CREATING SHARED VALUE WITH ECO-EFFICIENT AND GREEN CHEMICAL SYSTEMS IN SHIP OPERATIONS AND IN BALLAST WATER MANAGEMENT

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ABSTRACT

Green systems in ship operations and in ballast water management are needed to enhance marine sustainability. There is a challenging debate between regulators and the shipping business over the pragmatism of forthcoming environmental legislation. This is an overview study of arguments over the sustainability transition to actual 'shared value' growth of global stakeholders. Re-ballasting in the high seas currently provides the best-available measure to reduce transfer risk of harmful aquatic organisms, but is subject to serious ship-safety and other practical and financial concerns. Corporate Social Responsibility (CSR) strategy could assist the shipping sector in tackling operational issues, re-conceiving innovative methods, despite global financial crisis. According to European Commission's renewed strategy on Corporate Social Responsibility for 2011-2014, enterprises should integrate social, environmental, ethical and consumer concerns into their business operations, shifting focus from "values" to "value" (from a morals-driven to a business-driven approach). At a global scale the issue at stake is how to maximize the creation of shared value (CSV) for the marine business, stakeholders and society at large**.** In times of serious downturn, shipping may endorse shared value solutions, linking eco-efficiency in ship treatment operations (e.g. discharges of wastewater and ballast water), with strategic social partnerships. Aligned to its economic and environmental objectives, the industry may support scientific research and development of alternative treatment systems that serve local communities & emerging societal needs e.g. water shortage. The shipping community could proactively lead social progress, beyond regulatory and administrative global efforts, as a collective effective response to global sustainable growth.

KEYWORDS: CSR, Create Shared Value (CSV), sustainability, shipping, chemical, ballast water treatment (BWT).

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1. INTRODUCTION

The United Nations Ballast Water Management Convention is expected to come into force, seriously affecting the shipping business at a time of global economic and resource crisis. Corporate Social Responsibility (CSR) requires that a company is proactive beyond its legal obligations, aiming to fulfill ethical drivers. The Creation of Shared Value (CSV) concept, a new theory on CSR that justifies voluntary and socially responsible action, shifts focus from CSR peripheral moral-driven & ethical valued mindset, to a core business-driven strategic approach of sustainable performance, promoting value creation from shipping operations as an advanced response to stakeholders' expectations and society at large.

This study discusses the possible implementation of CSV concept in the shipping industry, with relation to shipboard ballast and waste water treatment against forthcoming regulatory changes. An overview of options will be cited after a critical analysis of scientific and professional literature, including advanced views of classification societies, shipping associations, practitioners and academics. The above alternatives and concerns will be reinforced with empirical data and arguments collected through sampled interviews and a confidential survey of shipmanagers, regarding ballast water treatment systems with chemical and other methods.

Main aim and objectives of this study are to consider inter-related multi-disciplinary parameters, focusing on the business impact of BWT forthcoming regulation and to elaborate on possible practical problems and alternative proposals of proactive and feasible societal value for the shipping industry.

The paper concludes that ocean shipping companies have the opportunity to support and invest in scientific research of alternative BWT solutions not sufficiently explored e.g. ballast free ship-design or ballast tanks filled with either fresh or recycled (industrial processed) water, port based water treatment, either ashore or on specialized floating vessels. A collective industry response is of paramount importance to societal concerns i.e. water shortage, through viable shared value solutions that are aligned to the sectors economic and environmental objectives. The shipping community could lead social progress, by creating shared (economic, environmental and social value), beyond regulatory and administrative global efforts.

