knowledge management, assessment methodology, and contemporary labour issues. Momoko's research expands to the human element and social aspects in maritime energy management as well as capacity building for sustainable development. She also teaches research methodology and study skills for MSc students. Momoko is engaged in international collaborations, for example, Associate Researcher at the Seafarers International Research Centre (SIRC) – Cardiff University; Guest Lecturer at Open University, Japan; and Adjunct Professor at the AMET University, India.

Her previous work experience includes positions within both the private and public sectors, such as several major Japanese companies and organisations of trading, manufacturing, banking, social welfare and international aid (1994-2003); voluntary work for the Department of Conservation of New Zealand (1998); national leader of the 13th 'Ship for World Youth' programme (2000); internship at the Japanese Shipowners' Association, London (2003); research assistant for the IAMU research project (2003-2004); research fellow at SIRC – Cardiff University; writer for the monthly shipping magazine 'Kaiun' (2007-2009).

She has produced the following important publications: "Maritime Women: Global Leadership" (2015, Springer); "Risk management no Shinzui [The Essence of Risk Management]" (2017, Seizando); and "Trends and Challenges in Maritime Energy Management" (2018, Springer).

Dr. Aykut I. Ölçer *Nippon Foundation Professorial Chair of Marine Technology and Innovation, Head, Maritime Energy Management specialization. Programme Coordinator, PG Diploma in Maritime Energy. Dr. Ölcer is a naval architect and marine engineer holding the position of Professor of Naval Architecture and Maritime Technology at the World Maritime University (WMU), Malmö, Sweden. Prior to joining WMU, he worked at Newcastle University (England), University of Strathclyde (Scotland) and Istanbul Technical University (Turkey) within the fields of Naval Architecture and Marine Engineering.*

For many years, he has conducted research independently/jointly and collaborated with other researchers, academics and students all over the world, in particular from Europe and Asia. Dr Ölçer was involved in numerous EU funded FP5, FP6 and FP7 projects. He is the Head of Maritime Energy Management specialization and currently leads the WMU Maritime Energy Research Group - MarEner (http://wmu.se/research) that has secured funding from the EU and IAMU for several *projects including wind assisted ship propulsion (SAIL project, EU-Interreg IVB), improving energy efficiency of ships through optimization of ship operations (IAMU), and development of vocational education for LNG as a marine fuel (OTMW-N project, EU-Marco Polo). He has published results of his research in leading, internationally peer-reviewed journals such as "European Journal of Operational Research", "Quality and Reliability Engineering International", "Computers and OR", and "Applied Soft Computing". Prof. Dr. Ölçer is the first editor of the book, "Trends and Challenges in Maritime Energy Management" (2018) by Springer, ISBN 978-3-319-74575-6.*

Dr. Alessandro Schönborn *is assistant professor at WMU, where he teaches and researches Alternative Fuels and Marine Renewable Energy in the Maritime Energy Management (MEM) specialization. His research interests focus on fuel and propulsion technology, and on marine renewable energy from wave, tidal and ocean currents, but he has further interests in solar and wind power for marine applications.*
Before joining WMU, Alessandro worked as research and development engineer at the Injection and Hydraulics department at MAN Energy Solutions in Denmark, as research scientist in the combustion research group at SINTEF Energy Research in Norway, and as researcher on auto-ignition in gas turbines, at Lund University in Sweden.
He graduated from University College London (UCL) with an M.Eng. degree in Mechanical Engineering, with a project on simulations and tests of a Marine Current Turbine, and holds a Ph.D. in combustion (UCL) for a thesis on renewable fuels for diesel engines.

Dr. Fabio Ballini *has Economic and Maritime Transportation background. He is currently assistant professor in the Maritime Energy Management specialization and is a member of the Maritime Energy Research Group (MarEner) dealing with research topics related to Port Energy Management Planning, Gaseous Emissions from Ships in Harbours, Externality Cost in Transportation, Externality Modelling, Clean-Tech Solutions and Energy Audit Systems in Port. He furthermore developed an expertise in the Cold Ironing technology and it is cost benefit analysis as part of his PhD topic. He has also published several times on the issue of "cold-ironing technology", focusing on the society and externality impacts.*

Dr. Monica Canepa *Ph.D. in the field of the Economics of Energy and Maritime Energy Management in Ports.*
Monica strong interest are focused on economy and transport policy and research activities related to this area. She has performed scientific coordination of various conferences and posses many years of experience in the development and management of research projects for the University of Genoa and World Maritime University.

Abstract

Historically, sea-going vessels have been the most important means of transport. With the increasing demands on trade, its importance is becoming ever significant. However, considering their reliance on internal combustion engines and fossil fuels for propulsion purposes, these ships are also responsible for emitting a certain amount of pollutants towards the environment. On the positive side, both the International Maritime Organization (IMO) and the European Union (EU) have clear ambitions to reduce greenhouse gases (GHG) emissions associated with vessels engaged in shipping activities. This new -and rather tight- regulatory framework already created in relation to energy efficiency and monitoring environmental performance of ships is providing a strong driver for the maritime industry to explore different avenues of improving its environmental impact and even consider the use of alternative fuel sources. For the time being, Liquefied Natural Gas (LNG) is looking as one of the most promising solutions for the specific challenge. The “Go LNG” Project is focused on the development of demand and accessibility of LNG in the Baltic Sea Region (BSR). Activities associated with this strategic-in-nature project aim to promote the implementation of European Union’s “Clean Fuel Strategy” and boost LNG usage through the whole transport chain. Among other important tasks, the establishment and operationalization of a BSR LNG Competence Centre is included. The World Maritime University (WMU), along with its capacity building focus, is playing a pivotal role in these tailor-made training activities, which will be the epicentre of the analysis in hand. During the project under discussion, training modules were designed and tested by delivery in the classical classroom mode; distance learning modalities, such as video-streaming of the associated lectures and online tests should be integrated in the future delivery methods.

Keywords: Maritime Education and Training (MET), Liquefied Natural Gas (LNG), Baltic Sea Region (BSR), “Go LNG” Project, LNG Competence Centre.

Introduction

Collective action is needed to deal with the numerous and complex challenges of climate change; the maritime industry must contribute its fair share of Greenhouse gasses (GHG) reduction in those extremely important activities that are already underway and aim to mitigate a risk that can threaten even humanity's own existence. It is not a coincidence that a certain number of international - national policies and/or strategies call for a faster transition towards sustainable energy production and use. Of particular interest is the fact that on September 25, 2015, under the auspices of the United Nations (UN), countries adopted a set of goals *"to end poverty, protect the planet, and ensure prosperity for all"* as part of a new sustainable development agenda. The specific initiative is also more widely known under the title: "Transforming our world: the 2030 Agenda for Sustainable Development". There are 17 Sustainable Development Goals (SDGs)[1] ; recognizing that all the goals are interrelated and indivisible, of particular interest for energy related issues are Goal 7, which aims to ensure access to affordable, reliable, sustainable and modern energy for all and Goal 12, which focuses on sustainable consumption and production patterns. It is a self-explanatory fact that coordinated actions are urgently needed to achieve the afore mentioned ambitious aims; on the positive side, various regulatory efforts are already underway. For example, the International Maritime Organization (IMO) has rather recently updated the International Convention on Prevention of Pollution by Ships (MARPOL), which governs the issue of pollution in relation to the maritime industry. Especially those provisions in MARPOL Annex VI, have made very crucial for the maritime industry to explore different avenues of improving its environmental impact and even consider the use of alternative fuel sources. This trend is not restricted solely in the maritime domain: other means of transport, such as road and rail industries, are also under continuous scrutiny for their level of gasses emissions; many high level initiatives and regulations are pushing towards a framework of restricting these dangerous emissions and a tighter control on pollution in relation to internal combustion engines. For the time being, Liquefied Natural Gas (LNG) is looking as one of the most promising solutions for this challenge (Dalaklis et al., 2017a; Dalaklis et al., 2017b; Madjidian et al., 2018).

It is important to highlight that these new/updated regulations that were previously pointed out exercise a significant influence on the type of energy and fuel used during shipping operations, as well as the issue of "permitted emissions". More

[1] The 2030 Agenda for Sustainable Development, was adopted by all United Nations Member States; it provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its epicentre there are seventeen (17) Sustainable Development Goals (SDGs), which are an urgent call for action by all countries -developed and developing- in a global partnership. Each goal has specific targets to be achieved over a certain period of time, with more details being available at: http://www.un.org/sustainabledevelopment/sustainable-development-goals/, accessed November 2018.

specifically, MARPOL Annex VI represents the regulatory framework tackling exhaust gas emissions from ships. It prohibits deliberate emissions of ozone depleting substances and sets progressive reductions (tiers) in emissions of Sulphur oxides (SOx), Nitrogen oxides (NOx) and particulate matters (PMs). This Annex has also introduced designated emission control areas (ECAs) with more stringent standards for emissions; these areas are called SECAs for SOx and NECAs for NOx emissions respectively. Today, these areas are the Baltic Sea (SOx only), the North Sea (SOx only), the North American area (SOx, NOx and PMs), and the United States Caribbean Sea area (SOx, NOx and PMs)[2]. In November 2016, IMO further designated the North Sea and the Baltic Sea as NECAs, coming into effect on 1st January 2021. When it comes to GHG emissions from ships, amendments of Annex VI in 2011 added Chapter 4 which introduced two mandatory mechanisms (entered into force in January 2013), intended to ensure an energy efficiency standard for ships: (1) the Energy Efficiency Design Index (EEDI), for new ships, and (2) the Ship Energy Efficiency Management Plan (SEEMP) for all ships (Ölçer et al., 2018). These regulations have already influenced and will continue to shape the shipping industry's demand for different fuels, which in turn affect the fuel prices and the cost effective available technology and infrastructure. For ship-owners, in order to ensure compliance with these new regulatory demands, changes in their current business models are needed. In summary, three main options are standing out: a) integrating an emission abatement technology, such as a scrubber; b) opting for a more "environmental friendly" energy source (fuel) such as liquefied natural gas (LNG); c) using low sulphur fuel such as MGO (marine gas oil) or MDO (marine diesel oil). For the time being, LNG is considered as a very appropriate choice. It is becoming increasingly available, since bunkering facilities-infrastructure are created with a very satisfactory pace; LNG's physical properties also allow to easily meet the vast majority of stringent requirements within ECAs, without any additional significant costs involved (Dalaklis, 2016; Madjidian et al., 2018).

When the discussion revolves around the topic of "clean" technological solutions for the shipping industry, the Baltic Sea Region (BSR) (comprising Denmark, Finland, Estonia, Germany, Latvia, Lithuania, Norway, Sweden and Russia) is clearly a leading region of the world (Dalaklis et al., 2017b). It is indicative the fact that the countries surrounding the Baltic Sea are not only examining and applying different pollution reduction technologies, but also considering/introducing alternative fuels such as liquefied biogas, or methanol; numerous research and pilot-projects are also already underway in the areas of new-builds' design and retrofits. Of particular interest is the European Union (EU) funded "Go LNG" Project, which is focused on the development of demand and accessibility of LNG within the BSR. Activities associated with this strategic-in-nature project

[2] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Emission-Control-Areas-(ECAs)-designated-under-regulation-13-of-MARPOL-Annex-VI-(NOx-emission-control).aspx, accessed November 2018.

aim to promote the implementation of EU's "Clean Fuel Strategy" and boost LNG usage through the whole transport chain (Madjidian & Dalaklis, 2017). Among other important tasks, the establishment and operationalization of a BSR LNG Competence Centre is included. The World Maritime University (WMU), along with its capacity building focus, is playing a pivotal role in these tailor-made training activities, which will be the epicenter of the analysis in hand. Some initial thoughts and ideas in relation to the creation of this training initiative were presented in the 11th annual International Technology, Education and Development Conference (Dalaklis et al., 2017a). Considering that a significant period of time has elapsed since that point of time, it is now appropriate to provide the necessary update.

LNG and the shipping industry

Apart from the already well-established transport method of pipelines, specially designed barges and large sea-going vessels with cryogenic capabilities (LNG carriers), as well as road tankers with cryogenic equipment are already extensively used for LNG transport around the world. The progress already made in engine design, vessel design, performance and efficiency, as well as bunkering, containment and monitoring of LNG has given the maritime industry a pragmatic solution to traditional oil alternatives. It is true that LNG is a fossil derived fuel and therefore its use will result into the release -one way or another- of GHG in the Earth's atmosphere. However, despite being of fossil origin, LNG is considered to be a viable alternative and a contributor towards "cleaner" shipping. The main reason for this notion is that it is associated with better exhaust properties, when compared with other available (conventional) marine fuels. For example, in comparison to diesel, typical emissions savings associated with natural gas are: GHG reduction of between 11% and 20%, NOx emissions reduced by 80% and particulate matters and SOx emissions are removed by 99% (LNG Master Plan Project, 2016). As was already briefly mentioned, the IMO's restrictions on emissions have established the necessary framework that creates a unique opportunity for increased LNG demand within the whole maritime transport sector. However, in order to facilitate a fast and safe deployment of LNG in the shipping industry, not only regulations and respective responses from the involved actors must be on track, but also sufficient education and capacity building of people that in various and different ways will be operating LNG is needed. Within the BSR and under the EU's Interreg framework project "Go LNG", a strategy for a smoother and more efficient use of LNG as a fuel for transport is to be put in place with the aim to enable blue transport corridors in the region[3]. Additionally,

[3]Although the complete details are provided in a different chapter within the same book, for reasons of clarity it is also pointed out here that this will be done by investigating current and future transport flows, as well as LNG infrastructure future developments; researching and putting forward ways to improve the wider transport chain by incorporating all available transport modalities, including the enlargement of the number that correspond to entities/industries that can benefit from the use of

well before the end of the project, a "LNG Competence Center" should be established and deliver various training offerings in relation to LNG activities. This Center revolves around the partnership of the "Go LNG" project and the stakeholders connected to it, with the Maritime University of Szczecin, Poland, being the partner responsible for coordination. This partnership consists of twenty (20) main partners and about fifty (50) associated partners spread across the BSR. The aim of that Center is to offer LNG expertise through specialized and competitive training courses to the maritime industry on a global level. To enable a joint service, the Centre gathers BSR-based LNG competence, knowledge, as well as heavy specialized training facilities and research competencies in a well-functioning network that provides collaboration and management models.

Applications of LNG within the shipping industry have clearly gained momentum in recent years. On the other hand, gas and other low-flashpoint fuels pose their own set of safety challenges. IMO responded in a timely manner, via the adoption of the Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), with amendments to make that Code mandatory under the International Convention for the Safety of Life at Sea (SOLAS)[4]; obviously, the provisions of the Code provide the overall framework for the associated training activities necessary to support safe and efficient LNG operations. For example, considering that LNG is kept in a cryogenic state, there is a need for rightly skilled operators to balance tank pressures and temperatures during bunkering operations. Explaining in more depth the properties of LNG, the specific fuel is kept in its liquid state through the application of very low (cryogenic) temperature (near -163 Celsius). As a result, it can be stored within a high pressure tank (10 bar or more), or within an "ordinary" atmospheric tank depending upon the fuel system demands. Currently, many coastal vessels are fitted with independent type "C" pressure tanks because of their small capacity needs. Ocean going ships will certainly require much larger capacity than the coastal ones and therefore utilize membrane atmospheric tanks. Nevertheless, all types of LNG storage tanks are designed with extensive safety features, to include containment and monitoring. When LNG is exposed to the atmosphere, it will warm and return to its natural gaseous state. This is done

LNG will also take place. The strategy under discussion will further provide LNG stakeholders with a knowledge-base on policies and regulation as well as on technological standards that relate to LNG, and describe well-functioning solutions and business models already present in the transport sector of the region under discussion.

[4]This new "toolbox" of regulations came into force in 2017. The purpose of the IGF Code is to provide an international standard for ships, other than vessels covered by the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), operating with gas or low-flashpoint liquids as fuel. The basic philosophy of the Code is to provide mandatory criteria for the arrangement and installation of machinery, equipment and systems for vessels operating with the specific types of fuel to minimize the risk to the ship, its crew and the environment, having regard to the nature of the fuels involved. The Code's basic philosophy considers the so-called "goal based approach". Therefore, goals and functional requirements were specified for each section forming the basis for the design, construction and operation. http://www.imo.org/en/OurWork/Safety/SafetyTopics/Pages/IGF-Code.aspx, accessed November 2018.

by rapid boiling and evaporating. This evaporation process can be accelerated when LNG contacts surfaces with a higher temperature, such as seawater or even ice (Dalaklis et al., 2016). Initially, LNG is heavier than air and settles on the water's surface while changing state. As the temperatures elevates to -107°C, it will become lighter than air and begin to rise from the surface. Wave action will naturally sustain the accelerated evaporation, expediently dissipating the risk in absence of an ignition source. Vaporization studies have been on-going for several decades; a report from 1970 conducted by the U.S. Coast Guard Hazardous Materials Division (in a controlled environment) found that the vaporization rate was 0.037 lbs/ft sec (United States Coast-Guard, 1970). Flammability range, undeniably present, is only slightly higher than light oils and does not pose an explosion risk, despite public perception. LNG has a relatively low reactivity and low burning speed with a flammability range of 5 - 15% volume in air (Dalaklis, 2016). Unless a spill is trapped where vapors can accumulate over a period of time, such as a tank space or engine room, only then it might be possible to build pressure and cause rapid expansion. However, the level of detection mandated by the IGF Code requires detection redundancies in nearly every phase of the fuel system, proper installation of adequate ventilation (as outlined in the IGF Code); swift response action by the crew would also quickly mitigate any occurrence, with the importance of conducting realistic training in order to develop these competencies necessary to be highlighted here.

World Maritime University's previous involvement in LNG

With IMO as its parent organization and engaged in postgraduate maritime education activities, WMU's mission is to be the world center of excellence in postgraduate maritime and oceans education, professional training and research, while building global capacity and promoting sustainable development. WMU has gathered valuable cumulative experiences in relation to LNG, under an EU Project within the Marco Polo framework: "On the Mos Way Network (OTMW-N)". That project revolved around an extended set of professional trainings and vocational education activities in four (4) different EU countries, developed in five (5) distinct modules. The partners involved in this project developed and delivered a certain number of trainings that were categorized as follows: a) LNG fueled vessels design training; b) Safety of LNG Handling on Plant, Bunkering Station and On-Board Vessels; c) LNG cargo and ballast management training on LCHS simulator; d) Maneuvering of LNG driven vessel, special conditions and operations; e) Propulsion and power generation training of LNG driven vessel. Other activities included a number of dedicated visits on facilities related to LNG production/distribution, as well as various bunkering locations in order to identify/evaluate the type of technology applications available and best practices already in use.

Furthermore, a portal for disseminating news in relation to on-going developments in the LNG market was also included, mainly for public relations reasons. Also, clustering activities that engaged a large number of stakeholders and other LNG projects were a major part of the project. The objectives of OTMW-N included the understanding and the appreciation of the pros and cons of LNG's use as a marine fuel, the development of a new culture in all the actors (both onboard and offshore) to understand their role to the safe operation of LNG fueled ships, bridging the different perspectives that the crew onboard the vessels and at the port have, as well as creating a common understanding and bridging the gap in the existing training procedures and the different perspectives on the use of LNG for bunkering[5].

The take on LNG deployment under the OTMW-N was to focus heavily on safety. This choice was influenced by LNG's cryogenic nature and volatility, its properties, characteristics and behavior (which differ significantly from conventional marine fuels); introduction of new technology in the field must always be combined with the necessary training activities. On the positive side, the experience of the LNG marine transport industry so far shows that, when LNG is handled professionally, all the associated risks can be mitigated and kept under complete control. Under the specific research initiative, WMU developed and delivered a dedicated training module for maritime professionals in relation to the wider domain of LNG safety. This training package covered all aspects of the necessary procedures to assure safe and efficient handling of LNG under a wide variety of circumstances and to initiate an appropriate response in case of emergencies. More importantly, it provided participants a unique opportunity to interact directly with experienced technicians and authorities on firefighting, safety and security, specifically taking advantage of the first LNG practical training course in Europe. During 7-11 September 2015, WMU held the Safety of LNG Handling on Plant, Bunkering Station, and On-board Vessels course. This course was offered free of charge and included nearly sixty-five (65) participants, the majority of whom joined remotely (on the distance learning mode, via transmitting on-line the associated lectures in real time) from around the world; five (5) more individuals participated on-site, at WMU premises (Figure 1). Topics covered included properties of LNG, bunker delivery modalities, firefighting procedures, and emergency procedures. Key objectives (which are detailed in Table 1 below) were aiming at developing a working knowledge of LNG bunkering operations through best practices, industry standards, and regulations, properly identifying roles and responsibilities for safe and efficient operations on-board the delivery vessel and the receiving vessel including shore-side trucks or terminals, and appropriate and effective emergency response in terms of both spill and fire[6].

[5] https://www.onthemosway.eu/onthemoswaynetwork/?cn-reloaded=1, accessed November 2018.

[6] The course opened with remarks by WMU's President, Dr. Cleopatra Doumbia-Henry, who welcomed the participants and also noted the importance of the course in relation to the 2030 UN Sustainable Development Goals; she also highlighted the significance of the course as a collaborative

Figure 1. Delivery of the course under the OTMW-N Project

Table 1. Learning outcomes accomplished under the “Safety of LNG Handling on Plant, Bunkering Station and On-Board Vessels” Module

LEARNING OUTCOMES
Understand the unique characteristics of LNG as a cryogenic fuel
Develop a clear understanding of the background of LNG fuelling operations and regulations to assure safe and efficient operations on board bunker vessel, LNG vessels and LNG fuelling terminals
Be able to differentiate between different Hydrocarbon gases and their carriage conditions
Be familiar with the hazard of fire of gases and firefighting procedures of pool and pressure fires
Be familiar with operating commonly used instruments and monitoring equipment for LNG
Assure students a smooth transition to manage and operate LNG fuelling protocols starting with delivery of a LNG-fuel vessel, including barges, initial operations, familiarization of operations under routine and emergency situations
Understand common hazards of LNG storage, transfer, and handling
Develop and maintain on-going training of replacement crewmembers, LNG terminal staff and managers
Understand in detail the appropriate safety procedures in the event of an LNG emergency, including fire, spill, and rapid-phase transition
Understand the unique safety challenges associated with ships and terminals utilizing or handling LNG
Potential LNG Incident Scenarios and strategies
Be able to understand the basic procedure of Risk Assessment and Jettison of cargo in case of emergency

partnership with other Universities and its role in supporting the IMO’s mandate in the area of energy efficiency. WMU staff, along with external instructors were involved in the course delivery. Expertise integrated in the delivery included Mr John Egan of Excelerate Energy, a leading expert with over 36 years of experience in the LNG industry and Mr. Johan Lilliesköld, LNG Business Development Manager, of Mann Tek, who shared his in-depth LNG experience and first-hand knowledge of the MS Viking Grace LNG operation in Stockholm (the first large scale passenger ferry to be powered by LNG). https://www.wmu.se/news/free-online-lng-course-delivered-wmu, accessed November 2018.

Development of a LNG competence centre in the baltic sea region

A “Go LNG” affiliated Conference, under the title “Building LNG Competence and Business Partnership for the Baltic Sea Region” was held on the 26th of April 2017 in Vilnius, Lithuania. The main goal of that Conference was to formally establish two international cooperation platforms: a) the Baltic Sea Region LNG Cluster; and b) the LNG Competence Centre of the Baltic Sea Region (BSR)[7]. To elaborate more on the details, an agreement among thirteen (13) educational institutions from the BSR to establish a Competence Centre aimed at facilitating the growth of innovation, technologies and infrastructure in the area of LNG was signed. By pooling LNG competences and the right type of educational resources, this Centre brings together educational facilities and science oriented institutions in order to create a specific network which will enhance access to LNG technologies and enable the improvement of knowledge in the extended domain of LNG operations. It will also strengthen the critical mass of LNG specialists, an action which is imperative for the development of LNG technologies in the BSR. This network of institutions has been established to mobilize the infrastructure of science and research studies in the Baltic Sea countries, to further promote LNG study programs, to develop training and research in support of LNG activities, and to increase the availability of knowledge about LNG technology among business representatives, developers and the implementers of energy and environmental policies. The BSR LNG Competence Centre is based on a model of interinstitutional cooperation that will enable the development of the joint projects and services required for the LNG sector[8]. For the time being, there are two main categories of training activities provided (which are both summarized in Table 2): a) LNG Value Chain training (VC)[9]; and b) LNG Maritime Basic training (MB).

[7] https://www.wmu.se/news/wmu-joins-baltic-sea-region-lng-competence-centre-go-lng-conference, accessed November 2018. It is necessary to highlight here the fact that the BSR LNG Cluster is a business cooperation organisation which includes national parties from Lithuania, Sweden, Norway, Denmark, Germany and Poland which are now united to strengthen and to speed up the further development of LNG innovations, LNG technologies and LNG infrastructure in the BSR.

[8] https://www.wmu.se/project/lng-value-chain-clean-shipping-green-ports-and-blue-growth-baltic-sea-region-go-lng, accessed November 2018.

[9] The content of this type of training is quite flexible and corresponds mostly towards dealing with the needs, and future possibilities- opportunities of local stakeholders in relation to LNG field applications.

Table 2. **Training Activities under the BRS LNG Competence Centre**

No	Date	Place	Type of training	No of participants
1.	15-16/11/2017	Lithuania / Klaipeda	VC + MB	127
2.	6-7/12/2017	Poland / Swinoujscie	VC + MB	25
3.	06/03/2018	Poland / Gdansk	VC	50
4.	25-26/04/2018	Sweden / Malmö	VC + MB	38
5.	16/05/2018	Estonia / Tallinn	VC	17
6	7-8/06/2018	Germany / Rostock	VC + MB	12
7.	11/09/2018	Norway / Oslo	VC	42
8.	20/09/2018	Latvia / Riga	VC + MB	52
9.	26/09/2018	Denmark / Fredericia	VC + MB	18
10.	3-4/12/2018	Lithuania / Vilnius	VC	----
11.	7-8/02/2019	German / Hamburg	VC	-----

LNG MB type training (offered on behalf of the BSR Competence Centre) took place at the WMU premises in Malmö, Sweden, on 25-26 April 2018 with a total number of 65 participants from Sweden, Denmark, Norway, Lithuania, Germany, Poland and Turkey (Figure 2). The scope/composition of this training covered mainly requirements of the International Convention on Standards of Training, Certification and Watch-keeping for Seafarers' (STCW) regarding maritime personnel competencies. More specifically, STCW-related requirements concerning ships subject to the Safety for Ships using Gases or other Low-flashpoint Fuels (IGF) International Code were analysed in a sufficient level of detail. Participants representing providers of LNG technologies, LNG suppliers, science institutions, maritime authorities and ship-owners came together to learn about best practices involving LNG in the extended energy and transport sectors. Briefly, the content of this MB type of training reflected the STCW requirements for seafarers that are not directly responsible for transferring LNG or using LNG storage or fuel systems. It was dealing with: a) Explanation of physical and chemical properties of LNG and other low flash point fuels; description of fuel and storage systems for cryogenic liquids; b) procedures and devices providing the safety during LNG operations; c) Transfer/bunkering operation of LNG; d) Description of health, ship, equipment and environmental hazards associated with LNG operations and explanation on how to control these hazards; e) understanding of fuel characteristic presented on a Safety Data Sheet; f) Description of safety means applied during LNG operation; g) basic knowledge on Medical First Aid with references to a Safety Data Sheets; h) Organization of firefighting actions, firefighting agents and methods, firefighting system operations; i) (Theoretical only) Description of emergence procedures and requirements for: emergency breakaway, Emergency Shut Down procedures etc.; and ia) Description of measures and procedures to be taken in the event of leakage, spillage, venting of the fuels.

Figure 2. **Delivery of the course under the "Go LNG" project**

Summary and conclusion

In the 21st century where an increasing demand of trades to supply necessary foods, goods and resources around the globe, sea-going vessels are rightly considered the most important means of transport; vessels engaged in maritime transport activities hold the so-called "comparative advantage" over all other modalities. It is not a coincidence that associated statistics indicate that about 90% of the total volume of global trade is borne (exclusively – or, at least partially) by sea (UNCTAD, 2018); safe and secure shipping is a prerequisite for the normal conduct of global trade, many times termed as the "backbone of globalization" (Dalaklis, 2012). However, considering their reliance on internal combustion engines and fossil fuels for propulsion purposes, these ships are also responsible for emitting a certain amount of pollutants towards the environment. The rather tight regulatory framework already in place in relation to energy efficiency and monitoring environmental performance of ships is providing a very strong driver for the maritime industry to explore different avenues of improving its environmental impact and even consider the use of alternative fuel sources. On the positive side, modern technology provides a plethora of options of alternative fuels for future consideration: from hydrogen to methane, or even biofuel. For the time being, LNG is looking as one of the most promising solutions for the improvement of the shipping industry's "environmental footprint". However, in order for the LNG market to increase more rapidly, it needs to be spread more widely, and not just within the ECAs. Moreover, for the specific market to become more financially viable, the number of sectors interacting with it needs to increase further. One area of opportunity being already explored is the spread of LNG to remote regions: due to its properties, the volumetric energy density of LNG is 2.4 times greater than that of compressed natural gas (CNG) or 60% that of diesel fuel, allowing larger quantities of LNG to be transport in comparison with the other "competitors"[10]. Additionally, LNG is cost efficient to transport over long distances, in the case pipelines do not exist. Once the maritime industry has become prepared with a functioning distribution chain it is therefore quite probable that many other industries and more specifically entities that are located in more remote areas will switch to using LNG as a principal source of energy.

In many cases, the introduction of LNG is considered as a regulation-driven demand that has arisen to comply with the environmental regulations enforced by the Sulphur Emission Control Area (SECA), as introduced by IMO's MARPOL Annex VI. The Baltic Sea is also designated to become a Nitrogen Emission Control Area (NECA) as of 2021; this means that vessels built after 2021 will be required to reduce nitrogen oxides (NOx) emissions by 80% compared to the current emission levels. With the introduction of these regulations, a forced shift has been placed upon vessels/ship-owners operating in the region; changes to the current business models (and technologies involved) are necessary. For the maritime industry in the BSR, the question is no longer if LNG could be a solution to adhering to international regulations, but rather how much of the market will be replaced by LNG, and, importantly, how the LNG can best be introduced as the preferred fuel/source of energy. Although certain fuel alternatives provide a better environmental performance than LNG, unfortunately, they have limited bunker availability and the purchase-installation costs of the related equipment-systems can be quite high. LNG could therefore be considered as an extremely important facilitating tool in the shipping industry's on-going effort to become more environmentally friendly within a very short time-frame. Promoting the use of LNG can result into significant environmental benefits, with substantial economic savings included in the same equation. In any case, the numerous technical innovations already achieved in order to facilitate production and transport towards the end consumer of LNG have already created a significant need of trainings to ensure a high level of safety during LNG related activities. By considering that the specific type of fuel is now viewed as one of the least expensive transportable

[10] http://www.envocare.co.uk/lpg_lng_cng.htm, accessed November 2018.

ones, further use and build-up of additional infrastructures should be expected in the near future. By also factoring in that a rather high number of further research activities in the transport and usage of LNG domains are already underway, the roll out of new systems should be expected in the next few years; more opportunities for training will also follow swiftly. Finally, all the activities that were delivered in the last two years under the BSR LNG Competence Center were following the "physical presence" method (classical classroom setting); taking advantage of distance learning modalities and especially online tests should be integrated in the future delivery methods.

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Chapitre 6

Liquified natural gas as a marine fuel: the case of the baltic sea region

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Abstract

The International Maritime Organization (IMO) has rather recently significantly amended the International Convention on Prevention of Pollution by Ships (better known by the acronym MARPOL), which firmly controls pollution levels related to the shipping industry. These new/updated legal provisions in turn exercise significant influence on the type of energy and fuel used during shipping operations, as well as the issue of "permitted emissions". For ship-owners, in order to ensure compliance with these new regulatory demands changes in their current business models are needed. Briefly, three main options are standing out: a) integrating an emission abatement technology, such as a scrubber b) opting for a more environmental friendly energy resource such as liquefied natural gas (LNG) c) using low sulphur fuel such as MGO (marine gas oil) or MDO (marine diesel oil). For the time being, LNG is considered as a very attractive option and is gaining more and more momentum. It is becoming increasing available, since bunkering facilities/infrastructure are created with a very satisfactory pace; LNG's physical properties also allow to easily meet the most stringent environmental requirements, without any significant additional costs. The «Go LNG» Project, which will be the epicentre of the analysis in hand, aims to promote both demand and accessibility of LNG in the Baltic Sea Region (BSR). A strategy for a smoother and more efficient use of LNG as a fuel for transport is an action of priority in order to enable the so-called "blue transport corridors" and improve the environmental footprint of transport endeavours.

Keywords: "Go LNG" Project, Liquefied Natural Gas (LNG), Baltic Sea Region (BSR), Blue Corridor Strategy.

Introduction

When the discussion revolves around the topic of "clean" technological solutions for the shipping industry, the Baltic Sea Region (BSR) (comprising Denmark, Finland, Estonia, Germany, Latvia, Lithuania, Norway, Sweden and Russia) is clearly a leading region of the world (Dalaklis et al., 2017). The BSR is, since 2005, an Emissions Control Area (ECA) under the International Convention for the Prevention of Pollution from Ships (MARPOL). Initially, this restricted the emission of sulphur oxides from ships' combustion engines to the air, to an amount equivalent to 1.5 % m/m sulphur present in the fuel. This level was made progressively more stringent, with only 1.0 % m/m fuel sulphur equivalent being allowed since 2010, and only 0.1 % m/m allowed since 2015. The cumulative result of these regulations is that ship-owners now have to either remove the excessive sulphur from the exhaust gases of the engine by scrubbers, or to resort to fuels containing 0.1 % m/m sulphur or less. The latter path leaves the option between liquid fuel oils with low sulphur content, or alternative fuels such as liquefied natural gas (LNG), liquefied petroleum gas (LPG), biofuels, or synthesised energy carriers that naturally contain low levels of sulphur. To cut a rather long way short, three main options (which will be briefly discussed next) are standing out: a) integrating an emission abatement technology, such as a scrubber b) opting for a more "environmental friendly" fuel, such as LNG c) using low sulphur fuel such as marine gas oil (MGO) or marine diesel oil (MDO) (Dalaklis, 2016; Madjidian et al., 2018).

Scrubbers typically absorb the sulphur oxides (SOx) that are formed during fuel combustion into a liquid or solid phase and are subsequently binding the sulphur in a different chemical form. The so-called "wet-scrubber" systems (in open-loop configuration) can use sea water directly to absorb and bind the sulphur oxides, which are associated with a very negative impact towards the environment. This requires large water flow rates and to discharge the "wash water" directly to the sea. Wet-scrubbers also have the advantage of removing exhaust gas particulate matters by around 70-90 % (Lloyds Register, 2012). Some of the pollutants contained in the wash water are removed in terms of a sludge, that can be disposed more appropriately on designated facilities on land. The wash water discharged to the sea must be monitored for its acidity and for the presence of polycyclic aromatic hydrocarbons (PAHs) and turbidity (which indicates the presence of soot). Despite these measures, open-loop wet scrubbers discharge a proportion of these pollutants to the sea. The sea may thus be contaminated to some extent with sulphuric acid, products of incomplete combustion or unburned fuel, as well as various metals and metal oxide particles originating from either the engine or the fuel (e.g. aluminium silicate originating from fuel refinery catalysts, cat fines). Some of these emissions appear to be sufficiently problematic to suggest that widespread open-loop seawater scrubbing may be an unsustainable method to deal with the problem of ships' emissions to air.

Closed-loop water scrubbing systems recirculate their wash water within a water cycle on-board the ship and typically use sodium hydroxide or magnesium oxide to bind the sulphur and neutralise its acidity. A closed-loop scrubber can operate without discharge to the sea (for a limited amount of time). Yet, using current designs, they still need to remove wash water from the cycle, in order to limit sodium sulphate concentrations and crystallization within the wash water system. This requires them to eventually discharge their wash water to a tank, and when this is full, to the sea. The problem of sea contamination may be reduced due to improved sludge removal, but not entirely solved. An alternative to wet scrubbers, are dry scrubbers employing calcium hydroxide to absorb sulphur oxides and transform them via chemical reaction into calcium sulphate or calcium sulphite, or activated coke (Haase & Koehne, 1999) to absorb them in the form of sulphuric acid. Dry scrubbers do not cause seawater contamination from wash water, and may provide more environmentally sustainable alternatives to wet scrubbing systems. Dry scrubbers also have the advantage of being compatible with low-pressure SCR systems for simultaneous nitrogen oxides (NOx) reduction, since they do not cool the exhaust gases. They have been reported to be 80 % effective in removing particulate matters (Lloyds Register, 2012).

Low sulphur fuel oils, such as Low Sulphur Marine Diesel Oil (LSMDO) or Low Sulphur Heavy Fuel Oil (LSHFO), can facilitate compliance with the sulphur limits in ECA, without major technical changes to ship engines. It is expected that the price of low sulphur fuel oils will be higher than the one of high sulphur oils. Small technical adaptions for operating engines on low sulphur fuels are also required. Low sulphur fuel oils are derived from crude oil, and thus require removal of naturally present sulphur in order to meet the 1.0 % m/m fuel sulphur requirement. In order to obtain a low sulphur content, LSHFO consists to a large extent of the residues obtained from Fluid Catalytic Cracking (FCC) fuel refining processes. Such processes employ aluminium silicates (zeolites) as catalysts (Vogt & Weckhuysen, 2015), which can remain present in the final LSHFO product. Such “cat fines” are extremely hard particles, that can cause excessive wear and rapid failure of engine components. Fuel standardisation (ISO 8217, 2017) limits the presence of aluminium plus silicon to 60 mg/kg, within LSHFO, but engine manufacturers typically recommend no more than 10 mg/kg (MAN Diesel & Turbo, 2015). Fuel cleaning equipment in the form of a separator must thus be operated appropriately to meet this specification and ensure proper engine operation. In addition to this, the cylinder lubricating oil base number (BN) needs to be reduced when switching from high sulphur fuels to low sulphur fuels. This is to avoid the occurrence of calcium deposits in the engine, and to ensure that a healthy amount of acid corrosion keeps an open graphite structure in the cylinder liner of the engine, to ensure suitable lubrication (MAN Diesel & Turbo, 2014).

A third option can be achieved via LNG, which is kept in its liquid state through the application of very low (cryogenic) temperature (near -163 Celsius). When LNG is exposed to the atmosphere, it will warm and return to its natural gaseous state; this is done by boiling and evaporating. To maintain the required properties, LNG can be stored within a high pressure tank (10 bar or more), or within an “ordinary” atmospheric tank depending upon the fuel system demands (Dalaklis et al., 2017). LNG typically contains only very low levels of sulphur, and meets the requirements for 0.1 % m/m sulphur or less. In LNG, sulphur usually exists in the form of hydrogen sulphide (H2S), but is usually removed from the natural gas prior to its liquefaction. In order to employ LNG as a fuel for ship engines, a shipboard LNG tank, fuel system and gas injectors need to be installed. Ship engines can be operated on LNG using both Diesel and Otto cycle combustion modes. LNG engines and fuel systems can be installed as part of new ship building, or as retrofit projects for existing engines on ships. The environmental performance of LNG, its economic considerations, and an infrastructure strategy for further expansion of LNG within the BSR will be discussed in the ensuing sections.

Enviromental perormance of LNG

LNG consists predominantly of methane (CH_4), the simplest alkane, but can include various higher alkanes, such as ethane (C_2H_6) or propane (C_3H_8). Components such as ethane are often included in LNG up to its allowed specification limit, since they may be available at a lower cost. Pure methane boils from liquid phase at a temperature of 112 K (Atkins & De Paula, 2001). The boiling point of LNG is very similar to that of methane, and it is gaseous at standard conditions of temperature and pressure. Its latent heat of evaporation of 511 J/kg (Kim et al., 2015) allows it to be stored at its boiling point, permitting a given amount of heat to evaporate a portion of the LNG, while the rest is kept liquid. Nevertheless, suitable insulation, a liquefaction plant, and associated energy requirements are necessary to keep LNG liquid over long periods of time. Methane, has a higher hydrogen to carbon ratio than MDO, or HFO (see Table 1 that follows). This has important implications for its environmental performance when combusted in an engine. Firstly, less carbon dioxide (CO_2) is emitted when setting free a specific amount of energy during combustion, compared to HFO. Methane releases about 28 % less CO_2 than HFO. The HFO used for comparison assumes an overall carbon to hydrogen ratio of 1.51, derived from the data obtained by Garaniya et al. (2018), and a Lower Heating Value (LHV) of 42.7 MJ/kg (WinGD, 2018). Pure methane has a heating value of 50.1 MJ/kg, which can be calculated from the enthalpies of formation of the reactants and products (Glassman & Yetter, 2008). This leads to CO_2 emissions factors of 54.84 t CO_2/TJ for methane, and 76.28 t CO_2/TJ for HFO. Secondly, methane inherently has a lower adiabatic flame temperature T_{ad} than HFO. Since the formation of nitrogen oxides (NO_x) in diesel engines is dominated by the occurrence of peak combustion temperatures (Heywood, 1988), T_{ad} provides a simple means of comparing the NO_x forming propensity of these two fuels. The flame temperature for methane and HFO were calculated using the combustion reactions and lower heating values (LHV); they are presented in Table 1. T_{ad} was calculated for a stoichiometric fuel and air mixture at constant pressure without dissociation of the combustion products. The combustion product mixture enthalpy was estimated using a constant ratio of specific heat evaluated at $T_{Cp} = ½ (T_i + T_{ad})$, where T_i was the initial temperature of the reactants (298 K), and T_{ad} was the adiabatic flame temperature. The procedure for such a simplified calculation of the adiabatic flame temperature is described by Turns (1996).

Table 1. **Salient combustion related properties for LNG and MGO**

Name	Simplified chemical formula	Reaction	LHV [MJ/kg]	T ad [K]	CO_2 emission [CO_2/TJ]
Methane	CH4	CH4+2·(O2+3.76·N2) →CO2+2·H2 O+7.52·N2	50.1	2283	54.84
HFO	CH1.5	CH1.51+1.38·(O2+3.76·N2)→ CO2+0.75·H2 O+5.19·N2	42.7	2450	76.28

Thirdly, methane is gaseous at standard conditions, and can therefore be used to readily form a lean fuel and air mixture with the intake air of an engine, prior to compression. This allows LNG to be burned as a lean fuel and air mixture, whose combustion temperature can be controlled via its fuel to air ratio. Typically, such a mixture is ignited by a small pilot injection of HFO, or a spark. The bulk of the mixture is typically combusted by deflagration, in what is commonly described as an Otto cycle engine. This has the advantage of eliminating fuel-rich zones and high combustion temperatures present in burning jets, resulting in a significant reduction of particulate matter (PM) and NOx formation. The emissions reduction with respect to conventional diesel engines operating on HFO is as high as 95% in the case of PM, and 85% in the case of NOx (Miller & Bowman, 1989). This allows ships to meet IMO Tier III emissions regulations without requiring exhaust gas after treatment. A problem with this technology is that premixing of fuel and air in the engine prior to full compression and the low combustion temperatures associated with burning lean fuel air mixtures, can lead to quenching of the combustion along the walls and in any crevice volumes of the cylinder. The result is the emission of unburned methane and is commonly termed "methane slip". Methane is a powerful GHG and its emission is problematic, though it is currently not regulated under IMO International Convention for the Prevention of Pollution from Ships (MARPOL, Annex VI). The latest IPCC report estimates its cumulative GHG forcing effect over 20 years to be 84 times as severe as that of CO_2, and its cumulative GHG forcing effect over 100 years to be 28 times as severe as that of CO_2 (IPCC, 2014). Its lifetime in the atmosphere is estimated to be 12.4 years, meaning that it has a severe impact in the years directly ensuing its release. Its GHG effect is thus significant, contrary to CO_2, strongly time dependent. Although it is not regulated as of now, it threatens to undermine the CO_2 emission advantages of LNG over HFO in the short and medium term. Methane slip can be avoided if methane is burned as a high-pressure jet. This engine technology requires high pressure injection of methane, and thus its compression to pressures significantly above the cylinder pressure of the engine. It also requires a reliable source of ignition, which typically takes the form of a small pilot injection of a fuel that readily "auto ignites", typically HFO. This technology almost completely eliminates the occurrence of methane slip, but it requires additional emissions reduction technology such as Exhaust Gas Recirculation (EGR) or Selective

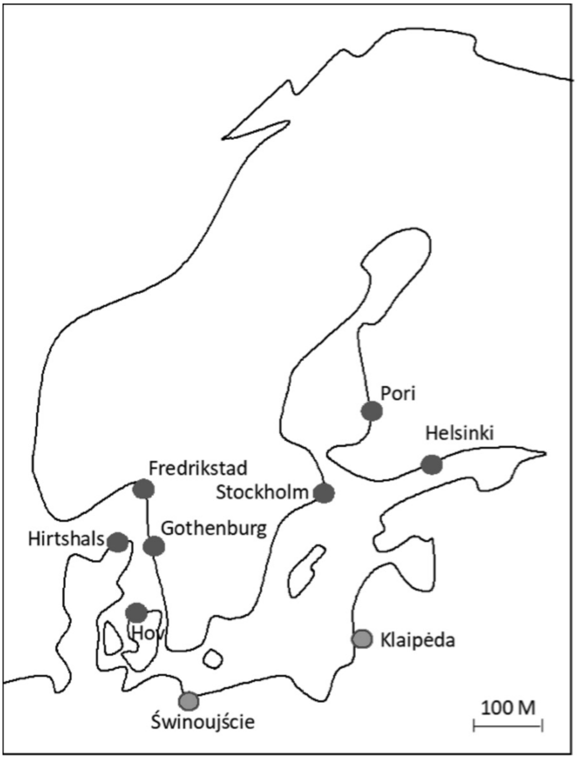
Catalytic Reduction (SCR) to meet IMO Tier III emissions regulations (MAN Energy Solutions, 2018). Fourthly, the volatility of LNG, is translated into the fact that it is easily emitted to the atmosphere via accidents, purging of fuel systems, safety relief of pressurized pipes or vessels. This is a significant disadvantage in terms of its GHG impact, when compared with liquid fuels.

In terms of its environmental performance, it is likely that LNG offers to be a bridging technology for more sustainable fuels in the future. It allows reducing emissions of sulphur completely, reducing the emissions of nitrogen oxides and somewhat reduce the CO_2 emission from ships. However, LNG from fossil sources will not reduce GHG emissions by considerably more than 28%, since the efficiency of LNG-fueled engines is currently similar to that of diesel engines operating on fuel oil. Switching to LNG on its own is thus an insufficient measure to meet the aims of IMO Resolution MEPC.304(72) of reducing carbon intensity by 40% from 2008 levels by 2030. LNG is also far from able to reduce carbon intensity by 70% from 2008 levels, which IMO Resolution MEPC.304(72) (IMO, 2018) requires by 2050. The use of LNG is thus likely to be most needed in the immediate future. Its environmental performance depends also on how LNG is used. At worst, methane emissions from LNG powered ships could efface its GHG advantage over HFO. At best, if the LNG methane is derived from biogas, or synthetically produced using energy from renewable sources, LNG could become an energy carrier for renewable energy and a bridging technology to facility the development of more renewable energy. Yet, even as an energy carrier, its strong GHG effect when released to the atmosphere, the energy losses associated with synthetic production of methane from renewable energy (Connolly et al., 2014) and its necessity for cryogenic storage and transport could become disadvantages in the long term.

Infrastructure strategy for LNG

LNG infrastructure in the BSR has to be designed strategically, so as to provide ships with suitable facilities for (safe and efficient) LNG operation. Starting to put all the blocks together, LNG needs to be made available to ships from bunker terminals. The distance between bunker terminals should be sufficiently short so as to provide both an environmental and an economic benefit over LSHFO. The basic environmental performance of LNG has been discussed in the previous section of this chapter (Environmental Performance of LNG), with a first principles calculation showing that methane releases about 28 % less CO_2 than HFO to provide the same amount of energy. If an LNG-powered engine has the same energy conversion efficiency as an HFO powered engine, this ship can, if sailing on LNG, travel a distance equivalent to 128 % of the distance it would have originally travelled on HFO, and emit the same amount of CO_2. The relevance of this assessment for the infrastructure strategy of the BSR is, that ships can travel an additional distance of 28 % with respect to their usual route, to find an LNG terminal and refuel, before the additional distance travelled effaces the CO_2 benefit of LNG. Depending on their operational route, this yields a measure for the maximum distance at which LNG terminals should be spaced apart. From a CO_2 emission perspective, the distance at which LNG terminals should be positioned apart within the BSR, becomes a function of the distance which a ship can travel on LNG before having to refuel, and on its intended route. The distance which a ship can travel on LNG before having to refuel depends on the LNG tank capacity available, and off course on its fuel consumption rate. Large ships are typically designed to travel long distances without refueling. Their routes are longer and more likely to lead them past an LNG terminal. Smaller vessels are typically designed to travel shorter distances before having to refuel, and thus require more closely spaced LNG infrastructure for refueling. This leads to an LNG bunkering station network that has larger distances between bunkering facilities for large ships, and smaller distances between bunkering facilities for small ships. A generic overview of the BSR, and existing LNG bunker facilities (end of year 2018) is presented via Figure 1.

Figure 1. **Existing LNG bunker facilities within the BSR (2018)**



[Figure generated by the authors].

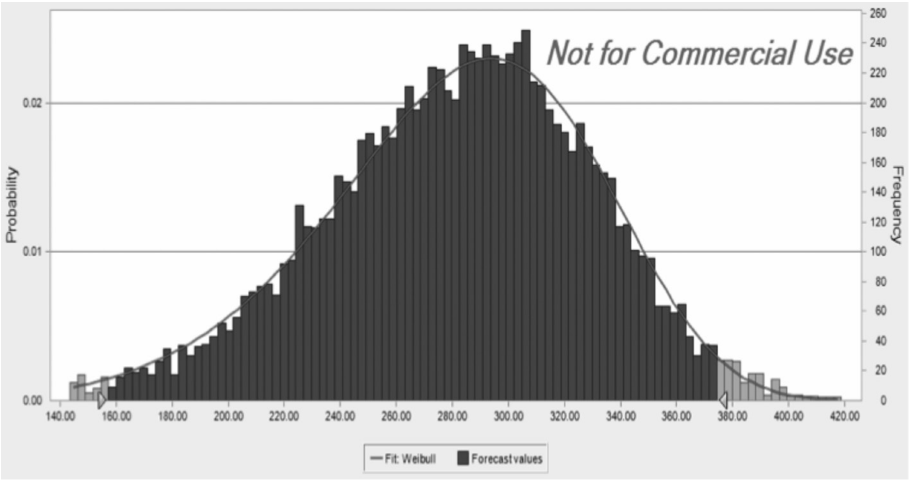
The additional distance a ship can travel in order to get access to an LNG bunker facility, can also be calculated from an economic point of view. This allows making an estimate of how closely LNG bunkering infrastructure needs to be spaced apart in order to provide an environment that is favorable for the installation of LNG powered ships. This critical LNG bunker station density can be illustrated using a simplified business case scenario for a ship operator: A bulk carrier, having power consumption of 14400 kW at its design speed of 14 knots (TEFLES 2012), travels from Tallinn, Estonia to Liepaja, Latvia. The round trip comprises approximately 621 nautical miles, and with a main engine efficiency of 50.8 % requires around 30 t of LSMGO. Assuming a price of 17.29 $/MMBTU (DNV-GL, 2018) for LSMGO, this journey costs around 74255 $ in fuel. To accomplish the same journey with LNG, with a main engine efficiency of 51.1 % requires around 26 t of LNG. Assuming a price of 10.79 $/MMBTU (DNV-GL, 2018) for LNG, this journey costs around 46060 $ in fuel. Switching to LNG thus allows saving 45 $ per nautical mile covered, which is around 38 % of the total fuel cost. Adding a distance of up to 236 nautical miles to the journey is thus worthwhile for the ship, if this allows refueling with LNG. This would allow the ship to travel the additional 98 nautical miles to reach the Klaipeda LNG terminal, and still operate more cheaply than on LSMGO. An overview of three (3) such examples for different ship types is provided in Table 2.

Table 2. Overview of additional distance worth travelling for various ship types to bunker LNG

Ship type	Cruise speed [knots]	Cruise power [kW]	Route Distance [M]	Additional Distance [M]	Price MDO [$/MMBTU]	Price LNG [$/MMBTU]
Bulk carrier	14	14400	621	236	17.29	10.79
Car carrier	16.5	7618	270	103	17.29	10.79
Container ship	16	9992	810	308	17.29	10.79

The additional distances shown in Table 2 provide a simple indication of how closely spaced LNG terminals need to be in order to provide the critical LNG bunker location density necessary to make investing in LNG powered vessels advantageous for ship operators. The values given herein are similar to the recommendation of 400 km given for LNG maritime ports by the trans-European transport network (TEN-T) core network (EU Commission, 2013). The additional distance which a vessel is able to travel to reach an LNG terminal is strongly dependent on the price difference between SFMGO and LNG. In order to evaluate how the critical additional distance that a vessel can travel changes with bunker prices, a sensitivity analysis on SFMGO and LNG prices was conducted using a Monte Carlo Simulation (MCS) software. SFMGO and LNG prices were varied individually over 10000 trials. A normal distribution was assumed having a standard deviation of 25 % of the price values stated above. The results showed that even with these variations the additional distance worthwhile taking for the bulk carrier was above 150 nautical miles for 95 % of the cases, allowing the vessel to reach the port of Klaipeda.

Figure 2. **Distribution of "additional distance worth travelling for LNG" for a bulk carrier on a 621 M route**



[Figure generated by the authors]

The distance between the only two large scale LNG terminals in the BSR is that between Swinoujscie and Klaipeda is currently 262 nautical miles. This is within the range of distances observed in the examples shown in Table 2. Smaller scale LNG terminals currently already exist at the ports of Helsinki, Pori, Stockholm, Nynäshamn, Gothenburg, Hirtshals, Hov, Lysekil, and Fredrikstad. As the examples above showed, smaller scale LNG terminals will need to be more closely spaced in order to provide an economic incentive to owners of small vessels to operate on LNG, since smaller vessels typically cover smaller distances and are less likely to pass one of the major LNG bunker facilities on their way. For large scale commercial vessels sailing far beyond the BSR, the BSR entry paths of the Skagerrak, Kattegatt, the Great Belt, and the Øresund are strategically placed as LNG bunkering locations, since these vessels have to pass them on their way into the BSR. These areas already feature a number of LNG bunkering facilities, and there need to be several of them, in order to provide the necessary competition, given their privileged location at the entry to the BSR. To further assess the economic benefits from the ship-owners point of view, the payback period was calculated using one of the above vessel examples. Assuming that a large LNG tank was installed on the vessel, which would allow it to sail 31075 nautical miles on LNG, and assuming a specific LNG tank cost of

2500 $/m³, a total cost for the LNG engine and fuel systems of 3.2 M$, a total cost for the LNG propulsion system amounted to around 32 M$.

Figure 3. **Payback period for LNG installation on new ship**

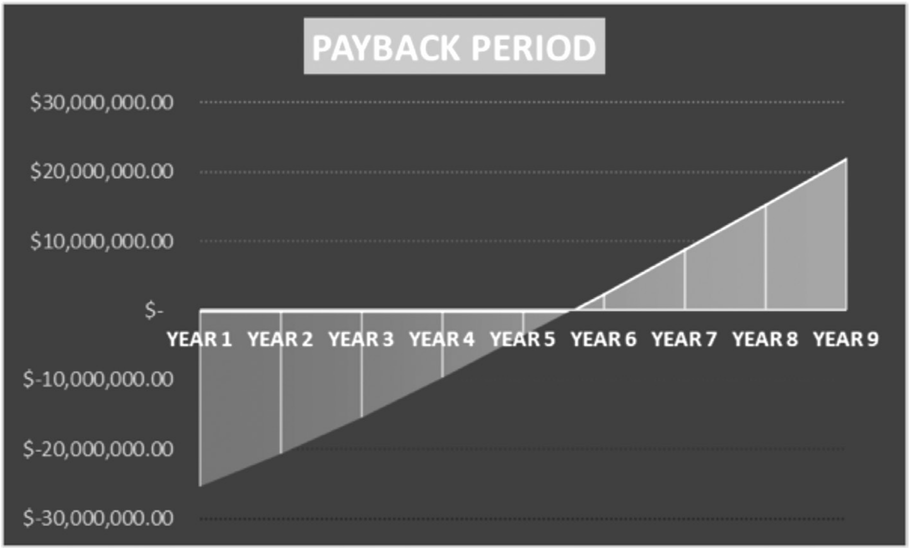


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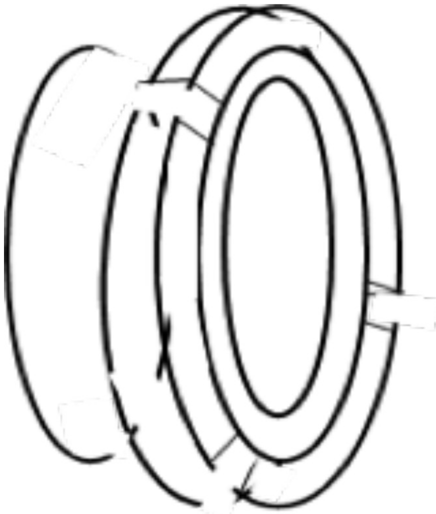
Figure 3 demonstrates that the payback period for such an LNG powered vessel would be around 5.6 years, assuming a net discount rate of 0.45. The payback period can be reduced significantly if the tank capacity is reduced. If the tank capacity is reduced to only accommodate the LNG capacity for one round trip of 621 nautical miles, the payback period is reduced to under one year. This highlights the economic benefits of sufficient LNG bunker infrastructure for vessel owners.

