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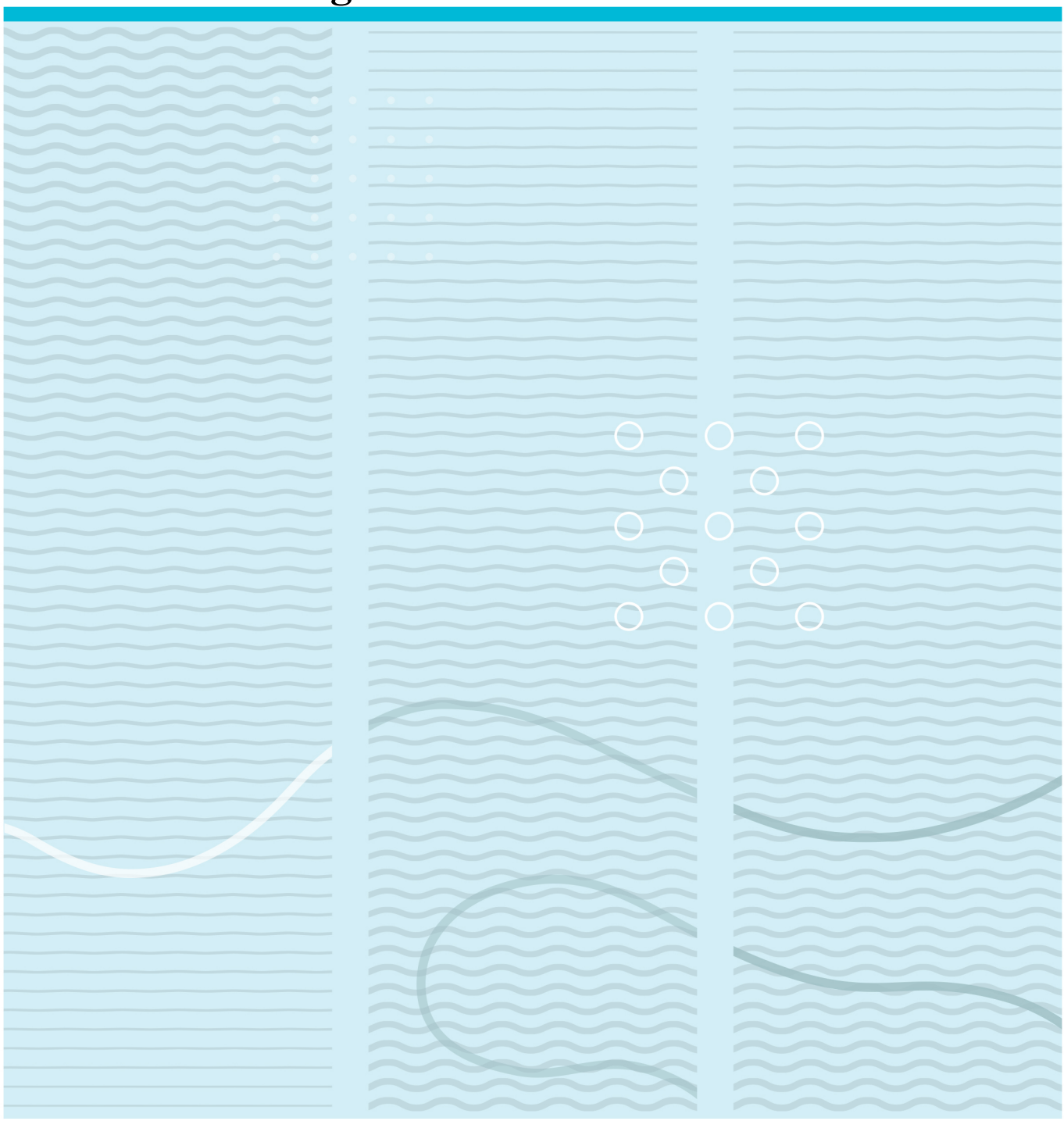
The Role of Sustainable Development in Maritime Technical Management



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This thesis is worth 30 study points

Abstract

The Technical Superintendent position in technical management team is the link between sea staff and office. As a middleman, he faces pressure from different directions, resulting in conflicting goals. To decide according to sustainable development principles, he must be able to handle complex decisions. The theoretical model *Framework for Sustainable Development* is the framework for this research, that aims to find *how Technical Superintendent handle conflicting goals regarding Sustainable Development basic principles*. The method used is qualitative based on case study research. The results showed technical superintendent in the current approach is mainly a problem solver and his decisions, when handling conflicting goals, reflect his basic principles that have a direct influence on sea staff. Therefore, this study suggests, as a contribution to field of Technical Management, a model on how TS can influence his organization towards sustainable development principles.

Keywords: Technical Superintendent; Sea staff; Sustainable Development; Conflicting Goals; Container Ship Business, Framework for Sustainable Development

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Abbreviations

C/E	Chief Engineer
CEO	Chief Executive Officer
CGs	Conflicting Goals
C/M	Chief Mate
CRs	Customer Requirements
CRs	Customer Requirements
DRs	Design Requirements
FFSD	Framework for Sustainable Development
GHG	Greenhouse Gas Emissions
GSPs	Green Shipping Practices
HR	Human Resources
IMO	International Maritime Organization
ISM	International Safety Management
MDGs	Millennium Development Goals
NO_X	Nitrogen Oxides
PM	Particulate Matter
PMS	Power Management System
SD	Sustainable Development
SDGs	Sustainable Development Goals
SMS	Safety Management System
SOLAS	Safety of Life at Sea
SOX	Sulphur Oxides
STCW	Standards of Training, Certification and Watchkeeping for Seafarers
TS	Technical Superintendent
UN	United Nations
USA	United States of America
WWF	World Wildlife Fund

List of Figures

List of Tables

Table of Contents

Introduction

The subject of this thesis reflects on the role that Sustainable Development plays on the Maritime Technical Management. Sustainable development goals are being adopted by all sectors of society, also in shipping. The sector for years, due to its importance on international trading has been protected from more restrictive rules (e.g., compared to road transport). The paradigm is changing, and regulation on emissions is challenging companies and forcing them to act. Also, society's increased awareness, demanding more sustainable products and modes of transportation, pressure this industry.

According to DNV-GL, the shipping industry can influence both positively and negatively the Sustainable Development Goals (SDGs). Therefore, shipping managers of the future must face the tension between providing sustainable and affordable services, while contributing to preserve common resources (Gjølberg, Longva, & Kjersti, 2017).

There are opportunities to improve sustainability in the shipping industry. This work will set its focus on the container shipping industry, a fierce competitive market focused on reducing costs which can make the sector more prone to unsustainable practices. Such practices usually stem from conflicting goals where Technical Superintendents (TSs) have some degree of influence. The scope of our unit of analysis, the Technical Superintendent (TS) relation with sea staff, has not yet been covered in literature with a focus on sustainable development practices. However, researchers have been studying methods for middle managers to influence organizations towards sustainable practices like the *Attentive Responsibility Ethical Framework* (Jones, Michelfelder, & Nair, 2017) designed for engineering managers.

In the case of TSs, there are no relevant studies addressing the reception of SD principles by them and sea staff, as well as if current practices on the relation are sustainable. In this matter, the current study benefits from an inside view since it is conducted in the researcher's workplace with access to privileged observations. The study is characterized by an interpretivist approach, focused on particulars within the whole system by an empathetic understanding of phenomena (Collis & Hussey, 2013), but also adds limitations of credibility, confirmability and transferability.

As relevant concepts we have the sustainable development basic principles. They include all of the ideas around the topic rooting in the seventeenth century until the recent Sustainable Development Goals (SDGs). Special attention will be given to the principles present in SDGs concerning the conflicting goals we will address: *Shore demands vs Ship Independence*; *Efficiency vs Safety*; *Very fast pace of change of Technology vs safety*; *Environmental compliance vs work related stress*.

The next concept is Technical Superintendent. Here, I follow the definition of DNV-GL (2014, p. 5) as *"the person ashore, responsible for providing technical and operational support to the ship, and to facilitate safe and efficient running of the ship"*. In this work the focus TS will be on his relationship with the Ship (sea staff). Since challenging aspect of SD is to handle trade-offs between pillars (Broman & Robèrt, 2017), the conflicting goals arising from the relation with sea-staff are the ground where TS are able to influence organization towards SD. By conflicting goals, we mean two desirable and comprehensible objectives that are apparently incompatible demanding trade-offs by managers. Some address them as a burden, others as an opportunity for innovation.

Research Question

The aim of this work is to know *how Technical Superintendent handle conflicting goals regarding Sustainable Development basic principles.* The analysis is focused on the relationship Technical Superintendent – Ship finding what is limiting and direction towards Sustainable Development. The proposition of the study is that adoption of SD basic principles support TSs handling conflicting goals stemming from TS-Ship relationship.

Structure of the Thesis

The thesis is divided into four main parts. Part A, includes the literature review where we introduce the history of sustainable development and its roots in resources management. After, we present the concept applied to shipping industry and challenges to implement it on the ground. These first points are general and pretend to introduce us the basics of SD.

The complexity inherent implementation of SD values, led systems thinking authors to develop tools like *Framework for Sustainable Development* (FFSD) (Broman & Robèrt, 2017) based the steps: *A – awareness and success*; *B- baseline assessment*; *C- creative solutions* and *D- decide on priorities*. Since this frame influence the structure of the work, it will be first explained and later applied to the first steps of case study. Accordingly, step A consists in defining the system, the maritime transportation system, characterizing its key elements and basic principles. The next step (B) consists in listing the current challenges that the shipping industry is facing today and find subsystems that can contribute to a considerable change in the main system (Maritime transportation system). The selected shipping sector is the container business by its importance inside the main system, and TS-Ship relation as relevant subsystem supportive of solutions able to influence positively the overall system. As part of the step B it was identified in literature and observations a list of challenges (conflicting goals) affecting TS-Ship relation in order to be tested in the field. To help TSs handling the challenges (CGs) and reach the vision (basic principles of SD) a list of current assets (tools) were listed. To finalize, a summary of basic principles gathered from literature review is presented as a support for the TS-Ship relation.

In the research methodology section, it is addressed the approach paradigm based on abductive research and research design framed by framework for sustainable development. The research design includes two steps already mentioned (step A and B) where it is defined the system, relevant sub-systems (TS-Ship relation) and basic principles. The data analysis is also addressed and how it will be handled using coding methods to form concepts and build theory.

In Part B, the results of my work, it is represented the primary data contribution to the B step (i.e., current reality and current assets on the ground to deal with the challenges). They appear in the form of structured interviews, web survey, email interview and observations.

The part C (associated with C step) is the discussion part. Here are identified possible solutions to the challenges found on data and possible action to close the gap with the vision established in basic principles (step A). This will be done by reflecting on the concepts resulting from coding of data.

The Part D (step D) includes the answer to the research question and contributions to theory given by the process of *TS as an influencer of sustainable shipping*. The model is result of reflection on the concepts. Finally, some considerations about limitations, applicability and main conclusions of the study.

PART A

"Preliminary vision of success framed by the basic sustainability principles." (Broman & Robèrt, 2017)

1 Literature Review

1.1 History of Sustainable Development

The concept of Sustainable Development (SD) is often assigned to the Brundtland report *Our Common Future* (WCED, 1987) yet, some researchers dates back the term to seventeen century in the context of timber industry concern for a "sustained yield forestry". The concept present in *Our common future* was previously introduced by William A. Duerr, an expert in forestry:

> "*To fulfil our obligations to our descendants and to stabilize our communities, each generation should sustain its resources at a high level and hand them along undiminished. The sustained yield of timber is an aspect of man's most fundamental need: to sustain life itself"* (Grober, 2007, p. 7).

It is possible to recognize in this sentence today's main idea of intergenerational solidarity associated to SD. Throughout twenty century many individuals contributed to build the concept we know today but first step to make it global was made at the 1972 United Nations Conference on the Human Environment, in Stockholm, to be finally presented in 1987's report, *Our common future*. According to the WCED (1987):

> *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs"* (WCED, 1987, p. 43).

Furthermore, the concept is enriched by specialized teams and world forums where core ideas like three pillars of SD (economic, social and environmental) (Kates, 2005) and specific targets like the "Millennium Development Goals" (MDGs) were developed.

The goals terminology was developed to better explain what is meant by SD and set the focus in a group of objectives to be accomplished in a timeframe. As an outcome of MDGs in 2015, 17 development goals were introduced in the 2030 Agenda for Sustainable Development

inaugurating a new wave of concern culminating in the Paris agreement (COP21) aiming to limit global warming well below 2°C.

The need to measure progress towards SD objectives lead to the creation of indicators, some of them became popular like Wellbeing Index, Environmental Sustainability Index, Global Scenario Group and Ecological Footprint. The objective is to explain SD by focusing on a part of the whole system. They can be analysed on what is to be sustained, what is to be developed and for how long (Kates, 2005).

In the definitions of SD and related texts underlie a set of fundamental values, they represent the goals to pursue in order to reach sustainability. Though, they must be internalized by all actors to progress effectively. Most of the agreements and goals require a shift of mindset, policies require clear steps and commitment because indicators will measure how agreements were put into practice. Discussions that take place in international forums are an opportunity to discuss what SD means in the context of specific places and peoples (Kates, 2005).

Although, not entirely free of criticism the SD has been embedded in a large number of institutions from public to private sector. The goals of achieving sustainable growth and mitigation of greenhouse gases (GHG) effects boosted new forms of technologies and new scientific areas. The decision of United States of America to not ratify Paris agreement climate deal (House, 2017) resulted in condemnation around the world and reaffirmation of the renewables track (Commission, 2017) which confirms the large consensus around the problem. This reversal also shows how sustainability is interpreted in different ways and how countries are challenged to manage the tension between national interest and global responsibility. In fact, the success of SD relies exactly on that, solving tensions by negotiation and compromise between different values and perspectives (Kates, 2005).

1.2 The pillars of sustainable development

The pillars of *Environment*, *Society* and *Economy* were introduced in the Brundtland report but only consolidated in Rio de Janeiro Earth Summit in 1992 resulting from texts debating ideas around economic growth, social inclusion and environment. The literature on the subject considers SD based on these three pillars but recently *culture* has been progressively introduced as a complement.

Since the introduction of SD pillars, became normal practice to focus concerns on economic growth ignoring effects on others pillars (Strange & Bayley, 2008). Recently, some organizations (e.g., OECD) have been addressing the issue reflecting on risks of ignoring inter-relation between the pillars. The SD is often illustrated through the image of three pillars supporting a roof (SD),

such idea explains the consequences of removing one or more pillars. However, this image has been replaced by others since it gives a wrong idea that pillars should have the same weight. The fact is that economy and society are dependent on the existence of environment which means there is a hierarchy of pillars. A less flawed figure is the overlapping balloons (figure 1) where is possible to see their interrelation. Therefore, this work follows the Gjølberg et al. (2017) approach where environment is seen as the base for human living, society including us as humans and economy the interaction between the two.

Even tough widespread information about SD, institutions still ignore the need to address all pillars to avoid negative consequences in the long term. On this matter decision-making processes based on holistic analysis can help organizations to accomplish sustainable outcomes. Typically, the practice is based on fixing one-off cases, such vision fails to deal with the multiple forces that can move towards the sustainable path. For instance, policymaker's interventions regarding global ecological threat often do not underlie deep causes, producing on the one hand short term benefits but on the other hand increasing problems in the long term (Senge, 1990). The holistic approach is supported by OECD defining SD conceptual framework as a *"way of changing the predominant world view to one that is more holistic and balanced"* (Strange & Bayley, 2008, p. 30). SD is also identified as a process in *"a way of applying the principles of integration – across space and time – to all decisions"* (Strange & Bayley, 2008, p. 30) and an end goal of *"identifying and fixing the specific problems of resource depletion, health care, social exclusion, poverty, unemployment, etc."* (Strange & Bayley, 2008, p. 30).

1.2.1 Environmental pillar

Environmental pillar cares about the ecosystems we depend on to live and thrive as humans. One example of the interrelation between pillars are the consequences of environmental disasters like reduced production, migration induced by climate change and wars. The environment is the root of SD, our habitat as humans and foundation of the other pillars. Additionally, the early concept of SD emerged mainly by observing negative impacts of humans on nature caused by unsustainable practices (Grober, 2007). These practices are common especially when humans explore resources given by nature, in the past was the forest, today oil. Therefore, in general SD seeks to harmonize the difficult tension between finite resources and the infinite desire of people to exploit them and grow.

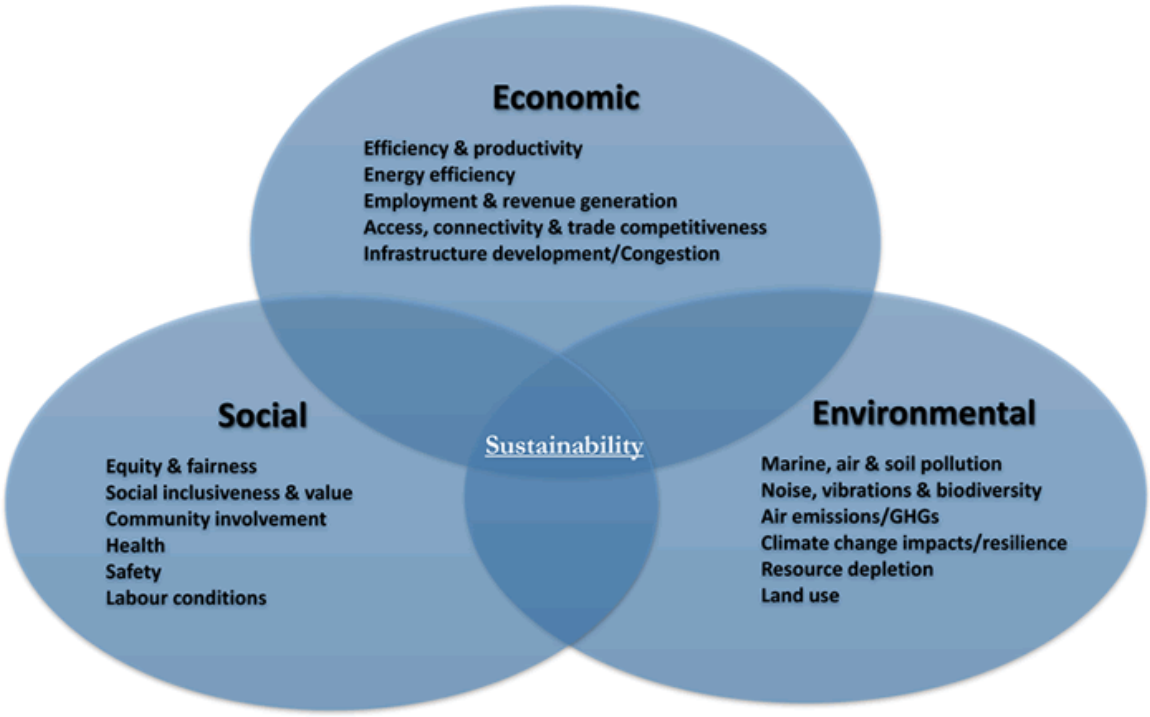

Figure 1 - multiple dimensions of SD applied to the freight transport

Source: author

1.2.2 Social pillar

The social side of SD concerns with problems like poverty, social justice, peace and good health. The humans are dependent of a protected environment to live and reach a good health. For instance, eradication of poverty and gender equality require from society solutions that must take into account interactions between environment and economy, this process is reserved to politics, civil society and organizations.

In resume, this pillar deals with all issues that can threat the sustainability of human society and core characteristics of SD: satisfying basic human needs, promoting intra-generational equity, and promoting inter-generational equity (WCED, 1987).

1.2.3 Economic pillar

The last pillar relates to economic development based on environment and society. It includes goals regarding industry, innovation and infrastructure. Since it relates to interaction between environment and society this pillar calls for responsible consumption and production that produces economic growth but not at the expense of environment and society.

1.2.4 Cultural pillar

The reconciliation of the three pillars is complex and require wise trade-offs, favouring one pillar at the expense of other. To achieve that, policymakers must have the ability to move between local, regional and global perspectives. This requires hard work and acceptance that SD can only be achieved if all agree uncertainty, limits to growth and different realities require different priorities and projects (Strange & Bayley, 2008). These issues led UNESCO and researchers to develop the Culture pillar (Governments, 2010). The debate on how to get there and which pillar to emphasize at determined moment is essentially a cultural debate because it involves values shared by governments and civil society (James, 2015). Culture is a mirror of the community shared values, from them we can decode the shared meaning and purpose of the society. Ultimately, the values are the drivers for action and if SD issues are not shared within communities (i.e., bottom-up approach) there is no chance to do it by "top down" efforts (James, 2015).

Culture has to be addressed separately since conscious cultural action and coordination with other pillars are needed to efficiently achieve sustainability.

To sum up, SD includes four pillars that are:

- Cultural vitality: wellbeing, creativity, diversity and innovation.
- Social equity: justice, engagement, cohesion, welfare.
- Environmental responsibility: ecological balance.
- Economic viability: material prosperity.

Source: (Hawkes, 2003)

1.3 Sustainable development goals

The 17 SD goals (SDGs) listed in appendix A were presented in 2015 to the public and are built upon the achievements of the Millennium Development Goals (Assembly, 2015). The major commitment of the SDGs is towards poverty eradication, an indispensable goal for SD linked to the human dimension. Regarding ecologic system, commitment is to combat degradation of the planet through *"sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change…"* (Assembly, 2015, p. 5). Therefore, socio-ecologic commitment is made through recognizing that economic, social and technological progress occurs in harmony with nature (Assembly, 2015).

The agenda document introduces a shared vision and states goals and targets objective is to shape the "supremely ambition" of a world free of poverty and where all human life can thrive. Next, the document collects all shared principles and commitments (i.e., in what all world leaders

can agree upon) and makes a review of the situation today. The document alerts on the necessity to follow up and review the process at national level, regional and global level.

1.4 Sustainable development in shipping industry

The SD relates to all society and must be also applicable to shipping industry. The shipping industry can argue about environmental benefits when compared to other types of transportation, although shipping activities are not free from impacts on pillars.

1.4.1 Environmental pillar for shipping industry

The literature about consequences of shipping in three pillars, especially in environment is vast. The shipping industry is responsible for approximately 3% of total anthropogenic CO_2 emissions, emit around 18 million tonnes NO_X (15% of world total) and 10 million tonnes SO_X (5–8% of world total) annually. On the water side, shipping is a major contributor to introducing alien species across ecosystems through ballast water and biofouling (Gjølberg et al., 2017). The authors Andersson, Baldi, Brynolf, Lindgren, Granhag, and Svensson (2016) listed additional sources of pollution like water pollution by discharges of oil due to accidents/groundings, operational discharges, shipwrecks, bilge water, propeller shaft bearings, illegal discharges and marine litters. Other source is the anthropogenic noise affecting both humans in ports and marine organisms by the rotation of the propeller.

Another fact is that despite its international nature and enormous growth, the maritime transport sector has been extremely slow in achieving global agreements for the reduction of ships emissions.

1.4.2 Social pillar for shipping industry

A great amount of criticism towards industry targets its social agenda (i.e. working conditions, safety, ship dismantling practices, etc.) as well certain mechanisms established within the industry artificially keep international costs of maritime shipping low at the expense of environmental and labour concerns.

Thanks to shipping and low transport costs, society benefited from globalization of trade. For this reason, society is “hooked” on shipping (80% of all goods by volume are transported by ships) and tendency is to increase dependence.

Promoting intra-generational equity and inter-generational equity is at the core of SD. Therefore, the question of including fairness in business comes up. The author Rubin (2012) points

two reasons for considering it on decision making: (1) fairness is a virtue, and (2) the positive consequences of being fair outweigh the negative consequences. The shipping operations affect negatively equity and fairness not only when contribute for pollution of marine ecosystems but also when directly or indirectly increase poverty or inequalities.

Regarding social inclusiveness and value, shipping can ensure equal opportunities for all, regardless of their background. Shipping industry can also create conditions to active participation of members specially in decision making processes. In the event of economic pressure shipping can easily affect social side of SD through irresponsible cost cutting.

For health and safety goal shipping contributes negatively with NO_x, SO_x and particulate matter (PM) emissions in coastal areas and cities. Emissions of PM from shipping are estimated to cause 60 000 cardiopulmonary and lung cancer deaths per year (Gjølberg et al., 2017). Oceans are a source of food and is the largest source of protein for humankind (Virapat, 2011). As an example, illegal fishing, depletions of fishing stocks and the perception of toxic waste coming from ships was considered to be in the origin of piracy in Somalia (Beri, 2011).

Regarding supply chain social responsibility, it includes improvement in employee's job satisfaction, customer loyalty, relationships with partners, community, authorities and financial performance (Lam, 2015).

The labour conditions also impact on society since is not only shipping industry employees but those who are employed by ocean industries that are affected by unsustainable practices. In this regard a special mention to the scrapping problem where most of the workers typically use little or no protective equipment and are exposed to toxic chemicals (Andersson et al., 2016).

Regarding safety and working conditions, the safety of life at sea (SOLAS) and Maritime Labour Convention still have room for improvements in order to decrease fatalities to levels as low as possible.

1.4.3 Economic pillar for shipping industry

While the world is claiming for changes in business models, shipping industry continue with business as usual which can lead to future problems. Not complying with legislation or ignoring SD will soon or later impact negatively on economic side. For instance, a ship without environmentally friendly technologies will have a reduced price on the market. Also, a negative impact is expected anytime a company is perceived as unsustainable.