2. CREATING SHARED VALUE, AS A DRIVER FOR SUSTAINABLE PERFORMANCE IN THE SHIPPING INDUSTRY

A strategic approach to Corporate Social Responsibility (CSR) as a fully measured, integrated and evaluated management system, [1] becomes increasingly important to a company's competitiveness in terms of obtaining value from integrating ESG factors (Environmental, Social, Governance) into key processes. CSR addresses improved performance benefits in risk management, cost savings, access to capital, customer satisfaction, retention of talented human resources and innovation capacity. At a global scale, an innovative academic perspective of CSR was sought in January 2011 by Porter and Kramer [2] on the Creation of Shared Value (CSV), a concept that urges corporations owners/shareholders to maximize their business, by using their skills, resources and management capability to advance the economic, environmental and societal conditions in communities in which they operate with radical and systemic sustainability transition changes. What differentiates CSV is that current and future societal needs have to be addressed, expanding conventional CSR practices on redistribution of corporate profit, by effectively expanding company’s values in their supply chain with initiatives of societal and economic value [3]. Social awareness and commitment of leaders, employees and citizens is now widely required over the increased scarcity of natural resources, in finding new ways of serving the markets, wasting less resources and still being productive and profitable. Shared value pioneers are those that openly discover opportunities and join efforts to enhance a cluster’s infrastructure with collective partnerships or form social entrepreneurship schemes, in order to share the cost, skills and risk. The CSV concept successfully blurs the notion of for-profit and non-profit organizations, introducing hybrid social enterprises. An example is *Water-Wealth International*, where investors, like the socially focused Acumen Fund, World Bank and Dow Chemical’s venture fund, formed a fast growing, for profit enterprise that uses innovative water purification techniques to distribute clean water at minimum cost, to more than one million citizens of Ghana, India and the Philippines. Another hybrid example is *Waste Concern* (Lions Club with UNDP) that initiated collection of trash in Bangladesh, improving the citizens’ health, while earning a substantial gross margin through fertilizer sales and carbon credits [2].

Similar new elements were introduced in the European strategy in order to encourage and extend the impact of corporate social responsibility. According to European Commission’s Renewed strategy on CSR (Corporate Social Responsibility) for 2011-2014 [COM (2011) 681] [4] enterprises should implement & integrate social, environmental, ethical and consumer concerns into their business operations and core strategy in cooperation with their stakeholders. This Renewed EU Strategy on CSR, initiates the need to create shared value with a shift from “values” to “value” (from a morals-driven to a business-driven approach) and recognized that the further development of CSR requires new skills as well as changes in values and cultural behaviour. Member States can play an important role by encouraging education establishments to integrate CSR, sustainable development and responsible citizenship into relevant education curricula, including at secondary school and university level. High quality academic research supports the development of business practice and public policy in the field of CSR and the Commission promised to explore opportunities for financing further research and innovation on the importance of corporate citizens cooperation. [4] Therefore, the latest European sustainability approach recognizes the need for fundamental change among many and confusing interpretations and definitions [5] and tries to combine environmental concerns with socio-economic consequences, aiming to reforms that challenge the status quo theories [6].

The concept of "creating shared value" aims to identify and prevent possible adverse impact and mitigate externalities that enterprises may have on society. Moreover, this concept links CSR strongly to innovation, especially in terms of developing new products and services that are commercially successful by helping to address societal challenges. The aim of maximized creation of shared value means is to create returns on investment for the company's shareholders and capital investors ensuring at the same time, impact benefits for the company's stakeholders. Notably in the European Union, after a decade of CSR evolvement, not many companies have widely integrated social and environmental factors into their operations and their core business strategy, since only 15 out of 27 EU Member States have mandatory or voluntary national policy frameworks to promote CSR; moreover, only a small minority of European enterprises publishes Sustainability Reports. There is however, the firm intention in many EU jurisdictions to impose mandatory monitoring, measurement and reporting of non-financial disclosure on governance, social and environmental metrics for publicly listed and very large companies. Furthermore, the global tendency is rather to ‘encourage’ than to oblige, businesses to share their best practices with annual Sustainability Reports in a consistent, comparable and reliable way, preferably verified by independent assurance providers [7]. There is also a rising trend for “Report or Explain why not” obligations of the material and core non-financial data and ESG metrics that affect a company's sustainability in order to improve investment analysis and decision-making.