Salient technical aspects of LNG bunkering infrastructure

The low storage temperature of LNG of around 77 K (-196° C) or below at atmospheric pressure, means that it has to be contained by materials withstanding these conditions. The commonly used structural material carbon steel with its Body Centered Cubic (BCC) crystal structure becomes brittle at such low temperatures, and more ductile materials with Face Centered Cubic (FCC) crystal structure, such as austenitic steels containing 12 % chromium or 9 % nickel should be used (Kim et al. 2015).

Figure 4. **LNG refueling connector**



[Figure generated by the authors]

LNG is stored around atmospheric pressure, but pumping of the fluid will require pressure differentials in order to transport the LNG between facilities. The minimum pressures necessary for pumping can be calculated using the dynamic pressure of the fuel when pumping at the minimum speed necessary. Current proposals at the EU Commission have been quoted at 350 m3/h, and a maximum flow speed of 10 m/s. Assuming an LNG density of 470 kg/m3 (IMO Maritime Safety Committee, 2014), a simplified application of Bernoulli's equation, yields a dynamic pressure 24 kPa as per equation 1.

$$P_{dynamic} = {}^{1}/_{2} \cdot \rho \cdot u^2 = 24\ kPa \quad (1)$$

To this initial estimate of pressure should be added reasonable estimates for static pressure that could result from a pressure head building up within the tank. Assuming a maximum tank height h of 25 m, and a gravitational acceleration g of 9.81 m/s2 the maximum static pressure would be estimated as 115 kPa according to equation 2.

$$P_{static} = \rho \cdot \mathrm{g} \cdot \mathrm{h} = 115\ kPa \quad (2)$$

The minimum total pressure for refueling equipment would thus be:

$$P_{total} = P_{dynamic} + P_{static} = 24\ kPa + 115\ kPa = 139\ kPa \quad (3)$$

In addition to the above considerations, refueling equipment should be able to withstand the dynamic pressure fluctuations induced in the pipe during pump upstarts and valve closures. The resulting maximum pressure during such acceleration or decelerations of the fluid may be calculated from first principles using equations 4 and 5. Assuming that the length of the pipe may be up to 50 m, and that the acceleration of 20 m/s accelerates from rest to full flow velocity within 0.5 s, this yields a pressure of:

$$F = m \cdot a = P_{acceleration} \cdot A \quad (4)$$

$$P_{acceleration} = \frac{m \cdot a}{A} = \rho \cdot l \cdot a = 470\ kPa \quad (5)$$

The maximum pressure is thus:

$$P_{max} = P_{total} + P_{acceleration} = 139\ kPa + 470\ kPa = 609\ kPa \quad (6)$$

A safety factor should be applied to the above value to accommodate deviation from the above conditions. Given the large impact of failure of the refueling equipment, a safety factor of around 5 may seem reasonable, thus resulting in a pressure resistance to around 3 MPa.

In addition to the above specifications for temperature and pressure, dimensions should be specified to keep refueling times at a reasonable level. The refuelling time can be calculated using the relation between tank volume, refueling flowrate and time in equation 7.

$$Q = \frac{\mathrm{V}_{tank}}{t} = \frac{1950\ m^3}{3h} = 650\ {m^3}/{h} \quad (7)$$

If the LNG velocity should be limited to say 10 m/s, then the diameter of the refueling hose can be calculated using equation 7:

$$D_{hose} = 2\sqrt{\frac{\mathrm{Q}}{u_{max.}}} = 2\sqrt{\frac{650\ {m^3}/{h}}{10\ m/s}} = 0.27\ m \quad (7)$$

A typical hose size of 0.27 m diameter can thus be recommended to fulfil the above requirements. Before moving to a different direction, it is useful to note that an LNG refueling system should consist of a minimum of two pipes: one pipe to carry the LNG in the direction of the LNG flow, and one pipe to carry the gas vapor in the opposite direction, in order to avoid significant pressures building up in the tanks (Swedish Marine Technology Forum, 2013). Additionally, an “earthing” cable needs to be present to safely earth LNG ship and bunkering facility prior to connection. Dry break-away couplings should be used in order to avoid leakage of LNG in emergency situations in which the LNG refueling pipe is ruptured (Swedish Marine Technology Forum, 2013).

The "Go LNG" project

A strategy for the LNG infrastructure requirements is being developed as part of the EU funded "Go LNG" project (http://www.golng.eu/). Aim of the project is to bring together stakeholders from the BSR region to develop LNG infrastructure, business models, research and education and to provide an LNG developments strategy that can further the aims of the EU Clean Fuel Strategy and the Directive on the Deployment of Alternative Fuels (EU Parliament and Council, 2014). As part of this work, a Blue Corridor Strategy is being developed to support the development of a maritime transport corridor in the BSR (Madjidian et al., 2018). This strategy takes into consideration the "TEN-T Core Network and "Motorways of the Sea" concepts (EU Commission, 2013) to develop an efficient transport network making use of several modes of transport. Under the EU Commission plans, a North Sea - Baltic Core Network Corridor will be established, connecting the Baltic sea ports of Tallinn, Riga, Ventspils, Klaipeda. The establishment of LNG bunkering facilities for sea ports forms part of the TEN-T Core Network strategy.

Summary and Conclusion

LNG is one of several possible options for ships in the BSR to be able to meet the requirements Emissions Control Area (ECA) under the International Convention for the Prevention of Pollution from Ships (MARPOL). It is likely to be an environmentally and economically attractive option, since scrubbers have considerable environmental impact, and LSMGO is likely to be expensive. LNG has the added advantage of reducing CO_2 emissions with respect to LSMGO, yet caution is warranted not to reduce or efface this advantage by the release of methane, either through excessive methane slip, accidents or purging as part of the vessel's operational procedures. Yet, for the deployment of LNG to be successful in the short and medium terms, a critical amount of LNG infrastructure needs to be established to warrant environmental and economic benefits. Thus, the distance in between LNG bunkering facilities should not exceed a critical distance. This distance depends on the CO_2 advantage of LNG, as well as its economic benefits, and thereby the LNG and LSMGO bunker prices. It is also important that technical standards for LNG bunkering are established as soon as possible under the IGF code, in order to facilitate safe LNG technology and compatible standards.

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Partie II

Strategy & Perspective

Chapitre 7

Connecter l'espace baltique : enjeux et perspectives

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Biographie

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Ses thèmes de recherche actuels sont centrés sur trois axes principaux : le transport maritime en mer Baltique, des travaux sur l'axe Seine via l'angle de l'adaptation des acteurs de l'économie maritime, portuaire et logistique aux aléas de la mondialisation et des travaux plus globaux consacrés au transport maritime notamment en lien avec l'utilisation de technologies modernes dans le monde maritime (AIS, GNL) et avec des publications à vocation pédagogique (préparation à l'agrégation).

Introduction

Malgré une situation en cul-de-sac et une fermeture par les détroits danois qui la laissent à l'écart des grandes routes maritimes qui desservent les ports ouest-européens (Serry, 2017a), la mer Baltique supporte plus de 8 % du trafic maritime international (Ojala L., 2016). Caractérisée par sa vitalité et un vif taux de croissance de son trafic maritime depuis près de vingt ans, elle doit tout de même faire face à de nouveaux défis. Ceux-ci sont multiples : aussi bien d'ordre géopolitique car nulle part ailleurs en Europe, il n'y a eu, ces dernières années, autant de mutations politiques et économiques, que d'ordre économique puisque la mer est encore synonyme de discontinuités entre ses rives, ou encore d'ordre environnemental pour cette mer très impactée par les activités humaines (terrestres et/ou maritimes) et très sensible aux conséquences du réchauffement climatique.

Les enjeux maritimes et portuaires sont eux aussi variés, dépassant la simple insertion d'un système de transport dans l'organisation maritime mondialisée. En effet, la Russie et le premier marché régional avec près de 30 % du trafic maritime régional et les aspirations russes à s'affranchir de l'utilisation de ports de pays tiers (surtout baltes) se matérialisent par le déploiement de nouveaux ports (en eau profonde), tout comme par la restructuration des réseaux terrestres notamment ferroviaires et de conduites.

Si les flux sont panachés, allant de certains vracs secs comme le charbon ou les engrais aux produits manufacturés conteneurisés, ils concernent en premier lieu le pétrole. Pour répondre à l'augmentation continue (malgré quelques soubresauts conjoncturels) de la demande, de nouvelles capacités ferroviaires sont développées entre les ports du nord-ouest et l'extrême orient russe. Se pose ainsi la question de la mise en relation (ou pas) des ports de la Baltique avec les projets ferroviaires eurasiatiques. Une des alternatives à la route royale est le transport ferroviaire (Serry, 2012). Si le développement d'une route alternative entre l'Europe et l'Asie semble à la fois stratégique (Alix, 2017a), vitale mais aussi complexe, elle mérite d'être étudiée et discutée, spécialement au regard du positionnement de la Baltique à son égard.

En gardant ces éléments en mémoire, ce chapitre se propose donc, dans une première partie, de caractériser cette région maritime encore méconnue avant, dans un second temps, d'interroger les réseaux maritimes régionaux. Enfin, une troisième partie s'intéressera sur le positionnement des ports baltiques face aux potentielles alternatives, notamment eurasiatiques.

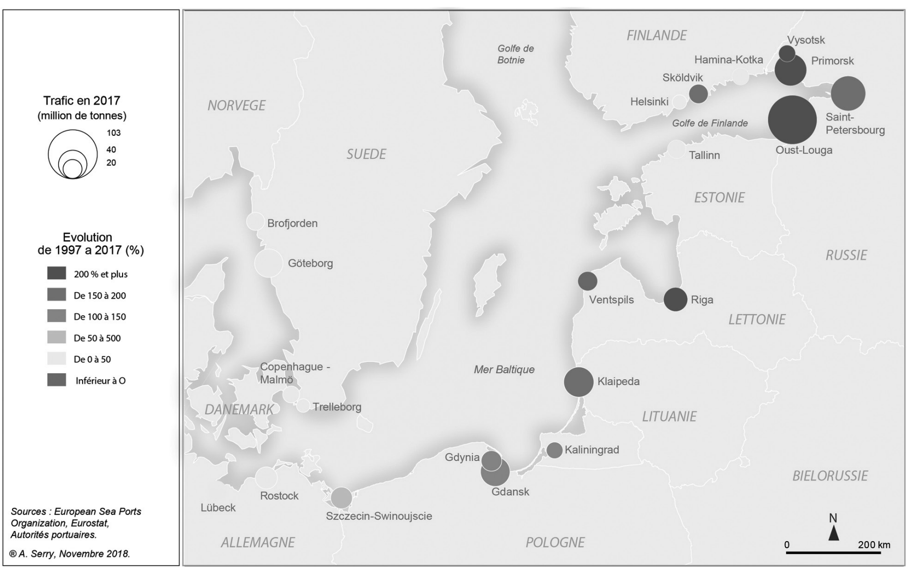
Une mer secondaire marquee par la croissance et la modernisation

Le retour de la Baltique dans le jeu maritime global

Le début des années 1990 constitue une période charnière pour l'espace baltique et appelle une croissance continue et vigoureuse du trafic maritime parallèlement à une intense modernisation portuaire. Ce dynamisme fait régulièrement appel au souvenir de la Hanse et à la tradition commerçante des villes portuaires régionales. Ces villes baltiques répondent au modèle de la ville moyenne portuaire, qui était déjà celui de la cité hanséatique au Moyen Âge. Ainsi, pour des raisons politiques, sociales et historiques, la Baltique est dominée par des ports municipaux et des ports sous tutelle des Etats (Mickiene, Valioniene, 2017).

Au début du XXIe siècle, la croissance est partagée par la majorité de la communauté portuaire baltique, aussi bien scandinaves, baltes que russes (Cf. Fig.1). Le trafic global en mer Baltique a ainsi doublé de 1997 à 2017 passant de 420 millions de tonnes (Mt) à près de 800 Mt, alors que dans le même temps la croissance du trafic maritime mondial, bien que rapide, n'était que d'environ 65%.

Figure 1. Ports de plus de 10 millions de tonnes de trafic en 2017

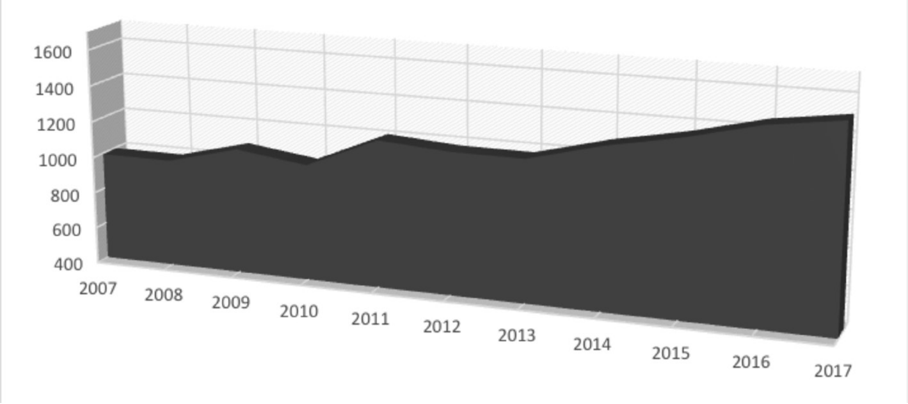


Cette augmentation est principalement le fruit de trois moteurs fondamentaux : la croissance économique mondiale ; les intenses mutations géopolitiques de la région ; l'insuffisante capacité portuaire de la Russie d'abord pour ses croissantes exportations de matières premières, puis pour l'approvisionnement de son marché de consommation.

Désormais, les ports russes de Saint-Pétersbourg et d'Oust-Louga sont les plus grands de la région. Les ambitions pour Oust-Louga sont importantes, les investissements omniprésents ce qui en fait déjà le leader régional en terme de volume total avec 103 millions de tonnes en 2017. Ils sont révélateurs de la mise en œuvre de la politique d'aménagement stratégique du littoral de la Baltique russe dans une logique de « nationalisation » des trafics entrants et sortants de la Russie, sans passer par les ports voisins étrangers.

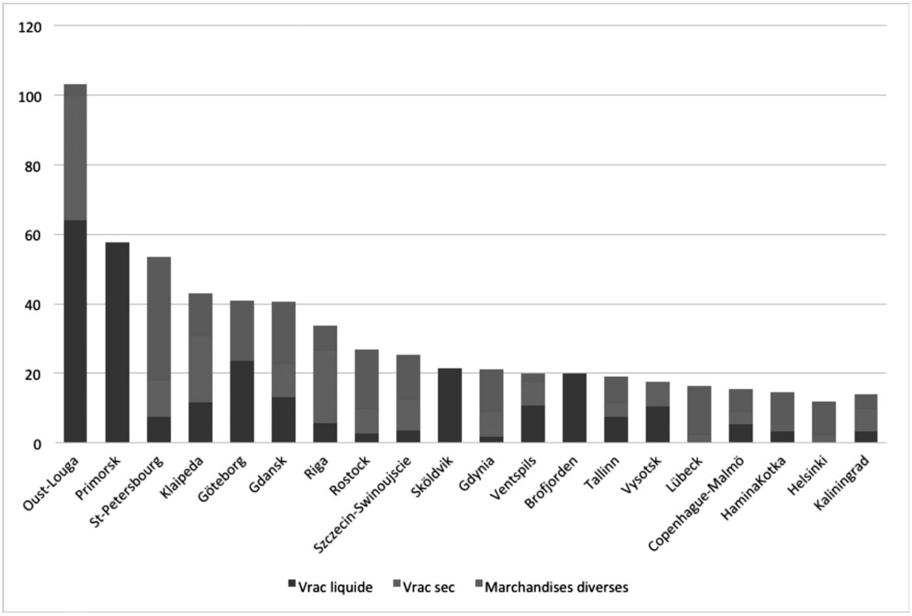
Toute proportion gardée avec le gigantisme maritime contemporain, cette croissance prend également la forme d'un accroissement de la taille des navires croisant dans les eaux baltiques (Cf. Fig.2).

Figure 2. Evolution de la taille des porte-conteneurs dans le port de Klaipeda (En EVP)



Simultanément à la croissance globale du trafic, les flux maritimes régionaux ont connu une redistribution catégorielle au profit des hydrocarbures et du conteneur qui constituent désormais l'essentiel des tonnages manutentionnés (cf. Fig.3).

Figure 3. **Structure du trafic des 20 premiers ports en 2017 (millions de tonnes)**



Pour synthétiser, les connexions maritimes baltiques peuvent être divisée en trois catégories de routes :

- les liaisons maritimes par *tramping* ; principalement dédiées aux vracs russes, qui mettent la Baltique en lien direct avec des ports outre marins ;
- les navettes conteneurisées reliant les ports de la Baltique avec les ports majeurs de l'Europe de l'Ouest, puis par transbordement au reste du monde (Serry, Lévêque, 2016) ;
- les routes intrabaltiques dominées par les liaisons entre les ports nordiques (Helsinki, Stockholm) et les ports occidentaux, c'est-à-dire danois (Copenhague) et allemands (Lübeck, Kiel), de la région. Déjà en 1998, l'activité de cabotage intra-baltique représentait près de la moitié du trafic portuaire et expliquait l'activité de nombreux ports le long des côtes.

Les hydrocarbures au cœur des circulations (maritimes)

Les vracs liquides, parmi lesquels les hydrocarbures, occupent une place dominante dans les flux à l'exportation (Est-Ouest), principalement dans les ports de la Baltique orientale. Ceux-ci, principalement le pétrole brut et désormais le gaz naturel, représentent un enjeu particulier en raison des fortes relations d'interdépendance existant notamment entre l'Union Européenne et la Russie dans ce domaine.

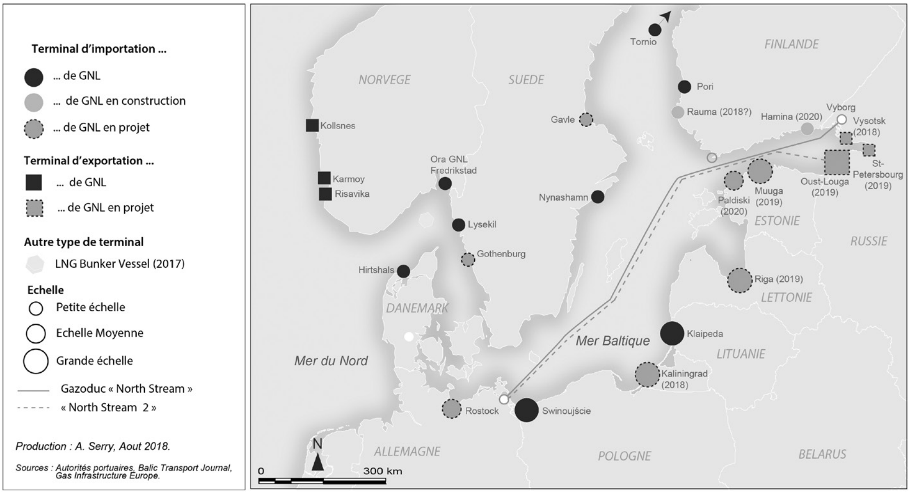
Le système de transport des hydrocarbures russes a progressivement glissé d'une complémentarité imposée par les héritages historiques à une concurrence féroce et à une différentiation du rôle des ports.

En effet, après avoir profité aux ports baltes, ces flux se sont recentrés sur les ports russes, principalement Primorsk et Oust-Louga. Les ports baltes (Tallinn, Ventspils et dans une moindre mesure Klaipeda) ont de plus en plus de difficultés à capter ces trafics car le pouvoir politique russe ne cesse d'œuvrer pour parvenir à cette autosuffisance portuaire. Désormais, le pétrole russe est en grande majorité exporté par les ports russes de la mer Baltique ce qui matérialise une politique de développement portuaire basée sur l'argument « stratégique » d'un contrôle national des flux énergétiques via des infrastructures sur le territoire russe. Cette ambition unilatérale et politique met en perspective le rôle essentiel des interfaces portuaires dans l'insertion des économies nationales (russe en l'occurrence) dans les chaines de valeur mondiales et les sillons maritimes dominants. Toutefois, il convient de noter que de nombreuses sociétés russes, tant locales que relayant des capitaux de Russie continuent à prendre des parts importantes dans divers secteurs économiques. Par exemple, la compagnie russe *Global Ports* a investi plus de 500 millions d'euros en Estonie en 2014 via ses deux filiales *Vopak E.O.S. AS* et *Global Trans Spacecom* principalement dans les terminaux pétroliers de Muuga. La compagnie est également présente dans les ports de Kotka et Helsinki.

De plus, si les flux d'hydrocarbures constituent par ailleurs des trafics importants dans certains ports scandinaves comme Brofjorden, c'est principalement à l'importation pour répondre aux besoins nationaux de la Suède et de la Finlande. Il y a donc une évidente dichotomie entre des ports nordiques qui sont des ports de marché, principalement d'importation, supportant des flux ouest-est et des ports russes et baltes à vocation mondiale exportant des flux de pétrole d'est en ouest.

En Baltique, le cas du Gaz Naturel Liquéfié (GNL), à la croisée d'enjeux économiques et géostratégiques est particulièrement intéressant. La logistique du GNL en Europe est largement tributaire des connexions aux réseaux de gazoducs. Cette géographie des conduites explique d'ailleurs en partie la dépendance balte à l'égard des livraisons gazières russes. Pour cette raison, les ports de la baltique orientale montrent un intérêt accru pour les installations dédiées au GNL. Le premier terminal est devenu opérationnel fin 2014 à Klaipeda (Cf. Fig.4). Ce terminal, symboliquement baptisé *Indépendance*, a pour objectif de diminuer la dépendance énergétique à l'égard de la Russie et d'accroître la diversification de l'approvisionnement en gaz de la Lituanie, voire de ses voisins lettons et polonais. Les crises énergétiques récurrentes entre l'UE et la Russie ont particulièrement pesé sur cette volonté de diversification (Serry, 2017b).

Figure 4. Développement du GNL en Baltique en 2018



Par ailleurs, depuis le 1er janvier 2015, la mer Baltique est une zone classée SECA (Sulphur Emissions Control Area). Les navires ne peuvent plus y utiliser de carburant dont le contenu en soufre excède les 0,1%. L'intérêt pour le GNL en mer Baltique est donc accru par sa capacité à servir comme combustible marin conforme aux dernières réglementations. Ainsi, les premiers ferries propulsés au GNL ont été mis en service en mer Baltique dès 2013. L'annonce stratégique du groupe CMA-CGM de propulser ses futurs porte-conteneurs de 22 000 EVP au GNL marque un tournant historique pour les ports mondiaux même si ces géants connecteront une vingtaine de ports entre la Chine et l'Europe. En effet, cela signifie que si le GNL est retenu pour propulser efficacement des 22 000 EVP, alors toute une flotte largement plus pléthorique pourrait suivre, faisant alors des ports déjà équipés au GNL de sérieux outsiders et posant la question de savoir si des navires pourraient restructurer leurs rotations en fonction du soutage en GNL. Or, la Baltique portuaire est certainement le territoire mondial le plus avancée en la matière. Par exemple, *Skangas* a lancé à l'été 2017 un navire de soutage en GNL, *Coralius* (Ice Class 1A), qui permet aux bateaux à propulsion GNL de s'approvisionner à l'entrée des détroits danois.

De plus, la question des flux de GNL interroge sur la mise en concurrence des ports baltiques avec d'autres ports ou d'autres modes de transport comme l'illustre le cas de Nord Stream 2, projet de doublement du gazoduc Nord Stream qui, depuis 2012, relie la Russie à l'Allemagne via la mer Baltique. Le projet a été porté par une compagnie mixte présidée par l'ancien chancelier allemand Gerhard Schröder (Gazprom y détient 51% des actions, Wintershall et E.ON 15,5 %, Nederlandse et GDF 9%). Courant sous la mer Baltique sur 1220 km, doté comme le Nord Stream 1 d'une capacité de 55 milliards de m^3 de gaz par an, le Nord Stream 2 vient de voir signer un accord de financement entre les entreprises Wintershall, Uniper (Allemagne), Royal Dutch Shell (Royaume-

Uni/Pays-Bas), OMV (Autriche) et Engie (France). Il devait voir sa construction lancée en 2018 et s'achever, officiellement, fin 2019 (Bayou, 2017), mais les oppositions de certains États riverains laissent planer le doute sur sa réalisation. Le gazoduc *Nordstream* illustre cette volonté russe de s'émanciper des ports de la Baltique. Cette question de la concurrence / compétition devrait également se poser face au développement des opportunités de navigation arctique.

La question des circulations énergétiques est donc essentielle dans la région tant au point de vue économique que politique. Celle-ci a souvent symbolisé les évolutions et exacerbé les tensions.

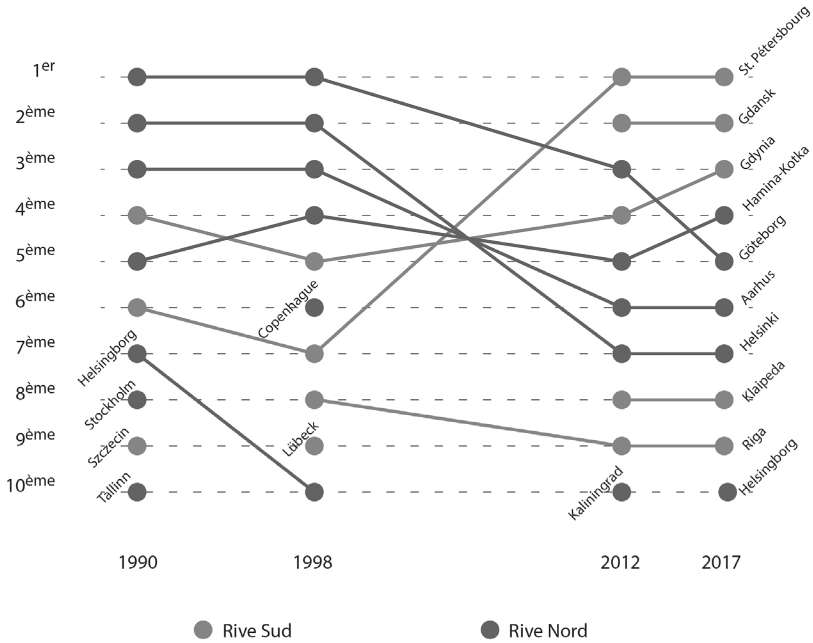
L'intégration dans les réseaux maritimes : feedering intra-européen et roulier régionalisé

En mer Baltique, le transport maritime et tout spécialement le transport multimodal conteneurisé, joue un rôle important comme élément constitutifs de la chaine globalisée mais aussi en raison des chaines de transport régionales (Daduna, Prause, 2016).

Croissance du trafic conteneurisé malgré de modestes potentialités

Dans la région, les besoins en marchandises générales diverses et manufacturées restent modestes, même si les rives orientales sont en progrès significatif (Guillaume, 2012). De ce fait, les « grands » ports à conteneurs y sont rares. D'autant plus que l'effet « cul-de-sac » limite l'opportunité commerciale et opérationnelle de rotations de grands navires. Ainsi, le trafic conteneurisé de Hamina-Kotka n'atteint que 690 000 EVP en 2017 et celui de Saint-Pétersbourg, leader régional, 1 920 000 EVP (Cf. Fig.5). Même le port à conteneur historique de la région, Göteborg n'atteint que 644 000 EVP.

Figure 5. Trafic des 20 premiers ports à conteneurs en 2017

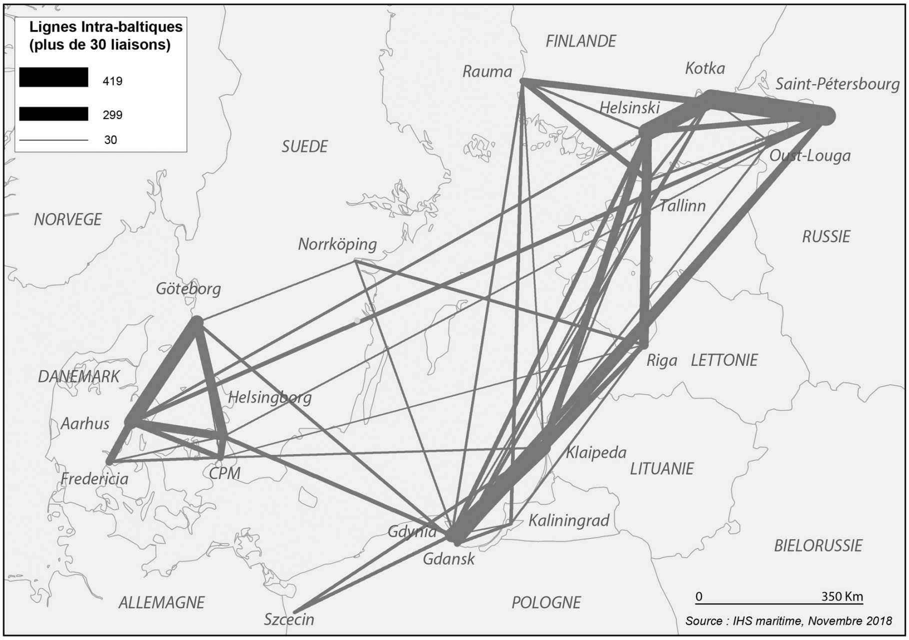


Source : European Seaport Organisation (ESPO), Autorités portuaires, 2018.

Les ports baltes, Klaipeda et Riga principalement, et certains ports sud-finlandais comme Hamina-Kotka assurent également une partie du transit conteneurisé vers la Russie. Le port de Klaipeda a bénéficié de nouveaux investissements dans le terminal *Smelte*, controlé par *Terminal Investment Limited* (fonfiliale de *Mediterranean Shiping Company*) depuis 2008 afin d'accroitre ses capacités et de moderniser ses outils et d'en faire un centre de distribution régional.

Parmi les principaux acteurs portuaires de la conteneurisation, nous retrouvons désormais les ports polonais de Gdansk et Gdynia, respectivement (1,5 million et 710 000 EVP en 2017). S'ils sont traditionnellement des ports d'hinterland pour le marché de la Pologne et d'Europe centrale, ils s'affirment désormais comme des ports de transbordement pour le trafic régional. De ce point de vue, Gdansk bénéficie des choix et des investissements de *Maersk* et du jeu des alliances maritimes pour s'imposer comme un pivot régional (Cf. Fig.6). Il y a désormais 4 terminaux à conteneurs dans la baie de Gdansk, dont 2 dans le port de Gdynia. Le plus important est le *Deepwater Container Terminal* (DCT). Toutefois, Saint-Pétersbourg, principale porte d'entrée de la Russie, domine toujours le réseau baltique. La morphologie du réseau conteneurisé régional est très clairement illustrée par la carte des dessertes conteneurisées en mer Baltique en 2015 (Cf. Fig.6).

Figure 6. **Les dessertes conteneurisées en mer Baltique en 2017**



Au sein du réseau conteneurisé, le golfe de Finlande et plus largement la Baltique orientale représentent deux zones particulièrement actives. Le déplacement du centre de gravité de l'espace baltique vers l'est semble une évidence au regard des réseaux maritimes.

Par ailleurs, l'analyse du trafic conteneurisé permet de distinguer trois types de ports majeurs dans la région :

- Les ports d'importance régionale traditionnelle comme Göteborg dont la localisation et la précoce ouverture aux marchandises conteneurisées expliquent l'importance contemporaine. Cela démontre combien les dimensions géographiques (physiques et socio-économiques) demeurent toujours prégnantes dans la réussite commerciale d'un port conteneurisé moderne. Ces ports Scandinaves entretiennent historiquement des liens économiques étroits avec l'Ouest de l'Europe, s'appuyant sur un dense réseau de services maritimes, rouliers ou conteneurisés, à travers et hors de la Baltique. Ils cependant fortement concurrencés par les ports émergents.
- Les ports de desserte nationale ou locale, essentiellement localisés sur la rive occidentale ou septentrionale de la Baltique. Leur trafic souvent modeste ne doit pas minimiser leur rôle surtout pour le Golfe de Botnie. Ces activités peuvent se comparer aux intensités maritimes et portuaires de la Mer de Chine orientale avec des connectivités maritimes essentielles dans le fonctionnement économique et sociétal des territoires éloignés (géographiquement et logistiquement). D'ailleurs, à l'instar de ce qui se

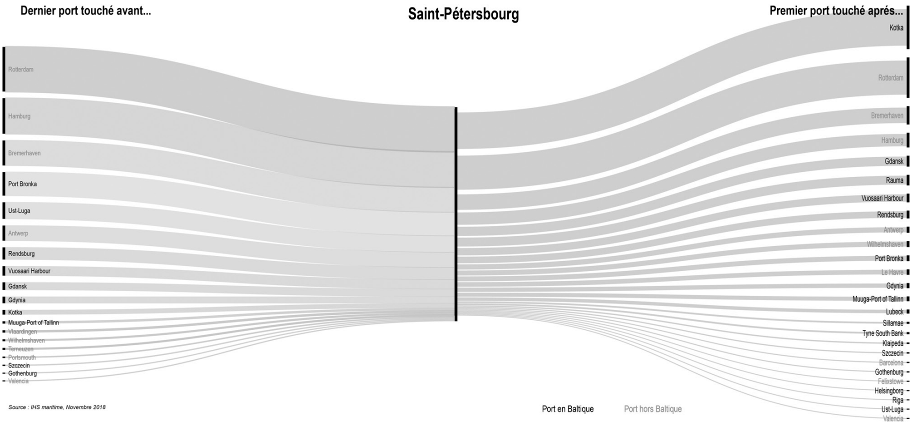
passe en Mer de Chine mais dans une magnitude incomparable, un chapelet d'opérateurs maritimes spécialisés maillent l'intra-baltique de relations à courte et moyenne distances nautiques.

- Les ports russes, baltes voire finnois et polonais interagissent dans un système de desserte d'un arrière-pays plus vaste englobant premièrement le monde russe ainsi qu'une partie de l'Europe centrale. Les marchandises sont diffusées à partir de cette région *gateway* dans un milieu différent et avec des modes différents. Cet essor est lié à la mise en service de nouvelles capacités portuaires, de Gdansk à Oust-Louga. En conséquence, nous assistons à une forme d'intensification concurrentielle avec des multichoix possibles de ports maritimes.

Nous observons clairement une distinction des activités maritimes et portuaires au sein de cette façade. Celle-ci est flagrante sur la rive orientale de la mer Baltique, où la mise en réseau des ports est évidente. Evidente également est la hiérarchisation comme l'illustre l'affirmation comme pivot régional du port de Gdansk qui affiche d'ores et déjà des ambitions de leadership régional. Elle apparait pareillement dans les détroits danois avec un réseau dense de liaisons intra-baltiques entre ports danois et suédois. Ces liaisons intrabaltiques utilisent notamment des navires rouliers et des ferries.

Concrètement, la mer Baltique est une façade maritime secondaire, desservie à partir des ports pivots européens via des services maritimes de moindre importance appelés « *feedering* ». Les relations directes avec des ports extérieurs à l'Union européenne y sont négligeables. Le cas de Saint-Pétersbourg est révélateur de cette situation (Cf. Fig.7) : les ports d'origine immédiate des navires y sont d'abord des ports de la rangée nord-européenne. Par ailleurs, les ports touchés après St-Pétersbourg sont plus nombreux et les flux moins concentrés illustrant son rôle de pivot dans le réseau baltique.

Figure 7. Insertion des ports baltiques dans les réseaux : l'exemple de Saint-Pétersbourg en 2018



Source : IHS maritime, Novembre 2018

Par conséquent, le *feedering* est devenu le fonds de commerce de nombreux ports et les plus grands opérateurs maritimes se positionnent sur la desserte de la Baltique, ce qui stimule une fois encore de nouvelles intensités concurrentielles. Le rachat mi-2018 de *Containerships* (Finlande) par *CMA-CGM* illustre clairement cet intérêt. La régionalisation baltique existe ainsi principalement via la concentration des liaisons maritimes sur les ports de Hambourg et Bremerhaven. En 2015, 88 % des ports conteneurs baltiques entretiennent au moins une liaison avec Hambourg. Hambourg est connu pour bénéficier de longue date d'un *wet transit* puisé dans le monde balte et scandinave (Weigend, 1956).

La rapide croissance des trafics conteneurisés du port de Hambourg, au cours des vingt dernières années (moins de 2 millions de boîtes EVP en 1990, 8,9 millions de boîtes EVP en 2016) est principalement due à la redécouverte des hinterlands traditionnels du port, suite à la réunification allemande et à la réintégration de l'Europe centrale et orientale à l'économie de marché. Selon les autorités hambourgeoises, 30% des conteneurs sont transbordés principalement à destination de la mer Baltique.

Les couts de transport apparaissent comme l'an des éléments explicatifs de cette domination hambourgeoise. Ainsi, en utilisant une méthode développée par Sevin (Sevin, 2011), nous pouvons comparer les coûts de transport au départ de Rotterdam ou Hambourg et à destination de certains ports baltes (voir tableau 1). Pour un navire un 1659 EVP de capacité (capacité moyenne des porte-conteneurs en 2017), deux solutions sont possibles pour relier la Baltique au nord-ouest européen : via les détroits danois ou en utilisant le canal de Kiel. Pour comparer ces deux solutions, nous avons intégré les droits de passage par le canal, ainsi que le temps de passage (environ 12 heures d'après les autorités).

Ainsi, nous avons calculé les dépenses suivantes :

- Les couts de transit via le canal (incluant les frais de pilotage) : 10 977 € ou 9714 $ (1€ = 1.13 $ en 2017) soit 5,86 $ par EVP (source : https://www.kiel-canal.de/).
- De plus, le temps de passage du canal estimé à 12 heures représente un supplément d'immobilisation du navire soit 13442,55 $ (source : AX - HAMBURG Index) ou 8,1 $ par EVP.
- Le cout total du passage par le canal de Kiel est donc de 13,96 $ par EVP.

Tableau 1. Comparaison des coûts de transport maritime en 2017 ($)

	Helsinki	Saint Pétersbourg	Gdansk	Klaipeda
Transit via le canal de Kiel				
Distance depuis Rotterdam	1162	1303	874	925
Cout par EVP (fonction de la distance)	80	90	60	64
Coût du canal (EVP)	13,96	13,96	13,96	13,96
Cout total par EVP	**94**	**104**	**74**	**78**
Distance depuis Hambourg	900	1041	434	487
Cout par EVP (fonction de la distance)	62	72	30	34
Coût du canal (EVP)	13,96	13,96	13,96	13,96
Cout total par EVP	**76**	**86**	**44**	**48**
Transit par les détroits danois				
Distance depuis Hambourg	1212	1377	870	905
Cout par EVP	**84**	**95**	**60**	**62**

Le tableau précédent illustre l'avantage économique du transbordement à Hambourg pour desservir la Baltique. Il montre aussi que lorsque c'est possible, le passage par le canal de Kiel est économiquement la plus intéressante solution économique : avec une économie de 8 $ par EVP.

Cette analyse éclaire également sur le nouveau rôle du port de Gdansk qui offre des avantages économiques, même si un port comme Göteborg offre le coût le plus bas pour ses connexions directes (28 $ par EVP depuis Hambourg). Mais son emplacement (à l'extérieur des détroits danois), assez loin des autres principaux ports à conteneurs de la région, constitue un handicap.

Des relations intrabaltiques portées par le roulier

Le transport roulier est amplement associé à la mer Baltique. En effet, l'image de la mer Baltique traversée par de nombreux ferries participe à l'idée très répandue d'unité régionale baltique liée au transport maritime (Cf. Fig.8). De fait, il complète et concurrence les services feeder pour l'acheminement des flux conteneurisés dans la région.

Figure 8. **Ferries dans le port de Lübeck - Travemünde**

En termes de fret, les premiers ports rouliers sont des ports de l'Öresund et du littoral allemand : Rostock (16 millions de tonnes en 2017), Lübeck/Travemünde (15 MT), Trelleborg (10 millions de tonnes), ou encore Göteborg (10 MT). Dans le domaine du transport de passagers, les premiers ports ferries *(ro-pax)* sont des ports du Golfe de Finlande, notamment Helsinki (12 millions de passagers) et Tallinn (9,9 millions de passagers) et des ports du détroit de l'Öresund comme Helsingborg (7,3 millions de passagers). D'un point de vue plus global, ro-ro et ro-pax confondus, les ports comptant le plus de lignes roulières sont les ports du golfe de Finlande, notamment Helsinki et Hamina-Kotka, Saint-Pétersbourg ou Hanko, et les ports du littoral allemand comme Travemünde/Lübeck.

Sur l'ensemble des lignes régulières empruntées par des rouliers en Baltique en 2015, seules 22 % reliaient des ports baltiques à des ports extra-baltiques, principalement des ports de la *Northern Range*, des ports anglais ou des ports norvégiens. Ces liaisons extra-baltiques sont particulièrement importantes au niveau des détroits danois (ports suédois, danois et allemands) ou dans les golfes de Finlande et de Botnie.

Parmi les liaisons intra-baltiques, de nombreuses lignes concernent des lignes locales notamment par des navires *ro-pax*. Trois zones sont particulièrement concernées : l'Öresund, le Golfe de Finlande et la Baltique méridionale. Au niveau de l'Øresund, les ports rouliers proposant une ou deux liaisons vers des ports voisins sont nombreux : Greena, Varberg, Puttgarden, Rødby. Les liaisons transnationales sont finalement peu nombreuses et concernent majoritairement des ports de la Baltique orientale (Klaipeda, Liepaja, Ventspils, Riga) ou des ports du littoral allemand comme Lübeck, Travemünde ou Kiel. De fait, les principales connexions transnationales relient majoritairement des ports allemands aux ports baltes ou du Golfe de Finlande selon une logique ouest-est.

Les politiques des armements participent à cette régionalisation. Par exemple, le second grand opérateur nordique, la société danoise DFDS a repris successivement *Lisco* (Lituanie) en 2001 et *Latline* (Lettonie) en 2003. *Scandlines*, déjà présente sur certaines lignes baltes, a repris par sa branche allemande l'activité fret de *Esco* (Estonie), devenue *Scandlines Estonia*. Ces armements passés sous contrôle danois ou allemand sont essentiellement positionnés sur des liaisons intra-baltiques de services mixtes ou fret.

Le cas du transport roulier est intéressant à titre prospectif car deux scénarios possibles se font face. Le premier est un scénario optimiste dans la perspective d'un objectif européen de report modal de la route vers les autres modes, notamment le transport maritime à courte distance. La densité du réseau actuel et le savoir-faire des acteurs régionaux positionnent le roulier comme un secteur potentiellement porteur. A contrario, se pose la question de la capacité du système de transport roulier baltique à faire face à la tendance européenne du tout routier, voire au développement de la concurrence ferroviaire.

D'ailleurs un constat simpose, celui de l'incapacité à exporter cette compétence baltique vers le reste du transport maritime de courte distance (TMCD) européen, à l'exception du développement de la compagnie danoise DFDS en mer du Nord et sur une liaison méditerranéenne entre Marseille et Tunis. L'auteur s'interroge sur cette absence de développement extra régional : est-elle le résultat d'un protectionnisme nationaliste ou l'expression d'un manque d'audace stratégique à venir se frotter sur des territoires économiques et logistiques nouveaux ?

Pour conclure, l'analyse réalisée dans cette partie illustre la multiscalarité des jeux maritimes et portuaires régionaux :

- Les flux conteneurisés participent à une connexion de l'espace baltique par des liens indirects qui impliquent une mise en réseau de la région via les ports ouest-européens.
- Les flux rouliers sont timidement d'échelle européenne et se définissent majoritairement comme des flux intra baltiques.

Nouvelles routes : atouts ou menaces pour la Baltique

La fonte des glaces dans l'océan Arctique ouvre de nouvelles perspectives à la circulation maritime entre l'Europe et l'Asie. La route maritime du Nord et les corridors terrestres empruntant les anciens tracés de la route de la soie pourraient compléter voire concurrencer les itinéraires existants.

Corridors terrestres et ponts ferroviaires euro-asiatiques

L'espace baltique fait aujourd'hui face à des enjeux se font jour à l'échelle eurasiatique. Certes, les différents projets ou itinéraires restent à définir clairement. Mais, les potentialités ferroviaires eurasiatiques intègrent désormais les stratégies portuaires baltiques. Des services existent déjà, des marchés s'entrouvrent, des opportunités apparaissent comme pour le Kazakhstan qui pourrait passer d'une situation malchanceuse d'enclave maritime à de chanceuses opportunités logistiques (Alix, 2017a). Capter une partie des flux engendrés par le programme transcontinental chinois de la Nouvelle route de la soie devient l'objectif de multiples acteurs comme l'illustre la signature en juin 2015 d'un accord entre la compagnie *KTZ Express*, filiale des chemins de fer kazakhes et le port lituanien de Klaipeda. La nouvelle route de la Soie ou *Obor*, pour “One Belt, One Road”, traduction littérale du nom chinois du projet, “Une ceinture (terrestre), une route (maritime)”, consiste à relier par de nouvelles infrastructures l'Asie, l'Europe et l'Afrique. Techniquement c'est la possibilité de relier la Chine à l'Europe par rail en 15 jours, soit plus rapidement que par la voie maritime. S'il s'agit pour le moment plus d'une vision géopolitique que d'une réalité économique, la question de l'intégration ou non des ports baltiques dans ce nouveau schéma circulatoire se pose. Les enjeux économiques pour une expansion de l'influence chinoise à l'ouest de ses frontières terrestres s'assument par l'accompagnement dans les infrastructures ferroviaires. L'ensemble constitue une pièce d'un puzzle géopolitique et géostratégique qui pourrait aboutir finalement à la délimitation progressive d'une aire de marché communautaire sous régionale.

De nombreux exemples confirment la pertinence logistique de telles routes à l'instar des services dédiés pour le constructeur automobile allemand *BMW* qui utilisent le lien exploité par *DB Schenker* pour envoyer des pièces automobiles de son usine de Leipzig à destination de son usine d'assemblage chinoise de Shenyang. Les transit times (entre 21 et 23 jours) et la flexibilité (une rotation par jour) permettent une logistique à stocks réduits avec un lien ferroviaire de 11 000 kilomètres sans rupture de charge à part aux passages frontaliers avec les écartements de voies et changements de matériels de traction. Au-delà du raccourcissement des délais de transport, ce sont l'élimination des kilomètres routiers depuis les ports maritimes allemands et chinois qui apparaissent décisifs dans la gestion des opérations (Alix & Daudet, 2015). Dans le déploiement logistique des ponts terrestres ferroviaires, la Russie reste totalement incontournable. Son territoire est emprunté, ses infrastructures utilisées et ses services engagés dans des schémas de coopération avec les autres prestataires. Moscou, mais aussi Astana pour le pourtour politique du Kazakhstan ou Ankara pour sa position géostratégique centrale entre les marchés européens et moyen-orientaux, jonglent entre intérêts particuliers et partenariats stratégiques avec le richissime pouvoir central de Beijing (Alix & Daudet, 2015).

La question de l'insertion des ports de la baltiques dans des corridors de transport eurasiatiques est en réalité multiscalaire. Les ports de la Baltique sont également des portes d'entrée potentielles vers les pays enclavés comme la Biélorussie et ceux d'Asie centrale. Le train-bloc *Viking*, navette acheminant les conteneurs sans remaniement intermédiaire, relie depuis 2003 le port de Klaipeda (Cf. Fig.9) à Odessa via Minsk. L'ouverture du *Baltic Transit* la même année a parallèlement permis d'atteindre l'Asie centrale - Almaty (Kazakstan) en 12 jours, Tachkent (Ouzbékistan) en 13 - depuis Riga, avec correspondance possible vers la Chine.

Figure 9. Terminal et train de conteneurs dans le port de Klaipeda

Ces nouveaux corridors de transport ont été établis grâce à des réseaux institutionnels associant autorités portuaires, acteurs municipaux et entreprises. D'abord considérés comme des opportunités de développement accru, ils se présentent aujourd'hui comme des alternatives au recul du transit russe dans les ports baltes.

Depuis 2013 par exemple, un train relie Chengdu en Chine à Lodz en Pologne, transportant des marchandises pour l'Europe en onze jours, contre au moins quarante jours par la voie maritime. En 2016, une liaison directe a été instaurée entre la ville chinoise de Yiwu et Riga, la capitale lettone, via la Russie (11 066 kilomètres en 12 jours). Le 10 novembre 2017, un premier train a relié la ville chinoise de Xi'an à Kouvola en Finlande : cette connexion ferroviaire implique les 2 municipalités et des partenaires sur l'ensemble du parcours en Russie et au Kazakhstan *(KZT Express)*. Il est encore aujourd'hui difficile de considérer le développement potentiel de ces ponts continentaux comme une menace ou une opportunité pour les ports de la région. Les projets se multiplient (Cf. Fig.10) comme le montre l'ouverture par *Gefco* en collaboration avec la société russe *Transcontainer*, d'une nouvelle route multimodale connectant l'Allemagne et la Chine via Riga (le premier train constitué de 52 conteneurs de 40 EVP est parti de Riga le 8 mai 2017). De plus, portuaires et logisticiens ne sont pas les seuls à agir dans le cadre de ces liasions eurasiatiques. Depuis 2014, le plan kazakh *Nurly Zhol* (9 milliards de dollars) vise à développer et moderniser les systèmes de transport et à promouvoir des débouchés maritimes aux périphéries russes (Alix, 2017b). En septembre, *Islamic Republic of Iran Shipping Lines* (IRISL) et la compagnie ferroviaire publique kazakhe KTZ Express ont ainsi créé une joint-venture pour connecter l'Asie centrale et le sud de l'Iran. Les Kazakhs estiment vitale la diversification des connexions stratégiques de leur territoire enclavé aux différentes façades maritimes. L'espace Baltique, à l'instar du traitement vis-à-vis de la Mer Noire ou de l'Océan indien, constitue une «porte de sorties» sur laquelle les potentiels énergétiques et agro-business Kazakhs pourraient s'appuyer. La captation de valeur logistique ajoutée sur le marché national Kazakh constitue une autre dimension de la connectivité encouragée dans *Nurly Zhol*.

La question de l'intégration des ports régionaux dans les corridors se pose également à l'échelle européenne afin de connecter entre autres l'espace économique baltique à celui de la Mer Noire avec l'ambition des artères terrestres (routières et ferroviaires) pour intensifier les trafics sur ce corridor périphérique de l'Europe communautaire. Les ports du littoral sud de la Baltique se trouvent souvent à l'embouchure de grands fleuves dont la plupart ont connu une intense industrialisation : Ems, Weser, Elbe, Oder, Vistule. Aujourd'hui ces axes sont utilisés dans le cadre de corridors institutionnalisés ou de corridors de projet. La plupart sont financés par des fonds européens régionaux comme INTERREG et certains reprennent un tracé similaire à ceux des réseaux de transport transeuropéens. Ces corridors facilitent les coopérations entre villes à l'échelle de l'Europe et permettent le financement d'infrastructures. Les ports du littoral polonais comme Gdansk et Gdynia ont longtemps constitué la porte de sortie des produits industriels acheminés par les axes Varsovie/Gdansk et surtout Lodz/Gdansk. L'Allemagne du nord se situe au centre de deux voies alternatives : la voie du Fehmarn via Hambourg et Puttgarden et un projet de corridor passant par Rostock nommé SCANDRIA. Ce corridor est résolument tourné vers une connexion Baltique-Adriatique via le port de Trieste qui a multiplié ces dernières années l'ouverture de liaisons vers l'Asie. Le cas de l'opérateur multimodal turc *EKOL* est symptomatique de ces organisations de transport sur les sillons existants organisés entre la Baltique et l'Adriatique. *EKOL* utilise Trieste pour établir des prestations multimodales intégrées entre la Turquie, Trieste, l'Europe de l'Ouest et finalement l'Europe du Nord et la Baltique. Le tout se veut écologique et vertueux puisque les remorques routières sont dorénavant convoyées sur des trains-blocs sur les corridors de fret transeuropéens. Le projet peut utiliser des infrastructures existantes puisque l'itinéraire retenu reprend les principales lignes ferroviaires du COMECON, notamment l'axe Copenhague-Berlin-Prague-Bucarest-mer Noire. Le corridor mer du Nord-mer Baltique relie les ports de la côte orientale de la mer Baltique aux ports de la mer du Nord, de la Finlande à l'Estonie par ferry et via des axes autoroutiers et ferroviaires (Rail Baltica) entre les trois États Baltes, d'un côté, et la Pologne, l'Allemagne, les Pays-Bas et la Belgique, de l'autre.

La route du nord, mythes et réalités baltiques

Le réchauffement climatique laisse entrevoir le développement d'une nouvelle route maritime d'importance. Ce passage du Nord-Est permet de relier l'océan atlantique à l'océan pacifique et constitue le plus court chemin entre l'Europe et l'Asie. Ainsi, les réflexions sur une possible concurrence de la route du nord et des ports arctiques russes est régulièrement évoquée. Cependant, la réalité est beaucoup plus nuancée, la rentabilité escomptée de cette route est discutée et les possibilités de gain en distance et en coût du transit sont loin de convaincre de nombreux transporteurs maritimes (Lasserre, 2011). En dépit de la fonte de la banquise, dès que le marché est un peu mieux saisi par les entreprises maritimes, les routes arctiques ne sont pas perçues comme proposant un fort potentiel commercial pour le transit : dans les stratégies des entreprises. *« L'unique perspective d'utiliser des vraquiers sur des routes arctiques […], c'est d'aller charger dans des ports arctiques la production locale ».* Cette remarque, relevée à l'occasion d'un entretien avec un responsable du transporteur maritime Louis Dreyfus en 2010, vient nuancer les propos largement relayés par les médias qui voudraient que « des routes mythiques émergent des glaces » (Doyon, 2016).

De fait, ce développement est encore timide. Le trafic arctique semble effectivement augmenter, mais ce n'est ni une explosion, ni une circulation de transit, mais bien de destination. Une stagnation du trafic de transit par la route maritime du Nord a même été observée, ce qui s'inscrit en décalage par rapport aux prévisions des médias annonçant l'avènement d'un fort trafic par les routes arctiques. Ce sont surtout la desserte des communautés locales et le trafic lié à l'exploitation des ressources naturelles qui constituent le moteur de cette croissance. Le segment du vrac demeure circonspect, tandis que le segment du conteneur se désintéresse des routes arctiques. En effet, pour qu'une telle route maritime soit rentable, elle nécessiterait des escales intermédiaires comme celles proposées dans le détroit de Malacca, à Dubaï ou en Méditerranée. Ceci n'est pour l'instant pas le cas et une telle perspective semble peu vraisemblable. Les relations tissées entre l'Etat et les grandes entreprises nationales, le premier soutenant le développement des secondes et celles-ci participant à la stratégie de grande puissance adoptée par le gouvernement, peuvent néanmoins avoir pour conséquence d'engendrer une nouvelle dynamique des régions arctiques et de la route maritime du Nord (Thorez, 2008). Le port de Mourmansk, libre de glaces toute l'année, y a supplanté celui d'Arkhangelsk, premier port choisi comme tête de la Route maritime du Nord. Un terminal minéralier apte à traiter des navires vraquiers de plus de cent mille tonnes de port en lourd a été ouvert. Le port historique d'Arkhangelsk, en mer Blanche, est pris par les glaces en hiver, mais joue encore un rôle pour les exportations de bois (Thorez, 2016).

Le développement de l'arctique est dépendant de la logistique de l'arctique qui sera largement basée sur le transport maritime. Pour que le shipping y soit compétitif, il doit fonctionner à la fois comme un corridor de transport vers l'extérieur et comme une alternative à la route traditionnelle entre l'Est et l'Ouest. Son succès requerra une approche holistique et une coopération par-delà les frontières de l'arctique, notamment pour développer les infrastructures indispensables afin de renforcer le potentiel économique de la route maritime du nord (Tschudi, 2016). Les ambitions de la Russie de maitriser la Route du Nord et d'en faire un élément moteur du développement de ses régions arctiques, vont devoir affronter des défis avant tout économiques. L'avenir de la Route du Nord et de ses ports dépendra en grande partie de l'état des finances publiques et des sommes que les grandes firmes russes pourront réinvestir dans les infrastructures arctiques, donc, *in fine*, des prix mondiaux des matières premières, sur lesquels la Russie n'a pas de prise (Laruelle, 2016). Par contre, l'accès facilité aux ports russes de la mer de Barents, de la mer Blanche voire de la mer de Kara peut à moyen terme renforcer la concurrence à l'égard des ports baltiques, notamment pour les exportations de matières premières, surtout d'hydrocarbures. Toutefois, ces craintes peuvent-être relativisée par la réorientation de certaines routes d'exportation des matières premières, notamment le gaz naturel avec l'ouverture du terminal russe d'Ust-Luga sur la mer Baltique, acheminant les volumes jusqu'alors expédiés via Vitino en mer Blanche (Pettersen, 2014).

Conclusion

Ces dernières années, la mer Baltique a gagné en efficience maritime, ce qu'elle a perdu en accès direct au monde maritime. Les recompositions réticulaires et le recours aux économies d'échelle ont participé à l'apparition de hubs régionaux dans la région, en lien direct, par gros feeders, avec les grands ports de la mer du Nord, eux-mêmes branchés sur les lignes est-ouest. Ces hubs assurant l'éclatement et la distribution des frets dans leur environnement proche.