1.4.4 Cultural pillar for shipping industry

The cultural pillar includes dimensions like wellbeing, creativity, diversity and innovation (Governments, 2010). These dimensions have been addressed by researchers separated from SD context. For instance, multiculturalism (diversity) among the crew onboard and different part of the company has been studied by Gausdal and Makarova (2017) on the context of trust and safety onboard. Their study concluded multicultural crews are an obstacle to interpersonal trust.

The innovation subject is becoming popular in shipping since drivers of change are forcing reshaping of shipping companies of the future (Lorange, 2009, p. 3). Some drivers of change mentioned by Lorange (2009) cover sustainable development issues like rebalancing the competitive edge, environmental and safety concerns, uneven economic growth, demographic shifts, increased demand for goods. The authors Wijnolst, Wergeland, and Levander (2009) address innovation and creativity thinking in shipping industry highlighting the importance of different methods like interpersonal relations, networking, maritime clusters and brainstorming. The author outlines some psychological obstacles to overcome in order to have a positive attitude towards change and innovation like convictions based on experience of "things that do work" and "things that do not" (mindset), such vision is not working under marketplace turbulence. To stay in the business under these circumstances managers must be creative and flexible which requires work on the cultural side of shipping industry managers.

1.5 Challenges on implementation of sustainable development

Currently, awareness on the topic is increasing; the Paris Agreement has shown that despite disturbances from major political actors, almost all countries agree on anthropogenic climate change. According to World Wildlife Fund (WWF) three planets would be needed if every citizen adopted the UK lifestyle (DESA, 2010), yet seems to be difficult and unfair to convince developing countries for voluntary simplicity or degrowth policies. Therefore, the key question is if it's possible to raise living standards and human development everywhere and for all while keeping ecosystems carrying capacities (DESA, 2010).

The same occurs in shipping industry, the competitive market that characterize shipping seems to be incompatible with long term perspectives. The business is complex and variables constantly changing unpredictably.

Nevertheless, we believe when business is supported by research and innovation the complexity can be diminished and long-term vision achievable. To support organisations in decision making process, some authors developed frameworks to strategically handle these

challenges. This is the case of Broman and Robèrt (2017) and their *Framework for Sustainable Development* (FFSD). The FFSD defends a systematic approach to handle complexity, such methodology can be associated to *systems thinking* that has his roots in the middle of the 20 century by author Senge (1990) in the context of cybernetics. Further contributions like Sterman (2000) moved the discipline into problem solving in the context of management. Next, we will study how system thinking method through FFSD can help us to solve complexity. Later, we will apply it to our case study.

1.5.1 The systems thinking contribution to sustainable development

The complexity inherent to SD requires a holistic analysis. System thinking theory accepts complexity as part of reality. In what concerns SD, complexity arises every time we need to sacrifice one pillar and favour another without losing track of the SD (Strange & Bayley, 2008). This shift of mind as it is advocated by Senge (1990), requires not only adaptive learning (more concerned on reactions to reality) but also a generative learning that enhances capacity to create long-term vision.

The common error of isolating problems from a broader context, as it happens with the focus on economic growth ignoring other pillars, manifest how relevant is systems thinking approach for SD. This limited analysis also leads to ignorance about how growth can be achieved, whether or not it is lasting, who benefits and who might be left behind (Strange & Bayley, 2008).

In fact, systems thinking relates to SD since it gives us *"The ability to see the world as a complex system, in which we understand that "you can't just do one thing" and that "everything is connected to everything else.""* (Sterman, 2000, p. 4). The systems thinking is intrinsically linked to the methodological holism that can be expressed by *"the laws of the more complex situations in the system are not deducible by way of any composition laws or laws of coexistence from the laws of the simpler or simplest situation(s)"* (Audi, 1999, p. 566). This is called *explanatory emergence* and may exist in a system if a variable behaviours in complex systems in a way that does not at simpler levels, that a property of the "whole" interacts with properties of the "parts" or that relevant variables interact by different laws at more complex levels (Audi, 1999). This concept has been adopted in SD as opposite to *explanatory reductionism*, *"according to which all laws of the "whole" (or more complex situations) can be deduced from a combination of the laws of the simpler or simplest situation(s)"* (Audi, 1999, p. 566).

1.6 Framework for Sustainable Development

As a result of systems thinking theory the *Framework for Sustainable Development* (FFSD) purpose is to gather all fields of knowledge and actors around SD creating favourable conditions for cooperation among different expertise. To increase cooperation, first all actors must agree on the problem and share a vision. During the process of building a shared vision *systematic backcasting planning* has proved to be a suitable approach rather than forecasting (Broman & Robèrt, 2017). In the words of Robinson (1982) *systematic backcasting planning*, applied to energy policy analysis, consist in *""working back-wards" from a particular future end-point to the present to determine what policy measures would be required to reach that future."* (Robinson, 1982, p. 337). At the same time, forecasting can take place when exploring early steps (e.g., simulations of likely implications of different choices in the shorter term) (Broman & Robèrt, 2017).

As we pointed before, without a principled definition of sustainability (i.e., the principles that all can agree in order to start visioning the future) four potential shortcomings can occur: risk of indifference and inactivity due to lack of agreement in large groups with many different values and preferences; difficulties to know whether any given scenario is truly sustainable or not; problems to achieve transferability of elements between scenarios which hinder general conclusions and gain learning. Finally, if we focus on scenario instead of principles, what might currently be seen as a specific optimal final solution, might be seen as completely obsolete later due to the continuously changing of society and technology (Broman & Robèrt, 2017).

1.6.1 The 5 levels in framework for sustainable development

The FFSD was developed to unify principles across disciplines and sectors assuring they are necessary, sufficient, general, concrete and non-overlapping. The framework is based on 5 levels: *system, success, strategic, actions* and *tools*.

1.6.1.1 System level

The systems that physically exist are open systems because they don't depend on the system itself but exchange energy or information with exterior (input and output variables). The systems commonly addressed in SD are the Human system, ecological system and socio-ecological system. The human system is associated to the *"very weak sustainability"* concept since defends economy as the relevant system and nature the provider of natural resources (Gallopín, America, Environment, & Division, 2003). On the other hand, ecologic system is associated with the concept of *"very strong sustainability"* which *"favours a more fundamentalist mode of ecological solidarity*

with the Earth and all forms of life" (Gallopín et al., 2003, p. 15) asserts that *"natural resources cannot be substituted by human-made capital; they cannot be depleted, therefore, without an irreversible loss in social welfare."*(Gallopín et al., 2003, p. 14). The third way is the socio–ecological system that recognizes the interlinkages between society and nature. It is considered the *"strong sustainability"* because acknowledges that *"some environmental components are unique and that some environmental processes may be irreversible"* (Gallopín et al., 2003, p. 15). In the socio-ecologic system we have a whole system approach.

According to Broman and Robèrt (2017) assimilation capacity, purification capacity, food production capacity, climate regulation capacity, and diversity must be sustained in ecological system. In the social system: trust between people and between people and societal institutions, diversity of personalities, ages, gender, skills, etc., common meaning, capacity for learning, and capacity for self-organization (Broman & Robèrt, 2017).

1.6.1.2 Success level

This level concerns the nature of sustainability basic principles. Given the conclusions about social and ecologic system, Broman and Robèrt (2017) defends the sustainability principles of the FSSD must be *"generally applicable and still sufficiently concrete to guide analyses, innovation, planning, and selection, development and a coordinated use of supplementary methods, tools and other forms of support"*(Broman & Robèrt, 2017, p. 22).

1.6.1.3 Strategic level

The strategic level is concerned with how to approach the vision framed by principles agreed and shared within the organization, discuss possible actions to follow and map the multitude of viable routes. Also include an economic analysis to ensure enough resources to feed the process (Broman & Robèrt, 2017).

1.6.1.4 Actions level

The previous analysis in strategic level require a selection of priorities. On Actions level theory becomes practice and feedback collected from reality to reassess strategic plan if necessary (backcasting) (Broman & Robèrt, 2017).

1.6.1.5 Tools level

The tools level is where all forms of support required for decision making, monitoring, and disclosures of the actions are collected and chosen to reach the vision (e.g., the tools presented in this work).

To simplify implementation of the framework, creators of FFSD introduced the ABCD method[1] that can be easily adopted by organizations working on a determined *system*. In the *success level* principles are underlined and organization analyses the current situation. The s*trategic level* discusses where organization wants to be in order to reach success. Additionally, through assessment and evaluation of actions taken, determine if organization is moving towards the vision. A strategy requires *actions* that could be selections, dialogue with stakeholders, analysis of life cycle of a product or even to end business with unsustainable suppliers.

Table 1 - ABCD process

A: Awareness and success	• take contact with the system they are in (the funnel), FSSD and ABCD method. • agree on preliminary vision of success framed by the basic sustainability principles. • vision may include the organization's core purpose, core values and overall 'end-goals' to a level of specificity that is felt relevant and can be agreed upon after they are analysed with regard to their overall potential in relation to the sustainability principles
B: Baseline assessment	• analysis and assessment of the organization current situation in relation to the vision • list current challenges as well as current assets to deal with the current challenges or that can in other ways potentially support the transition towards the vision. In particular, the analysis and assessment should reveal how in concrete terms the organization contributes to society's violation of the sustainability principles and how current assets contribute or could contribute to society's compliance with the sustainability principles. • identifying relevant subsystems and their interrelated nature will allow for coordinated development, such that solutions within each subsystem can be supportive of solutions in other subsystems, or in any event not be counter-supportive.
C: Creative solutions	• participants apply creativity methods such as brainstorming to identify possible solutions to the challenges and for capturing of the opportunities implied by the gap between the vision established in (A) and the current reality established in (B). All possible actions that can help closing the gap are listed, including ideas for how to utilize the existing assets listed in (B). The ideas generated are scrutinized only with respect to the vision within the sustainability principles. • Constraints implied by the current reality, e.g., the current infrastructure, energy system, stakeholder dependencies, financial capacity, etc., are temporarily disregarded. Just because an action is not feasible immediately, does not preclude it as a viable step later in the transition. • additional overall 'end-goals' may come up and can then be added to the vision, or the goals already there might be adjusted based on the new ideas. For a discussion on dematerialization and substitution as examples of broad and dynamically interrelated approaches to addressing sustainability challenges at the C-step.

[1] This method was tested around the world with successful examples like IKEA, Scandic Hotels, Interface, and Collins Pine (Nattrass & Altomare, 1999).

D: Decide on priorities	• prioritize among the possible solutions established in (C) into a strategic plan. • The most basic guidelines imply that early steps should be (1) flexible platforms for forthcoming steps that, taken together, are likely to support society's transition towards sustainability and take the organization to the sustainability- framed vision, while striking a good balance between (2) the pace of progress towards the vision and (3) return on investment. • The guidelines must be combined. Otherwise, an actor might, e.g., run out of financial resources and find its competitive position diminished or select actions that give quick wins but then turn out to be sub optimized in the longer perspective. It is only in the context of coming steps and the identified gap to the vision that an action can be evaluated in a meaningful way, not in isolation

Source: (Broman & Robèrt, 2017)

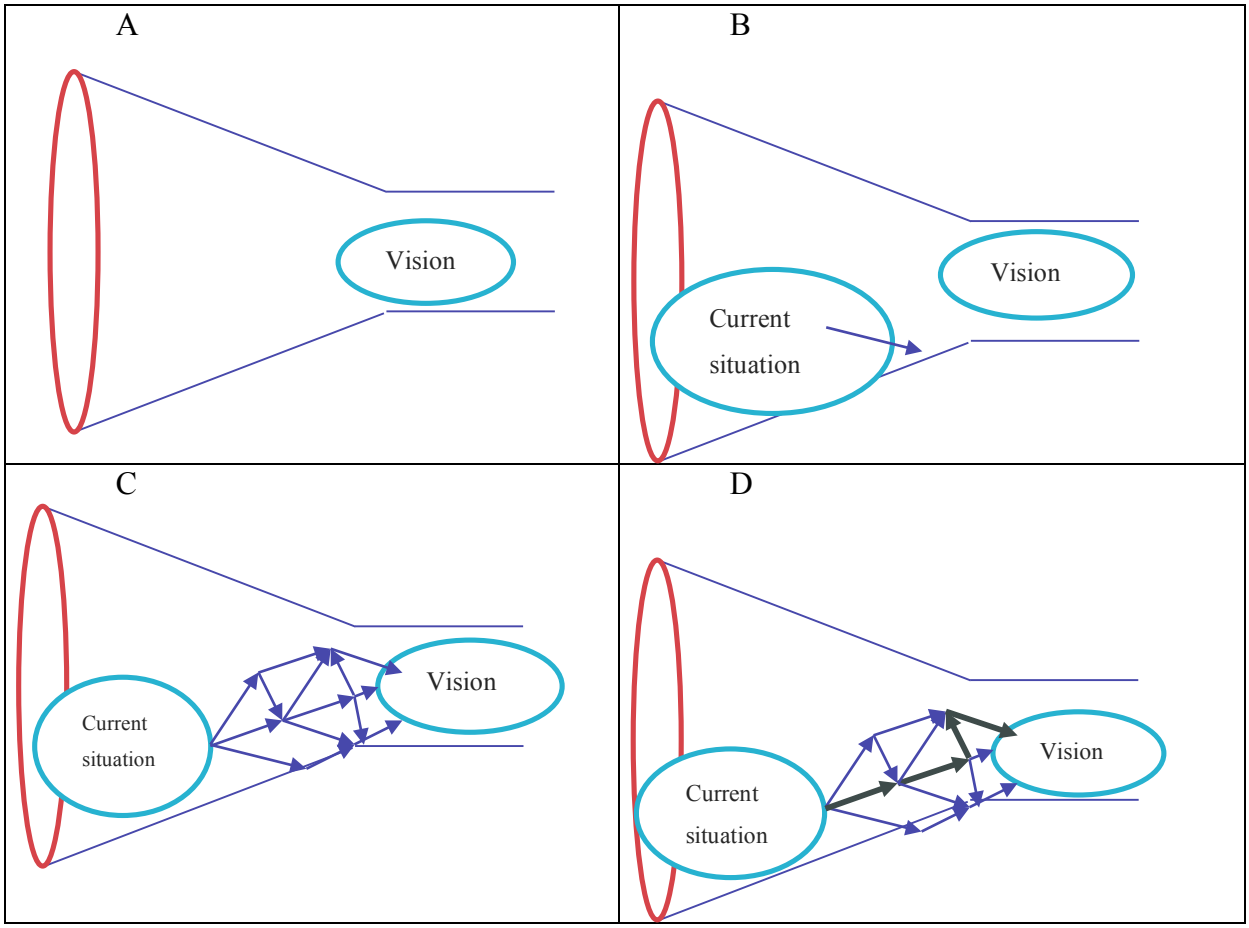

Figure 2 - Funnel metaphor

Source: author adapted from (Broman & Robèrt, 2017)

The table 1 lists guidelines of ABCD process while figure 2 and 3 illustrate the method. The figure 2 compares the method to a funnel. The inclined funnel wall represents the increased challenges as close as organization gets from the vision. In A step, there is an eye contact with the vision, in step B is possible to identify the current situation, the current challenges, hindrances to reach the vision and assets to overcome them. In step C, possible steps towards vision are mapped

and finally in step D, a strategic plan is delineated. The figure 3, illustrates the importance of backcasting.

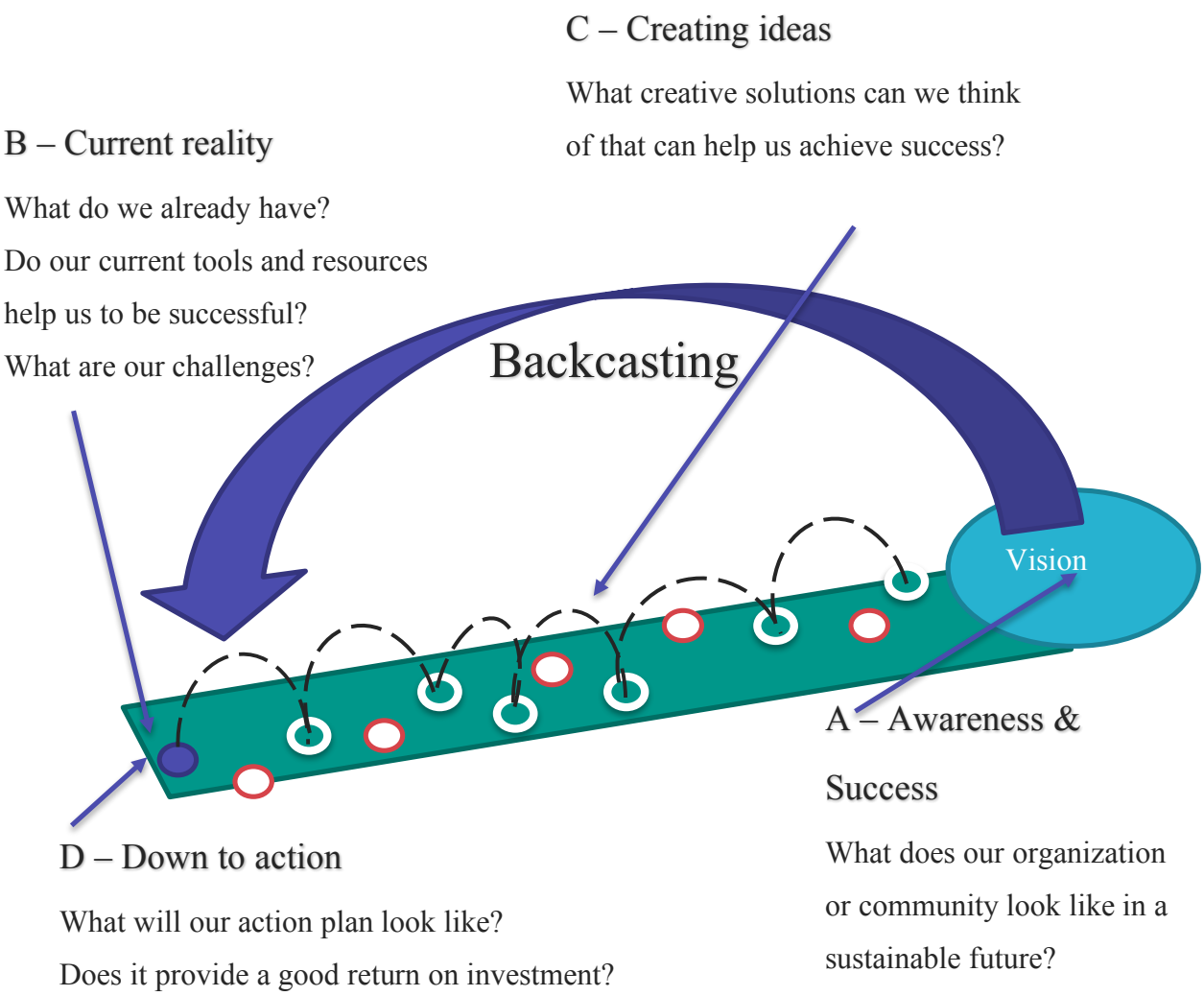

Figure 3 - ABCD method

Source: author adapted from (Step, 2016)

1.7 Step A applied to the case study

The step A requires a contact with the system (our funnel). The system of this study is in general, the Maritime Transportation System. According to ABCD method, by looking into some characteristics will be possible to identify in step B *"relevant subsystems and their interrelated nature will allow for coordinated development, such that solutions within each subsystem can be*

supportive of solutions in other subsystems, or in any event not be counter-supportive". The relevant subsystem will be later identified as TS-Ship relation.

1.7.1 The Maritime transportation system

One of the most recognized aspects of this system is its globalized nature, this is observed by multiple nationalities working today directly and indirectly in the industry. Companies are getting more international; the trade of a country is moved mainly by foreign companies. The developments in maritime transport and international seaborne trade are influenced by worldwide macroeconomic conditions (UNCTAD, 2013). The easy access to information about markets overseas, encouraged transport of raw materials and manufacturing to places where costs are lower. For instance, agricultural products are produced somewhere in American continent, shipped to another continent to intermediate processing and to a third continent for final assembly and delivered to the market (J. Corbett, 2010).

Cargo containerization boosted the globalization of goods in smaller packages. The possibility to use integrated freight transportation across all modes and containerization, standardized the shipping package and reduced the per-unit cost of transporting. The increased globalisation along the centuries drove competition for new markets overseas, due to this fact, the industry used technology to increase efficiency and greater performance at lower cost (e.g., shift from sail to coal, and from coal to oil). The fuel costs represent 20% to 60%, hence, since managers main concern is to operate ships efficiently, measures are taken to assure efficient operations at sea and technologies to reduce fuel consumption were integrated (J. Corbett, 2010).

Globalisation also influenced positively safety at sea due to the global community environmental awareness (Grammenos, 2010). Under UN, IMO has contributed with key developments like safety of ship operations, namely International Safety Management (ISM) code and Standards of Training, Certification and Watchkeeping for Seafarers (STCW) amendments (Mukherjee, 2013). The STCW convention introduced minimum requirements for training and work at sea motivated by easy access to low cost crew from developing countries which increased the risks regarding safe ship operations (Grammenos, 2010).

When material move internationally, at some point is required a common ground of commercial regulations, global standards, rules and regulations. For this purpose, IMO set the standards and certify rules are being applied. Locally, at the port or final destination different rules may apply and be stricter than international. Both nationally and internationally should be expected future changes in order to *"accommodate new challenges, such as technological advances and*

increased societal expectations for improved safety, security and environmental protection." (IMO, 2013, p. 6). Regarding stricter regulations, a balance between cost and benefit and holistic analysis must be performed, otherwise they can put at risk the low cost of movement with consequences for growth and prosperity (IMO, 2013). It is pointed by IMO (2013) the importance of all actors in the value chain to work together and make maritime transport system more sustainable. These actors are affected by costs in different ways (figure 5), attention should be taken into costs affecting links which may lead to transferring of costs from one part of the system to the other, compromising the SD basic principles. Hence, one of the challenges of the system is how burdens can be distributed *"equitably and fairly across the chain of actors in order to make the whole System sustainable"*(IMO, 2013, p. 7). As an example, the author Grammenos (2010) agrees outsourcing of non-core activities adds efficiency and value to the end customer but warns that basing a global supply chain only on least cost channel members could result in drastic consequences (e.g., loss of life, global climate change and environmental degradation) (Grammenos, 2010).

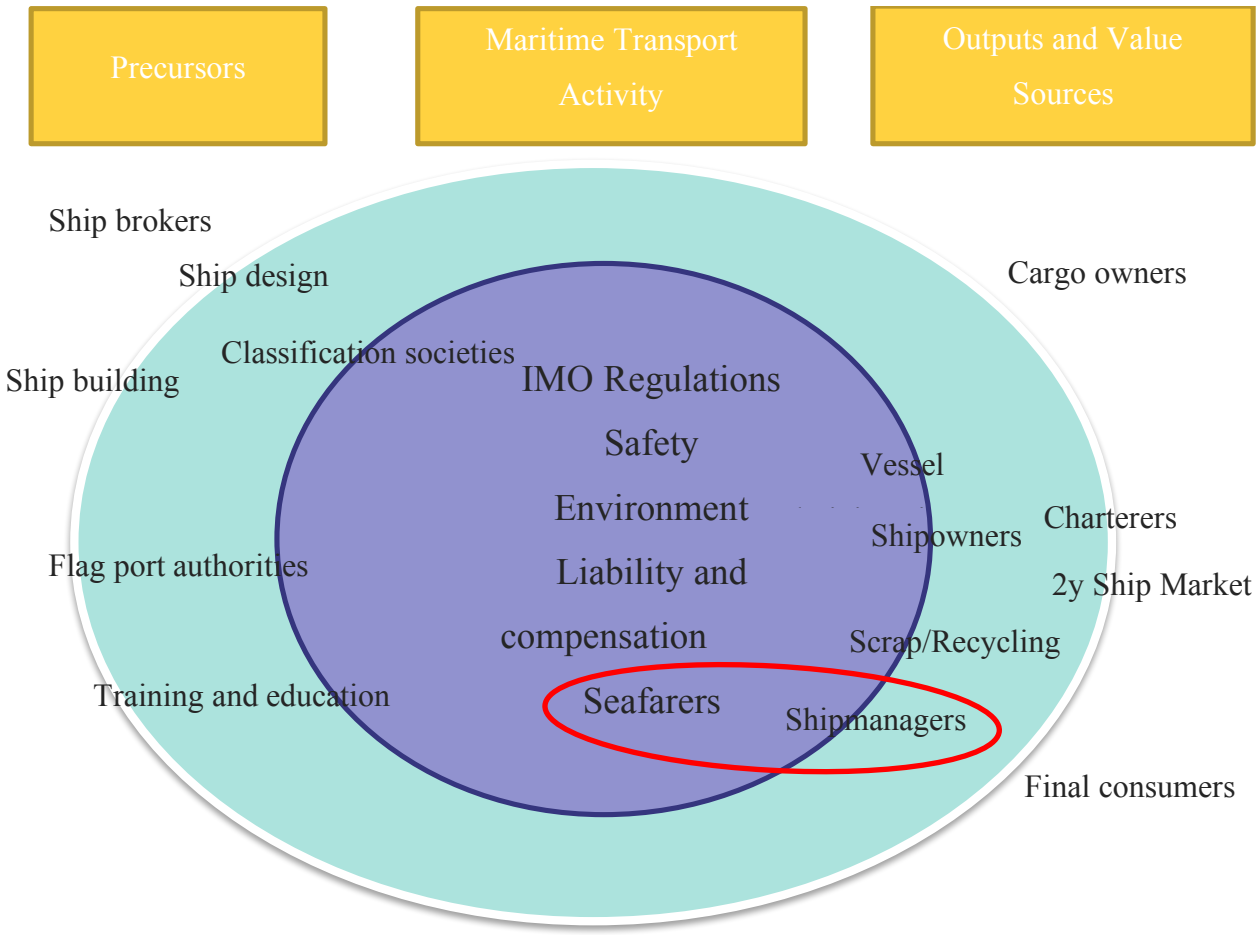

Figure 4 - Maritime Transportation System

Source: (IMO, 2013)

The actors in the system consist in designer, construction company, ship owner, those who operate the ship, management and crewing of ocean-going merchant vessels, schools who do seafarer training, organizations who guarantee the safe operation of the ship like classification societies, International Maritime Organization (IMO) regulations and finally liability and insurance companies. The IMO (2013) report refers as the main barrier of the sector regarding SD the *"…prevalent tendency towards profit-maximizing by each of the actors, who may succeed in shunting costs to other actors, and this may in turn affect the sustainability of those other actors' operations…"* (IMO, 2013, p. 7).