The marine business functions in a highly free competitive market as a 'globally' expanded industry, rarely linked and influenced from one market or community with specified scope and boundaries, except of the short-sea shipowners. So the ocean carriers' engagement perspective of their value chain addresses mainly the marine environment, as their global stakeholders and society at large. The strongest shipping forerunners, according to CSV and ESG factors, however, will be those that establish deeper and material roots in important communities, e.g. enabling port cluster development, with a locational thinking that creates shared value. With the means of supporting community projects, even major competitors benefit from strategic collaboration, something impossible in reputation-driven CSR initiatives [2]. Ship owners are challenged nowadays to link eco-efficiency and growth with greener ship operations technology eg. in management of contaminated marine waters and shipboard water waste, such as ballast water, gray-water, dredge waters, sludge, black-water etc (under MARPOL Annex V– effective from 1.1.2015-). Environmental regulation in shipping takes the form of 'command-and-control' mandates and enforcement actions that punish companies, instead of simultaneously boosting innovation & productivity. Effectively, pioneer leaders from the shipping industry could be encouraged and motivated to monitor, measure and publicly report their best practices, shipboard effectiveness, proactive initiatives and sustainability performance in Annual Sustainability Reports, ideally Integrated into their Financial Accounts and verified as true and fair, by an independent Assurance Provider.

3. BWT REGULATORY FRAMEWORK

The Ballast Water Treatment (BWT) Convention imminent to become in force, aims to prevent the spread of harmful aquatic organisms carried by ships' ballast water (BW), but is one of the biggest current regulatory challenges that shipping industry is facing, since a global fleet of 60.000 vessels is urged to retrofit in shipyards at an expected total retrofitting and operating cost of 74 Billion USD!

The UN Ballast Water Management (BWM) Convention for the Control and Management of Ships' Ballast Water and Sediments, was adopted by the UN International Maritime Organization (IMO) in 2004 and will enter into force 12 months after ratification by 30 States, representing 35% of the world's merchant shipping tonnage. For many years, the shipping community was obviously reluctant to ratify (36 States and 29% of the gross tonnage only ratified till end of 2012). The adoption of stricter rules for ballast water treatment has already motivated and is expected, to spawn an expensive market for BW treatment technologies in the next years. The additional cost inflicted to each shipowner for equipment and onboard infrastructure, is significant; as indicated in our survey, this cost ranged in 2012 from 550.000- 1.000.000 USD for the newbuild installation or retrofit of a Panamax Bulk carrier, cost tending to drop in the future, due to the development of competitive treatment technologies. The additional capital expenditure of retrofitting becomes a serious incentive to end service of old vessels, given that the D1 approved exchange methods (BWE) in deep ocean sea (Sequential, Flow-through and Dilution) will be invalid after 2016/17 (or whenever the Convention comes into force), for ships flying party flags or visiting Party waters.[8] Moreover, all ships are already required to carry out ballast water management procedures that meet certified standards and have to carry Management Plan and Record Book of Ballast Water and Sediments. Parties to the Convention were given the option to take additional measures that are subject to criteria set out in the Convention, the IMO guidelines and other regional regulations. IMO MEPC has standardized and adopted D2 Testing standards of various existing and forthcoming BWT systems, so that technology developers and manufacturers follow uniform guidelines on test and performance specifications for any vessel [9]. The latest MEPC64 (October 2012) concluded that there are enough BWT systems in the shipping market (28 systems are D2 type approved) and examined the imminent entry into force of UN BWM Convention framework in agreed dates [9]. Moreover, there are respective shore-side regional regulations already in place i.e. in the United States where many marine environmental rules and regulations (especially in the state of California) are strictly enforced and patrolled by the U.S. Coast Guard for all vessels approaching in territorial waters and shores. Therefore, shipmanagers anyway, have to proactively comply with major national specifications in order to continue their trade business.

Indicative costs of BWT were estimated at GloBallast Partnerships Symposium in 2001, as follows:

"The use of fresh water of between 83c/m3 and $1.20/m3 would generally be regarded as prohibitively high, but the estimated cost of using recycled process water at 6.9c/m3 in a particular application is potentially quite attractive. Chemical treatment, based on operating cost alone has been estimated to cost between 24c/m3 and $40/m3. Land based treatment estimates have suggested costs in the vicinity of 34c/m3 to $13.80/m3, and 54c/m3 for a dedicated treatment ship."[9]. These costs were very heavily dependent on additional infrastructure and collection costs and required close scrutiny for particular ports and specific requirements [9,12].

