Article

LEFlexi – A Way Forward for the Shipping Industry

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Abstract
This is a short article discussing the latest international efforts in making shipping more competitive. The challenges facing the industry are formidable and for some company particularly the smaller ones the future is bleaker than it has been in the last few years. The shipping companies are now expected to be leaner, more fuel efficient and have skills to seek finance as well as being au fait with latest trends in legislation. Logic dictates that a holistic approach is the safest bet. The approach requires applying well tested lean techniques in making the shipping operational more effective and efficient and at the same time find means of reducing fuel consumption and the resultant harmful emissions such as GHS and CO2 etc. and specifically particularly carcinogenic particulates.

Introduction
The introductory report contains the information obtained by seeking permission from C4FF and is based on Sahayam and Ziarati (2014) report; this report formed part of the research carreid out by Norra Brinthici Vernon Sahayam for her Master studies, supervised by Coventry Univesrity and C4FF under the aupics of Professor Ziarati based at C4FF.

European Union and its Member States have a strong preference for a global approach to reducing GHG emissions from international shipping led by the International Maritime Organization (IMO).

From Second IMO GHG study in 2009 MEPC 59 came to the following main conclusions which are as follows:

Exhaust gases are the primary source of emissions from ships. In terms of quantity and of global warming potential, CO2 was the most important GHG than other GHG emissions from ships.
International shipping was estimated to have emitted 870 million tonnes or about 2.7% of global emissions of CO2 in 2007.In the absence of regulations, ships emissions could grow by 200% to 300% by the year 2050 as a result of expected growth in world trade.(IMO 2013)

A significant potential strategy for reducing GHG emissions from global marine shipping can be broken into three categories: operational changes that reduce fuel consumption, technological advances that improve ship fuel efficiency, and alternative fuels with lower net lifecycle GHG emissions.

These cost effective measures together if implemented could increase efficiency and reduce emissions rate by 25% to 75% below the current levels. However, the international discussions have yet to bring agreement on global MBMs or other instruments that would cut GHG emissions from the international maritime transport sector as a whole, including existing ships.

The study also found that, by 2020, an average of 151.5 million tonnes of annual CO2 reductions are estimated from the introduction of the measures and by 2030 it will increase to 330 million tonnes annually leading to significant reduction in fuel consumption and saving of fuel costs in shipping industry.(IMO 2013a)

Industry Structure and Statistical Evaluation
The average size of ship building companies differs strongly per region. In Europe 10% of largest companies represent 92% of turnover which are characterized by large number of SMEs and few large companies. The average size of the companies is largest in China compared with that of Europe.(EC 2013a)

Marine equipment is highly internationally oriented .Europe exports 46% of marine equipment which is much higher than South Korea (10%) and Japan (25%).
In terms of Labour productivity the countries such as Korea, Japan and Europe shows a similar pattern which is about €40,000 value-added per person employed in the shipyards. A high concentration is observed, at the buyer side in Europe whereas the shipyards are strongly dominated by Asia. This confirms high international character of ship building of Europe.

According to this basic evaluation, the size of the world market for marine supplies is estimated to be 61 billion Euros. Japan, Korea and Germany are dominated by merchant shipbuilding where many companies like TRANSAS etc ,offers products for all three dominant markets which gives us a fair idea on the estimation of world market size. Very high market values of USA, Norway and UK are predominantly caused by offshore markets and navy.(EC 2013a)

Labour costs typically account for some 20% of the overall costs. Europe clearly shows higher labour costs in comparison to its Asian competitors. R&D is important for shipbuilding in Europe which focuses on relatively complex, high value ships shows high ratios as well. (EC 2013a)

Regulations for Emissions –IMO
International shipping is a heavily regulated industry. Key environmental regulations coming into force in this decade address emissions of sulphur oxides (SOX), nitrous oxides (NOX), particulate matter (PM) and greenhouse gases (in particular CO2), as well as ballast water management .
The IMO, being the main regulatory body for shipping, has, in recent years, devoted significant time and effort in order to regulate shipping energy efficiency and thereby control the marine emissions.

The MARPOL Convention remains the most important international treaty instrument covering the prevention of pollution by ships by setting regulations for the pollution of ships.(EC 2013).