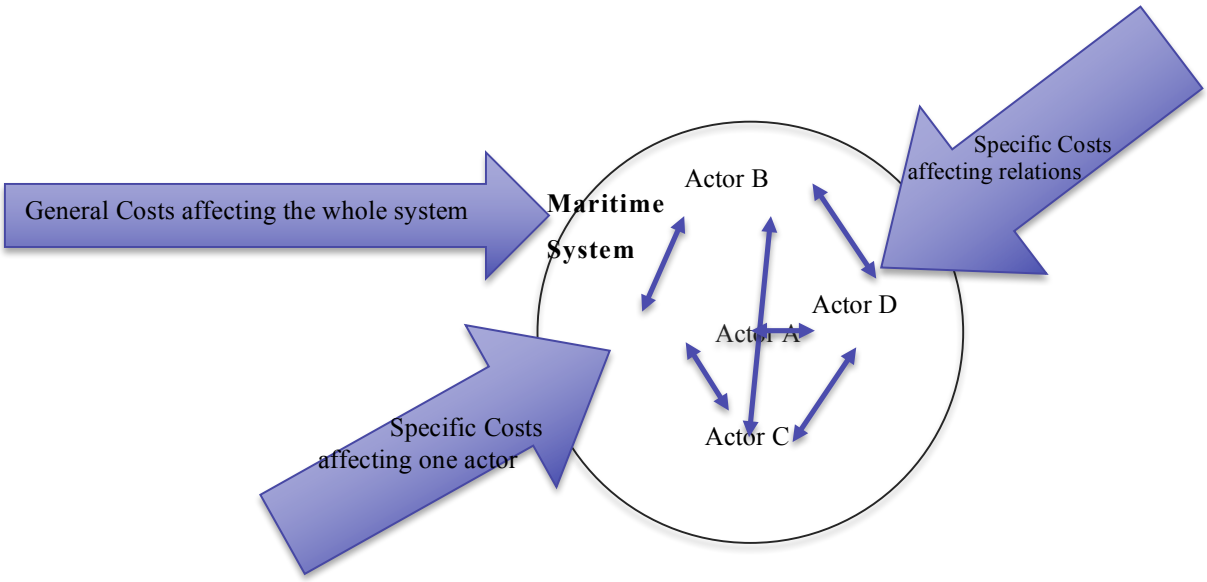

Figure 5 - Distribution of costs in the system

Source: Author based on (IMO, 2013)

1.7.2 Sustainability principles of maritime transportation system

In the previous point, key elements of the system and its globalized nature were identified. As part of step A, there are shared basic principles of SD that must be agreed in maritime industry system. In this aspect the SDGs applied to shipping can contribute especially those where operational level (Ship side) and management (TS) can directly influence.

1.7.2.1 Biosphere

The biosphere is the basic system, it is where we live and form the base for human life. The goals of clean water and sanitation, life below water, life on land, and climate action depend directly of shipping industry.

The goals of *clean water and sanitation* and *life below water* require from seafarers awareness about the consequences of irresponsible operations at sea. Their positive actions can reduce harmful discharges to sea, improve water efficiency and prevent transfer of alien species. Regarding the goal of *climate action* it requires from seafarers awareness on the consequences of operational inefficiencies (Gjølberg et al., 2017).

1.7.2.2 Society

These goals are not separated from biosphere since social development depends on it. The same happens between societal related goals and economic goals (Gjølberg et al., 2017). The goal

of *good health and wellbeing* shipping can contribute by providing physical and psychological support to its employees. The *no poverty* goal can be positively influenced by facilitating job creation within its own operations and by responsible management of human resources even during economic crisis. Finally, *affordable and clean energy* goal can be pursued by motivating energy efficiency in operations.

HIGH		**8- Decent work and economic growth**	**13 – Climate action** **7 – Affordable and clean energy**
MEDIUM	1 – No poverty	16 – Peace and Justice 17 – Partnerships for the goals 2 - Zero Hunger **12 – Responsible consumption and production**	**14 - Life below water** **11 – sustainable cities and communities** **3 - good health and well being** **15 – life on land**
LOW	10 - Reduced inequalities	4 – Quality education 5 - Gender equality 6 – Clean water and sanitation	
	INDIRECT	MODERATELY DIRECT	VERY DIRECT

Figure 6 - The potential for shipping to contribute to each goal

Source: author adapted from (Gjølberg et al., 2017)

1.7.2.3 Economy

It represents interaction between the two previous pillars. Shipping can influence the goal of *decent work and economic growth* by improving labour rights and safety practices in its own operations and sponsoring training and development.

1.8 Step B applied to the case study

The step B of the framework, the organization current situation is assessed in relation to the vision and current challenges. This will be done by studying the impact of shipping in the pillars

and analysis of industry current challenges by Martin Stopford (2017). During the following baseline assessment, the container business will come as the relevant subsystem under Maritime transport system.

1.8.1 Effects of shipping in SDGs and current challenges

The main challenge marine transport system face is producing economic improvements while protecting environment. The focus has been in better ships but Martin Stopford (2017) believes such objectives can only be solved by a better transport system updated to 21st century transport market. He points five important topics of today's market (table 2).

Business model can be changed by smart ships, smart fleets, smart global logistics integrating door-to-door transport. The technology is there, but needs cultural change in the industry to put it to work.

Regarding economy, the challenge is to solve the conflict *"of providing a decent and safe working environment on board ships and throughout its value chain; and to facilitate economic growth through affordable shipping services, but not at the expense of the biosphere"* (Gjølberg et al., 2017, p. 15).

The authors Jorgensen and Farrag (2010) consider the current sustainability challenges for container business the Environment, Health and Safety, Security, Social Responsibility and Business Ethics.

The environment has been repeatedly mentioned as the biggest risk and opportunity, other issue comes from shipping companies operating in regions or countries with no or limited enforcement of the rule of law being exposed to risks regarding human rights and unethical business practices (Jorgensen & Farrag, 2010).

Table 2 - Challenges by M.Stopford

Challenge:	**Possible solution:**
Cycles are getting bigger and increasingly problematic	Discuss what is the right business model for tomorrow.
Sea trade growth is slowing and regional trade is changing form OECD to non-OECD countries	Today OECD controls 37% of seaborne imports and is going down at a rate of 1% a year. The potential growth area of the future is Asia- Pacific. The actual growth trend is 3% against 5% of last decade.
Shipyard capacity problem is hanging over the industry and acerbating shipping cycle problem	Shipbuilding has an important role to stabilise the business. We need a better capacity management system.

Transport system must find a way to deal with climate change	Marine Engineering and Naval architecture have little to offer. Information and management is the only way to go down on the carbon problem.
Put digital revolution to work	Break the barrier between shore-ship communications Actual business model is not a suitable platform for introducing new digital technology

Source: (Stopford, 2009)

1.8.2 Container-Ship business subsystem

The step B requires an identification of *"relevant subsystems and their interrelated nature will allow for coordinated development, such that solutions within each subsystem can be supportive of solutions in other subsystems, or in any event not be counter-supportive"*(Broman & Robèrt, 2017, p. 24). In the following points it will be possible to see how container ship business and particularly TS-Ship relation can move the whole system towards the goals mentioned before.

The container-ships consist in cellular "lift on, lift off". The dry cargo is stored in containers that can have two sizes, 20 or 40 TEU (twenty feet equivalent unit). Container-ship business is included in the liner business model among other types of ships, they are now the biggest and most modern part of commercial fleet (Stopford, 2009). All the ships in this fleet have open holds with cell guides and are designed exclusively for the carriage of containers. The type of cargo is most of the times dry, but reefer containers have been increasing to satisfy the need for transportation of perishable cargo and liquid cargo.

The cargo can require transhipment or go directly from port of loading to the destination port. To reduce trade imbalances, where empty containers have to be repositioned at minimal cost to the container shipping line, careful planning is required (Lam, 2015).

Liner shipping has a key role in global trading. It is a fierce competitive market, characterized by alliances where companies under commercial pressure try to achieve greater economies of scale, reduce costs through bigger ships and offer a degree of stability in volatile business environment (Stopford, 2009). As a structure, the container shipping industry can be considered as an oligopoly (Lun, Lai, & Cheng, 2010).

Despite the popularity of containerization, the profits have been decreasing, one of the largest companies profit ranged from 4% to 10% from 2000 to 2005 what is considered a prosperous time (Stopford, 2009). The freight rate is characterized by variations due to fuel cost, at the same time demand of frequent shipping services by shippers pressurizes liner shipping companies to reduce their operations costs. To tackle this challenges, companies looked for alternative forms of cooperation and started to form alliances to exchange resources and merge with

logistics service providers to reduce operations cost and expand its service coverage in geographical locations (Parthibaraj, Subramanian, Palaniappan, & Lai, 2016).

The societal mega-trends can affect in particular container business since *"customers will want to look to transportation companies as strategic innovation partners instead of simply service providers, thereby forcing greater differentiation in the industry"* (Jorgensen & Farrag, 2010, p. 3).

Research made by Lam (2015) about sustainable maritime supply chain in container shipping line, concluded the design requirements (DRs) of Green Design Ships, Engines, and Machinery are the most important element. The DRs can respond well to customer requirements (CRs) of pollution reduction, efficient use of fuel and resources and health, safety, and security.

The pressure to achieve good results in a fierce competitive market, make this industry particularly prone to shortcuts and transference of pressure to other actors in the value chain. These phenomena can be easily observed every time conflicting goals occur.

The internal organization mainly consist in three large divisions: Commercial, Technical and Administration. Each large company is under supervision of general management linked to the Board of Directors. The general director, normally named as Chief Executive Officer (CEO), coordinates all activities of the company and is responsible for the results. The liner companies are generally more complex and the shore–staff ratio is closer to 40 persons per ship (Stopford, 2009). One of the conflicts is the tensions arising from ship-shore relations (Sampson, 2016) (Florin, 2010) and technical department is directly dealing with this issue.

At the head of the *marine department* there is usually an ex-master (e.g. a port captain). He is responsible for the nautical operation of the ships and particularly, the personnel (sailing as well as shore-gangers), the nautical equipment, the ship's supplies: provisions, deck equipment, safety equipment, etc. Some companies employ only technical superintendents (TSs) which beside dealing with engine department are also responsible for most of deck department.

Table 3 - Technical division of a container company

Position:	**Function:**
CEO and the board of directors	control organisational budget allocation and policy making
senior managers	involved with the external liaison in the company business
ship superintendents (technical/marine superintendents)	look into the daily operation of the ships
captain, chief officer, chief engineer and second engineer	supervisory responsibilities

seafarers	Each belongs to one of the three shipboard departments: deck, engine or catering, and acquires seniority by gaining experience and a higher level of qualification

Source: (S. Bhattacharya & Tang, 2013)

The TS is at the head of *engineering department*. He is responsible for the technical operation of the ships and particularly the good working and maintenance of main engines, auxiliary engines, boilers, electrical installations, cranes, winches, windlasses, cargo pumps, etc. The head of the engineering department is also responsible for eventual repairs to the ship. He must prepare the plans, the specifications of the ship, directives to the wharf, etc. He must also verify if the ships comply with the required certificates (international safety certificates, classification certificates) and must make all preparation with regards to yearly and four yearly surveys, dry docking of the ships, etc. In case of new ships being build or ships being converted, this department shall carefully study the tenders from the wharfs and lead the negotiations as regards to the construction and the equipment of the ships. When buying second-hand tonnage, he must examine the ships thoroughly and make a substantiated report before the bill of sale is signed. In case of a time charter agreement, he needs to make the "on-hire" and "off-hire" reports. He is also responsible for the purchase of spare parts, lubricating oil, negotiations with the insurers and the representatives of the classification society and other surveyors in case of damage to the ship.

The captain and TS must always work in close cooperation with one another and mutually agree on the hiring or the eventual promotion of deck or engine officers, sailing schedules and leave arrangements of the crew etc.

Some very large companies may have a department for "Research and Development". This department occupies itself mainly with the:

- analysis of freight markets;
- study of new concepts regarding the handling of goods;
- diversification of the company's activities;
- study of new investments policies;
- study of new or more efficient types of ships;
- maintain competence within the company by keeping pace with computer techniques.

The Technical and Marine Departments take care of fleet management, including ship operations, manning, storing, repair and maintenance and dockings. The departments are also usually responsible for building of new ships, often organized in a new-building section. Project

development with optimization studies and operational analysis is done in cooperation with other departments, mainly the shipping departments.

1.8.2.1 Technical superintendent role

The Marine Engineering Superintendent is part of the Technical Management team; the designation of the position can appear on literature as Technical Superintendent or Marine Superintendent. To help clarify the role, DNV-GL (2014) introduced standard of competence "DNVGL-ST-0009 Competence of ships' superintendents" where three types of levels and categories of competence are distinguished (table 4). In general, we can identify two basic types of manager or management levels inside the technical department, the *strategic managers* who are concerned with the design of the strategy or long-term plan, setting objectives that position organisation as a whole so it may operate more efficiently and effectively. The *operational manager* that implement the chosen strategy in relation to their particular operational or functional area, dealing with everyday problems that arise in the management of personnel (Dickie, 2014). As we can see on DNV standards, *superintendent* (general) is on operational side since strategy and design in container companies are responsibility of the managing director and a group of marine and technical superintendents. In our study we will focus on the *Superintendent* (general) and *Technical Superintendent* (TS) role. Since the latter has the qualifications to act as a superintendent (general) we will consider both under the same designation of TS.

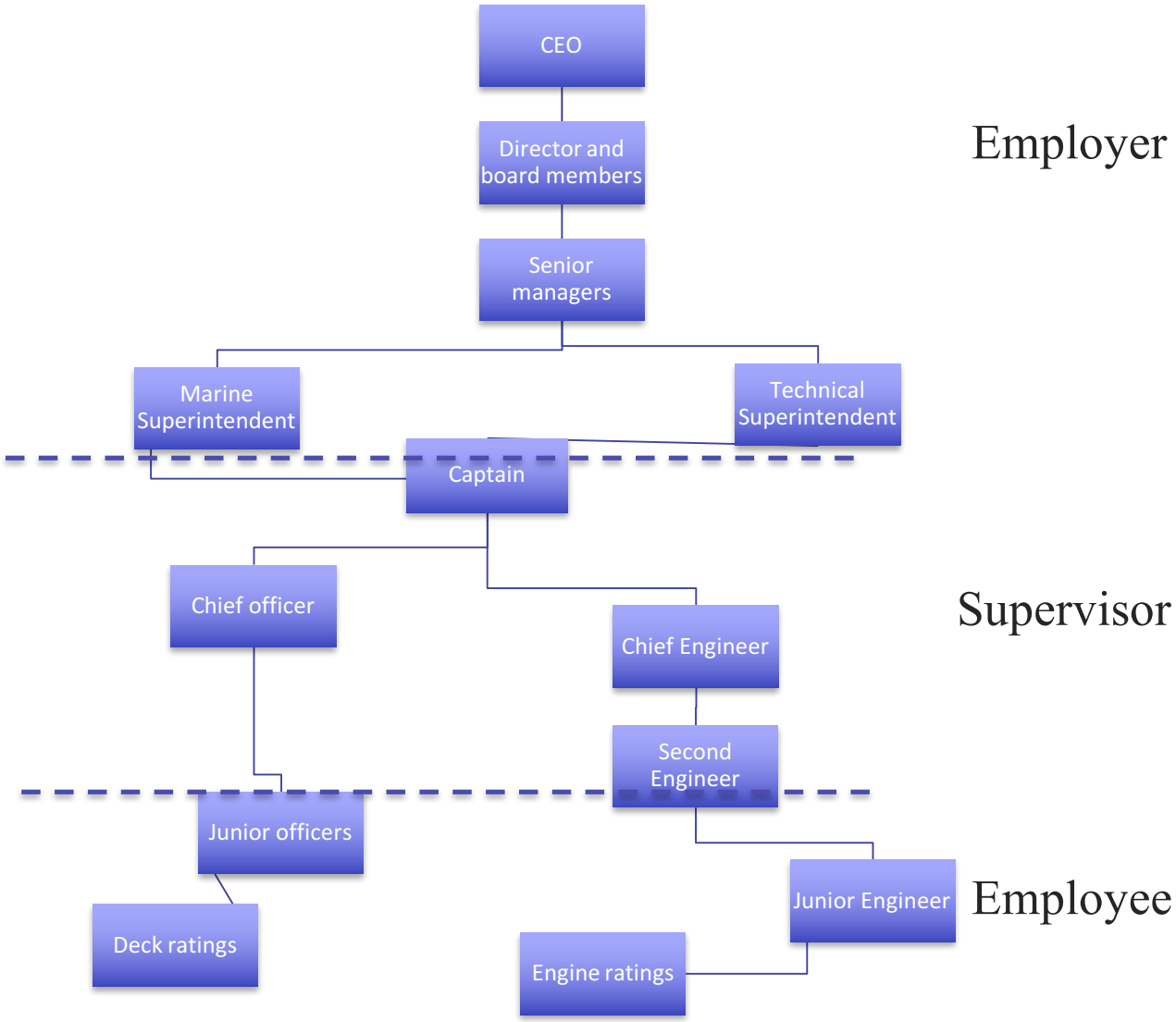

Figure 7 - An organization chart of shipping company

Source: author, adapted from (S. Bhattacharya & Tang, 2013)

The TS is normally an experienced seafarer, normally transitioning from Chief Engineer or in some cases worked only as 3rd or 2nd Engineer. When transitioning from ship to office or from operational level to management level on the ship, TSs or officers may face some conflicting goals regarding his technician past and the new functions as manager. This issue is well documented by Treher, Piltz, Jacobs, and Carr (2010).

Table 4 - Levels and categories of competence

	Competence requirements for superintendent	Competence requirements for marine superintendent	Competence requirements for technical superintendent
Superintendent (general): the person ashore, responsible for providing organisational and operational support to the ship, and to facilitate safe and efficient running of the ship.	X	_	_
Marine Superintendent: The person ashore, responsible for providing nautical and operational support to the ship, and to facilitate safe and efficient running of the ship.	X	X	_
Technical Superintendent: The person ashore, responsible for providing technical and operational support to the ship, and to facilitate safe and efficient running of the ship.	X	_	X

source: author, adapted from (DNV-GL, 2014)

The table 5 lists the main key responsibilities of TS according to Wall (2014) and DNV-GL (2014). Most of the work of TS is to act as middle man between vessel's managers and the ship (Wall, 2014), to effectively do this job the knowledge and understanding of human resource management is vital (DNV-GL, 2014). As a middle man, TS has to serve as an ambassador between the ship and the various stakeholders. Additionally, he ensures that all resources made available by the company are used in an optimum manner to maintain the value of any ship under his charge, plans all surveys, repairs, storing and dry-docking activities in a cost and time effective manner (Wall, 2014).

Table 5 - Key responsibilities of Technical Superintendent

Action	What?	How often?	To:
Monitoring	Regular planned Power Management System (PMS) reports	Monthly	Ensure that those ships are effectively using all functions in the safety management system (SMS) related to voyage abstracts, risk assessment etc., and are in line with the company's key performance indicators (KPIs) for overdue jobs.
	Noon reports	Daily	Ensure that ships are maintaining their charter party speed and consumption, cylinder oil consumption is in line with the engine makers' recommendations, a second generator is not started without a valid reason auxiliary boiler is not fired up unnecessarily.
Reviews	Voyage abstracts	Monthly	Verify that main engine rev/min and power output are optimally maintained Verify the main engine is not running in a torque rich condition
Analyses	Performance of main engine and auxiliary engine	Monthly	Verify that one generator can take at least 75% of the rated load with no abnormal consumption of lubes water, refrigerants or chemicals, the fresh water Verify that fresh water is producing around 80% of its capacity Verify other auxiliary machinery is performing within normal parameters and the economizer is coping with steam demand.
	Budget status of the ships under his charge		Provide inputs where necessary
	Accident reports	When necessary	Find root causes by dialogue with ships to encourage safety culture onboard.
Submission	Classification and statutory survey status to ships	Every 3 months	Noting which surveys are due
Planning	The surveys in consultation with owners and commercial operators	Every 3 months	Ensure they are carried out with minimum disruption to the vessel's operations.
Inspections	Ships under his charge	Twice annually	Verify that the ships are well maintained and providing a condition report to owners
Appraisals	Officers and crew, particularly the four senior officers	When necessary	Performance appraisals, records can be maintained by the company.

Source: adapted from (Wall, 2014) and (DNV-GL, 2014)

1.8.2.2 Technical superintendent as an agent of sustainable development

As a middle manager, the TS is the focal point of contact between different actors, internal and external to the organization. As we can see on figure 8, the external relations in red seem to cover most of the work of TS. However, since normally more than one ship is assigned to him, the internal relations cover a considerable time of daily work. On the ship side, sea staff is essential to keep the ship running in good performance, complying with regulations and environmental standards. Additionally to the office work, he is engaged in frequent visits to the ship and should

maintain a close relation with vessel personnel regarding operation procedures (Andersson et al., 2016). On the other side, he is dealing with office technical staff on a daily basis and upper levels in the company. Thus, TS has a privileged role to influence organization since he is the point of contact between different internal actors. Jones et al. (2017) in their study on how engineering managers can foster SD, refer to project managers and line managers as those who need to influence their teams to develop sustainable projects as part of the everyday practice of meeting client needs. Therefore, they are responsible to embed sustainability in day-to-day practices.

As mentioned before, culture as a 4th pillar of SD alerts us to the importance of shared values in a community and to avoid a top-down imposition of values. The idea is that employees must understand and interiorize sustainability values as important to behave according to it. This is more urgent in shipping where organization tend to be more hierarchical, especially at the ship (Theotokas, Lagoudis, & Kotsiopoulos, 2014).

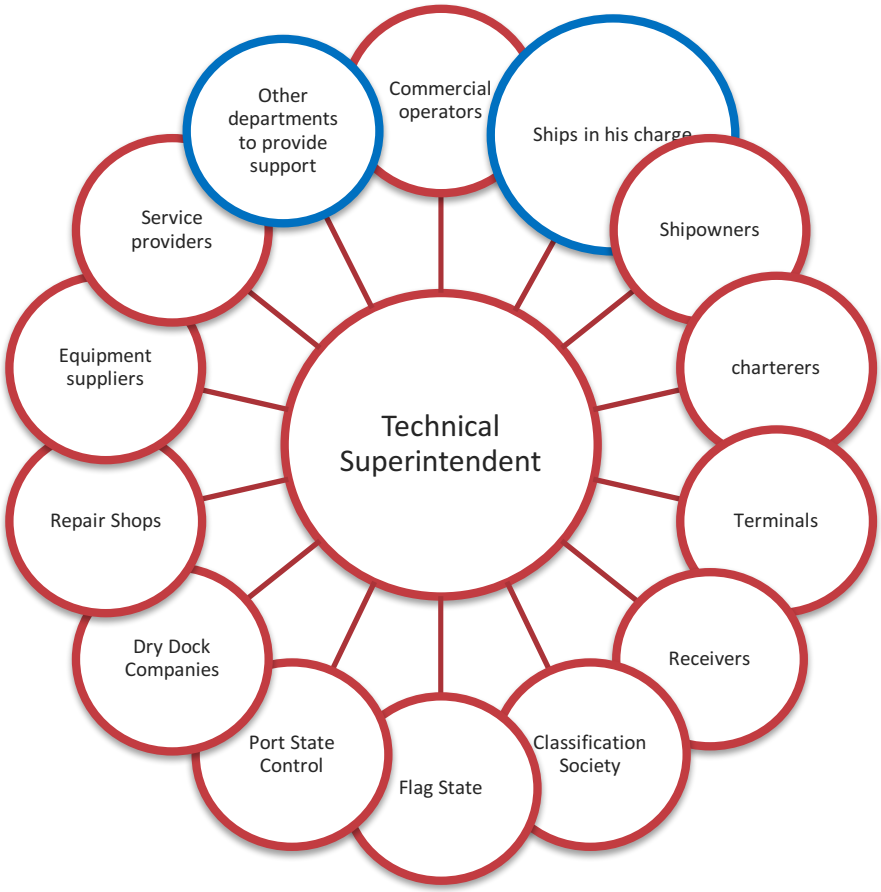

Figure 8 - TS focal point of contact between different actors

Source: author, adapted from (Wall, 2014)

The TS as middle manager is often responsible for the successful execution of a sustainability vision, Jones et al. (2017) assign to engineering managers the role of influencing their team members to include sustainability as part of everyday engineering practice. When justifying the statement, the author makes reference to the hierarchic position as unique *"to serve as a role model because he/she is in touch with the vision of upper management while also a participant on the team"* (Jones et al., 2017, p. 206). Further, the research found as main difficulty the *"ability to influence individuals to change deeply ingrained daily habits of the profession"* to be successful this may require an appeal to their values. In order to do this TS has to transmit sustainability rationale and be internally motivated.