Back in 2001, based on provided data and the prosperous prospects of the shipping industry, the regulators opted to pursue legislation for BWT onboard and abandoned further research on reception alternatives at port facilities or on floating barges and off-shore mobile settlements. Spatial planning institutes, global downturn and eco-efficiency measures were unthinkable and out of scope parameters then.

4. SURVEY BUSINESS ESTIMATES OVER BWT INVESTMENT

The business case for sustainable BW treatment methods shall be analyzed at company level, addressing possible long-term economic and Triple Bottom Line benefits: ethical, environmental and social of the three main BWT technologies available: the Mechanical (Filtration, Cyclonic Separation and Electro-separation), the Natural Disinfection (Ultraviolet Light –UV- , Cavitation / Ultrasound, and De-oxygenation) and the Chemical Treatment methods (with Disinfectants, and Chlorine treatment via electrolysis) [10]. For the needs of this generic study, however, special interest will be mostly given to the chemical treatment impact, as most usual way of clean water disinfection. From a sustainability perspective possible problems already arise from the treatment of BW and onboard waste with harmful chemical agents and additives, as well as in monitoring of toxicological impact and in verifying toxicity of chemical samples from ships by competent authorities. According to our survey, the common thread in most of these treatment systems advantages are the cost of equipment and retrofitting as well as the space issue for such equipment. Chemical treatment is apparently more attractive, especially on ships already built. For newbuild vessels the combination of filtration, as primary treatment and ultraviolet light as secondary treatment is preferable and has the most R&D efforts at the moment. [11]. Chemical biocides, ozone and chlorine are the major chemical ways used, but with serious risk of harm to the seamen and sea life depending on handling. [12] Implementation of regulatory requirements and verification of toxicity of chemicals through seawater sampling is a very complicated process for the crew and verifiers since 6,000 samples are needed for a VLCC (Very Large Crude Carrier) to verify ballast tanks toxicity. Until now available documentation of chemical analysis and water parameters of by-product formation is limited [12].

Shipowners testified that they are substantially obliged at their own cost and knowledge risk, to retrofit existing vessels or add on new-buildings advanced BWT systems, according to vessel size and type. Operational costs may be somehow shared, depending on many factors, such as the way and region of trade hire/time-charter/liner, the type of vessels and transported cargo. Selected ballast water treatment technologies, when tested onboard, have to meet the criteria of safety, environmental acceptability, practicability and be type-approved systems under the D2 review criteria on BWT by IMO Regulations. Additionally selection will depend on whether the BWT treatment equipment is approved by U.S. Coast Guard, if those vessels call on U.S. ports.

According to the conducted interviews and industry press releases, owners must make strategic decisions on whether they should be proactive and invest in technology ahead of compliance dates or they will afford the risk of huge congestion at shipyards, whenever 60.000 vessels rush to retrofit, obliged by law. In one case, they may risk obtaining first generation equipment that may be soon outdated, faulty or not durable. However, this may be best, against the risk of having too little time, if compliance dates are fixed or additional cost burdens have arisen.

Possible economic gain from early and proactive compliance to regional or shore-side regulation could therefore be considered from the perspective of creating shared value. In order to determine and select the optimal technology, a cost-benefit analysis methodology can be used [13,14]. Value-driven BW management requires previous careful evaluation of various BW techniques and then monitoring, reporting and verification, necessarily based on multi-criteria investigation and consistent data collection. As a further step, multi-perspective target-setting through KPIs (Key Performance Indicators) and collection of data may become an incentive for responsible and proactive Reporting, ideally verified by third independent assurance providers (e.g. classification societies). There is however an apparent skepticism as to the feasibility and effective ability to safeguard ballasting processes in environmentally sound ways.