La mer Baltique comme support d'échanges maritimes constitue indéniablement un trait d'union entre ses pays riverains, où l'activité maritime et portuaire connaît depuis une vingtaine d'années un dynamisme incontestable. La prise en compte du fait maritime, de son importance économique parfois vitale pour les économies locales mais aussi de ses impacts constitue ainsi un dénominateur commun sur les rives de la Baltique. Il y a néanmoins en son sein une évidente dichotomie entre des ports nordiques qui sont des ports d'importation à l'échelle nationale et des ports russes et baltes à vocation mondiale participant principalement à des flux transversaux. Pour l'avenir, le défi pour les ports baltiques est de maintenir leurs parts de marché dans les vracs secs et liquides (principalement le charbon et les produits pétroliers) tout en développant le fret conteneurisé et le trafic roulier. Pour attirer davantage de marchandises à forte valeur ajoutée, le premier point et surement le plus important est de diminuer les coûts et d'améliorer la fiabilité de toute la chaîne logistique (notamment en gérant la congestion routière et ferroviaire et la capacité ferroviaire). Dans ce domaine, les ports finlandais perdent leur avantage compétitif sur les ports baltes et russes qui n'ont de cesse de renforcer leurs capacités et leur fiabilité.

Aujourd'hui, la région Baltique quitte une situation relativement confortable, de croissance partagée, qui a favorisé sa revitalisation rapide. Les acteurs maritimes et portuaires doivent développer de nouvelles stratégies pour répondre aux enjeux, voire aux défis, régionaux contemporains. Connecter la région reste le premier d'entre-eux. En effet, de grandes parties de région de la région sont peu peuplées et éloignées des autres marchés. Pour des raisons historiques, les systèmes de transport et les marchés de l'énergie se sont développés indépendamment les uns des autres et ne sont pas encore suffisamment intégrés pour tirer le meilleur parti du potentiel de la région en termes de compétitivité et de qualité de vie. Cette connexion avance à grands pas comme en témoignent la multitude de nouvelles infrastructures portuaires ou multimodales et la multiplication des services logistiques qui leurs sont liés.

Actuellement dans une situation d'interface, d'espace intermédiaire, espace transitionnel permettant le passage graduel entre deux espaces, la mer Baltique voit ce rôle possiblement remis en cause, même si la question de la relation gazière russo-européenne reste importante.

La première remise en cause vient d'abord de la politique russe d'autosuffisance portuaire qui, si elle profite aujourd'hui à ses ports baltiques va, notamment pour des raisons de disponibilité d'espace, se réorienter également vers d'autres façades maritimes. La Russie a été et reste le principal marché pour de nombreux ports de la région, de Gdansk à la Finlande. Le ralentissement de la croissance économique russe, les incertitudes géopolitiques, la baisse du cours du pétrole ou encore un manque de réformes économiques ne laissent pas entrevoir un futur étincelant et un rebond des volumes d'échange. Ainsi, les ports de la région doivent s'adapter à des trafics de transit moins importants qu'au cours des dernières années. Toutefois, malgré les incertitudes, certaines tendances se dessinent (Baltic LINes, 2016). Le trafic maritime intra et/ou extra européen est ainsi appelé à croitre dans les années à venir.

Par ailleurs, l'impact du développement de ponts continentaux entre l'Asie et l'Europe reste à évaluer pour la région Baltique. Si ses ports, et l'ensemble de la filière logistique, peuvent en tirer profit, ces mêmes corridors eurasiatiques peuvent constituer une réelle concurrence notamment pour la desserte du monde russe. A contrario, la région Baltique pourrait stratégiquement devenir une nouvelle zone tampon entre l'espace économique balte et de la Russie occidentale d'une part et l'espace ouest et centre européen d'autre part. Des grands acteurs industriels et manufacturiers pourraient alors faire de la Baltique un immense territoire de rupture de charge pour des trains blocs en provenance de l'Asie et une opportunité de consolidation des frets au départ de l'Europe-Baltique-Russie occidentale.

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Chapitre 8

Les ports de la mer Baltique orientale : entre la desserte d'un arrière-pays réel et un relais hypothétique de la route de la soie

Eastern Baltic ports: actual hinterland and hypothetical gateway to the Silk Road

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Biographie

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Résumé

Certains pensent que l'avenir des ports de la mer Baltique orientale dépend du développement du commerce entre l'Europe et l'Asie orientale. Les flux maritimes entre les deux continents semblent bien plus efficaces qu'un long trajet ferroviaire. Le changement climatique peut favoriser la croissance du trafic sur la Route maritime du Nord susceptible de devenir un sérieux concurrent. Or les ports Baltes disposent déjà d'un vaste arrière-pays « naturel » qui englobe l'Europe orientale, le Belarus, la Russie et l'Asie Centrale. C'est avant tout avec cet espace qu'ils doivent accroître leurs échanges.

Mots-clés : Ports de la Baltique orientale, arrière-pays, porte, conteneurs, chemin de fer, Route de la soie.

Abstract

Some believe that the future of Eastern Baltic ports is linked to the development of Euro-Asiatic trade. Actually sea flows are more efficient between the two continents than a long railway transport. If the Artic route is to progress due to climate change, it will be a new serious competitor. In fact, Baltic ports have already a large obvious hinterland, including Eastern Europe, Belarus, Russia and Central Asia. They have to increase trade with this area to ensure their traffic.

Keywords: East Baltic ports, hinterland, gate, container, railway, Silk road.

Introduction

Lorsque l'on regarde une carte de la mer Baltique, elle apparaît bel et bien comme un cul-de-sac. Les seules ouvertures maritimes vers l'espace océaniques se limitent aux détroits du Danemark et au canal de Kiel. Malgré l'absence de tout autre accès maritime, la Baltique supporte un important trafic depuis des temps reculés (Cf. Figure 1). La région a été animée par des flux qui se prolongent en Europe orientale et en Russie par les voies fluviales et les lacustres. La construction des lignes de chemin de fer a ouvert de nouvelles possibilités au transit des voyageurs et des marchandises par les ports de la Baltique orientale. Pendant plusieurs siècles ils ont été les portes d'accès à un vaste arrière-pays, en parti perdu au cours du XXe siècle. En fait, depuis fort longtemps la Baltique n'est pas un cul-de-sac mais une voie majeure entre l'espace océanique d'un côté et les pays de l'Europe orientale et de l'Asie Centrale de l'autre.

Figure 1. Les ports de la Baltique

Source : Serry A., Le transport maritime en Mer Baltique, 2018.

Le transit entre l'Europe occidentale et l'Asie orientale

La renaissance de la Route de la soie, une opportunité ?

Après la disparition de l'URSS, la Route de la soie est redevenue un sujet d'étude de chercheurs de même qu'elle a fait l'objet de projets gouvernementaux et internationaux. Plusieurs enjeux expliquent ce renouveau d'intérêt. Pour certains il s'agit d'une stratégie de contournement de la Russie grâce à l'aménagement, d'un axe de transport *via* le Caucase du sud entre l'Europe et l'Asie Centrale et les pays situés au-delà. Pour la Chine il s'agit de développer ses échanges avec l'Asie Centrale et d'y renforcer son influence. La Russie comme le Kazakhstan y voient le moyen de jouer un rôle central dans les échanges euro-asiatiques. Ces intérêts divergents expliquent pour une large part la pluralité des itinéraires de la Route de la soie pour laquelle il serait plus conforme de parler des routes de la soie. Chaque itinéraire correspond en effet des objectifs stratégiques différents, voire opposés.

La route méridionale qui relie l'Asie Centrale à la mer Méditerranée en évitant aussi bien la Russie que l'Iran, itinéraire en partie financé par l'Union européenne et les États Unis, présente le désavantage d'imposer une traversée maritime de la mer Caspienne et éventuellement de la mer Noire pour relier la Géorgie à la Bulgarie, à la Roumaine ou à l'Ukraine. Cela signifie soit des opérations de manutention sur les deux rives, soit des relations par navires rouliers de grande capacité. Ces contraintes semblent réserver cette route aux relations avec l'Europe du sud. Elle ne semble pas concurrencer directement les ports de la Baltique.

Les itinéraires par chemin de fer sont multiples[1]. Des trains blocs empruntent les axes du Transsibérien. D'autres traversent le Kazakhstan et le Chine de l'ouest. Sur le réseau russe, des trains blocs de conteneurs, aussi bien de la compagnie historique, les RZD, que d'opérateurs privés telle la FESCO *(Far Eastern Shipping company)*, circulent entre les ports russes du Pacifique et les régions centrales de la Russie de même que vers les ports de la Baltique. Peu de convois ont pour destination l'Europe centrale et occidentale. Le réseau russe est un des plus chargés au monde. Il supporte un intense trafic de marchandises pondéreuses, charbon, minerais, pétrole et produits pétroliers, céréales...Les nouveaux sillons sont difficiles à libérer pour des trains en transit. Il en est de même pour les trains qui traversent le Kazakhstan et doivent circuler sur le réseau russe pour atteindre l'Europe. Néanmoins le trafic ferroviaire entre l'Extrême-Orient, principalement la

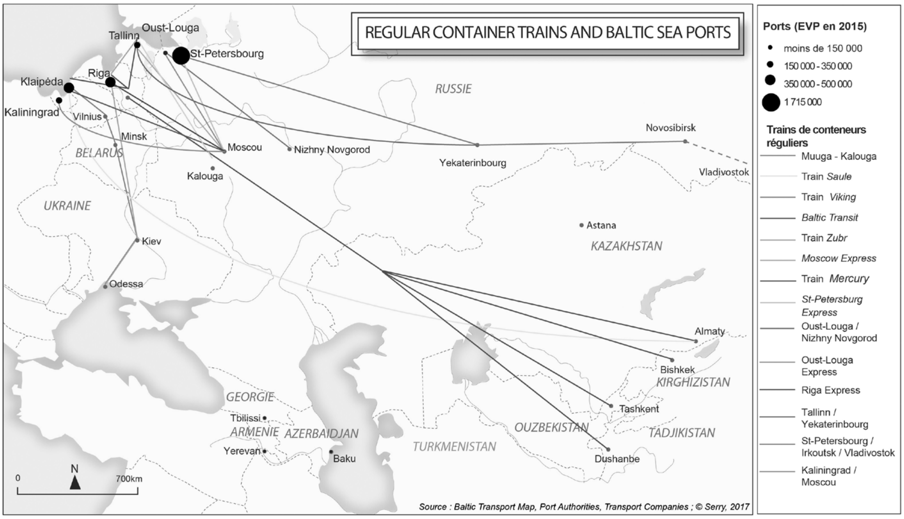
[1] Cf. Lewandowski Krzysztof (2018): *New rail silk road, the competition on the rail.* Colloque Klaipeda et *Silk road transport corridors: assessment of trans EAEU freight traffic growth potential.* Eurasian development bank, report 49, 2018.

Chine, et l'Europe augmente. Il a atteint environ 500 000 EVP[2] en 2017, dont 262 000 entre l'Europe et la Chine. Toutefois, sa part dans le commerce entre l'Europe et l'Asie demeure faible (moins de 2 pour cent). La durée du trajet est certes plus courte par chemin de fer. Mais le coût du trajet est plus élevé que celui du transport par mer, surtout à l'heure où des armateurs pratiquent le *slow shipping*, navigation à vitesse réduite, qui diminue la consommation et donc les frais de combustible. Le coût par EVP entre l'Europe et l'Asie orientale est de l'ordre de 2 500 dollars par mer et de 5 500 dollars par chemin de fer. La capacité du chemin de fer pourrait atteindre 5,4 millions d'EVP par an à l'horizon 2030, d'après les entreprises ferroviaires de Russie et du Kazakhstan. Ce volume reste modeste au regard des échanges. On peut constater aussi que dans le cadre du développement durable et de la lutte contre le réchauffement climatique l'utilisation des navires est plus écologique. La consommation se situe aux environs de 3 kw/h par tonnes kilomètre contre autour de 10 kw/h pour un train de fret.

Qui plus est, on peut se demander si les ports de la Baltique seraient bénéficiaires du chemin de fer transcontinental. Lorsque des marchandises ont parcouru plus de 10 000 km sur des trains, quel intérêt y a-t-il à les transférer sur des navires pour rejoindre l'Europe de l'ouest depuis les ports baltes ? Le changement de gabarit ferroviaire (l'écartement des voies en Russie et dans les pays postsoviétiques et de 1 520 mm et 1 435 mm en Europe, écartement dit standard) est certes un inconvénient, mais pas au point de justifier le transport maritime pour les derniers kilomètres. On le constate avec les trains qui circulent dores et déjà entre la Chine et l'Allemagne (Chonqing - Duisburg) ou la train *Saulé* ou *Sun Train* Anvers – Chonqing (Cf. figure 2).

[2] EVP conteneur équivalent 20 pieds.

Figure 2. **Relations ferroviaires des ports de la Baltique orientale**



Source : Serry A., Le transport maritime en Mer Baltique, 2018.

Dans ces conditions, les ports baltes ne semblent pas devoir compter sur la Route de la soie comme stratégie essentielle pour assurer leur avenir.

Un nouvel itinéraire concurrent peut prendre de l'importance, la Route maritime du nord *(Sevmorput).* La navigation estivale puis toute l'année de Mourmansk à l'Iénisséï voire certaines années sur toute sa longueur, se pratique depuis de plusieurs décennies. Deux faits majeurs modifient les possibilités de l'emprunter : premièrement, la décision des autorités russes d'ouvrir aux navires étrangers le *Sevmorput* dont l'accès leur était interdit du temps de l'URSS ; deuxièmement, le changement climatique qui fait rapidement reculer la banquise ce qui allonge la durée de la saison navigable en Arctique et y améliore les conditions de navigation. Jusqu'à présent l'Arctique est fréquenté principalement par les navires qui desservent les ports du Grand nord russe. Outre le ravitaillement des villes, bourgades et bases, ces ports sont utilisés en particulier pour l'évacuation du pétrole brut et du gaz naturel liquéfié, extrait dans les gisements de Yamal et de la mer de Kara ainsi que de minerais. En 2017 quelques 10 millions de tonnes ont été transportées sur la Route maritime du nord. Malgré son augmentation, le trafic en transit entre l'Europe et l'Extrême Orient qui émerge, n'a atteint que 194 000 tonnes en 2017, principalement des navires chargés de minerais. Une première traversée par un porte-conteneurs a été expérimentée par Maersk, premier armateur mondial. Entre le 22 août et le 28 septembre 2018, le *Venta Maersk* d'une capacité de 3695 EVP a relié Vladivostok à Saint Petersbourg. Parti de Pusan il a fait escale à Bremerhaven. Cependant Maersk a tenu à souligner que ce voyage a été effectué a titre expérimental pour tester le navire, les systèmes de navigation, les relations avec les pilotes et les brise-glace dans une région méconnue par les commandants de l'armement. Certes l'expérience a été positive mais Maersk considère que dans l'immédiat cet itinéraire ne présente pas de réel avantage commercial ni économique. Les conditions de navigation demeurent pour l'heure délicates, et il n'existe aucun port justifiant des escales le long de l'itinéraire. L'armateur reste cependant attentif à l'évolution de la situation et des marchés[3].

A court et moyen terme l'itinéraire classique par le canal de Suez semble devoir garder sa primauté. Les routes alternatives n'ont de toutes manières qu'un effet limité sur le trafic des ports de la Baltiques orientale qui disposent d'autres atouts.

L'arrière-pays naturel des ports de la Baltique

Il semble plus efficace pour les ports de la Baltique orientale de consolider leurs liens avec leur arrière-pays « naturel ». Celui avec lequel ils sont en relation par des voies fluviales et ferroviaires. Ce n'est certes pas un arrière-pays captif car les ports de la Rangée du nord, Anvers, Rotterdam et surtout Hambourg, mais aussi ceux de la Baltique méridionale (Gdansk) viennent y concurrencer les ports baltes. Mais c'est bien sur ce terrain que se joue une part importante de leur avenir.

La Baltique orientale a été depuis le Moyen Age le support d'un commerce intense entre l'ouest et l'est de l'Europe. Dès le XI[e] siècle, des marchands Visby établirent un comptoir à Novgorod. Les marchandises y arrivaient et en partaient par le fleuve Volkhov, le lac Ladoga et la Néva. Au fil des siècles suivants, les marchands de la Ligue Hanséatique ont tissé un réseau de relation par mer et par les fleuves, jalonné de villes relais. Plusieurs ports et entrepôts ont été établis sur les rives de la Baltique orientale dont Danzig actuelle Gdansk, Königsberg aujourd'hui Kaliningrad, Riga, Reval devenue Tallinn. De nombreux comptoirs ont été implantés à l'intérieur du continent parmi lesquels, Novgorod, Pskov, Tver, Kaunas, Polotsk... Ce réseau montre que, loin d'être un cul-de-sac, la Baltique se situe depuis des siècles, au cœur d'un système commercial dynamique. Malgré les vicissitudes de l'histoire, les flux ont perduré. Pendant les années qui ont suivi la seconde guerre mondiale, les pays situés au sud de la Baltique orientale ont été intégré dans l'URSS (les pays Baltes) et dans le bloc soviétique (Pologne et RDA). Il en est résulté un recul des échanges et du transit maritime entre les régions situées de part et d'autre du «rideau de fer». Cependant les ports

[3] Palle Laursen, responsable de Maersk déclare *"Currently, we do not see the Northern Sea Route as a viable commercial alternative to existing east-west routes. In general, we plan new services according to trading patterns, population centres and our customers demand» (...) "That said, we do follow the development of the Northern Sea Route. Today, the passage is only feasible for around three month a year which may change with time. Furthermore, we also must consider that ice-classed vessels are required to make the passage, which means an additional investment."*

ont conservé leur arrière-pays pour lequel ils ont gardé leur fonction de portes ouvertes sur le monde. Inclus dans le cadre de l'économie planifiée, les ports s'étaient vus attribuer des fonctions spécifiques au sein d'un système intégré de transports, tant en terme de nature des marchandises que de dessertes maritimes. La fin du système soviétique a créé des conditions nouvelles par l'ouverture les frontières et de la concurrence. Cette dernière s'est développée non seulement entre les ports de la région, mais aussi avec ceux de la Rangée du nord qui cherchent à reconquérir un arrière-pays qui leur avait échappé pendant près de cinquante ans.

Dans ce contexte les ports des États Baltes peuvent être confrontés à une éventuelle contradiction entre les enjeux économiques, leur propre activité, et les considérations géopolitiques, les relations entre les gouvernements des États dans lesquels ils se situent et de l'Union européenne dont ils font partie d'une part et la Russie de l'autre.

Parmi ses objectifs dans la région balte, la Russie, depuis la fin des années 1990, vise à limiter le recours au transit de ses marchandises par les ports estoniens, lettons et lithuaniens. C'est pourquoi elle s'est dotée de nouvelles infrastructures portuaires. Le nouveau port généraliste de Ust-Luga est devenu le premier port de la Baltique avec un trafic proche de 100 millions de tonnes (98,7 millions en 2018). Il devance le Grand Port de Saint-Pétersbourg (59,3 millions de tonnes), suivi du terminal pétrolier de Primorsk 57,6 millions de tonnes en 2017). Avec les ports secondaires russes dont Vysotsk, Vyborg et Kaliningrad le trafic global des ports russes en Baltique a atteint 246 millions de tonnes en 2018.

La concurrence vient aussi de l'ouest. A Gdansk (49 millions de tonnes en 2018) le trafic conteneurisé augmente rapidement, surtout depuis l'arrivée de l'armement Maersk. Les terminaux ont manutentionné 1,95 million d'EVP en 2018 et Gdansk occupe la deuxième place en Baltique orientale derrière Saint Petersbourg (2,1 millions d'EVP) pour ce trafic. Hambourg, Rotterdam et dans une moindre mesure Anvers irriguent et drainent l'arrière-pays de l'Europe centrale et orientale, grâce notamment à de nombreux services ferroviaires. S'ils sont des concurrents, ils sont aussi complémentaires en apportant du trafic par les services réguliers qui les relient aux ports baltes.

L'enjeu essentiel pour les ports baltes consiste à faire face à leurs concurrents et à rester des portes de la Russie, du Belarus et de l'Asie centrale. L'enclavement de ces derniers qui ont besoin de débouchés maritimes, peut profiter aux ports baltes. S'ils venaient à perdre la totalité de ces marchés, ils risqueraient de devenir des culs-de-sac à la périphérie de l'Union européenne.

Aussi les ports baltes mènent une politique de promotion et agissent avec des entreprises ferroviaires pour conserver voire élargir leur présence dans l'arrière-pays postsoviétique. Plusieurs trains bloc ont été mis en circulation entre Tallinn, Riga et Klaipeda d'un côté le Belarus, l'Ukraine, la Russie et l'Asie centrale de l'autre : *Zubr* service trois fois par semaine entre Tallinn Riga, Minsk, Kiev et Odessa, *Viking Train* Klaipeda, Minsk, Kiev et Odessa, *Riga Express* entre Riga et Moscou, *Mercury* service à la demande entre Klaipeda et Moscou, *Moscow Express* Tallinn Moscou trois fois par semaine, *Nemunas* service à la demande entre Klaipeda et Minsk, *Baltic wind* service à la demande entre Klaipeda, Minsk, Samara, Astana, *Baltic Transit* Tallinn, Ventspils, Riga, Klaipeda, Kazakhstan, Ouzbékistan, service proposé trois fois par semaine par la FESCO prolongé vers les autres pays d'Asie Centrale, un service hebdomadaire entre Tallinn et Ekaterinbourg et un service saisonnier entre Tallinn et Perm.

Ces relations sont toutefois très dépendantes de la situation géopolitique. Ainsi le trafic ferroviaire vers l'Ukraine est très affecté par la conjoncture de ce pays (chute de 40% à 60% du trafic en 2018).

Ces trains offrent un service pour conteneurs. Mais l'arrière-pays fournit aussi un trafic de marchandises pondéreuses, charbon, pétrole, engrais, principalement acheminées par chemin de fer. Les trains de pondéreux sont opérés soit par les entreprises industrielles elles-mêmes *(Belaruskali)*, soit par des opérateurs de transport (compagnies ferroviaires historiques ou groupes privés comme *Novotrans*). Certes la politique de la Russie en faveur de ses ports a fait régresser le transit par les ports baltes. L'exemple le plus marquant est sans doute la disparition des exportations de pétrole et de produits pétroliers russes par Ventspils. Néanmoins une partie des exportations russes de matières premières passe encore par les ports baltes comme du charbon et des engrais à Tallinn et Riga. Klaipeda demeure un port vital pour le Belarus qui, entre autre, exporte des engrais. L'Asie centrale n'occupe pour l'heure qu'une place modeste. Les ports baltes s'efforcent d'y renforcer leur attractivité. Ils promeuvent leur ouverture vers l'Afrique occidentale et le continent américain.

Klaipeda occupe la première place des ports baltes (46,6 millions de tonnes et 750 000 EVP en 2018). On semble ici savoir faire la distinction entre logiques politiques et logique économique. Les autorités portuaires sont par exemple hostiles à d'éventuelles sanctions de l'Union européenne à l'égard du Belarus. Riga après une période de déclin due au recul du transit russe connaît une progression de son trafic (36,4 millions de tonnes et 469 000 EVP). Tallinn (20,6 millions de tonnes et 222 000 EVP) est pénalisé par les relations diplomatiques difficiles entre l'Estonie et la Russie.

Conclusion : concurrence ou complémentarité ?

Les espaces continentaux sont les lieux où s'exacerbe la concurrence entre les ports. Mais ces derniers peuvent aussi bénéficier de leur complémentarité. Cette complémentarité peut résulter de la somme de leurs capacités respectives pour répondre à la croissance du trafic. Elle peut résulter de leur spécialisation par type de marchandise (charbon, engrais, minerais, vracs liquides...) ou par type de manutention (ro-ro, conteneurs, vracs). Elle peut aussi être envisagée en terme d'avant pays maritime. Ces ports peuvent enfin s'appuyer sur des trafics de niche. Cela dépend en grande partie des relations politiques entre l'Union européenne et la Russie. Sur un continent apaisé, les ports de la Baltique orientale, ceux de la Russie comme ceux des États baltes, peuvent concourir à la desserte d'un vaste arrière-pays commun qui s'étend de l'Europe orientale à l'Asie centrale. La Baltique orientale peut confirmer son rôle de voie de passage et non de cul-de-sac à la périphérie de l'Union européenne.

Chapitre 9

L'impact de la gestion du risque sur l'attractivité du passage du nord-est

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Biographies

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Résumé

La Route Maritime Nord (RMN) est un sujet d'actualité au vu de son potentiel énergétique et de la diminution de la couverture de glace. Si la RMN a un véritable potentiel économique, elle n'est pas exempte de limites et de contraintes. Cependant de nouveaux outils techniques et législatifs ont été mis en place afin de les gérer au mieux ces contraintes dont le coût peut influer son attractivité. L'objectif de ce chapitre est de comprendre comment ces contraintes et outils interagissent et d'évaluer leurs impacts sur l'attractivité de la RMN. Enfin, ce chapitre mettra en évidence l'importance des variations des conditions de navigation subies par un navire ainsi que les différences de coûts induites.

Introduction

La réduction de la surface et de l'épaisseur de la glace a suscité ces dernières années un intérêt grandissant pour l'océan Arctique de la part des mondes académique et professionnel. En effet, la navigation le long des côtes russes permettrait en fonction du port de départ et de destination, de diminuer de 40% la distance parcourue comparé à la Route du Canal de Suez (RCS). La RMN a été utilisée depuis de nombreuses années pour subvenir aux besoins des populations locales. Cependant son niveau de fréquentation a varié au fil des ans avant d'atteindre en 2018, 18 millions de tonnes[4] soit 3 fois le record de 1986 longtemps resté inégalé jusqu'en 2016 (tableau 1). Cette évolution peut être attribuée au réchauffement climatique, aux avancées technologiques, à la mise en place d'un cadre légal et aux investissements qui ont permis d'augmenter la durée de navigation et d'atteindre des zones isolées. Cependant, malgré ces avancées, le nombre de navires utilisant la RMN reste confidentiel en comparaison aux 17 000 navires transitant via le canal de Suez.

Si le réchauffement climatique, via une diminution de l'épaisseur de glace et de sa superficie, permet d'augmenter la période de navigation, il subsiste d'autres aléas tels que les glaces dérivantes, une cartographie des fonds lacunaire, des températures extrêmes et des risques de collision lors de navigation en convoi.

Nonobstant, cette même diminution de la glace facilite l'accès à des champs de pétrole et de gaz qui étaient jusqu'à présent difficilement accessibles, même si la fonte du permafrost pose d'autres problèmes techniques pour les infrastructures

[4] https://thebarentsobserver.com/en/arctic-industry-and-energy/2018/12/explosive-growth-russias-arctic-shipping

terrestres (Gunnarsson, 2014). Le coût de production plus important, conséquence directe de l'isolement et des conditions climatiques extrêmes et la forte volatilité du prix du pétrole apparaissent comme des freins potentiels au développement économique de cette région (Faury et Givry, 2017). Ce chapitre a pour but de mettre en lumière l'impact que la gestion des risques peut avoir sur l'attractivité de la RMN.

Pour cela, la première section dresse un constat des différentes marchandises transportées via la RMN. Dans un deuxième temps, nous nous concentrerons sur les éléments qui agissent comme des freins sur son développement économique puis, dans la section suivante, sur les outils qui permettent de dépasser ces limites. La partie précédant la conclusion mettra en évidence l'impact économique de ces différentes gestions du risque.

Etat des lieux de la RMN

La RMN offre un raccourci de 40% entre l'Asie et l'Europe, permettant d'accéder à des ressources énergétiques inédites et de subvenir aux besoins des populations locales parfois trop éloignés des zones de production.

Raccourci de 40% entre l'Europe et l'Asie comparé au passage de Suez

Le raccourci de 40% qu'offre la RMN entre l'Asie et l'Europe présente un avantage pour les compagnies maritimes, les chargeurs et les états côtiers. Conscientes de ce potentiel, les compagnies maritimes Maersk et Cosco ont fait des tests le long des côtes Russes ces dernières années via l'envoi annuel par Cosco du Yong Sheng, ou du Venta pour la compagnie Danoise[5]. La RMN permet aussi à la production de pétrole et de gaz norvégiens et/ou russes d'approvisionner plus rapidement le marché asiatique et pour le gouvernement russe de développer économiquement ces régions isolées.

Pour une compagnie maritime, ce raccourci offre en théorie la possibilité d'augmenter le nombre de rotation des navires et donc d'en accroître la productivité. Il permet aussi de diminuer la consommation de fuel tout en conservant le même temps de transport.

Dans le cas où les décideurs souhaitent et peuvent se passer de l'assistance d'un brise-glace, grâce à des conditions climatiques favorables, ils feront aussi l'économie des frais de péage du canal de Suez ou de Panama tout en évitant des zones de piraterie.

[5] https://www.reuters.com/article/us-arctic-shipping-maersk/maersk-sends-first-container-ship-through-arctic-route-idUSKCN1L91BR

Tableau 1. Flux en milliers de tonnes

	2010	2011	2012	2013	2014	2015	2016	2017
Transit	110	820	1 262	1 176	274	40	215	194
Destination	1 975	2 405	2 488	2 738	3 708	5 392	7 050	9 543
Total	2 085	3 225	3 750	3 914	3 982	5 432	7 265	9 737

Source : auteurs sur la base de Doyon et al. (2017)

Pour les chargeurs, la RMN donnerait la possibilité de diminuer le temps et le coût d'approvisionnement leur offrant en conséquence un peu plus de flexibilité dans leur gestion de stock (Lavissière et Faury, 2019).

Enfin, la valorisation du passage du Nord-Est comme une ligne maritime de transit permet aux pays limitrophes de développer de nouvelles infrastructures et de fixer l'implantation des populations isolées du reste du pays.

Le développement de nouvelles infrastructures telles que la construction du port de Sabetta ou la création d'un zone Franche à Mourmansk (Mourmansk Transport Hub), a pour objectif de permettre à la RMN de se rapprocher des 40 millions de tonnes de produits transportés, quantité nécessaire selon le rapport AMSA (2009) afin qu'elle devienne rentable. Cela nécessiterait de connecter ces espaces avec le reste de la Russie pour d'une part faciliter l'approvisionnement en pièces et marchandises diverses, et d'autre part pour fixer les populations.

À plus long terme, le développement de telles infrastructures assurerait un développement économique qui ne serait pas totalement basé sur les ressources minières. En effet, plusieurs ports ont payé au prix fort leur dépendance par rapport à une ressource, parmi eux les ports de Kirkenes ou Vitino. Kirkenes est un port situé le long des côtes norvégiennes qui a été majoritairement utilisé pour l'exploitation de la mine Sydvaranger[6]. La fermeture de cette dernière a forcé le port à repenser son activité pour finalement se positionner comme hub régional.

Typologie des marchandises transportées

La majorité des analyses académiques relatives à l'attractivité économique de la RMN se base sur des flux de marchandise conteneurisée (Teocharis et al., 2018). Cependant, si la navigation par porte-conteneur est limitée, la RMN est très majoritairement utilisée pour le transport de matières premières du type pétrole et gaz (Humpert, 2014) conséquence directe de la richesse de l'Arctique russe en hydrocarbures et autres minerais tel le nickel dont l'économie Russe est dépendante.

[6] https://thebarentsobserver.com/en/industry/2016/04/tschudi-buys-arctic-iron-mine

Conscient de l'importance stratégique de ces ressources pour l'économie nationale, le gouvernement russe, via son rapport IES (2010) sur la capacité des ports de l'Arctique, souhaite porter la capacité de l'ensemble des ports de cette zone à l'horizon de 2030 à plus 150 millions de tonnes, dont 72 millions provenant du port de Sabetta[7]. Cet objectif suppose la mise à jour des infrastructures existantes vieillissantes ainsi que la création de nouvelles structures mais plusieurs difficultés subsistent.

L'une des premières difficultés réside dans le surcoût que nécessite l'implantation de ports dans ces régions isolées et cela particulièrement dans la partie Est du passage du Nord-Est. Cette difficulté d'accès influence négativement, de manière considérable, l'intérêt économique pour le développement de cette partie de l'Arctique Russe et questionne la rentabilité des champs pétrolifères et gaziers.

L'un des symboles du renouveau de l'Arctique russe est la construction du port de Sabetta et de son usine de liquéfaction de gaz avec une capacité de production de 16,5 millions de tonnes de GNL. En 2016, le port a réceptionné 505 000 tonnes de marchandises pour la construction de l'usine. La construction du port aura nécessité un investissement d'1,3 milliard de dollars. Afin de respecter les délais de production, des projets dans les ports d'Ust-Luga, St Pétersbourg et Kaliningrad ont été gelés, et les 504 millions de dollars qu'ils représentaient ont été alloués à Sabetta (Pettersen, 2014). Le port de Mourmansk n'est pas en reste en termes d'investissements, avec l'implémentation de la zone franche, le Mourmansk Transport Hub (MTH), ainsi qu'avec des FSO destinés au transbordement du pétrole. Le pétrole ainsi transbordé est transporté à Mourmansk depuis les champs pétroliers de l'Arctique russe connectés aux ports de Novy et Varandey via des pétroliers spécialement conçus pour ces conditions de navigation extrême. Ces différents projets montrent clairement quelle voie sera suivie pour le développement de cette zone dans les années à venir.

L'isolement des zones de production a un effet négatif sur le prix de revient d'un baril de pétrole. Afin de limiter au maximum ce paramètre, les acteurs ont dû mettre en place un système de transport le plus efficace possible. Pour cela, comme le montre Faury et al. (2019, à venir), les autorités russes ont mis en place un système portuaire reposant sur des ports exportateurs tel Novy, Varandey ou Sabetta et un Hub, Mourmansk, libre de glace toute l'année et pouvant accueillir des navires inaptes à naviguer dans les glaces, dont l'objectif est d'assurer une continuité logistique avec les autres ports.

[7] https://thebarentsobserver.com/en/arctic/2017/12/new-era-starts-northern-sea-route

Origine et destinations des flux de marchandises

Clairement, dans l'état actuel, la RMN est très majoritairement utilisée pour la gestion des exports de matières premières provenant des gisements russes et pour l'approvisionnements en matériels pour le développement des infrastructures portuaires. Si l'utilisation de la RMN comme ligne maritime reliant les deux pôles de la Triade (Omahe, 1988) est ce qui semble attirer le plus d'attention, cela ne se reflète pas dans les statistiques disponibles (Tableau 1).

En observant de manière plus approfondie les ports principaux, il apparait clairement que certains ports ou terminaux génèrent des flux plus importants que d'autres. Les ports d'exportation de Sabetta, Novy et Varandey ainsi que le terminal pétrolier de Prirazlomnoye apparaissent comme les ports soutenant l'activité de la RMN.

Si depuis quelques années, le nombre de tonnes transportées le long de la RMN augmente, il faut en chercher la raison du côté des approvisionnements de marchandises et des exports de matières premières, le transit étant pratiquement absent des flux.

La quasi-absence du transit dans les statistiques de la NSR Administration peut trouver son origine dans plusieurs éléments qui agissent comme des facteurs bloquants sur le développement de la RMN.

Les facteurs bloquants

Nombreux sont les paramètres qui impactent de manière plus ou moins directe la navigabilité de la RMN et par conséquent son attractivité. Les risques que le navire et son équipage devront gérer sont d'ordre climatiques, géographiques, technologiques et humains (Code Polaire, 2015) et ont des conséquences importantes sur le coût de la navigation.

Le facteur climatique

L'évocation de l'Arctique est souvent concomitante avec celle de la couverture de glace et de conditions climatiques extrêmes. Si la diminution de la couverture permet un allongement de la durée de navigation, elle ne réduit pas pour autant les risques qui pèsent sur le navire. Sur les dix sources de dangers identifiés par le Code Polaire (Code Polaire, 2015), les facteurs climatiques ne concernent que cinq dangers sur les dix et un seul concerne directement la glace mettant ainsi en évidence que si la présence de glace est un risque majeur cristallisant toutes les attentions, ce n'est pas le seul, loin s'en faut.

La diminution de la banquise en surface et en épaisseur voit l'augmentation du nombre de plaques de glaces dérivantes. Comme l'ont mis en évidence Fedi et al. (2018a) leur présence représente un réel danger pour l'intégrité de la coque.

Si la glace est clairement le risque le plus mis en valeur (point 3.1 Code Polaire), elle n'affecte pas uniquement l'intégrité de la coque mais aussi d'autres parties du navire comme le système de propulsion. La présence de glace sur le pont du navire suite au givrage (point 3.2) affecte la capacité de l'équipage à atteindre le système de sécurité ou le temps de réaction en cas de risque d'accident. Une trop grande concentration de glace sur le pont du navire peut en outre affecter sa stabilité.

Le point 3.3 met en évidence qu'un froid intense peut avoir des conséquences sur les membres d'équipage et leur environnement de travail. Il peut impacter d'une part le bon fonctionnement des équipements de survie et le déplacement des membres d'équipages sur le pont d'autre part.

Le Code Polaire met en lumière l'impact que les longues périodes d'obscurité sur le comportement de l'équipage (point 3.4), ce qui ne plaide pas en faveur de l'utilisation de la RMN tout au long de l'année.

Comme le signifie le point 3.9, les conditions climatiques extrêmes et changeantes rendent difficiles l'anticipation des conditions de glace.

Si les risques autres que ceux liés à la glace (3.1) peuvent être considérés comme plus facilement gérables malgré la tendance générale de diminution de sa superficie et de son épaisseur, la période, la durée d'ouverture de la RMN et les conditions de glace varient d'une année à l'autre, rendant difficile l'utilisation de la RMN en tant que route de transit régulière, en particulier pour les transports de container particulièrement sensibles à cette variable.

Paramètres géographiques

Le Code Polaire (CP) souligne par ailleurs que la géographie de l'Arctique est elle-même génératrice de risques.

Dans le point 3.5, il établit la difficulté de communiquer une fois les 70°N dépassés. Le CP met aussi en lumière la conséquence que la navigation dans les latitudes élevées peut avoir sur la capacité à recevoir des informations sur les conditions de glace à venir.

En dehors du fait qu'une cartographie de glace est primordiale pour une navigation sécurisée, elle est aussi nécessaire pour permettre aux navires de briser leur isolement et recevoir un soutien rapidement en cas d'échouage, possible conséquence de cartes obsolètes (point 3.6). La non mise à jour des fonds marins a déjà posé problème à de nombreux navires malgré des équipages et des capitaines expérimentés (Marchenko, 2014). Un des navires de la compagnie de croisière Le Ponant s'est échoué dans la baie de Penkigney en 2013[8]. Cette compagnie est pourtant dotée d'une solide expérience dans ces zones Arctiques.

[8] Rapport d'enquête technique Maritime safety investigation report.

Parmi les éléments ayant causé ce naufrage qui n'a duré que quelques heures, figurent des cartes non mises à jour dans une zone où les secours mettent du temps à arriver. L'OMI met elle-même en garde les équipages sur le manque de mise à jour des cartes dans cette zone.

Le point 3.6 du CP pointe également le fait que la RMN se situe dans une zone particulièrement isolée, sur des fonds marins peu profonds, et comptant peu d'infrastructures portuaires aptes à recevoir des navires en cas de dommages. La présence de glace, permanente ou non, tout comme des déplacements de bancs de sable ont comme autre inconvénient de rendre difficile la cartographie des fonds.

Comme Fedi et al. (2018a) l'ont mis en évidence, la faible densité des ports le long des côtes russes rend difficile la captation de nouveaux flux. D'autres chercheurs mettent en exergue également le manque d'infrastructures comme étant l'une des causes principales du manque d'attractivité de la RMN (Ragner, 2000). Ce manque d'infrastructures marines est aussi relevé par le CP (point 3.8) et le rapport AMSA (2009).

La faible profondeur de certains passages comme le détroit de Sannikov (profondeur de 13m) a le même effet que la taille des écluses de Panama ou que la largeur du canal de Suez : elle limite la taille des navires. A l'heure du gigantisme des triple E, cet handicap ne permet pas à la RMN d'offrir la même capacité de chargement qu'un navire passant par le sud.

Les facteurs technologiques

Comme détaillé par Faury (2015) et Fedi et al. (2018a), les conditions climatiques imposent l'utilisation de navires spécialement construits pour naviguer en eaux polaires. Ces derniers rentrent dans la catégorie des navires de classe glace ou polaire selon plusieurs paramètres, comme la capacité de la coque à résister à une certaine épaisseur et pression de la glace, la puissance du moteur ou encore la capacité des systèmes de survie à fonctionner dans des conditions extrêmes.

Les conditions de navigation étant variables, les compagnies d'assurance peuvent imposer aux navires une route à laquelle les navires devront se conformer ou bien même l'obligation d'être assisté par un brise-glace. Cette assistance implique parfois une navigation en convoi. Si cette manière de naviguer permet d'éviter les risques de blocage par la glace, elle augmente considérablement le risque de collision et cela malgré le respect des règles mises en place.

Le facteur humain

Via les entretiens qu'ils ont pu mener, Faury (2015), Fedi et al. (2018a) mettent en avant le poids du facteur humain dans la navigation de manière générale et plus particulièrement en Arctique. Marchenko (2014), la Nordic Association of Marine

Insurers (Cefor), (2012) et le CP (Code Polaire, 2015) s'accordent également pour souligner ce risque majeur. Les conditions de navigation changeantes et difficiles, couplées à des périodes plus moins longues d'obscurité « mettent sous pression » le capitaine et son équipage.

Faury (2015) a mis en évidence que nonobstant la compétence qui peut s'acquérir par des formations, l'expérience et l'habitude de navigation sont aussi à prendre en considération. L'auteur a mis en avant la difficulté de trouver des équipages avec une véritable compétence et surtout une expérience de la navigation dans les glaces. Une des personnes interviewées a insisté sur le fait que peu de certifications valident les compétences des officiers. A fortiori, si les membres d'équipages peuvent être la source d'un incident, ils peuvent également en être victime.

Les risques auxquels sont confrontés les navires naviguant le long de la NSR sont donc nombreux. Leurs interactions amplifient leurs effets. Ainsi, une blessure simple peut entraîner la mort du marin à cause d'un délai d'intervention des secours rendu trop long suite à de très mauvaises conditions de navigation pour permettre une intervention rapide. Certains facteurs tel que l'isolement, s'ils ne représentent pas de risque à proprement parler, peuvent agir comme des catalyseurs ou des facteurs aggravants lors d'un accident.

Les réponses et leurs conséquences

L'ensemble des risques et des freins au développement de la RMN que nous avons évoqués représentent un danger réel non seulement pour la navigation mais aussi pour les membres d'équipages et les écosystèmes. Afin de sécuriser et de rendre cette zone plus accueillante pour de futurs acteurs économiques, ces dernières années ont vu la mise en place d'un cadre légal contraignant, ainsi que de lourds investissements dans les infrastructures portuaires. Ces derniers ont un impact direct sur la capacité de la RMN à générer un profit.

Le cadre légal

En janvier 2017, le Code Polaire est entré en vigueur (Fedi et Faury, 2016). Son intégration aux conventions SOLAS (Safety of Life at Sea) sur la sécurité en mer, MARPOL (Maritime Pollution) sur la prévention de la pollution marine et en juillet 2018 pour la convention STCW (Standards of Training, Certification and Watchkeeping for Seafarers) sur la formation des équipages, lui permet d'intégrer des modifications rapides par acceptation tacite en 12 mois pour SOLAS 10 mois pour MARPOL. Cette capacité d'adaptation à un environnement changeant à bien des égards (technique, économique, écologique, climatique) est avec son approche prophylactique sans doute, l'un des points fort de ce nouveau code. En effet, en listant l'ensemble des risques existants, ce code apparaît comme une « boite à outil » (Fedi et al., 2018a) pour les armateurs et les assureurs qui souhaitent entrer sur le « marché » de la RMN, si toutefois, considérant sa taille, nous pouvons parler de marché (Fedi et al., 2018a). Le recensement de ces risques, majoritairement liés aux conditions climatiques et à leur impact sur l'intégrité du navire, ainsi que la grande diversité des classifications de navires, ont amené l'OMI à regrouper ces derniers selon 3 catégories : A, B et C. Chacune de ces catégories se définit en fonction de la typologie de glace que la structure du navire peut supporter ; la catégorie A étant la plus résistante et la C la moins apte à naviguer dans des eaux polaires (Code Polaire, 2015). En se basant sur cette classification, deux types de navires se détachent : les navires de classe polaire et de classe glace.

Les navires de classe polaire (du PC1 au PC7) sont organisés selon 2 catégories, la A qui permet une navigation toute l'année quand la B ne permet une navigation que pendant les mois d'été et d'automne (DNV, 2018). Les navires de catégorie C, à savoir classe glace (à partir de 1AS jusqu'aux navires non préparés pour la navigation dans les glaces) ont une capacité de navigation plus limitée (DNV, 2018).

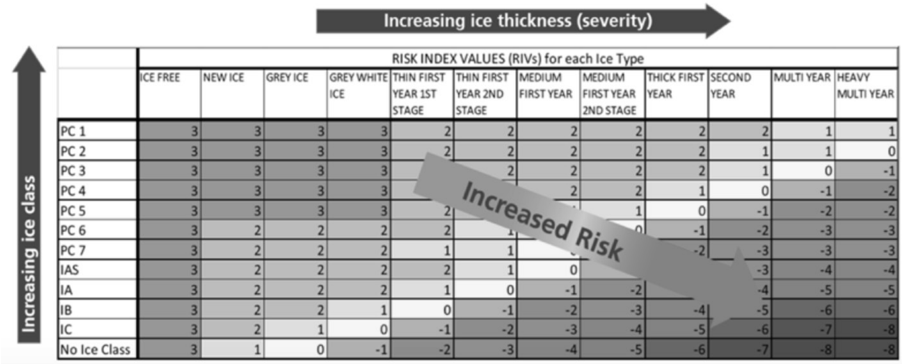
En conséquence, la définition de la classe du navire est primordiale et est au centre de la stratégie de l'armateur ou de l'affréteur.

Afin d'aider le décisionnaire dans ce choix complexe, un outil sort du lot : le système POLARIS ou 'Polar Operational Limit Assessment Risk Indexing System' (IMO, 2016). S'il est vrai que POLARIS est un outil d'aide à la décision pour les armateurs ou affréteurs, intégré au CP mais non obligatoire, il est aussi utile aux compagnies d'assurance, aux sociétés de classifications et aux officiers de pont. POLARIS intervient à plusieurs niveaux entre le moment où le décisionnaire fait le choix d'investir dans un navire préparé pour les zones polaires et celui de sa navigation (Fedi et al., 2018b), nous allons ici nous attarder sur son impact sur la navigation.

POLARIS est un système faisant la synthèse entre des paramètres climatiques, techniques et managériaux, à savoir l'épaisseur de glace, la typologie de la glace, la concentration de chaque type de glace, la température pour la partie climatique, la classe du navire pour la partie technique et enfin le chemin choisi ou le choix d'être assisté par un brise-glace pour la partie managériale.

En effet, le système définit un RIO (Risk Index Outcome) en fonction du RIV (Risk Index Value) et de la concentration de la glace. Le RIV est un indice de risque du navire en fonction de la typologie de la glace. Ce dernier va de 3 (meilleure situation) à -8 (situation la plus risquée) comme indiqué dans la figure 1.

Figure 1. Échelle de risque POLARIS



	RISK INDEX VALUES (RIVs) for each Ice Type											
	ICE FREE	NEW ICE	GREY ICE	GREY WHITE ICE	THIN FIRST YEAR 1ST STAGE	THIN FIRST YEAR 2ND STAGE	MEDIUM FIRST YEAR	MEDIUM FIRST YEAR 2ND STAGE	THICK FIRST YEAR	SECOND YEAR	MULTI YEAR	HEAVY MULTI YEAR
PC 1	3	3	3	3	2	2	2	2	2	2	1	1
PC 2	3	3	3	3	2	2	2	2	2	1	1	0
PC 3	3	3	3	3	[illegible]	2	2	2	2	1	0	-1
PC 4	3	3	3	3	[illegible]	[illegible]	2	2	1	0	-1	-2
PC 5	3	3	3	3	2	[illegible]	[illegible]	1	0	-1	-2	-2
PC 6	3	2	2	2	2	1	[illegible]	0	-1	-2	-3	-3
PC 7	3	2	2	2	1	1	[illegible]	[illegible]	-2	-3	-3	-3
IAS	3	2	2	2	2	1	0	[illegible]	[illegible]	-3	-4	-4
IA	3	2	2	2	1	0	-1	-2	[illegible]	-4	-5	-5
IB	3	2	2	1	0	-1	-2	-3	-4	-5	-6	-6
IC	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8
No Ice Class	3	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-8

Source : Qvistgaard, (2018)

L'utilisation de POLARIS dans le cadre de la navigation a un impact sur la sécurisation de la navigation et sur son coût.

En se basant sur un historique plus ou moins long des conditions de navigations, l'armateur ou l'affréteur est capable de définir la faisabilité technique de la navigation en anticipant le risque d'être bloqué dans les glaces. Ce système permet au capitaine du navire d'anticiper à plus court terme le chemin à prendre en fonction de l'évolution en temps réel des conditions climatiques.

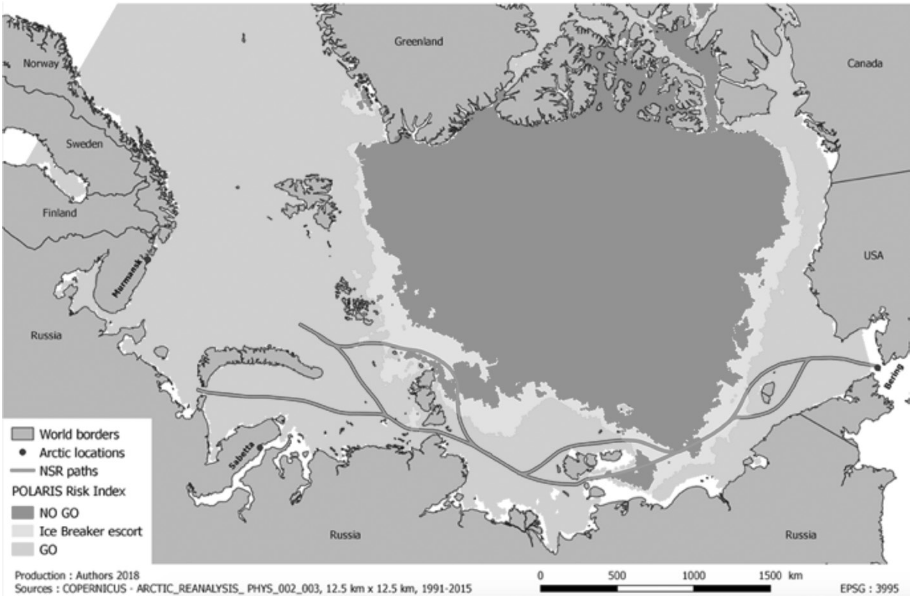
D'un point de vue économique, le fait de définir au préalable la route que suivra le navire permet d'agir en avance sur plusieurs postes de coût.

Premièrement, l'éventuel surcoût de l'assurance. En effet, en définissant au préalable le passage qu'empruntera le navire, la période de navigation et les moyens utilisés pour sécuriser la navigation, la compagnie d'assurance pourra être amenée à revoir sa tarification en faveur de son client. Cet outil est d'autant plus utile pour les compagnies d'assurance que ces dernières se basent sur des historiques pour évaluer le risque et donc estimer le coût de l'assurance, or le développement de la navigation en eaux polaires est encore trop récent pour ce faire (Faury, 2015; Fedi et al., 2018a).

En second lieu, la compagnie sera capable de déterminer si l'utilisation d'un brise-glace est nécessaire bien que rendue non-obligatoire par l'administration Russe (NSRA, 2017). En général, cette assistance est requise par les compagnies d'assurance qui y voient un moyen de prévenir de nombreux risques pouvant survenir durant la navigation.

Le fait de définir les conditions de navigation que le navire va probablement rencontrer permet à l'entreprise de mettre en place une stratégie d'exploitation optimale du navire, notamment en évitant les périodes délicates et donc le coût d'assistance d'un brise-glace russe ou alors en augmentant la durée de navigation, même si cela implique un surcoût important des frais de transit.

Figure 2. Conditions de navigation pour un navire de classe glace 1AS en Arctique le 19/07/2000 dans des conditions de glace médianes



Source : Auteurs

La figure 2 illustre ce qui a été précédemment énoncé et montre comment le système POLARIS peut être appliqué à une carte de l'Arctique. Dans le cas présent, il est question des conditions de navigation POLARIS pour un navire de type 1A le 1er septembre 2000. Le résultat est représenté par quatre couleurs : le vert signifie que le navire peut naviguer sans risque, le jaune que la navigation est possible mais qu'un navire de catégorie C devrait être assisté d'un brise-glace. Enfin, les couleurs orange et rouge sont des zones qui lui sont interdites car les conditions de navigation dépassent sa capacité de résistance.

Les infrastructures

Comme nous l'avons souligné précédemment, pour se développer la RMN nécessite des infrastructures permettant de sécuriser la navigation. Ce développement implique la construction de nouvelles infrastructures portuaires avec une meilleure connexion des ports aux réseaux ferrés existants et le renouvellement de la flotte de brise-glace.

En ce qui concerne les ports, plusieurs investissements lourds ont été effectués ces dernières années avec la construction et la remise à niveau de plusieurs ports en vue de faciliter les exportations de matières premières mais également pour sécuriser le transit via la mise en place de SAR (Search and Rescue) tout le long de la côte russe.

En ce qui concerne la capacité d'exportation, le gouvernement Russe a fixé des objectifs ambitieux en termes de développement portuaire en voulant atteindre entre 133 et 153 millions de tonnes de la capacité pour l'ensemble des ports de l'Arctique russe en 2030 (Rosmoport, 2013). Deux ports apparaissent comme les « piliers » du développement de la RMN, Mourmansk et Sabetta. Mourmansk se positionne comme un Hub régional. Les récents investissements réalisés ont permis au port de gérer 60,7 millions de tonnes de marchandises en 2018, majoritairement des hydrocarbures provenant des ports de Sabetta, Varandey ou Novy et de la plateforme Prirazlomnoye. À ces produits s'ajoute le charbon géré par la compagne SUEK. Le projet qui personnifie le mieux le développement de Mourmansk est sans aucun doute le MTH. Les 133,2 Milliards de Roubles investis (The Ministry of Foreign Affairs of the Russian Federation, 2010) ont permis la création d'un terminal charbonnier de 20 millions de tonnes et d'un terminal pétrolier d'une capacité de 35 millions de tonnes sur la côte Ouest de la baie de Kola (Glukavera, 2011). Al vôte Est verra la création d'un terminal conteneur d'une capacité de 1 million TEU (The Ministry of Foreign Affairs of the Russian Federation, 2010). Le port de Sabetta et le port de Novy sont principalement dédiés aux exportations de GNL (Gaz Naturel Liquifié) pour 16,5 millions de tonnes par an et de pétrole pour 8,5 millions de tonnes. Si ces deux ports représentent une part importante des futurs flux de matières premières, les ports de Varandey et Indiga, dans la mer de Pechora, ne sont pas en reste avec une capacité de 12 millions de tonnes pour Varandey et 5 millions de tonnes pour Indiga. À ces 42 millions tonnes de marchandises s'ajoute la production provenant de la plateforme Prirazlomnoye, à savoir 6,5 millions de tonnes. Si les flux de matières énergétiques sont clairement dominant dans cette partie du monde, la compagnie Norilsk Nickel utilise aussi la RMN pour exporter 1,2 million de tonnes de nickel par an[9].

Parallèlement au développement de la RMN sur la base des flux de matières premières, les autorités russes ont investi ces dernières années dans la mise en place de centres dédiés au sauvetage le long de la route. Au nombre de 10, ces derniers ont bénéficié d'un investissement de 20,6 millions d'euros. En plus de fournir un port où des réparations peuvent être réalisées, leur objectif est de réduire le temps de sauvetage. En effet, même si le CP impose aux navires d'être capable de rester cinq jours sans sauvetage, ce délai reste théorique et considérant les conditions climatiques, il peut être bien plus important.

Si les ports demeurent un paramètre central du développement de la RMN, les brise-glaces en sont la pierre angulaire (Moe et Brigham, 2017). Ces derniers

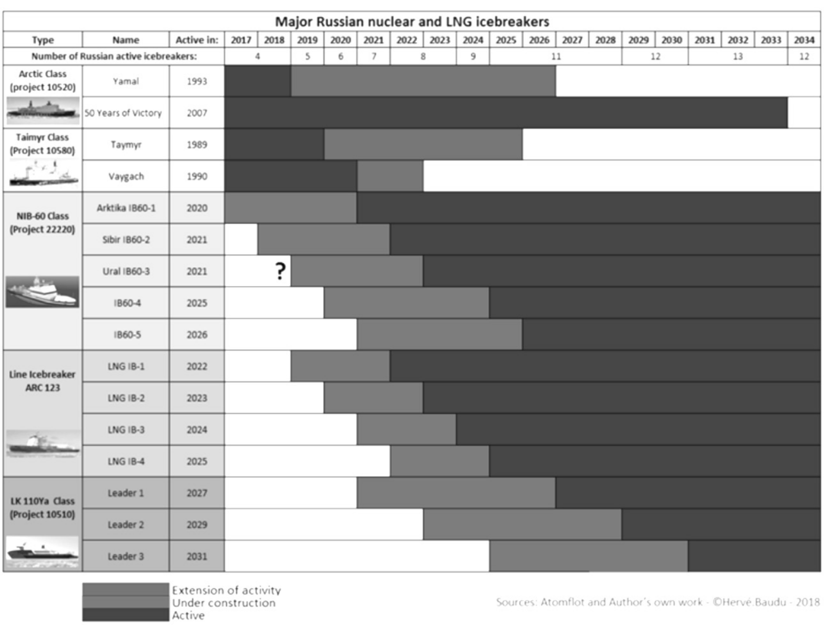
[9] https://thebarentsobserver.com/en/industry-and-energy/2017/03/norilsk-nickel-opens-new-murmansk-terminal-says-it-will-boost-arctic
https://ar2017.nornickel.com/pdf/ar/en/business-group_transport.pdf

rendent possible la navigation dans les eaux polaires. Les russes étant les seuls à posséder de tels navires à propulsion nucléaire. Actuellement, six brise-glaces à propulsion nucléaire sont officiellement exploités (Baudu, 2018). Les années à venir devraient voir l'arrivée de trois nouveaux brise-glaces, de la même classe que le « 50 Let Pobedy » et le « Yamal », déjà en activité, « l'Artika » en 2019, le « Sibir » en 2020 et « l'Ural » en 2022.