1.8.3 TS-Ship relation and conflicting goals

Before addressing the CGs it is presented a short preview of maritime and engineering department working environment. The life onboard is dependent on individuals, these individuals are influenced by their national, professional and organizational culture (Grech, 2008). Factors such as communication, teamwork, responsibility and authority stem from the roots of national culture. Professional culture in merchant shipping is strong due to its particularities. The professional culture is characterized by a social and power distance between ordinary sailors and officers and by low levels of open communication and team work (Grech, 2008). Organizational culture has influence on crew behaviour and it is one of the main contributing factors since we are dealing with a high risk industry (Grech, 2008).

The container vessel's hierarchy is divided by deck and engine department with captain as the direct chief of the entire crew (Florin, 2010). The ship working culture has a high level of vertical hierarchical power since despite the everyday communication with the ship ashore, captain still has the full power and control onboard (Theotokas et al., 2014).

Regarding engine department, the Chief Engineer (C/E) is the leader of the team and communicates with the TS frequently by email. All email communication is normally established with captain being informed through direct mail or carbon copy (cc). Traditionally, engineering department in container companies consist in a chief engineer (C/E) as first engine officer in charge of the engine department. After, in the hierarchy line and management level is the Second Engineer. He assists the C/E in keeping the vessel running efficiently, daily maintenance and operation in the engine room. The Second Engineer is also responsible to assign duties to the operational level officers and ratings. In the operational level, the Electrical Engineer is in charge of maintenance and proper functioning of electrical systems and electrical part of machinery. At the same level, Engine watch officer position is usually held by Third and Fourth Engineer in charge of the machinery

operation and maintenance. Apart from the officers, some vessels have Engine and Electrical Cadet who are training onboard. The ratings consist in motorman who assists the engine officers, fitter who is specialized in welding or repairing and finally ordinary seaman who is responsible for cleaning engine spaces, ensuring lubrication and general maintenance.

The decisions outcomes of conflicting goals coming from TS-Ship relation are of less impact to SD than top manager's decisions regarding future regulations, design of ships, conversion, choice of fuels, etc. Yet, regarding TS-Ship relation, conflicts may arise that difficult the path towards SDGs.

The first conflict addressed is well documented in literature and is related to communication between shore side and ship side. Conflicts arise when shore legitimate demands are perceived by sea staff as losing independence. Due to the characteristics of work environment, daily life on the ship, experience, distance from office, seafarers tend to feel independent from managers ashore.

The second conflicting goal is also well studied since it was one of the posterior reasons contributing for Titanic accident. The shipowner wished the vessel to maintain record breaking speeds and despite the observation of icebergs, the captain still allowed such high speeds resulting in the sad history we all know. The question is whether the captain was comfortable to say no to the pressure coming from owner (Battles, 2001). This episode reflects a conflicting goal between efficiency and safety.

The third conflict concerns the very fast pace of change of technology and its implication on safety. In this point I try to find if TSs are supporting seafarers on new technology and making the connection between external actors and the ship staff.

In the conflict goal Environmental compliance vs work-related stress, I look how environmental regulations are being received onboard. The severe consequences of no compliance have been extended to seafarers which can contribute to increased stress.

Finally, a conflicting goal in technical department occurs when engineers transition from operational level to management. At sea, 2nd engineers are required to both operate machinery and manage people. The lack of officers in this rank make it easier to promote people only based on technical abilities. The management at sea ends on C/E rank and when they move to office for TS position difficulties arise.

1.8.3.1 Shore demands vs ship independence

The physical distance between sea and shore based personnel contributes to prejudices about work and environment on both sides (Sampson, 2016). The communication is performed mainly by TS using email and telephone, as a man in the middle he must be aware of the complexity of

communication when more than two persons are involved since the potential for information not being passed is bigger. Therefore, is important to identify the circulation list to ensure everyone is kept in the loop (Dickie, 2014).

The study conducted by Sampson (2016) on the relationships between seafarers and shore-side personnel found that TS *"generally adopted a managerial and hierarchical approach when visiting ships and were consequently felt to be on the other side of what emerged as a considerable gulf between ship and shore staff working for the same companies"* (Sampson, 2016, p. 4). The lack of experienced sea staff amongst shore staff is seen by those onboard as a problem since it will contribute to limit understanding of the ships needs and priorities. The same problem occurs with experienced sea staff forgetting the real situation on board once they enter shore-side management.

The author Sampson (2016) study mention some cases of pressure from office staff and charterers to take actions which were unwise or even in contravention of regulations. The temporary contracts also bring vulnerability in the face of pressures to deviate from best practices. Additionally, the requirement for documentation from shore side is experienced by ship side as a lack of trust in their professional skills.

To overcome the Shore-Ship communication the author Sampson (2016) make some recommendations:

- Reduce the temporary contracts in the employment of senior officers
- Better training of shore based personnel,
- Analyse the pros and cons of introduction of particular key performance indicators (KPIs) for shore based staff
- Reconsideration of the basis for ship- shore communications (which could include the design of protocols for email and phone contact),
- 24-hour office working to support vessels operating in different time zones,
- Reduce overall demands on ship staff,
- Prioritisation of the protection of seafarers on board in terms of workloads, fatigue, and stress.
- Company demands for documentation should be minimised.
- Checklists should be vessel specific.
- Checklists should be limited to essential coverage and should not be unduly detailed.
- Companies should recruit and train seafarers in a manner which allows them to place greater faith in their judgement and skill.

- Minimise the degree to which shore staff seek to remove decision making from on board staff.
- Improve the mutual understandings of seafarers and shore staff in relation to their respective jobs and working environments
- Promotes honest exchanges of information about shipboard operations, constraints, and activities.
- Companies should only recruit personnel (on board and ashore) with a high degree of fluency in a single shared language.

1.8.3.2 Efficiency vs safety

One way to pursue production goals is cost cutting, on the other side this cause conflicts with protection goals. Here, I address the consequences of cost cutting in the work environment, first by increasing risks through increasing economic and workload pressure and secondly by deterioration of working conditions.

As mentioned before, cost cutting strategy has shown not to be sustainable. Two types of cut costing can be identified, the sustainable and necessary having a good impact and the unsustainable with poor long term results. Next, I present some cases where management, namely TS and officers, can be tempted to cut costs affecting negatively SD.

The first case is cost cutting in the form of pressures from top management side as for example to load more cargo than permitted or to operate at higher speed than safe. Like Titanic case, TS or any management level officer aim to make the company perform efficiently can result in unsafe behaviours from crew side. The happens, if officers trying to please TS in order to get good appraisals, start to overload lower rankings. This will lead to unsustainable practices like reduced trust levels, communication problems and fatigue. This aspect can be understood using Rasmussen (1994) migration model (figure 9) where two pressures affect the sharp end, if boundaries are crossed the company will go bankrupt, be overworked or have an accident (Pettersen, 2015). Therefore, managers must be aware of these undesired effects of pressures when cutting costs. The manipulation of an optimal stress level as a tool for performance is criticized by M. Corbett (2015) as a long discredited model that lead to costly disasters resulting from increased stress levels. The author Tepper (2010) alerts about the managers pressure on employees to behave unethically. One of the techniques used by managers is to make workers choose between performing acts that hurts others and the livelihood on which they and their loved ones depend. This issue is more burdensome in workers with precarious contracts having consequences in performance and mental health.

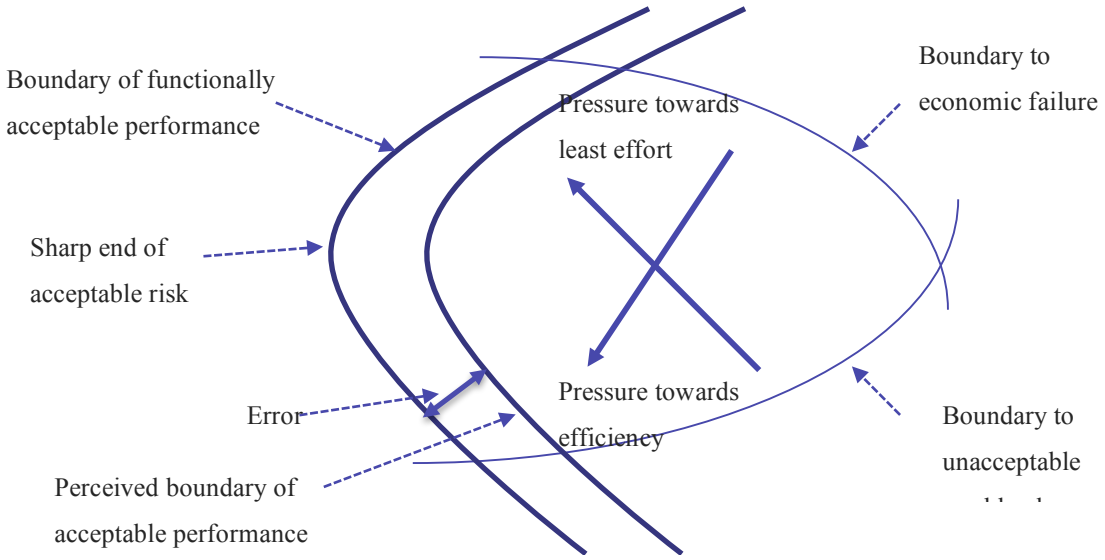

Figure 9 - Rasmussen's migration model

Source: adapted from (Rasmussen, 1994)

Another case of unsustainable behaviour is showed by MS Herald of Free Enterprise disaster where shore management had turned down installing alarm on the bridge to notify if the bow door was open (Pettersen, 2015), this fact combined with active and latent failures, caused the capsizing of the RO-RO when large quantities of water swept the car deck (Grech, 2008). This case is again one example of cost-cutting at the expense of safety standards that has lead more costs (Rasmussen, 1994). In summary, cutting costs cannot sacrifice quality, environment and safety or transfer the costs to other segments of the production value chain (Barden, 2006).

The loyalty of workers is positively correlated with the customer loyalty (Altman, 2015). Cost cutting at the expense of working conditions like food and water quality, air condition or safety may look a good strategy for short term gains but like Grech (2008) notices, the costs of interventions occurs long before returns are realized. That means, the amount saved at the expense of workers tends to get more attention than accidents avoided by proper care of working conditions. Measures like increase air movement by fans or air conditioners, extend the time to complete the task, schedule frequent rest pauses, avoid high temperature periods, maintain hydration by drinking water, provide portable heating units, increase body insulation, moderate energy expenditure, provide protection from the wind at extreme temperatures, provide warm liquids at some extent represent costs and could be targets for cutting costs by management level onshore or on the ship. A sustainable approach is to cut costs maintaining the quality or even improving it (Altman, 2015). An example could be measures to improve auxiliary energy efficiency through more efficient

components such as pumps, compressors, and light bulbs, frequency converters applied to rotating components and better insulation (Andersson et al., 2016).

Studies like Yuan, Li, and Tetrick (2015) pointed the positive correlation between job engagement and safety compliance. The motivational factor is important to engage workers, but when the focus is on minimal expenditures this leads to demotivation on TS and officers. The author Y. Bhattacharya (2015) alerts to the influence uncertainties associated with employment can play in motivation. For instance, ratings don't feel engaged cause if they involve or ask questions they are normally seen as troublemakers (Y. Bhattacharya, 2015).

Some areas can be improved without expending resources including creating a working environment where blame is not apportioned, providing job security by changing over to a continuous employment system and by augmenting pay packages by adding benefits which can give better results. Most of the above can be achieved just by modifying HR practices and changing organizational culture; additional monetary resources are not required. These practices will also enhance engagement levels of seafarers and provide additional dividends in the form of improved safety, performance, and profits. High rates of turnover also have the potential to undermine safety standards as an unstable workforce adds to the challenges involved in maintaining a safe workplace (Y. Bhattacharya, 2015).

1.8.3.3 Very fast pace of change of technology vs safety

Another conflicting goal is between the *very fast pace of change of technology and safety.* Faced with increased complexity, management and operational level cannot keep up and they end up learning by doing. The figure 10 stresses the communication problems between the actors in the shipping sector. First, legislators and national administrations found strategies for legislation to be inadequate regarding fast technological change (1, 2). They refer to Underwriters Classifiers to receive updates but these corporations are somehow influenced by ship-owners (4, 5). *"Owners and classifiers co-operate and do not inform legislators adequately"* (Rasmussen & Suedung, 2000, p. 12) and the communication problem affects the designers and shipyards that continue to rely on established practice (6, 7, 8, 9). The communication between design, manufacturing and operating communities is inadequate and they must learn by doing during fast pace of technological change (11, 12). These communication problems affect the relation between TS-Ship since both cannot keep up with the fast pace. Only the sharing of information in the relationship can contribute to speed up the pace and run after the trend.

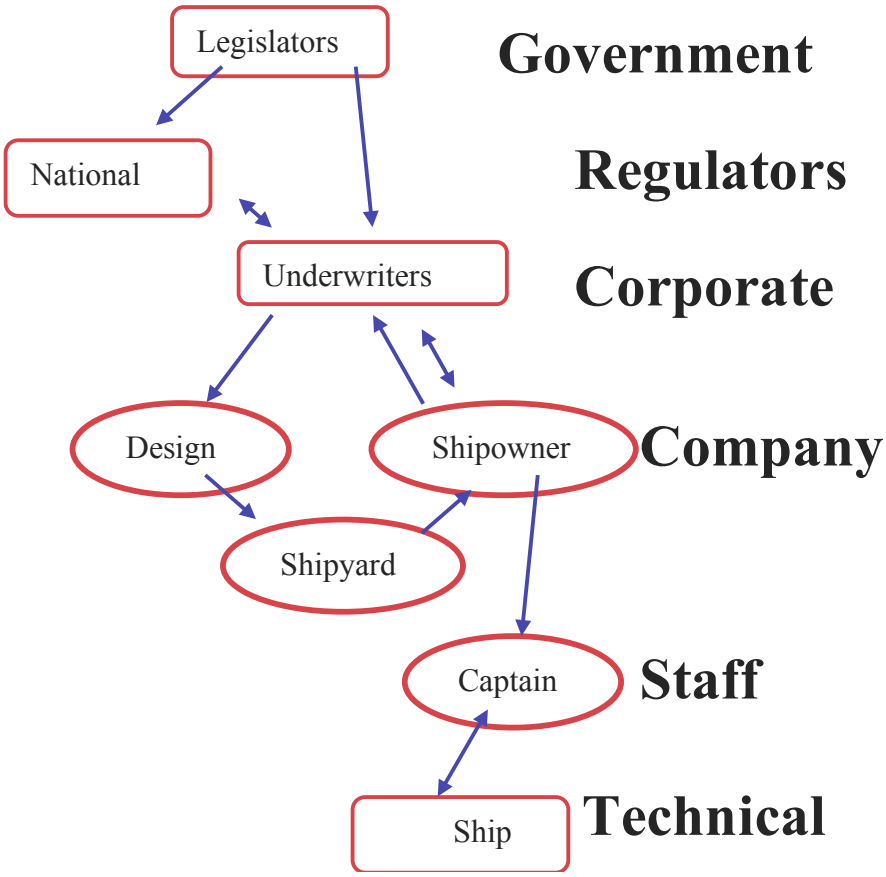

Figure 10 - conflicts among actors in shipping

Source: adapted from (Rasmussen & Suedung, 2000)

This conflict relates to the *industry, innovation and infrastructure* goal since a very fast pace of technology is necessary to tackle SD environmental goals and related regulations, on the other side the goal of *quality education* is necessary to provide the background to run after the very fast pace. This requires incentives to continuous education and strait collaboration with maritime academies to ensure a skilled workforce.

1.8.3.4 Environmental compliance Vs work-related stress

The adoption of environmental measures to avoid pollution has been mentioned along our work as a step to the SDGs related to the biosphere. The international organizations, classification societies, regional and national entities have been implementing severe regulations and tight control of what happens onboard. This is beneficial to the environmental pillar but can be counterproductive by affecting the social pillars and only partly solve the problem. The author Akamangwa (2016) developed a research study of the effects of environmental compliance on ship crews and found environmental compliance may be a contributing factor to job stress. This fact is

worsened by low level of support to workers not giving sufficient importance to personal safety and well-being considerations. Since penalties are severe for the company and officers can be held responsible, the workload is increased *"…the activity of shipboard environmental protection entails, on aggregate, high psychological demands while being constrained considerably by management controls, commercial audits and regulatory inspections"* (Akamangwa, 2016, p. 140).

Some managers are not aware of the amount of work to fill monthly environmental compliance reports. Difficulties to comply with all requirements can occur depending on the ship route and time between ports since it require available crew that in busy ships traveling from port to port is very demanding (Akamangwa, 2016). The job stress is worsened by a poor social environment and lack of adequate support to job security concerns (Akamangwa, 2016).

The environmental compliance seeks to conforming with environmental laws, regulations and standards. In one side they have led to an overall improvement of the SDGs related to biosphere, on the other side this has been achieved at the expense of crew workload (social pillar). Regarding the unit of analysis, TS-Ship relation must be improved to balance manager's and regulators demands on environmental compliance with workload onboard.

1.8.3.5 Technical manager vs engineer

This conflict is very common in shipping industry since engineers face a transition to the management level (from 3rd Engineer to 2nd Engineer and Chief Engineer). Later they can apply onshore for TS position much more immersed in management. The transition problems tend to not be recognized, challenges can occur when supervising former peers (balancing friend versus boss in the case of TS). According to Treher et al. (2010) the transition phase when managers and engineers have equivalent technical capabilities is difficult given the fact manager must handle the art of delegation to make the relation a success. If manager (TS) still rely on the previous relation where he was superior in technical capabilities, officers may resent having little influence on direction (Treher et al., 2010). The fact is that TS face many situations where they have less technical capabilities than engineers. In this situation authority and respect flow from the ability to manage resources and not from technical capabilities.

1.8.4 Current assets from literature to deal with challenges

In previous points I explored some key aspects to the research question in the subsystem TS-Ship relation. The relationship and tensions arising from it are an opportunity to drive organisation towards SD. Next, I explore as part of B step, the *"current assets to deal with the current challenges or that can in other ways potentially support the transition towards the vision"* (Broman

& Robèrt, 2017, p. 23). The tools here highlighted can be used by TSs or lower management levels to support a transition to the goals (the vision). However, the strategy tools can be used with limitations since they are tailored for upper levels. For TSs and sea staff on management level, fostering sustainable behaviours, attentive responsibility ethical framework and decision support techniques are the core tools.

1.8.4.1 Business strategies for SD in container business

The container-ship business strategy has been based on cost-leadership[2] or *integration strategy*[3]. Cost-leadership provides some protection against the five forces[4], on the other side may be difficult to sustain position if a new entrant appears with a superior sustainability performance and value adding factors.

The *integration strategy* seeks to combine lower cost with uniqueness and is adequate for globalised industries competing with firms in countries with lower labour costs or customers that may have different requirements. To perform a successful *integration strategy*, the company must master the art of reconciliation between differentiation and low cost (Rothaermel, 2015). To accomplish this, firm needs to manage effectively internal value chain activities. An important value and cost driver that container ship managers can use in *integration strategy* is customization, mainly by using information technology to do mass customization with higher quality at a lower cost. A second important driver is innovation as a key resource to resolve existing trade-offs (Rothaermel, 2015). Every time a tension between cost leadership and differentiation arise, the solution lies on innovation. Thirdly, by intervening in the firm's structure, culture and routines, the managers can both control cost and motivate the creativity necessary for differentiation. The goal of managers is to build an ambidextrous organization[5] using management practices like flexible and lean manufacturing systems, total quality management and just in time inventory management, use of teams in the production process and decentralized decision making at the level of individual customer. There is required a *"balance between exploitation (applying current knowledge to enhance firm performance in the short term) with exploration (searching for new knowledge that may enhance a firm's future performance)"* (Rothaermel, 2015, p. 184).

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[2] *"A cost-leadership strategy is defined by obtaining the lowest-cost position in the industry while offering acceptable value"* (Rothaermel, 2015, p. 178).

[3] *"A differentiation strategy is defined by establishing a strategic position that creates higher perceived value while controlling costs*" (Rothaermel, 2015, p. 180).

[4] Threat of New entrants, Bargaining Power of Suppliers, Bargaining Power of Buyers, Threat of Substitute Products or Services (Sipp, 2013).

[5] Ambidextrous organization is an organization able to balance and harness different activities in trade-off situations (Rothaermel, 2015, p. 184).

If a container company seeks to differentiate through superior sustainability performance, according to Jorgensen and Farrag (2010) the following strategies must be considered:

- Showing year-on-year Performance Improvement: Reporting continuous improvement in baseline social and environmental performance, including energy efficiency, will be critical to validating sustainability credentials.
- Tactical Investments: Incorporating robust and integrated management systems, clean technology and effective employee training programs to sustain long term performance improvements.
- Innovation: Developing new "green" solutions and services for customers who seek to mitigate their own sustainability footprints.
- Sustainability Risk Management: Mitigating sustainability risks throughout the supply chain to offer customers a complete, door-to-door solution.
- Redefining Value: and proactively identifying opportunities for value creation, beyond low cost service delivery.
- Collaboration: Partnering with stakeholders throughout the supply chain (including local communities) to generate socioeconomic and environmental benefits.

The value propositions major consumers seek in the business are: reduced costs stemming from operational efficiencies, reduced reputation and operational risk exposure, reduced sustainability footprint, increased efficiency and reliability resulting from good management of environmental, social and financial activities, sustainability innovation (Jorgensen & Farrag, 2010). These requirements only tend to test the conservative mindset of container company's owners. The author Jorgensen and Farrag (2010) listed the value propositions of tomorrow customers: the weight of sustainability factors in procurements decisions, transparency down to product level and container specifics impacts, focus on full range of environmental impacts, human rights and labour issues.

Resuming, four strategies can be pursued. The "Winners" strategy (figure 11) requires willingness to embrace a new sense of responsibility and better collaboration for innovation. The author Glave (2014) believes companies embracing a full program of initiatives (table 12) can "*boost earnings by as much a 10 to 20 percentage points"*(Glave, 2014). To achieve such earnings companies must prepare for change, this is particular difficult in container business due to low motivation of executives and staff to change status quo or strategy. This can be caused by difficulties in providing performance based incentives and structural problems that don't value departments efforts to be efficient.

Value creation from product and business model transformation	**Dreamers** - Only green lanes, low sulphur fuel only, loose sigh of costs, solar panel driven ships, etc.	**Winners** - use operational efficiency as a baseline to develop new green services to customers such as green lanes, and complete data sets on cargo impacts - proactively work with customers on reducing their sustainability impacts
Value creation from waste, cost, and risk reduction	**Losers** - pursue a strict legal compliance strategy	**Defenders** - focus on operational efficiency while building green elements into existing business models - limited innovation around services - limited cooperation with value chain partners
	Capacity of tactical execution	Capacity for strategic execution

Figure 11 - Four strategic option for Container companies

Source: author, adapted from (Jorgensen & Farrag, 2010)

The author Glave (2014) alerts to the need of finding ways to help employees embrace new ways of working, in this particular strategies to fostering SD can play a role. Another deficiency detected by the author and mentioned early in our study is the lack of innovation that result in missing opportunities to charge premiums for value-added services. It is perceived that shore-ship communication or lack of trust can hinder any attempt of innovation (Gausdal & Makarova, 2017). Furthermore, companies lack analytical resources and forecasts made with only a minimum of in-house information.

1.8.4.2 Green shipping practices.

To improve environmental performance, some shipping companies adopted Green shipping practices (GSPs) that are environmental management practices undertaken by shipping firms when performing shipping activities. The emphasis of these practices is on waste reduction and resource preservation in handling and distributing cargoes. To assess the efficiency of the practices, they use tools like carbon footprint of shipping routes and using alternative shipping equipment with the aim of reducing environmental damage in transporting cargoes (Y. H. V. e. a. Lun, 2016). From a supply chain perspective *"GSP requires internal functional coordination within the shipping company as well as external integration with upstream shippers and downstream consignees in the physical cargo movement process"* (Lam, 2015, p. 71). The benefits of adopting of GSPs is not

consensual but literature agrees on the competitive advantage to a great extent (Y. H. V. e. a. Lun, 2016).

1.8.4.3 Fostering SD behaviours

A SD vision requires from all actors in the system a change of behaviours (i.e., mindset). Information solely will not change behaviours when unsustainable behaviours are rooted in individuals.

As humans, in our daily life we make decisions and actions. Regarding small decisions, we are tempted to think they produce small effects but when replicated, they often result in big disasters. Big decisions are often result of interactions among individual citizens, businesses, civil society and governments (i.e., the decision-making process we call politics) (Strange & Bayley, 2008). Tools like the FFSD, politics and norms can support behaviour changing but we must be conscious that in the decisive moment, only individual can judge and act. Hence, the focus will be on how to foster SD in individual sphere in order to support TSs fostering SD behaviours in their relations.

The author McKenzie-Mohr (2013) introduces the *Community-Based Social Marketing* consisting in *identifying barriers to a sustainable behaviour*, *designing a strategy* that utilizes behaviour change tools, *piloting the strategy* with a small segment of a community, and finally, *evaluating* the impact of the program. When a sustainable behaviour is not embraced by individuals, it means some internal or external barriers are impeding. His study lists a couple of methods used to foster SD like sharing groups where topics are discussed, commitment by voluntary means, prompts, non-punitive norms, persuasion, motivation and incentives.

In shipping industry, the use of prompts and non-punitive norms are commonly used. The question is if they are enough to engage individuals. In a 21st century company, focused in innovation strategy is crucial to form sharing groups, develop motivation and incentives side to foster SD.