6. DISCUSSION ON PRACTICAL PROBLEMS OF BW TREATMENT

An industry survey under the form of short interviews was conducted, on a confidential basis, among representative ship management executives over shipboard waste water treatment faced in practice and related regulatory matters. Some views of regulators, classification societies, shipping associations and researchers, were critically analyzed from a theoretical aspect, according to the aims of this study.

Primary and secondary data were collected from interviews of experienced ship operators/practitioners that have decisive role on when and whether to pay the extra cost for BWT systems. Their answers were examined against the critical factors of technology versus cost and against their associations' views, as published in the shipping press and in informative Bulletin Updates issued by various Classification societies and flag states.

Ship operators were willing to answer on which BWT method they prefer for their vessels, however, most of them admitted not having yet installed those systems on existing vessels/fleet, but only on newbuildings. For existing vessels and always in compliance with IMO provisions, they plan to retrofit BWT installation on the first scheduled dry-docking after January 2016. Cost comparisons were requested, regarding to a certain medium size type of vessel (Panamax type). Retrofit costs -without special prices (ie package deals for a whole fleet) for installing a UV system on a Panamax size Bulker summed at best to 600.000 USD at the end of 2012, compared to around 900.000 USD in 2011 while prices ranged at around 1,5 to 4,5 millions USD per VLCC vessel.

Some shipmanagers preferred the chemical, but most opted for the other BWT methods. The sea water chemical treatment is the least expensive in terms of equipment, installation cost or retrofit cost, but with very high operational costs, because of the continuous need for chemicals' supply and negative effect on ballast tank coatings, therefore is used for aged vessels with short lifespan expectancy. Considering technical details, all opted for the technology that presents, optimum operational and financial advantages, according to vessel type and size. In this respect UV technology, is deemed the best alternative for vessels of low ballast capacity, but for larger ballast tank capacity, other methods e.g. electrolysis / UV, seem more appropriate. Major shipbuilders, unwilling to openly further disclose exact quotations, have embodied the provision of a BWT Plan in their standard Technical specifications, as a package commercial deal with ship owners at the new build order, together with a full scope of technical supply terms. Other shipmanagers confirmed that BWT systems' prices for newbuilds are similar to the cost of retrofit. Smaller shipbuilders offer the installation service of BWT free of charge. Therefore the cost of equipment's provision heavily remains on the shipowner, as supply purchase deal in free market terms. Installation of a Ballast Water Treatment Plan should be considered in light of both applicable technology (that continues to mature) and cost. The process of improving the applicable technology is ongoing, while potential manufacturers are still developing their products. Simultaneously with their technological improvements and intending to gain bigger share of the market, they approach the owners with gradually better price quotations. Considering the above, shipowners are reluctant to expedite installation of a BWT Plan ahead of compliance dates as might be proven not a wise investment in technological and commercial terms. Always the first series / generation of any kind equipment will be optimized after obtaining adequate experience by use in practice.

As an ethical issue, shipmanagers believe that environmental damage in the oceans and rivers is already done for hundreds of years ago, despite basic healing processes of nature. Shipping continuously has therefore the responsibility of taking every measure possible to protect the environment, but is nowadays unreasonable to use so many chemicals and technology just to clean seawater; they fully agreed that R&D should focus on innovative ways on ballasting, on BW sampling, testing etc

In the crucial question: *Would you consider, to support experimental R&D on carriage of irrigation quality-water in ballast tanks instead of seawater, towards future profit on a ballast voyage?* (suggested answers were YES, NO, Depends), there were more ["DEPENDS"] answers that show either reluctance, due to complexity of these issues or that ship managers do not yet consider ballast water as possible cargo. This answer also reflects the added expenses that a company may sustain from the BWT issue, so that ship managers, focus on BWT monetary immediate cost control and not on experimental possible gains. Prudent ship management in times of crisis will definitely concentrate on how to acquire well-informed knowledge ahead of ordering and on how to absorb effectively any extra cost per vessel from new ballast water treatment demands.