The IMO commissioned study entitled "**Assessment of IMO Mandaded Energy Efficiency Measures for International Shipping**" (November 2011) made a progress by adopting the following:

- **The Energy Efficiency Design Index (EEDI),** which sets compulsory energy efficiency standards for new ships
- **The Energy Efficiency Operational Index (EEOI);**
- **The Ship Energy Efficiency Management Plan (SEEMP)** ; a management tool for ship owners

This entered into force on January 1, 2013 within a new Chapter 4 of MARPOL Annex VI. This also includes the use of global market-based measures (MBMs). Even stricter sulphur requirements will enter into force for specific sea areas in 2015 and globally in 2020 as shown in the **below figure 1**:

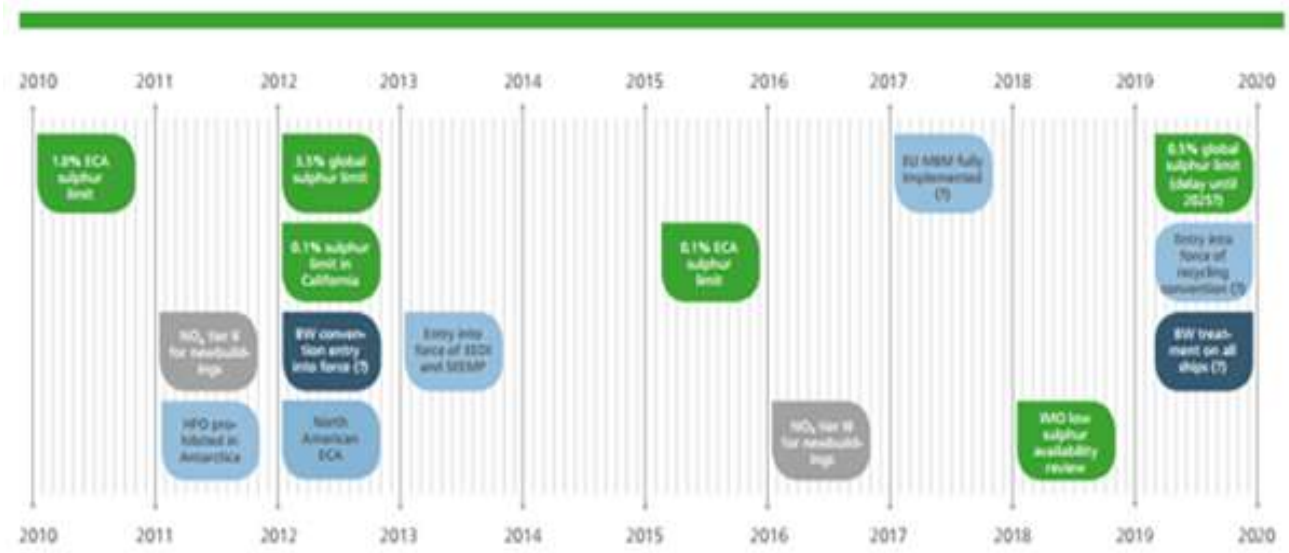

Figure 1: Upcoming maritime regulations Source : DNVNL 2013

At MEPC 63 in March 2012, the IMO Guidelines relating to these Regulations were adopted under the following resolutions:

- Resolution MEPC.212(63) – 2012 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships;
- Resolution MEPC.213(63) – 2012 Guidelines for the Development of a Ship Energy Efficiency Management Plan (SEEMP);
- Resolution MEPC.214(63) – 2012 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI);
- Resolution MEPC.215(63) –Guidelines for Calculation of Reference Lines for use with the Energy Efficiency Design Index (EEDI); (Marifuture 2013)

The EEDI will only affect new ships above 400 gross tonnes* and will be applicable to the following ship types:
Bulk carriers; Gas carriers; Tankers; Container ships; General cargo ships; Refrigerated cargo ships; Combination carriers; Passenger ships**; Ro-Ro cargo ships** (including vehicle carriers); and Ro-Ro passenger ships**
*Excludes ships with steam turbine, diesel-electric and hybrid propulsion.
** Not initially subject to regulatory limits.