En plus de ces brise-glaces, un nouveau modèle est en projet, le « Lider ». D'une puissance de 120 MW et d'une largeur de 47 mètres, il permettra de convoyer des navires plus larges que les Panamax au nord du détroit de Sannikov où les conditions de glace sont plus difficiles avec une limite de 4 mètres de glace et cela tout au long de l'année.

S'il s'avère couteux, ce renouvèlement est plus que nécessaire, car les brise-glaces nucléaires sont les seuls navires capables d'assurer une navigation le long de la RMN en convoi (Moe et Brigham, 2017). Actuellement, quatre brise-glaces nucléaires sont exploités en plus des deux précédemment cités, le « Taymir » et le « Vaygach ». Cependant, comme l'ont indiqué Moe et Brigham (2017) ainsi qu'avant eux Bukharin (2006), la flotte de brise-glaces est âgée. Les brise-glaces « Yamal », « Taymir » et « Vaygach » ont déjà largement dépassé la durée de vie considérée comme normale et bénéficient d'une extension de dix ans (Bukharin, 2006) qui pourrait bien être prolongée.

Figure 3. Prévisionnel du renouvellement de la flotte des brise-glaces russes



Le coût de la gestion du risque

Les conditions de navigation changeantes ont un impact direct sur le chemin emprunté par le navire et donc sa vitesse et le temps du voyage.

Selon la période de navigation et/ou la classe du navire, il peut être nécessaire d'utiliser un brise-glace pour rejoindre l'Asie au départ de l'Europe. En fonction de la période navigation, des conditions de glace rencontrées et de la classe glace du navire, le même trajet peut ne pas être réalisable ou s'il l'est, ne pas avoir les mêmes coûts.

Faury et Cariou (2016) ont mis en évidence l'impact que peut avoir l'épaisseur de la glace sur les coûts, réduisant ainsi la durée de navigation le long de la RMN, pour un navire de classe 1A, entre les mois de juillet et novembre. Cariou et Faury (2015) avaient déjà démontré l'impact de la vitesse sur les revenus générés quand le navire est dans des conditions nécessitant l'assistance d'un brise-glace. En comparant ces derniers à ceux de la route maritime Sud via Suez, les auteurs ont montré que même si la RMN permet d'économiser de l'argent, cela n'est pas forcément suffisant pour opter pour cette route quand la vitesse moyenne utilisée par les navires est faible.

Gritsenko et Kiiski (2016) et Lasserre (2014) ont souligné l'impact négatif que peuvent avoir les frais d'assistance d'un brise-glace par rapport à la route maritime passant par le canal de Suez. Cependant, si Faury et Givry (2017) ont mis en exergue que la RMN n'est pas forcément intéressante économiquement par rapport à la Route du Canal de Suez (RCS), c'est la combinaison des deux routes qui apparaît comme plus pertinente.

Pour sa part, Lasserre (2014) a démontré la dépendance de la compétitivité de la RMN vis-à-vis du prix du fuel, de l'importance de la vitesse de navigation, de la capacité de chargement et parce qu'il est question de transport de container, de la difficulté à respecter les délais.

Il apparaît donc que la vitesse est un des facteurs déterminants pour l'attractivité de la RMN. Cependant, il n'en est pas moins vrai qu'une vitesse non adaptée aux conditions climatiques peut engendrer un accident avec des conséquences économiques, écologiques et humaines importantes.

En outre, si le développement du transport de container est un des axes sur lequel parie le gouvernement russe avec le brise-glace « Lider », une bonne anticipation des conditions de glace pour une meilleur estimation du délai de transport est primordiale et en l'espèce à nouveau, la vitesse joue un rôle prépondérant.

Stoddard et al. (2016) ont présenté le système POLARIS comme un outil permettant une meilleure gestion des risques et intégrant une vitesse conseillée en fonction de la classe du navire et des conditions de glace et de navigation (assisté ou non d'un brise-glace) (Table 2).

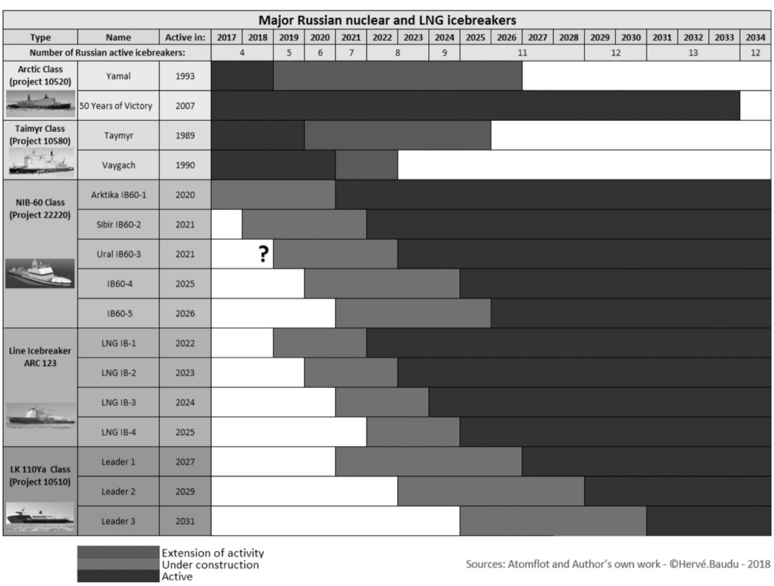
Tableau 2. Risk Index Outcome Criteria

RIO_{SHIP}	*Ice classes PC1-PC7*	*Ice classes below PC 7 and ships not assigned an ice class*
RIO ≥ 0	Normal operation	Normal operation
-10 ≤ RIO < 0	Elevated operational risk*	Operation subject to special consideration**
RIO < -10	Operation subject to special consideration**	Operation subject to special consideration**

Source : OMI (2016)

En se basant sur l'ensemble de ces travaux, Etienne et al. (2018) ont quantifié économiquement la différence de conditions climatiques pour un même navire partant depuis Mourmansk en direction d'un port en Asie. Rigot-Müller et al. (2018) ont mis en évidence l'importance que peut avoir l'utilisation de POLARIS dans la gestion de projets telle que la construction d'une usine de liquéfaction de gaz en Arctique.
Leur étude a pris en considération l'épaisseur, la typologie et la concentration de la glace pour des carrés de 12,5 km de côté le long de la RMN, ce qui leur a permis de définir un RIO pour l'ensemble du chemin défini. A titre d'exemple la figure 3 montre l'évolution du RIO d'un navire de type 1A pour un point de la RMN.

Figure 4. Évolution du RIO d'un navire 1A au Nord des iles de la Nouvelle Sibérie sur l'année



Source : Baudu (2018)

Les résultats obtenus correspondent au RIO pour 50% de données après exclusion des extrêmes. Si pour les semaines 1 à 24, la médiane ainsi que 25% des premières données sont dans le rouge et l'orange, impliquant une impossibilité de passage pour un 1A et indiquant une forte probabilité de blocage à cet endroit, en semaine 25 la prise de décision la n'est pas aussi évidente.

En effet, en fonction de la stratégie de la compagnie maritime et de son appréhension du risque de blocage, elle peut choisir de supporter le risque et de naviguer cette semaine en considérant que la probabilité de passage est plus importante que celle de blocage.

Une telle décision a des implications économiques. Si les conditions de navigation retenues sont celles permettant le passage, alors, pour le cas médian et pour l'option optimiste, le coût du transport serait de 349 948 USD et 305 402 USD avec une vitesse de moyenne de 13,5 et 15,1 nœuds ce qui prendrait respectivement 9,35 et 8,34 jours. Dans le cas pessimiste, le navire serait bloqué à 41% de la distance totale de la RMN. Malgré ce, cela nécessiterait quatre jours au navire pour parcourir cette distance et cela lui coûterait 341 648 USD (Tableau 3).

Tableau 3. Impact des conditions de glace sur le coût de la navigation

	Scénario pessimiste	Scénario médian	Scénario optimiste
Distance parcourue	41%	100%	100%
Coût de la navigation	341 648 USD	349 948 USD	305 402 USD
Vitesse moyenne	12,9 Nds	13,5 Nds	15,1 Nds
Durée de la navigation	4 jours	9,35 jours	8,34 jours

Source : Etienne et al. (2018)

Ce calcul est une estimation du coût réel et il ne prend pas en considération tous les facteurs mais il intègre cependant les paramètres de coût considérés par les auteurs comme principaux et permet de mettre en évidence l'impact négatif que peuvent avoir les conditions climatiques sur l'attractivité de la RMN.

Conclusion

Ces dernières années ont vu la RMN être le sujet de nombreux investissements laissant penser que cette dernière se trouverait à la croisée des chemins. La fonte des glaces (Comiso, 2012), l'arrivée de nouveaux navires à coque renforcée (Baudu, 2018), le renouvellement annoncé de la flotte de brise-glaces russes, le positionnement de ports tel que Mourmansk comme Hub régionaux permettant une meilleure connexion avec les autres ports Russes dédiés à l'exportation de matière première, sont autant d'indicateurs qui semblent attester de la nouvelle dynamique de la RMN.

Toutefois, les risques de blocage dans les glaces, d'échouage liés au possible isolement du navire ou aux longues périodes d'obscurité, ne sont pas des éléments incitateurs pour de potentiels nouveaux entrants et cela en dépit des mesures adoptées pour assurer une navigation aussi sécurisée que possible.

Au regard de ces risques et de leurs impacts négatifs sur l'attractivité de cette zone, de nouveaux outils légaux et des investissements ont été réalisés ces dernières années. D'un point de vue légal, l'entrée en vigueur en 2017 du Code Polaire (Fedi et Faury, 2016) a permis une harmonisation des différentes classifications de navires et l'utilisation d'outils tel que POLARIS pour faciliter la prise de décision des armateurs pour mieux appréhender les conditions climatiques extrêmes.

Si la mise en place d'un cadre légal contraignant permet d'assurer un certain niveau de sécurité en Arctique, les infrastructures ont également un rôle déterminant à jouer. La construction de nouvelles infrastructures est au centre du développement de la RMN, que ce soit d'un point de vue économique, avec les exportations de matières premières ou du point de vue de la sécurité en offrant un refuge en cas de sinistre. Faisant partie intégrante des infrastructures, les brise-glaces sont la « colonne vertébrale » de la RMN. Ils permettent aux navires d'atteindre leur destination finale et peuvent être amenés à secourir un navire en perdition.

L'utilisation du système POLARIS comme outil pour optimiser la navigation en intégrant des paramètres liés au risque de blocage, à la classe de la coque du navire, à la température ambiante et à l'utilisation ou non d'un brise-glace, a un impact direct sur le coût du transit en fonction de la politique de gestion de risque de la compagnie. POLARIS nous montre également la variation importante des conditions de navigation, et par conséquent des risques, au cours d'une même semaine. Il ne fait donc aucun doute que la gestion des risques demeure une des clés de voute du développement de la navigation le long de la RMN combinée à une structuration indispensable des infrastructures portuaires.

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Chapitre 10

Prospective géoénergétique et ses conséquences portuaires sur la circulation maritime arctique russe

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Biography

Since 2011, **Dr Yann Alix** *is the General Delegate of the SEFACIL Foundation which aims to set up, lead and animate a unique international think-tank of excellence around strategic & prospective analysis on themes* related to the future of Maritime Transport, *Ports & Logistics. Since 2012, Dr. Yann ALIX is the founder and director of* Les Océanides *(five volumes) as well co-founder and co-director of Afrique Atlantique since 2017 (four volumes available).*

After obtaining his PhD from Concordia University and his PhD in transportation geography from the University of Caen in 1999, Professor Alix began his career as a consultant in maritime innovation in Rimouski. In 2005, Dr. Yann Alix joined the Normandy Business School (NBS) as a professor of maritime and port studies. In 2007, he was appointed

Director of IPER (Institut Portuaire d'Enseignement et de Recherche) and Director of the Logistics Department of NBS. In 2011, he moved to SOGET, a French leading company in Port Community System, to work as Business Development Manager (2011-2015) and therefore as Head of Strategy & Marketing (2016-2019).
Since April 2019, Dr Yann Alix is Senior Manager at Abington Advisory, an independent consultancy firm inspired by Darwin's evolution theory

A Polar affairs expert with 10 years of experience in the field, **Mikaa Mered** *has been professor of Arctic and Antarctic geopolitics at the ILERI school of international relations in Paris, France, since 2017. Starting 2018, he has also been head of ILERI's MPI degree programme in International Cooperation applied to Overseas France and Environmental affairs. Alongside his duties at ILERI, he is also adjunct lecturer in geopolitics and international relations at NEOMA Business School (Rouen campus, France), and adjunct lecturer in Arctic business and innovation at Sciences Po Rennes (Caen campus, France).*
Co-founder and president of the French Polar Cluster since 2014, Mikaa is also external expert-evaluator to the European Commission, occasionally contributes on Arctic affairs to the French Institute of International Relations' Centre Energie *and is a member of the Humanities and Social Sciences Expert Group of the Scientific Committee for Antarctic Research. After 7 years as an Arctic and Antarctic political risks and market analyst in the private sector (2008-2015), he has served as Arctic advisor to the Senator for Saint-Pierre-and-Miquelon (France, 2015-2017), and has held undergraduate and/or graduate-level lecturing positions since 2016. His first monograph, «The Polar Worlds»* (Les Mondes Polaires), *will be published in October 2019 by the French University Press (PUF, 522 pages). Mikaa Mered is also currently a post-graduate non-military student at the French War College (Ecole de Guerre).*

Abstract

Supply, transport and energy security are the heart of the shipping industry. With the induced effects of climate change, new territories hitherto little exploited become new energy leaders. The rise of numerous news projects across the Arctic is likely to have a strong impact on the ordering of major intercontinental trade flows. The aim of this chapter is to analyze the latest port and maritime developments in the Russian Arctic and to project the logistical and strategic consequences of such developments. In the first part, the paper draws a broad picture of the global energy market in order to figure out how energy-intensive the current global economic is. The second part puts into perspective the planning of large-scale territorial development. Two main case studies are considered: Sabetta and the Murmansk-Arkhangelsk port competition. The analysis aims at showing how Russia manages to raise its own Arctic's business profile with the help of Chinese, Korean, Japanese and large international conglomerates and energy majors such as China's CNPC and France's TOTAL. A third, more forward-looking, section offers a projection of future international maritime traffic flows inside the Russian Arctic. The chapter concludes with an outline of the new analytical framework considered by those amongst Russian and international investors who are interested in turning the Arctic into an intercontinental seaway. In other words, this paper offers one vision on what the future "Arctic market" may look like, with an emphasis on Asia-Russia-Europe intercontinental flows in the Eurasian Arctic. That is, within Russian waters or immediately nearby.

Introduction

L'approvisionnement, l'acheminement et la sécurisation énergétique sont au cœur des schémas circulatoires maritimes planétaires. Avec les effets induits du changement climatique, de nouveaux territoires jusqu'alors faiblement exploités révèlent toujours plus leur potentiel, en particulier dans le secteur de l'énergie. D'immenses zones de l'Arctique s'inscrivent désormais dans de nouvelles perspectives d'exploitation massive qui modifieront l'ordonnancement des grands courants d'échanges intercontinentaux. Avec une politique assumée pleinement par le pouvoir fédéral, l'Arctique russe s'aménage au gré des champs d'hydrocarbures, des mines, des zones de pêche et des forêts ouverts aux investisseurs privés et para-publics.

Avec cette multiplication des zones à exploiter et les infrastructures qui s'y développent, le paradigme qui a sous-tendu une première idée de système de transport maritime régulier de conteneurs à travers l'Arctique est, lui aussi, en train de se modifier en profondeur. Alors même qu'il y a encore dix ans, la perspective d'un service commercial régulier entre l'Europe et l'Asie du Nord-Est via l'Arctique était vue comme de la science-fiction inenvisageable avant la fin du siècle, les premiers services réguliers sont actuellement en phase de test, sous l'impulsion du chinois COSCO Shipping, de l'administration fédérale et de gouvernements locaux russes, de même que sous le regard appuyé des communautés industrielles sud-coréenne, japonaise, néerlandaise, finlandaise, islandaise ou encore allemande. Aussi, même si certains grands acteurs du maritime étrangers à la zone comme CMA-CGM promettent désormais de ne « jamais passer par la Route Maritime du Nord » (Descamps, 2019), on peut néanmoins noter que l'intérêt d'acteurs grecques, dubaïotes, mais aussi singapouriens ou encore panaméens, qui cherchent à prendre position dans le nouveau jeu portuaire et/ou diplomatique de l'Arctique en prévision des développements anticipés, forment aujourd'hui une dynamique supplémentaire en faveur du développement des routes arctiques, et en particulier du Passage du Nord-Est.

Le présent chapitre a ainsi pour ambition d'analyser les derniers développements portuaires et maritimes dans l'Arctique russe et d'en projeter les conséquences logistiques et stratégiques. Dans une première partie, il est indispensable de considérer le marché mondial de l'énergie pour constater combien notre monde contemporain demeure toujours plus énergivore. La transition énergétique et la part de tous les modes renouvelables restent très minoritaires dans la consommation énergétique mondiale avec des géants démographiques comme la Chine et l'Inde qui persistent dans l'usage d'énergies « conventionnelles » comme le pétrole et le charbon. Cette première partie confirme cependant la croissance rapide du gaz naturel dans le mix énergétique planétaire ce qui justifie en partie les ambitions stratégiques de la Russie à l'égard des immenses réserves prouvées des territoires arctiques.

La deuxième partie met en perspective la planification des aménagements territoriaux de grande envergure, depuis la péninsule de Yamal et le port spécialisé de Sabetta jusqu'au duo Mourmansk-Arkhangelsk. De l'exploration à la livraison, de véritables stratégies intégrées permettent aux intérêts russes de « sortir » leurs matières premières énergétiques avec le soutien politique, économique et financier de partenaires publics et privés internationaux. L'analyse permet de démontrer comment Moscou coordonne une valorisation de ses réserves énergétiques avec l'appui géopolitique de Beijing mais aussi des coréens, des japonais et de grandes entreprises privées internationales comme le groupe français Total.

Une troisième partie plus prospective propose une projection des futures circulations maritimes internationales dans l'espace arctique sous contrôle russe. L'analyse des investissements maritimes et portuaires orchestrés par Moscou met en évidence l'ambition stratégique russe de contrôler au maximum les passages commerciaux dans son espace maritime. La maîtrise technologique du nucléaire civil permet aux entreprises spécialisées russes d'anticiper la planification de convois maritimes sécurisés par le déploiement de futurs brise-glaces à propulsion nucléaire de nouvelle génération. Une véritable TransArctic Russian Maritime Highway pourrait ainsi se matérialiser dans les prochaines années à l'instar de ce qui est démontré déjà dans les mouvements stratégiques des méthaniers spécialisés ARC7.

Le chapitre se conclut par la proposition d'une nouvelle organisation maritime et portuaire internationale qui verrait l'avènement d'une nouvelle génération de ports de transbordement aux entrées occidentales et orientales de l'espace maritime arctique sous contrôle souverain russe. Considérer l'Arctique russe comme une nouvelle mer intérieure aux potentiels considérables exige de changer de paradigme avec des exploitations commerciales qui combineront les volumétries entrantes et surtout sortantes du « marché Arctique » avec les flux intercontinentaux Asie-Russie-Europe qui profiteront d'un raccourci nautique qui reposera sur une organisation de transport encore jamais expérimentée nulle part ailleurs.

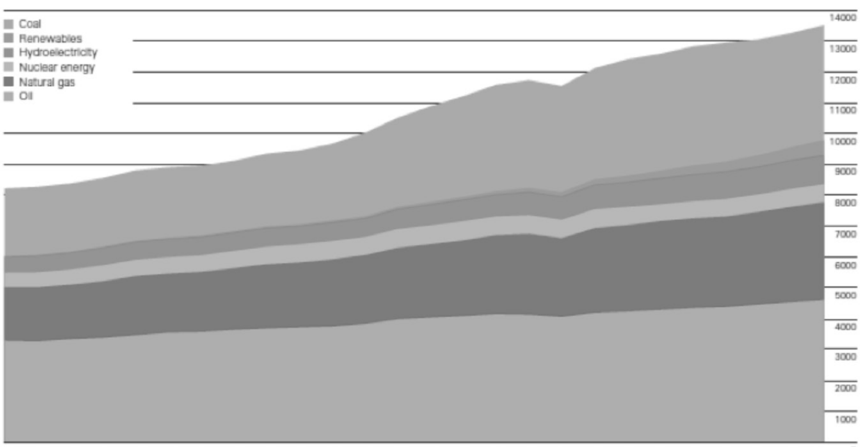
Pour une perspective basée sur les réalités prévisibles du marché mondial des matières premières énergétiques

L'art de la prospective consiste en premier lieu à partir des connaissances acquises par le passé et le présent pour mieux anticiper et participer aux évolutions du futur, principalement en tirant des tendances partant de l'existant. Dans le contexte actuel connu, le développement portuaire russe Arctique repose pour l'essentiel sur l'extraction, l'exportation et le transit de deux catégories de produits souvent confondus mais aux logiques industrielles bien distinctes : le pétrole et le gaz naturel liquéfié (GNL). En sus, aux réserves énergétiques considérables constituées par ces deux produits, s'additionnent les terres rares, l'hydrogène, le charbon ou encore de gigantesques autres potentiels miniers qui complètent des volumétries de fret exports en progression constante depuis cinq ans (Mered 2019b) avec la singularité de reposer sur des organisations logistiques très dissemblables. Cela signifie que les structurations des chaînes d'exportation depuis l'immense territoire russe sont distinctes et peu compatibles les unes avec les autres. Que ce soit à Mourmansk, Arkhangelsk et encore plus les deux ports de Sabetta et Novy Port, la quintessence des trafics en tonnage repose aujourd'hui sur des mouvements de navires vraquiers spécialisés. D'autres sites portuaires devraient émerger au fil des années avec la combinaison de la mise en exportation des typologies de marchandises déjà susmentionnées, des opportunités de navigabilité arctique accrue par l'émergence de nouvelles technologies, et enfin de la fonte accélérée des glaces de mer (banquise) tant estivales qu'hivernales (Mered 2019c, figure 2).

Les ambitions énergétiques sur le pourtour russe de l'espace Arctique reposent sur quatre réalités de marché intangibles extraites des travaux contenus dans le Rapport 2018 de British Petroleum :

- Notre monde contemporain est de plus en plus énergivore avec une croissance quasi constante des volumes consommés qui correspond à 5000 millions de tonnes équivalent pétrole supplémentaires depuis 1992 pour atteindre un total de 13 400 millions de tonnes équivalent pétrole en 2017.
- Plus de 60% du total énergétique consommé à l'échelle planétaire relève de deux énergies fossiles primaires soit le pétrole et le gaz naturel avec une quote-part qui ne faiblit pas malgré la croissance constante des énergies renouvelables et l'augmentation de la part du charbon dans le total du mix énergétique planétaire.
- Les deux géants que sont la Chine et l'Inde n'en sont qu'aux balbutiements de leur mutation énergétique avec pour l'instant un recours massif au charbon.
- La consommation de gaz naturel a augmenté de 3% en 2017, soit la croissance la plus significative depuis 2010 avec une croissance remarquable pour la seule Chine (31 milliards de mètres cubes supplémentaires en 2017) et le marché européen (26 milliards de mètres cubes).

Figure 1. Consommation mondiale d'énergie (en millions de tonnes équivalent pétrole)

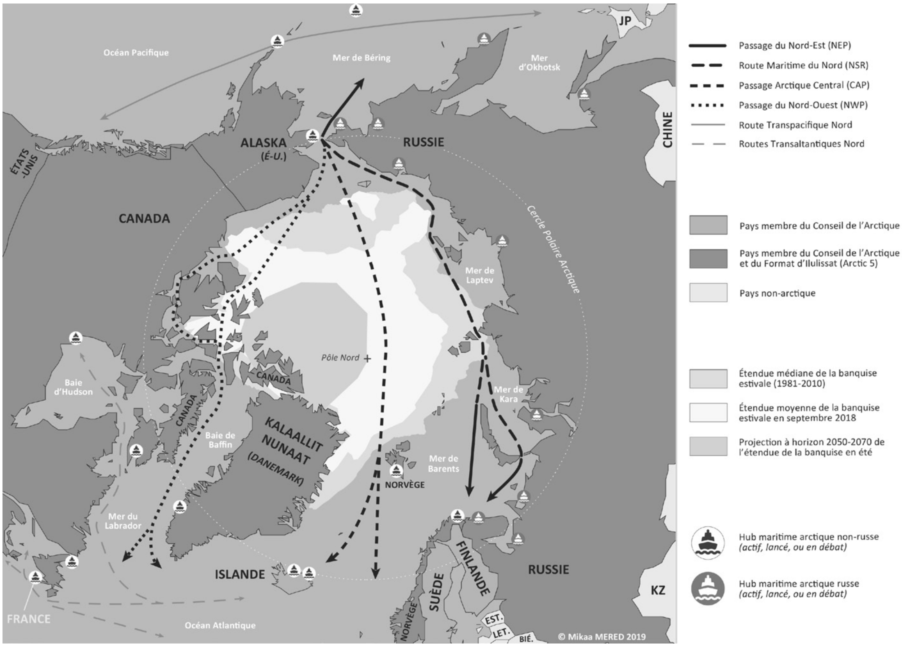


Source : British Petroleum, 2018

En établissant une corrélation avec la croissance économique programmée des économies internationales les plus énergivores (Chine, Etats-Unis d'Amérique, Russie, Inde, Union Européenne, etc.), le seuil symbolique des 15 000 millions de tonnes équivalent pétrole pourrait être dépassé avant 2030 ; considérant que 2017 a vu une croissance de 2,2%, soit la plus importante depuis 2013 et que la croissance décennale s'établit tout de même à 1,7% *(BP Energy 2018).* Rappelons d'ailleurs que la Chine est, pour la 17e année consécutive, le pays avec la plus importante croissance de consommation énergétique avec 3,1% en 2017. Cela en fait donc le marché de destination le plus intéressant à court et moyen termes, considérant par ailleurs une intéressante évolution dans la projection du futur mix-énergétique chinois. Un tiers de la croissance nette de 2017 en gaz naturel (96 milliards de mètres cubes) concerne le seul marché chinois, ce qui signifie une augmentation de 15% de sa consommation de gaz naturel pour la seule année 2017 ! Cette augmentation remarquable doit s'inscrire dans la durée car Beijing planifie de convertir des pans entiers de l'industrie lourde du charbon aux énergies plus propres (gaz naturel et électricité).

Pour ce faire, la Chine consolide ses réseaux d'approvisionnement énergétique en multipliant les partenariats stratégiques le long de plusieurs routes maritimes et terrestres. C'est toute l'ambition initiale de l'Initiative Ceinture et Route *(Belt and Road Initiative, BRI)* qui alimente les spéculations et les fantasmes géopolitiques les plus fous. Pourtant, en restant très pragmatique, il suffit de s'attarder sur l'inclusion des routes maritimes de l'Arctique dans les objectifs de la BRI et le rapprochement avec la Russie pour percevoir une vision intégrée voué à interconnecter des zones économiques et stratégiques majeures les unes avec les autres afin de servir les besoins de la Chine (figure 2).

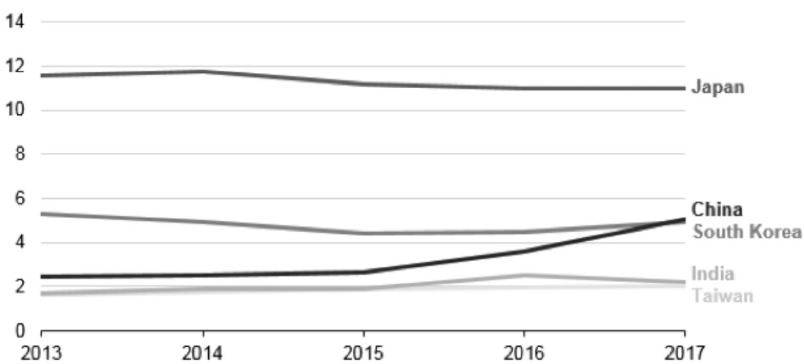
Figure 2. **Carte des principales routes maritimes arctiques et projets de hubs**



Source : Mikaa Mered, 2019

Avec une croissance historique de 10% en 2017, le trafic mondial du LNG continue d'être stimulé par cette demande chinoise, comptant pour près de la moitié de ladite croissance, devenant pour la première fois de l'histoire le second importateur net de LNG après le Japon encore largement devant mais surpassant la Corée du sud (Figure 3).

Figure 3. **Top 5 des importateurs de LNG (en milliard de mètres cubes par jour – 2013-2017)**



Source : EIA, 2018

Beijing orchestre actuellement la conversion de millions de logements particuliers au gaz naturel afin de dépolluer l'air des principales métropoles du nord-ouest du pays, source à la fois d'inquiétudes du public comme du régime. D'un point de vue purement géographique et stratégique, les investissements infrastructurels chinois se réalisent partout sur la frange littorale avec un vingtième terminal confirmé en 2018. L'ouverture du marché infrastructurel du LNG au secteur privé devrait stimuler une saine compétition avec les acteurs historiques publics. L'entrée en opération du terminal ENN Group à Zhoushan dans la province du Zheijang (capacité de 3 millions de tonnes par an) devrait atteindre 10 millions de tonnes à terme avec près de 1,5 milliard d'investissements (Xin, 2018). L'importation chinoise du LNG ne cesse de croître avec une spectaculaire augmentation de 47,3% entre 2016 et 2017 pour atteindre un total de 39,1 millions de tonnes. Les 6 premiers mois de 2018 s'avèrent encore plus prometteur avec une augmentation de 50% des volumes.

Cela corrobore aussi le fait que la politique énergétique chinoise et le développement des terminaux LNG sur les rives de la Chine continentale devraient intensifier la relation stratégique entre Sabetta et les capacités d'absorption des immenses marchés asiatiques. Pour le moment dépendant des approvisionnements gaziers australiens (17,8 millions de tonnes en 2017) et qataris (7,7 millions de tonnes en 2017), Beijing ne cesse de se rapprocher de Moscou pour développer des contrats à terme qui consoliderait la route maritime arctique et surtout les liens entre infrastructures arctiques russes et leurs homologues chinoises. Les perspectives d'ouverture de nouveaux terminaux arctiques russes à l'horizon 2030 comme Arctic LNG 3, Pechora LNG ou Ob LNG s'inscrivent dans cette dynamique globale.

Pour conclure sur les perspectives énergétiques connues, il convient d'affirmer que toute la pertinence d'une prospective territoriale et stratégique dépend de la réalité des données connues sur les réserves potentielles de pétrole et de gaz dans les aires Arctiques. En 2008, le *US Geological Survey* table sur « seulement » 10% des réserves pétrolières et 29% des réserves de gaz qui pourraient se trouver en Arctique. Ces 90 milliards de barils de pétrole et 47 261 milliards de mètres cubes de gaz naturel représentent environ 3 années de consommation réelle mondiale de pétrole contre un peu plus de plus de 7 années pour le gaz naturel (Lasserre, 2014).

Ces chiffres ne prennent toutefois pas en compte les zones où les conditions d'opération sont comparables à celles de l'environnement arctique au moins partiellement dans l'année. Les régions à forte exploitation ou potentiel comme le Khanty-Mansi, Sakhalin, ou la région Irkoutsk ne sont pas comptabilisées dans cette évaluation de l'USGS, alors même qu'ils sont soumis à des glaces, du pergélisol, de l'isolement, ou des températures toutes aussi extrêmes qu'en Arctique et sont comptabilisés comme « arctique », « subarctique » ou « cold-climate » par certains États et majors énergétiques comme Gazprom, Rosneft ou

Shell, par exemple. Cette étude ne prend pas non plus en compte les ressources dites non-conventionnelles, comme les gaz de schiste par exemple, dont la présence à travers toute la Sibérie orientale reste encore à quantifier.

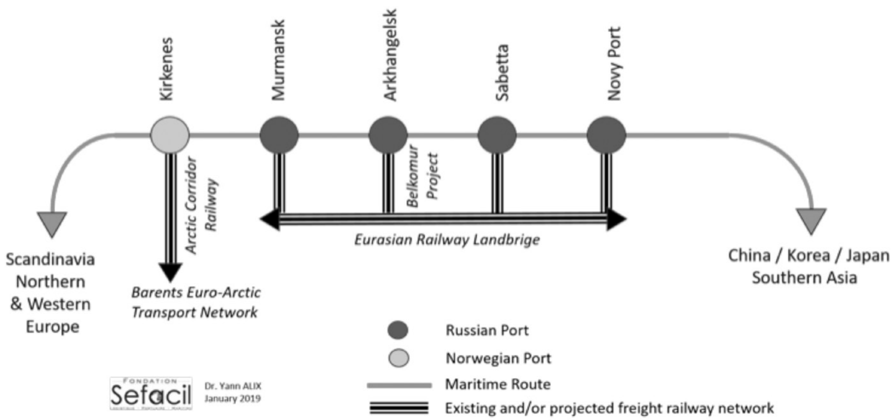
Ainsi, depuis la publication de l'étude de l'USGS il y a onze ans, de nombreuses autres études réalisées à des échelles locales sont parues. Beaucoup ont renforcé l'attention des investisseurs et des médias pour l'Arctique de par les promesses annoncées en particulier au Canada et en Russie. Celles-ci, estimant désormais également les ressources non-conventionnelles telles que les gaz et pétrole de schistes ou encore les sables bitumineux, ont fait exploser les chiffres, conduisant à un regain d'intérêt pour l'ensemble de la zone dépassant les seules ressources conventionnelles. Dans le même temps, de nombreuses innovations ont été développées et mises en place pour adapter les actifs pétro-gaziers arctiques à un prix du pétrole redescendu autour de 50 dollars le baril (2015-2017).

En 2018, pour la seule Russie, si les territoires arctiques ne couvrent que 15% de la superficie totale nationale pour à peine plus d'un million d'habitants, ils représentent déjà 20% du GNP. Il n'est donc pas anodin de rappeler que 80% des extractions gazières actuellement en production par la Russie se trouvent dans les aires d'exploitation arctiques, stricto sensu (Arctic Herald, 2018). Ce chiffre monte à 90% si l'on ajoute les zones arctiques impermanentes ou subarctiques de Sibérie Orientale.

Ports énergétiques et nouvelle rangée portuaire arctique russe

De l'Union européenne/Scandinavie au triptyque Japon-Corée-Chine, la façade Arctique russe s'intègre dans de nouvelles perspectives circulatoires maritimes avec un schéma aujourd'hui assez classique. D'un point de vue purement géographique et stratégique, les marchés de consommation nord-ouest européens d'une part, ceux du nord-est asiatique d'autre part, enchâssent le potentiel d'exportation énergétique Arctique dont le cœur névralgique est aujourd'hui le port de Sabetta pour le LNG et Novy port pour le pétrole (Figure 4).

Figure 4. **Projection de la rangée portuaire de la Russie arctique occidentale**



Source : Alix 2019, in FAURY, O., ALIX, Y., KERBIRIOU, R., PELLETIER, J.F., SERRY, A., 2019

L'héritage de l'histoire (et aussi de la géographie climatique) continue de faire de Mourmansk le principal port arctique russe et demeure toujours la porte d'entrée et de sortie de l'Arctique occidentale russe (jusqu'à la Péninsule de Yamal), jouant autant le rôle de « Gateway Arctique » que de port stratégique de transbordement et de stockage (Faury, Alix, Kerbiriou & Serry, 2019). Même perspective malgré des contraintes physiques plus importantes pour Arkhangelsk et son port avancé de Severodvinsk mais qui continuent d'intéresser les investisseurs chinois (Nilsen, 2016).

Toutefois, l'analyse des circulations maritimes récentes tendent à démontrer plusieurs tendances qui pourraient autant renforcer la tête de pont que représente Mourmansk qu'exacerber de nouvelles rivalités portuaires arctiques avec l'émergence de complexes industrialo-portuaires de grande envergure, tant en Arctique russe que sur ses marges proches comme en Norvège avec l'immense projet logistico-portuaire du corridor Arctique-Scandinavie-Europe de Kirkenes. La fixation d'investissements internationaux et russes sur quelques points portuaires focaux historiques (Mourmansk, Arkhangelsk et Vladivostok) et nettement plus récents (Sabetta et Dudinka) constitue l'ossature d'un futur réseau portuaire arctique interconnecté aux mondes asiatiques, scandinaves et européens.

Des ports secondaires situés plus à l'est comme Pevek et Tiksi ou encore Provideniya constituent d'intéressants ports-relais dans les futures circulations entre la péninsule de Yamal et l'Asie du nord-est. Ces futures installations portuaires s'inscrivent dans d'immenses projets énergétiques et miniers qui se construisent dans une logique d'exportation massive. L'ensemble des investissements infrastructurels (ports, voies de chemin de fer, villes nouvelles, etc.) s'inclut dans des modèles d'affaires sur mesure où les dividendes attendues de l'exploitation des matières premières doivent couvrir ces aménagements durables de l'immense territoire côtier arctique russe. Dans une perspective nettement plus prospective, il est même à penser qu'une future rangée portuaire arctique russe pourrait se consolider et constituer des points d'origine et de destination qui relieront les marchés européens mais surtout asiatiques via de nouveaux sillons nautiques.

La sécurisation des approvisionnements énergétiques est au cœur de projets de la triade Chine-Japon-Corée des trois et le réchauffement climatique à moyen et long termes pourrait rendre crédible une circulation maritime directe entre de futures complexes industrialo-portuaires orientaux russes et les économies asiatiques.

La péninsule de Yamal : centre névralgique de l'actuelle circulation énergétique Arctique russe

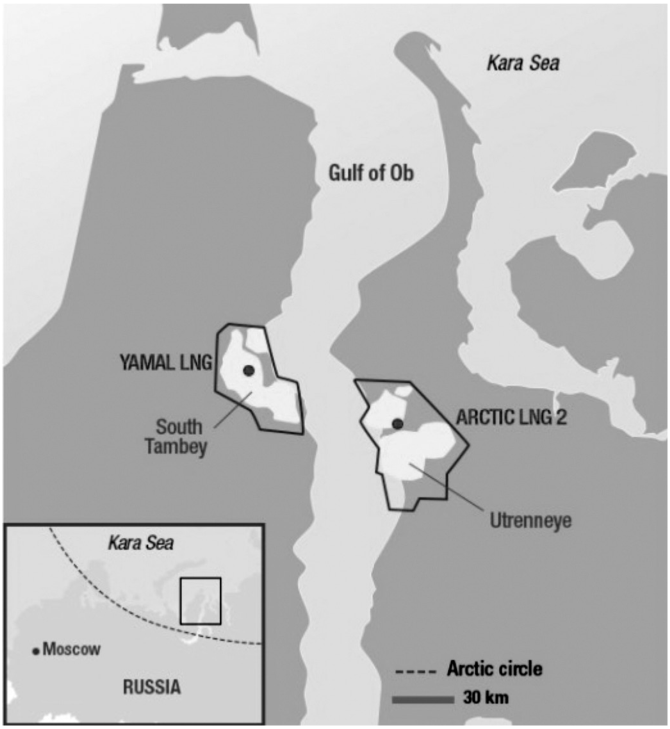
Les volumétries gazières et pétrolières sont avérées avec déjà 4 millions de tonnes de GNL exportés depuis Sabetta et un peu plus de 4 millions de tonnes de pétrole de Novy Port (Antonov, 2018). Les réserves prouvées de gaz naturel du South Tambey Field sont estimées à 926 milliards de mètres cubes avec une capacité de transformation qui permet l'exportation programmée de 17,5 millions de tonnes annuel d'ici 2021 (Krotov, 2017). Le dimensionnement des investissements russes et internationaux laisse entrevoir un véritable aménagement territorial et stratégique de tout l'estuaire de l'Ob, à l'image de ce qui a déjà été réalisé sur les 5 dernières années sur le seul site de Yamal (Figure 5).

Figure 5. **Évolution quinquennale du site de production de LNG de Yamal (2014-2018)**

Source : Antonov, 2018

Nous en sommes déjà à la projection du quatrième site d'exploitation gazière toujours piloté par la compagnie russe Novatek. Le projet Ob LNG exploitera les champs gaziers de Verkhnetiuteyskoye et Zapadno-Seyakhinskoye, tous deux situés dans la partie centrale de la péninsule de Yamal. 157 milliards de mètres cubes sont estimés, ce qui justifie l'implantation d'un nouveau site industriel d'une valeur estimée à 5 milliards US$ qui pourrait produire jusqu'à 4,8 millions de tonnes de LNG chaque année, exportés depuis le port proche de Sabetta (Liubov, 2019). Cela complète les capacités totales de *Yamal 1* (16,5 millions de tonnes annuelles de LNG), de *Arctic LNG 2* (19,8 millions de tonnes annuelles de LNG), et du futur *Arctic LNG 3* (actuellement en étude d'opportunité) faisant de la péninsule de Yamal l'une des régions gazières les plus dynamiques de la planète avec des coûts d'exploitation et d'expédition très compétitives malgré les conditions climatiques extrêmes au nord du cercle polaire (Figure 6).

Figure 6. Localisation des sites de Yamal LNG et de Arctic LNG 2 dans le Golfe du fleuve Ob



Source : Groupe TOTAL, 2018

Les seuils de rentabilité ne cessent de se bonifier tant par les effets d'échelle que par l'apport continuel de nouvelles technologies et techniques d'exploitation. Dorénavant, les seuils de rentabilité des hydrocarbures arctiques onshore et offshore se situent entre 30 et 35 US$ le baril équivalent pétrole (Mered, 2019a).

De plus, l'engagement de Rosatomflot pour une assistance maritime avec des brise-glaces nucléaires aux navires spécialisés de LNG jusqu'en 2040 confirme qu'en plus des infrastructures industrielles terrestres, une véritable stratégie de services aux pré- et post-acheminements intercontinentaux maritimes est déjà opérationnelle. Par ailleurs, la livraison de 15 ARC7 tankers arctiques géants d'ici fin 2020 manifeste clairement l'engagement des opérateurs spécialisés russes et internationaux de se projeter sur le long terme sur le complexe de Yamal. Ces navires baptisés YamalMax présentent une longueur de 300 mètres pour une capacité d'emport de 172,600 mètre-cubes. Ils peuvent surtout, avec leur classification par *Bureau Veritas* et the *Russian Maritime Register*, naviguer dans une épaisseur de glace de 2,1 mètres *(The Maritime Executive, 2014)*. Ces navires sont le fruit d'une véritable collaboration internationale arctique puisqu'ils ont été dessinés par le cabinet finlandais Aker Arctic et construits par les coréens de *Daewoo Shipbuilding & Marine*. Les YamalMax ont été charté à long-terme (45 ans) par cinq compagnies *(Sovcomflot, Teekay, Dynagaz et Mitsui O.S.K Lines* en collaboration avec le géant chinois COSCO) pour garantir un modèle d'affaires qui satisfassent toutes les parties prenantes, de l'extraction initiale à l'exportation maritime aux transbordements, transformations et distributions dans les terminaisons portuaires européennes et asiatiques.

Deux ports ouest-européens, Zeebrugge en Belgique et Montoir en France se sont déjà positionnés comme de futurs hubs de transbordement du LNG en provenance directe de Yamal, profitant de services maritimes hivernaux sans rupture assurés par les navires brise-glace de type ARC7. Pour Montoir, le contrat initial signé en 2015 avec Elengy (Groupe Engie) porte sur 1 million de tonnes de LNG pendant 23 ans à partir de 2018. Cela signifie pour le russe Novatek Gas & Power de repositionner rapidement les navires spécialisés directement sur Yamal et ainsi optimiser l'usage maritime de la capacité navale spécialisée. A Zeebrugge, port belge qui a fait du gaz naturel une spécialité, le contrat signé aussi en 2015 porte sur un transbordement stratégique sur 20 ans avec le groupe belge Fluxys LNG. Ce dernier prévoit, en collaboration avec l'autorité portuaire, de porter à 8 millions de tonnes par an la capacité de traitement du terminal spécialisé.

Une logistique à deux faces articule un tel développement stratégique sur deux têtes de pont ouest-européennes du transbordement LNG russe arctique. Pendant la période hivernale, les navires spécialisés empruntent la solution européenne pour un transbordement stratégique sur des méthaniers conventionnels qui approvisionnent essentiellement l'Asie via le canal de Suez. Pendant la période estivale, les méthaniers brise-glaces ARC7 peuvent de manière autonome servir directement les marchés asiatiques via la route maritime du nord. Raccourcissement du temps de transit et optimisation des capacités de transport permettent une logistique annuelle articulée depuis les installations de Sabetta, renforçant de facto ce nouveau point de fixation portuaire absolument crucial dans la dynamique stratégique arctique de Moscou.

Toutefois, ces stratégies de transbordement demeurent très précaires face aux ambitions russes d'optimiser les rotations des ARC7 dans le périmètre géographique arctique sous contrôle russe. Les norvégiens en ont fait les frais, passant de l'euphorie de transbordements effrénés en ship-to-ship dans les eaux protégées du fjord Sarnesfjord à la décision unilatérale russe de « rapatrier » les transbordements de l'autre côté de la frontière, redonnant le contrôle total des opérations de transbordements des ARC7 vers des méthaniers conventionnels aux opérateurs économiques et logistiques russes. L'histoire est assez simple : avec 6 mois d'avance dans l'opération du deuxième train de production LNG du site de Yamal, la société russe Novatek avait passé un accord avec l'opérateur spécialisé norvégien Tschudi Shipping Group pour accélérer les transbordements ship-to-ship. Entre le 21 novembre 2018 et le 29 juin 2019, plus de 300 transbordements stratégiques ont eu lieu à la grande satisfaction de la petite ville norvégienne de Honningsvåg qui servait de port-relais dans le fjord Sarnesfjord (figure 7).

Figure 7. Opération de transbordement LNG dans le Sarnesfjord à proximité de la ville portuaire norvégienne de Honningsvåg

Source: Kjell Bendik Pedersen/TSS – The Barents Observer – 2019 - July, 5th

Les transbordements *ship-to-ship* vont repasser de l'autre côté de la frontière dans la baie de Kola, à proximité de l'île de Kildin suite à l'investissement de Novatek pour un terminal spécialisé d'une capacité de 20 millions de tonnes qui pourrait être construit à *Ura Guba* (Staalesen, A 2019). Ce fjord situé à 50 kilomètres à l'ouest de Mourmansk est libre de glaces toute l'année et assez profond pour accueillir des très gros porteurs. Total sera une nouvelle fois partenaire pour chacun de ces hubs de transbordement, à hauteur de 10% en propre – c'est-à-dire sans compter les parts de Novatek détenues par Total. Le gaz issu de Yamal LNG voué à être transbordé à destination de l'Europe n'ira ainsi plus jusqu'en Norvège. Ce projet de nouveau terminal LNG s'inscrit dans une stratégie maritime et logistique d'optimiser les rotations des ARC7 dans les eaux arctiques russes. Elle inclut aussi l'opportunité de consolider les connaissances et compétences russes, tant dans la maîtrise des opérations de *ship-to-ship* que dans la construction, par des sociétés prioritairement russes, des futures installations portuaires de LNG. Cela met en perspective ce que nous illustrerons plus en avant dans la partie prospective, à savoir des hubs de nouvelle génération qui structurent l'éclatement des flux en entrée/sortie d'une future autoroute maritime arctique russe.

En effet, l'Asie est le principal marché-cible de Novatek qui s'inscrit désormais, pour ses prochains projets arctiques, dans une logique dite 80/20 ; c'est-à-dire 80% de sa production vers l'Asie et seulement 20% vers l'Europe : un partage du marché intelligent avec Gazprom, lequel exporte via gazoducs depuis l'Arctique vers l'Europe, tandis que ses exportations vers la Chine proviennent principalement du sud de l'Extrême-Orient russe (Sakhalin, région d'Irkoutsk et sud de la Yakoutie). Novatek prévoit donc de bâtir à l'horizon 2022 pour près d'un milliard d'euros une île artificielle dans la Baie de Bechevinskaya sur la péninsule du Kamchatka, pour réaliser ces transbordements de LNG arctique vers l'Asie.

Depuis, ce modèle intégré usine + brise-glaces dédiés + hubs en entrée et sortie des zones de glaces développé par Novatek a fait tache d'huile. Rosneft s'en inspire pour son projet Pechora LNG et les suivants au centre du Passage du Nord-Est. Gazprom Neft l'a appliqué sur un autre projet en péninsule de Yamal et a pris livraison de deux nouveaux brise-glaces en Février 2019. Gazprom va également l'adopter pour ses prochains projets GNL (Mered, 2019c).

Le cas des aménagements industriels de la Péninsule de Yamal et des futures zones de transbordement constitue en ce sens une excellente illustration de la consolidation stratégique d'une série de futurs hubs arctiques incontournable où se combineront la transformation des extractions énergétiques, le développement d'une future grande ville arctique avec des capacités de croissance liées à la R&D, aux FDI, etc. Les premières phases de construction des infrastructures du complexe LNG ont représenté une importation nette de 500,000 tonnes de marchandises (essentiellement sous forme de modules préfabriqués en Chine), mobilisant 650 entreprises russes et environ 60,000 personnes selon les chiffres officiels (Bogoyaslensky, 2018).

Dans la future circulation maritime internationale en zone Arctique, la péninsule et son écosystème constitueront une zone refuge en cas de problèmes, une future aire de réparation navale en cas d'incidents sur les unités flottantes, un territoire sophistiqué pour toute évacuation d'urgence, etc. Cette projection territoriale relève autant du pragmatisme de marché qui conforte les investisseurs énergétiques russes et internationaux que d'une prospective nettement plus stratégique de la part de l'Etat russe ; ce dernier fixant un aménagement dense et productif pour des décennies au cœur de territoires quasiment vides de population. La péninsule de Yamal pourrait représenter jusqu'à 15% des réserves mondiales prouvées ; ce qui implique une projection stratégique à très long terme avec une planification et un aménagement du territoire qui dépassent très largement les seuls sillons maritimes et leurs terminaisons portuaires. L'agrandissement de l'aéroport est déjà programmé et divers projets connectent la péninsule aux réseaux ferroviaires et routiers de l'ouest du pays via des pénétrantes stratégiques reliant Arkhangelsk, Moscou, Saint-Pétersbourg et les réseaux centre/ouest européen.

A terme également, à l'instar des projections au Canada et aux Etats-Unis, l'embranchement des terminaisons portuaires arctiques aux axes eurasiatiques transsibériens orientés est-ouest doit être aussi à l'esprit. Les sillons ferroviaires existent et sont modernisés par l'augmentation continue des services réguliers de trains-blocs remplis de produits manufacturés qui connectent les marchés chinois, centre-asiatiques, russes et européens. Des projections réalistes russes visent un train eurasiatique toutes les heures sur leur territoire (entretien privé avec Dyakanov, 2018).

Un bémol toutefois dans ces projections stratégiques : les incitatifs socio-économiques (salaires, logements, etc.) ne suffisent pas à attirer et fixer des populations sur ces zones arctiques jugées toujours hostiles. Comme c'est déjà démontré dans le cas actuel de Mourmansk, étudiants, chercheurs, cadres supérieurs peinent à combler la demande de main d'œuvre. Pour les seuls services médicaux, il manquerait 750 docteurs dans la zone pourtant plus accessible et moins septentrionale de Mourmansk (Tsybulsky, 2016).

Mourmansk – Arkhangelsk – Kirkenes : compétitions maritimo-portuaires et connectivités logistiques terrestres

Les villes portuaires de Mourmansk et d'Arkhangelsk ont historiquement joué des rôles primordiaux dans la circulation maritime de l'ouest et du centre de l'Arctique russe ; la première, libre de glace à l'année longue, a toujours officié comme un port stratégique pour toutes les catégories de produits, jouant même de manière pionnière un rôle de hub autant commercial que militaire. C'est même précisément dans ce but – déjà – qu'elle fut créée de toutes pièces par la Russie tsariste dès 1916. Les prochaines années devraient être charnières dans le développement industriel et portuaire de Mourmansk qui profite autant de son accessibilité nautique que de l'amélioration des connectivités terrestres.

Au registre des grands investissements connus et confirmés, le très puissant groupe SUEK *(Siberian Coal Energy Company)* va se connecter, via 46 kilomètres de nouvelles voies ferroviaires dédiées, au futur terminal charbonnier de Lavna dans la Baie de Kola. Programmé pour fin 2019, la première tranche d'extension portuaire permettra d'exporter 9 millions de tonnes de charbon issues principalement des immenses gisements de la région du Kusbass. A terme, soit dès 2023, ce sont 25 millions de tonnes de capacité que la région portuaire de Mourmansk devrait proposer via l'extension des capacités du site de Lavna et la modernisation des installations historiques de Mourmansk (capacité portée à 8 millions de tonnes).

Le plus important dans cette projection sur les vracs secs d'exportation depuis l'ensemble portuaire de Mourmansk, c'est le rôle crucial des connectivités terrestres. Dans de tels projets industrialo-portuaires, la logistique et les transports terrestres constituent des éléments structurants indispensables et SUEK travaille de concert avec The State Transport Leasing Company and the Federal Agency for Maritime and River Transport pour projeter une infrastructure intégrée, depuis les gisements jusqu'aux superstructures portuaires sur les terminaux maritimes. D'autres projets structurants sont d'ores et déjà confirmés sur le nouveau site de Lavna comme celui d'un terminal d'exportation de fertilisants qui aurait une capacité nominale d'exportation de 6 millions de tonnes métriques.

L'autre grand port maritime de la Russie occidentale mais qui ne dispose pas des mêmes prédispositions naturelles, c'est Arkhangelsk sur la mer blanche avec, entre autres, les chantiers navals historiques de Severodvinsk en aval où se construisent les flottes russes à propulsion nucléaire. Demain, Arkhangelsk, ce pourrait être un grand hub portuaire en eaux profondes avec une projection stratégique qui viendrait probablement aiguiser la compétition avec Mourmansk. En effet, connu sous le nom de Arkhangelsk Transport Hub, un ensemble colossal de projets d'investissements permettrait, malgré une assistance hivernale à la navigation par des brise-glaces, de transformer le port historique d'Arkhangelsk en un véritable complexe accessible à l'année longue.

Parmi les projets les plus avancés figure la construction d'un nouveau port en eau profonde à 55 kilomètres des quais historiques de la ville portuaire d'Arkhangelsk avec plusieurs phases de déploiement comprises entre 2023 et 2028. Le conglomérat chinois Poly Group s'est engagé dès 2016 à accompagner un tel développement *greenfield*, argumentant notamment que cet ensemble avec une profondeur d'eau à -14,5 m. constituerait un point d'ancrage stratégique de la future *Ice Silk Road* en Russie occidentale (Nilsen, 2016).

L'argument stratégique majeur pour ATH repose sur sa proximité géographique et logistique des différents potentiels de trafics russes, à commencer par les gisements de charbon du Kusbass (en concurrence directe avec les projets d'extension de Lavna). L'incertitude sur le financement et le développement des différents tronçons ferroviaires du projet BELKOMUR (795 kilomètres de nouvelles voies pour connecter le port d'Arkhangelsk aux corridors de transport russe et transeuropéen) pourrait néanmoins contraindre les perspectives optimistes de manutentionner 38 millions de tonnes de marchandises à l'horizon 2035.

Le port en eau profonde vise aussi à devenir un hub stratégique du supply Oil & Gaz pour les futures explorations et exploitation russes situées plus à l'est. La plus grande proximité géographique par rapport à Mourmansk est avancée dans la perspective d'une offre logistique plus agile et à moindres coûts comme c'est déjà le cas avec les développements de Sabetta ou de la plate-forme de Prirazlmonoye au nord du port de Varandey. Pour ATH, une part significative des 80 millions de tonnes métriques projetées sur la route arctique russe doit s'arrêter sur les installations d'Arkhangelsk pour trouver une combinaison entre les services logistiques à valeur ajoutée et les opportunités de trafics captifs issus de l'extraction et du stockage des matières premières minières (distances et coûts réduits pour les pré-acheminements ferroviaires massifiés).

Aux marges immédiates de la frontière occidentale russe figure le complexe portuaire de Kirkenes en Norvège, immédiatement à l'ouest de Mourmansk, qui vise peu ou prou les mêmes destinées et les mêmes marchés que les concurrents portuaires russes. Au cœur du projet infrastructurel norvégien, l'*Arctic Corridor Railway Project* qui relierait Kirkenes à Rovaniemi en Finlande, tête de pont d'une liaison qui continuerait vers Helsinki, les capitales des pays baltes jusqu'à Varsovie. Le tout s'inclut dans une logique circulatoire du *Barents Euro-Arctic Transport Network* qui optimiserait les connectivités ferroviaires et routières entre l'Europe du Nord, la Scandinavie, la Baltique et l'immense système russe. (Eilertsen, 2018a). L'*Arctic Corridor Railway Project* permettrait aussi de raccourcir les routes d'exportation des sites d'extraction miniers russes de Kevitsa, Sakatti and probablement de Sokli (*Arctic Corridor*, 2018).

