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Maritime sector has always been influencing the global economy. Shipping facilitates the bulk transportation of raw material, oil and gas products, food and manufactured goods across international borders. Shipping is truly global in nature and it can easily be said that without shipping, the intercontinental trade of commodities would come to a standstill.

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Abstract

The shipping sector faces unprecedented challenges from regulatory regimes to meet ambitious and zealous environmental objectives. Given its global scale, there is a need to bring in a voice of reason on what is achievable and how to go about it from those that will eventually be tasked to actually implement these goals. The challenge is therefore to innovate to bring in better efficiency. Such innovation promises much needed reduction in industry’s carbon footprints creating a convergence of environmental goals with commercial incentives.

The question will be whether the investment in such innovation be worth the combined savings in fuel and environmental costs. And how can the industry manage these global diversities of expectations and contradictions?

**Key Words:** Regulatory Compliance, Green Shipping, Technology, Innovation.
UNDERSTANDING THE NEXUS:

1. INNOVATION AND TECHNOLOGY ADVANCEMENT:

Technology stems from the acquisition of new knowledge and is as a result of scientific enquiry. Technological change today is among the most prominent of all things that can change the rules of competition. The companies that apply competitive strategies like differentiation through technology usage, market focus and competitor analysis are more likely to be high performers (Porter, 2004; Panayides 2003).

Jenssen (2003) affirms that in the face of aggressive competition from low-cost economies in Asia, it is imperative for high-cost countries like Norway, to build their competitiveness in most industries, including shipping, on innovation and knowledge-intensive products to create distinctive competitive advantages that are difficult to imitate.

Lorange (2001) when speaking of strategic re-thinking in shipping companies cites many examples of Nordic owned tonnage companies that embark on technological innovations as they move from pioneering a concept to rapid expansion and there-by be world leaders.

The MARSIKT (2000) is a research and development project funded by the Norwegian Ship Owners Association. Its main objective is “To improve the competitiveness of the Norwegian maritime sector by developing new technology and new forms of organisation, focusing on shipping companies’ commercial and technical operations.”

Innovation hence, is an effort to create something new, to create differentiation through technology, and is thus an ‘economic objective’. The slow and selective diffusion of technological innovations then becomes a source of competitive advantage over a strategically significant time span. The advantage obtained by being an early adopter is cumulative because early adopters add to their advantage by making additional adoptions before many competitors have made their first adoption of the new technology.
2. TECHNOLOGY ADVANCEMENT, SAFETY AND ENVIRONMENT PROTECTION:

Shipping is a high asset value industry. Failure of either a technological or a human kind, causing a single marine accident, carries the risk to cause damage to property, loss of life and pollution of the environment on a scale that is unlikely to be equalled in any other sector of industry and almost certainly in no other mode of cargo transport.

It was originally considered that the optimum ship was simply the most profitable one, and that in the long run, competitive markets would ensure that this would be that with the lowest costs. However, in maritime transport, as elsewhere, there has been an increasing concern with safety and the protection of the environment. Following several well publicised disasters, this economic approach has been extended to maritime safety and environment protection in general, which has to be factored in beyond the lowest cost principle and as value-added services.

A firm creates value for its customers and returns for itself by offering better perceived quality in any differentiated feature for which customers are willing to pay a premium (Hambrick and Fredrickson, 2001). Value creation is the raison d’être for firms (Woiceshyn and Falkenberg, 2008); and whenever technology can be shown to give greatly improved safety and environmental protection at an affordable cost there will be inevitable pressure for its introduction.

While acknowledging the inevitability of technological advancements, its uptake in shipping is seen to be driven predominantly by (a) new regulations in the aid of enhancement of safety and environment protection and (b) the need to be competitive. However, the economic logic of low costs underpins every technology change decision, be it a reactive compliance ideology or a more proactive stance of value creation in enabling vessel operation to be more efficient.

At the same time, there are expectations that the industry will be ever greener, ever safer and ever more efficient and it is the role of innovative shipping company to satisfy them all and at the same time to remain economically viable. As Peter Drucker (2007) the famous management guru puts it, “The first duty of business is to survive and the
guiding principle of business economics is not the maximisation of profits, it is the avoidance of loss.”

3. INDUSTRY APPREHENSIONS:

However, there are serious apprehensions within the industry! For example, some noting from the author’s earlier research (Bhardwaj, 2013) on similar topics reveal,

Progress however gets hampered by the question of ‘who should pay’ for these investments and there was a need to provide evidence of payback from innovations. Perhaps, those offering devices or improvements to efficiency might consider financing these on a ‘no cure, no pay’ basis. (A)

Regulatory changes were still not always clear and industry generally is anxious not to be taken down ‘a blind alley’ on a range of regulation based technical changes that owners must be taking on-board. For example, where is there any proper impact assessment data to justify the regulation demand? (B)

What seemed to emerge from research findings was that while the ship’s staff to an extent welcomed the considered increase in safety and environment protection, probably because it concerned their own selves more, the companies were seen to be reticent about its need and cost implications, even apprehending safety used as ploy to push in more technology.