The main changes are a progressive reduction in SOX emissions from ships, with the global sulphur cap reduced initially to 3.50% (from the current 4.50%), effective from 1 January 2012; then progressively to 0.50 %, effective from 1 January 2020, subject to a feasibility review to be completed no later than 2018.

The limits applicable in **Sulphur Emission Control Areas (SECAs)** have been reduced to 1.00% since 1 July 2010 (from the previous 1.50 %); being further reduced to 0.10 %, effective from 1 January 2015. (DNVNL 2013)

Progressive reductions in NOX emissions from marine engines were also agreed, with the most stringent controls on so-called "**Tier III" engines**, i.e. those installed on ships constructed on or after 1 January 2016, operating in **Emission Control Areas (ECA)** as shown in the below figure2 .

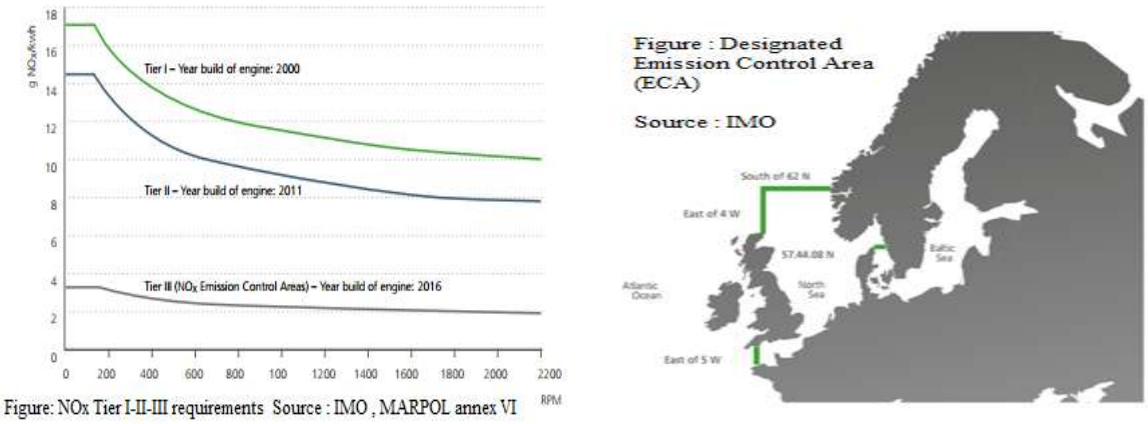

Figure: NOx Tier I-II-III requirements Source : IMO , MARPOL annex VI

Figure 2. Tier I-II-III requirements and Designated Emission Control Area (ECA) Source :IMO 2013

According to IMO, there has been a tenfold increase in the number of vessels using the Northern Sea route during recent years, with 46 ships recorded in 2012, compared with 34 in 2011 and only four in 2010.

Potential new trading routes are identified that brings environmental protection; one area that is being keenly watched in this respect is the Arctic. In recognition of the shift in traffic to these inhospitable regions, the IMO has been proactively working to establish a **Polar Code** as well.(IMO 2013)

Technology Outlook
CO2 regulations were first formally adopted by IMO in 2011which comprises of EEDI and SEEMP and it entered into force by 2013. These measures are different from that of other abatement technologies which fulfils two purposes. They help in reduction of fuel consumption and not emission directly and they are potentially cost effective.(IMO 2013a)

Several measures are also been taken into consideration in reducing the SOX , NOX emissions as well along with the CO2 emissions. Several technological measures will be increasingly used in the coming years and they are categorised into four groups:

- Reduction in ship resistance
- Increase in propulsive efficiency
- Increase in power production efficiency
- Reduction in auxiliary consumption

The below diagram list some maritime technologies and their relevant motivating regulations:

		MOTIVATING REGULATION						
TECHNICAL MEASURE	POSSIBLE FOR RETROFIT	SECA 1%S	SECA 0.1%S	GLOBAL 0.5%S	NO_x TIER III	EEDI	ENERGY EFFICIENCY	BALLAST WATER
Low sulphur heavy fuel oil								
SO_x scrubber								
Distillate fuel								
Pure LNG engine						20 %		
Dual-fuel engine						20 %		
Exhaust gas recirculation								
Selective catalytic reduction								
Propulsion efficiency devices						2 %		
Waste heat recovery						4 %		
Shaft generators						0-1%		
Hull shape optimisation						5 %		
Contra-rotating propulsion						4 %		
Air cushion						6 %		
Wind power						2 %		
Smaller engine/de-rating (speed reduction)						10 %		
System efficiency improvement								
Hybrid propulsion system								
Ballast Water Treatment System								
Water injection	Considered, but not selected due to limited impact/effect							
Water in fuel								
Low NO_x tuning								
Lightweight constructions								
Reduction of seawater ballast capacity								

Figure 3: Maritime Technologies and Relevant Regulations Source :DNVNL 2013

LEFlexi

LEFlexi refers to Lean, Efficient and Flexible. This article suumarises the latest international efforts in making shipping more competitive focussing on ship fuel efficiency and the need for reducing ship harmful emissions particularly considering the expanding ECA areas.

The challenges facing the industry are formidable and for some company particularly the smaller ones the future is bleaker than it has been in the last few years. Shipping companies are now expected to be leaner, more fuel efficient and have skills to seek finance and be au fait with latest trends in legislations. Logic dictates that a holistic approach is the safest bet. The approach requires applying well tested lean techniques in making the shipping operations more effective and efficient and at the same time find means of reducing fuel consumption and the resultant harmful emissions such as GHS and CO2, etc. and specifically carcinogenic particulates. The key challenges facing the shipping industry are:

1. the ability to read the market trends, understanding of recent legislations and their impact on shipping business, ability to raise finance and have the means to make the support, operation and management as lean as feasible without sacrificing safety and operational quality. In parallel it is crucial that the ship owners would make sure that they run their ships as efficiently as possible particularly with regard to IMO guidelines and indexes such as the Ship Energy Efficiency Management Plan (SEEMP), Energy Efficiency Operational Index (EEOI) and the EEDI Energy Efficiency Design Index and

2. the expansion of he ECA areas hence the engine efficiency efforts should go hand-in-hand with reducing the harmful and known ship pollutants particularly GHS, and diesel fuel particulates some are which are known to be carcinogenic. What has become significant in recent years is the notion of the fuel flexibility that is putting a greater emphasis on ability of ships to burn different quality and type of fuels, and in ECA areas the ability to reduce engine emissions to significantly lower levels.

The Challenges facing the shipping industry

A review of current business clearly shows that the secret of success is 'looking into future' and keeping a close eye on the legislation particularly with regard to manning issues and engine emissions. Therefore while Safety and Security will remain key issues, environmental aspects will gain, if not more, equal significance.

A review of recent publications (Lloyd's Register, Life Matters, June 2012) and the IMO's own reports (Marine Environmental Protection Committee (MEPC), 64 session, Agenda item 4, 29th June 2012) and similar reports by learnt societies and classification societies and maritime organisations give a clear view of the roadmap for reducing the marine engine emissions in particular in the near future. The whole of Central and North America coastal areas are now almost an ECA (Emission Control Area) and it is expected that coasts of Mexico, Alaska and the Great lakes, Singapore, Hong Kong, Korea, Australia, Black Sea, Mediterranean Sea and Tokyo bay are currently considering becoming ECAs. What is significant is that these constitute 90% of shipping routes so the implications are serious.

The IMO has devoted significant time and effort in order to regulate shipping energy efficiency and thereby control the marine emissions in addition to EEDI also the Energy Efficiency Operational Index (EEOI) and the Ship Energy Efficiency Management Plan (SEEMP). The Regulations on Energy Efficiency relating to the EEDI and SEEMP entered into force on 1st January 2013 within a new Chapter 4 of MARPOL Annex VI. Within the regulations, there remains the option for administrations to adopt a waiver up to 4 years from the entry-into-force criteria.

It is important to note that the IMO has also been working on a number of Market-Based Measures (MBMs) for the marine industry. The MBMs' development is still ongoing and EEDI is only one of several these emerging.