Figure 8. Tracé et connexions intermodales de l'Arctic Corridor Railway Project

Source : Arctic Corridor, 2018

Les potentiels d'extractions miniers de l'ouest russe se cumulent dans la perspective de Kirkenes avec les réserves également géolocalisées dans le nord de la Scandinavie (en Laponie en particulier). La connectivité avec la mer Baltique et les pays riverains soutient une telle projection infrastructurelle qui se divise en deux parties pour un total d'environ 500 kilomètres et d'un coût estimé entre 2,5 et 3 milliards d'euros Des questionnements financiers et logistiques persistent cependant autour des potentiels de trafics énoncés. Les promoteurs tablent sur d'importants « compléments de trafics » comme les réserves forestières finlandaises (toujours en Laponie) ainsi que celles situées côté russe et facilement « captables » par les futures infrastructures ferroviaires et routières (Eilertsen, 2018b). A l'instar de ce que peuvent revendiquer les futures installations de Mourmansk et de Arkhangelsk, Kirkenes a l'ambition d'être le premier hub portuaire européen de la future *Polar Silk Road* situé sur la route maritime la plus courte entre les aires de marché de l'Europe et de l'Asie du Nord-Est.

Vers une future autoroute maritime arctique russe pour un changement radical de paradigme ?

Dans un entretien croisé intitulé *« On se trompe sur l'enjeu arctique »*, Mikaa Mered et Yann Alix mettent en avant plusieurs arguments pour justifier une projection inédite de la future circulation des flux maritimes arctiques entre l'Asie et l'Europe (Mered & Alix, 2018). En premier lieu, il convient de tordre le cou sur les fantasmes des raccourcis maritimes arctiques en concurrence avec les routes hyper-densifiées qui empruntent les détroits de Malacca et de Suez. Avec des records de gigantismes battus tous les mois ou presque (au moment d'écrire sort des chantiers coréens Samsung H.I. le *MSC Gülsun*, premier d'une série de six porte-conteneurs de 22 960 EVP pour un tirant d'eau de 16,5 mètres et une longueur hors-tout de 399,9 mètres), il est utopique de penser que des unités conteneurisées équipées glace puissent remettre en cause le modèle économique dominant basé sur les économies d'échelle et le contrôle des parts de marché via les alliances stratégiques.

Quelque-soient les gains de temps et de distance, par ailleurs fluctuants selon la saisonnalité et les conditions climatiques, le Passage du Nord-Est ne s'inscrit pas comme une alternative mais bien comme une nouvelle artère à explorer d'un point de vue opérationnel et commercial. Les travaux de recherche académique sur cette opportunité de navigation sont aussi nombreux que contradictoires, ne parvenant pas aux mêmes conclusions (Liu & Kronbak, 2010) (Verny, 2012) (Lasserre, 2014b). Cela n'empêche pas la simulation de transits internationaux complets qui tend à prouver – sur la base de données fournies par COSCO – que l'opération d'un 5,000 EVP de capacité devient totalement crédible d'un point de vue purement commercial sur la rotation directe entre Shanghai et Rotterdam (Wan, Ge & Chen, 2018).

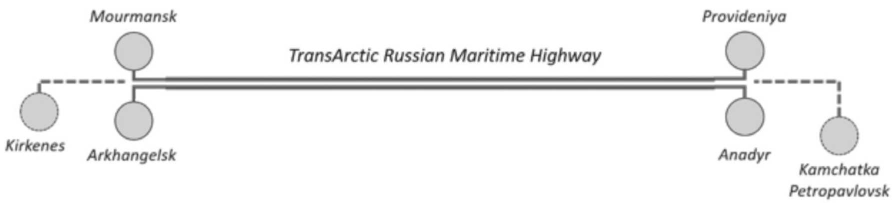
D'ailleurs, les intérêts chinois et russes ne s'y trompent pas et perçoivent l'émergence d'une nouvelle route maritime qui relie deux continents via une nouvelle mer intérieure. Les intérêts russes et chinois dominent les transits maritimes intégraux puisque sur les 27 voyages intercontinentaux complets réalisés en 2018, 8 concernaient des navires russes et 8 étaient réalisés par la seule compagnie chinoise COSCO qui projette déjà 14 voyages complets pour 2019. Les opérations commerciales de COCSO sur cette nouvelle route maritime s'inscrivent évidement dans les objectifs politiques contenus dans la politique Arctique de la Chine publiée dans un livre blanc le 26 janvier 2018 par le bureau d'information du Conseil d'Etat de la République populaire de Chine (Mered, 2019c). Une autre étude réalisée par Hervé Baudu de l'Ecole Nationale Supérieure du Maritime (ENSM) pour CMA-CGM en 2019, sur la base des données de l'armateur marseillais, montre également que l'Arctique est avantageux par rapport aux mers du sud, mais que cet avantage reste trop limité pour que le géant français bouleverse sa stratégie de long terme, à raison.

Une fois ces réalités tangibles énoncées, il est impérieux de changer de paradigme et de considérer le transport maritime arctique selon de nouvelles conceptions stratégiques et opérationnelles. Il suffit pour s'en convaincre de s'inspirer de l'actuelle maîtrise du sillon maritime arctique par les navires méthaniers spécialisés ARC7. Avec la quantité croissante de LNG « à sortir » des eaux glacées arctiques, les opérateurs maritimes au premier rang desquels Novatek désirent qu'une seule chose, comme déjà mentionné précédemment : optimiser les rotations des ARC7 dans les conditions Arctiques et surtout pas que ces unités flottantes à très haute valeur ajoutée ne fraient dans des eaux plus clémentes ; depuis les fjords norvégiens aux unités portuaires de transbordements localisées en Europe de l'Ouest, au Japon, en Corée ou encore en Chine Continentale.

Les considérations économiques et logistiques de la gestion optimisée des flottes maritimes croisent alors les ambitions politiques et stratégiques de la Russie qui désire « réguler » pour ne pas dire contrôler le passage de la navigation commerciale aux larges de ses côtes et dans ses eaux territoriales. Les ARC7 ne doivent à terme être que des « super navettes arctiques » qui pourraient se délester de leur précieuse cargaison sur des points stratégiques comme à Ura Guba et aller au plus proche des marchés finaux asiatiques via un ou plusieurs hubs à l'extrême est du territoire russe. Les ports de Provideniya et de Anadyr pourraient d'ailleurs se retrouver dans une situation quelque peu semblable de celle du binôme Mourmansk-Arkhangelsk avec une nouvelle forme de compétition interportuaire qui sera probablement arbitrée autant par les priorités stratégiques et politiques du Kremlin que par la propension à attirer des capitaux asiatiques (et pas seulement chinois) dans des projets industrialo-portuaires.

Et si l'on veut continuer la comparaison avec l'ouest arctique, le port historique russe de Kamchatka-Petropavlovsk pourrait se comparer avec Kirkenes dans une position plus méridionale et excentrée avec toutefois la grande différence que l'établissement russe fait partie des pièces stratégiques du puzzle géostratégique de Moscou sur la rangée côtière extrême-orientale de l'immense territoire national (Figure 9).

Figure 9. Schématisation de la future compétition portuaire arctique aux extrémités de TransArctic Russian Maritime Highway



Source : Yann Alix, 2019

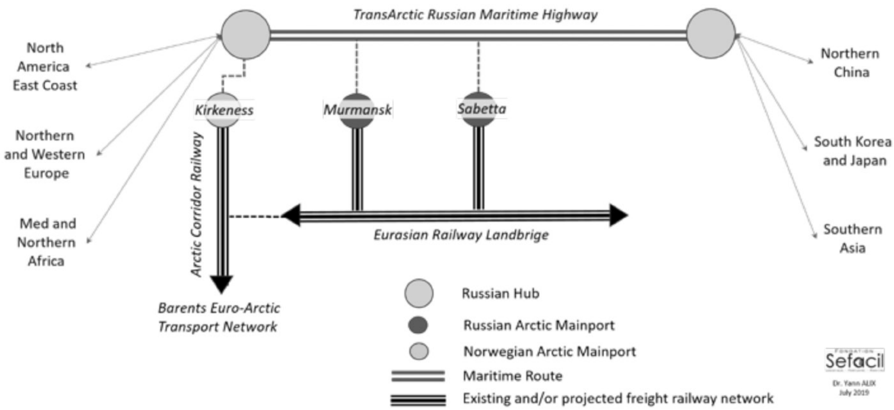
Si l'on établit une projection sur les futures circulations maritimes arctiques, ces futurs hubs « d'entrée-sortie » de l'aire maritime russe pourraient intéresser toutes les autres marchandises, à commencer par les volumétries conteneurisées en transit intercontinental entre l'Asie du nord, l'Europe du Nord et même l'Amérique du Nord. La construction planifiée de futures générations de brise-glaces nucléaires avec des puissances encore inégalées va dans ce sens, constituant les seules unités flottantes capables de tracer des sillons toute l'année pour de futurs convois arctiques dans un format classique de lignes régulières (Figure 10).

Figure 10. Universal Atomic Icebreaker et IB Leader : les deux futures générations de brise-glaces nucléaires russes

Source : Mikaa Mered, 2019b (visuels de Rosatomflot)

Le changement de paradigme tient dans l'idée prospective que ces hubs portuaires positionnés à l'extrémité de la « *TransArctic Russian Maritime Highway* » alimentent et soient alimentés par les grands bassins de production et de consommation mondiaux situés dans l'hémisphère nord. Les raccourcis nautiques trouvent une nouvelle appréciation organisationnelle par l'avènement de hubs de nouvelle génération, portes d'entrées et de sorties où convergent et éclatent des flux qui n'ont pas comme origine première ou destination finale l'Arctique (Figure 11).

Figure 11. Pour une autoroute maritime TransArctique connectée à des terminaux de consolidation Arctique et d'éclatements internationaux



Source : Yann Alix, 2019

Adeline Descamps, rédactrice en chef du *Journal de la Marine Marchande*, qualifiait cette vision prospective de : "Hub & Spoke inversé" avec des navires-mères arctiques qui relieraient entre des hubs arctiques où se connecteraient des navires classiques alignés sur des rotations Nord-Sud ». *(JMM, N° 5091, Novembre 2018, p. 21)*

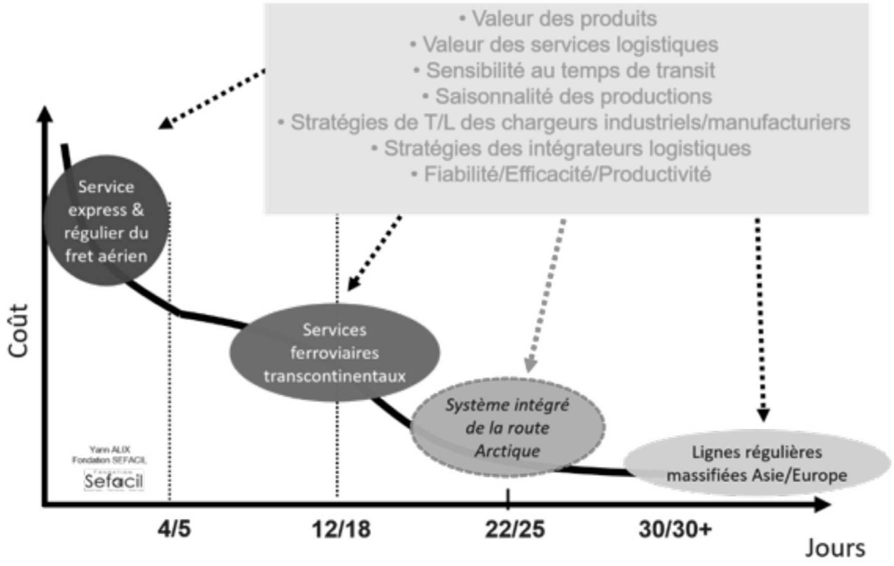
La vision projetée d'une circulation septentrionale sécuritaire dans des eaux régulées par moult accords politiques bilatéraux/multilatéraux anticipe les potentiels quasi illimités d'une nouvelle mer intérieure d'une dimension géographique et géostratégique unique dans l'histoire de la navigation commerciale vieille de 3 500 ans (Alix, 2018a). Cette projection modifie sensiblement l'actuelle distribution maritime internationale par sa tridimensionnalité :

- l'ouverture sécurisée (d'un point de vue géopolitique et climatique) d'une immense mer intérieure, pour ne pas dire d'un nouvel espace océanique dénué de contraintes géographiques fortes ;
- l'ouverture d'un immense marché où les potentiels énergétiques seront couplés à d'autres potentiels tout aussi géostratégiques comme l'exploitation et la valorisation des terres rares ou de l'hydrogène vert (Mered, 2019a), et ;

- le changement de paradigme dans l'organisation des flux maritimes conteneurisés avec le développement stratégique de « Hub and Spoke inversé » qui serviraient de zones tampons et d'éclatement à l'entrée et à la sortie d'une ligne maritime arctique unique.

La quatrième dimension (!) de cette projection reprend à son compte les arguments souvent utilisés de manière erronée sur les raccourcis nautiques et temporels d'une route arctique qui connecterait directement les plus grands ports d'Asie et d'Europe de l'Ouest. Les processus de transbordements stratégiques sur ces futurs hubs ajouteront quelques jours supplémentaires dans le temps de rotation des marchandises Asie-Europe-Asie mais les gains resteront substantiels, pouvant intéresser des typologies de marchandises qui pourraient se situer entre le fret maritime traditionnel et les frets actuellement en circulation sur les sillons ferroviaires eurasiatiques (figure 12). Loin de combattre les économies d'échelles des *Ultra Large Containerships* (ULCC), le nouveau paradigme intégré de l'Arctique pourrait s'intercaler dans une combinaison économique où les gains en temps pourraient se conjuguer aux gains de soutes (logique des convois arctiques nucléaires) et de distance (entre 4 000 et 5 000 kilomètres entre Shanghai et Rotterdam selon les options de hubs arctiques retenues).

Figure 12. **Typologie des différentes solutions de transport de marchandises entre les espaces économiques européens et asiatiques**



Source : Yann Alix 2019 à partir de Y. Alix 2015

Les typologies de produits ne sont pas toutes « éligibles » avec une sensibilité aux extrêmes climatiques qui concernent autant les convois maritimes arctiques que les convois ferroviaires eurasiatiques qui empruntent les territoires de l'Asie centrale et enclavée (Portier & Gallo, 2012) (Alix, 2018b). La question des stockages des marchandises sur ces futurs hubs interroge aussi la célérité des rotations maritimes et les temps de transit que pourraient proposer les convois hivernaux sous assistance des brise-glaces nucléaires russes de dernière génération.

En guise de conclusion : projections au-delà des ressources énergétiques

L'espace Arctique constitue un véritable eldorado dans un monde multilatéral où la captation des ressources énergétiques constitue un enjeu géostratégique majeur pour les plus grandes puissances. Mais surtout, la mer intérieure Arctique devient au fil des années un territoire navigable avec des aménagements infrastructurels qui laissent envisager l'exploitation des immenses ressources naturelles restées longtemps inaccessibles. Les surcouts d'exploitation arctiques (exemple de la fonte prématurée du pergélisol qui complique les logistiques terrestres par la fonte des routes de glace) semblent de mieux en mieux s'équilibrer avec les rémunérations par les marchés mondiaux sur les matières premières. Au-delà du gaz et du pétrole, l'Arctique russe regorge de ressources minières qu'elles soient des matières premières minérales à faible valeur unitaire comme le charbon ou au contraire à fort potentiel économique et stratégique comme les terres rares (potentiel de 25% des réserves mondiales) et des produits très recherchés comme le palladium et le platinum (Brigham, 2017). Sur ces minerais très « sensibles », les futures solutions logistico-industrielles Arctiques seront à mettre en concurrence avec notamment des marchés actuellement pas nécessairement simples à exploiter d'un point de vue économique et politique (exemple des réserves de terres rares du Bassin Congo par exemple).

Pour la seule province orientale de la Yakoutie, les réserves prouvées de diamants alimentent de nouveaux projets d'aménagement afin de lancer l'exploitation et l'exportation du produit des futurs sites d'extraction. Dans la zone Taimyr-Norilsk, les infrastructures spécialisées de Dudinka et de Dikson permettent déjà d'exporter le nickel (et aussi le charbon) en attendant les résultats de prospections géologiques sur d'autres typologies de minerais. Si l'on se réfère aux cartes du US Geological Survey, un nombre important de « greenfield ports » pourraient voir le jour et ainsi structurer des aménagements qui n'auront cependant comme caractéristiques que de servir principalement et prioritairement les intérêts de l'extraction, du transport et du stockage des volumes miniers. (Alix & Lacoste, 2013).

Autre ressource naturelle au grand potentiel, les réserves halieutiques et de la pêche. Au-delà des moratoires internationaux et autres traités bilatéraux/multilatéraux, il apparait somme toute évident que l'ouverture de nouvelles zones de captation de ressources et l'extension par la fonte de glaces de zones déjà actives constituent des potentiels considérables. Une estimation fait état de 10% des réserves de pêche internationale qui pourraient se trouver dans les eaux Arctiques (Brigham, 2017). Même si la quasi-totalité de ces futures exploitations risque de se faire avec des navires-usines exigeant très peu d'infrastructures terrestres, il n'en demeure pas moins qu'un chapelet de petites et moyennes structures pourrait émerger dans les prochaines années tout au long de la côte Arctique russe, en gardant à l'esprit le rôle clé du pouvoir central de Moscou dans l'organisation territoriale de ces éventuelles futures installations légères. La transformation éventuelle de ces ressources halieutiques pourrait servir au pouvoir central russe pour organiser des territoires vierges de concentration de population, particulièrement dans la partie orientale de l'Arctique russe, à proximité des plus importantes zones de consommation de produits de la mer (Japon, Corée, Chine).

Et finalement, dernière opportunité nouvelle qui fait déjà l'objet d'importants développements du côté américain et canadien, ce sont les capacités d'un tourisme arctique russe. A l'instar de ce qui est déjà largement éprouvé au départ de plusieurs ports de la Scandinavie, le tourisme de croisière en zones polaires constitue un indéniable potentiel. Sans établir de parallèle, force est tout de même de constater que ces industries de services demeurent relativement autonomes et peuvent frayer dans les eaux arctiques russes sans nécessairement impacter de manière significative l'actuelle système portuaire. Les infrastructures structurantes liées au développement du tourisme polaire demeurent balbutiantes, sauf dans des cas précis comme au Groenland où la construction d'aéroports internationaux pourrait largement contribuer à une augmentation de la manne touristique. Dans l'organisation des rotations maritimes des services de croisière, le repositionnement des croisiéristes via des services aériens de qualité constitue un élément important.

Or aujourd'hui, en dehors des deux grandes villes « historiques » de l'Arctique occidentale russe (Mourmansk et Arkhangelsk), les infrastructures et les services dédiés au tourisme manquent. Toutefois, Mourmansk a inauguré en 2016 un tout nouveau quai dédié à la croisière dans l'ambition de doubler le totale de 10,000 passagers de croisières accueillis en 2015 (Nilsen, 2018). Même chose à Arkhangelsk et sa région qui cherchent ensemble à promouvoir une vraie politique culturelle et touristique qui pourrait autant combiner le potentiel domestique russe avec celui des touristes étrangers, transformant les territoires de la mer blanche et de l'embouchure de la Dvina en pôles de tourisme maritime et fluvial arctique.

Le gouvernement russe par décret du premier ministre Medvedev a même mis à disposition en 2016 une exception de visa de 72 heures pour les croisiéristes en escale sur les deux villes portuaires de Mourmansk et d'Arkhangelsk.

Toutefois les résultats ne sont pas encore probants puisque les rotations actuelles naviguent prioritairement en période estivale alors que les croisiéristes arctiques désirent vivre les conditions extrêmes de l'hiver comme le prouvent les excellents résultats des ports spécialisés norvégiens de Lofoten, Tromsø and Svalbard qui ont flirté avec les 500 000 passagers en 2018 pour 456 touchés de navires de croisières (Nilsen, 2018). Hurtigruten, le spécialiste norvégien de la croisière arctique, ne s'y trompe pas puisqu'il lance un nouveau service incluant les ports de Tromsø, Svalbard et Mourmansk avec l'exclusivité de naviguer jusqu'au 80° parallèle et visiter les territoires vierges de Franz Joseph (*Hurtigruten*, 2018).

LNG, pétroliers, navires de croisières, porte-conteneurs et navires commerciaux de pêche industrielle : la mer intérieure Arctique pourrait vite devenir un océan d'opportunités maritimes en espérant vivement que les considérations écologiques et environnementales soient au cœur de futurs développements pérennes et inclusifs.

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Chapitre 11

Complex approach to maritime sector attractiveness and state competitiveness

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Biography

Jelena Belova *was born in 1954 in Russia. In 1976 she graduated from university as an engineer economist. During her studies, she worked as an economist at the shipyard of Murmansk. She began teaching in 1976 at the Lithuanian Maritime Academy. While working at the Academy, she completed internships at the shipping companies of Klaipeda, participated in international projects of the Academy. In 2002 she defended her dissertation and received PhD in economics. She has more than 30 scientific publications, 8 books on the subject of Maritime economics (co-authored), of which 3 are monographs.*

Rima Mickiene *has acquired her Masters Degree in educology in mathematics and informatics also in education management fields. Currently she is studying in doctoral studies in the field of economics. The disseration research oriented on the link between seaport economics and state competitiveness. During Ms Mickiene's professional career at the Lithuanian Maritime Academy she gave lectures on IT and research related subjects, acted as the Head of the Port economics and Management Department and Deputy Director for academic affairs. In cooperation with other researchers and individually Ms Mickiene has prepared 4 study books and more then 20 scientific publications in the field of port economics, referred to in international science data bases.*

Elena Valioniene *has a mathematical background and the specialisation in applied mathematics. She started at the position of head of information technology laboratory at Lithuanian Maritime Academy and also at the position of lecturer of port and shipping management department in 2002. While working at the Academy, she completed international trainings, participated in international projects of the Academy and developed her knowledge in the area of maritime transport and seaport management. Also together with the IT colleagues the whole Academy's computer infrastructure was developed and installed, of e-library and e-services and another electronic services for the Academy's network users. Main study subjects are: mathematic modelling, economical statistics, management theories, ICT and systems. Scientific activities expressed in the area of maritime sector attractiveness researches, also in the area of maritime policy and governance, smart port cities and computer technologies integration into the business processes. In 2019 as a result of flexible reaction to the technological changes in global supply chain new study program "Shipping and logistic information systems" was created and approved by ministry. Main goals of study program to apply new technologies for the data analysis in shipping and logistic program, including machine learning and big data technologies. In 2016 she started PhD studies in the* *management sciences. She has more than 32 publications together with co-authors, and she is an active participant of national and international scientific conferences with the seaport governance topics. The areas of interests: port and shipping management, public administration, new ICT technologies and data sciences, also e-learning technologies.*

Abstract

Maritime transport sector, seaport and shipping, create preconditions for maritime states to implement strategically significant national market regulatory measures in order to create added value to the national economy. The state seaport as an element of the maritime transport sector is analyzed as an area of activities of the whole state and region in the transport sector which create preconditions for improving the international, political and economic positions of maritime states in the region. Therefore the efficiency of the state seaport from the management and economic perspective is one of the features of the attractiveness of the maritime transport sector in the region, which directly influences the competitiveness of the entire economy of the country. The peculiarities of the efficiency of the maritime transport sector have to be analyzed in a complex manner and its complexity can be revealed in various ways: optimal and effective distribution and exploitation of state-owned resources, effective private capital involvement by strengthening the supra-structure of the seaport, attractiveness for the cargo consignor and the consignee, performance, socio-economic progress and other. In order to maximize the positive impact of the activities of the maritime transport sector on the country's economy and its competitiveness, a shift in the seaport's mission is observed: the aim to increase the productivity by the growing volume of cargo has shifted to the goal of creating added value to the stakeholders. Taking into consideration the nature of seaport and shipping activities in order to increase the attractiveness of the maritime transport sector and the competitiveness of the country in the region, it is relevant to substantiate the value-oriented management as a means of increasing efficiency on theoretical and managerial assumptions. The theoretical assumptions are illustrated by the results of the analysis of the activities of the Estonian, Latvian and Lithuanian maritime transport sector.

Keywords: maritime transport sector attractiveness, state competitiveness, seaport governance, seaport economics, added value

Introduction

The globalization process of the international logistics chain has significantly affected not only the private capital sector, but the public sector as well. Such an impact manifested itself through the transformations of management forms and scientific paradigms, which were preconditioned by the imbalance between intensive and dynamic changes in the environment and the rigid, complex and ever-expanding state management apparatus, defined by the vast variety of procedures and functions. The public sector has become a highly complex system of allocating economically significant national resources, which operates in an ever-changing environment characterized by high uncertainty. The problems of the effective allocation of said resources is evident from the lack of flexibility of the operational decision making process. Even the application of new principles of public management and the seaport reform that began at the end of 1980s did not yield the expected result in increasing the efficiency of seaport management. Ports did not become objects of strategic importance to the state, whereas the decision making on regional development and other strategically important decisions in many cases remained implemented centrally as in the progress of the reforms seaport authorities were only granted financial autonomy and prompt decision-making discretion.

The results of the seaport reform under the principles of the new public management are criticized arguing that the reform did not address crucial issues of ensuring the public interest, identifying the eco-social added value, the issues of connectivity with other land transport systems, and the implementation of the principles of green logistics (Notteboom, de Langen, Jackobs, 2013; de Langen, 2015; Ibrahimi, 2017, etc.).

According to scientific discussions and despite its acknowledged importance, the concept of competitiveness is still misunderstood, and a discussion of its underpinnings remains a central task (Porter, Ketels, Delgado, 2007; Navickas, Malakauskaite, 2010; Cann, 2017, etc.). This research described the competitiveness as relative or comparative position of an economical subject with regard to others similar subjects and titled it a central preoccupation of advanced and developing countries in an increasingly open and integrated world economy. On the supply side maritime transport sector are seeing the introduction of new technologies that create entirely new ways of serving existing needs, significantly disrupt existing industry value chains and leads to creation of sustainable added value based on productivity.

The latter supports the relevance of the problems of seaport management, attractiveness of the maritime transport sector and regional competitiveness arguing that legal simplicity, functionality and “government without-government»” are modern value added-oriented methods of the management of maritime transport sector by enhancing its attractiveness in the region.

Object of the research: relation between maritime sector attractiveness and state competitiveness.

Aim of the research: to evaluate relation between maritime sector attractiveness and state competitiveness.

Objectives of research are the following:

1. To explain complexity of relation between state seaport governance, maritime sector attractiveness and state competitiveness;
2. To analyse the maritime transport sector attractiveness and state competitiveness research methodology;
3. To explain the consequences of the relationship of seaports attractiveness and countries competitiveness.

Research methods: analysis of scientific literature, statistical and financial analysis, multi-criteria analysis based on the principles of modeling.

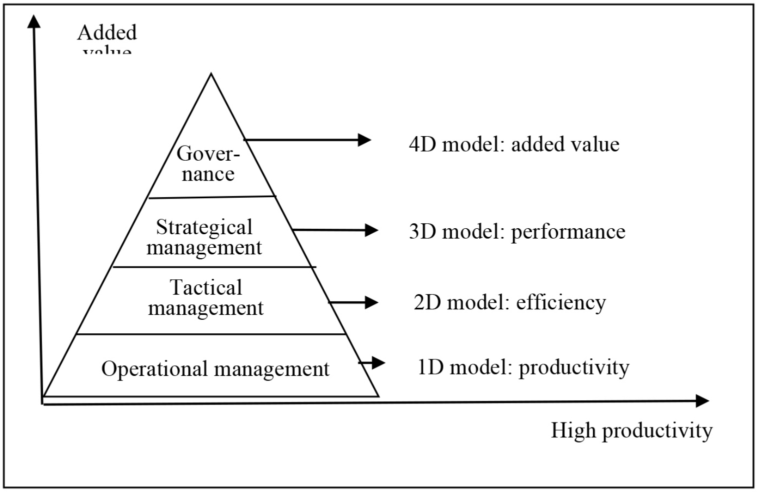
The main purpose of this research is to identify the link between the attractiveness of the maritime sector and the country's competitiveness and to evaluate the severity of this link and its impact on the development of the country's economics and the maritime sector. The empirical part of the research covers the analysis of indicators of the main seaports and economics of Baltic countries, Estonia, Latvia and Lithuania.

Theoretical approach to link between state seaport governance, atractiveness and state competitiveness

The Role of State Seaport Governance in the Context of Maritime Sector Attractiveness

The application of the notions of the new public management in the research on effective management of state enterprises expanded the field of issues of effective management of state-owned seaports. Said application also formed the preconditions for the application of the complexity approach, and the establishment of the interpretative approach to investigated phenomena and their interrelationships.

Figure 1. **Complexity of effective management concept**



Source: de Langen, 2015; Rainey, Steinbauer, 1999

The concentration of the principles of the theory of effective governance of state-owned enterprises (Ayub, Hegstad, 1987; Rayney, Steinbauer, 1999) presupposes the interconnectivity of high productivity with the efficiency of management through a variety of measurable and mutually comparable criteria (Fig. 1):

- Criteria of the efficiency of technological operations: absolute performance indicators, productivity indicators, performance indicators.
- Criteria of the efficient financial management: profitability, return on capital, real added value, return on investment.

- Criteria for the effectiveness of strategic management: cooperation and partnership, competitiveness and attractiveness, meeting the needs of stakeholders, leadership and mission clarity.
- Legal-political criteria for management efficiency: financial and institutional autonomy and accountability.

Analysis of the elements of effective seaport management in theory of effective management point of view supposed to form a multi layered complex structure (de Langen, 2015; Ibrahimi, 2017). This structure combine the qualitative characteristics of management attributes with the quantifiable indicators in a multidimensional model (Fig. 1). This possibility follows from the preconditions under the theory of public management stating that state-owned enterprises are not only complex hierarchical structures but also complex social structures with a sufficiently large number of social entities forming a complex and highly predictable multiplicative communication network operating in a highly uncertain environment complex systems that are based on adaptability and self-reflectivity (Naguyen, 2015).

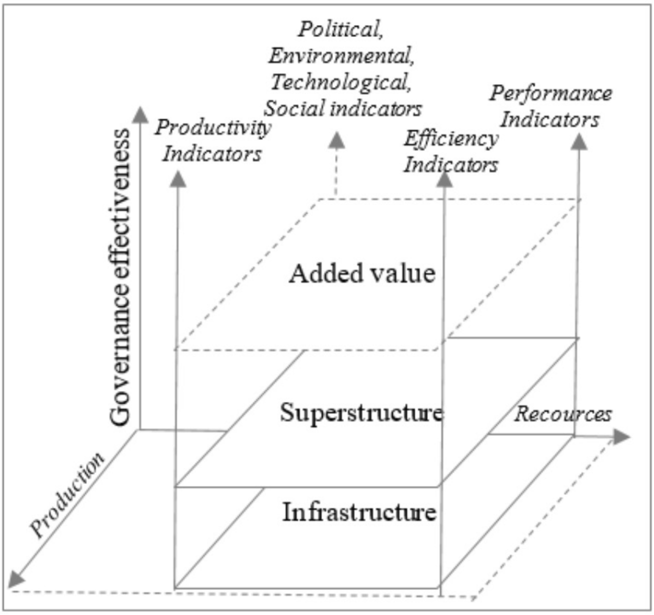
G. Teisman and E. Klijn (2008) distinguished the phenomenon of the public sector and determined the key principles for analyzing it and developing its development scenario. The first principle - dynamism of systems, which is used to analyze the changes and development of the phenomenon. This principle defines the decision-making process not in the linear equilibrium state, but as non-linear processes, during which the phenomenon endures various effects from the external environment. Another principle encompasses the features of self organization and self regulation of systems that trigger changes in control mechanisms and forms in systems. Based the latter principle, the aforementioned authors state that while the public sector managers are focused on realizing their personal ambitions and changing their capabilities, actors in the complex system of public sector entities are dependent on circumstances and the state of the system is changing as the external conditions change. Such a division of management and management subjects into different systems results in the ineffectiveness of the decision-making process. The application of the complex approach introduced by G. Teisman and E. Klijn (2008) creates preconditions to model the potential decisions of effective public sector management.

By analyzing the model of efficient state-owned seaport governance (Fig. 1) it may be noted that the application of the rules of new public administration theory to the theoretical provisions for effective seaport management include not only the principles of complexity, but also the multiplicative effect of the network economy effect. The multiplicative effect is interpreted differently by the contingency (Cho, 2014) and through the theory of complex systems (Noteboom et al., 2013).

H. Cho (2014) distinguishes various dimensions of uncertainty, such as eg. behavioral uncertainty. T. Notteboom, P. de Langen, W. Jacobs (2013) based their research methodology on the systematic complex approach. They defined importance of the interconnection between the system actors and the status of each of them, brought the methodology of modeling of seaport management reform closer to systemic self-regulation, based on the theory of economic evolution. The research methodology is based on the theory of complexity according to which seaports are complex structures that depend on geographic location, various actors, operating in different levels and sectors, and the multiplicity of their interests and interactions in different territorial dimensions. Based on the key elements of effective management, an efficient seaport management model is constructed starting with the lowest level of management that is dominated by high productivity indicators: indicators of cargo flow characterizing infrastructure productivity. Relying on the theory of configuration and the theory of uncertainties, R. Baltazar and M. Brooks (2007) modeled economic performance efficiency indicators related to the indicators of resource allocation. Their model of efficient seaport governance is based on economic returns as a result of high productivity and economic returns as a result of high efficiency. The first is related with the economic return that forms the system of requirements for the organization, which is based by high productivity in providing services and produce. The other states that the pursuit of maximal economic return between similar organizations requires the highest efficiency and effectiveness and, at least, the average competence and strategic planning of that field.

In analyzing the development of the new public governance theory in the context of the uncertainties theory, the link between the environmental change oriented strategic planning and the effectiveness of the organization's management becomes evident. The latter proves the influence of the configurations doctrine. Under the configurations theory, alternative strategies mean the selection of the operating environment and related characteristics. The latter justifies the link between tactical and strategic governance levels in modeling the possibilities of improving the efficiency of seaport governance in a 3D model perspective. This model encompasses the indicators of productivity, efficiency and performance indicators (Fig. 2).

Figure 2. **Concept of efficient seaport governance**



Source: authors own elaboration

In order to link the concept of efficient governance with the principles of high productivity management, based on the importance of financial and institutional autonomy under the theory of efficient governance of state-owned enterprises, the principles of increasing the efficiency of seaport governance, developed and analyzed X. Naguyen (2015) and other researchers, may be employed. The latter authors prove that efficiency of seaport governance can be measured by port performance indicators. However by relying on the principles of the theory of complex systems, the authors also emphasize the formation of quasi-market in the maritime transport sector, where demand and supply decisions are coordinated by market-based mechanisms. The quasi-markets encompass only a part of the main market elements, which are directly linked to the legal regulation. Actors of such quasi-markets aim to promote the public and private actors to operate under the principles of the market, whereas the elements of competition, rules on charging and tolls, individual accountability and autonomy are introduced via financial and institutional autonomy and accountability models. In this way the internal market in the maritime transport sector is formed. In this case state regulation and financing become an important mechanism for representing the efficiency of management of state-owned seaports, the impact of which can be measured by the dimensions of attractiveness of the maritime transport sector. T. Notteboom, P. de Langen, W. Jacobs (2013) rely on the results of their research in justifying the link between the effective seaport governance with the attractiveness of the maritime transport sector by distinguishing the created added value as a separate measurement unit. In this way it becomes possible to link the highest level of management with the lower levels of management, combining all the indicators into one model (Fig. 2).

Considering the concept of the attractiveness the maritime transport sector provided by R. Sanchez et. al. (2011) and in analyzing the peculiarities of efficient seaport governance, the application of the particularistic internationally comparable management approach provides preconditions for analyzing not only individual productivity, efficiency and effectiveness indicators, but also the interactions between institutions and the ambiguity in the environment. This approach may also be applied in analyzing the seaport governance model in the dynamic logistics chain, where the efficiency of seaport governance may be measured in a complex manner by combining the basic productivity, efficiency, effectiveness indicators and the indicator of external environment into one multi-criteria model. Moreover the approach may be employed to identify the significance of the seaport for increasing the logistic connectivity of the transport sector, which creates preconditions for assessing the attractiveness of the maritime transport sector through the integrated logistic performance indicator.

The Phenomenon of Competitiveness

Competitiveness can be described as a complex economic phenomenon which has macro- (national economy), mezo- (regional economy, industry), and micro- (company economy) levels (Navickas, Malakauskaite, 2010). Each level has its own specifics and unique indicators that are to be applied in the process of competitiveness evaluation. The evaluation of competitiveness is economically relevant for few reasons: it is a process which enables to identify all the strengths and weaknesses of a national economy, striving for balanced and sustainable economic growth; provides the basis for the creation of efficient economic stimulation instruments, as it identifies the competitive advantages of goods and services, and enables to forecast their ability to compete with analogical goods and services in local and foreign markets. Evaluation of competitiveness enables to define the relative position of an object with regard to other analogical objects by the use of various competitiveness indicators.

The World Economic Forum defines the competitiveness as the set of institutions, policies and factors that determine the level of productivity of a country (Cann, 2017). This definition related to the M. Porter, C. Ketels, M. Delgado (2007) conclusion, that country's competitiveness can be define with a focus on the microeconomic level, because competitiveness focused on the macroeconomic, political, legal, and social circumstances, that underpin a successful economy, progress in these areas is necessary but not sufficient. Productivity ultimately depends on the microeconomic capability of the economy, rooted in the sophistication of companies, the quality of the national business environment, and the externalities arising from the presence of clusters of related and supporting industries. Productivity depends both on the value of a nation's products and services, measured by the prices they can command in open markets, and the efficiency with which they can be produced.

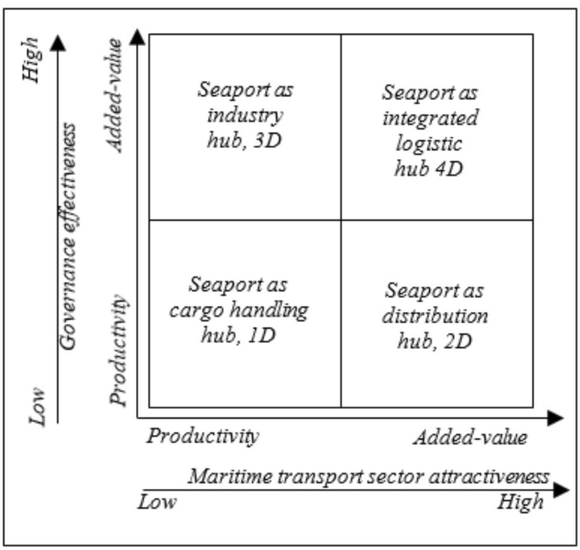
Another way to think about what makes a country competitive is to consider how it actually promotes our well-being. New approach of the socio-economic progress the actual economic state is characterized by applying an integrated analysis of various aspects of life welfare indicators - material living standards, health, employment, environment, i. e. competitive economy is a productive one, and productivity leads to growth, which leads to income levels and improved well-being (Porter, Ketels, Delgado, 2007; Stiglitz et al., 2010; Cann, 2017).

The similar dimensions formed the concept of sustainable development, which assumes relations between economic, environmental and social aspects on the societal as well as on the entrepreneurial level (Figgea, Hahn, 2004; Faber, 2008). The dilemma of sustainability in the age of globalization in the 21st century reflects the various political, social, economic and cultural circumstances that created the conditions for the start of sustainable development and are inspired by the context of neoliberal capitalism and globalization (Bakari, 2017). Growth that distorts ecosystem services is sometimes called "non-economic growth" as it leads to a deterioration in quality of life. This trend can be proven by population, economic growth and environmental performance indicators. Sustainable value added allows assessing the sustainable performance of enterprises similar to financial performance in monetary terms and supports better knowledge and understanding of other competition – sustainable practices are considered to be one of the competitive advantages, enterprise could determine its strengths and weaknesses, enhances creative leadership and better formulation of an efficient business strategy (Strakova, 2015).

Added value in maritime transport sector, presented mainly by shipping and ports industry, in global supply chain related on differences of operated assets: enabling a charterer to provide a value added service to the sender or the carrier are different from those of the ship operator, which allows the ship operator to add value to the service to the sender. What captures value added is another question that depends on the individual transactions of the chain participants. A port agent can add value to the carrier, ensuring smooth operation of the port, thereby reducing waiting times. However, the added value can be captured by the forwarder, which forces the carrier to reduce the price or is likely to be distributed to several actors (Olesen, 2015). On the supply side, many industries are seeing the introduction of new technologies that create entirely new ways of serving existing needs and significantly disrupt existing industry value chains, and leeds to creation of sustainable added value based on productivity. In the future, technological innovation will also lead to a supply-side miracle, with long-term gains in efficiency and productivity. The 4th Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world. Transportation and communication costs will drop, logistics and global supply chains will become more effective, and the cost of trade will diminish, all of which will open new markets and drive economic growth (Schwab, 2016).

The physical footprint of supply chains is being reshaped partly in response to infrastructure improvements (Mapping Global Transformations, 2018). Infrastructure projects including ports, pipelines and highways provide the bedrock of national prosperity and well-being. Logistics real estate is being restructured in response to the upgrading of transport infrastructure. Ports have strengthened their position within supply chains by diversifying their storage and handling services. Companies are generally becoming more interested in logistics facilities that combine good road access with rail or waterway transport connections. Physical products and services can be enhanced with digital capabilities that increase their value. Thus, in certain level developed maritime transport sector will be attractive for the maritime business actors and will be able to create added value. To summarize the maritime transport sector attractiveness level, there is a possibility to establish the link between maritime sector governance efficiency and sector attractiveness. It can be defined by the matrix model (Fig. 3), which generated the scope of attractiveness indicators: 1D – productivity indicators; 2D – efficiency indicators; 3D – performance indicators; 4D – effectiveness or added value indicators.

Figure 3. **Maritime transport sector attractiveness levels matrix model**



Source: authors own elaboration

The arguments show that, the country's competitiveness can be described by the sustainable added value indicator, which measures whether a maritime transport sector creates extra value while ensuring that every environmental and social impact is in total constant, and increasing of added value in maritime sector creates and raises attractiveness of the maritime transport sector.

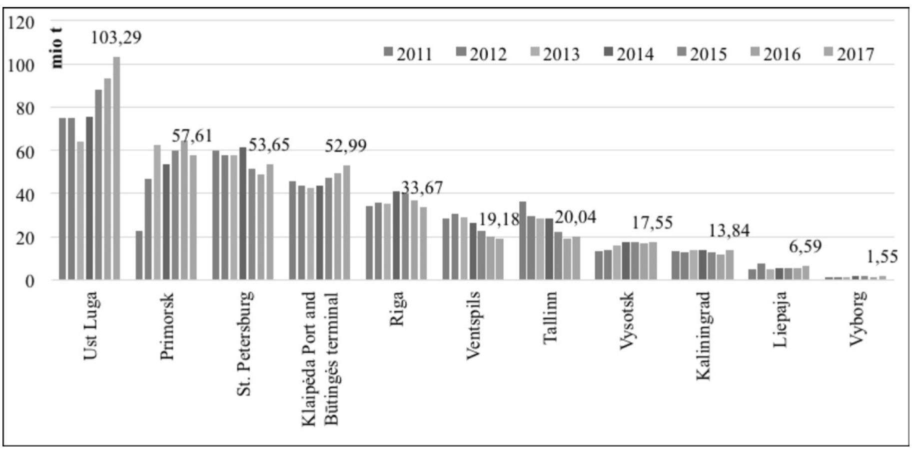
Analysis of the link between seaports attractiveness and countries competitiveness

The Comparison of Baltic sea ports and other European ports performance

Expected to illustrate the present situation in Baltic sea ports, the number of seaports was selected for the benchmarking according to following criteria: port technical parameters; cargo turnover, financial indicators. The performance indicators of eastern coast of Baltic sea region seaports Tallinn (Estonia), Ryga (Latvia) and Klaipeda (Lithuania) are compared with indicators of ports of neighbor state from South Baltic region – Poland (Szczecin, Gdansk) and European biggests ports – Hamburg (Germany), Antwerpen (Belgium) and Rotterdam (The Netherlands).

The players in the eastern coast of Baltic sea regional market are ports of Russian Federation – 65% of cargo turnover in the region (turnover in 2017 is 247,48 mln. t), Latvia – 16% (60,29 mln. t), Lithuania – 14% (52,97 mln. t) and Estonia – 5% (19,2 mln. t).

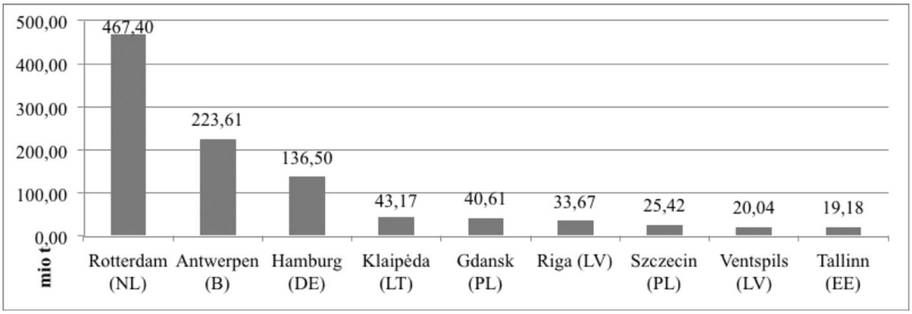
Figure 4. The cargo turnover of eastern coast of Baltic Sea ports in 2017, mio t



Source: Seaport Authorities Annual reports, 2017, Eurostat, 2019

According to cargo turnover in seaports (Fig. 5), it can be highlighted, that the competitors in the market of Baltic sea of the Eastern coast of Baltic Sea ports are the seaports of Poland from the Southern coast of the Baltic Sea. The vibe of competition can be strengthened by creation and activities global shipping alliances, for example, 2M (MSC and Maersk) and changes in those companies dedicated ports in the Baltic sea.

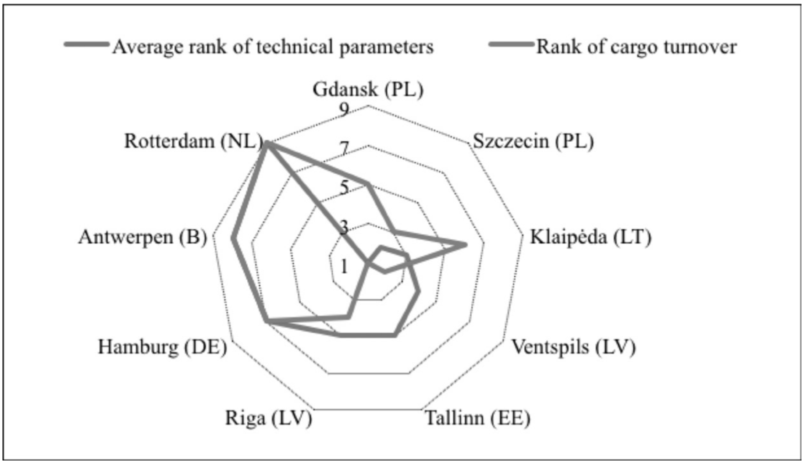
Figure 5. The cargo turnover of seaports in 2017, mio t



Source: Seaport Authorities Annual reports, 2017, Eurostat, 2019

The set of the technical parameters of the port - depth of port channel (m), territory area (ha), length of the quays (m) - not always leads to the biggest turnover of cargo (Fig. 6). It can be illiustrated by applyig ranking method, where the rank is from 1 (lowest) to 9 (highest).

Figure 6. The rank of cargo turnover and average of rank of ports technical parameters in 2017



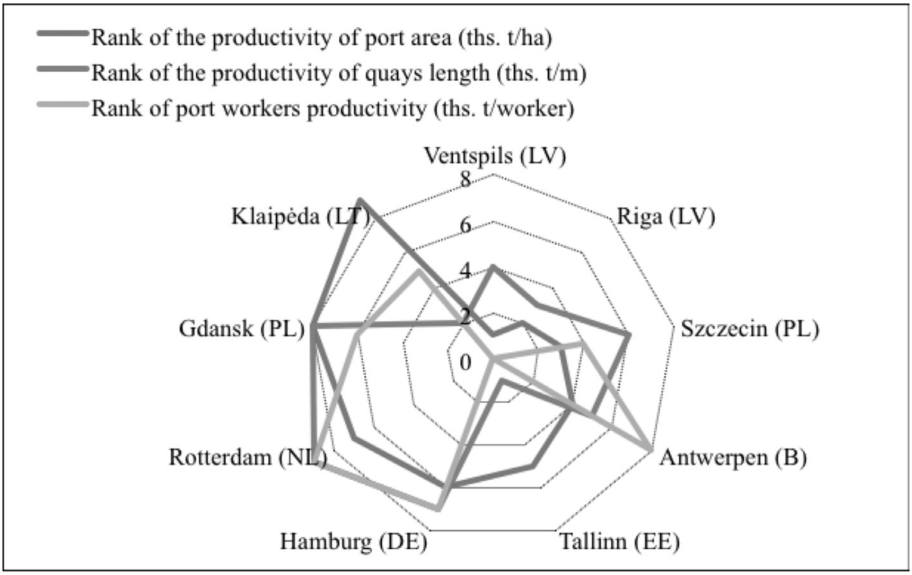
Source: Seaport Authorities Annual reports, 2017, Eurostat, 2019

The correlation between rank of turnover and technical parameters is week (0.6) (Fig. 5). An exceptional situation is evident in the case of Klaipeda (LT) port – with the smallest port territory (rank 1 of 9) port reach the turnover, rated by 6 of 9. Different situation in Tallinn (EE) port – average rank of port technical data 5, rank of the turnover 1). The analysis of ports productivity ranking (Fig. 6) shows, that highest rank of port area, territory, productivity is reached in Klaipeda (LT) port, despite, that, productivity of quays length and port workers are very low (rank 2).

For all ports of eastern and southern region of Baltic sea are characteristic low level of productivity of port workers. According to the ranking (Fig. 6-7), ports can be divided into three groups: worldwide leaders Hamburg (DE), Antwerpen (B) and Rotterdam (NL) (rank 7-9), region leaders Riga (LV), Klaipeda (LT) and Gdansk (PL) (rank 4-6) and ports "in transition" - Ventspils (LV), Tallinn (EE), Szczecin (PL) (rank 1-3).

These ports are undergoing changes in cargo flow: Ventspils changing from row oil cargo to the dry bulk (coal), Tallinn – switched to the passengers and ro-ro cargo.

Figure 7. The rank of productivity of ports in 2017

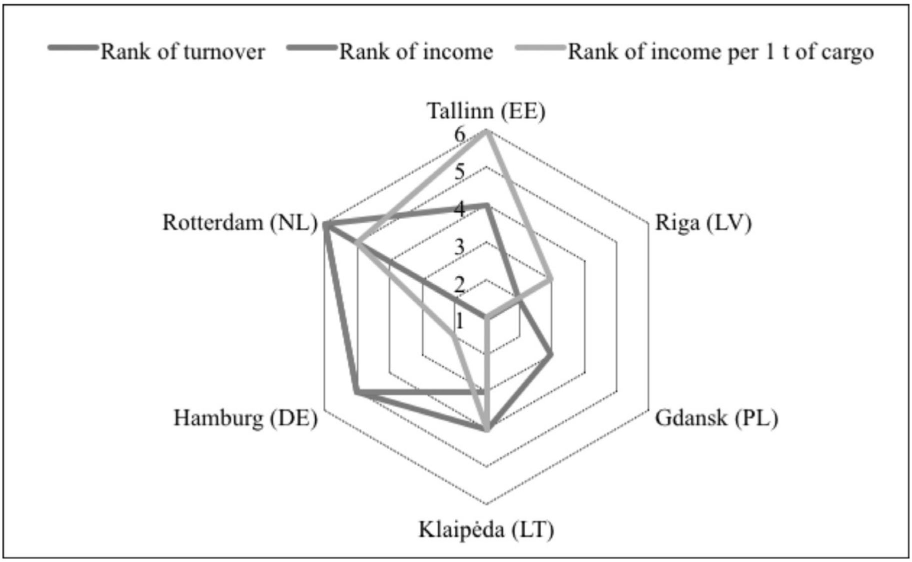


Source: Seaport Authorities Annual reports, 2017

The analysis of financial indicators describe different picture (rank from 1 – lowest, to 6 – highest, Fig. 8). The port of Tallinn shows best financial results of income per 1 tone of handled cargo in 2017 (rank 6), port of Hamburg – rank 2. Lowest financial results rank (1) of port of Gdansk.

There may be various reasons for it, e.g. port dues and land rent price of ports are inadequate with the low level of income; not certain level of utilization of port infrastructure; high level of port authorities expenditures; not certain level of productivity of technologies of stevedoring companies in the port etc.

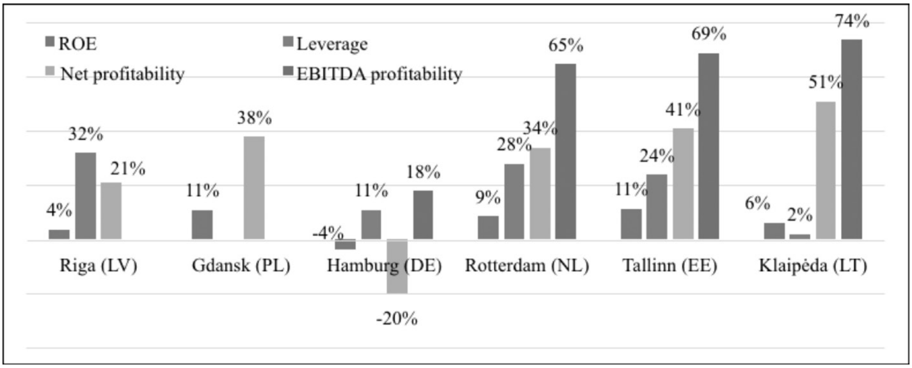
Figure 8. The rank of cargo turnover and financial indicators of ports in 2017



Source: Seaport Authorities Annual reports, 2017

Measurement of financial efficiency of ports (Fig. 9) describes possibilities to create added value and proves the motto of leading seaports in Europe: "From tones - to added value".

Figure 9. **Financial efficiency of ports in 2017**



Source: Seaport authorities Annual reports, 2017

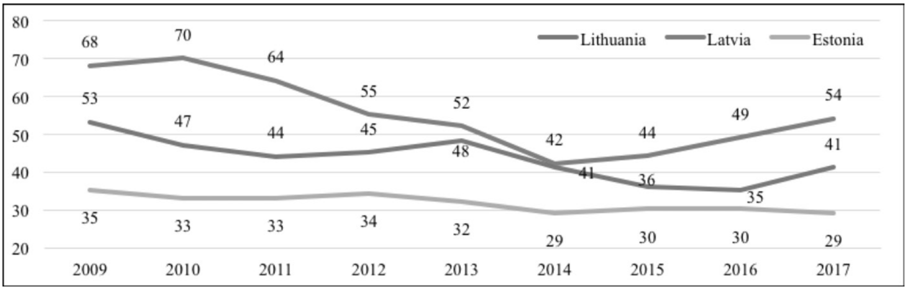
The best financial performace of profitability fixed in Klaipeda (LT) seaport authority (Fig. 9). The difference between EBITDA and net profitability depends on country's tax policy. The lowest level of financial leverage is stated for the Klaipeda (LT)– 2%, and Gdansk (PL) – 0%. This level rate is discussed by economists, because small number of leverage can be provided by low level of investment of port, and to high level of leverage shows the appropriate level of financial risk. For port authorities indicator of return on equity (ROE) is useful for comparing the profitability with others. Best return on equity fixed in port of Tallinn (EE) and Gdansk (PL) - 11%.

Overview of the changes of the competitive positions of Estonia, Latvia and Lithuania

According to the World economic forum, Latvia and Lithuania are in transition from stage 2 to 3, Estonia – in stage 3, innovation-driven economies group. In this research the country‘s competitive position is analyzed by competitiveness indices at global level by as determined by the Global Competitiveness Index (GCI), compiled by the World Economic Forum. Also the competitiveness of countries transport infrastructure is analysed. It should be noted that the transport infrastructure are only a part of the overall competitiveness index of the country, but are related and may effect the overall assessment of the country‘s competitiveness.

Throughout the analysis period 2009-2018 Estonia was the most competitive country in the group, its GCI consistently improved, the country's position changed by 6 positions, from 35 in 2009 up to 29 in 2017 (Fig. 10).

Figure 10. **Countries GCI 2009-2017 (1 - highest position)**

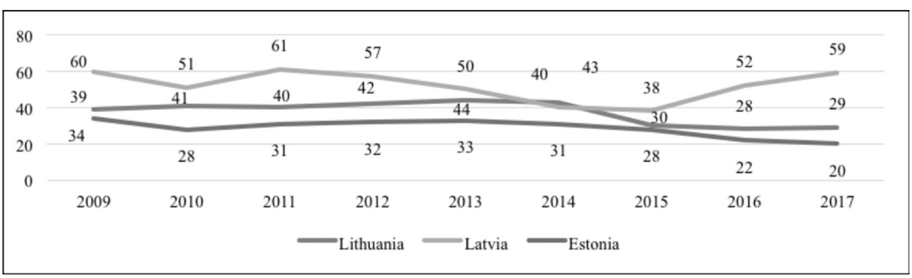


Source: The Global Competitiveness Reports 2009-2018

GCIs in other countries have also improved, but with higher volatility and lower positions (Fig. 10). The extreme amplitude of fluctuations is characteristic of the Latvian economy: 2009-2014 it has improved by 28 positions (from 70 to 42), but since 2014 the index began to deteriorate - worsened by 12 positions (from 42 to 54). Lithuanian competitiveness in 2009 2011 increased by 9 positions, from 53 to 44, in 2011-2013 it fell by 3 positions, 2013-2016 improved by 13 positions (out of 48 to 35). In summary, only the Estonian GCI continued to improve, Latvia's rating began to fall since 2014, and Lithuanian GCI was in decline in 2017.