1.8.4.4 Organizational strategies for SD

The TS as a middle manager has the key responsibility of promoting SD in his relations, the extent he is able to do that is dependent on how organisations are engaged in that goal. According to Baumgartner, Mark-Herbert, and Ketola (2009) there are four common strategies. A company pursuing an *introverted sustainable strategy*, characterized by a weak or minimum sustainability strategy consisting in complying with those environmental and social aspects considered in external

pressure of stakeholders. The author alerts *"companies following these strategies are exposed to the risk of non-recognition of important trends and issues caused by sustainable development and the interests of stakeholders in sustainability issues above a minimum level"* (Baumgartner et al., 2009, p. 105). This issue was discussed previously regarding the risk of non- recognition of important trends. In container industry we can find also *extroverted strategy,* consisting in *"creating ambitious environmental programs, but effort and progress in the light of the sustainability principles can be still minimal"* (Baumgartner et al., 2009, p. 105). The *conservative strategy* is focused on eco-efficiency and uses efficiency and low environmental impacts as a competitive advantage. In this case, there is a strong internal orientation towards SD and low implementation risks, benefiting from increased competitiveness and improved effectiveness of production processes (Baumgartner et al., 2009). Finally, a *visionary strategy* is focused on sustainability as a competitive advantage through differentiation and innovation. In order to make it possible the strategy requires very strong orientation on sustainable development and commitment from entire organization.

To move companies towards SD, managers have to integrate the concept at the level of values and basic assumptions (Baumgartner et al., 2009). Values, according to organizational theory characterize what an organization stands for, they are intangible and give a distinguishing character (Bolman & Deal, 2013). They convey a sense of identity shared at all levels in the company. On the other side, the pattern of basic assumptions can clarify the company culture. They are the way members perceive, think and feel regarding the problems of external adaptation and integration (Bolman & Deal, 2013). Baumgartner et al. (2009) suggest two points for integration, show the business case for SD and secondly to give confidence about SD as a long-term strategy of the company.

1.8.4.5 Attentive responsibility ethical framework

The previous points highlight the importance TS-ship relation to influence SD since many of SDGs can be improved through cooperation between parties. However, we cannot ignore the importance of CEO's and upper levels in implementing a business and organizational strategy coincident with SD values by funding initiatives or requiring ethics be incorporated into reward systems. Notwithstanding, I consider the focus on a middle manager like TS crucial. First, because the vision can be both adopted by Technical Management companies and shipping companies with own technical management department. In both, TS is able to influence organization in the long term mainly through small decisions.

To help TSs leading towards sustainable systems, Jones et al. (2017) introduced the *Attentive responsibility ethical* framework for leadership by the engineer managers. The framework has two primary components: the *ethics of care* and the *new perspective on sustainability ethics*. They can potentially solve difficulties found in implementation by managers, since they are foremost tailored for setting attitudes managers (i.e., TSs) must cultivate in relations in order to better influence those around him and create a ground for future transformations.

This framework highlights relations, emphasising that moral self is a self-in-caring-relation that only flourish with attitudes such empathy, compassion, cooperation and most of all trust between engineering managers and their teams. It consists in four elements: *Attentiveness* (recognizing and assessing need), *Responsibility* (assuming responsibility to address the need), *Competence* (needed to design a response) and *Responsiveness* (designing the response, and seeing if it addressed the need appropriately) (Jones et al., 2017).

The combination of these two components seek to help engineering managers to move out from a consequentialist perspective, where sustainability only concerns about complying with regulations (i.e., reacting to legislation or authority's inspections). The ethical framework perspective assist engineering managers to see themselves and team members as part of the very processes they are aiming to sustain (i.e., they may be more internally motivated to be concerned about sustainability). Resuming, TS must be an internally motivated person in what concerns sustainability and must be "moral person" and "moral manager". To foster SD in engineering teams, they must believe SD actions *"not only make the project more successful, but make them better engineers"*(Jones et al., 2017, p. 207).

1.8.4.6 Decision support techniques

When faced by complex problems or conflicting goals people use biases to help make quickly and easy decisions. However, the results are not sustainable at a long term base (NBS, 2012). The Network for Business Sustainability, NBS (2012) alerts that sustainability decisions can be subjected to biases more often than other decisions. Also, divide decisions between complex and routine decisions. The TS is faced mostly with complex decisions, however as manager of his ship he knows engineering crew face numerous routine decisions. Decisions can be affected by biases and errors (table 6), complex decisions can occur for individuals or groups, experts or lay people, managers or policy makers and tend to be rare, requiring technical solutions and a lot of information. On the other hand, routine decisions are frequent and typically performed by individuals and do not involve a lot of conscious thought (NBS, 2012).

The author NBS (2012) presents some decision support techniques to counteract these problems. The first step, is to decide which kind of decision to deal with: complex or routine. Next, what are the characteristics of the decision, context to be addressed and finally which interventions are most likely to assist in getting a more sustainable outcome.

Table 6 - Biases and Errors that come into play when making sustainable decisions

Decisions Biases and Errors	What happens?	For example…
Loss avoidance	We judge gains and losses relative to our present state. We don't like to give up things we already have	Sustainability decisions may require us to give up something (even if we get something else in exchange)
Short Cuts	We focus on information that's familiar, recent or easy to interpret – even if it's not very relevant	Sustainability decision often use hard-to-evaluate criteria, e.g. recreational benefits or human health effects, which are trumped by simple financial metrics
Intuition	We over-rely on gut feeling and intuition when distracted or faced with new situation	Sustainability decisions are often novel, so individuals may struggle to process all relevant factors and rely instead in intuition
"Wants" vs "shoulds"	We tend to let "wants" trump "shoulds" – particularly when we're tired or distracted	Sustainability decisions may yield longer term paybacks, falling into the category of "shoulds" rather than "wants"

Source: adapted from (NBS, 2012)

In table 7, based on NBS (2012), I present some solutions for routine decisions and some examples that can be adopted in container shipping companies.

Table 7 - Interventions for routine decisions and examples added by the author

Intervention	**What it is**	**Possible examples in shipping added by the author**	**Why it works**
Commitment	Publicly commit to performing a sustainable behaviour in the future	When signing in onboard the seafarer read and sign the garbage segregation policy.	Public commitment enhances positive feedback for sustainable behaviour – and provides for negative feedback if you don't deliver

Defaults	Make a sustainable behaviour the default choice	The daily work of 3rd and 2nd Engineer focused on improving efficiency of engines.	Defaults and opt-out programs build on the power of the status quo and our aversion to losses
Feedback	Provide verbal, written or digital feedback on behaviour outcomes	Development of software to monitor in real time efficiency and green practices.	Makes long-term costs tangible and relevant "now"; enhances "good feelings" of meeting sustainability goals
Goal setting	Set an expected level of performance or compliance for a sustainable behaviour	Reward the seafarers who adopt environmental friendly practices (e.g. reward the greener ship of the fleet).	Enhances the meaning of feedback by providing a benchmark against which to judge progress

Source: adapted from (NBS, 2012)

1.9 Backcasting of basic principles

As part of FFSD, backcasting happens during the process of framing a vision. After finalizing the literature review I review all basic principles mentioned by the literature contributing for a sustainable relation TSs-ship (table 8). They will later be coded and compared with field data to build new concepts. The basic principles here addressed are those where TS-Ship relationship is able to influence (even in a limited way).

Table 8 - Final list of basic principles

Basic principles	**Related pillar**
Internalization of SD principles; Discussion if SD; Interpretation of SD; Balancing the three pillars; Holistic view; acceptance of uncertainty; Develop community shared values around SD; innovation; economic, social and technological progress occurs in harmony with nature; socio–ecological system; better transport system; cultural change in the industry; Break the barrier between shore-ship communications; change deeply ingrained daily habits of the profession; transmit sustainability rationale; keep in mind the real situation on board when moving to office staff; change HR practices; improve communication between design, manufacturing and operating communities; reconciliation between differentiation and low cost; decentralized decision making; balance between exploitation with exploration; sustainability innovation; move towards visionary organisational strategy; integrate the concept of SD at the level of values and basic assumptions	Culture
Efficiency and productivity; Employment and revenue generation; changes in business model; environmentally friendly technologies; increase efficiency and greater performance at lower	Economic

cost; burdens distributed equitably and fairly across the chain of actors; good working and maintenance of machinery; analyse introduction of particular key performance indicators; responsible cost cutting; industry, innovation and infrastructure; just in time inventory management; weight of sustainability factors in procurements decisions; transparency down to product level;	
Equity and fairness; Health and safety; Labour conditions; Community involvement; safety; equal opportunities for all, regardless of their background; active participation in decision making processes; avoid irresponsible cost cutting; improvement in employee's job satisfaction; trust between people and between people and societal institutions; diversity; capacity for learning; capacity for self-organization; no poverty; Ensure that those ships are effectively using all functions in the safety management system (SMS); Find root causes by dialogue with ships to encourage safety culture onboard; Performance appraisals; open communication and team work; improve the relation shore-ship, increase the number of experienced sea staff amongst shore staff; Reduce the temporary contracts in the employment of senior officers; Better training of shore based personnel, Reduce overall demands on ship staff; demands for documentation should be minimised; recruit and train seafarers in a manner which allows them to place greater faith in their judgement and skill; honest exchanges of information about shipboard operations, constraints, and activities; engage and motivate workers; quality education; balance the manager's and regulators demands on environmental compliance with workload onboard; prepare officers to career transitions to management level; develop Attentiveness, Responsibility, Competence and Responsiveness in TS and officers in management level	Social
Marine, air and soil pollution; Noise vibrations and biodiversity; Air emissions and GHGs; Climate change impacts; Resource depletion; *sustainable consumption and production; clean water and sanitation; life below water;* water efficiency; prevent transfer of alien species; good working and maintenance of machinery; compliance with the required certificates; Ensure that those ships are effectively using all functions in the safety management system (SMS); Find root causes by dialogue with ships to encourage safety culture onboard; balance the manager's and regulators demands on environmental compliance with workload onboard;	Environmental

2 Research Methodology

The research design represents the structure of the work that aims to answer the research question: *"How TS handle conflicting goals regarding SD basic principles?".* The purpose of the research question is explanatory (i.e., explain, rather than simply to describe the phenomena studied). The qualitative research method adopted is tailored to explain local causalities (i.e., actual events and processes that led to specific outcomes) where the emphasis is on explanation as the understanding of causal processes in specific cases rather than formulation of general laws. Therefore, it is assumed that the research design may or may not produce regularities (Given, 2008).

The aim of this study is to increase understanding in TS-Ship relationship (unit of analysis) and how conflicting goals resulting from it are handled. Therefore, the focus is on TS ability to handle conflicts resulting form TS-Ship relationship (dependent variable) and how he is influenced by his own perception of SD basic principles (independent variable). Based on this, the proposition is that adoption of SD basic principles by TSs will help them to handle conflicting goals resulting from TS-Ship relationship.

The qualitative study approach is consequence of the unit of analysis nature (i.e., subject-subject relationship) where researcher focus on the particulars within the whole system. Although explanatory research have been applied to quantitative research, in some circumstances authors argue that *"quantitative approaches are not necessarily the best (or only) ways of reaching explanatory conclusions"* (Given, 2008, p. 2).

The data collection is characterized by few informants, hard-to-reach populations, observations, interviews, surveys and text analysis. Since inductive explanations are not feasible with such few data and deductive explanations are not possible to make, the method used is classified as abductive explanation. The authors Frankfort-Nachmias, Nachmias, and DeWaard (2014, p. 10) argue abductive explanations "*tend to be employed when researchers want to provide a more "on the ground" empathetic understanding of phenomena."*

2.1 Approach

The approach is based on case study research: the TS-Ship relationship in a container ship company. The case study is part of qualitative methods, for Given (2008) case study can be a powerful strategy for causal explanation and Miles and Huberman (1994) claim qualitative research is in fact far better than purely quantitative approaches at developing explanations of local

causality[6]. Regarding causality, the emphasis is on how TS vision (i.e., his SD basic principles) influence ability to handle conflicts stemming from TS-Ship relation. In this sense, the context of the phenomena matters since it can influence results. The case study method is an empirical inquiry that investigates a contemporary phenomenon (the «case») in depth and within its real world context (Yin, 2009), that emphasize rich, real-world context in which phenomena occur (Eisenhardt & Graebner, 2007). The case study is justified by the contemporaneity of SD issues in shipping industry and by the opportunity of observing ship's crew behaviour, specially concerning interaction with TS. The case in his explanatory component can *describe* how technical improvements and sustainable practices are effectively being practiced by those onboard and *understand* how SD is being received on the operational community. Finally, by understanding possible hindrances to SD principles some improvements and adjustments can be adopted as contribution to theory since the purpose of a case study research is to develop theory due to his ability *"for illuminating and extending relationships and logic among constructs"*(Eisenhardt & Graebner, 2007, p. 27).

2.1.1 Approach paradigm

Based on aforementioned approach the research philosophy is *interpretivist.* According to Myers (1997) this paradigm is concerned with the uniqueness of a particular situation. To Collis and Hussey (2013) interpretivism has 5 kinds of assumptions:

- ontological assumption: focus on personal perception of reality;
- epistemological assumption: the researcher tends to minimize the distance between the researcher and what is researched;
- axiological assumption: the researcher is involved with what is being researched;
- rhetorical assumption: researcher uses personal voice and *a priori* definitions are limited
- methodological assumption: small sample over a period of time and focus on understanding what is happening in a situation and looking for patterns that may be repeated in similar situations.

The authors Frankfort-Nachmias et al. (2014) situate interpretivism as an outgrowth of the *Verstehen tradition*[7]*,* one of the social scientific knowledge components. Therefore, the focus will be more on understanding rather than reliability, replication and solid theory which are part of the natural science approach (Frankfort-Nachmias et al., 2014).

[6] Local causality consists of local events and processes that have led to specific outcomes in a specific context (Miles & Huberman, 1994).

[7] German term meaning "understanding" that in an extended sense can be translated as "empathy". This tradition believes that natural and social scientists should employ different research methodologies that allows to comprehend the others view of reality, how is expressed in symbols, and the values and attitudes that underlie these views (Frankfort-Nachmias et al., 2014).

2.2 Research process

The figure 12 illustrates the logic of research process in 3 sections representing the flow of data collected. In the first section (S1) the literature review (secondary data), in section 2 (S2) the "weak data" (literature, observations onboard and email interview) and section 3 (S3) the collection of more solid data.

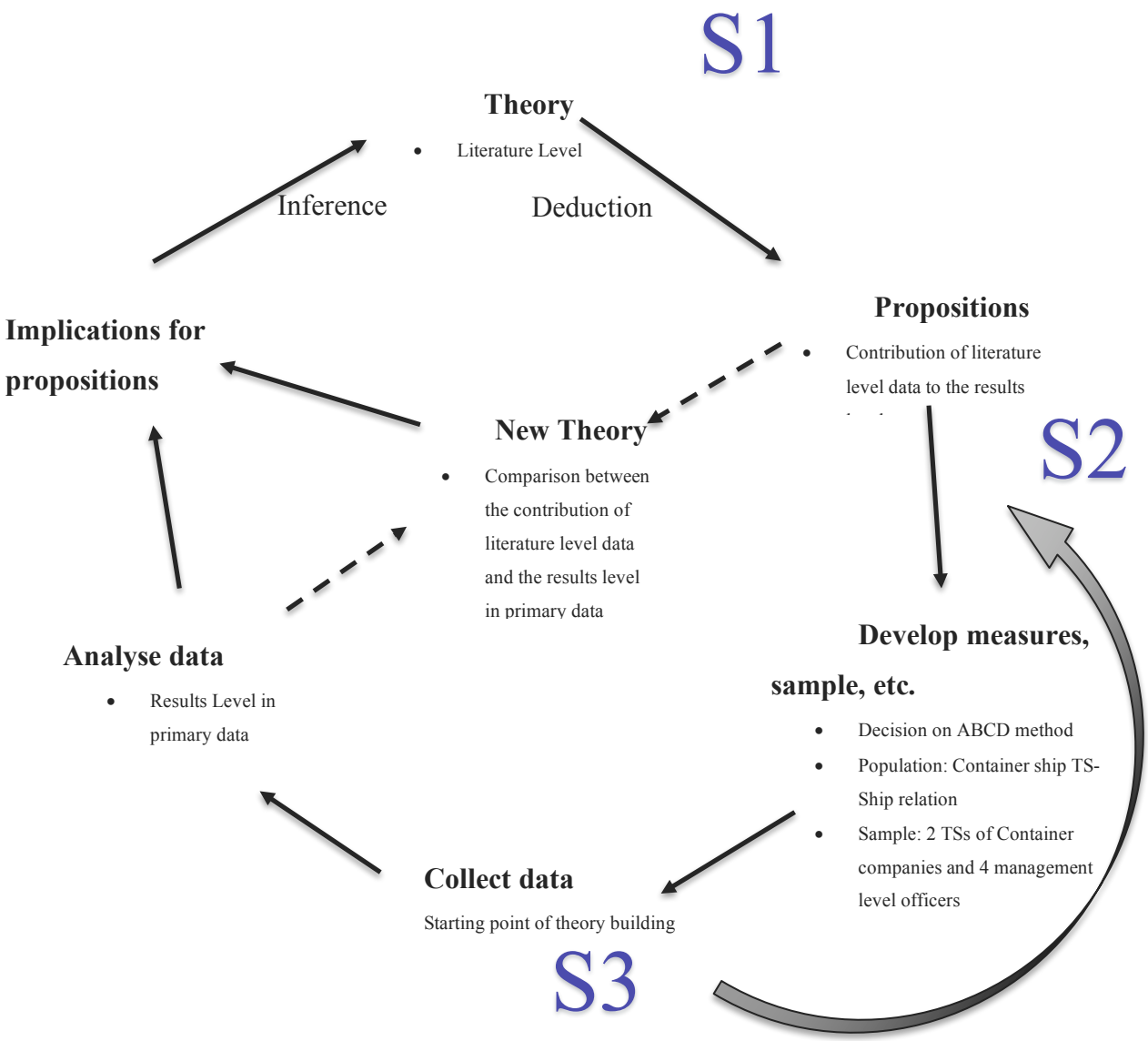

Figure 12 - Logic connection between data and propositions

Source: author

2.2.1 Research design based on Framework for Sustainable Development

Regarding structure, on table 9 are listed the different levels of data, each one based on ABCD process. The legend follows the table and explanation in following points.

Table 9 -Resume of Research Design based on FFSD

	FFSD framework across levels					
Data collection method	Levels	A Basic Principles	B Conflicting Goals (CGs)	C Proposed Solutions to CGs	D Sustainable steps towards vision?	Answer to the Research Question:
Literature Review	Literature Review level	What are the basic principles that can be applied to TS-Ship relations	What are the CGs that applies to TS-Ship relation	Solutions to handle CGs collected form literature and creativity methods to find solutions	Priorities and strategies collected from literature	
Discussion	Results level Literature	SD basic principles	Conflicting Goals in TS-Ship Relation from secondary data	Solutions gathered from literature	Priorities and Strategies for handling CGs are consistent with basic principles	How TS handle conflicting goals regarding to SD basic principles?
	Results level TS-Ship	TS-Ship basic principles	Conflicting Goals in TS-Ship Relation from primary data	Solutions created within the relation	Priorities and strategies on TS handling CGs	
Data collection method	Data level	A Basic Principles	B Conflicting Goals (CGs)	C Proposed Solutions to CGs	D Sustainable steps towards vision?	
Email interview Web survey	TS level	What are the basic principles of TS?	What are the CGs in the TS perspective?	What are the solutions available to deal with CGs?	Are solutions consistent with the step A? Do the steps show a good balance between the pace of progress towards the vision and return on investment?	
Coding	Results level of the Relation	Do we find CGs here?	New CGs from the data?	Are solutions created within the relation?	Are the TS basic principles helping TS handling CGs stemming from the relation?	
Observations Structured Interviews	Ship level	How are the basic principles interpreted by the crew?	What are the CGs in the crew perspective?	What are the solutions purposed to deal with CGs? How are the crew involved in the brainstorming?	What are the crew feeling about the outcomes?	

Legend:

Literature Review data
Data from TS level
Data from Ship level
Results level TS – Ship
Results level Primary – Secondary data

Source: Author

2.2.2 Analysis of data

The analysis of data objective is to *describe* the basic principles, conflicting goals, solutions proposed and how they are implemented (based on FFSD framework). In the discussion concepts will be assigned to patterns (coding) and used to contribute to theory and answer our research question. The study will have *implications for the proposition* since by understanding the perception of SD principles in both sides of the relation and how TS handle conflicts, we will know how and where to improve in order to foster SD.

2.2.3 Primary data level: TS-Ship relation analysis

Primary data is divided in "weak data" and "strong data". In weak data it is included an email interview to a TS and ship's side unstructured observations. The data is classified as "weak" due to the weaknesses on data collection and reliability. In contrast, the "strong data" include the web survey and structured interviews performed onboard designed to address the conflicting goals. Since one of limitations of this study is the few informants, "strong data" is not strong in itself but when compared to "weak data".

2.2.4 Data Collection

In the TS level, it was not possible to perform personal interviews due to schedule incompatibilities, lack of availability from TSs and financial restrictions. Therefore, the inquiry method used was web survey with open questions to gather as much information as possible. The method is convenient to both sides and does not inflict major problems in terms of validity since interview context is not important. According to literature, questionnaires in case study research are not useful for investigating the context (Yin, 2009), the opposite on the ship side where context is an important factor. According to Meho (2006, p. 1293) web resources *"can be a viable alternative*

to the face-to-face and telephone interviews, especially when time, financial constraints, or geographical boundaries are barriers to an investigation".

The coding method used in results level is a procedure for organizing text to discover patterns that we cannot see directly in the massive amount of text (Auerbach & Silverstein, 2003). The qualitative data analysis in the results level was made by coding secondary data into themes and then categories in order to identify patterns and form conclusions. The process was carried out by reading the raw text and attributing a code to sentences representing a theme or idea.

2.3 Coding Process

The structured interviews and the TS questionnaire were transcribed and anonymised (removing real names, company, ship, ports) and finally coded using NVIVO 11.4.0, a computer aided qualitative data analysis software.

2.3.1 From coding to theory

According to Saldana (2009), clusters of coded data form categories that can be refined into sub-categories. The major categories are compared to each other constructing higher level and more abstract constructs, the themes and concepts levels. The way themes and concepts interrelate lead to theory. This general process is summarized and simplified in figure 13. Finally, by combining the figure 13 and table 9 I designed table 10 including now the coding process.

In the first cycle coding, different coding methods are used. The *Structural coding* in TS email interview since its designed to start organizing data around research question and is considered suitable for interview transcripts (Saldana, 2009). The *descriptive coding* for the observations since in a first stage the aim is to identify the topic for further analytic work. The *In Vivo* coding was used for unstructured interviews in order to analyse perspectives, participant language and worldviews. This method requires reflection through analytic memo writing and uses the richness of observation (voice intonation, gestures, facial expressions) (Saldana, 2009). Additionally, the interviews analysis from TS side and ship side will use affective methods coding like *versus coding* since the aim is to capture phrases and conceptual conflicts among them.

In the web survey I use different code methods, the first set of questions aims to find patterns in characteristics of the participants. In question 3 the *values coding* aim is to search outcomes values, attitudes and beliefs that reflect participant's perspectives and worldview. The questions regarding conflicting goals were addressed using a mix of *versus coding* and *evaluation coding*. On one side through *versus coding* it is possible to identify patterns on how each side

perceives and acts towards the conflict (Saldana, 2009), on other side *evaluation coding* grasp judgement about outcomes and describe patterned responses (Saldana, 2009).

In second cycle coding data is recoded to more accurate words, some codes are merged, or dropped some "marginal" or "redundant" codes. The main goal of second cycle is to distribute first cycle codes into categories and develop them into concepts (Saldana, 2009). The method used here will be *pattern coding* since it fulfils the explanatory component of research design, "*they pull together a lot of material into a more meaningful and parsimonious unit of analysis"* (Saldana, 2009, p. 152).

In the post coding period, focus is on how concepts can help us to understand the TS-Ship relation in order to prepare for final analysis.