According to information obtained from interviewed BWT expert practitioners, there are some indicative practical problems of chemical treatment onboard, not to be underestimated. Ballast operations of high ballast depended ships, such as tankers and bulkers, require full ballast load or discharge in a rapid port turnaround fixed period of 12/24 hours. Continuous awareness on how to prevent the spread of aquatic pathogenic organisms, familiarization and training of crewmembers, are essential for effective and efficient monitoring of BW and sediments treatment. The need for understanding of basic chemistry, chemical engineering and risk assessment will be required onboard and ashore to deal with imminent associated risks, at times that there is a crew shortage and labor rules are globally highly demanding; moreover, time and effort will be demanded to monitor thousands of samples at microbiological studies; onshore trials conducted in the laboratory may address different feasibility issues than real life in full-scale applications onboard the vessel. BW equipment installations (pumps, pipelines and valves) need a large floor space onboard, located in one of the densest, packed and hardly accessible (for inspection and maintenance) area of the ship. Safety and seaworthiness due to vibrations, speed and ship's motion, salty water atmosphere, flow rates and pressure drops, must be taken into account when designing devices robust enough for such onboard installations. Also, the characteristics of ballast water (pH, salinity, suspended solids, rubbish etc.) differ from typical industrial process waters onshore and may cause problems, if not adapted in naval system design. The duration of the voyage is another important factor: the shorter the time for treatment, the higher dose of disinfectant or energy will be required and higher capital and operational costs.

7. DISCUSSION ON SOCIAL EXPECTATIONS

The business case for proactive implementation of BWT, considering Triple Bottom Line (economic, environmental and social) benefits at company level, can be further examined through a cost-benefit analysis beyond trade-offs. [13]. If shipping endorses innovative proposals, beyond regulation, targeting to a socially sustainable economic growth, as prescribed by the 'shared value' concept [3,16] there could occur the following indicative impact benefits due to seaborne trade:

Economic impact with integration of ethical, transparent, long-term vision and mission in decision-making & trade practices that decreases unemployment, engages in continuous training and advancement of human capital' skills, treatment operations with absolute safety and seaworthiness, Environmental impact that considers threats to the coastal, terrestrial ecosystems from exotic aquatic bioinvaders; clean and fresh water shortage; reduction of greenhouse gas emissions (with a saving energy mindset and technology combating adverse impact of use heavy marine fuels for BWT) energy efficiency; effective strategy against pollution (water, air, soil) and finally Societal gains in the field of disruption of ecosystems, fishing and fish-farming employment, community cohesion, public health (from spread of diseases), water & seafood shortage.

Social issues in performance management and ESG factors now become mainstream business issues for institutional investors. There is a global trend to form synergistic standards & joint initiatives in other industries towards a social screening of the capital market; global impact investment networks and scientific researchers have built a wide infrastructure of a plethora of assessment tools used in cost benefit and cost effectiveness analysis for SRI–Socially Responsible Investing (GIIRS, IRIS, GRI G4, AA1000, Bloomberg ESG etc). Impact investing seeks to invest in companies or initiatives with heightened accountability, that engage in continuous innovation, adopting a mission that creates shared value beyond financial return of nominal capital.

Significant research and development (R&D) efforts are underway by a number of leading experts around the world in order to replace BW Exchange systems with other BW treatment methods. The most effective BW technique, the exchange *en route* into the open ocean (since bioinvasive species from the ocean cannot survive near ports and vice versa) will remain until 2017, but requires long distance voyages. Apparently anticipated compliance with BW exchange obligations in open seas, although regulations prevailed for years, was not effectively inspected and patrolled, considering the present ocean and coastal disruption. Therefore, the potential risk of excessive use of chemical and organic substances and their rejection in the sea will again threaten the marine ecosystems and public health and may lead to the total degradation of the environment [12, 13,16].

Shipowners therefore, feel that legislators and regulators initiate tremendous pressure on the shipping industry to invest significant capital and operational expenditures for onboard equipment and installation time, in order to comply with environmental requirements, disregarding issues over practical feasibility, wide economic crisis or societal growth needs. By taking into account social indicators suggested e.g. by a balanced scorecard, the environmental and social aspects of the company's performance could be better embodied [17]. According to the 'de-growth' transition advocates, spatial planning on community settlements together with restrictions in energy consumption will not result in a decline of economic growth rates; although, the global economy is heading to de-growth [18], innovations that count on the critical assessment of social needs are prerequisites for business sustainability and a radically systemic transition to sustainable global growth [19].