The overall infrastructure consists of land and port infrastructure. Analyzing the change in the GCI index of quality of overall infrastructure (Fig. 11), it was determined that Estonia has the highest competitive infrastructure position, which has steadily improved entire analyzed period, from 34 to 20, i.e. up by 14 positions.

Figure 11. **GCI Indices of Quality of overall infrastructure 2009-2017 (1 - highest position)**



Source: The Global Competitiveness Reports 2009-2018

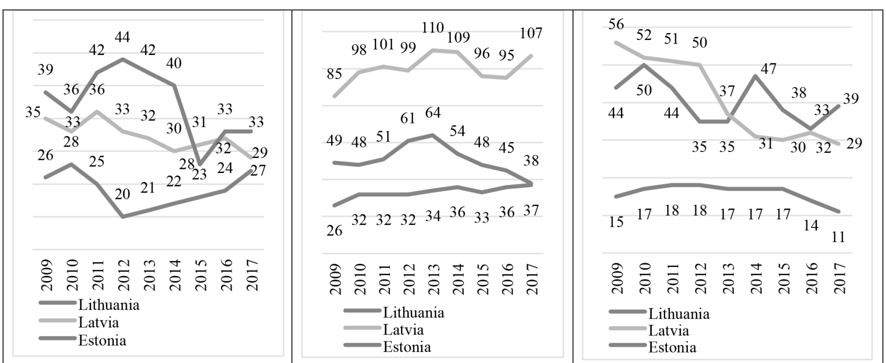
Significant changes in competitiveness of quality of Lithuanian overall infrastructure in 2015 occured: it improved by position comparing with 2014 (it got from the 43 position to the 30 position), and by 2017 it increased by one position (Fig. 11). On the other hand, 2015-2017 there were no major changes in the performance of the infrastructure, while Estonia improved its infrastructure competitiveness by 8 positions (from 28 to 20). The competitiveness of Latvian infrastructure has changed unevenly: in 2009-2015 it increased by 23 positions (61 to 38) and 2015-2017 it fell from the 38 to the 59 position. This is the biggest negative change in the group of countries.

Different infrastructure elements – road, rail and port – have been identified for different competitiveness changes (Fig. 12). The evolution of the data of the individual GCI infrastructure of the country's indicators coincides with the overall GCI of the country. Despite the increased amplitude changes in the railway GCI, in general, the GCI of infrastructures in Estonia has steadily increased (Fig. 12a). In terms of rail GCI, Estonia was not the most competitive country in the group of countries analyzed. In the rail sector Lithuania is the most competitive in 2009-2018, but Lithuania's position on quality of rail transport infrastructure GCI's declined: GCI of railways has decreased by 7 positions, from 20 to 27, since 2012.

The GCI change in the group of road transport infrastructure of the group of countries shows a steady improvement in the indicators of Estonia, the change of Latvia's road infrastructure is unstable and Lithuania's indicators are slightly weakening (Fig. 12b.). In terms of GCI of road, Latvia is the least competitive country and its GCI is the worst, and its individual data are inconsistent, with frequent fluctuations.

GCI of quality of seaports infrastructure fluctuates significantly (Fig. 12c).

Figure 12. GCI Indices of Quality of transport infrastructure 2009-2017 (1 – highest position)



b) rail	a) road	c) ports

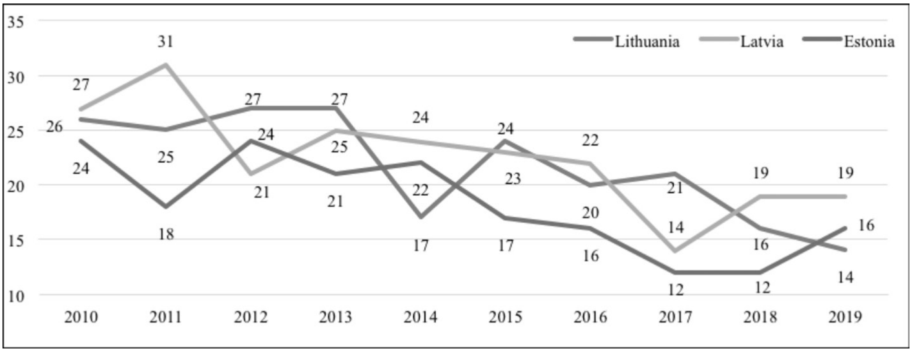
Source: The Global Competitiveness Reports 2009-2018

The competitiveness of quality of roads and railways infrastructure of Lithuania is in a higher position than other Baltic States, but the competitiveness of port infrastructure is at the lowest position (Fig. 12a, b). Exceptionally high level of competitiveness, 11 position, is that of the Estonian port infrastructure. To increase the competitiveness of port infrastructure, Lithuanian government decided to build an external deep-water port. The potential of the external port is 34-38 mio. tons of additional cargo to Klaipeda port (capacity of Klaipeda port is 60-80 mio. tons). The priority would be containerized cargo and oil products. Two possibilities of the use of an external port are considered: the formed territory and a tender for the operator or a concession possibility.

Summing up the GCI changes of the individual infrastructure elements of the countries (Fig. 12), it should be noted that Estonia was the most competitive country in the group, the country's GCI improved consistently, but this does not always correspond to the GCI change of quality of different infrastructure elements. The GCI values of Estonian roads and seaports are steadily improving, but the a recent GCI decline has been found. Lithuania is the most competitive in terms of rail GCI, but least competitive in quality of seaport infrastructure. Although Estonia was not the most competitive country in terms of road and rail data, the country's seaport infrastructure GCI were significantly better than other countries (18 points better than Latvia, 28 – than Lithuania), so the overall Estonian GCI was the best in the analyzed countries.

The business environment is important in assessing the competitiveness of both national and sea port economics. This can be seen as a consistent indicator of the usage of available infrastructure in international trade. The World Bank's Doing Business Business Environment Index describes the business environment regulation that aims to improve the business environment (1 – highest place). The index is compiled for the economies of 189 countries. Doing Business analyzes 11 business areas, 10 of which are related to business benefits: starting a business, issuing building permits, purchasing electricity, registering ownership, receiving credits, insolvency, protecting minority investors, paying taxes, cross-border trading, enforcing contracts, and decision-making.

Figure 13. **Estonia, Latvia and Lithuania Business environment 2010-2019**



Source: Doing Business 2010-2019 Reports, World Bank

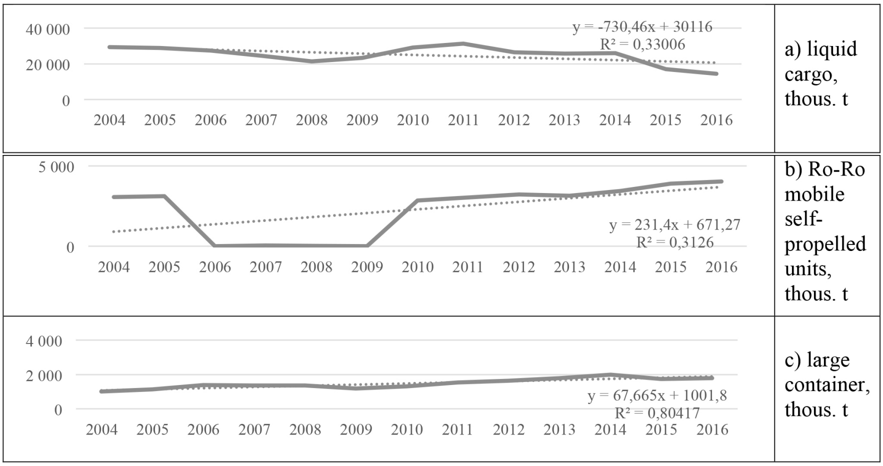
Summarizing the indicators of the Doing Business group (Fig. 13), it is noted that Lithuania is the most competitive country in terms of the business environment, Estonia is 2 positions lowers, and Latvia is the least competitive in the group. It should be noted that the World Bank Index does not measure the data of individual infrastructure elements, but evaluates the overall regulatory environment and how it helps business development, therefore this data is interpreted in the scope of the article.

Analysis of the link between the maritime sector performance and the competitiveness of the countries

The analysis of the link between Estonian, Latvian and Lithuanian maritime transport sector activities and the country's economic indicators, which determine the country's competitiveness, can be interpreted in various ways.

According to the statistical analysis of the link between Estonian gross domestic product (GDP), gross value added (GVA) and maritime freight turnover, it can be summarised that in opposite theoretical conclusions, the maritime freight turnover has weak negative correlation with GDP and GVA (r=-0,2). The maritime freight of Estonia is strongly dependent on liquid cargo flow (correlation coefficient r=0.97), but this flow is characterized by a downward trend (Fig. 14a). This may be associated with geopolitical factors in the region (EU sanctions against Russia and Russian embargo and the national transport policy of Russia, targeting cargo through Russian ports). The strong link between sea freight and Ro Ro cargo (mobile, self-propelled units) has been identified, r=0.7, and this cargo flow is characterized by an upward trend (Fig. 14b), which particularly increased after global economic crisis in 2008. Constantly increasing turnover of large container handling is observed (Fig. 14c). The average strength of the sea freight volume is also determined by the tonne kilometer turnover of freight transported by rail, r=0.4. Thus, following the upward trend of self-propelled vehicles and large containers, it is necessary to improve the Estonian road and rail infrastructure in order to maintain and increase the cargo flow at Tallinn port.

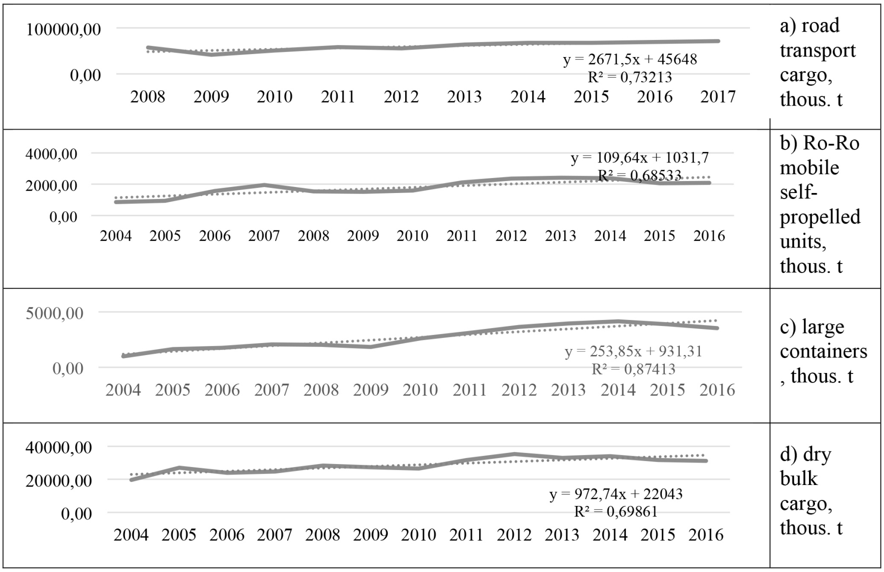
Figure 14. **Trend of maritime cargo in Tallinn port 2004-2016**



Source: Eurostat, 2019

The dependency between gross domestic product (GDP), gross value added (GVA) and maritime freight turnover of Latvia was determined as average: between maritime freight turnover and GDP r=0.5; and GVA r=0.6. Latvian maritime freight, on one hand, is heavily dependent on bulk cargo, ro-ro (self-propelled vehicles) and large container traffic, r=0.9, and, on the other hand, on freight transported by road (r=0.6).

Figure 15. Trend of maritime cargo in ports of Latvia 2004-2016

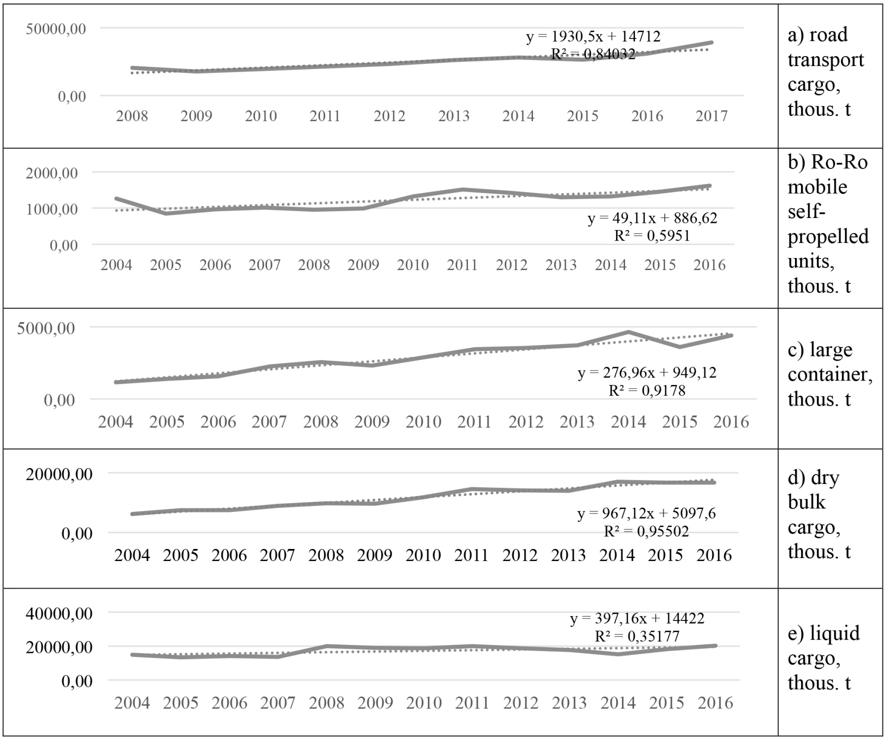


Source: Eurostat, 2019, Rigas Brivostas Parvalde, 2019

The flow of goods transported by road in Latvia has a strong influence on the number of business operating entities in the country (r=0.7). Also the maritime freight has a strong influence on the county‘s export volume (r=0.9). The cargo, transported by road, can be characterized by an upward trend (Fig. 15a), also the ro-ro mobile self-propelled cargo related to this trend (Fig. 15b) and the numbet of large containers cargo (Fig. 15c). The upward trend of bulk cargo flow allows to asume that bulk cargo is transported by road. In this case, it can be concluded that the main cargo flow to the seaport is transported by land transport, which has a strong positive impact on the country‘s export and business development, therefore it is necessary to improve road and railway transport infrastructure.

The main indices of the country‘s economics and competitiveness, GDP and GVA, in Lithuania strongly depend on maritime freight – r=0.9. On one hand, maritime freight has strong impact on Lithuanian export (r=0.8), on the other hand, the link of turnover of cargo, transported by road (Fig. 16a) is stronger – r=0.96, and also it is strongly related to maritime freight (r=0.7). The maritime freight also strongly depends on cargo transported by rail (r=0.6). Maritime freight strongly depends on bulk cargo and ro-ro, mobile self-propelled units (r=0.9), large containers (r=0.8). The mentioned types of cargo turnover are characterised by an upward trend (Fig. 16 b, c, d). The fluctuation of large container turnover is related to the establishment of the container hub in JSC “Klaipedos Smlete”, where the MSC company operates. It is noteworthy, that despite the decrease of liquid cargo turnover in Latvia and Estonia, in Lithuania liquid cargo turnovre has an upward trend (Fig. 16).

Figure 16. Trend of maritime cargo in port of Lithuania 2004-2016

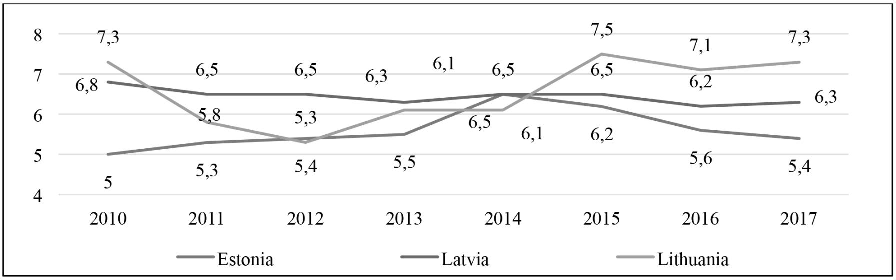


Source: Eurostat, 2019; Statistics Lithuania, 2019

Despite the positive development of the economics and maritime sectors of the country, analysis the Eurostat (2018) data of 2014-2016 shows that indicators of Lithuania of social exclusion, poverty and income inequality are distinguished by negative trends with a rising trend. The share of persons in the area of social exclusion and poverty in increased by 3%, while in Estonia it decreased by 3%, in Latvia it increased insignificantly (by 0.2%).

The inequality income distribution indicator in Lithuania remains one of the largests in the EU – 7.3 (income quintile share ratio). The indicator of Estonia is 5.4, in Latvia – 6.3 and it's can be characterized by a consistent downward trend (Fig. 17). Despite the trend, in Latvia in year 2018 the inequality indicator increase and reached 6.8.

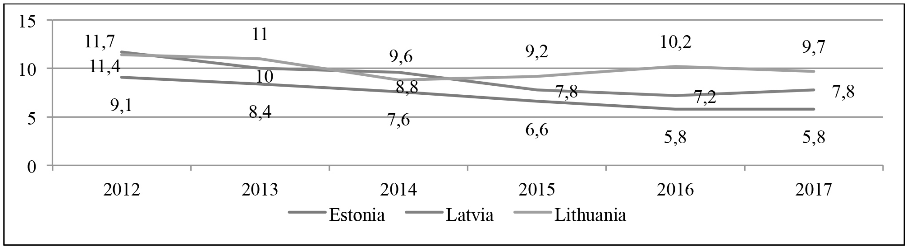
Figure 17. Inequality of income distribution - Income quintile share S80/S20 ratio, %



Source: Eurostat, 2018

The part of the population by the low intensity of work, in Lithuania is aprx. 10%, in Latvia increased and reached 8%, in Estonia remained unchanged, less than 6% (Fig. 18).

Figure 18. People living in households with very low work intensity (population aged 0 to 59 years), %



Source: Eurostat, 2018

The change in the indicator is due to the consistent development of national, EU and international environmental maritime transport. The positive impact of seaport activities can be illustrated by the Lithuanian municipal index – Klaipeda city and district are in the best position: business is active, it creates more and better paid workplaces, higher quality of life, less emigration. It is likely that the development of a deep-water port in Lithuania will increase the competitiveness of the country's infrastructure, seaport performance indicators, increase the indices of social, economical and ecological environment and decrease the separation of the seaside and the territory of the other countries.

Conclusions

1. The application of the principles of complexity theory makes it possible to analyze the seaport management in a 4D perspective, by assessing the efficiency of seaport governance in terms of productivity, efficiency, effectiveness, and taking into account the external political, economic social and technological conditions. On the basis of the principles of the new public administration and the theory of complexity, using the particularistic approach to the study of systems, it is evident, that results of the 4D model create preconditions to link the indicators of effective state-enterprise management with the indicators of logistic connectivity of the maritime transport sector in the multi criterion integrated assessment model of logistic productivity, which can be used to assess the attractiveness of the maritime transport sector. The attractiveness of maritime sectors can be explained as the maritime transport competitiveness and its sustainability have impact to the formation of the country's competitiveness advantages.

2. Summarizing the analysis of the competitiveness of Estonia, Latvia and Lithuania, it was found that Estonia is the most competitive country in the group under the Global Competitiveness Index. The Estonian GCI is significantly better than the Latvian and Lithuanian GCI, the difference between Latvia and Lithuania is not that significant. Although Lithuania is considered to be the most competitive in the group in terms of railway infrastructure competitiveness, the GCI of Estonia's seaports is significantly higher than Latvia's or Lithuania's. It should be noted that Latvia is the least competitive country of the group in terms of the GCI of individual infrastructure elements. The World Bank rated Lithuania as the country with the most favorable business environment of the analysed countries, in this respect Lithuania is ahead of Estonia and Latvia.

3. Only in Lithuania the main indices of the country's economics and competitiveness, gross domestic product and gross added value strongly depend on maritime freight, average dependence was indicated in Latvia, and a weak-negative dependence was estimated in Estonia. The exeptional Estonian case can be explained by innertion of the development and impact of infrastructure projects. Based on the usage of port infrastructure and high level of quality of transport infrastructure, it can be stated that the advantage of the Estonian seaport and transport infrastructure is currently underutilized, and the more significiant impact of the port on economics of Estonia can be expected in the future. Regarding Lithuania, the good quality of land transport infrastructure (rail and road) leads to the creation of the possibility to increase maritime freight and strengthened the Klaipeda seaport (Lithuania) connection with hinterland. These characteristics describe that the maritime freight turnover has the strongest impact on Lithuania's GDP and GVA, comparing in with Latvia and Estonia. It can be stated that the link between the competetiveness of the country and its maritime sector attractiveness exists, if the infrastructure is developed and is an advantage and properly used. The infrastructure competitiveness of Baltic States is influenced by the infrastructure of the port.

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Chapitre 12

Digitalization in maritime logistic sector

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Biography

Mrs. Kristina Gontier *(a graduate from Vilnius University, MA Linguistics; and IMO Port Management Programe) has been working in Klaipeda State Seaport Authority since 1995. She started her professional career in the Marketing Department as a project manager; in 2005 was appointed as the Head of Marketing Department, in 2018 as International Relations Manager. Mrs. K. Gontier is responsible for implementation of Klaipeda Port Marketing Strategy, EU projects, International relations, etc.*

Preface

Lithuania is the Eastern Baltic Sea state, with a population of nearly 3 million people and area of 65.300 km2. The capital city: Vilnius. Since 2004, it is the member of the European Union and NATO. The country profits from its excellent geographical location: it is a crossroads of 3 large consumer markets: the CIS with 250 mln., the Baltic Sea region – 110 mln. and the West European market with 340 mln. consumers.

Klaipeda – the country's only port and the largest transportation centre which provides all maritime business and cargo-related services: stevedoring, shipbuilding, ship repair, logistics, cargo forwarding and agency services, etc. The port plays the significant role in the Lithuanian transportation system as it bridges the country with global markets. Klaipeda Port serves as Lithuania's gateway to the World and unveils extensive opportunities for export-import trade, businesses, investments, tourism, etc.

2019 will be marked as a record-breaking year in the history of the port: the cargo volumes are expected to reach 50 million tons. The outstanding results speak of the effective and performance-orientated port administration, hardworking staff, whose efforts plays a decisive role in the port's achievements. Klaipeda port is a catalyst of economic prosperity for the city and the entire country. Therefore, the development and modernization of the port has always been and will remain the priority of Lithuanian Government.

History Of The Port

Old seaport

Klaipeda was founded in 1252. Under the agreements of Curonian Bishop and the Vice-Regent of the Livonian Order with the approval of Mindaugas, the Grand Duke of Lithuania, it was decided to build the castle of Memel. In the small port established adjacent to the castle, boats of Lübeck and Bremen merchants used to moor.
In 1743, the first timber trade office was established in Klaipeda. Since then the port became the best-known timber-trading port in the Baltic Sea.

A chronicle dating back to 1797 mentions that the Port of Klaipeda consisted of the river port on the Dane River and the large port waters within the strait of the Curonian Lagoon, where timber used to be handled and over 300 boats could be accommodated at once.

In 1919, after Germany's defeat in World War I, according to the Treaty of Versailles, Klaipeda Port was handed over to the Entente Alliance countries.

On May 8, 1924, in Paris the Klaipeda Convention was signed, according to which the management of Klaipeda Port was handed over to the Port Directorate consisting of the representatives of the Lithuanian State, the Klaipeda Region, and the League of Nations.

Throughout 1924–1939, Klaipeda Port flourished: new quays were constructed, various marine business companies were established, and shipping activity was developed.

History of the Port of Klaipeda during 1945–1991

The first vessel, which called at Klaipeda Port after World War II, was the military boat Luban. It arrived to Klaipeda Port during a storm, in October 1945. The navigation, disrupted by World War II, was eventually restored with the arrival of the Finnish steamboat Astoria. By the end of 1945, eight more vessels called at Klaipeda Port.

During the Soviet period, in Klaipeda Port waters, there were three ports with different subordination: Klaipeda Commercial Seaport, Nemunas Shipping Port, and Klaipeda River and Fishing Port. Later on, Sea Fishing Fleet was established, which supplied fish to the largest European part of the Soviet Union.

In 1969, the newly constructed specialized Western Ship Repair Yard began its first vessel repair operations.

After World War II, within the Commercial Seaport, the navy fleet was established. For several years the navy fleet was used to transport the captured property from Germany and Poland to the Soviet Union. Therefore, the reconstruction of the Commercial Seaport was postponed. The largest reconstruction projects of the port were implemented only at the end of the sixties and the beginning of the seventies. In 1969, Lithuanian Shipping Company was established, to which the control of the Commercial Seaport was handed over.

In 1986, the International Ferry Terminal Klaipeda–Mukran (Rügen Island, the former GDR) was open in Klaipeda Port. This Ferry Terminal served, at that time, the largets rail ferries in the World with carrying capacity of 103 railway cars. The ferries were used to transport Soviet military equipment, ammunition and soldiers. With the launch of the International Ferry Terminal, annual cargo handling turnover in Klaipeda Port increased rapidly and the port was ranked among the 100 largest ports of the world.

History of establishment of Klaipeda State Seaport Authority

In 1991, according to the Decree of the Government the Republic of Lithuania, the Ministry of Transport and Communications established State enterprise Lithuania Seaports Authority.

In 1991, Klaipeda Harbour Master's Office, independent from Lithuania Seaports Authority was established.

In 1992, Klaipeda Port was granted the status of the State Seaport.

In 1993, according to the Decree of the Government of the Republic of Lithuania, State enterprise Lithuania Seaports Authority was renamed as State enterprise Klaipeda State Seaport Authority.

In 1993, Klaipeda Harbour Master's Office and State enterprise Klaipeda State Seaport Authority were merged.

In 1996, Klaipeda State Seaport Act was adopted, whereby the port land, port waters, quays, hydrotechnical installations, shipping routes and channels, and other infrastructural facilities were declared the property of the state and not subject to privatization. These objects are controlled and developed by State enterprise Klaipeda State Seaport Authority.

In 2001, according to the Order of the Ministry of Transport and Communications, Maritime Safety Administration, an affiliate of Klaipeda State Seaport Authority was established.

In 2002, Maritime Safety Administration was separated from Klaipeda State Seaport Authority and the budgetary institution Lithuanian Maritime Safety Administration was established instead.

In 2002, Maritime Safety Administration was separated from Klaipeda State Seaport Authority and the budgetary institution Lithuanian Maritime Safety Administration was established instead.

In 2017, Lithuanian Transport Safety Administration was established by merging 3 different institutions responsible for transportation security (Maritime Safety Administration, State Motor Transport Inspectorate and State Railway Transport Inspectorate).

Klaipeda Port Nowdays

Klaipeda Port Advantages

Klaipeda Port – Lithuania's largest transportation centre. Klaipeda Port is a multi-purpose deep-water port operating 24/7. It is a port, which remains ice-free even in harsh winters. 14 large stevedoring, shipbuilding and repair companies provide all maritime business and cargo-related services.

Characteristics of the Port of Klaipeda:

- port territory area – 498 ha;
- port waters area – 629 ha;
- total length of port quays – 26.9 km;

- port railway length – 100 km.

The port is capable of accepting large tonnage vessels:

- dry-cargo vessels up to 100,000 DWT,
- tankers up to 190,000 DWT;
- containerships up to 19 000 TEU's.

The port can accommodate vessels up to 400 m in length and with a maximum draft of 13,8 m.

Main goals and objectives of Klaipeda port:

- to ensure the growth of cargo and passenger flow,
- to attract the new shipping lines,
- to increase the competitiveness of the port,
- to increase the number of ship calls to the port,
- to guarantee safety and efficiency of the port operations,
- to enhance the image of Klaipeda Port in the country and abroad,
- to encourage cooperation between the city's residents and the port community,
- to promote Lithuania worldwide as a maritime state.

The main advantages of the Klaipeda port are the following:

Competitive. The Port of Klaipeda quickly adjusts to market changes, handles different types of cargo at the specialized terminals, applies flexible dues and charges, renders the highest-quality services, and operates 24/7.

Crossroad of transport corridor. As the Port of Klaipeda is situated at the crossroad of two international transport corridors, it serves as a bridge between the markets of the Commonwealth of Independent States and the Asian region on the one hand, and the European Union and other markets on the other hand. The Port of Klaipeda lies closest to the ports in the North-West of Europe and southern parts of Scandinavia.

Ice-free. Unlike the ports located to the north, the Port of Klaipeda remains ice-free even during the coldest winters and thus guarantees uninterrupted navigation and stevedoring works.

Deep-water. The depth of the entrance channel is 15 m. The depth of the inner channel is 13-14.5 m. The port is capable of accepting large-tonnage vessels including dry-cargo vessels up to 100,000 DWT, tankers up to 170,000 DWT, and containerships up to 19,000 TEU's.

Access to large markets. The same width railway lines connect Klaipeda Port to Russia, Belarus, Ukraine, Kazakhstan and other CIS countries thus ensuring access to the market of 250 million consumers in the continental part, 30 million consumers in Western Europe and 110 million consumers in the Baltic region.

Intermodal. The Port of Klaipeda is the leader among the ports of the Baltic States in terms of container handling. Its well-coordinated operations of sea and hinterland transport, the Free Economic Zone, the EU short-sea shipping network, and the wide-range of logistic and industrial service providers ensure smooth intermodal transportation.
Safe and reliable. At the terminals of Klaipeda Port, within the port territory and port waters, the requirements set forth in the International Ship and Port Facility Code (ISPS Code), Regulation No 725/2004 and Directive 2005/65/EC of the European Parliament and of the Council have been implemented. The terminals of the Port of Klaipeda operate in compliance with the ISO 9000 and 14000 standards.

The core activities of klaipeda port

Cargo handling

Klaipeda cargo volumes has enjoyed the steady growth throughout the last 20 years. Throughout last several years, large infrastructural projects which considerably increased the port competitiveness, were completed: LNG terminal, MSC container distribution hub, Central Klaipeda Ro-Ro Terminal, dredging of the port fairways up to 15.5 m. The annual capacity of Klaipeda Port is over 65 million tons.

Klaipeda is a multipurpose port which has 33 specialized terminals to handle all types of cargo (Fig. 1, Fig. 2).

Figure 1. Structure of types of cargo handled in Klaipeda Port

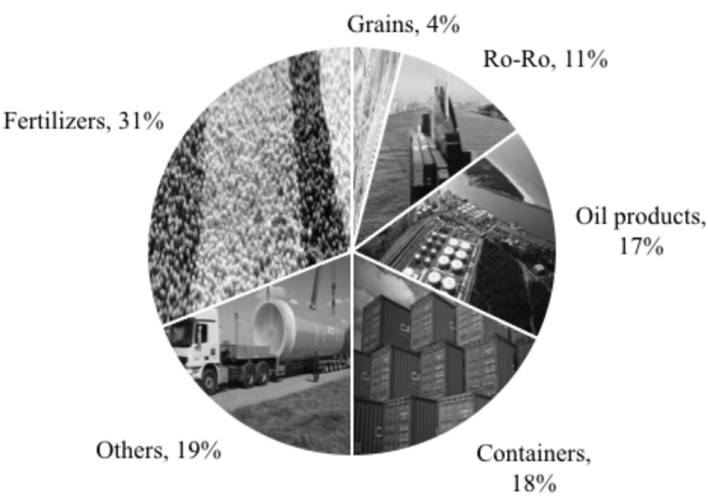
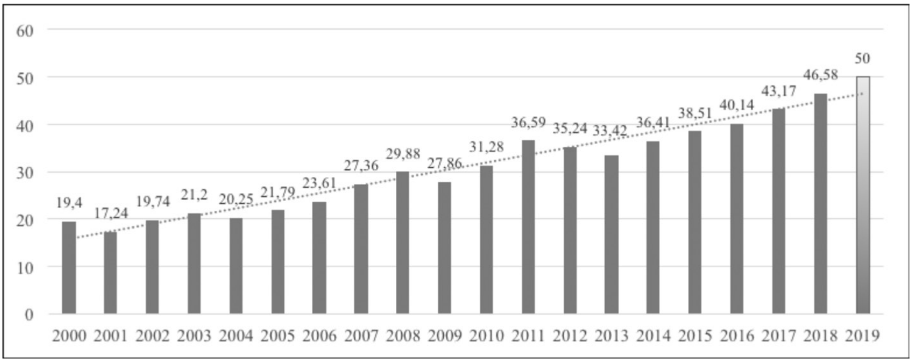
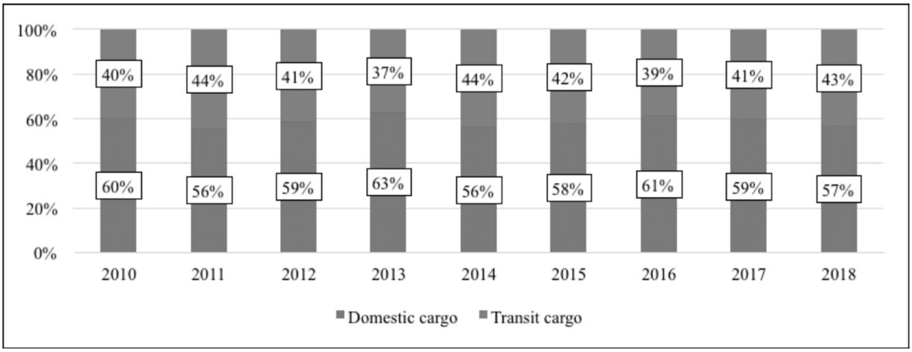


Figure 2. **Growth of cargo volumes in Klaipeda within 2000-2019 (2019 - expected)**



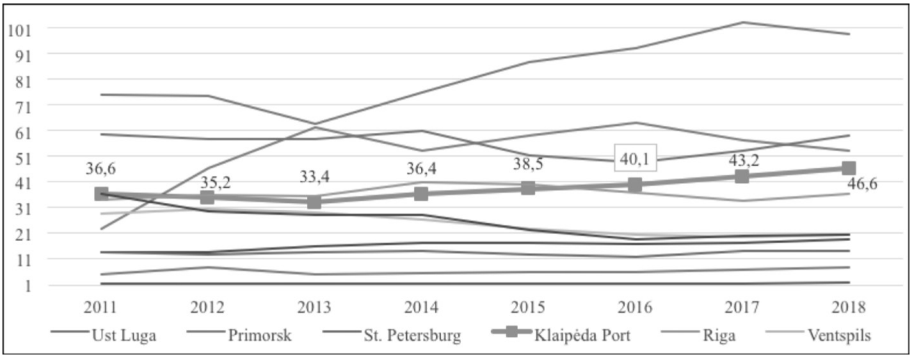
Klaipeda port is dominated by domestic cargo (Fig. 3).

Figure 3. **Share of transit and domestic cargo in Klaipeda 2010-2018**



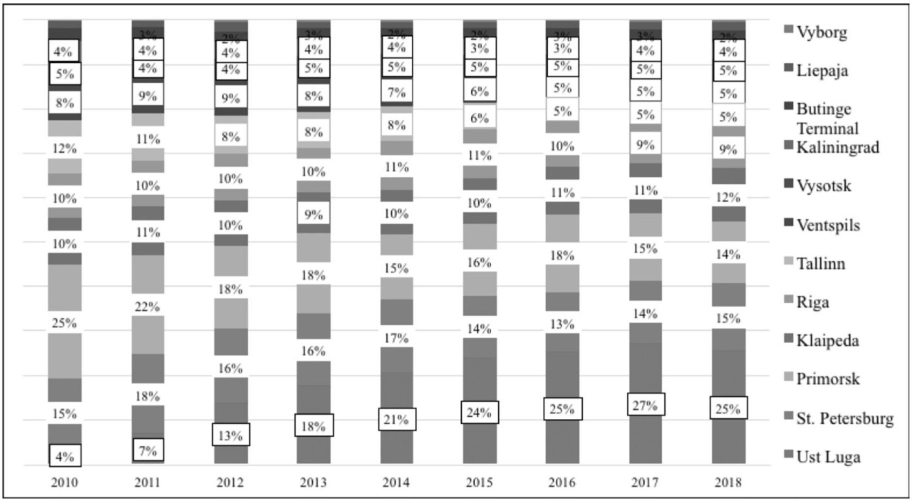
The ports of the eastern Baltic Sea are considered as competitors of Klaipeda port, which have the opportunity to compete with Klaipeda port for cargo flows passing the East-West transport corridor. Klaipeda port is the 4th largest port among the eastern Baltic Sea ports (Fig. 4).

Figure 4. **Ports turover among the eastern Baltic Sea ports, mln. t**



Cargo volumes growth in Klaipeda port resulted in increased market share of Klaipeda port among the total cargo volumes of the ports on the Eastern coast of the Baltic Sea (Fig. 5).

Figure 5. **Market share in Klaipeda port compared to other port of the Eastern coast of the Baltic Sea**



The port market share increased from 10 per cent in 2010 to 12 per cent in 2018 respectively (Fig. 5). In 2019, the share of Klaipeda port is expected to grow even more considerable, expected up to 12.5 per cent.

Shipping lines of the Port of Klaipeda

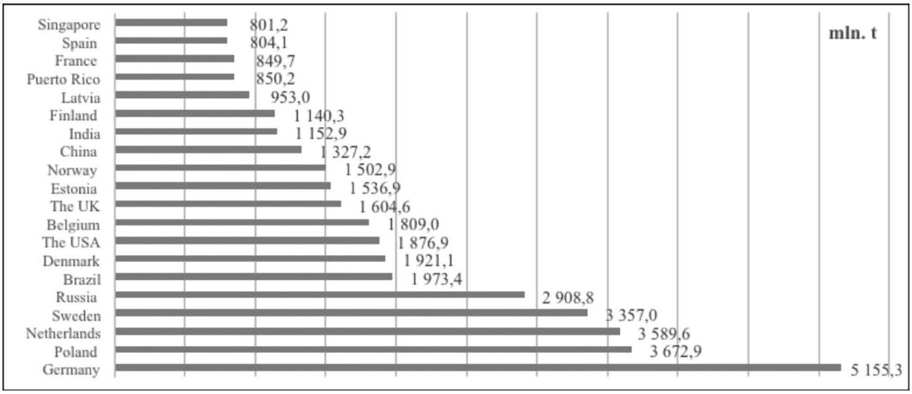
The Port of Klaipeda has one of the widest networks of shipping lines among the Baltic State ports. Every day shipping lines connect Klaipeda with the ports of Denmark, Sweden, Germany, Poland, Belgium, Russia, Finland, Great Britain, and other countries (Table 1).

Table 1. **Klaipeda port shipping lines Ro-Ro, Ro-Pax and Container shipping lines in Klaipeda Port**

Line	Itinerary
TT-Line GmbH &Co.KG	• Klaipeda–Trelleborg–Klaipeda
MEDITERRANEAN SHIPPING COMPANY (MSC)	• Le Havre – Antwerp – Rotterdam – Bremerhaven – Gdynia – Klaipeda – Stockholm – Gävle – Helsinki – Rauma – Norrköping – Oslo – Sankt Petersburg – Kaliningrad – Riga – Tallinn • Antwerp – Bremerhaven – Rotterdam – Le Havre – Sankt Petersburg – Kaliningrad – Helsinki – Rauma – Riga – Norrköping – Kotka – Stockholm – Gävle – Gdynia – Tallinn • London Gateway Port – Antwerp – Rotterdam – Gdynia – Klaipeda – Kaliningrad – Bremerhaven – Le Havre – La Spezia – Naples – Gioia Tauro – Suez – King Abdullah Port – Sidney – Melbourne Adelaide – Frema
MAERSK A/S	• Wilhelmshaven –Bremerhaven – Norrköping – Baltiysk – Kaliningrad – Gdansk – Klaipeda – Riga – Tallinn – Sillamäe – Ust Luga – Sankt Petersburg – Gdańsk – Bremerhaven
HAPAG LLOYD AS	• Hamburg – Bremerhaven – Gdynia – Halmstad – Riga – Tallinn – Ust Luga – Sankt Petersburg – Kotka – Oslo – Rauma – Gävle – Norrköping – Klaipeda – Hamburg
YANG MING	• Hamburg–Gdynia–Klaipeda–Hamburg
CONTAINERSHIPS	• Klaipeda – Teesport – Rotterdam – Helsinki – Sankt Petersburg – Lubeck – Riga – Ghent – Aarhus – Thamesport – Zeebrugge – Gdynia – Klaipeda • Klaipeda – Teesport – Rotterdam – Helsinki – Sankt Petersburg – Lubeck – Riga – Ghent – Aarhus – Thamesport – Zeebrugge – Klaipeda • Klaipeda – Gdynia – Oslo – Klaipeda • Klaipeda – Gdynia – Oslo – Aarhus – Klaipeda
UNIFEEDER A/S	• Klaipeda – Riga – Bremerhaven – Hamburg – Rotterdam – Szczecin – Gdansk – Gdynia – Immingham – Teesport – Felixstowe – Hull – Sankt Petersburg – Rauma – Kotka – Tallinn
DFDS SEAWAYS (RO-PAX)	• Klaipeda – Kiel – Klaipeda • Klaipeda –Karlshamn – Klaipeda • Klaipeda – Fredericia – Copenhagen – Aarhus
TEAM LINES DEUTSCH-LAND GMBH	• Gdansk – Riga – Gdansk – Klaipeda – Gdansk
COSCO SHIPPING LINES FINLAND	• Gdansk – Helsinki – Riga – Klaipeda – Gdansk
NT Marine AS	• Riga – Klaipeda
NCL Corporation Ltd	• Southampton – Amsterdam – Oslo – Copenhagen – Warnemunde – Gdynia – Klaipeda – Riga – Tallinn – Stockholm – Helsinki – Sankt Petersburg

In the overseas transportation German, Poland and Netherlands predominates, whereas Germany makes over 5 million tons, Poland – 3.6 million, the Netherlands – 3.5 million tons of cargo (Fig. 6).

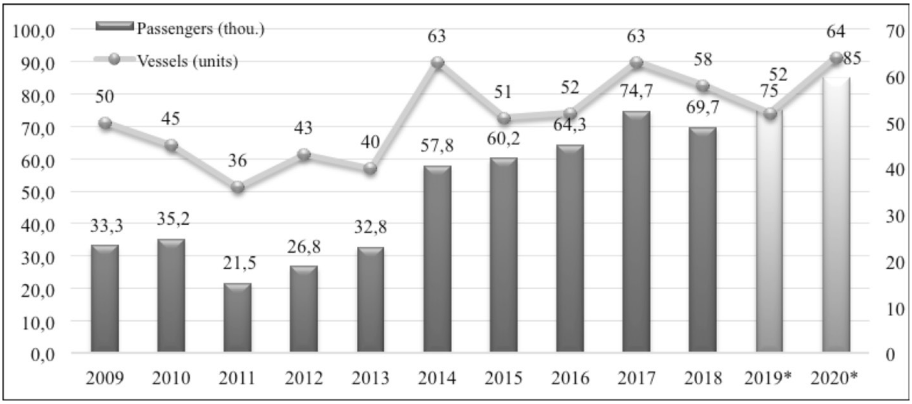
Figure 6. **Top 20 overseas countries of Klaipeda Port in 2018**



It should, however, be noted that cargo shipped from Klaipeda to Germany and the Netherlands (Fig. 6) is not destined to these countries, as they are transhipped further to other countries in German and Dutch Hub ports.

Cruise shipping in Klaipeda started to considerably develop since 2003, when Cruise Vessel Terminal (in the city centre) was constructed. Until that year, a few cruise vessels used to call at the port. Having the required cruise infrastructure in place, the port could accommodate all size cruise vessels and propose to cruise passengers outstanding cruise experience.

Figure 7. **Cruise shipping development in Klaipeda port (2019-2020 – estimated)**



Klaipeda Cruise Vessel Terminal covers an area of 1.2 hectares and is located about 100 m from the city centre. Vessels with the length of 315 m and the draught of 8.5 m are able to moor at the terminal. All services necessary for tourists are rendered in the terminal and its approaches: taxi, postal services, telephone and currency exchange, ATM, souvenir shops, bars, restaurants and hotels.

Striving to even more expand maritime tourism, the new Klaipeda Cruise Pier on the left bank of the Dane River will be constructed within next few years (Fig. 8). This will allow the port to increase competitiveness in cruise and maritime tourism markets. It will also expand possibilities of Klaipeda to accommodate ever increasing number of cruise calls and will guarantee the highest quality of services to the passengers.

Figure 8. Visualisation of Klaipeda Cruise Pier and the Vessel Terminal

Maritime tourism is extremely important for Klaipeda Port and the city. For over 15 years, the port and city representatives have participated in the international cruise exhibitions «Cruise Shipping Miami» in Miami and «Seatrade Europe» in Hamburg. Moreover, Klaipeda is a regular host of the industry events, as cruise business and maritime tourism conferences, workshops, and seminars are taking place here. Cruise business is also promoted in a proactive Cruise Europe and Cruise Klaipeda welcomes cruise passengers with Lithuanian national dance and song performers and invites them to visit folk craft fairs held in the old town.

Hinterland transportation

Klaipeda port is proud of its excellent hinterland transportation offer, too. Thanks to a well-developed railway network and harmonised border crossing procedures as much as 80% of all goods handled in our port are transported by rail, which is much cheaper, faster, and more environment-friendly than road transports. The wide-gauge rail system allows the port to reach the neighbouring countries such as Russia, Belarus, and the Commonwealth of Independent States.

So as divert cargo flows from the roads to the sea, Klaipeda port together with Lithuanian, Belarusian, and Ukrainian railways launched several intermodal projects, aiming at connection of container and con-trailer trains to the hinterland of the eastern Baltic Sea region. The most successful intermodal project is the “Viking” train, which connects the Black and the Baltic Seas. The train starts in Chornomorsk port, passes through Kiev, Minsk, and Vilnius and reaches Klaipeda in a very short period of time (around 55 hours) covering a distance of some 1700 km. The delivery time and transportation tariff are very competitive compared to similar road transport.

Governance of klaipeda port

In 1991, when Lithuania regained its independence, the port of Klaipeda was established; a year later it was granted the status of a state seaport. In 1996, the Law of Klaipeda State Seaport was adopted, whereby the land, harbour waters, quays, waterworks, navigational ways, channels, facilities and other objects of infrastructure were declared property of the state and not subject to privatization. All these objects are managed and developed by state enterprise Klaipeda State Seaport Authority (KSSA), which functions as the “landlord“. KSSA is not engaged in commercial operations (stevedoring, forwarding, agency services, etc.).

The ministry of Transport is the founder of KSSA and qurantees that the required investments are channeled trought one focal point and carried out efficiently and instantly to all maritime and surface transportation projects.

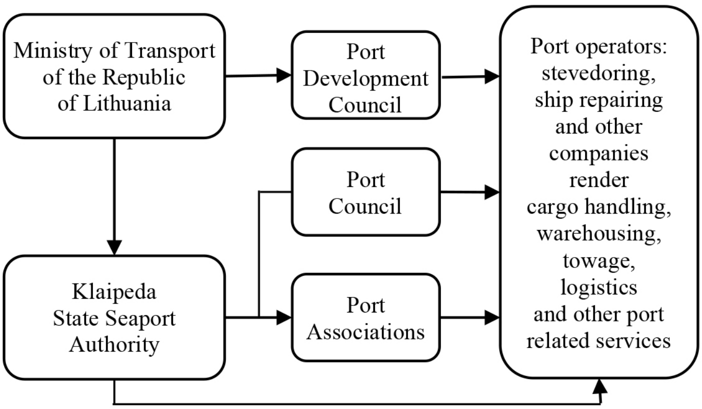
Klaipeda State Seaport Authority performs the following functions:

- Coordinates the protection of the port territory and ensures safe navigation in the port.
- Ensures the operations of the Harbour Master‘s services.
- Controls and maintains port reserve territories.
- Ensures efficient use and management of the state property held in trust.
- Leases port land and collects port dues and charges.
- Makes arrangements for rescue of ships and humans in the harbour waters.
- Draws up port strategy projects, detailed plans of port and port reserve territories, makes arrangements for their implementation, scientific research works, and takes care of advertising the port.
- Considers and approves projects designed for the reconstruction of the existing port structures and the construction of new ones; compiles and approves mandatory terms of reference for such projects.
- Implements measures aimed at prevention of pollution in the port, and makes arrangements for the elimination of consequences of incidents involving pollution.
- Builds, uses and develops port infrastructure.
- Maintains design depths in the harbour waters and in the areas next to quays and piers.

• Makes arrangements for and implements port environment protection measures.
• Carries out preparatory works intended for infrastructure development in the port reserve territories upon approval by municipal government institutions.
• Ensures control in non-leased sectors of the port land (territory).

The structure of the port management is presented in Fig. 9.

Figure 9. Klaipeda port management system



Klaipeda State Seaport Authority is a proactive member of international organisations and associations.

It has been a member of the Baltic Ports Organization (BPO) since 1995, and a member of the European Sea Ports Organization (ESPO) and the Cruise Europe (CE) since 2001.Membership in these organizations allows the port to represent the interests of its maritime policy on a wider scale, to participate in marketing projects and studies, to build and maintain its relationship with partners, to exchange information, and gain experience.

Klaipeda Port is rapidly developing, thanks to the efficient funding system. Efficient investment system applied in Klaipeda port guarantees excellent port infrastructure and superstructure, effectiveness of its operations and ever increasing growth of cargo volumes.

Klaipeda State Seaport Authority's revenue generated by port dues and port land lease make up over 50 million euros per year. This amount of money, as well as bank credits and the EU funding, comprise the total share of the state funding which is allocated for the development of the port infrastructure, access roads, railways, maintenance and capital dredging of the port waters and the improvement of the security requirements.

Private companies invest double amounts of money for the development of the port superstructure. Their contributions to the port superstructure, close cooperation with cargo owners and forwarders, and competitive rates of stevedoring works ensure the effective operations of the port. The port contributes to the well-being of the city and its residents by allocating required funds to the construction and renovation of the streets, recreational and leisure areas, restoration of beaches.

Klaipeda Port is a catalyst of the city's strength and stability. The port activity and its services generate economic and social benefit for both the city and the country.

More than 800 different types of companies, which employ over 4,000 people, are engaged in port-related activities. In addition, approximately 58,000 indirect and induced jobs are created by Klaipeda Port operations. The port activity generates about 4.5 per cent of Lithuania's gross domestic product and with its indirectly related business share it creates as much as 16 per cent of the country's GDP.

In order to assure smooth port operations and to protect the port against illegal actions, it is critically important to have established a comprehensive and well-coordinated port security system. The establishment of such system began in 2001 when Klaipeda Port Complex Safety Plan was prepared and approved. Nevertheless, the system undergoes further improvements.

In 2004, the requirements of International Ship and Port Facilities Security Code (ISPS Code) and Regulation (EC) No 725/2004 of European Parliament and of the Council of Europe were implemented; the security of port terminals was assessed and their security plans were worked out and implemented. According to Directive 2005/65/EB of the European Parliament and of the Council of Europe, and the recommendations of International Standard ISO 20858:2007(E), in 2007 the assessment for the entire port security was carried out.

Klaipeda Port is equipped with a number of sophisticated security systems that belong to Klaipeda State Seaport Authority, the state controlling authorities, and the users of the port land. These television, radiolocation, communication and signalling security systems cover the port waters, territories, terminal perimeters and the gateways. All these port security systems are regularly updated.

Klaipeda State Seaport Authority coordinates and controls how the port land users, the stevedoring companies and the port terminals comply with security requirements.

Klaipeda Port is an inseparable part of city's scape and has a huge influence on everyday life and quality of Klaipeda inhabitants. Klaipeda Port is a Maecenas, organiser and a host of a number of maritime, cultural and sports events: Sea Festival, Klaipeda Castle Jazz Festival, Tall Ships Regattas, Running race Amber Mile, etc. Striving to promote maritime activity among local communities and every summer, Klaipeda residents and tourists enjoys free boat tours in Klaipeda Port waters. This campaign is a contribution of Klaipeda Port to the initiative of the European Commission to promote the image of ports, to get the city's residents acquainted with the maritime industry, and commemorate European Maritime Day on 20 of May.

Klaipeda Port Development Plans

Constant growth of cargo flows, intensified navigation, larger vessel tonnage, and increasing number of vessels arriving at the port calls for the port expansion projects. Throughout 1999–2019, the cargo turnover in Klaipeda Port increased from 15 million tons to 50 million tons. The annual capacity of Klaipeda Port amounts to over 65 million tons. It is presumed that by 2025, due to the growth of cargo throughput, the port capacity will be entirely exhausted.

The largest part of the territory of the port, which is historically situated in the neighbourhood of the city, is intensively used for stevedoring operations. However, limited space restrains the port from expanding its territory, building new terminals and warehouses. Klaipeda port development requires new territories, greater water depth, and wider navigation channels.

In 2004, Japan International Cooperation Agency (JICA) completed the Feasibility Study on Klaipeda Port Development. The study presented comprehensive assessment of business conditions in Klaipeda region and the port, technological characteristics and natural environment. It also analysed several feasible port expansion alternatives. The study experts came to the conclusion that the port expansion within the existing territory is limited. Following JICA recommendations, the future outer port with the natural depth of 17–17.5 m could be constructed in the northern part, next to the port entrance (near Melnragńsettlement). An artificial island (1.5 km long and 700 m wide) would be constructed 350 m from the coast; the reclaimed outer port area would have road and railway access linked to the existing port.

Taking into consideration the rapid growth of cargo flows, as well as economic and social benefits, generated by the port to the city of Klaipeda and the entire country, the Government of the Republic of Lithuania has already taken the necessary steps in order to implement expansion plans.

The main document - Klaipeda Port Master Plan – after approval will give the green light for the port expansion in the norther and the southern parts of the port. However, the construction time of the outer-port will depend on the situation in the maritime business market. Presumably, the first terminal the outer-port could start operating in approximately 2025-2029. Preliminary cost of the facility may reach over 1 billion euros (Fig. 10).

Figure 10. Visualisation of preliminary layouts of the reclaimed territories of Klaipeda port

a) preliminary layouts of the reclaimed territories in the northern part of Klaipeda port

b) preliminary layouts of the reclaimed territories in the southern part of Klaipeda port

During 2020–2022, the largest port dredging operations will be carried out deepening and widening of the port fairways. Currently, the port entrance is 15.5 m and the northern and the central parts of the port is 14.5 m deep. Seeking to increase cargo turnover and to accommodate and fully load 90 000 DWT vessels, the port entrance and the entire fairway will be dredged up to 17.5 m, 17 m and 15.5 m. Over 13 million m3 of soil will be excavated during the dredging operations scheduled for 2020–2022. Having completed these dredging operations, the cargo turnover handled and the number of vessels arriving in the port will be increased. It will also improve the navigation and environmental safety in Klaipeda Port.

Well developed port access railway and motorway systems, which provide for rapid and smooth delivery of cargo to the port terminals, are extremely important for the successful functioning of the port. In Klaipeda Port, over 78 per cent of the total volume of cargo is transported by rail. Therefore, it is important to develop the port railway network because rail transportation, compared to the road, is more environmentally friendly, faster, and cheaper. The construction of port railways provides not only a fast delivery of cargo, but also solves traffic-related congestion, pollution, and noise problems. Klaipeda Port is served by two railway stations: Klaipeda and Draugyste, and five railway shunting yards: Klaipeda Station, Perkelos, Pauoscio, Rimkai and Angline. The two latter shunting yards have been recently reconstructed by developing a supplementary access to the port and installing a centralized control system. Such reconstruction is of utmost importance, as it now allows the port to shorten the time required for transferring railcars to the port terminals.

Every port has to assure a convenient berthing place and safe navigation of yachts, cutters, and other small boats. Therefore, the new Quay for Small and Pleasure Boats will be constructed in a convenient location: in the southern part of the port, beyond the existing navigation channel. Thus, small boats going to the Curonian Lagoon will avoid crossing the intensive navigation channel and the ferry turning basin. The quay will accommodate up to 690 boats: 430 – alongside quays and another 260 – on slipways. Moreover, it is planned to establish a yachting school there.

Partie III

Human & Technology

Chapitre 13

Digitalization in maritime logistic sector

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Biography

Mr. Olli-Pekka Brunila, *(M) M.Sc. Ph.D. student is Research Manager of Logistics, Marine Technology and Transport focus area of South-Eastern Finland University of Applied Sciences. Currently his focus is on logistics research and regional development of logistics. Previously, Brunila worked as project manager at University of Turku Centre for Maritime Studies, during which he focused on research on logistics and port operations as well as their environmental impacts. At University of Turku, Brunila participated in several national and EU funded research projects.*

Mrs. Vappu Kunnaala-Hyrkki, *(F) M.Sc. works as RDI Specialist in South-Eastern Finland University of Applied Sciences. Her focus is on international research, development and innovation projects. Kunnaala-Hyrkki has worked previously as a research specialist and project manager at University of Turku Centre for Maritime Studies. At University of Turku, Kunnaala-Hyrkki participated in several national and EU funded research projects in the field of logistics, maritime logistics and maritime safety.*

Abstract

Digitalization is revolutionizing the maritime logistics sector that has previously been relatively conservative. Nowadays there is an increasing amount of digital and electrical solutions that are used or could be used also in ports. New digital solutions are being developed every day. Within the transport and logistics sector, some companies are already experimenting with new connectivity and data-enabled technologies, leading to the Internet of Things (IoT) and industry 4.0. In addition, digital solutions that have been used and are found to be useful in other industry sectors can be adjusted to suit the needs of ports also.