The interviews therefore indicated that technology integration was largely because of a reactive stance to regulatory or customers’ directive compliance rather than a proactive initiative that often gets marred in the myopic view on cost-benefit analysis by the decision makers.

There was thus a need for a responsible compliance regime that would assess all risks and its cost-effectiveness prior mandating requirements.

4. REGULATION DRIVEN COMPLIANCE CULTURE – REGULATION OF TECHNOLOGY:
There is an established leading theory of regulatory politics, that concentrated industry groups could capture regulation and bend it to serve their own interests (Wiener, 2004). These suppliers put up a barrage of prominent eye-catching graphics extolling the virtues of technology and it takes a while to scratch beneath the surface to discover a slightly less enthusiastic take on the matter with self-serving objectives.

In a global scenario like that of shipping, one fall-out is that if the technology move is costly, the economically advanced countries that regulate first, take the lead in selling new technologies to countries that follow. It is often reported that it is this club of economically advanced countries and the body of technology suppliers through their country representatives at the IMO, dominate the proceedings in pushing the technology agenda. Often this is done behind the shield of safety enhancement and green shipping that finds appeal and ready buy-in.

In the global context, the policy making is seen to get politicised with a self-serving agenda of the constituent members of policy making bodies belaying the notions of any common good for the industry. The issue, particularly in safety-critical industry like shipping becomes that the dividing line between social regulation on health, safety, environment and economic regulation of technology gets blurred when technology is passed off as enhancing safety. The regulation of technology follows the leading theory of interests lobbying to shield business profits. The theory that it is the subgroups of the industry that drive technology in the garb of social regulation on safety, health and environment, do so to serve their own parochial advantage by raising rival firms’ cost, endures (Wiener, 2004).

Stiglitz (2006) has argued that the developed world has carefully crafted laws which give innovators the exclusive right to their innovations and the profits that flow from them. In cases like pharmaceutical industries the costs go beyond money when access is denied to affordable lifesaving drugs and highly profiteering companies researching on lifestyle drugs rather than lifesaving drugs simply because the poor cannot afford to pay for the drugs. RandD intensity defined as the ratio of RandD expenditure to GDP is an important determinant of innovation. This is in excess of 4% in OECD countries.
with USA alone accounting for 41% in the OECD area gross domestic expenditure in 2009 (Dumont et al. 2011, OECD, 2011).

5. MANAGING CONTRADICTIONS:

Having clarified the nexus of Innovation-Technology-Regulatory Regime-Green shipping, one can now move to the issue of managing the contradictions.

Since this industry is driven by regulatory regimes, it thus calls for exercising care and caution in framing regulations. Indeed, there can be more imaginative ways of rulemaking. There is a need to move from Regulation of Technology to Technology of Regulation.

Different regulatory mechanisms do exist, like performance standards, management system requirements, taxes and incentives, tradable allowances, information disclosure, etc. that can affect differently and influence consequences. Thus, for example, a technology requirement approach may turn out to be less effective at stimulating technology change than a performance standard or tradable allowance as in carbon emissions. If say scrubbers were mandated for washing off the sulphur-di-oxide emissions prior to its release to atmosphere, firms would have lesser incentives to invent better methods. The Goal Based Standards (GBS) approach now being adopted by the IMO is one such example where the IMO would state what has to be achieved, leaving classification societies and ship designers the freedom to decide how best to employ their professional skills to meet the requirements.

Another major development is the regulatory impact assessments to forecast the impacts of new regulations before their enactment through Formal Safety Assessment (FSA) thus encouraging regulatory innovation in testing alternate designs of technology and regulation and selecting the best. The IMO is seen to be adopting this of late that promises enabling balance between various technical and operation issues, including the human element and between safety and costs. However, as yet there are few empirical investigations of actual impacts sighted.
A strategy much used particularly in the area of environment protection is technology forcing, where the regulator specifies a standard that cannot be met with existing technology, or at least not at an acceptable cost (Gerard and Lave, 2005). The intent is to elicit advances in technology and force firms to invest in R&D, whereas firms want regulators to delay or relax standards. The outcome of such conflicts then determines the rate of technological innovation and its diffusion. This option may enjoy more political support than others like gasoline taxes. The IMO in its efforts towards mandatory energy efficiency measures for international shipping is seen to embrace this approach with its Energy Efficiency Design Index (EEDI) for new ships along with its set of guidelines. A more tempered approach is with the Ship Energy Efficiency Management Plan (SEEMP) that uses the management system approach and provides a mechanism for operators to improve their energy efficiency of ships over time.

Social rules, practices and standards of accountability characterise an industry at any given time and have as significant an impact on safety and environmental protection as traditional command-and-control regulations by the State that rest on tacit assumption that government regulations are the only source of accountability. Self-regulation is in fact a notable trait of professional organisations.