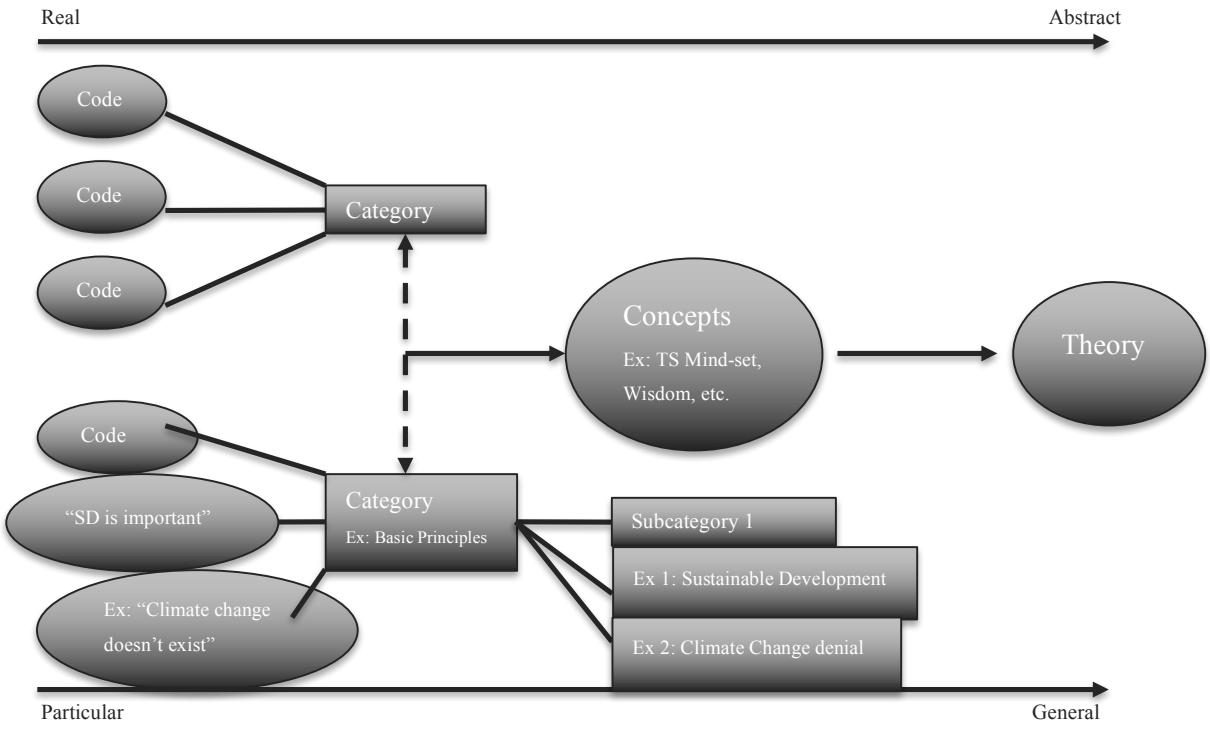

Figure 13 - A streamlined codes-to-theory model for qualitative inquiry

Source: author adapted from (Saldana, 2009)

Table 10 - Codes-to-theory method applied to our case study

	FFSD framework across levels					
Data collection method	**Levels**	**A Basic Principles**	**B Conflicting Goals (CGs)**	**C Proposed Solutions to CGs**	**D Sustainable steps towards vision?**	**Answer to the Research Question:**
Coding	Literature Review level	What are the basic principles that can be applied to TS-Ship relations	What are the CGs that applies to TS-Ship relation	Solutions to handle CGs collected form literature and creativity methods to find solutions	Priorities and strategies collected from literature	
Coding	Results level Literature	Codes	Codes	Codes	Codes	**How TS handle**
	Results level TS-Ship	TS-Ship basic	secondary data	Solutions	Priorit	
			Categories from secondary		Concepts	Theory
			Categories from primary data			
Data collection method	**Data level**	**A Basic Principles**	**B Conflicting Goals (CGs)**	**C Proposed Solutions to CGs**	**D Sustainable steps towards vision?**	
Email interview Questionnaires	TS level	Codes	Codes	Codes	Codes	
		are the principles of TS?	perspective?	CGs?	Are solutions consistent with steps balance between the pace of progress towards the vision and return on investment?	
Coding	Results level of the Relation	Do w here?			TS basic g TS handling CGs stemming from the relation?	
			Categories from primary data			
Observations Structured interview	Ship level	How are the basic	What are the CGs in the	What are the solutions ed to	What are the crew feeli	
		Codes	Codes	Codes	Codes	
				involved in the brainstorming?		

Source: author

2.4 Sampling

The case study picked one of the top 30 container shipping companies owning more than 10 vessels of different sizes. From the TS side the web survey was sent to all TSs working in the company (5 emails with web link). To increase the chance of getting enough data about 30 emails

were sent to TSs of different companies from the researcher *Linkedin* network. From the total of emails sent, only received back two web surveys fully answered. It was not possible to identify the TSs in the web survey.

2.4.1 Sampling method

The sample method can be classified as Convenience Sample or Snowball Sampling (Bryman, 2012) since the selection is not controlled by the researcher but from the company where he works. The study may not represent the entire population which doesn't affect the validity of our work since in *"qualitative research, the orientation to sampling is more likely to be guided by a preference for theoretical sampling"* (Bryman, 2012, p. 203) Regarding sampling in interpretivism paradigm, Collis and Hussey (2013) suggest the tendency to use small samples that produce low reliability but high validity. The sampling of participants on the ship side was aleatory at the convenience of the container company where the research took place.

2.4.2 Participants

Concerning "strong data" side, 6 participants were interviewed. On TS side 2 persons answered the web survey and on ship side 4 officers from management level were interviewed. Prior to data collection I performed an unstructured observation of 50 persons composing the crew of two container vessels. Additionally, to give an overview and inspire theory assumptions an email interview was performed with a TS active in internet by publishing articles and opinions about his daily job.

The crew observed is from Eastern Europe, Central Europe and Asia, officers of management level (Engine and Deck department) interviewed were from Western Europe and Eastern Europe. The ages range from 28 to 64 years old and working at sea minimum 9 years.

Regarding primary data, web survey was designed and collected through *www.surveymonkey.com* website and TS interview was performed by email. The structured interviews were performed onboard and audio recorded.

The collection of primary data onboard was carried out onboard two container vessels in researcher's workplace. Each vessel's crew consisted in 25 persons. The management level in each vessel is represented by 4 officers. In table 11 is presented all information regarding participants.

Table 11 - Participants

Nº of Participants contacted	**Type of participants contacted**	**Method of contact**	**Nº of participants answers**	**Type of data**	**"Weak" or "strong" data**
5	Technical superintendents contacted from researcher workplace	Link of Web Survey sent to the company personal email	1	Web Questionnaire	Strong data
30	Technical superintendents contacted from researcher network	Link of Web Survey sent by researcher personal network on Linkedin	1	Web Questionnaire	Strong data
4	Management level officers from researcher workplace (Vessel nº1)	Personal contact	4	Personal structured Interview	Strong data
50	Entire crew of researcher workplace (Vessel nº1 and 2)	Personal contact	50	Unstructured Observation	Weak data
1	Technical Superintendent active in internet blogging about superintendent activities	Email	1	Email Interview	Weak data

2.4.3 Designing of questionnaires

Regarding web surveys (Appendix D), the questions were designed to identify Basic Principles assumed by TSs, the perceived conflicting goals, what are the solutions available to deal with CGs and finally how the vision acquired from basic principles is expressed in action.

The theory about questionnaires by Saris and Gallhofer (2014) point out some important steps to consider when doing surveys. An important step when designing surveys is to clearly indicate how the *concepts-by-postulation* used can be operationalized in *concepts-by-intuition* (Saris & Gallhofer, 2014). Concepts-by-postulation are less obvious concepts, general, not intuitive that require explicit definitions (for example: Racism, ethnocentrism…). Since they are complex they require more items to be defined, this is done by a set of items that represent concepts-by-intuition. Concepts-by-intuition are simple concepts where the meaning of which is immediately obvious (judgements, feelings, evaluations, norms and behaviours) (Saris & Gallhofer, 2014).

The questions used in the web questionnaire are listed in Appendix D with implications for TS-Ship relation (concepts-by-intuition). The concepts by postulation are listed and are related to concepts we have been studying. Therefore, the scope of each questions can be easily associated to literature review (secondary data).

The structured interview performed onboard to management level officers is based in the web survey to improve clarity and posterior analysis of data sets.

2.4.4 Registration and organizing of data

Regarding TS side, the survey was designed, registered and analysed in *survey monkey* web site. In the Ship side, the data of structured interview was registered in the form audio and later transcribed to word processing software.

The observation method can be classified by participant observation, where the researcher participate in the social setting (Bryman, 2012) and unstructured observation with an interpretivist approach where researcher are more concerned about the people interpretations, perceptions, meanings and understandings, as the primary data sources (Mason, 2002). The method is preferred as participants may feel no obstruction to behave as they normally do.

On the ship, I performed four structured interviews (Appendix E). The interview guide was prepared by the researcher beforehand and interviews were performed face to face in a room atmosphere prepared according to the informant preferences.

2.4.5 Data quality

In the case of email and web interviews, according to Meho (2006) data quality is not affected since quality is dependent on who is being interviewed and the quality of the interviewer. The author also stresses the importance of a highly committed or motivated participant since it can give detailed and in-depth interviews (Meho, 2006). Nevertheless, Bryman (2012) alerts data quality may be poorer compared to other sources even if respondents were found to reply more positively online.

Regarding data quality, O'Leary and Hunt (2016, p. 104) argue the researcher focus on high reliability and validity he shuts the door to research into the hard-to-pin-down reaches of the human/social world found in small scale workplace-based research. Therefore, in the context of interpretivism we should *"call on authenticity alongside validity, and dependability alongside reliability"*(O'Leary & Hunt, 2016, p. 104).

Regarding the sampling of times, places, events, people, issues and questions it was possible to observe during the period onboard a large sample of events and issues. From the ship side, bias

regarding affinity with people, data, theories and concepts can occur due to the period onboard and seafarer culture prone emotions.

2.5 Ethical dilemmas in workplace research

The author O'Leary and Hunt (2016, p. 110) alerts to the risks of psychological harm when performing workplace based research. It can be unplanned and unintentional and lead to legal actions. In this regard, additionally to research ethics when signing contract, the seafarer is obligated to secrecy on internal matters, even after leaving the Shipowner's service.

2.5.1 Confidentiality

Since two vessels and many crew members on referred departments and positions have regularly signed on-off, confidentiality is assured and tracing of individuals becomes impossible. The vessel name, period and trade where interviews took place was not mentioned, the same where observations took place.

2.5.2 Putting respondents in a tense situation.

Problems can arise if informants are not well informed about the nature and purpose of the research since they are also obligated to secrecy. To overcome this problem, a considerable amount of time was dedicated to explain the resources to assure anonymity. The captain of the ship was contacted and informed about the research on both vessels.

2.5.3 Asking insensitive or potentially threatening questions.

The web survey and interview guide was designed to avoid threatening questions that can put the informants in a difficult position. Additionally, the persons were informed on the anonymity and possibility to refusing answering without consequences (cf. Appendix B).

PART B

"Analysis and assessment of the organization current situation in relation to the vision." (Broman & Robèrt, 2017)

3 Results

3.1 Weak Data

On the ship side, since it's the researcher working place some observations, memos of conversations and some episodes were collected during his work onboard. On the TS side an email interview was performed. The weak data purpose is to inspire and give additional information to the conflict goals addressed.

3.1.1 Email interview with TS

The transcript of the whole interview can be found on Appendix C. From this email interview I quote what is a clear contribution to the conflict between *efficiency vs safety* in the form of cost cutting measures influencing job engagement:

> *"Superintendents want perfect ships and this costs money. The office doesn't want to spend money and this causes a conflict between the ideal and the reality. Many years ago ships were built with perfection and money was spent on aesthetics and in the best equipment. Today the opposite exists. Ships are built without pride or additional cost and built to serve a single purpose - to make money. A superintendent's goal of having pride in his ship is often lost as he has to realise the importance of minimal expenditure."*

The next quote is related to transitioning problems from operational to management level. Here, the TS mentioned some differences on working habits. Life at sea in terms of organization and leadership follows a hierarchical system as decisions must be clear and solutions promptly achieved in order to stay afloat. The life at office in this matter is less pragmatic.

> *"Working ashore can be difficult as decision making slows down and routine sets in. A superintendent's goal of quickly achieving projects is diminished as pointless discussions and delays continually block output."*

The next quote shows why environmental compliance can be a source of work-related stress since TS or officers do not "see the point of" some paperwork as a valid contribution for efficiency and safety.

> *"A Superintendent wants his ships to work perfectly and safely but thus is often hindered by paperwork that he may not see the point of."*

Regarding *shore demands vs ship independence* conflicting goal the TS interviewed is very clear to point a division between shore and sea staff, such division create obstacles on sea to shore transition.

> *"There has always been a divide between shore staff and sea staff so suddenly changing from sea to shore is difficult."*

3.1.2 Ship level observations

In table 12, I resume the main findings of ship level observation related to each conflicting goal addressed on literature. The raw text can be accessed on Appendix H.

Table 12 - Main results from ship level observations

Resume of observations	**Related CG**
• In one of the surveys, surveyor requested to change all oils stored in steering gear room. When asked where to put them, he refused to give advice and reported to regulations. The officers felt confused since no location is written on regulations. The TS was informed and start a complaint against the surveyor. • Engineers showed stress and anxiety every time email from TS reported they are going to delay important spare parts (on ship side perspective). • situation is evaluated as moderated risk, but if a serious malfunction occurs, extra stress and workload is on the crew side	Shore demands vs Ship Independence
• Engineer faced stress and anxiety due to delay in part deliveries. • desired to leave the industry due to management only concern about the money • classification society surveyors are eager to find minor malfunctions that later require extra job from crew and refuse to give advice or explanation when malfunctions are detected. This leads to extra work and stress. The actual classification society was recently chosen based on price.	Efficiency vs Safety
• some officers showed lack of trust in their TS because was hired after some contracts as 3rd Engineer. • management skills should supersede technical, but engineer officers showed no agreement with this perspective.	

• half of the engineers on management level observed in two vessels showed a lack of basic emotional skills. Authority in this group was only formal. • engineers on management level who gave enough degree of independence for ratings to organize their work and showed care for their staff easily got endorsement from lower levels. • …work was efficient, more productive and motivation levels higher. Authority on this group of engineers was formal and informal.	Technical Manager vs Engineer
• 2nd engineer showed no enthusiasm every time environmental aspects were raised on weekly drills. The same 2nd engineer tried to send a plastic bag overboard • It was rarely observed ratings or officers of younger generations having the same attitude. • …legal discharge (far from coastline) of sewage overboard without proper treatment (i.e., without going through the sewage treatment plant) is common practice.	Environmental compliance vs Work-related stress levels

The general findings show on *Shore demands vs Ship Independence* conflicting goal that shore side demands affected negatively physical and psychologically the crew. On *Efficiency vs Safety* side it is observed some cases where cheaper prices and cutting costs impacted on seafarers motivation. On *Technical Manager vs Engineer* conflicting goal different authority styles have the power to influence atmosphere, motivation and consequently production. The conflicting goal *environmental compliance vs work-related stress levels* shows different attitudes towards environment depending on age. Management level officers on the vessels observed were not particularly interested in environmental protection aspects.

3.2 Strong Primary Data Results

In table 13, I resume the results given by web survey and interviews performed onboard. The raw data is presented on Appendix F and G.

Table 13 - Summary of data collected from TS and Ship side

Question 1	
How old are you?	How old are you?
TS side	**Crew side**
N=2 Mean age=54 SD=6.32 Min-max: 50-58	N=4 Mean age=47.5 SD=14.6 Min-max: 28-64
Question 2	

About how long have you been in your current position and how long have you worked on- board?	About how long have you been in management level and how long have you worked on- board?
TS side	**Crew side**
Current position: N=2 Mean years=12.5 SD=2.5 Range: 10-15 **Years onboard:** N=2 Mean years=17.5 SD=2.5 Min-max: 15-20	**Years on Management Level:** N=4 Mean years=13.56 SD=10.51 Range: 0.25-27 **Years onboard:** N=4 Mean years=24.5 SD=13.23 Min-max: 9-40
Question 3	
The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)	The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)
TS side	**Crew side**
Economy Pillar: N=2 Mean=4 SD=1 Min-max: 3-5 **Society Pillar:** N=2 Mean=4.5 SD=0.5 Min-max: 4-5 **Environment Pillar:** N=2 Mean=3.5 SD=0.5 Min-max: 3-4	**Economy Pillar:** N=4 Mean=4.75 SD=0.43 Min-max: 4-5 **Society Pillar:** N=4 Mean=4.5 SD=0.5 Min-max: 4-5 **Environment Pillar:** N=4 Mean=4.25 SD=0.83 Min-max: 3-5
Question 4	
How much trust do you have in your sea staff ability to make the right decisions?	How much trust you have in TS abilities to make the right decisions?
TS side	**Crew side**

TS1: *"Currently, less and less. It is my opinion that standards have dropped over the last ten years and it is harder to find the right staff who can carry responsibility. So the answer is; not much trust nowadays. However, there are some good seafarers out there, but even they complain that they can't trust the seafarers they work with."* TS2: *"That depends on staff professional qualification - there is no fixed rule. Some I trust in limited way some I do not trust at all"*	Informant 1 (Captain): *"In this company I met many TS and relation is very good."* *"I had a lot of friends from the engineer departments that's maybe I understand their problem"* *"…others guys who are coming to this company from other companies they have problems."* *"…in this company I feel free to ask questions."* Informant 2 (Chief Engineer): *"Good, 4 (in a range 1-5)"* Informant 3 (Chief Mate): *"You cannot rely on the office because they decide you don't need the spare parts…"* *"They just sit and see the excel the final amount and start cutting. We care about the prices but what can you do if you need something."* *"If you want the vessel to run smooth and safe you have to order parts."* *"…we cannot trust completely this guys."* Informant 4 (2nd Engineer): *"It depends in which matter, cause every time they have a problem they actually ask the supplier and they have a professional answer. Most of the times is not the answer of the superintendent but of the supplier."*
Question 5	
How strong is the pressure on sea staff coming from your department in times of economic pressure?	How strong is the pressure on sea staff coming from TS in times of economic pressure?
TS side	**Crew side**
TS 1: *"Quite a lot - most of the pressure tends to be from the engineering department or in regard to the purchase of spares. They always want more but the money is not there. It is such a waste of money*	Informant 1 (Captain): *"there is not such a pressure now. There is proposal and advices"* *"budget for this year is this and this, so please keep in the range"* *"The pressure is from the management, from the company, TS are not talking with us like slaves."*

to have spares sitting around on shelves when they are never used". TS 2: *"Safety first is main principle Vessel should be run safely staying within approved Budget".*	*"…maybe the new guys need some pressure from TS."* *"I've got an info from TS and sent my ships order regarding the stationary, regarding Overalls, shoes and he asked me if I really need so much… "if you can please reduce", if you can."* *"It was a question; "do you really need this?" Because people can order without imagination."* Informant 2 (Chief Engineer): *"Strong pressure, but is not coming from the TS but from the owner. TS is only a man in the middle."* Informant 3 (Chief Mate): *"You order some spare parts in your opinion needed onboard to safe sailing and proper working of equipment and somehow your request is deleted."* *"…the problem is when and where to send (spare parts) due to the high cost of freight."* *"For me, this is ignorance of this guys in the office. They have no idea how the life can be on the vessel, they just think: "ok please do something better, faster, cheaper because we have now economic crisis you have to understand is very expensive to send the spare parts." Finally, when the system like now is completely off: "ok we send you the spare parts", because there is no other choice."* *"Because of this, I had to stay in the office 12 h to manually adjust the list of the vessel. The problem is that he thought is not so important for the vessel which is not true. The main sentence of this topic is: we cannot trust completely this guys. If you can see this situation you start thinking what for TS if you cannot rely on him, if they just send some stupid messages (ideas) that I knew were not working. Because my approach is not to trust them completely, solve the problem by my own and then after that you count on yourself and try to fix. I think all CM has limited trust to technical department. You try to make some requisition and you don't know if they cancel or no. You put the port and they say: "in this port we not deliver the parts" and then you start getting angry."*

	"If order something and they don't care or they cut, for sure this cause the separation to become bigger. They don't care I don't care neither. Always the big issue is the money." *"They try to save money and you need something more. You need two paint brushes not only one, because you need to do this job again latter. I think we will never have an understanding because they are not here and they don't see what is going on exactly."* Informant 4 (2nd Engineer): *"the same…A good technical department is not necessary evil, when they start cutting the money on the engine department, something is wrong. Sometimes you just wait more for the spare parts."*
Question 6	
Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?	Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?
TS side	**Crew side**
TS1: *"The issue is that the sea staff are not trained well enough in electrical / electronic problems.* *The design of equipment is complex and made more difficult by the amount of electronics that control them."* TS2: *"Very difficult since manufactures are protecting their business in the way which restricts important informations needed for proper Operation or maintenance."*	Informant 1 (Captain): *"I think it works quite well…"* *"…if I have some questions I send to IT department with a copy to superintendent because he must be informed."* *"…we have a problem with accounting system, but the company employed a person only to quality management department to ask a question, all questions should be sent to her. She was in touch and the link between us and shore."* Informant 2 (Chief Engineer): *"Is ok is good, in case I have any problems I ask TS, he asks the owner and is giving feedback, communication is good otherwise the ship will be drifting."* Informant 3 (Chief Mate): *"…they send message to the maker of this equipment they send some ideas how to solve the problem which didn't work…"*

	"…the TS send messages to the maker, they send some solution which didn't work…" *"…there is communication between designer and TS but (communication between) the TS and us in this particular manner is not great."* *"In this case (heeling system) TS have to decide this is important, and with heeling system not so much (was done) the answer is "we can postpone to convenient port" - and this means the money."* Informant 4 (2nd Engineer): *"I have no experience with this…Usually the normal stuff, when you are new on the ship this is also new electronics for you, you go by the manuals and yourself, when you reach the point you don't know you ask the TS. TS is just the guy who's redirecting the answers, he knows the same like the ship staff."*
Question 7	
To what extent environmental compliance is a source of increased workload to sea staff?	To what extent environmental compliance is a source of increased workload?
TS side	**Crew side**
TS1: *"It encroaches more and more into daily life and work; but on an over-all scale I would say the workload due to compliance is not more than ten percent. The largest volume of the work is in the paperwork and survey side - ensuring that the authorities are satisfied that compliance has been met."* TS2: *"Substantial since technical solution are still not reliable and requires a lot of maintenance."*	Informant 1 (Captain): *"Yes, it is. Answer is very clear. Yes, it is."* Informant 2 (Chief Engineer): *"Most important is not care about it too much. Read all these papers."* *"No, US is ok now, China is getting worst."* Informant 3 (Chief Mate): *"Now, I have to do something more, I have to do additional trainings because the crew very often don't know the regulations. I have to increase my awareness to check the trash bins, the garbage room, my attention has to be increased."* *"Yes, exactly huge penalties. That why in Brazil or US we have to take some precautions like clean up the vessel, check if there is bugs in the cooling chambers, expiring date regulations. The problem is event though you have international regulations, each country has own stricter regulations,*

	especially in Brazil, to keep fruits and vegetable in plastics not in wooden. In US there are special type of bins marked by colours." *"…sometimes I have the impression that some countries make the regulations just to catch you and take from you some penalty."* *"It looks like there is someone guy sitting in the office in front of computer thinking in what to do to make our life worst."* *"Unfortunately, the companies do not protest, do not argue, they just get the regulation and they have to follow. They don't ask us what we think about this regulation, they just send information from IMO or Brazilian authorities we have to follow these rules. They don't listen to us, our opinion. Officially they do, but is just on the paper, in reality no."* *"…it increases the workload very much, specially C/M and C/E."* Informant 4 (2nd Engineer): *"For me its normal to take all these precautions.* *Interviewer: because you were educated on this mentality?* *Yes, To maintain safety"*
Question 8	
How do you evaluate your transition from technical/operational to management level?	How do you evaluate your transition from technical/operational to management level?
TS side	**Crew side**
TS1: *"It was quite difficult. I find that there is a misunderstanding of what seafarers do all day. Many management think that the seafarers just sit there with nothing to do - they don't appreciate that it is a full time job. When I moved ashore and into management I had to change the way people think and view seafarers, to tell them that it is not always easy and that they have to consider that they are trying their best. Their best may not*	Informant 1 (Captain): *"There was a different time. They provided at the time a mobile phone in case we need to ask TS."* Informant 2 (Chief Engineer): *"50- 50, I cannot explain all… in case you have problems or questions everybody will help you."* Informant 3 (Chief Mate): *"They didn't care. They start caring if there is some complain of loader or receiver of the cargo, then they have to react. In this case there was no assistance and I think this is the standard. In engine department I think is better. From my point of view, I think they care more with Engine*

always be right, but as long as they try. I feel that I have done well, that I managed to keep the understanding of the sea and to move into management positively. I feel that I have helped many people ashore to learn more about the sea." TS2: *"I have not met any problems. Good technical Background allows to make right decisions quicker."*	*department. Maybe because they are not familiar with deck procedures or operation because before they were C/E."* *"Can also be my fault because you try to solve a problem and you don't want to inform the company because you think they will say you're a not a good C/M because you cannot solve the problem which supposed to be so easy."* *"Than you are afraid, especially when you are a new C/M. Then you have some doubt to inform the office or not, so you try not to. So that's the problem - you are afraid they complain you're not so good and next time they hire another guy."* *"During management level I was working with many TS. From my experience you try to solve the problem by yourself because you don't know the reaction of this guys. They are there to help you and assist you but when you ask, they can tell you: "try this, try that". Officially they advise, but normally its stupid advice that is not working."* Informant 4 (2nd Engineer): *"2nd engineer is never asking the TS, only to the chief. Regarding the questions of TS I cannot say. Interviewer: and regarding to the chief? Yes."*
Question 9	
What are your thoughts about sea staff contributions when solving challenges concerning to both sides (TS and ship crew)?	Do you feel your contributions valued when solving challenges concerning to both sides (TS and ship crew)?
TS side	**Crew side**
TS1: *"Not much. Sea staff do not tend to contribute much at all."* TS2: *"Cooperation is limited."*	Informant 1 (Captain): *"There is proposal and advices…"* *"I didn't have a problem it was always gentle discuss, never shouting never crying, just gentle discussion."* *"It can take few days but finally we have an agreement."* *"…ground of discussing, everybody was involved and informed and they got a final agreement."* Informant 2 (Chief Engineer): *"It's a good cooperation if not he will be removed by the owner."*

	Informant 3 (Chief Mate): *"They are happy to hear your ideas for saving money. If you solve the problem by your hand (instead calling service) they can be grateful for that."* Informant 4 (2nd Engineer): *"Normally the thing is, the proper way to ask a TS is to say what is the problem and also to put a solution inside and how you plan to handle this problem, and the TS always say or write just go ahead like you think or I will ask supplier and figure out another option."*
Question 10	
How do you evaluate the results coming from your relation with sea staff regarding the objectives of Sustainable Development?	How do you evaluate the results coming from your relation with TS regarding the objectives of Sustainable Development?
TS side	**Crew side**
TS1: *"Unfortunately, I don't feel that ship's staff have much to contribute towards sustainable development. Most seafarers feel that they are being asked too much and that all procedures and systems are simply designed to make office life better - not ship life."* TS2: *"Sea staff is focused mainly on keeping Equipment running and operating vessel within mandatory rules."*	Informant 1 (Captain): *"Definitely number one is economy, next is society and environmental it is because it must be…"* *"I feel also in my private opinion environment is the last one."* *"…tried to combine all of them but starting from economy."* *"…by the relation from office and me that they have the same priorities."* *"Maybe sometimes they are talking environment is the first, this is some show and good looking in internet, newspaper, tv, port authorities, but it's a kind of show. They make a lot of noise, if they start dividing the money: first for economy, second safety (society) and remaining to environment."* Informant 2 (Chief Engineer): *"All sides its ok yes."* Informant 3 (Chief Mate): *"Finally, when the system like now is completely off: "ok we send you the spare parts", because there is no other choice."* *"In the economy part they are following close the objective, environment I think too. This is what I like in this company, in others company's*

	environmental situation officially in the paper yes, but off the record no. In this company no, you follow strictly the regulation, not only IMO but Brazilian and US regulations. In this matter you can expect some assistance. If you ask for garbage bins by colours they agree. Society – in this company compared to the other companies I would say they are following the objective, you enter the recreation room you see a lot of movies, the gym, the captain in the meeting asked "we have this amount of money to the crew what can we buy? "I cannot complain, you have internet, email system, recreating room in good condition, tv, dvd players. So they care about the society onboard. In the contract you have in last page the date of sign off, this is not common in other companies. You don't know what to expect, companies can find some trick to keep you longer or shorter. *Than at home I can make some plans."* *Informant 4 (2nd Engineer):* *"They just check how much money they can save on the different pillars, they only do what is necessary to achieve the limits, specially for the environment. Everything could be cleaner. But why not? Because much more money and more work."*

The answers to questions 1 and 2 give information about age and experience in management (at sea and shore). Later, conclusions about influence of age and experience can be drawn. The TSs mean age is higher as expected due to requirements of previous experience at sea. The management experience at first sight looks higher on crew side, this is because TSs are only asked about "years on current position" (i.e., technical superintendent) but we need to consider the years on management level at sea included on years at sea. Therefore, TS management experience surpass the crew side. Both sides have been similar periods onboard but as expected more years on the crew side.