Due to the high requirements in the logistics sector for productivity, efficiency, safety and sustainability, digital innovations are essential. The degree of digitalization varies between ports as large ports show a higher degree of digitalization than smaller ports. Bigger Central European ports, such as Port of Hamburg, have already incorporated digitalization deep into their operations, but ports, such as the ports in the Baltic Sea region, are still searching for solutions, that enhance their efficiency and productivity, are cost-effective, can reduce emissions, and suit the needs of smaller, often specialized ports. Thus, for example, advanced automated solutions, such as automated terminals, handling technologies and effective single-window systems are still lacking in several ports.

It is important that the ports decide which technologies to introduce and how to implement those technologies. The challenge with deciding on the right technologies lies in the variety of companies and ecosystems within ports. Different stakeholders operate different kinds of equipment and require different types of solutions. In addition, the data of the different operators is not necessarily compatible and the data transparency provides challenges as the port related operators include competing companies.

This paper consist of a current state analysis and predictions for the future of port digitalization in the Baltic Sea Region.

Keywords: digitalization, logistics, maritime, ports

Introduction

Background

Digitalization is revolutionizing technological trends, industry, and the maritime logistics sector that has previously been relatively conservative especially in the Baltic countries (e.g. Heilig et al., 2017; Leviäkangas, 2016; Kayikci 2018 & Fruth, 2017). Digitalization is a necessary tool for the needs of the logistics and transport sector. In logistics, different technologies, solutions and applications can be adopted, including mobile technologies, cloud services, sensors, data analytics, machine learning, big data, block chain and Internet of Things (IoT) (Leviäkangas, 2016; Kayikci 2018; Barreto 2017). Digitalization brings many advantages but also disadvantages to the whole shipping and logistics industry.

Digitalization brings many advantages, such as real time information and databases related to cargo. Even the International Maritime Organization (IMO) supports the implementation of automated electronic data exchange from ship to ship and ship to shore to increase efficiency, safety and security of maritime navigation and communications (Berg 2015). Digitalization and transforming industry around digitalization can also decrease environmental impacts (Berg 2015; Kayikei 2018; Gebler et al. 2014).

Due to the high requirements in the logistics sector for productivity, efficiency, safety and sustainability, digital innovations are essential (Heilig et al. 2017). Heilig et al. (2017) recognize three generations of digital transformation, which are paperless procedures, automated procedures, and smart procedures. Heilig et al. (2017) estimate that paperless procedures' transformation occurred in the 80s, automated procedures were introduced during the 1990's and 2010's and now is the time for smart procedure development. Nevertheless, Heilig et al. (2017) admit that the degree of digitalization varies between ports as large ports show a higher degree of digitalization than smaller ports. Some smaller ports have barely evolved into the paperless procedures phase and are merely at the beginning of the automated procedures era described by Heilig et al. (2017). Automated solutions, such as automated terminals, handling technologies and effective single-window systems are still lacking in several ports.

Digitalization can also bring disadvantages especially during the initial phase of digitalization. As different ports and shipping companies digitalize their operations at a different pace, companies can experience problems related to incompatible systems. If the digital solutions are separate and cannot communicate with each other, they can become an inconvenience instead of being a strength. In addition, the variation of digital solutions and rate of digitalization in ports affects the ports' competitive advantage. Smaller ports with fewer resources for digital development are left behind in the competition. For example in Europe, bigger Central European ports, such as Port of Hamburg, have already incorporated digitalization deep into their operations, but ports in the Baltic Sea region are still searching for solutions, that enhance their efficiency and productivity, are cost-effective, can reduce emissions, and suit the needs of smaller, often specialized ports.

Disadvantages can also come from general attitudes towards digitalization, robotization and automation (Ministry of Transport and Communications, 2013). Labor Unions have relatively strong opinions and they are generally against digitalization, since they are afraid that digitalization decreases the need for employees in the port and within the logistic industry. For example, in Finland there was a case, in which a Finnish stevedoring company brought up a safety issue in port areas. It was noted that there should be some sort of an identification system for personnel who work in the area. Currently, there are smart clothes and tags for these kinds of purposes in the market, but Eurepean Union's general Data Protection Regulation denies personnel following with GPS systems or other similar systems, even though they would be very beneficial, if viewed only from a safety perspective. Thus, the stevedoring company in in the need of a passive recognition system, which would be more suitable in terms of workers, legislation and labor unions.

Within the transport and logistics sector in the Baltic Sea Region, companies are already experimenting with new connectivity and data-enabled technologies, leading to the Internet of Things (IoT). In reality, Baltic Sea ports are lagging behind and trying to catch up. Currently there have been some attempts at development related to e.g. automation technologies, but there attempts remain isolated (Vonck, 2017).

Research and methodology

The aim of this paper is to establish the current state of digitalization and development trends in ports and, based on that, build an estimation on the development prospects of port digitalization in the Baltic Sea region. During the current state analysis, a literature review will be performed, during which the digital solutions that are currently being used and developed in the maritime sector will be discussed. Based on the literature review, predictions are made on the future of port digitalization. The structure of this paper is as follows: chapter 1 will establish the background of this study. Chapter 2 will discuss the current state of port digitalization. Chapter 3 presents the future predictions. Chapter 4 consists of the discussion and conclusion of this study.

Current state of digitalization in ports

Nowadays there is an increasing amount of digital and electrical solutions that are used or could be used also in ports. The whole transport network is changing, and transportation volumes are becoming larger. In addition, there are increasingly more and more players and operators in the transport network, who want to use and process information using breakthrough technologies and concepts (block chain, physical Internet, etc.). New digital solutions for different purposes are being developed every day. In addition, digital solutions that have been used and are found to be useful in other industry sectors, such as aviation and road transportation can be adjusted to suit the needs of ports also. The next step is that the ports need to decide which technologies to introduce and how to implement those technologies. The challenge with deciding on the right technologies lies in the variety of companies and ecosystems within ports (Vonck, 2017; Leviäkangas, 2016; Barreto et al. 2017; Witkoswski, 2017).

Different stakeholders operate different kinds of equipment and require different types of solutions in the different ecosystems. In addition, the data of the different operators is not necessarily compatible and the data transparency provides challenges as the port related operators include competing companies (Vonck, 2017). Digitalization of ports offers many opportunities for ports to improve their efficiency and productivity, security and sustainability (Pernia & de los Santos, 2016; Heilig et al. 2017). The amount of potential digital and electrical solutions is vast and in constant change. Thus, it is not feasible to discuss all of them separately. For the purpose of this study, the different digital solutions have been separated into three main groups based on their use and purpose. These groups include:

- Digital and electrical solutions that improve port efficiency and productivity.
- Digital and electrical solutions that reduce emissions or improve sustainability.
- Digital end electrical solutions that improve port safety and security.

Digitalization in ports causes operational changes also, which requires commitment from different stakeholders in the whole logistics change. According to previous studies, smaller companies do not have similar recourses as bigger companies. It is also clear that, in smaller ports, cargo volumes are relatively small, thus making investments on digitalization and new technology unreasonable. This leads to a situation, in which the logistic chain is only partly digitalized and smaller companies and ports are automatically out of this digitalization process (Kunnaala-Hyrkki et al., 2015).

Generally, everyone within the port sector is interested in digitalization. Some ports have digitalization strategies or plan to do something towards digitalization.

Nevertheless, it seems that some actors do not fully understand or know what their organizations role is, when it comes to digitalization and how they can benefit from it. Digitalization does not mean that information is in an electrical mode or in the internet as a pdf or word document. Ports must understand what they can do, when they can get information from, for example, intelligent sensors, different platforms such as 4G, 5G and 6G, connected mobile devices, stakeholders commercial electronic devices and applications, and connection to infrastructures. Digitalization and IoE in the port sector means that the ports' receive massive volumes of data from different sources and provided by different actors and stakeholders. The ports need to assess whether and how they can benefit from this information flood and can they, for example, open the data to developers who create and improve logistics operations or use the available information as in decision making. Nowadays ports are rather closed systems and attitudes are often against the idea of open data sharing. Ports and the logistic sector require more information about digitalization and the solutions it provides (Leviäkangas, 2016; Srai & Lorenz, 2018; Kane et. al., 2015; Conca et al., 2018; Bechtsis et al., 2018).

As stated above, digital solutions in ports can be divided roughly into three categories: solutions that improve port efficiency and productivity, solutions that reduce emissions or improve sustainability, and solutions that improve port safety and security. Next, different solutions within the categories that are used in present day ports will be established.

Digital and electrical solutions that improve port efficiency and productivity

When digital solutions are developed, the focus is often to increase efficiency and productivity and to decrease costs. Efficiency and productivity can usually be measured in saved time and resources or other benefits. Larger ports with ample resources have also invested in automation and robotization in cranes operations, or in automatized terminals, which reduce personnel costs and result in saved time. Yet, cargo volumes must be relatively large in order for such investment to be profitable (Leviäkangas, 2016; Witkowski, 2017; Kunnaala-Hyrkki et al. 2015). Before investment and digitalization, the required resources must be planned. Digitalization brings visibility and transparency to the logistic chain and to port activities, which means more resources to people, materials and equipment. Implementation of digitalization and IoT need specialization of human resources and new skills from the workers and human resource industry (Barreto et al., 2017; Witkowski, 2017; Qin et al., 2016).

In the perspective of efficiency and productivity, ports are complex operational environments comprised of different stakeholders who need to work together to maximize port efficiency and productivity. Thus, collaborative sharing of data is a prerequisite (Pernia & de los Santos, 2016). In the future, ships can provide ports with more accurate information regarding the cargo, which allows better planning and faster unloading from port operators. Radio-frequency identification (RFID) in containers, or integrated in goods, allow tracking and monitoring goods for better-optimized transport and distribution (Berg 2015; Kayikei 2018). In addition, digitalization can solve problems related to trucks' waiting times and possible bottlenecks in ports. Sensors, barcodes and tracking devices are in use to get real time information on track and trace, and in loading and unloading processes. Just in time (JIT) is a bottleneck in logistics chains and it can be tackled with real time information. In the port areas, one of the largest problems is the waiting time i.e. the time trucks or rail wagons wait for loading or unloading in the port area (Giuliano & O´Brien, 2007). This causes delays and congestions. With real time information and right planning, unloading or loading process can done more smoothly as the trucks or railway wagons do not have to wait in the port area and they can arrive just when they are needed. Warehouses are vital part of logistic chain.

IoT brings new technologies for ships and working machinery in ports. Machinery and equipment in ships and working machines can be fitted with sensors and transmitters that report performance and early signs of malfunction. Consistently repairing or replacing faulty systems during the ship's stay at the home port can save time and money, since the cost of flying technicians and parts to a ship's location in transit is substantial. In addition, real-time updates on weather systems, wind and ocean currents enables captains to readjust navigation for lower energy consumption.

Today smart warehouses produces competitive advantage to customers and logistic provider. Warehouse integration needs commitment from actors and stakeholders, which leads to integration with transport system. Transportation and warehouses must be connected and communicate in order to achieve optimizations in JIT and to increase efficiency and productivity (Barretto et al. 2017; Witkowski, 2017; Conca et al. 2018).

Port Community Systems (PCS), which are connected ICT and ITS systems, increase the efficiency of port and decrease environmental impacts (Carlan et al. 2016; Brunila et al. 2011). In the Baltic Sea region, there are only few PCS systems in the ports. The largest ports have their own systems. In Finland, there are no bilateral PCS, because transport volumes in the ports are not big enough to cut the costs. On the other hand, some companies have built their own networks amongst the port, port operators and transport companies. Other companies have their own systems. In the end, many different systems could be combined as a one PCS. Competition between companies and earlier investments lead to a situation, in which in the near future, smaller ports do not have the possibility to have or connect to PCS (Brunila et al. 2011; Carlan et al. 2016; Cepolina & Ghiara, 2013).

Digital and electrical solutions that reduce emissions or improve sustainability

One key element in the competition of ports now and in the future will be their environmental statuses and their capability to respond to the challenges of sustainable development (Brunila & Anttila 2013).

Ports' environmental best practices can include digital and electrical solutions, such as dimming lights (Kunnaala-Hyrkki et al. 2015). One efficient way to reduce the environmental effects of ships during port visits is electric power supply from shore to ship as the electrical connection eliminates the need to run the auxiliary engines (Brunila et al. 2015).

It should be noted that, even though a division between the three different categories of digital solutions can be done, the solutions often produce all three kinds of benefits, efficiency, sustainability and safety. The other benefits gained can often be indirect or unintended, but they are nevertheless desirable. According to a questionnaire study performed by Kunnaala-Hyrkki et al. (2015), ports considered enhanced cost-effectiveness and increased efficiency with new technologies to be the third and fourth most important positive effects that port's voluntary environmental actions can have.

ICT, ITS and PCS can bring forth also environmental benefits. With the systems, emissions can be reduced through the intensification of logistics activities, and the decrease of paper documents and use of printing paper due to the use of electronic documents provided by a PCS. A PCS can also affect indirectly to the environmental aspects of logistics through, for example, optimisation of transport routes and load capacity, tracking of cargo and central servers. Despite the potential environmental benefits, economical profits and service content are usually considered the more important factors, when ICT systems are designed and deployed. However, green values should be taken very carefully into account in the planning and implementation of PCSs since they can bring a major competitive advantage to related actors and promote environmental protection in a broader perspective as well (Brunila et al. 2011).

Digital end electrical solutions that improve port safety and security

The most effective incentive for ports to introduce solutions related to sustainability, safety and security is legislation. For example, requirements for emission measurement and control can spark digital innovations as ports strive to comply with regulations. Both EU and national legislation regulate the port operations and set different kinds of economic incentives or disincentives to the operation. Regulatory instruments include for example jurisdiction and law based decrees, restrictions and licenses (Kuronen & Tapaninen 2010). Regulatory instruments are effective and easy to enforce, but their implementation and enactment can be expensive and difficult (Vieira et al. 2007). In addition, regulatory instruments do not always promote innovations but rather create resistance (Klemmensen et al. 2007; Vieira et al. 2007). Yet, digital innovations can give the port advantages, since innovations can take the ports' environmental performance farther than regulations require. Thus, the ports have vantage, when new, stricter environmental and safety regulations come to force (Kunnaala et al. 2013).

When it comes to the safety of the personnel working in the port areas, couple of safety risks can be solved or at least minimized with digital solutions. One security problem is related to disinfection of containers. Disinfection is a simple and effective way of removing pests from containers and preventing them from causing damage to the cargo. Unfortunately, the use of disinfectant gases at the same time insidiously endangers the safety and health of workers handling containers. Exposure to disinfectant gas is always a serious matter, as these gases are dangerous to any living being - whether it is a chemical or a chemical already banned in the European Union. Against that exposure, workers can train for safety issues but there are also novel equipment that can detect the gases before the personnel handles the containers.

Another risk factor in the port areas is related to personnel movement within the port area. There are always risks for the employees, if they have to travel within the port, especially on foot. This is due to the fact that there are several large working machines operating within the port area almost continuously. Thus, novel tracking equipment and smart clothes have been developed in order to improve the safety of workers.

It should be noted that digitalization also gives rise to new security threats. Especially threats related to cyber security need to be taken into consideration, when ports carry out their information exchange. In addition, information related to cargo movement and cargo types can sometimes be sensitive and thus, has to be handled with care. Open data, shared systems, interconnected networks and information interfaces make port operations more effective and productive, but also make the ports more vulnerable to cyber attacks. Cyberattacks are usually targeted at port operators inside the port area, since they tend to have fewer security controls than the port itself (Shackleford 2015; Barreto et al. 2017).

For ports, cyber security threats include, for example, an action to delete operational data containing time schedules and information for container shipments. In addition, a cyberattack may gain access to commandeer a ship, close a port or its terminal, access delicate information and change manifests or container numbers. Even the smallest cyberattacks can lead to significant losses (Caponi & Belmont 2014; Jensen 2015). Potential vulnerabilities of ports include, limited training and readiness for cyber security, software errors and connection and interdependence of networks (Homeland Security 2016).

The future of port digitalization

Digital transformation in ports can be divided roughly into three generations: paperless procedures, automated procedures, and smart procedures (Heilig et al. 2017). Yet, it should be noted that the degree of digitalization varies between ports as large ports show a higher degree of digitalization than smaller ports. This is particularly evident in the smaller ports of the Baltic Sea Region. The ports have barely evolved into the paperless procedures phase and are merely at the beginning of the automated procedures era described by Heilig et al. (2017).

The basis for paperless procedures was in the development of ports. Due to ports evolving from simple loading and discharging points to intermodal logistics service hubs, there was a growing need to ensure efficient information flows. The main focus was in EDI Electronic Data Interchange (Heilig et al. 2017). According to Heilig et al. (2017), the second era of digital transformation in ports was related to automated procedures. The new innovations included, for example, automated container terminals, automated handling technologies and automated identification systems. In addition, information exchange became more effective and complex through, for example, single-window systems.

Many smaller ports in the Baltic Sea Region have succeeded in implementing effective information exchange and paperless procedures, but automated solutions, such as automated terminals, handling technologies and effective single-window systems are still lacking in several ports. Some partly automated systems and identification systems have been adopted but the full revolution of the terminal equipment and IT infrastructure has not yet fully occurred.

Digital solutions for efficiency

As shipping companies and supply chains become more digitized, ports must follow the trend. Digitalization has to reach the whole supply chain and all its actors so that the full benefits of digitalization actualize. In addition, there is a possibility that shipping companies begin deciding their ports based on the port's level of digitalization. Whether the port's digital systems are compatible with the shipping company's systems or not, can also become an issue.

Real time information on cargo movements and activities of the port operators can be considered one of the most beneficial digital solutions that improve port efficiency. In order to achieve maximum benefit from information, almost all port data should be open and available. In addition, all the systems of different port related operators should be available and compatible. Common sharing of data and information, and creation of common service platform is preferable. It should be noted that open data sharing solutions can also face resistance. Ports and logistics companies can sometimes have a problem with sharing data and information, because they do not want to share information with their competitors, who might benefit from the data.

It can be estimated that the next steps in Baltic Sea ports' development are related to automation, equipment integration and more efficient data flow. What is hindering this development is lack of resources. This is typical for smaller ports, since equipment development and updating requires a lot of resources at once. Another challenge for the next development stage is lack of information sharing and cooperation. Port related operators do not necessarily identify the advantages of open data and information exchange and sometimes information is withheld on purpose. In addition, the incompatibility of data sources and systems can become a problem.

The third generation of port's digital development, which is smart procedures, is still in the far future for many Baltic Sea ports. Some common smart applications and procedures, especially for information exchange purposes have been adopted, but groundbreaking innovations are still lacking. It is likely that especially the larger ports in the Baltic Sea Region that have not yet entered the smart procedures era will adopt the basic digital solutions related to efficiency, productivity and information exchange in the near future. This also applies to ports operating as important transportation nodes. Fluent exchange of data is especially important when it comes to multimodal transportation in ports, where there is a risk for delays and congestions. Nevertheless, these digitized ports in the Baltic Sea region have to maintain their ability to operate without digital tools and communication devices, because for several years still there will be operators and companies with aversion to digitalization that refuse to evolve beyond paperless procedures.

When it comes to smaller ports, the situation might vary from port to port. Sometimes ports, especially smaller ports, can be specialized or serve only few customers. Specialized ports are less likely to invest in digital solutions due to lack of resources and lack of incentives, unless their customers require such solutions. It can be estimated that smaller ports will not adopt digital solutions beyond requirements in the near future.

Digital solutions for sustainability, safety and security

The most effective incentive for ports to introduce solutions related to sustainability, safety and security is legislation. Unfortunately, regulatory instruments do not always promote innovations but rather create resistance (Klemmensen et al. 2007; Vieira et al. 2007). Yet, digital innovations can give the port advantages, since innovations can take the ports environmental performance farther than regulations require. Thus, the ports have vantage, when new, stricter environmental and safety regulations come to force (Kunnaala et al. 2013).

One key element in the competition between the Baltic Sea ports now and in the future will be their environmental status (Brunila & Anttila 2013). Not only actors in the supply chain, such as shipping companies, but also the society is expecting that the ports take responsibility of environmental protection and safety (Van Breemen et al. 2008). Therefore, adopting digital solutions related to sustainability and safety can become a significant competitive advantage even for smaller ports. It should be noted that digitalization also gives rise to new security threats. Especially threats related to cyber security need to be taken into consideration, when ports carry out their information exchange.

Thus, it can be assessed that ports in the Baltic Sea Region will adopt new digital solutions for sustainability, safety and security. Mostly because they have to in order to follow regulations, but also partly in order to improve their operations. In addition, all ports have to prepare for cyber security issues hand in hand with their digital development. It is likely that larger ports with more digital solutions, more safety and security risks and more attractiveness to cyber attackers will adopt more safety and security solutions that smaller ports.

Discussion and Conclusion

In this study, the aim was to perform a literature analysis on the current state of digitalization and development trends in ports and, based on the literature analysis, build an estimation on the development prospects of port digitalization in the Baltic Sea region.

Digitalization of ports offers many opportunities for ports to improve their efficiency and productivity, reduce emissions and improve sustainability, and improve safety and security. As the study showed, ports are a part of the digitalization trend, but they required more information about what are ports' role, when it comes to digitalization and how they can benefit from digitalization. Digitalization brings many advantage but also disadvantages to the port environment.

Digitalization can also solve several problems that ports face nowadays. One of the biggest bottlenecks in port operations is waiting time in the port area for loading and unloading on goods. In order to tackle the problem, several techniques have been adopted, such as, sensors, RFID, GPS, ICT, IoT, PCS, 4G, 5G, 6G, automation, robotics, block chain etc. Thus, it can be said that there are several technologies already ready for different purposes and for digitalization of ports.

Bigger ports within the Baltic Sea region that have more resources have already adopted some of these techniques for their daily operation but some ports are still looking for techniques that would suits their purposes. As shipping companies and supply chains become more digitized, ports must follow the trend. Digitalization has to reach the whole supply chain and all its actors so that the full benefits of digitalization actualize. Digital innovations can give the ports competitive advantages, but also other advantages, especially when it comes to environmental innovations. Since innovations can take the ports' environmental performance farther than regulations require, the ports have vantage, when new, stricter environmental and safety regulations come to force.

One key element in the competition between the Baltic Sea ports now and in the future will be their environmental status. Not only actors in the supply chain, such as shipping companies, but also the society is expecting that the ports take responsibility of environmental protection and safety. Therefore, adopting digital solutions related to sustainability and safety can become a significant competitive advantage even for smaller ports. It should be noted that digitalization also gives rise to new security threats. Especially threats related to cyber security need to be taken into consideration, when ports carry out their information exchange.

It will take a long time, until ports in the Baltic Sea region are fully automatized. For example in South-East Asia, some ports are already automatized, but these ports are often larger with more resources. Within the Baltic Sea region, ports are still relatively conservative and thus it will take time. Nevertheless, the first steps towards automation and smart processes have already been taken.

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Chapitre 14

Big data improved forecasting? Transport cost and vessel speed in seca region

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Abstract

Fuel costs are approximately from 40% to 60% of vessels's operating costs. Since 2015 ships operating in SECA-regions were required to change their fuel quality from heavy fuel oil (HFO) to low sulphur marine diesel oil (MDO). This paper examines and simulates with alternative bunker prices and various vessel speeds how different combinations have an impact on transportation costs and profit margins of an international export company. Vessel speed has a great impact on daily operating costs through fuel consumption. The research data was acquired from Big Data storage of a large export company operating in process industry. The latest bunker price data was applied in the study. In addition, slow steaming has not become widely used fuel consumption reduction method in the Baltic Sea area transports.

Keywords: Simulation, Slow steaming, Logistics, Transportation, Costs

Introduction

Maritime logistics is an important topic for all those countries, which are heavily dependent on short sea shipping (SSS) routes. Countries like Sweden, Finland and Great Britain are transporting most of their export through SSS routes (also Arlbjørn et al. 2008; Arvis et al. 2013). Hämäläinen published a paper in 2014, which focused on forecasting how estimated increase of bunker price and slow steaming could be balanced from the shipper's perspective (also Karampampa 2014). At that time crude oil price was exceptionally high. Naturally, also bunker prices were high. It was expected that price of bunker would increase up to 150% from 2015 onwards. One reason was a so called SECA-decision, which forced shipping companies to change bunker from heavy fuel oil (HFO) to marine diesel oil (MDO). This change was expected to have serious impacts on the maritime transportation especially short sea shipping (e.g. Utriainen 2013). These concerned mainly the economic feasibility and market development of the industry. Impacts on nature (and people) were estimated to be clearly positive because of the lower sulphur emission volumes into the air. Later it has been revealed that using low sulphur bunker does not mean that for example black carbon levels would be analogically getting lower in burning (e.g. Notteboom 2011; Wuisan et al. 2012; Aakko-Saksa et al. 2017). Emission impacts and environmental management requires multiple angles and perspectives obtainable through interdisciplinary research (also Psaraftis & Kontovas 2009; 2010).

The purpose of this study is to produce simulations focusing on how slow steaming, together with four different bunker price scenarios, have an impact on logistic operations. The data concerns paper industry and is collected from a single mill (also e.g. Arbia 2001; Hämäläinen 2011b; Psaraftis 2012; Yao et al. 2012). The authors have simulated that how slow steaming together with increasing bunker price variables would impact the gross margin of the mill. Harilaos et al. (2013) observed that the speed of a vessel has been an important factor for economic viability as it is the key-determinant of fuel costs that is a significant component of the overall daily operating costs. Moreover, speed is an important parameter of the overall logistical operation of a shipping company. Speed in overall supply chain may also directly (or indirectly) impact fleet size requirements, ship size selections, cargo inventories and balance sheets (Æsøy et al. 2011; Schinas & Stefanakos 2012). From the viewpoint of a large exporting mill, this study increases understanding of how the economically challenging impacts of emission reductions could (at least partly) be eliminated. This takes place by using slow steaming as a way to manage supply chain from the mill to different customers in European locations.

Dennis and Berry (2000) highlight the fact that in order to achieve significant improvements in environmental conditions, all participants of the multimodal transportation network must identify potential environmental impacts caused by their activities, monitor their environmental performance, and control or prevent environmental damage through proactive environmental practices (Kontovas & Psaraftis 2011). Companies operating from Nordic countries that locate, in terms of absolute and relative distance, far from the European main markets have to adapt to extra costs. This adaption quite often increases freight prices. However, impacts can be softened by operating vessels differently. For example in Finland, the logistic costs from turnover are on average 14%, covering also transportations abroad (Solakivi et al., 2012).

Logistics is understood as a process in which wrapped paper products are transported from a case mill warehouse to customers in four countries in Europe by 1) truck or train – 2) SSS – 3) truck or train, i.e. by multimodal means (also Koskinen 2009; Koskinen & Hilmola 2008). Transportation costs are estimated by using four different bunker price parameters, and analyzed impacts of slow steaming on sea freights and gross margins in four largest European markets in order to expose interesting variations between these market areas.

The structure of the paper is as follows. First, section 2 presents background information regarding slow steaming and bunker consumption. In section 3, we present the estimated cost consequences that the marine sulphur directive has on logistics dependent export industry. The case mill (as a data source), the origin of the data, data mining, and research methods are described in section 4. The detailed results, which are based on empirical data analysis, are presented in section 5. Discussion and conclusions are summed up in section 6. Finally in section 7, the authors introduce future research needs concerning the paper industries in Nordic countries.

Vessel speed and bunker efficiency

Harilaos et al. (2013) address that there are many indications that slow steaming will be the norm in the future. Cost and emission reductions can be achieved by varying speed as a function of sea conditions and freight market. Slower speed in combination with accurate weather data enables voyage routings to be defined so that they give significant cost and emission reductions (Lindstad et al., 2013). Still, slow steaming is being practiced today, and it can be confirmed by the fact that the fleet overcapacity that has existed has been virtually absorbed. Clarksons (2013) notes that, when slow steaming is in play, the surplus is much reduced. In the end of 2013, the surplus of 3.0m TEU drops to a current surplus of 0.7m TEU when allowances are made for 1.9m TEU now absorbed by slow steaming and the 0.4m TEU still idle. If this trend continues, slow steaming is expected to continue as a widely applied practice, and logistical networks will be impacted as a result of this (e.g. Miller-Hooks et al. 2012). Armstrong (2013) indicates that slow steaming is seen as a remedy for low-carbon and low-emission shipping in the world of expensive fuel, sharing the benefits of slow steaming among stakeholders. When ship speed is reduced, fuel consumption and emissions are reduced too, in some cases drastically (also Hulskotte & Denier van der Gon 2010).

Reducing vessel speed may have significant positive side-effects: cost reduction is the most important, another is the aid for a depressed market in which shipping overcapacity is the contemporary norm. Ships with slower speeds may be considered to be analogous to sailing stocks with rolling stock in cargo trains. It was estimated in several future bunker indexes that the bunker used in the SECA region (see Croceanx.com 2014) in 2015 may cost upwards from 900 USD per metric ton, so using speed reduction as a saving method will be seriously considered. However, it is noteworthy to remember that the current bunker price per metric ton for Marine Diesel Oil (MDO) is on the level of 600–640 USD per metric ton.

Slower ship speed has verified positive effects for the operating economies of shipping companies. In addition, shipper's decisions, prospects, and future considerations require further elaboration. Kloch (2013) considers that longer transit times can actually increase shipping costs, because there is a need for larger inventories in order to feed the longer supply chain. Longer ocean transit times may also have an impact on cash flow, as the time from production to end sale is extended. For some companies this is not a significant issue, but it may cause problems for those companies that rely on an expedited cash flow process

(Ballou 2001). Additionally, Koch (2013) reminds that slow steaming vessels are more likely to arrive at port on schedule (e.g. Brouer et al. 2013). Chen and Miller-Hooks (2012) indicate that if ships sail at slower speeds, preparedness becomes an important factor, when planning supply chains and intermediate warehouses in more detail. After 2015 in the SECA regions, slow steaming was expected to become a serious alternative, but however low oil price did not make it obligatory to utilize slow speed with full effect. Ship owners have to take serious considerations in the daily economics of their businesses, and slow shipping offers undeniable potentials to daily operating costs. On the other hand, shippers are also interested in effective customer service, efficient delivery times and the seamless functionality of the supply chain (e.g. barometers, see Alhosalo 2013). For example, travelling time from the port of Kotka (Finland) to Rotterdam (the Netherlands) can increase from 5 days up to 8 days, adding mainly other costs, not exceedingly fuel costs. Impacts of slow steaming are needed to be assessed together with changing bunker prices. Thus, varying cost parameters are needed. Wiesmann (2010) estimated that the overall savings in shipping costs due to slow steaming could be in the range of 10%–25%. The saving ratio depends on the proportion of slow steaming vessels in a fleet and on the achieved speed reduction (Bruckner-Menchelli 2009; Notteboom et al., 2010; also Song & Dong 2012; Steadie Seifi et al. 2014; Wang & Meng 2012a; 2012b).

There are opinions that large cargo volumes could be transported through the Arctic ports (e.g. Murmansk). However, as an example, container handling in the port of Murmansk is not realistic in the foreseeable future (e.g. Osin, 2011). The usage of the Northern Sea Route is very low, totalling up to approximately 70 ships a year. MDO price levels in 2015 were under serious discussion especially in the Nordic countries because of the SECA decision. Several forecasting calculations were presented in order to anticipate the most probable MDO price-level in 2015 (Swedish Forest Industries Federation, 2009; EMSA, 2010; Traffi 2013). All these studies expected the development of oil price all too high (see e.g. AECOM, 2011a; 2011b; Hilmola, 2011; 2013).

Notteboom et al. (2010) estimated in their study that the price of MDO would increase from 25% up to 200% in 2015 in comparison to the existing bunker prices. Analogically European Maritime Safety Agency (EMSA, 2010) has stated in their forecasting study that the MDO will be approximately 60%–70% more expensive in 2015 than the oil with sulhur content. The impacts of oil prices can be completely different depending on industry and market. The most significant effects are likely to be found in heavy bulk industries such as paper manufacturing. Furthermore, it is a challenge to estimate the supply-demand balance of the different fuel distillates in the European markets. Industry and logistics researchers from Great Britain addressed their concerns (House of Commons, 2012) in their critical report stating that economic impacts of soaring bunker prices (based on sustainability regulations) for marine logistics may bring heavy extra costs for involved industries (also Wang et al. 2013). This is significant, because approximately 80%–90% of the Nordic industry production is transported to Europe through SSS routes, all which go through the SECA region (for regulation, see EP 2005; 2012; EC 2011; 2013; 2014; IMO 2009; 2013).

Reflecting simulation approach

In this study, the impacts of the variation of bunker prices as well as slow steaming will be analyzed with the case data, which was obtained from one large paper mill located in Finland (also Hämäläinen & Inkinen 2017; Hämäläinen et al. 2017). The business environment of logistics and sea transportation is changing rapidly, and it affects to whole Nordic bulk manufacturing. We assumed that cargo vessels may operate within three speed regimes; optimal speed, 25% lower, and 50% lower speed. Optimal speed means that it is optimized (e.g. with fuel consumption vs. total costs) before slow steaming is used. The assumption is to exhibit varying responses in terms of costs and emissions resulting from reductions in operating speed. In terms of utility, RoRo-vessels are used for the transportation of cars, trucks, heavy machines, forest products and project cargo, and they typically have dead-weights between 15 000 and 40 000 tons with service speeds around 20 knots. Fuel consumption is considered as a key-driver because it is directly affecting operating costs.

There are estimations that the additional costs will increase approximately 10% per transported ton, when ships are sailing at a slower speed. This is due to the increase of transit times even in SSS in the Baltic and North Sea routes. Slower transit times also cause an increase in capital costs due to the longer supply chain time in deliveries and due to extra storage days (also White 2010). The estimated figure 10% also covers other ship costs, because e.g. personnel and maintenance costs will increase (see Maloni et al., 2013; Hilmola & Lorentz 2012). These costs slightly eliminate the positive impacts that slow steaming brings as fuel savings (see e.g. Gallagher, 2010). Other cost increases caused by slow steaming are difficult to estimate in the current fluctuating bunker price market condition.

Slower steaming, when speed is lowered down to 50%, will increase delivery times and this creates distance gains to those paper mills that are located closer to the buyer (in European context Central and Western European markets). This entails also a potential loss scenario (in sales) for peripherally located suppliers. Paper deliveries and prices are usually agreed for a longer period of time (years) and slow steaming does not really affect paper prices during supply chain transportation. This is an additional question for future studies: “How slow steaming would impact the sales in the studied markets?”.

Schinas and Stefanakos (2012) remind to avoid making plans in the marine sector based on static assumptions or on historical data (for case studies, see McCutcheon and Meredith 1993; Lewis 1998; Flyvbjerg 2006; Yin 2009). In this study, the authors have utilized the historical data of one case mill to a certain extent. The figures were modified with forecasting tools and methods to estimate price values, variable and fixed costs, and gross margins. The actual and forecasted data was copied into Excel spreadsheets for analysis. In this analysis, the focus was to expose how transportation costs and sea freights impact gross margins. All economic figures were reported in ratio for research purposes only. The conducted simulation analysis indicates how various variables will impact transport costs and margins (also Hämäläinen, 2011a; 2011b; 2011c; Hämäläinen & Inkinen, 2017).

Simulation results

In the following are the presented results on how the recent environmental decisions will impact the Nordic export industry and how slow steaming could soften and reduce the impacts of bunker price (Lindstad et al. 2011). The study concerns one representative export industrial unit (mill) and therefore generalizations of results should be considered with caution. Figure 1 addresses transport costs in ń per tons. There can be up to 40% difference in transport costs between countries and creating a challenging situation for a supplier (in terms of pursuing cost reductions for those more expensive markets). Our case concerns the paper industry and within it particularly magazine and office paper consumption (demand) is diminishing in the European markets. The decline in demand causes pressures to increase sale prices, which are not very flexible due to the global market pressure. The cost reductions (e.g. in logistics as is the case here) are therefore essential for the case industry. Figure 1 indicates that there are clear variations in transport costs per ton between different market areas. Country 1 is physically located the closest to the case mill, whereas Country 4 is the most distant. Distance is measured from export port to destination port by sea route in kilometers. There are clear variations between the countries, based on the fact that sea transport routes are different in length, and the share of sea freight out of the total transport costs varies from market to market. Figure 1 address that even if bunker price would increase by 50% from existing price shipping companies have a choice to lower its cost impact with slow steaming.

Figure 1. **Estimated changes in transport costs (€/T) with different bunker costs estimations: -25%, optimal speed, 25%, or 50% lower bunker consumption**

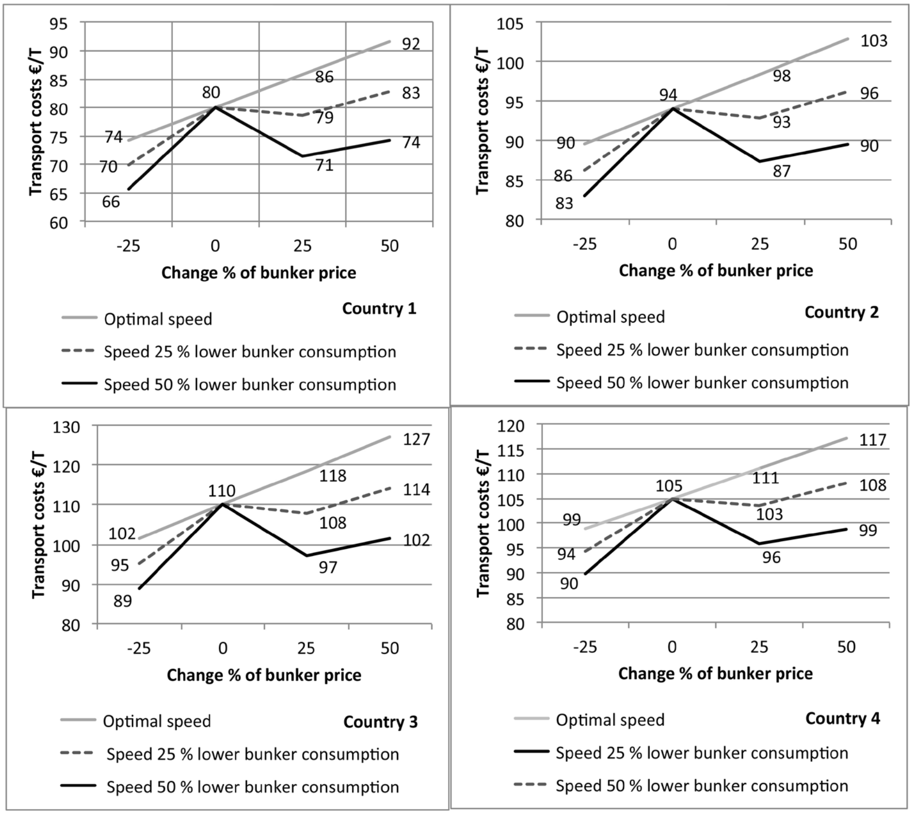

Figure 1 may be interpreted that expensive bunker is not as fatal as it could be from the business point on view. The use of larger ships that are slow steaming will aid shipping profitability. Transport costs are just one cost component, which companies have cover when they are running and making products to different markets. As earlier mentioned in Nordic paper industry transport costs are round 15%–20% of turnover, which is heavy burden. In order to tackle this, Figure 2 presents combinations of slow steaming and different bunker price scenarios that would impact gross margins in different European markets. The mitigation gross margin losses caused by increasing bunker prices requires slow steaming, particularly if other means have been exhausted.

Figure 2 presents how the total transport costs would increase when calculated by using different bunker increase scenarios. Transportation costs from Finland to Central Europe include sea freights, which are circa ¾ of the total transportation costs per ton (Hämäläinen, 2014). Total transport costs vary substantially from country to country.

Figure 2. **Estimated changes in transport costs (€/T) with different bunker costs estimations: -25%, optimal speed, 25%, or 50% lower bunker consumption**

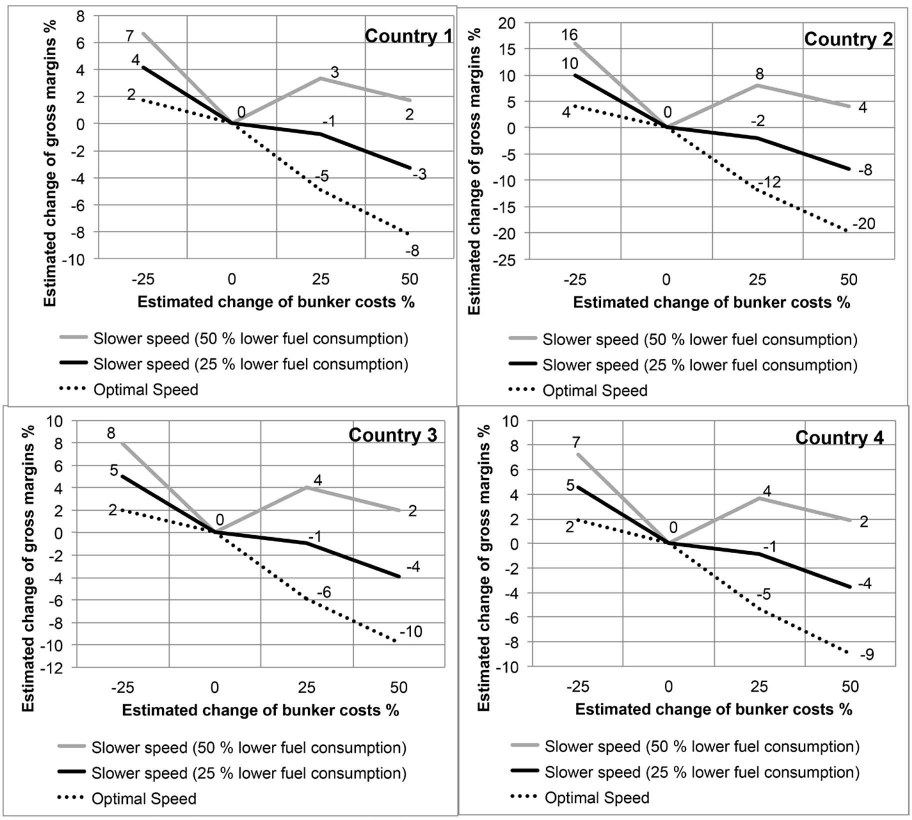

Figure 2 also provides understanding, when it is reasonable to use slow steaming in the cases of extensive bunker price variations. The changes are noticeable in freight prices. It also informs that if bunker prices are increased by 50%, and slow steaming aids diminishing those cost increases (thus improved gross margins), the required mitigation percentage may be very low (e.g. 1% –3%) in order to achieve positive results in millions of Euros in the case of large paper industry unit (also Hämäläinen, 2011; Forestindustry, 2013).

Modern corporate risk management requires scenarios and preparations for unexpected events. In export industries, such as paper industry, global oil price changes are a textbook example of a factor that is continuously monitored and, when needed, quickly responded. In the case of maritime transports the response means concern mainly the selection of vessel size, vessel properties, running speed, and the use cost-optimized route planning. These considerations are done simultaneously according to shipments. In this case study, there is an extensive variation in transportation costs between the four markets (countries in Figures 1 and 2) due to different modes and modality. Considering the end-price variation for customers, the variations are evidently more extensive.

Concluding remarks

In terms of the fuel options in shipping, there are discussions to replace MDO with liquid natural gas (LNG), which is used in a number of lately (after 2010) manufactured ships in the Baltic Sea. However, it will take decades before diesel ships are fully replaced with cleaner LNG ships. Shipping industry and cargo vessel owners are fully aware of global bunker prices, because in daily operations bunker cost is currently one key-element in the search of profitability (also Acciaro et al. 2013; Acciaro 2014). The realized price difference between the main bunker qualities (HFO/MDO) is expected to be extensive in ship operations also in the future. Even MDO shortage was anticipated in forecasting scenarios as there are numerous studies that expect cost management problems for shipping companies and export industries using maritime transport. Exporting manufacturing industries behind SSS-routes are now heavily working in order to adapt into continuously changing business environment in order to serve customers both ecologically and cost-efficiently.

At the beginning of 2018 oil price has slowly started to increase. A reflective lesson to be learned from this study is to recognize that all forecasting calculations that are using hypothetical figures may produce misleading information if business fundamentals (such as oil prices in logistics) change unexpectedly. For example, anticipatory calculations made before year 2015 regarding the impacts of SECA decision were not reliable due to rapid decline of oil prices globally. These calculations may have impacted for example scrubber investments. The conducted analysis addressed that there are variations between export markets due to different types of transport chains. The authors note that whole SSS industry, as well as logistics and supply chains, should work together if sudden changes occur in logistics business environment. Extrapolation results of this research should limit for transportation of large volumes bulky products through SSS routes. Usually every cargo group and sea length needs specific research on how slow steaming has an effect on freight prices. Impacts of slow steaming in SSS routes are clear and they vary according to different markets.

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Chapitre 15

Shipping opposes protectionism and trade wars

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Biography

In 1993 **Gintautas Kutka** *graduated from Vilnius Gediminas Technical University with the study program in Construction Economics and Management. In 1993-2001 he used to work as a ship agent, freight forwarder, later as a commercial director of the JSC "Klaipeda Shipping Agency". Later in 2001-2002 he had acted as executive director for Lithuanian Stevedoring Companies Association. From 2002 till now he is working as an executive director of Lithuanian Shippowners Association. He used to be a commercial director in JSC, Navalis maritime agency" for the period 2007-2008. In 2002 Gintautas Kutka joined to the Lithuanian Maritime Academy as a lecturer with teaching subjects: Ship`s Agency, Forwarding, Shipping and Containerization, International Trading. We was a member of the Lithuanian Maritime Acedamy council for two cadencies in 2009-2012 and 2012-2017, and member of Seafarers school council for period 2018-2019. Recently he was elected as a chairman of Lithuanian Sea museum council.*

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Abstract

The article discusses the main challenges for nowadays shipping companies: shipping connectivity vs. Cul de Sac; its importance for small scale economies and the future improvements. Situation in shipping market is briefly described according to the following indicators: year 2017 was generally a difficult year for shipping, though several segments noted signs of improvement; no many indicators that market fundamentals will improve significantly within the next year or two; shipbuilders' slim orderbooks; statutory requirements; outcomes of IMO Marine Environment Protection Committee (MEPC) 72nd session.

Keywords: Shipping, Liner shipping connectivity index, world trade

Introduction

The US Government has shaken the foundations of world global trade, injecting sharp tariffs on billions of dollars' worth of goods from the EU, Canada, China and Mexico.

At the beginning of March, 2018 the US Government introduced a 25 per cent tariff on steel imports and a 10 per cent levy on aluminium imports (hereinafter also referred to as the Metal Tariff). China has announced it will put a 25 per cent tariff on liquefied natural gas (LNG) imports from the US as well as increase levies on copper, agriculture, power and renewables as part of a wider plan to introduce $60m worth of measures to counterbalance the US's recently imposed trade tariffs. In September the White House announced plans to increase the measures by raising taxes from 10 per cent to 25 per cent, a move that could impact around $200m worth of Chinese imports. Even though the Metal Tariff is based on an exemption under the laws of the United States, it is directly linked to the law of the World Trade Organization (hereinafter – WTO). The Metal Tariff may be a stepping stone into further disruptions of international trade as even though the Tariff is based on the sole reason to ensure the national security of the States it is increasingly proving to be not only a challenge to the local metal industry, but also to the global community economically and legally.

The aim of the research is to determine the legal and economic implications of the international trade tensions to the maritime shipping sector in terms of the role of the shipping sector in international trade.

The tasks of the research are the following:

1. To describe the current economic state in the shipping market under relevant indicators.
2. To determine the main legal and economic implications of the Metal Tariff in terms of international trade law.
3. To determine the challenges in the maritime shipping sector under current trade conditions and requirements.

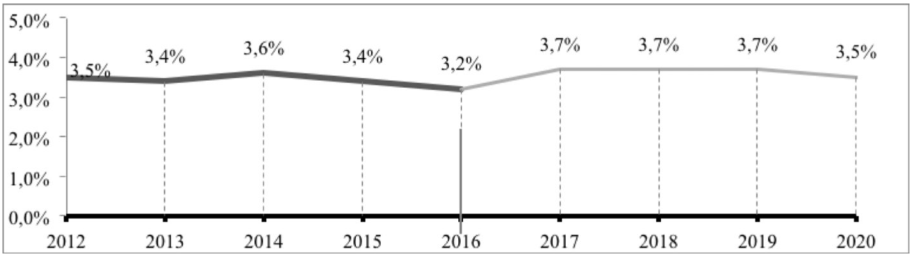
The following theoretical and empirical scientific research methods are applied. The document analysis method is employed to collect primary data, to analyse the provisions of relevant agreements, reports and relevant positions of authoritative researchers. The method of systemic analysis and classification is employed to divide the object of the research, its purpose and tasks into components, as well as to assess the internal structure of relevant documents, their interaction with each other in order to identify the complexity of the topic and the its most significant aspects. The logical analysis method is used to identify, associate and generalize the material of the research, to evaluate the relevant aspects of legal documents and economic data, its interpretation possibilities and the reasonableness and consistency of the research problem.

The article outlines the main challenges in the shipping sector in the context of international trade tensions. The article's main idea is that international trade and the shipping sector should not be analysed in isolation since both of the areas share a certain level of interconnectivity. In this sense, the expanding protectionist trends that inhibit international trade are opposed by the shipping industry.

Global economic outlook

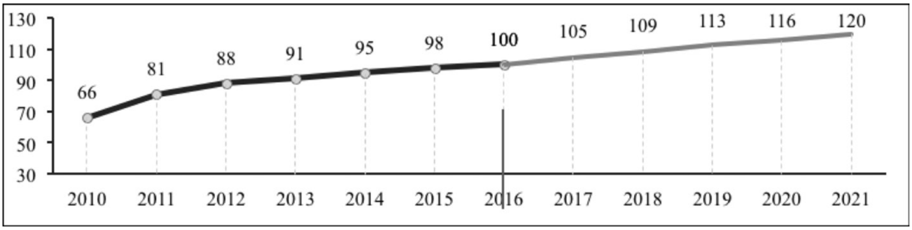
The global economy strengthened in 2017 driven by the US, China, the Euro-zone and Japan. 2018 is expected to proceed along similar lines with more growth in the Euro-zone and China managing its economic slowdown carefully. Global GDP is forecast to hold at its 2017 level of 3.7% during 2018-19 (Fig.). A shallow dip at 3.5% is expected in 2020 before recovering to 3.8% in 2021-22. In the developed world, US GDP is expected to grow by 2.5% in 2018. A mild recession is forecasted early 2020 followed by a brisk recovery in 2021-22. The Euro-zone economic recovery gathered momentum in 2017 with 2.5% GDP growth and 2018-19 is expected at a similar level. Japan GDP growth for 2018-19 is forecasted at 1.5%. In emerging markets, conditions are expected to become more challenging as US interest rates rises. India will be Asia's fastest-growing large economy in 2018-22, expanding 7.9% average per annum. China is on track to meet its target to double real GDP between 2010 and 2020. China is expected to slow down slightly in 2018, to 6.4%, from 6.9% in 2017. It is expected to move away from GDP targeting in the next decade and growth will slow down gradually to 5.2% in 2022. Latin America ongoing economic recovery is forecasted to gather momentum in 2018-19. However, trade tensions could escalate, denting global activity. This improved economic outlook is shadowed by political stability risks, threatened Free-Trade agreements, Middle East region stability and US-North Korea tensions [17].

Figure 1. **World GDP Annual Growth, % [18]**



Driven by improving global economic conditions, global trade growth accelerated to 4.6% in 2017 driven by strong export growth of 4.8% in emerging markets compared with 3.8% export growth in advanced economies (Fig. 2). Global trade growth is expected to slow modestly to 4.3% in 2018 in line with a deceleration in China's economy, given its outsized role in global supply chains. On the assumption that the US will make only modest adjustments to trade policy, global trade growth is expected to continue to average 3.6% per annum in 2019-22.

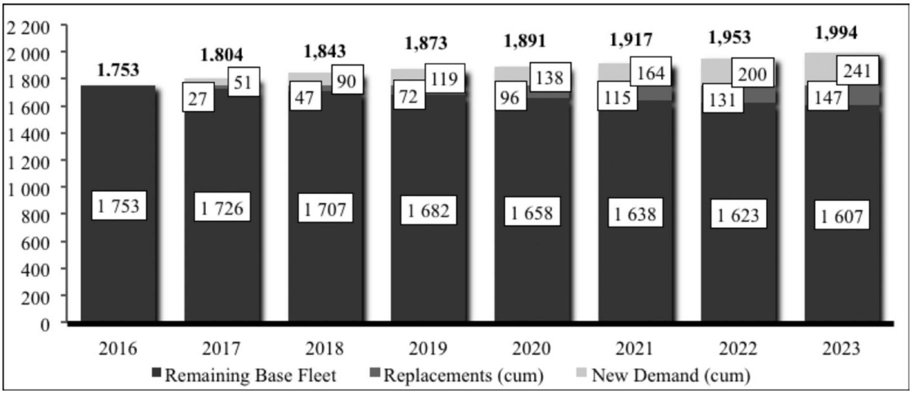
Figure 2. **World Trade Growth (Growth Index Relative to 2016=100) [19]**



Global Economic and trade fundamentals rebounded in 2017 which translated into so signs of improvement for the shipping and shipbuilding market (Fig. 3). While trade demand is increasing for each market sector, strong deliveries continues to dampen freight rate recovery. Scrapping continues to be high, although the activity level has levelled off as some segments have already scrapped most old vessels. Some accelerated scrapping may take place driven by the incoming environmental regulations, industry consolidations and low ship price opportunities.

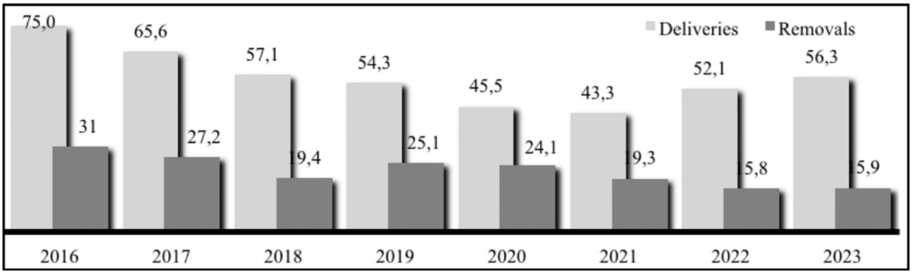
The World orderbook totalled 3,110 vessels / 197.0 m dwt in January, 2018. It has reached its lowest level since October, 2003 in number terms. The global orderbook declined by 16% decline in number term since Janury 2017. 902 vessels / 73 m Dwt were ordered in 2017 representing a 130% increase YoY in Dwt terms. The tanker sector accounted for 41%/30 m Dwt, and represented 154% YoY increase in Dwt. The Bulk Carrier sector accounted for 45%/33 m Dwt, and represented 134% YoY increase in Dwt. 1,472 vessels / 97 m Dwt were delivered in 2017, representing a 14% and 4% YoY decline in number and Dwt respectively.

Figure 3. **World Fleet, MGT: Replacements & Demand Cumulative to Base Year [20]**



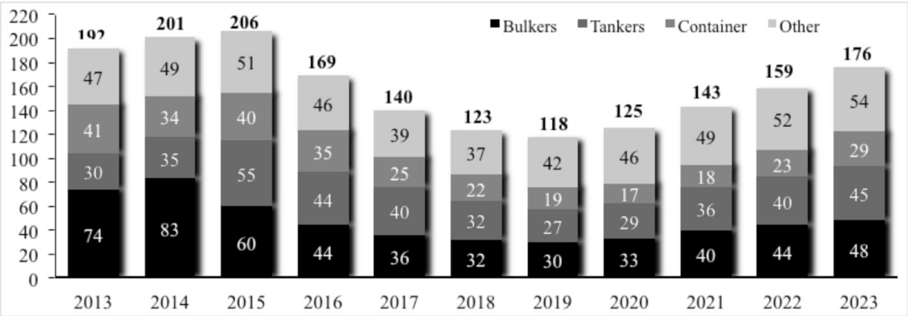
Deliveries are forecast to reach 79 m Dwt in year 2018, a 19% decline YoY. The World orderbook continues to decline with low levels of contracting driven by the excess supply being slowly absorbed and the continuing low freight rates. The Offshore market continues to be depressed driven by the low oil prices. Delivery slippage continues to be strong for the offshore sector while the marine sector deliveries have been more resilient with a strong volume in 2017 [8].

Figure 4. **World Fleet Ins & Outs, MGT [20]**



Stronger fundamentals in terms of GDP and World Trade growth provides a background for improvement subject to geopolitical risk and trade policies.

Figure 5. **World orderbook, MGT [20]**



Crude tanker dwt demand is projected to expand by 4.7% in 2018, similar to 2017, while the crude tanker fleet is expected to expand by 3.5% (Fig. 5). Product tanker dwt demand is expected to grow by 3.4% in 2018, while the product tanker fleet is projected to expand by 1.6%. Global seaborne dry bulk dwt demand is projected at 2.7% in 2018 compared with 4.0% in 2017. The dry bulk dwt fleet is projected to expand by 1.7% in 2018 compared with 2.9% in 2017. Global container trade grew by 5.2% in 2017 and is expected at 5.0% for 2018 while fleet capacity is expected to expand by 4.1%. In 2019, trade growth is expected to moderate slightly to 4.7%. Container ship fleet capacity in 2018 is expected to grow by 4.1% [8].