In the maritime industry, it was the insurance sector that created the classification societies as a way to reduce uncertainty and to manage marine risk. Many classification societies have now assumed statutory functions on behalf of flag states thus blurring the distinction between intermediary institution and a system of self-governance. Abrasions in as much as lowering of standards have been noticed though, because classification societies are not monopolistic and have competitive practices, a trend noted in times of sluggish demand for ships when ship owners in a bid to cut operating expenses engaged in ‘class hopping’. Also, a case in point was the use of high tensile steel and poor design produced by shipyards that led to a number of bulk carrier losses in the mid-80s (ABS, 1992; Intercargo, 1995). However, it is notable that the marine system of governance has displayed a surprising ability to address its own institutional failures in a timely manner. Marine insurers being institutional counterparts to classification societies, could force ship owners to be registered with reputable classification societies to obtain adequate insurance and a superimposed system of self-governance in IACS came to be exercised (Furger, 1997). IACS adopted developing
Common Structural Rules (CSR) to remove variations and achieve consistency, and further to be incompliance with IMO's Goal Based Standards. This changes the *century-long practice* of independent classification rule making and also marks a significant step taken by IMO, as it has never been involved in the past in the detailed convention requirements for the structures of the ships (Kim, 2005). The IACS press release of 2nd July 2012 confirms the placing of draft IACS harmonised CSR on its website and states that the harmonisation project is also set out to achieve full compliance with the IMO's GBS which comes into force in the middle of 2016 (IACS, 2012).

The regulatory framework in the shipping industry in practice extends much beyond the IMO and flag states. The fragmentation of the industry and the range of organisations and decision-making structures involved can be illustrated by the typical example of a German owned ship flying a Panama flag, manned by Indian officers and Filipino crew carrying Saudi crude oil to Japan. The ship may be classed with the Norwegian classification society, have her hull and machinery insurance placed in London and her cargo insurance in Paris.

With such a multitude of stakeholders of different nationalities, the regulation of the shipping industry is inevitably complex. There are then intra- and inter-organisational relationships within and among the various members of the global maritime community. These intermediary organisations also interact to form both systems of self-governance and private systems of governance. Examples are the International Association of Classification Societies (IACS), International Association of Independent Tanker Owners (INTERTANKO), International Association of Dry Cargo Ship Owners (INTERCARGO), etc. Porter (1995) points out that INTERTANKO is a good example of *self-governance* where membership is subject to a number of requirements, and members found not in compliance may be expelled from the association. Classification Societies, Marine Insurance companies and Protection and Indemnity (P&I Clubs, who are concerned with safety of crew and integrity of cargo), also have the ability to set standards of accountability among ship owners and ship operators (Fueger, 1997).

In summary, in a global shipping environment with fragmented structures of organisation and split incentives for number of stakeholders in a venture, if regulation,
as it strongly emerges, is to be the basic means of driving technology uptake, then it is calls for far more caution and imagination in its making and its implementation.

6. POLICY RECOMMENDATIONS:

A responsible and risk-assessed regime of regulatory and customer requirements is thus seen to be the key driver in enhanced technology integration in modern ship management practices. If the potentials are there as seen to be, then it needs the attention of the policy makers’ like the IMO, Maritime Administrations, Classification societies and industry organisations like Oil Companies International Marine Forum (OCIMF) and Society of International Gas Tankers and Terminal Operators (SIGTTO). What is fundamentally lacking is policy entrepreneurship that will encourage policy innovators who will develop and test new forms and approaches to regulation for greater effectiveness, less caustic side-effects, even less cost and promote other desirable attributes. Regulatory design should be about consequences – what works, how much, with what costs and side effects compared to the available alternatives. The influence of regulation on technology is complex and as Wiener (2004) puts it, depends on the “technology of regulation” that aids governance - the actual design of instruments of enforcement.

There is thus a need for the rules to become more performance based with defined outcomes, rather than set technological solutions in a prescriptive format. This would also allay the view that it tacitly supports influence of commercial players in the adaptation of technology. Prescriptive regulations tend to be a distillation of experience and as such become less and less relevant over time. It is the innovator that is best placed to ensure the safety of design rather than the regulator. Care should also be taken to see that the additional regulations do not add to the administrative burdens on the ships’ crew and calls for a user-centric approach in even designing of regulation in as much as the design and implementation of technology integrated practices. The user-centric approach puts employees in the centre where they play an active role in identifying potentials for rethinking of business regulation and how burdensome experiences can be reduced (DMA, 2011).

Lastly, all the gaps stem from a lack of synergy between research and practice that results in the practitioners insufficiently aware of relevant research and at the same time
research tends to be not sufficiently informed by the body of knowledge gained from practices. In the shipping domain, particularly, there is a need to develop methods and tools to more effectively leverage the knowledge and insights gained from practice and improve the cross-dialogue between research and practice.

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