Accordingly, a visionary shipping business will be accredited by a 'social license to operate' for its improvements on its vessel or fleet technical hull design and energy use, as well as for its aim to redesign its scope of marketing to nontraditional markets as a response to social needs. Consequently, a shipmanager has to reconsider to gain possible profit from targeted routing, or to improve operational treatment handling and efficiently exploit every capacity of its vessel (i.e. ballast tanks). Significant related results are noted on Crude carriers' hull design with little or zero ballast tanks or novelties in cargo-tanks segregation. A pilot example of technically feasible solutions is the joint program of a shipping company together with Det Norske Veritas (DNV is the Norwegian classification society of shipowners), named "TRIALITY" to develop a concept VLCC, which is ballast free, economically and environmentally superior than conventional designs [20]. Treatment of ballast and waste water will be imperative for dry bulkers, since tankers could more drastically limit ballast use [15].

However, the shipping community has not adequately supported the alternatives of ballast and waste treatment onshore at specific ports or on mobile floating vessels. An alternative trade could be developed so that ocean-going vessels carry as ballast, instead of seawater, clean fresh or recycled industrial processed-water supplies directly to receivers or to reception facilities of water starved areas in the Middle East, sub-saharan African, Australia etc.; usually shore-side infrastructure for potable water treatment exists already near to port facilities (with pipelines or specialized barges). It would be then possible for non time-chartered vessels, to get paid on a ballast voyage, provided there is a receiver and that the port of call is convenient and equipped with needed infrastructure.

An undisputable argument for ballast water port-based reception facilities, consists that the personnel ashore could be permanently employed, having, therefore received specialized and focused training over environmental, health and general safety risks and not hired as a, short-term or per voyage, seaman. Yet, the majority of scientific research underway over chemical treatment methods focused mainly over ballast seawater treatment onboard. Shore based or dedicated treatment ships in 2001 were regarded as attractive options, however their availability was limited, installation cost was considered high, as well as quality control and shipboard operational difficulties (in ballasting and de-ballasting) plus considerable delays, that restricted their widespread development [12]. However, these options may currently prove attractive for oil tankers that have the infrastructure to handle dirty ballast water into shore based treatment plants. The Port of Rotterdam proceeded on cost estimates for such a treatment plant, on-shore infrastructure (which would be converted to handle clean ballast water), port space use, reception infrastructure (barges etc.) together with a shipping company in Cyprus and the Dutch Government [15]. It represents an optional case scenario to be seriously considered, for development of full reception facilities in some ports and hubs, where ballast water exchange methods are widely used before port entry.

Notably in parallel to the above, the UN 2011-2016 pilot GloBallast Partnerships project (simply referred as GBP) [9,20] aims to develop technology, information and knowledge exchange globally to overcome technical challenges, by Building Partnerships to Assist Developing Countries to Reduce the Transfer of Harmful Aquatic Organisms in Ship's Ballast Water and sediments. GBP is a Public-Private sector Partnership of the Global Industry Alliance (GIA) and GIA Fund, with partners UN and major maritime companies, working to expand government and port management capacities, coordinate regional co-operation, and develop industry assessment tools for legal and institutional reforms and sustainability mechanisms.

Another partnerships paradigm is the Sustainable Shipping Initiative (SSI) (a voluntary non profit NGO scheme of 18 companies) that unveiled a novel financing scheme to encourage retrofit of vessels with energy saving technologies. They developed a model that shares the fuel-cost savings value among the ship-owner, the time-charterer and the finance provider.