In question 3 the crew side rated similarly the pillars when compared to TS side. With very small difference from other pillars, the crew side rated higher (4.75) economy pillar while TSs rated Society pillar higher. This results are later analysed individually, the overall results stress out that environmental pillar is rated lowest in both sides.

In question 4 results concern the level of trust in the relation, this fact will influence the way TS handle conflict regarding the two sides. From TS side, trust is decreasing depending on professional qualifications. From crew side, with exception of one informant the relation and trust in TSs is good.

In question 5 pressure is assumed by TSs regarding the demand of spare parts from the crew side. The crew side also feels pressure but they recognize it coming from the owner. However, one informant mentioned some management practices not owner dependent influence negatively the pressure and motivation on sea staff.

The question 6 shows TS side feel problems in communication, on one side due to the lack of knowledge of electronics by the crew and on other side by manufacturers protectionism. From the crew side communication in general is felt as good, however one informant mentioned the answers from TS and manufacturers in some cases are not useful in practice.

In question 7, both sides agree on increased workload coming from environmental compliance. Only one informant (the youngest) identified environmental compliance as something natural. Regarding research question, the answers partially reflect awareness and acceptance of environmental values.

In question 8, one TS informed about transition difficulties given by ship-shore distance, other TS highlighted the good technical background. The crew side with one exception showed no problems in transitioning to upper levels. Both sides except one informant from crew side, based their answers on technical aspects when referring to transition problems.

In question 9, TSs stressed the limitations for cooperation with sea staff while crew side evaluated the cooperation as good. Regarding research question it is possible to perceive willingness for participation on the crew side when TS handle conflicts.

In last question there is a clear perception from the crew side that TSs, as middle man between upper levels and ship, is giving preference to economy in his decisions. In what concerns environment, the crew side believes the main concern is compliance with regulations and not environment itself. Regarding society pillar the evaluation is good but always dependent on economy. TSs believe there is no space for sea staff to contribute for SD objectives (as they are seen by TSs current mindset).

3.2.1 Word frequency Query

In this section I used all data collected (weak and strong data) and performed a word frequency query in NVIVO software. The result can be observed on figure 14 and table on Appendix I. In table 14 I grouped words by pillars addressed in literature. The analysis on the results will be further developed on the discussion section. The advantage of this analysis is to give us a visual and statistical perspective of important keywords, they are not used as an alternative to coding but instead an additional tool for the assumptions we are going to make.

Table 14 - Primary data words assigned to the pillars

Related Words	Categories
Economy, Money, Parts, Order, Vessel, Ship, Equipment, engine, company	Economy
Environment, environmental, sea, regulations, garbage	Environment
TS Society, company, department, seafarers, crew, staff, care, trust, pressure, captain, officers, management,	Society
Problem, think, good, care, need, time, pressure, work, problems, solve, answer, question, life, change, opinion, difficult, understand, know	Culture

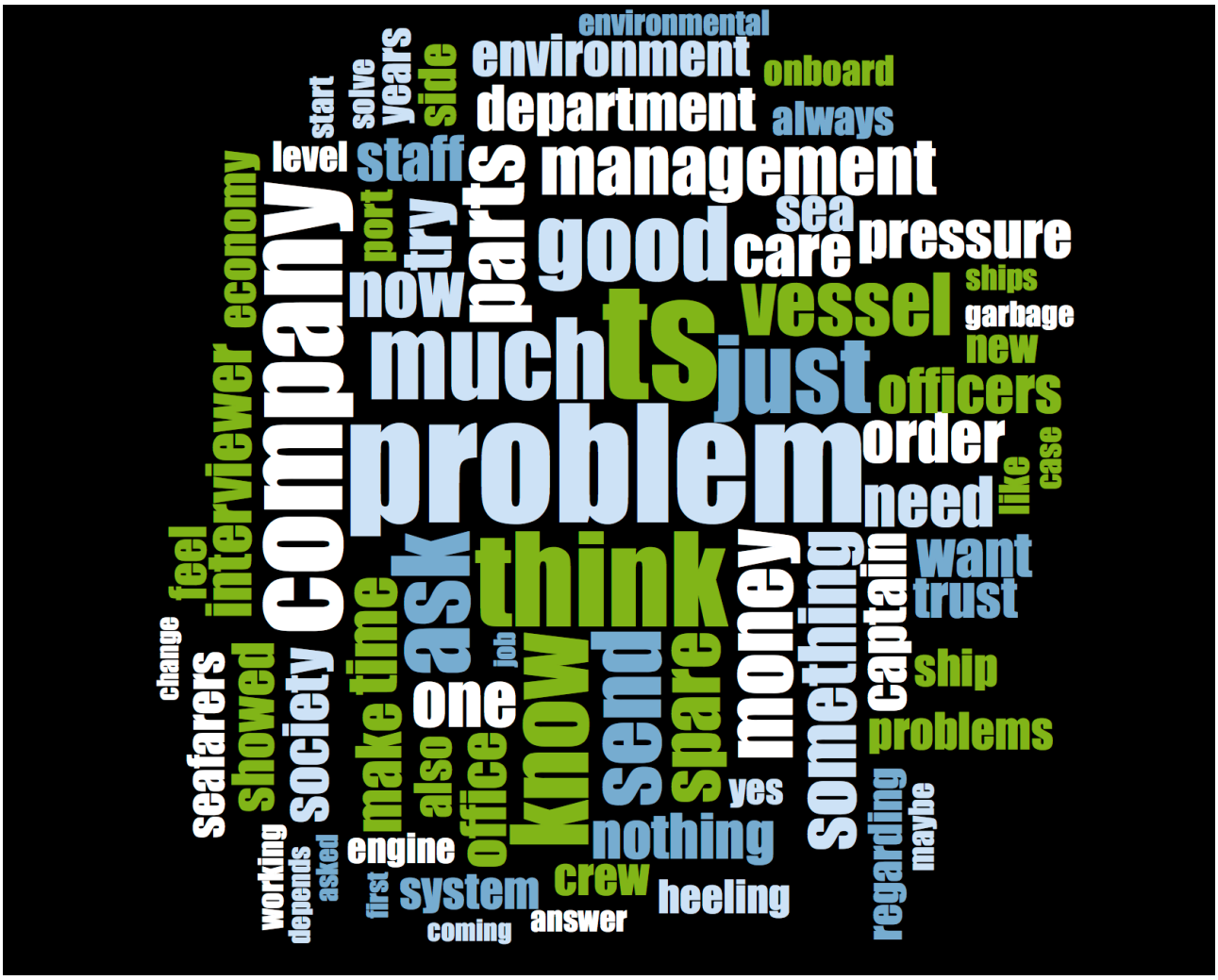

Figure 14 - Word frequency query

The word query shows the word “problem”, “ts” and “company” as the most visible words. The word problem is assigned to cultural pillar (table 14) since it is interpreted as a result of a

mindset. Regarding research question, this query can suggest the focus on problem by both sides when discussing conflicting goals since it was a result of primary data.

3.2.2 Literature review and primary data second cycle coding

In table 15, I relate primary and secondary data by grouping the most cited words (cf. Appendix I and J) into related concepts. In discussion section these concepts will be assigned to key statements of informants and later used to build new theory.

Table 15 - Resulting concepts of second cycle coding

Literature review word frequency		**Primary data word frequency**		**Related Concepts**	**Total word frequency**
Safety	**1.73%**	**Good**	**0.73%**		
community	0.58%	Care	0.50%		
workload	0.58%	Staff	0.50%		
dialogue	0.58%	Office	0.50%		Literature review: 4.63 %
employment	0.58%	Society	0.47%	Care	
encourage	0.58%	Officers	0.47%		Primary data: 4.5 %
		Pressure	0.47%		
		Trust	0.43%		
		Environment	0.43%		
shore	**1.16%**	**TS**	**1.16%**		
staff	**1.16%**	**Problem**	**1.16%**		
innovation	**0.87%**	**Think**	**0.93%**	Shared	Literature review: 5.22 %
Ship	**0.87%**	**Company**	**0.93%**	knowledge	
communication	0.58%	Ask	0.78%	culture	Primary data: 5.74 %
dialogue	0.58%	Know	0.78%		
Water, air	**0.87%**	**TS**	**1.16%**		
Environmental	**0.87%**	**Know**	**0.78%**		
community	0.58%	Society	0.47%		Literature review: 2.32 %
		Sea	0.43%	Awareness	
		Trust	0.43%		Primary data: 4.09 %
		Environment	0.43%		
		Crew	0.39%		
Change	**1.16%**	**TS**	**1.16%**		
demands	**1.16%**	**Think**	**0.93%**		Literature review: 4.35 %
innovation	**0.87%**	management	0.58%	Change	
Culture	0.58%				Primary data: 2.67 %
improve	0.58%				

Cost	**1.16%**	**Problem**	**1.16%**		
system	**1.16%**	**Think**	**0.93%**		
innovation	**0.87%**	**Company**	**0.93%**		
environmental	**0.87%**	Good	0.73%	Vision	Literature review: 6.09 %
efficiency	**0.87%**	Money	0.66%		
cutting	0.58%	Care	0.50%		Primary data: 5.41 %
values	0.58%	Time	0.50%		
Balance	**0.87%**	**Problem**	**1.16%**		
Compliance	**0.87%**	**Money**	**0.66%**		
Innovation	**0.87%**	Care	0.50%		
cutting	0.58%	Officers	0.47%	Mindset	Literature review: 4.35 %
better	0.58%	Pressure	0.47%		
culture	0.58%	Trust	0.43%		Primary data: 4.9 %
		Environment	0.43%		
		Crew	0.39%		
		Economy	0.39%		
management	**1.45%**	**TS**	**1.16%**		
Change	**1.16%**	**Problem**	**1.16%**		
cost	**1.16%**	Parts	0.66%		
demands	**1.16%**	Vessel	0.62%		
onboard	**1.16%**	Spare	0.58%		
ships	**1.16%**	Management	0.58%	Middle	Literature review: 13.05 %
shore	**1.16%**	Staff	0.47%	manager	
system	**1.16%**	Office	0.47%		Primary data: 6.17 %
balance	0.87%	captain	0.47%		
officers	0.87%				
communication	0.58%				
decision	0.58%				
dialogue	0.58%				

The total word frequency shows the concept of awareness emerged mainly from primary data and middle manager from literature review. The remain concepts emerged from the relationship between the two sources of data.

PART C

Apply creativity methods such as brainstorming to identify possible solutions to the challenges and for capturing of the opportunities implied by the gap between the vision established in Part A and the current reality established in Part B.

adapted from (Broman & Robèrt, 2017)

4 Discussion

4.1 From categories to concepts

From comparison between literature review and primary data, I have selected the following concepts as structural to handle conflicting goals and pursue a sustainable path toward the vision framed by the SD basic principles.

4.1.1 Care

From the outcomes of question 5 it is possible to identify a consequentialist approach. In question 4, it is observed a lack of trust in relations, even among seafarers. Trust is the basic element to flourish a self-in-caring relation (Jones et al., 2017). In the tension between profit and social good, the profit is on top which can explain the lack of innovation culture in container shipping and passivity by management onshore and offshore. This pattern contributes to increased sense of exploitation and lack of commitment to the company.

> *"If order something and they don't care or they cut, for sure this cause the separation to become bigger. They don't care I don't care neither. Always the big issue is the money."*

> *"Because of this, I had to stay in the office 12 h to manually adjust the list of the vessel. The problem is that he thought is not so important for the vessel which is not true."*

"The main sentence of this topic is: we cannot trust completely this guys."

Chief Mate (C/M)

One informant quotes clearly suggest the consequentialist perspective (i.e., reacting to legislation or authority's inspections).

> *"Definitely number one is economy, next is society and environmental it is because it must be…"*

"Maybe sometimes they are talking environment is the first, this is some show and good looking in internet, newspaper, tv, port authorities, but it's a kind of show.

Captain

Nearly all informants see the regulations as increased workload. The crew side perception is that office and regulators are not aware of the consequences onboard.

Regarding workload:

"Yes, it is. Answer is very clear. Yes, it is."

Captain

Regarding sense of incomprehension from company office:

"They don't ask us what we think about this regulation…"

"For me, this is ignorance of this guys in the office. They have no idea how the life can be on the vessel."

C/M

Regarding regulators:

"It looks like there is someone guy sitting in the office in front of computer thinking in what to do to make our life worst."

C/M

The question whether TS is pressed from upper levels or not, is raised by the captain quote:

"The pressure is from the management, from the company, TS are not talking with us like slaves."

Captain

The care concept emerged from results on issues related to social pillar (i.e., by working conditions, workload as a result of perceived mismanagement). However, the concept is also important on environmental and economic side. The Captain interview shows TS are communicating polite with sea staff, but on C/M perception despite this polite communication they are not considering negative impacts of their decisions on the crew.

Regarding research question, care concept is crucial to handle conflicts since it is pointed by crew as an important aspect lacking from shore management. The nurture of relation Ship-Shore and management level on the ship will enhance TS relations since it sets a positive ground for handling conflicts. The study of Gausdal and Makarova (2017) mentioned lack of trust results in fear of conflicts and consequently incapability to engage in productive debates. This study about trust and safety onboard, shows that care on how to handle conflicts has a positive impact on trust and safety (i.e., positive impacts on all pillars).

4.1.2 Awareness (about SD)

Regarding awareness of SD, in question 3 TSs side prioritized Society pillar (mean=4.5) while environmental pillar was not considered as a priority for SD. A major difference can be identified when analysing individual answers, while TSs prioritize some pillars over others, sea staff seems to be aware of the need to give importance to all pillars. The exception was the captain (representing the company onboard):

"Definitely number one is economy, next is society and environmental it is because it must be…"

"I feel also in my private opinion environment is the last one."

"…tried to combine all of them but starting from economy."

Captain

The captain's answers match the TSs only in what concerns environment. In this sense, both are aware of social pillar and recognize the importance of economy.

Everything could be cleaner. But why not? Because much more money and more work."

2nd Engineer

It is observed in interviews some barriers to commitment with SD, first the perception at sea that upper levels only care about economic side and the spread idea that care about environment is only a cosmetic operation to authorities, customers and society in general.

The SD measures regarding society and environment are mostly adopted because of regulations. By the C/M interview there is no effort to engage people with SD issues.

"They don't ask us what we think about this regulation…"

C/M

Regarding incentives, they are given by communication ("they are happy…") when ideas to save money come from sea staff.

"They are happy to hear your ideas for saving money. If you solve the problem by your hand (instead calling service) they can be grateful for that."

C/M

When orders regarding environmental compliance are requested they are accepted promptly what can be interpreted as an incentive.

"If you ask for garbage bins by colours they agree"

C/M

It is possible to observe some tiredness of the global regulations and even stricter local regulations.

"No, US is ok now, China is getting worst."

C/E

"…each country has own stricter regulations, especially in Brazil, to keep fruits and vegetable in plastics not in wooden. In US there are special type of bins marked by colours."

C/M

Regarding improving the quality of life of seafarers and retaining qualified professionals the company studied is providing good conditions at sea according to one informant. In what concerns the research question the same informant even mentioned not feeling attention needed from TS to his deck department by TS.

"I would say they are following the objective, you enter the recreation room you see a lot of movies, the gym, the captain in the meeting asked "we have this amount of money to the crew what can we buy? I cannot complain, you have internet, email system, recreating room in good condition, tv, dvd players. So they care about the

society onboard. In the contract you have in last page the date of sign off, this is not common in other companies."

"From my point of view, I think they care more with Engine department. Maybe because they are not familiar with deck procedures or operation because before they were C/E."

C/M

In what concerns environmental awareness in maritime industry newer generations of seafarers are caring more than older generations.

"I feel also in my private opinion environment is the last one."

Captain

"For me its normal to take all these precautions."

2nd engineer

To be able to handle conflicts TS must be aware of the importance of different pillars and the consequences of decisions in each pillar. The awareness about environment is lower in all interviews except one. The younger informant considers normal all precautions regarding environment, this attitude can result from environmental education programmes on younger generations in the last decades. On the TS side, one informant rated environment higher than economy.

4.1.3 Mindset

Most of sea staff believed the pillars should be balanced. TS1 quote reveal that most of sea staff is not prepared to carry responsibility.

"…standards have dropped over the last ten years and it is harder to find the right staff who can carry responsibility."

TS1

Also TS2 alerts for uneven qualifications onboard:

"That depends on staff professional qualification…"

TS2

Some ideas are created in sea staff mind of shore staff attitudes:

"They just sit and see the excel the final amount and start cutting"

C/M

However, in engine department even recognizing the delay on delivery of spare parts, which can cause additional workload, there is a positive approach to office staff:

"A good technical department is not necessary evil, when they start cutting the money on the engine department, something is wrong. Sometimes you just wait more for the spare parts."

2nd Engineer

Some judgement about the knowledge of TS comparing to sea staff:

"...he knows the same like the ship staff."

2nd Engineer

The TS1 confirms some prejudices about seafarers by office side:

"When I moved ashore and into management I had to change the way people think and view seafarers…"

TS1

The next C/M quote stresses an important issue already discussed by Gausdal and Makarova (2017). In this case the afraid of consequences in reputation and future job which is worsened by contract terms:

"Then you have some doubt to inform the office or not, so you try not to. So that's the problem - you are afraid they complain you're not so good and next time they hire another guy."

C/M

The mindset from TS is marked by distrust as consequence of different job environments, lack of knowledge on ship side and according to previous studies the distance ship to shore (Gausdal & Makarova, 2017). In this study all sea staff except one, have shown trust in TS decisions and comprehension of shore side. Regarding SD basic principles, based in results the environment has low priority in both sides, social pillar is

high valued by TSs. However, the interviews revealed as main concern the economic side and technical issues. Only one informant (C/M) was touching upon important management topics in SD. Therefore, handling of conflicting goals seems to be based in technical and economic ground which is too narrow for a SD vision.

4.1.4 Middle manager

The work of TS as a man in the middle looks to be well understood by sea staff.

"TS is just the guy who's redirecting the answers, he knows the same like the ship staff."

2nd Engineer

"Strong pressure, but is not coming from the TS but from the owner. TS is only a man in the middle."

C/E

Regarding technical cooperation, the assistance is perceived by one informant as not useful. The reason mentioned is the TS ignorance of deck department operations:

"...they advise, but normally it's stupid advice that is not working."

"They are there to help you and assist you but when you ask, they can tell you: "try this, try that". Officially they advise, but normally its stupid advice that is not working."

"...there is communication between designer and TS but communication between the TS and us in this particular manner is not great."

"From my point of view, I think they care more with Engine department. Maybe because they are not familiar with deck procedures or operation because before they were C/E."

C/M

Concerning TS duties, the feedback from interviewers is generally positive, with the exception of one informant.

The Captain mentioned through all his experience the relation with TS was all the time good:

"…ground of discussing, everybody was involved and informed and they got a final agreement."

"There is proposal and advices…"

"I didn't have a problem it was always gentle discuss, never shouting never crying, just gentle discussion."

"They provided at the time a mobile phone in case we need to ask TS."

"In this company I met many TS and relation is very good."

Captain

C/M has a more reserved opinion since he is the one dealing with requisitions of spare parts in deck department:

"…we cannot trust completely this guys."

C/M

Contrasting with the vision of engine department:

"Good, 4 (in a range 1-5)"

C/E

The views of TSs on the sea staff does not go in the same direction. Though, they recognize some good professionals at sea where they can trust. This fact is also present in the email interview where TS mention HR are not sharing same view when promoting/hiring personnel.

"A Superintendent always wants the best crew on his ship but he is restricted by who is available and the human resources department who perhaps do not share his view on who should be on the ship."

TS (email interview)

The way TSs performance as man in the middle seems to depend on the trust they have in professional qualifications of sea staff. This role requires sometimes lateral coordination with other

departments (e.g., HR department) which creates hindrances since there is no shared view on what is the right crew for the ship. Further research can explain if TS preferences are based only in technical skills disregarding other fundamental skills as mentioned in SD basic principles. However, the extensive descriptions of C/M suggest improvements have to be made in communication specially with deck department.

4.1.5 (Change) Business and organizational strategy

Regarding business and organizational strategy, the data collected suggest this container business strategy is located on the losers and defenders side (figure 11).

> *"Unfortunately, the companies do not protest, do not argue, they just get the regulation and they have to follow."*

> *"They try to save money and you need something more."*

> *"Always the big issue is the money."*
>
> C/M

> *"…and he asked me if I really need so much… "if you can please reduce", if you can.""*
>
> Captain

> *"Sometimes you just wait more for the spare parts."*
>
> 2nd Engineer

Based on the previous sentences, the organizational strategy pursued is introverted consisting in complying to environmental and social aspects that are considered external pressure of stakeholders. The TSs perspective on this issue is not clear but judging from "weak data" the TS quote shows he is not fulfilled by a minimal expenditure strategy followed by companies.

> *"Ships are built without pride or additional cost and built to serve a single purpose - to make money. A superintendent's goal of having pride in his ship is often lost as he has to realise the importance of minimal expenditure."*
>
> Email interview

The implications to the research question is that TSs are influenced by business and organizational strategy when handling conflicting goals. This strategy is part of big decisions and normally TSs have limited influence on it. However, there is a possibility to influence organization towards SD when basic principles are included in everyday small decisions trying to avoid as much as possible upper level requests for short term vision based decisions.

4.1.6 Shared knowledge culture

The question is if there is some ground to build a shared knowledge culture. The next quote shows there is communication methods on the ground to solve some operational issues.

> *"…the proper way to ask a TS is to say what is the problem and also to put a solution inside and how you plan to handle this problem, and the TS always say or write just go ahead like you think or I will ask supplier and figure out another option."*
>
> 2nd Engineer

To implement SD solutions a different arena should be implemented that could bring all parts involved and make communication flow between office and sea staff contributing for increased levels of trust. The first step is to build a solid ground of trust where all the parties can overcome hindrances. On different conflicting goals can be observed the need for closer cooperation between actors in order to increase trust, safety and efficiency.

> *"you try to solve the problem by yourself because you don't know the reaction of this guys"*

> *"Then you are afraid, especially when you are a new C/M. Then you have some doubt to inform the office or not, so you try not to."*
>
> C/M

Trust can be increased if sea staff is aware like the captain that pressure is coming from upper levels.

> *"The pressure is from the management, from the company, TS are not talking with us like slaves."*
>
> Captain

As the captain notices, TS as a man in the middle must try to manage pressure and inform sea staff of all details.

On the conflicting goal regarding fast pace of technology change, TS2 mentioned the limitations imposed by manufacturers. In a shared knowledge culture, learning arenas can help to increase knowledge of operators on new technology.

> *"Very difficult since manufactures are protecting their business in the way which restricts important informations needed for proper Operation or maintenance."*
>
> TS2

> *"but (communication between) the TS and us in this particular manner is not great."*
>
> C/M

Regarding the conflicts of transitioning (i.e., operational levels to management), or from sea to office, there is no signs of openness in sharing problems and difficulties. The implementation of a shared knowledge culture, since is dependent of trust, is hindered by obstacles to interpersonal trust onboard (Gausdal & Makarova, 2017) and between ship and shore.

> *"…there is a misunderstanding of what seafarers do all day. Many management think that the seafarers just sit there with nothing to do."*
>
> TS1

> *"Then you are afraid, especially when you are a new C/M. Then you have some doubt to inform the office or not, so you try not to."*
>
> C/M

The distance between ship and office limits the cooperation, therefore platforms that can help cooperation are needed.