The metal tariff in the context of relevant international trade law

According to trade theory, it may seem to be rational for each country to opt for protectionism over free trade and to impose tariffs on foreign goods as it may results in the increase in net exports, which in turn will have the effect of increasing GDP per capita. However such protectionism would lead to a sub optimal outcome for all as protectionist trends have historically had a significant negative effect on the volume of world trade and are considered to be countercyclical [9]. In this sense strategic trade theory stresses the importance of trade agreements and the role of supranational institutions (such as the WTO) to police international trade [9]. At the core of the WTO lays trade facilitation by ensuring the predictability of trading system, providing means for reducing trade tensions and engaging in reciprocal and mutually advantageous arrangements directed to the reduction of barriers to trade, and to the elimination of discriminatory treatment in international trade [15]. WTO law provides both concrete multilaterally accepted rules on trading, also means for settling disputes among the member-states.

The US as a member of the WTO has undertaken an obligation that internal tax measures should not be applied to imported or domestic products so as to afford protection to domestic production. However WTO law provides a security exemption allowing the member-state to unilaterally take any action which it considers necessary for the protection of its essential security interests (GATT, Art. XXI), allowing the member-states to override general WTO requirements.

Formally it is argued that the Metal Tariff is established in order to protect the national security of the US. Following the rhetoric of the President of the United States, Mr. Donald J. Trump the Tariff is aimed at stopping the "attack against US" which the President calls the dumping of cheaper metal goods imported from China. Mr. Trump proceeds with the argument that the metal industry of the US is directly linked with ensuring the national security of US, thus for the domestic metal industry must be protected [10]. The rhetoric of Mr. Trump on protecting the domestic metal industry is verbatim contrary to WTO law as the Tariff was never grounded on anything else but on the sole protection of the domestic metal industry which is prohibited by WTO law.

However, even though disguised under false pretence of protecting the national security of the States (or providing quite the unorthodox interpretation of the national security of a country) the Metal Tariff has all of the potential to slip through. So far in the practice of the WTO Dispute Settlement Body (hereinafter – WTO DSB) the national security exemption was considered a self-judging norm meaning that it is up for the member-state to justify the application of the measure ("… *which it considers necessary for the protection* …"). The WTO Dispute Settlement Body has noted numerous times that the WTO has no mandate to examine the justification for the invocation of a general exception to the obligations under WTO law, thus the Judicial Body could find the state neither to be complying with its obligations nor to be failing to carry out its obligations [14].

However, on November, 2018 following the submissions of China, the European Union, Canada, Mexico, Norway, Russia and Turkey a WTO dispute settlement panel was established to review US steel and aluminium tariffs [12]. The parties argue that in its content and substance, the Metal Tariff is to be considered as safeguard measures under WTO law taken to protect the US steel and aluminium industries from the economic effects of imports [12]. The core questions therefore are whether it is possible to reconcile both trade liberalization and national sovereignty and how to prevent the abuse of trade restrictions when such restrictions are based solely on political reasoning. Opponents of the Metal Tariff could argue that the Tariff's reasoning is contrary to international bilateral agreements as the key aim of the restriction is to protect the domestic market.

Those in favour may claim that the country itself can best determine what is necessary for the protection of its security. Yet challenging the Metal Tariff before the WTO DSB may result in a *lose-lose* situation. On the one hand, by applying the WTO rules on the national security measure and legitimizing the false pretence of the Metal Tariff to increase import tariffs would incentivize the further abuse of trade restrictions based on purely political and protectionist reasons. On the other hand, if US loses the dispute before the WTO DSB this could be interpreted as restricting the national sovereignty of the States. Such a decisions could backfire to the international trading community as US could consider leaving the WTO.

Even though generally the domestic US metal industry may be benefiting from the trade restriction, according to recent data the economies of Canada, EU and Russia have been substantially affected by the Tariff because US is the major export market, whereas the effects on China (which was primarily targeted by Mr. Trump) were negligible as the US is not a major export market, thus it may seem that the Metal Tariff missed its target [13]. In so far the Metal Tariff has caused major fluctuations among competing markets. The escalating trade tensions and tit-for-tat retaliatory tariffs between the main trading partners of the US continue to be a major threat to global trade and investment, affecting both private and public bodies more by reducing demand for exports, raising import costs, affecting the purchasing the power of consumers and ultimately reducing trade levels which reduce competition and undermine productivity [11].

Moreover, countries have already engaged in retaliatory strategies under WTO law. For example, the European Union has notified the WTO bodies on its proposed suspension of substantially equivalent concessions and other obligations under GATT 1994 to the trade of the United States takes the form of an increase in duty of 10%, 25%, 35% and 50% on selected products originating in the United States [16]. Such measures are of compensatory nature thus the applicable nullification or impairment can be applied regardless the Metal Tariff's justification, and the legitimacy of the Tariff is not challenged. It must be noted that the discussed countermeasures are not of punitive nature thus the extent of the counter-tariffs must match those imposed by the Metal Tariff and the losses caused by it, making such measures of compensation the most efficient and timely response.

Shipping in nowdays trade war

With mounting alarms of a trade war between the two nations USA and China, shipping lines were hoped that a solution can be achieved soon. However, the further course of events shows that a boat of the trade war can be easily swung. Some industry experts fearing that a full-blown trade war could hurt shipping volumes and container shipping lines as well [1]. According to preliminary studies conducted by independent maritime research consultancy Drewry, a worst-case scenario could see 1 per cent of global loaded container traffic exposed to higher costs. New tariffs may negatively impact on overall container growth. The container market is in recovery mode after some hard years and any "eye for eye" trade dispute or even actions will be an unwelcome development for shipping lines, even if a lot of the tariff list goods will actually be airfreighted rather than move by sea.

The shipping industry is fed by globalisation. So far there is not any evidence yet showing that the shipping sector has been significantly impacted by the escalating U.S.-China trade war. However, this can be silence before the storm, knowing that the negative effects on the shipping sector are being gradually transferred.

European Shipowners are deeply concerned about the wave of trade protectionist measures proliferating around the world. As carrier of 90 per cent of the external EU trade, European shipping is particularly exposed to the trend of commercial protectionism in view of the wrong message given by the US to the rest of the world. China is already retaliating, whilst other developing countries have started taking unilateral protectionist measures. Defensive trade measures and countermeasures trigger off a trade war where there are no winners and all are losers. Whilst articles on the commercial implications widely touched in the international press, the maritime implications of a trade war are unknown. The maritime repercussions of a trade war have not been examined nor the maritime legal instruments at the disposal of the EU in order to fight with it. The maritime repercussions of a trade war will not be insignificant. Trade protectionism measures may lead to maritime protectionist measures like unilateral cargo reservations for ships under the national flag, bilateral or multilateral agreements on cargo sharing between countries excluding vessels of third (non-participant) countries and a whole spectrum of flag discrimination measures like extensive interpretation of "state cargoes". It is not coincidental that in the late 80's both the OECD and the EU adopted liberalisation principles in their maritime policies to cope with a wave of protectionist measures adopted at the time by third countries.

As stated expressly, this principle forms the guarantee of adequate and economic world shipping services of maximum economic benefit for shipowners, shippers and consumers. More particularly, the OECD Recommendation (1987) concerning common principles of shipping policy of member countries, provides the application of liberalization principles [2]. In Principle on "Freedom of Shipping in the Bulk Trades" it is stated that "OECD member countries reaffirm their commitment to a free and fair competitive environment in the dry and liquid bulk trades. They are convinced that cargo sharing in the bulk trades leads to substantial increases in transportation costs and has a serious effect on the trading interests of all countries".

Similarly, to the OECD, in 1986 the EU adopted a liberalisation policy for maritime transport services between its member states and between its member states and third countries [3]. This policy was reflected in Regulation 4055 and

Regulation 4058. Regulation 4055/1986 (22/12/1986) on “freedom to provide services to maritime transport between Member States and between Member States and third countries” stipulates free market access, freedom to provide services and liberalisation principles. Unilateral cargo reservations for vessels under the national flag and existing bilateral agreements on cargo sharing should be abolished. Cargo sharing arrangements are prohibited in any future agreements with third countries. The above stipulations concern transportation on a tramp and on a liner basis.

Regulation 4058/1986 (22/12/1986) on “coordinated action to safeguard free access to cargoes in ocean trades” provides the legal basis for EU action against protectionist maritime practices of third countries [4]. The coordinated action of the Regulation may be extended also in favour of other OECD countries non EU member states. The coordinated action consists in diplomatic representations to the third countries restricting access to trades (phase one) and countermeasures (e.g. permits to load/discharge, imposition of quotas, taxes and duties) (phase two). Coordinated action may be requested only by a Member State to the European Commission (Article 3).

Ever since 1986, Regulation 4055 has been used as the legal basis for the negotiation of dozens of bilateral agreements between EU and third countries. Its articles have served to define the beneficiaries of the liberalisation policies, the prohibited acts as well as the guiding principles of liberalisation. Nowadays, the EU is in process of negotiations regarding the signing of a spate of Free Trade Agreements and bilateral agreements with third countries (e.g. Indonesia, New Zealand, Mexico, Singapore, Vietnam, Australia, Canada, Chile and Tunisia). Regulation 4055/1986 provides the basic elements for the drafting of maritime clauses for these agreements. In case of violations by third countries, Regulation 4058/1986 provides the legal weapons for EU action.

There are already many other elements facing and challenging the industry – be it overcapacity or be it the avalanche of statutory regulation that we can notice coming to the shipping sector.

The forecast assumption is that a slight rise in protectionism will inhibit trade. Governments around the world have introduced protectionist measures over the past couple of years to support domestic industries – a pattern expected to continue; a structural slowdown in global trade as the integration of global supply chains abates; a mild recession in the US in 2020 which will pull down global trade followed by a brisk recovery in 2021-2022.

Of course for small, open-market countries there are no great opportunities to influence decisions and the consequences of the war trade. Baltic ports have to focus on their efficiency and to keep their goal to increase their connectivity, especially liner shipping connectivity.

The Liner Shipping Connectivity Index captures how well countries are connected to global shipping networks [5]. It is counted by the United Nations Conference on Trade and Development (UNCTAD) based on five components of the maritime transport sector: number of ships, their container-carrying capacity, maximum vessel size, number of services, and number of companies that deploy container ships in a country's ports. The data shows that all Baltic States make huge steps ahead. Here below Liner Shipping Connectivity Indexes are presented:

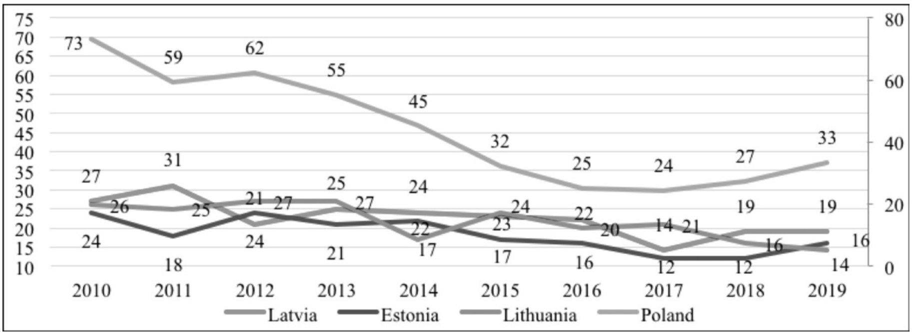
- Latvia 6,4 (in 2004 year) – 7,6 (in 2017 year);
- Lithuania 5,3 (2004) – 13,2 (2017);
- Finland 9,4 (2004) – 12,0 (2017);
- Estonia 7,0 (2004) – 8,4 (2017).

No doubt higher Liner Shipping Connectivity leads to lower trade costs, to ensure more competition, lower freights and more trade respectively. Connectivity index much depends on geography (which can't be changed), cargo volume, port efficiency and trade facilitation. Beyond question all countries need better regulations. Regulation status might be weighted by rate of "Doing Business" [6]. The "Doing Business" report measures business environment according to the methodology and scenarios defined by the World Bank. Business environment in the report on "Doing Business" is measured according to 11 indicators:

- Starting a business;
- Dealing with construction permits;
- Getting electricity;
- Registering property;
- Getting credit;
- Protecting minority investors;
- Paying taxes;
- Trading across borders;
- Enforcing contracts;
- Resolving insolvency;
- Labour Market Regulation.

The changes of the Doing business ranking (1 – top position) of neighbour countries fluctuate (Fig. 6). The biggest change was achieved by Poland – from position 73 in year 2010 till position 24 in 2017, but for the year 2019 the business environment got worse (position 33). The ranking of the Estonia, Latvia and Lithuania in year 2010 was practically the same – positions 24 (Estonia), 26 (Lithuania), 27 (Latvia). In period of 8 years business environment was improved. The Lithuanian business environment ranking is characterized by an upward trend (increase from position 26 in year 2010 till the position 14 in year 2019) and this situation can be titled as easiest doing business environment in the region.

Figure 6. **Doing business ranking of states [6]**



In Lithuania, the successful implementation of better regulation initiatives started upon approval of the Better Regulation Programme by Resolution No 185 of the Government of the Republic of Lithuania of 13 February 2008 [7]. The accession of Lithuania to OECD organisation in 2018 was another positive factor. Throughout its accession process Lithuania has been reviewed by 21 OECD Committees (including transport committee). Experts evaluated Lithuanian ability to implement OECD legal instruments and gave the best OECD practices. Lithuanian authorities had to guarantee, that there are no limitations for foreign investors to acquire effective influence or the management of an enterprise established in Lithuania which provides maritime services. Following the recommendations next year Lithuanian Government intends to change a legal status of Klaipeda port authority from state enterprise to joint-stock company. New status of Klaipeda port authority will allow the authority to concentrate on the business issues, to take quick decisions on port dues, investments and management of the port.

Whereas the links between development of seaports and economic, environmental and spatial development might be foreseen and planned, the geopolitical context – behaviour of our neighbouring countries Russia, Belorussia is hardly predicted. And this somewhat abridge our clear sailing ahead.

The next big challenge to shipping is environmental issues. Following the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse-gas-emissions mitigation, adaptation, and finance (Paris Agreement), starting in the year 2020 shipping sector is under presure to lower its emmisions as well as other industries. These issues are dealt with not only at the International Maritime Organization (IMO), but also at the reginal (for example European Union) level. In 2018 Marine Environment Protection Committee (MEPC) 72nd and 73rd sessions took on the table hard issues - reduction of greenhouse gas emissions from ships, further work on energy efficiency of ships, implementation of sulphur 2020 limit, marine plastic litter, ballast water management treaty implementation, use and carriage of heavy fuel oil as fuel by ships in Arctic waters. The shipping has to achieve enormous obligations - by 2050, to reduce emissions by 50 per cent compared to the 2008 emissions level. Now shipping currently accounts for 2 per cent of global carbon dioxide emissions, and if the sector is not cleaned up some experts predict this figure could rise to a fifth of emissions by 2050.

Furthermore the Baltic Sea and the North Sea currently Emission Control Areas (ECAs) for sulphur oxides (SOx), will be extended to also cover nitrogen oxides (NOx). This implies that engines with a power output of more than 130 kW, to be installed on vessels constructed on or after 1 January 2021, must be Tier III certified if they are operated inside the Baltic Sea and the North Sea ECAs.

To ensure a consistent implementation and enforcement of the global 0.5 per cent sulphur cap, IMO adopted regulations banning the carriage of non-compliant fuel in fuel tanks, unless the ship is equipped with a scrubber. The ban will enter into force in March 2020. There is no change to the 1 January 2020 deadline on the 0.5 per cent global sulphur limit.

These forthcoming statutory obligations put the ship owners under financial instability. We can clearly see that the society is not prepared to pay more for ecology, so no doubt most of the expenditure should be paid to ship owners. Some Western European countries announced a plan to ban all petrol and diesel vehicles by 2040-2050 as part of the Paris Agreement and introduce higher taxes on fuel. We can anticipate that public strikes and protests can make governments retreat from their original goals. But the shipping industry seems does not have option to step out from main stream.

Conclusions

1. The maritime shipping industry faces certain declines. The World orderbook continues to decline with low levels of contracting, whereas global container trade grew and is expected to expand. In 2019, trade growth is expected to moderate slightly whereas ship fleet capacity in 2018 is expected to grow.
2. With the introduced US Metal Tariff the international trade community faces significant shifts in their policies. Given that legal measures before authorities under relevant trade law may not necessarily provide timely results, countries are engaging in retaliatory measures. Such a trade war may lead to significant economic disruptions.
3. The ongoing trade tensions and protectionist trends may affect the shipping industry as increasing import tariffs may negatively impact on overall container growth and generally inhibit the shipping sector. Generally maritime shipping opposes protectionism as it follows the principles of free market access, freedom to provide services and liberalisation principles, thus seeming to oppose the escalating global trends. Moreover, shipping activities may have

positive economic outcomes, for example, higher Liner Shipping Connectivity leads to lower trade costs, ensures more competition, lower freights and more trade respectively.

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Chapitre 16

Seaport psychoanalysis: personality resistance to defense mechanisms

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Abstract

Defense mechanisms operate semi-consciously. They are natural and important because they help survive. However, at the same time they disturb the smooth collaboration in a work-team. It is necessary, as much as it is possible, to apply psychological self-management in stressful situations that prevail in the seaport characterized by intensive activities of cargo handling, warehousing, ship agency, forwarding, etc. A skilled seaport worker is operating in a port, which is characterized by the seashore that connects the sea and the land. In this connection, the seashore symbolizes a resistance to sea waves that psychoanalytically symbolize often destructive psychological defense mechanisms. The goal of the paper is a discussion of the personality resistance to psychological defense mechanisms regarding seaport psychoanalysis. The main methods such as scientific literature analysis, interpretation, heuristic method and systemization were used in the research based on symbolic interactionism, psychoanalysis and analytical psychology.

Keywords: seaport, psychoanalysis, defense mechanisms, resistance.

Introduction

Relevance of the problem. Psychological self-management of the personality is especially important when defense mechanisms (e.g. projection, regression, rationalization etc.), given by psychoanalysis, manifest. Psychological defense mechanisms operate semi-consciously. They are natural and important because they help survive. However, at the same time they disturb the smooth collaboration in a work-team. It is necessary, as much as it is possible, to apply psychological self-management in stressful situations that prevail in the seaport characterized by intensive activities of cargo handling, warehousing, ship agency, forwarding, etc.

One of relevant ways of the skilled seaport worker's psychological self-management, regarding defense mechanisms, is based on the analytical psychology as a direction of psychoanalysis. This psychological direction, created by C. G. Jung, bases the development of the symbolistic approach, which relates the human nature to:

- One's own life events,
- Dreams,
- Nature phenomena,
- Myths that grant significance and help cognize oneself from a broader and deeper point of view (The Earth Has a Soul, 2016 etc.).

A skilled seaport worker is operating in a port, which is characterized by the seashore (in a broader sense of reality) that connects the sea and the land. In this connection, the seashore symbolizes a resistance to sea waves that psychoanalytically symbolize often destructive psychological defense mechanisms. The number of scientific studies of this type is low. Investigations are only approaching to this scientific issue (Freud, 1930; Corbin, 1994; Jovaiša, 2001; Beresnevicius, 2002; Goldschmidt, 2003; Wirth, 2004; Kaufmann, 2006; Schmid-Höhne, 2006; Durkheim, 2007; Tenzer, 2007; Chiesa, 2014; Lileikis, 2011, 2015; Mega, 2016 etc.).

More relevant skilled seaport workers' psychological defense mechanisms such as restitution, rationalization, regression, opposite reaction, projection, conversion, avoidance, transference and compensation were chosen in accordance with the scientific works of Freud (1993).

The object of the research is psychological defense mechanisms regarding seaport psychoanalysis.

The goal of the paper is a discussion of the personality resistance to psychological defense mechanisms regarding seaport psychoanalysis.

The tasks are as follows:

1. Development of resistance to restitution, rationalization and regression.
2. Characterization of resistance to opposite reaction, projection and conversion.
3. Revelation of resistance to avoidance, transference and compensation.
4. Presentation of the anthropomorphic model of seaport psychoanalysis.

The methodological principles are as follows:

- *Symbolic interactionism* analyses human behavior that (at the level of the seashore) depends on the meaning of the seashore; perception of this meaning is the result of the social interaction (e.g. in higher education) but meanings are applied and changed (depending on situations) in processes of interpretation;

- *Psychoanalysis* as a psychological direction emphasizes the role of subconsciousness, internal conflicts and defense mechanisms, which can be partially solved regarding existential interpretation of semi-unconscious relationships between the seashore and the personality of a skilled seaport worker;

- *Analytical psychology*, as an archetypal direction of psychoanalysis, gives the basis for the development of symbolistic approach, by relating human nature to life events, dreams, nature phenomena and myths, which grant significance and help cognize oneself from the broader and deeper point of view.

The main methods such as scientific literature analysis, interpretation, heuristic method and systemization were used in the research.

The type of the research is theoretically descriptive.

The structure of the paper consists of the development of resistance to restitution, rationalization and regression, characterization of resistance to opposite reaction, projection and conversion, revelation of resistance to avoidance, transference and compensation, and presentation of the anthropomorphic model of seaport psychoanalysis.

Development of resistance to restitution, rationalization and regression

Restitution reveals itself when the person feels guilty and manipulates others by applying apologies. This phenomenon can be related to the chief of a seaport company but more to a young subordinate, especially female one, after conflicts at extreme conditions.

Advantage of the restitution mechanism - the person is searching ways to create good work relationships. However, when the situation does not require apology or it is not true, so, it is only manipulative one. Manipulations do not allow a creation of certain relationships. General possibility of solution of the problem is a development of adequate self-esteem and partnership at work.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which symbolizes self-esteem of the personality, who is able to resist to manipulative motives.

The person, who experiences failure at work, tends to justify oneself using, e.g. ineffective marketing of the port company, instead to make strategies further, applying self-criticism, too.

Rationalization mechanism advantage - the chief or a skilled seaport worker feels better when justifies oneself. However, the person deceives oneself and stops a creation of new strategies of the company activity for solution of problems. General possibility of solution of the problem is not to waste time for justification but to learn the solution of problems, perceiving them as natural challenges.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which symbolizes self-esteem of the personality, who is able to resist to the debased justification. Adequate self-esteem does not allow oneself to justify and calm down but it promotes to solve problems, unless the solution of problems is impossible at all honestly saying to oneself - *"feci quod potui"*.

Regression reveals itself when immature people, entered the unsuccessful situation, are degraded to primitive forms of communication, e.g. immature skilled seaport workers or chiefs of port companies, who are not characterized by the leadership competence, shout on each other in conflict situations.

Advantage of the regression mechanism is a false show of one's own power. However, the problem is more deepened. A chief loses his/her own authority in terms of his/her subordinates. A worker loses his/her reputation in terms of his/her colleagues. A shout reduces capacity of work.

General possibility of solution of the problem is learning of self-management. The person is more than a machine. The communication with him/her must be adequate, applying the supportive leadership. Regarding seaport psychoanalysis, possibility of the solution is anthropologically based studies of the embankment, techno-cultural infrastructure of which symbolizes dignity of the personality.

Characterization of resistance to opposite reaction, projection and conversion

Opposite reaction expresses itself when one person hates another and panders to him/her because of defensive motives. Seaport is characterized by fast activity and strong psycho-emotional tension regarding social managerial relationships. So, not only denial or compensation mechanism of a skilled seaport worker can manifest during the conflicts but also the opposite reaction.

Advantage of the opposite reaction mechanism - the person, applying false flexibility, avoids the strong negative reaction of others. However, it is not real relationships. Eventually, real motives unavoidably appear. General possibility of solution of the problem is learning to authentically communicate with oneself and others, by perceiving that pandering and lying express the schizophrenic state, divides the personality and causes diseases.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which symbolizes the strong personality. The sea, which is characterized by underwater currents, is symbolizing the mentioned defense mechanism. The personality has to learn to comprehensively perceive his/her nature and dignity, and to apply the authentic collaboration, resisting to debased motives of pandering.

Projection can express itself in the maritime sector and in any other situation of social life. Projection reveals itself when the person does not want to notice his/her own mistakes and tends to blame others. Usually, a weak and inadequately responsible chief can tend to apply over control to his/her subordinates, especially at extreme conditions of a seaport activity.

Advantage of the projection mechanism - the chief tries to protect his/her own reputation. However, he/she loses his/her authority because subordinates naturally perceive the real situation and real causes of problems. General possibility of solution of the problem is permanent self-development of the chief, regular development of his/her authority and application of supportive leadership.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which symbolizes the strong personality. Destructive sea power is not a cause when the embankment cannot sustain. This is problem of the embankment construction and its maintenance. The chief, who enriches his/her personality, does not allow oneself to blame others, even if others are really guilty. He/she applies leadership, creates adequate relationships to his/her subordinates and solves problems with them together ensuring positive psychological climate.

Conversion expresses itself when the person at work is afraid to ask on something. He/she feels bad because his/her super-ego (conscience) requires an implementation of the obligation, and the person eventually becomes sick. Activity in a seaport is characterized by many nonstandard situations, in which a skilled seaport worker (especially a young one) confuses but is afraid to ask for help in the beginning of his/her professional career. Melancholic introverts and isolated people, e.g. with Nordic mentality, can be more characterized by the conversion mechanism. Frequent illnesses of young specialists can be namely related to the conversion mechanism based on psychosomatic processes.

Although conversion is a big problem but its advantage is a temporary isolation of oneself from the problematic situation. A young specialist can know better about himself/herself and the real causes of his/her illness. General possibility of solution of the problem is learning of communication and collaboration when the person perceives oneself as a timid one, especially when transparency is the policy of the seaport company and the chief applies the supportive leadership.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which is namely devoted to resist to the sea waves. This is a symbolistic example of self-development, which is devoted to help the personality of a young skilled seaport worker perceive that any work relates to problems. They are natural challenges at work in the seaport, which is characterized by fast activity and problems that require urgent solution.

Revelation of resistance to avoidance, transference and compensation

Cargo handling in seaports is a fast and permanent process. Avoidance expresses itself as an abandonment to operate or collaborate etc. E.g. a skilled seaport worker feels bad, is afraid for criticism and is not doing, what he/she should do. A skilled seaport worker takes part at work, which is characterized by nonstandard situations. Young workers can avoid their operations because they do not know how to do the work.

Advantage of the avoidance mechanism - the person is protecting oneself against a possible mistake. Disadvantage of the mechanism - the unsolved problem is more deepening, collaboration is getting worse in the intense activity of cargo handling, warehousing, management of documents etc. General possibility of solution of the problem is development of professional vocation, professional interest and communication with mature colleagues.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which is devoted to resist to sea waves. This is a symbolistic example of self-development, which is devoted to help the personality of a skilled seaport worker not escape from problems but solve them as a natural professional challenge.

If a skilled seaport worker feels as a victim of the chief in managerial relationships, he/she can behave defensively and vent his/her anger on another person (on a colleague or a family member).

Advantage of the transference mechanism - the person as if proves his/her own self-esteem and power. However, he/she behaves inappropriately and disturbs relationships, e.g. to his/her subordinates or family members. General possibility of solution of the problem is development of consciousness of professionalism and reality of life by perceiving that others are not guilty regarding inappropriate behavior of the chief. It is important to learn flexible collaboration with the chief.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which is regularly observed and improved according to problems of the water element. This is a symbolistic example of improvement of the skilled seaport worker's personality, by observing himself/herself in reference to commitment to work in the port company, which is characterized by the natural tension of collaboration.

If a skilled seaport worker is a chief but is not able to communicate, does not have authority and is not able to be a leader, so, he/she can naturally portray a boss.

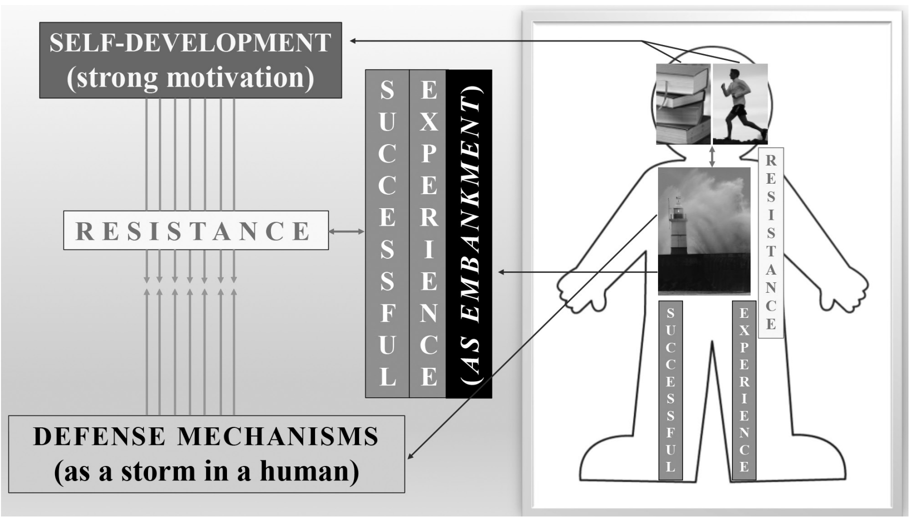
Advantage of the compensation mechanism - the person as if retains his/her authority. However, he/she loses it indeed much more. General possibility of solution of the problem relates to the self-development and psychological self-management.

Regarding seaport psychoanalysis, possibility of the solution is anthropological studies of the embankment, techno-cultural infrastructure of which composes the basis of the seaport superstructure and its activity. This is a symbolistic example, how it is important to learn of combining strictness with friendship because it is the basis of successful managerial relationships.

Anthropomorphic model of seaport psychoanalysis

The simplified anthropomorphic model of seaport psychoanalysis regarding personality resistance to psychological defense mechanisms is shown (Fig. 1).

Figure 1. Anthropomorphic model of seaport psychoanalysis



The Guardian. (2014). TEN Health & Fitness. (2017). List Challenges. (2017).

Self-development based on a strong motivation means a mental and physical development that helps the personality resist to psychological defense mechanisms that are as a storm in a human. The resistance to defense mechanisms operates under condition of the personality education and his/her successful experience as a seaport embankment from the psychoanalytic point of view.

Conclusions

The resistance to defense mechanisms operates under condition of the personality education and his/her successful experience as a seaport embankment from the psychoanalytic point of view:

- Restitution, rationalization and regression are related to self-esteem of the personality who is able to resist to manipulative motives; the personality is able to resist to the debased justification; adequate self-esteem does not allow oneself to justify and calm down but it promotes to solve problems, unless the solution of problems is impossible at all; anthropologically based psychoanalytic studies of the embankment are important, techno-cultural infrastructure of which symbolizes dignity and psychological self-management of the personality under any condition;
- Opposite reaction, projection and conversion are characterized by the personality who has to learn to comprehensively perceive his/her nature and dignity, and to apply the authentic collaboration, resisting to debased motives of pandering; the chief, who enriches his/her personality, does not allow oneself to blame others, even if others are really guilty; he/she applies leadership, creates adequate relationships to his/her subordinates and solves problems with them together, ensuring positive psychological climate; self-development is devoted to help the personality of a young skilled seaport worker perceive that any work relates to problems; they are natural challenges at work in the seaport, which is characterized by fast activity and problems that require urgent solution;
- It is important to learn of combining strictness with friendship because it is the base of successful managerial relationships; psychological self-management, regarding avoidance, transference and compensation, is characterized by the self-development, which is devoted to help the personality not escape from problems but solve them as a natural professional challenge.

The results of the research are limited by theoretical prerequisites and can be applied by methodologically basing empirical investigations and psychologically preparing future skilled seaport workers who have to recognize the defense mechanisms in them and do not have to allow that the mechanisms completely overpowered them.

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Chapitre 17

Young seafarers career: needs and expectations of z generation

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Biography

Viktoras Sencila *is a professor at Lithuanian Maritime Academy; his background higher education diploma is in a ship engineering, Ph.D. in technical science. He has experience in international marine transport as a ship engineer, COC of Chief Engineer on Ships powered by main propulsion of 3000 kW and less, 26 years' experience as a managing director of Maritime Education and Training institution; he is a Chairman of the Council of Lithuanian Centre for Quality of Higher Education. He is an author and coauthor of more than 50 scientific articles and 8 books.*

Genute KALVAITIENe *is head of career and communication department and associate professor at Lithuanian Maritime Academy. Her background higher education diploma is in a education, Ph.D. in social science. She is an author and co-author of more than 30 scientific articles and 5 books. Her interest's field is: MET, seafarer's career planning, education for career, self-management and etc.*

Abstract

Lately maritime education and training institutions and shipping industry admit new young seafarers' generation, called generation Z, those who were born during the middle 1990s and late 2000s. Characteristics of the generation Z vary by cultural and regional environment but are most impacted by technological development and generation Z can be defined as "instant online". MET institution's mission is not only preparing young people for maritime career at sea, forming their professional competences, but also providing help in their career management. For this reason, it is important to know new seafarers' generation needs and career ambitions, as well as expectations from employers' point of view. Mutual understanding would help to find a balance between expectations of both and adequately manage changes.

Results of research, regarding desirable contract conditions and seafarers' personal and/or professional characteristics, important for successful career, are presented in the article.

Analysing seafarers' personal and/or professional characteristics, which determine their successful employment and career in a company, some overlaps and differences in opinions of maritime students and shipping and crewing companies' experts were identified. Both groups, students and companies' experts, highly rated professional skills, attitude (assertiveness, diligence, responsibility) and communicability (teamwork, flexibility). In general, upcoming seafarers' generation, taking over the main companies' attitudes and approach to work, demonstrated good adaptability for labour market needs. On the other hand, students evaluated as less important foreign languages and did not name at all, reliability and tolerance, which were highly rated by the companies' experts.

This article summarizes analyses and results, published in previous authors' works.

Keywords: Generation Z, Seafarers' career, Maritime labor market, Seafarers' personal and/or professional characteristics

Introduction

Lately MET institutions and shipping industry admit new young seafarers' generation, called generation Z, those who were born during the middle 1990s and late 2000s. The main categories describing differences between generations are social environment, technological environment and historical environment. Characteristics of the generation Z vary by cultural and regional environment but are most impacted by technological development and generation Z can be defined as "instant online" (Levickaite, 2010).

They are always online on any technical device virtually, with no stop. To solve problems, they try to find the solutions on the internet. Arising from their habit, they have different expectations in their workplaces. We can speak about a careerist, professionally ambitious generation, but their technical and language knowledge are on a high level (Bencsik at al., 2016).

Authors indicate different features of Z generation. More thorough analysis allows determine some other featuring characteristics of this generation: growing hyperactivity, infantilism, multimedia literacy, loop reading, social autism, consumerism, lack of analytical evaluation of communication and etc. (Targamadze, 2014).

Because of increasing the retirement age, often 3 or 4 generations are obliged to cooperate and to work together. Based on the data, it is mainly the communication and the difference in the way of thinking that can cause difficulties in the process of working together. The research justified that the cooperation of different age groups could provide not only conflicts, but also positive results as well for the organisation (Bencsik at al., 2016).

Generation Z can bring us an additional advantage to the huge problem that we face in the industry: the overload of information. For example, think of the navigator; he has too much information through the many layers of ECDIS that simply cannot handle it. This generation can be trained at early stage sorting a lot of information quickly. Therefore, they will be much more able to process navigational information (Recruitment…, 2017).

The hiring practices of shipping industry employers should be targeted at meeting the career expectations of recruits (Caesar & Cahoon, 2015): what future career ambitions do they have, including where do they hope to be employed in ten and twenty years' time, and what do they know about the working career of seafarers?

Because of the global shortage of ship officers and the dynamic nature of the seafarer labour markets, shipping industry employers need to adopt appropriate measures to improve the future supply of maritime labour (Caesar & Cahoon, 2015). However, the new generation should also be desire to look for the balance of interests and be able for adaptation to the working environment and changing circumstances.

For MET institution is important to know new seafarers' generation needs and career ambitions, as well as expectations from side of maritime labour market. Mutual understanding would help to find a balance between expectations of both and adequately manage changes.

This article summarizes analyses and results, published in previous authors' works.

Global maritime labour market description

Generally, a labour market is discovering as a place where two sides, workers and employees, interact with each other. World maritime labour market represents a complex set of interconnected phenomena. The phenomenological model of global maritime labour market (Sencila. 2018) reflects seafarers demand and supply dependence and influence on key factors (Fig. 1).

The phenomenological model of a global maritime labour market, as a field of seafarers' demand and supply, influenced by economical, demographical, geopolitical, technological and other factors. Global demography and global economy in general determine the global trade. The allocation of resources, production and consumption, have a significant impact on the routes and volumes of different cargo movements, influenced to some degree by geo-political decisions (Sencila. 2018).

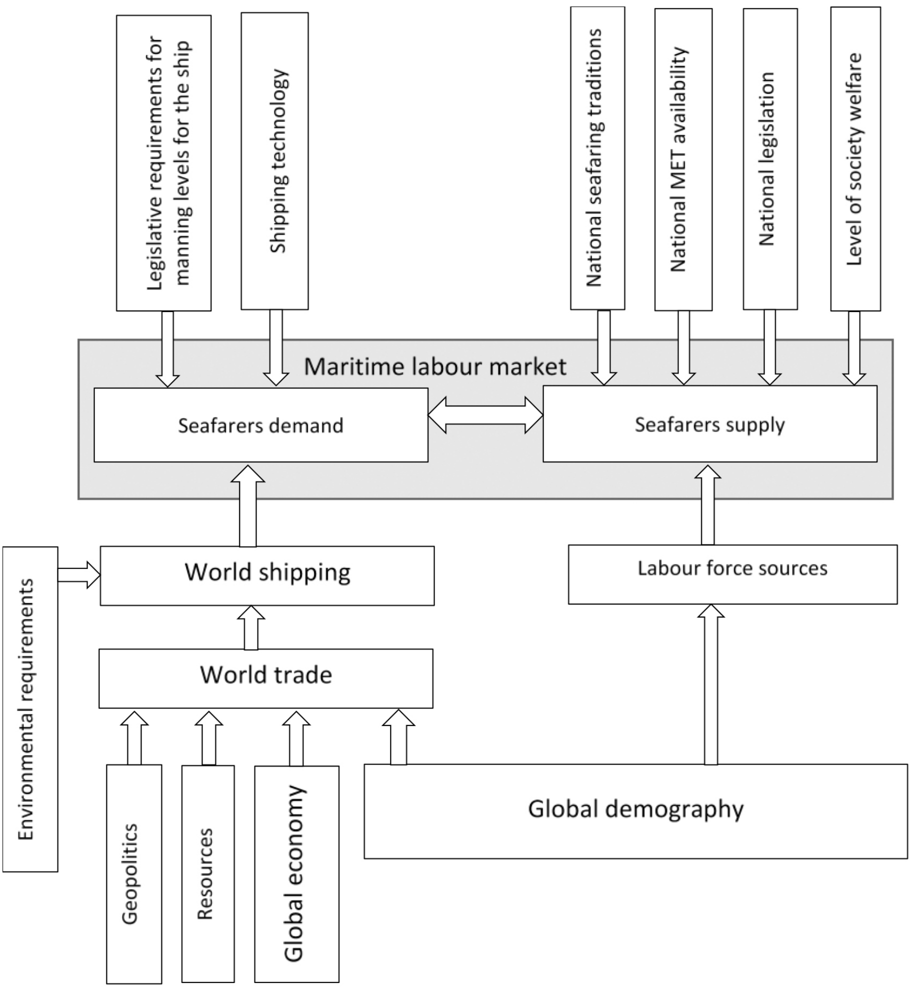
The maritime labour market currently became extremely global. UNCTAD data confirms a continued trend of industry consolidation, where different countries specialize in different maritime subsectors. It also confirms the growing participation of developing countries in many maritime sectors (UNCTADSTAT, 2018). The top five ship-owners in terms of cargo carrying capacity (dwt) are Greece, Japan, China, Germany and Singapore; together, these five countries have a market share of 49.5% of dwt.

BIMCO data confirms a continued growing of the global supply of seafarers, which increased from 1,187 thousand in 2005 to 1,647.5 thousand in 2015 (BIMCO, 2015). Top five seafarers' supply countries reported by companies were China, Philippines, Russian Federation, Ukraine and India. The most significant increase in the number of seafarers occurred in the Far East group, whose share of officers increased from 28 to 39% of the total number of officers, while the share of rating seafarers increased from 31 to 55%. China has a main increase in maritime labour supply, although the Chinese-owned fleet currently uses most of the additional workforce.

The participation of the country in seafarers' supply gets through the number of the seamen from that country and their qualifications (Sencila, 2015). National seafarers' supply depends on the national seafaring traditions (that can change), on the availability and capacity of country's maritime education and training (MET), on a motivating (or demotivating) factors such as the level of country's social welfare and national legislation in the field of seafarers taxation, and finally, of course it depends on the country's demographic potency (Sencila. 2018).

Over 90 per cent of the seafarers from the advanced economies work on board their home fleets, while 80 per cent of seafarers from the developing economies and over 60 per cent of the seafarers from transitional economies work on board the fleets of advanced economies. World shipping industry has offered opportunities for seafarers from developing countries and, increasingly, from transitional economies to develop careers outside their home country (Wu & Morris, 2006).

Figure 1. The phenomenological model of global maritime labour market



Shipping globality may be discovered out when the shipbuilder, ship's port of registration, ship's flag, ship's owner and ship's operator may have different addresses without a single clear national affiliation. Differently from ships, seafarers, even working in international crew on board ships of other country, remain seafarers of their country, with a greater degree of genuine link to nationality (Sencila. 2018).

Shipping is, obviously, an extremely old industry and one that has established and maintained a strict hierarchical occupation system in which seafarers' career development follows a common route from ratings, to junior officers to senior officers, depending on the accumulation of knowledge, experience and skills (Wu & Morris, 2006). The shipping industry is highly cyclical in nature and is characterised by extended periods of bust and boom (Sampson & Tang, 2016).

Work on board a merchant ship can be stressful (Agterberg & Passchier, 1998). Today the seafarer often works alone, comrades have finished eating when he or she enters the mess, and the fun and excitement of port visits has disappeared (Ljung & Widell, 2014). Seafaring careers entail long-term separation between seafaring couples, which make seafarer-partners feel that they live different lifestyles and that nonseafaring people could not fully appreciate their experiences (Tang, 2010; Thomas at al., 2003).

The motives to become a seafarer changed in recent decades. The myth of the exciting and free life at sea has largely been cracked. Research on how the major changes that permeated the work content and the organisation have influenced young people's motivation to choose a career in seafaring profession is hard to find (Ljung & Widell, 2014).

In case of maritime labour market ship owners/managers and seafarers have changeable characteristics and changeable expectations.

The research methodology (the model, sample and instrument)

The investigational model, presented in fig. 2, aimed to research differences and overlaps between new seafarers' generation needs and career ambitions and expectations from side of ship owners, mutual conformity of their needs, expectations and characteristics (Sencila, Kalvaitiene, 2017).

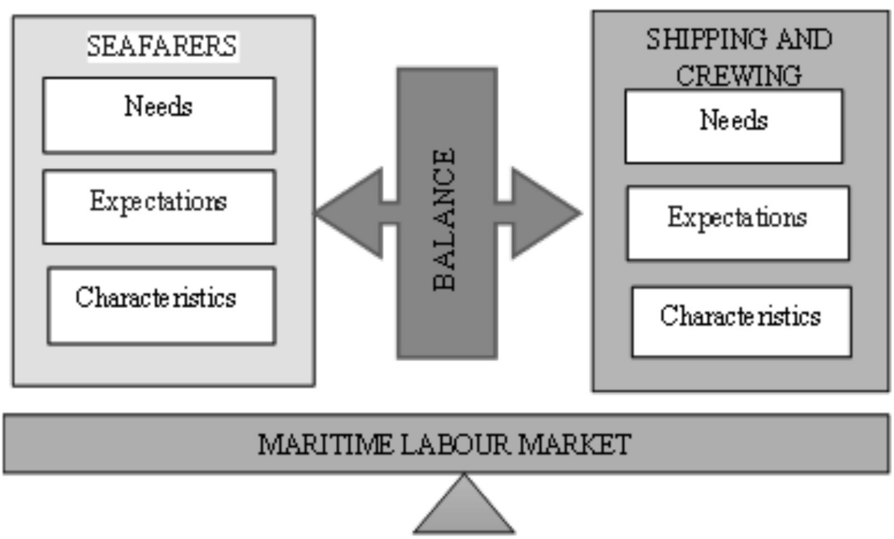
The research was conducted by surveying 4th year full-time students studying at the Lithuanian Maritime Academy, shipping and seafarer crewing companies in Lithuania and in Latvia. The sampling was based on the principle of free will, i.e. all the final year students, who attended the Academy on the days of the survey, were included into the sample. Such survey sampling method is considered to be reliable.

Final year bachelor programme students were surveyed: out of which 38 percent were Marine Navigation study programme students, 62 percent were Marine Electrical and Marine Power Plant Operation study programmes students. Other respondents were the employees of five shipping and crewing companies in Lithuania and three shipping and crewing companies in Latvia, where students had seagoing practice.

The data of the qualitative research was collected by using a written survey method. Original questionnaires made by authors were used for the survey.

The students of the Maritime Academy were asked about the planned duration of work at sea and what reasons would lead to the termination of a seafarer's career? The questions were aimed at identifying student's expectations and needs related to the work at sea: regarding the term of voyage and working conditions and their opinion about the personal and/or professional characteristics that determine successful employment of a seafarer and his career in a company. Two questions were aimed at identifying, what impact communication with older seafarers had during practice on board a ship and what means facilitated the adaptation, coping with the routine and other emotional issues relevant to final year students.

Figure 2. Investigation model of balance between companies and seafarers needs and expectations (Sencila, Kalvaitiene, 2017)



Respondents of the qualitative research include five shipping and crewing companies in Lithuania, Klaipeda, and three companies in Latvia were chosen as experts. Meanwhile, a qualitative survey consists of four open-ended questions. These questions reveal main things that are important for settling the balance between the expectations and needs of shipping and crewing companies and young maritime sector specialists:

- What general skills (foreign languages, teamwork, etc.) and personal characteristics (reliability, communication skills, etc.) are important for seafarer's career?
- What most significant changes took place during the recent decade: regarding requirements for seafarers and regarding seafarers' expectations and needs?
- What work/contract conditions (in addition to salary and term of voyage) are important for young seafarers?
- What means are decisive for seafarers' self-determination to work in the company for a long term?

The obtained data was analysed using a content analysis method.

Results of investigation

Maritime students' opinion regarding the term of seagoing career

The research was aimed at identifying, how long the final year students are planning to work at sea.

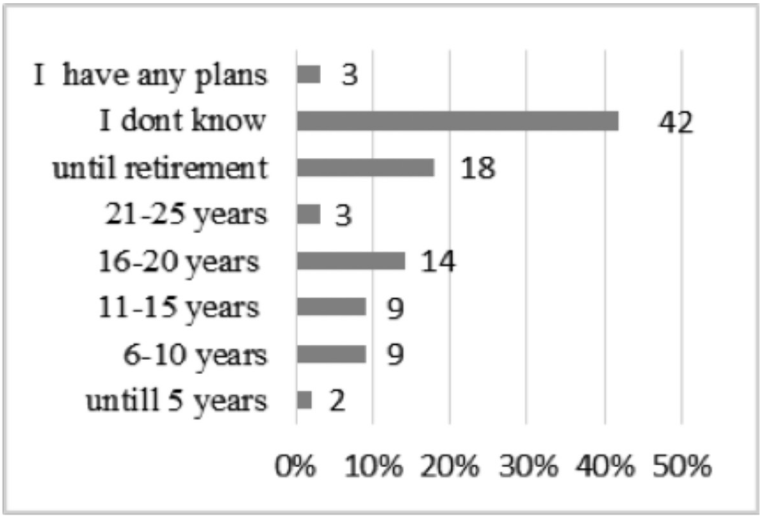
42 percent of the total number of respondents were uncertain about the term of marine career after the completion of the studies (Fig.3). 18 percent of respondents are planning to work at sea until retirement; 9 percent of the total number of respondents are planning to work at sea for 6-10 years, and 9 percent – for 11-15 years, 2 percent of respondents are planning to work in maritime sector up to 5 years.

From 67 final year maritime students, who participated in the survey, named following reasons to terminate their career at sea:

- because health problems (N=44), disease;
- due to family, small children (N=36);
- due to occupational injuries (N=28);
- due to low salary (N=27);
- due to long term of voyage (N=26);
- due to poor working conditions on board a ship (N=25);
- due to psychological issues (N=5);
- due to establishment of own business or another adequate alternative (N=1).

Three respondents did not identify a reason that would lead them to the termination of the seafarer's career.

Figure 3. Distribution of the respondents' opinions on the term of maritime career after the completion of the studies

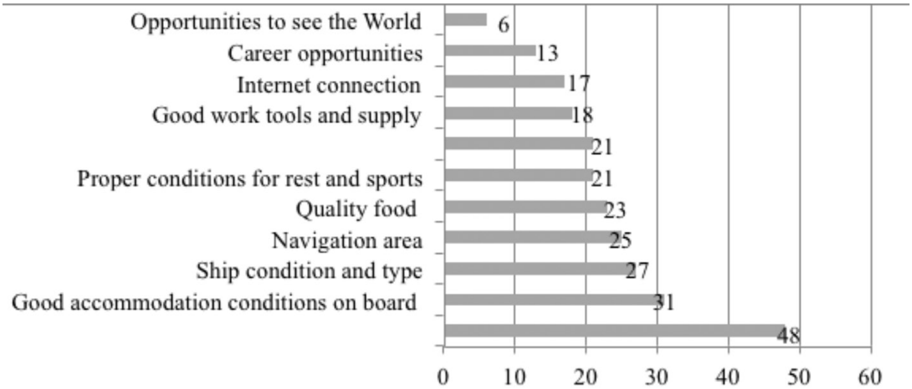


Maritime students' needs and expectations regarding desirable contract conditions

Maritime students (N=67) were asked to define, in their opinion, the best job offer. The most important factors defining a job offer as the best one were named salary (bigger, payable on time and adequate to the position held) (N=59) and shorter employment contracts (N=53). Most students, 41 percent expressed the opinion, that optimal voyage term would be 1-2 month, 33 percent named 2-3 month and 26 percent named 3-4 month voyage duration.

Maritime students were asked about other working/contract conditions (beside salary and term of voyage), which are important to their personally that would motivate them to work at sea. The most important working/contract conditions named by maritime students were (Fig.4).

Figure 4. **Maritime students' opinion about desirable working/ employment contract conditions (beside salary and term of voyage)**



Good relations between the members of the crew (48 respondents), good employment contract and accommodation conditions on board a ship (31 respondents); ship condition and type (27 respondents), navigation area (25 respondents), quality food (23 respondents), proper conditions for rest and sports, good reputation of the company and taking good care of employees (21 respondents in each category). As important working/contract conditions students named good work tools on board a ship and good supply. Internet connection and career opportunities were indicated as important as well.

Shipping and crewing companies experts opinion about working/employment contract conditions, most important for seafarers

The content analysis of the experts' opinions revealed that they believe that the following working/employment contract conditions are important to the seafarers and determine their decision to work in a company for a long period:

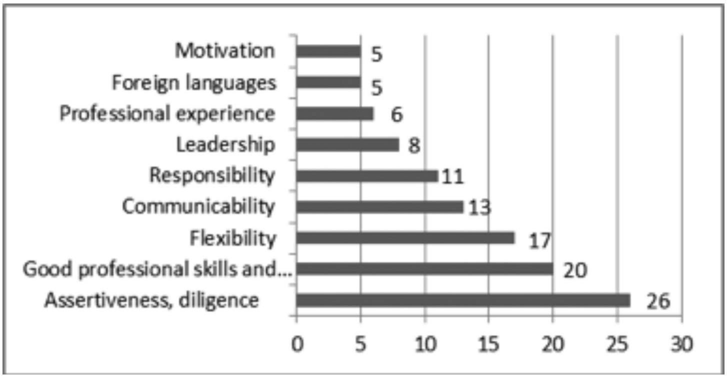
- Salary;
- Social security guarantees;
- Good reputation and reliability of the company;
- Policy of the company;
- Term of employment contract;
- Compliance of Employment contract to the laws;
- Career opportunities;
- Composition of crew (national);
- Navigation area;
- Good microclimate on board a ship and professional assistance of the crew.

Maritime students and experts opinions about seafarers' desired personal and/or professional characteristics

Maritime students and experts were asked in open question form about seafarers personal and/or professional characteristics, which determine their successful employment and career in a company. The results are presented in Fig. 5 and 6.

Figure 5. **Experts' opinions about seafarers' desired characteristics**

Figure 6. **Students' opinions about seafarers' desired characteristics**



Shipping and crewing companies' experts gave very similar responses to open question, indicating their very common approach to the question. All eight experts as most important for successful employment and career named: professional skills and training, responsibility and teamwork skills. Seven of them also noted communication skills, foreign languages, reliability and tolerance. Two of them as important named also the ability to adapt to the marine shipboard living and working monotony and physical health.

Students (N=67) as most important for successful employment and career named assertiveness and diligence (N=26) and good professional skills and knowledge (N=20). After that in descending order they identified flexibility (N=17) and communicability (N=13), responsibility (N=11), leadership (N=8), professional experience (N=6), foreign languages and motivation (N=5).

Some overlaps and differences in opinions of maritime students and shipping and crewing companies' experts were identified: both groups highly rated professional skills, attitude (assertiveness, diligence, responsibility) and communicability (teamwork, flexibility). Students as less important evaluated foreign languages and did not name reliability and tolerance, which were highly rated by the experts.

The impact of communication with older seafarers on the students' professional knowledge, skills and attitude

Maritime students were asked about the impact of communication with older seafarers' generations during seagoing practice on board a ship and their impact on the students' professional knowledge, skills and attitude to a seafarer's career (Tabl.1). Maritime students noted positive impact of communication with older seafarers' generations on their professional knowledge, on the motivation to seek a seafarer's career and help forming attitude on seafarer's career. Besides, students during the communication revealed negative aspects of seafarer's career, a phenomenon known as "learned helplessness" (Ljung & Widell, 2014).

Table 1. Maritime students answers about the impact of communication with older seafarers during seagoing practice on board a ship on their professional knowledge, skills and attitude to a seafarer's career

Given the professional knowledge	*Understood the specifics of the job (R7)* *Learnt things that helped to perform my assignments safer (R46)* *…how sth. Functions and how to do sth. Better (R53)* *…need Russian language skills (R57)*
Given the motivation to seek a seafarer's career	*Promising career opportunities (R17)* *Made a good impression, motivated to strive for career heights (R20)* *Motivated to study and go to work at sea, not to abandon seafarer's career (R9)*
Given help, forming attitude on seafarer's career	*Changed my attitude to performed work (R34)* *They changed my attitude to…(R43)* *I was advised to try to grasp a bigger picture (R27)* *Enabled to understand the real life of a seafarer (R23)* *I always tried to communicate with them not only about work, but also about life, they gave good pieces of advice (R58)* *Helped me to make up my mind on future career (R19)*
Revealed negative aspects of seafarer's career	*Hard and disadvantageous work, not worth doing due to low salaries (R67)* *There are no friend, everybody wants to harm each other (R53)* *If I find a job on shore, work at sea is not worth choosing it (R5)* *Most seafarers advised to continue studies and to work on shore (R40)* *To look for as short employment contracts as possible.…(R37)* *Dangerous work (R55)*

Conclusions

World maritime labour market, as a balance between seafarers demand and supply, represents complex set of interconnected phenomena and influenced by economical, demographical, geopolitical, technological and other factors.

Countries' participation in seafarers' supply gets through the number and qualification of seafarers. Seafarers supply depends on the national seafaring traditions (that can change), on the availability and capacity of the national maritime education and training (MET), on a motivating (or demotivating) factors such as the level of country's social welfare and national legislation in the field of seafarers taxation, and finally, of course it depends on the country's demographic potency.

Lately MET institutions and shipping industry admit new young seafarers' generation, called generation Z, those who were born during the middle 1990s and late 2000s. Characteristics of the generation Z vary by cultural and regional environment but are most impacted by technological development and generation Z can be defined as "instant online". The investigational model, presented in the article aimed to researches differences and overlaps between new seafarers' generation (Z) needs and career ambitions and expectations from side of ship owners, and their mutual conformity.

Qualitative research was conducted attracting experts from five shipping and crewing companies in Lithuania and three companies in Latvia and 67 final year maritime students. Meanwhile, the qualitative survey consisted of open-ended questions, which revealed main things that are important for settling the balance between the expectations and needs of shipping and crewing companies and young maritime sector specialists.

Answering about the best job offer most maritime students identified salary and short-term (1-2 month) voyages, which offer on the market is not so big. Beside salary and term of voyage, students and companies' experts, as the most important working/contract conditions, named good relations between the members of the crew, good reputation and reliability of the company, navigation area. Only students named as important ship's type and condition, good accommodation conditions on board a ship, quality food and proper conditions for rest and sports, internet connection. As important working/contract conditions students named also good work tools and good supply, but did not mention social security guarantees.

Analysing seafarers personal and/or professional characteristics, which determine their successful employment and career in a company, some overlaps and differences in opinions of maritime students and shipping and crewing companies' experts were identified: both groups highly rated professional skills and attitude (assertiveness, diligence, responsibility) and communicability (team work, flexibility). Students as less important evaluated foreign languages and did not name reliability and tolerance, which were highly rated by the experts.

Maritime students noted positive impact of communication with older seafarers on their professional knowledge, on the motivation to seek a seafarer's career and help forming attitude on seafarer's career. Besides, students during the communication revealed negative aspects of seafarer's career, a phenomenon known as "learned helplessness".

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Table des matières

Chapitre 2

Short sea shipping and hinterland container transport in the baltic sea area - Developments and competition

Chapitre 3

Unitized short sea shipping between Finland and Sweden: reasons of sluggish growth

Chapitre 4

Influence of the geopolitical situation on baltic sea region development

Chapitre 5

Chapitre 6

PARTIE 2 - Strategy & Perspective

Chapitre 7

Chapitre 11

Chapitre 12

PARTIE III - Human & Technology