8. RESULTS

Based on the empirical estimates of the survey responses, co-related to the academic literature review, it was determined that:

- a socially responsible shipmanager when selecting a BWT system, counts on: ease of installation and credibility criteria, safety of vessel and crew, but due to recession, mainly on Capital and Operational costs (Capex and Opex).
- The sustainability strategy of regulators worldwide should reconsider problems in treatment of BW, power consumption needed and onboard waste produced from harmful chemical agents and additives; also of challenges in monitoring the toxicological impact and in verifying toxicity of chemical samples from ships by competent authorities.
- The alternative of BWT ashore or afloat on port reception facilities should be explored further, as a way to respond to societal needs e.g. unemployment, water shortage.
- Creating shared value (CSV) pioneer thinking calls leaders on collective action that identifies actual societal expectations, builds strategic alliances and seizes emerging opportunities globally.

9. CONCLUSIONS

Detailed roadmap recommendations could not be produced in this introductory paper. However, it was demonstrated from surveyed practitioners' views, contrasted to the latest theories on CSR and other critical factors' analysis that a new worldwide sustainability strategy could motivate researchers to innovate, beyond regulatory trends. Shipowners logically anticipate persuasive and pragmatic ethical incentives as well as further scientific research on shared value, comprehensive spatial planning and economic growth before they respond to emerging global expectations. The Shared Value concept, could provide insights to both the shipping community and global or national regulators to act based on macroeconomic responsibility theories. There is apparent practical need to further research and develop Ballast Water Treatment (BWT) systems, based on value-driven solutions, like ballast free design, development of guidelines for effective shipboard BWT standards, ballast exchange zones or waste water-processing ports of call.

In times of serious downturn, worldwide shipping may endorse green initiatives targeting to create multi-dimensional efficiency, competitive effectiveness and growth for business and society, by funding or developing technologies that meet social challenges. Research laboratories around the world improve BWT processes in order to provide attractive and effective means of alien organism control. However, value from alternative BWT options that produce cost savings and societal benefit against cost for each shipowner is a challenge for researchers. Spatial planning institutions may advise on a Global Master Water Plan, relating BWM to fresh water scarcity at ports in need, initiated as an alternative option for global policy makers. Shipping associations and flag states have the power to propose synergistic investments in worldwide port reception infrastructure, in order to advance clusters' economies, produce local community income and combat unemployment. It could be explored as an alternative to the prevailed BWM marine policy that imposes on individual shipowner the legal obligation to invest on a costly and demandingly complicated onboard BWT monitoring, testing, reporting and verification methodology. The sum of 74Billion USD expected to be invested for systems onboard could be channeled into sustainable infrastructure and community settlements for ports reception facilities and emerging global societal needs.

Creating shared value (CSV) pioneer thinking means that the shipping industry takes critical steps to raise awareness over the fallacy of short-term innovation, trade-offs and legitimacy. The international policy makers should encourage the innovative initiatives and enhance dialogue and synergy among the shipping business and their stakeholders, away from the minimum compliance mentality. Forward thinkers in shipping trade, could solve global societal problems through shared value solutions, aligned to their own economic and environmental objectives, but also lead social progress, beyond regulatory and administrative global agenda.

GLOSSARY

BWE	Ballast water exchange
BWM	Ballast water management
BWT	Ballast water treatment
COM	Communication (EU)
CSR	Corporate Social Responsibility
CSV	Create Shared Value
D1	Ballast Water Exchange Standard
D2	Ballast Water Performance Standard
DNV	Det Norske Veritas, the Norwegian classification society of shipowners
ESG	Environmental, Social, Governance
EU	European Union
GIIRS	Global Impact Investing Ratings System
GBP (GloBallast)	Global Ballast Partnership Programme
IMO	International Maritime Organization (UN specialized agency)
IRIS	Impact Reporting and Investment Standards (assessment tool)
KPIs	Key Performance Indicators
MARPOL	Marine Pollution
MEPC	Marine Environment Protection Committee
NGO	Non Governmental Organization
R&D	research and development
SRI	Socially Responsible Investing
SSI	Sustainable Shipping Initiative
UN	United Nations
UNDP	United Nations Development Project
USD	United States Dollars
UV	Ultraviolet Light
VLCC	Very Large Crude Carrier

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