Opportunities and threats for the industry

Shipping is a global business and opportunities and threats are often appear hand-in-hand. There are so many opportunities and threats. The greatest threat to shipping is competitiveness and greatest opportunities are new good practices and technologies that can help the industry to become more competitive. Applications of 'Lean' techniques and policy deployment approaches have been known in the aerospace and automotive industries for some time but are relatively new in the shipping industry. Lean is an opportunity that needs to be harnessed as it is about the use of resources in most effective (doing the right things) and efficient (doing things right). The EEDI can be seen as a threat and an opportunity. It is pertinent to remember that this the first time an international piece of legislation (EEDI) has been introduced with far reaching consequences for the shipping industry.

Innovation in shipping

Innovation is about 'doing business not as usual' (Ziarati, 1995). You have to put yourself out of the box sometimes and not to rely on conventional wisdom only. Shipping is story of globalisation and efficient, reliable trade over many years and is littered with innovative advances in technology, efficiency and new business models. So what happens next and where should a company focus its efforts in the future? The future in my view is innovation, specifically through maximisation and optimisation. Developing future maps for the companies and identifying the resources needed. Then to seek knowledge need to build expectation and create opportunities for the business. We need to see into the future and assess demand for ships and shipping services. It is important to project into the future and studies trends. The many researcher who are predicting trends in shipping.

Lean Management Techniques

It is believed that one of the most important tools for the efficient management of the business as well as its succession to next generation is the employment of lean management techniques. This may overcome problematic issues such as gender and sibling rivalry by setting logical steps to follow.

The set of all specific actions required to bring a specific product through the three critical management tasks of any business:

- Problem solving
- Information management
- Physical transformation

Management of these value streams – value stream management – involves a process for measuring, understanding, and improving the flow and interactions of all the associated tasks to keep the cost, service, and quality of a company's product and services as competitive as possible (Keyte and Locher, 2004).

A lean enterprise is market driven and customer oriented, which means the company must design its future state to meet the needs of the market in an effective end efficient manner. To this end, a company must challenge all current business practices and improve them by implementing lean principles and practices. One of the key concepts of lean thinking is systematically eliminating waste during a lean implementation.

From this point of view, lean office management becomes the focal point of any family business especially for those working in the maritime transportation sector which main production line is the office itself. Most of the siblings, cousins and in-laws would like to take responsibilities in the office as managers without considering their background and skills for the respective position.

One premise of Hoshin Kanri is that people who are charged with executing a plan should participate in the planning process itself (Akao, 2001). The objective is to obtain alignment among all participating factions, and focus the business as a coherent whole system on its core objectives. Achieving this goal means that a company's management team must have the ability, desire, and means to communicate, cooperate, and integrate its planning process with the entire business structure.

Lean enterprise is a philosophy that focuses on using continuous improvement to eliminate non-value-adding activities in a company's own production facilities. Lean enterprise refines the control of time throughout all business functions by eliminating obstacles to the flow of material and information. The most famous of these obstacles are the ''seven deadly wastes'' of overproduction, transportation, waiting, inventory, defects, over processing, and unnecessary movement (Jackson, 2006). All these obstacles are very important for the successful shipping business but if these wastes are occurring due to misplacement then it becomes a real challenge to eliminate them.

Value stream management is not just a management tool; it is a proven process for planning the improvements that will allow a company to become lean. The key ingredient in this recipe is the involvement of people throughout the process (Tapping and Shuker, 2003). As long as the involvement of whole people working in the company is provided and maintained through a solid leadership, initial steps will be easily achieved to gain the competitive advantage in the business.

Conclusions

According to the generally accepted principles of financial management, the ultimate objective of the financial function is to maximize the value of the company's stock in terms of the market price. It is important not to lose sight of the challenges facing the shipping industry. The companies which will do whatever necessary to remain solvent and competitive are the ones that will have the greatest change of survival. Concept of lean practices applied in other industries should be taken seriously by the shipping industry as it deals with avoiding waste in the system. There are now new developments such as Lean Optimal (Ziarati, 2013) which not only identifies waste, it predicts waste and offers opportunity to prevent waste in a proactive manner. It is also important for family businesses to separate their business affairs from their family affairs and bring in people from the outside of the family to support their business activities.

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