> *Cooperation is limited."*
>
> TS2

These results are in line with the conclusions of the study of Gausdal and Makarova (2017) where lack of trust is seen as a barrier for knowledge sharing and quick information exchange due

to fear of showing lack of knowledge. Additionally, ship to shore communication problems are seen as an obstacle to trust.

The implication to the research question is that TSs face challenges to implement shared knowledge culture onboard as a support to handle conflicts. First, the actual levels of trust create resistance to change and secondly the multiculturalism among the crew result in different perspectives about the importance of trust.

4.1.7 Vision

The TSs vision believes sea staff don't have much to contribute to SD what conflicts with the results of sea staff showing an overall acceptance that pillars must be balanced.

> *"Unfortunately, I don't feel that ship's staff have much to contribute towards sustainable development"*
>
> TS1

Later, this fact is explained by TS1 that when actions are requested from their side there is low motivation.

> *"Most seafarers feel that they are being asked too much…"*
>
> TS1

The TS2 follow the same line of thought reducing their contribution only by keeping equipment running.

> *"Sea staff I focused mainly on keeping Equipment running and operating vessel within mandatory rules."*
>
> TS2

The C/M is feeling directly in his work the pressure from company to follow environmental regulations so he agrees company is following environmental policies:

> *"In the economy part they are following close the objective, environment I think too. This is what I like in this company, in others company's environmental situation officially in the paper yes, but off the record no. In this company no, you follow strictly*

the regulation, not only IMO but Brazilian and US regulations. In this matter you can expect some assistance"

C/M

However, the captain who is more immersed in company believes they follow environmental policies because it must be:

"Definitely number one is economy, next is society and environmental it is because it must be…"

"Maybe sometimes they are talking environment is the first, this is some show and good looking in internet, newspaper, tv, port authorities, but it's a kind of show.

Captain

"They just check how much money they can save on the different pillars"

2nd Engineer

The vision of SD shipping industry requires mostly from crew operational efficiency (Glave, 2014). The fact is to pursue a sustainable strategy where innovation plays an important role the workforce must be part of solutions. Container business characteristics tend to have managers corresponding to Theory X[8] assumptions since they are faced with pressure from upper levels to produce immediate results and instead of investing in people they *conclude that slashing costs, changing strategy, or reorganizing is more likely to produce a quick hit* (Bolman & Deal, 2013, p. 141). The container shipping company pursuing SD goals must follow different human resource philosophy where workforce is motivated, loyal and free spirited even at sea. The results show TSs vision about sea staff is they should mainly operate.

Regarding research question TS vision doesn't see sea staff contributing on handling conflicts regarding SD issues. In a company engaged in innovation strategy sea staff must be involved and take part on the exchange of ideas which potentially support TS on handling conflicting goals.

[8] Theory X believes subordinates are passive and lazy, have little ambition, prefer to be led, and resist change. (Bolman & Deal, 2013, p. 126)

The results showed SD is partially embraced by company. Nowadays, with increased awareness of stakeholders and society regarding SDGs, the TS has some space to perform the required trade-offs respecting the importance of pillars, especially the environmental.

PART D

"Prioritize among the possible solutions established in Part C into a strategic plan." (Broman & Robèrt, 2017)

5 Answer to Research Question

This study research question asks: *How TS handle conflicting goals regarding SD basic principles?* The proposition is that adoption of SD basic principles support TSs handling conflicting goals stemming from TS-Ship relationship.

We observed expected consequences on sea staff resulting from basic principles adopted by TSs. The social pillar was rated by TS1 and TS2 with 4 and 5 respectively. As a manager, he is aware of the importance of the relation with sea staff. Accordingly, almost all sea staff informants reported no relevant problems with TSs and highlighted the good cooperation. In general, sea staff showed understanding about the TS position as a man in the middle experiencing pressures from upper levels that later could impact negatively on sea staff.

One of the TS rated economy as the most important pillar and many of the informants mentioned they feel is a priority for the company. The perception of economy ruling over other pillars is felt by sea-staff as negative since it results in increased workload. The approach of the company is clearly felt by sea staff as focused on cutting costs.

It was possible to observe on TSs surveys, even aware that they could give the same rating to all pillars, a different rate to each pillar. On the ship side, the pillars were by almost all participants equally meaning that ship staff is aware of the need to consider all pillars when solving conflicting goals. Further studies could explain if this is caused by sea staff experiencing negative consequences of prioritizing economy over social pillar.

Regarding the conflict *shore demands vs ship independence,* the distance between two sides showed to increase lack of trust. An informant felt clearly the cut of orders as an "attack" to his competence and independence. This fact decreased motivation and proud to work on the company. Regarding communication, informants on ship side agreed there is no relevant problems while TSs stressed the lack of knowledge and qualifications. The problem pointed by Sampson (2016) regarding the lack of experienced staff onshore could not be observed here, but it is clear throughout weak and strong data the tendency of TSs to forget real situation onboard. The following table collects some suggestions by the author Sampson (2016).

Table 16 - suggested solutions for the shore demands vs ship independence conflicting goal

Sampson (2016) suggestions:	Author comments:
• Companies should recruit and train seafarers in a manner which allows them to place greater faith in their judgement and skill.	Companies should start building trust from the training period. Also IMO could intervene in education curriculum to introduce SD and management contents.

• Minimise the degree to which shore staff seek to remove decision making from on board staff.	The TSs showed lack of trust on some officers professional competence. Therefore, shore side tend to increase the paperwork to avoid wasting materials or expensive spare parts laying on the engineers store rooms. To improve this Rothaermel (2015) suggests total quality management and just in time inventory management.
• Improve the mutual understandings of seafarers and shore staff in relation to their respective jobs and working environments • Promotes honest exchange of information about shipboard operations, constraints, and activities.	Promote office staff travel on the ship and sea staff guided visits to the office and explanation of each position. Develop arenas to share work experiences and difficulties faced by both sides as a way to increase trust and in house innovation (e.g. meetings, company magazines, blogs).

On the conflicting goal *efficiency vs safety* a case was described where in order to save money in the freight of a spare part, C/M needed to work extensively to adjust manually the list of the ship. Due to cost cutting mindset, industry is prone to situations where workers have to choose between performing acts that hurts others and the livelihood on which they and their loved ones depend with serious consequences for performance and mental health. In this regard, was not possible to observe cost cuttings that could affect seriously safety. In the web survey one TS mentioned safety as a priority and rated environment higher than economy. Though, we observed cost cutting impacting on working conditions. One informant shared his disillusion when orders were repeatedly reduced by shore staff. A different informant explained this occurs due to irresponsibly of some officers when placing orders. Some problems are based in distance and lack of trust, but could be solved by improved communication and more shared information. In one episode TS wanted to reach efficiency through cutting costs and later resulted in more costs (e.g. to save money on the freight the ship stayed longer time on port due to the manual adjusting of the list). Regarding this conflict, TSs face the challenge of improving communications with sea staff regarding cutting of costs and to perform responsible cuttings without affecting other pillars of SD (i.e. in a sustainable way).

Regarding the conflict *very fast pace of change of technology vs safety* in general all informants agreed that exchange of information between all parties is good. The information given by TSs raised the issue of poor training of seafarers in electronics and raised another conflicting goal between need of manufacturers to protect business and need for proper operation and maintenance by sea staff. All sea staff feel support from TS side. To overcome training problems TSs can raise the issue on maritime forums where the future of shipping is discussed. Also it is on TS hands to redirect the training of cadets onboard to this area.

The *environmental compliance as a source of work-related stress* was assumed by all informants. At the same time, a considerable percentage of informants rated the environment with low priority. We observed a contradiction between the low importance that environment has in informant's basic principles and stress and workload as a result of fearing huge penalties for not complying with regulations. The solution for this issue can only be through cultural pillar since it requires a change in mindset of seafarers and TSs. The change on this matter is on their way since new generation of officers have a more positive vision about environmental regulations. To help on this issue, the implementation of sustainable indicators with a rigorous and independent measurement of data could be part of the solution.

Authorities also should re-evaluate some regulations and monitor classification societies surveyors. When surveying ships, classification societies should give advice about right procedures and avoid unclear situations. When the spirit of the regulation is not made clear or even misused by surveyors, sea staff later will develop more resistance to change mindset.

In the final conflict between *technical manager vs engineer,* sea staff feels supported by TS if necessary. However, when asked about difficulties during transition only technical issues were raised. This can mean technical management is immersed mainly on technical issues disregarding the management side. The fact is that all officers interviewed are responsible for managing people in a challenging environment where mismanagement of human side can lead to negative consequences on social side of SD.

The management of routine conflicting goals by TSs, based on the interviews are affected by decision biases and errors as stated in table 17. The reason for "What happens" might be out of the TSs responsibility.

In this research the focus is not in the sources of TS behaviour but how he handles conflicting goals. Mainly, it was identified shortcuts decision biases that tend to be based on financial metrics to simplify decisions. The fact is that even routine decisions require hard to evaluate criteria (i.e. measure collateral effects in other pillars). The next decision bias confirmed by our data is *"wants vs shoulds"* associated to short term perspective vision.

The solutions presented in the literature review, namely the FFSD, the fostering of SD behaviours by McKenzie-Mohr (2013), ethics of care, interventions for routine decisions by NBS (2012) and the business strategies addressed by different authors can represent a good starting kit for developing new methods within the relation.

The data has showed us, the way TSs handle CGs addressed is influenced by his basic principles that like we have seen are not entirely aligned with SD propositions. Since TS has shown

to have influence on the relation, he is on the right position to turn problems (figure 14) into solutions.

In the final question all informants were asked about the outcomes regarding the objectives of SD. From TS side, the sea staff is not part of solutions due to lack of interest on the issue. The sea staff recognized, basic principles defended by the company are being pursued but not coincident with basic principles of SD.

5.1 TS as an influencer of sustainable shipping

The aim of this research is to develop new theory. Based on the logic expressed by figure 13 the study started from general (i.e. literature review) to particular (data) and now returns to general (new theory). Therefore, based on theory (tools collected along the work) and concepts resulting from data, a model (figure 15) was developed to aid TSs influence SD in their organizations and consequently contribute for a positive change towards a sustainable shipping.

In the next points each stage is explained in relation to theory and findings. The author personal analysis is also included.

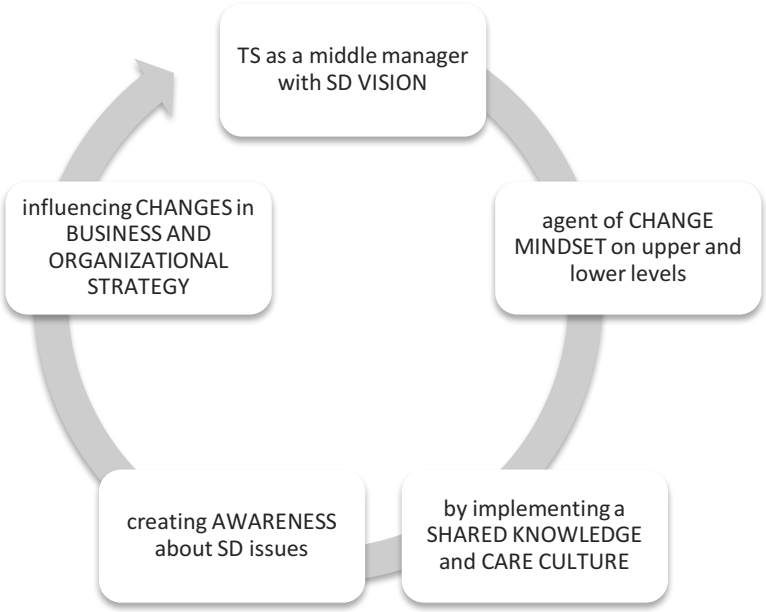

Figure 15 -TS as an influencer of sustainable shipping

5.1.1 TS as a middle manager with SD vision

The FFSD require a vision, container shipping companies already agreed externally on sustainability and more pressure is expected from society and costumers to turn it real. Therefore, a SD vision based on basic principles already mentioned will be a reality. Given the results of this

study, TS in a SD vision cannot escape from the challenge of addressing all pillars of SD and harmonize tensions stemming from his role as a middle manager. This must be seen as an opportunity to differentiation instead of a problem. The figure 14, highlights the word “problem” and “TS” (Technical Superintendent). In second cycle coding, as part of the vision the three most cited words on primary data were: problem, think, company. It was perceived in some questions approaches a tendency to focus on problems. This fact relates to the container business focus on surviving in competitive market instead of focusing on solutions (cf. Blue Ocean strategy by Kim (2004)). The two words coming from the figure can also means TS as a man in the middle is seen as a problem solver in the current industry approach. To pursue an innovative approach, TS must be proactive to problems and use them to create opportunities.

The literature review most cited words assigned to the vision concept, highlight the importance of the cost, system, innovation and environmental concerns, aspects not emphasised in interviews (table 12). As part of FFSD, TS must use backcasting to adjust reality and better plan the path towards the vision.

5.1.2 Change mindset

A committed TS is called to influence upper and mainly lower levels to engage on the vision. This work shed light on this issue since we have found a predisposition of sea staff to give importance to all pillars and through observations the need to change behaviours rooted in individuals affecting mostly environmental and social pillar.

The compliance with agreements and goals require from all concrete steps and consistency. To move organization to an innovation path, TS must reduce focus on problem and use the problems to boost innovation. With a positive approach towards problems TS can manage demands of external and internal actors to organizational change.

5.1.3 Shared knowledge and care culture

The challenges mentioned in conflicting goal between shore and ship side and the issue of fast pace of technology change, showed how crucial is creating learning arenas were all can share their thoughts and ideas in order to support TS handling the challenges. This culture will also give support in transitioning from lower levels. Additionally, sea staff motivation can be increased even in the event of necessary cuttings due to increased trust and involvement created by shared knowledge between all actors in the chain.

5.1.4 Create awareness about SD

The information given by TSs also shed light on some hindrances on sea staff about changing mindset. In fact, this step should be taken not only *posteriori* but also parallel to the change mindset step using for instance learning arenas to share experiences and motivate for the vision. Later, when upper and lower levels start to be aware of SD, learning arenas could lead to creative and shared solutions. In this aspect the cultural pillar is also fundamental to promote shared ideas and brainstorming.

Regarding table 12, environmental and community aspects were mentioned in literature review. TS must know the importance of this values to accomplish a change in mindset and consequently reach the vision.

5.1.5 Change business and organizational strategy

It is not expected all solutions to be adopted and accepted by owners. Reality require leaders to balance progress with return of investment. There is a risk of end in the same "business as usual". However, a TS engaged on SD can influence, upper levels (not including owners) and lower levels to press organization to a different vision.

5.2 Limitations

The adoption of a single case study with few informants results in a generalization problem. Furthermore, the interpretivist nature of the work raises problems in justifying the quality, trustworthiness and authenticity of the findings. Next, I address the five important limitations topics in qualitative research data.

5.2.1 Confirmability

The study describes in a limited way the overall picture of TS-Ship relation in container business due to the use of few informants. Even though researcher self-awareness about personal assumptions, values, biases and affective states, should be expected some measuring problems since study was conducted on the researcher workplace which is representing one side of the relation (the ship side).

Besides, all limitations, as author Eisenhardt and Graebner (2007) explains, the single case study main concern is not to test theory but instead to develop it. Single case studies are chosen because of unusual research access (i.e., the selected case study is characterized by hard to reach populations). To be able to provide stronger base for theory building and more generalizable

conclusions, the study needed to incorporate multiple case studies which would eliminate natural bias related to workplace research.

The reasons above mentioned impact negatively in ability to draw general conclusions. Further studies – especially of the qualitative type – are needed to strength and develop the conclusions drawn from the findings.

5.2.2 Reliability

Should be expected low consistency and stability over time and across researchers since conclusions are linked to the culture of observed company and limited number of interviews and web surveys.

The study design is well adapted to the research question. Despite deviations, results showed meaningful patterns across data sources (e.g., container business actual strategy, ship to shore communication problems, TS as a middle manager). The frame provided in theory, used to develop the study (FFSD), helped to connect and relate theory to the findings. As mentioned before, the research question required a larger sample of respondents, especially from TSs side which was not possible.

5.2.3 Credibility/Internal Validity

The structure of interviews and setting allowed respondents to provide rich context and meaningful descriptions. Potential sources of bias that could influence answers were noted and explained in the study (e.g., C/M affected with heeling pump problem, traditional rivalry between deck and engine departments, etc.).

Different methods of collecting data were used in each side of the relation (web survey and structured interviews) which affects the results. I believe structured interviews in the TSs case would enrich the conclusion since we could use probing to go deeper in sources of conflicting goals and difficulties TSs face to influence SD practices.

Internally the findings are coherent and some tendencies observed in theory and weak data could be confirmed (e.g., the focus on economic pillar; ship vs shore problems, problem of trust, business strategy, etc.). However, some areas of uncertainty can be identified like the feasibility of sea staff to change mindset, of TS to act as an influencer of SD and the degree of influence of upper levels in TS decisions towards ship level. Also, each conflicting goal addressed is so vast and complex that only a deeper investigation, which was not possible here, could aim to explain with certainty.

Finally, regarding the proposition, it was possible to confirm TSs decisions can influence ship crew regarding SD basic principles. Due to the interpretivist nature of the work was not possible to quantify the extent TSs were able to influence ship decisions. Also, not possible to quantify in what extent TS basic principles as practices deviate from SD basic principles. These exercises can be subject of further quantitative studies.

The main focus was on issues that could affect negatively the implementation of SD principles as presented in literature (SD vision) and coherency between the way TSs handle CGs (challenges) and his basic principles (TSs vision).

5.2.4 Transferability/ External validity

The transferability of this study and theory of TS as an influencer of sustainable shipping can be applied to middle managers and companies sharing the same patterns of container business. The business is part of maritime transport network, thus, theory can be adapted to other shipping sectors (tankers, bulk, offshore…) or in cases where TSs are part of technical management companies.

To reduce transferability problems, the original sample of persons, setting and processes were fully described as well the limiting effects of sample selection (i.e., few informants) to permit adequate comparisons with other samples. The generalization scope is the container business in the case of companies with in-house management system where TSs are responsible for deck and engine departments.

5.2.5 Application

The findings stimulate working hypotheses in particular applicability of theory: *TS as an influencer of sustainable shipping*. The analysis of conflicting goals and possible solutions given by the tools can be applied in similar conflicts faced by other technical middle managers.

The work would be enriched and theory more generalizable if more companies and informants in the container sector could be investigated. The knowledge offered by the study can be classified as of theory to guide action.

6 Conclusion

The purpose of this work was to study "The Role of Sustainable Development in Maritime Technical Management". The answer to the research question *How Technical Superintendent handle conflicting goals regarding Sustainable Development basic principles?* is that TS decisions when handling conflicting goals reflect their basic principles with this having direct impact on sea staff. Adopting the pillars language, roughly the economic and social pillar are important for TSs and sea staff acknowledge this. It was possible to observe indirectly that sea staff perception of prevalence in economic pillar is attributed to owner's pressure on TS. Further research could clarify the extent TSs basic principles are influenced by owner's decisions and pressures. Regarding environmental pillar, it was rated lowest in both sides which matches the rest data collected.

The comparison of literature review and secondary data resulted into to the concepts of *care*, *awareness, mindset, middle manager, SD vision, change (Business and organizational strategy)* and *shared knowledge*. These concepts are the main findings of the study and basis for developing theory: *TS as an influencer of sustainable shipping*. The process start in TS as a middle manager with a SD vision framed by SD basic principles here described. Such attitude makes him an agent and influencer of new mindset on upper levels but mainly on lower levels - the sea staff. This change of mindset is supported by implementation of a shared knowledge and care culture that lead actors to be aware of SD issues. These actors are later influencers of changes in business and organization strategy.

Even though the limitations aforementioned in discussion, the main contribution of this study is the theoretical framework that can be further developed by stronger and generalizable studies in shipping field. The combination of tools mentioned in this work applied to the framework can support TSs committed to SD to influence sustainable practices in shipping. On operational side, the work creates awareness on the long term benefits of caring about human and environmental elements. The project proposes practical tools that can be further explored and used by the industry on decision making. On other perspective, the project can create awareness of recruiters to focus in skills other than technical. To the marine transportation system, ideas like management tools (software), could be developed to help decision makers selecting the most sustainable option and observe beforehand the impacts of their decisions.

Since one of the limitations of this study was generalization, this opens doors to qualitative studies focused in some details here highlighted. For instance, to study the negative consequences on sea staff of prioritizing economy over social and environmental pillar. Also to understand, in what extent TSs mindset as managers are predisposed to balance potential conflicting goals or to prioritize some pillars.

This case study contributes to theory in the sense it showed how TS role can be used to influence organizations for a SD vision by solving tensions arising from conflicting goals. This is in part explained by the final theory *TS as an influencer of sustainable shipping*. Furthermore, there is an open door to extend research to other cases (e.g. other shipping sectors) since multiple cases can contribute for a more robust theory.

Finally, this work suggests managers have a vital role to play, without commitment from management in SD it will be impossible to influence culture and working practices towards a more sustainable future. From what we have learned, we can conclude good managers are those who handle conflicting goals grounded in a broader vision and this must include more than one pillar.

Bibliography

Akamangwa, N. (2016). Working for the environment and against safety: How compliance affects health and safety on board ships. *Safety Science, 87*, 131-143. doi:http://dx.doi.org/10.1016/j.ssci.2016.03.027

Altman, I. (2015). The Good, The Bad, And The Ugly Of Cost Cutting. *Forbes*. Retrieved from https://www.forbes.com/sites/ianaltman/2015/03/17/the-good-the-bad-and-the-ugly-of-cost-cutting/2/ - 1eae6eee2bef

Andersson, K., Baldi, F., Brynolf, S., Lindgren, J. F., Granhag, L., & Svensson, E. (2016). *Shipping and the Environment*. Berlin, Heidelberg: Springer Berlin Heidelberg.

Assembly, U. G. (2015). *Transforming our world : the 2030 Agenda for Sustainable Development*. Retrieved from http://www.refworld.org/docid/57b6e3e44.html

Audi, R. (1999). *The Cambridge Dictionary of Philosophy*: Cambridge University Press.

Auerbach, C., & Silverstein, L. B. (2003). *Qualitative Studies in Psychology : Qualitative Data : An Introduction to Coding and Analysis (1)*. New York, US: NYU Press.

Barden, R. H. (2006, 12-14 Nov. 2006). *Cost Savings at the Expense of Quality, Safety, and the Environment. A Plastic Molding Example.* Paper presented at the 2006 2nd International Conference on Power Electronics Systems and Applications.

Battles, J. B. (2001). Disaster prevention: lessons learned from the Titanic. *Proceedings (Baylor University. Medical Center), 14*(2), 150-153.

Baumgartner, R. J., Mark-Herbert, C., & Ketola, T. (2009). Organizational culture and leadership: Preconditions for the development of a sustainable corporation. *Sustainable Development, 17*(2), 102-113. doi:10.1002/sd.405

Beri, R. (2011). Piracy in Somalia: Addressing the Root Causes. *Strategic Analysis, 35*(3), 452-464. doi:10.1080/09700161.2011.559985

Bhattacharya, S., & Tang, L. (2013). Middle managers' role in safeguarding OHS: The case of the shipping industry. *Safety Science, 51*(1), 63-68. doi:http://dx.doi.org/10.1016/j.ssci.2012.05.015

Bhattacharya, Y. (2015). Employee Engagement as a Predictor of Seafarer Retention: A Study among Indian Officers. *The Asian Journal of Shipping and Logistics, 31*(2), 295-318. doi:http://dx.doi.org/10.1016/j.ajsl.2015.06.007

Bolman, L. G., & Deal, T. E. (2013). *Reframing Organizations: Artistry, Choice, and Leadership*. San Francisco: Wiley.

Broman, G. I., & Robèrt, K.-H. (2017). A framework for strategic sustainable development. *Journal of Cleaner Production, 140*, 17-31. doi:10.1016/j.jclepro.2015.10.121

Bryman, A. (2012). *Social Research Methods*: OUP Oxford.

Collis, J., & Hussey, R. (2013). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*: Palgrave Macmillan.

Commission, E. (2017). Statement by Climate Action and Energy Commissioner Miguel Arias Cañete on the US announcement to withdraw from the Paris Agreement [Press release]. Retrieved from http://europa.eu/rapid/press-release_STATEMENT-17-1513_en.htm

Corbett, J. (2010). *International Maritime Shipping*: OECD.

Corbett, M. (2015). From law to folklore: work stress and the Yerkes-Dodson Law. *Journal of Managerial Psychology, 30*(6), 741-752.

DESA. (2010). *Trends in Sustainable Development: Towards Sustainable Consumption and Production*. Retrieved from New York:

Dickie, J. (2014). *Reeds 21st Century Ship Management*. London: Adlard Coles Nautical.

DNV-GL. (2014). Competence of ships' superintendents (Vol. DNVGL-ST-0009:2014-08). Oslo: DNV-GL.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of management journal, 50*(1), 25-32.

Florin, I. (2010). Master of the Ship, manager and instructor. *Management & Marketing*(1s), 133-155.

Frankfort-Nachmias, C., Nachmias, D., & DeWaard, J. (2014). *Research Methods in the Social Sciences*: Macmillan Learning.

Gallopín, G., America, U. N. E. C. f. L., Environment, t. C., & Division, H. S. (2003). *A Systems Approach to Sustainability and Sustainable Development*: ECLAC, Sustainable Development and Human Settletments Division.

Gausdal, A. H., & Makarova, J. (2017). Trust and safety onboard. *WMU Journal of Maritime Affairs, 16*(2), 197-217. doi:10.1007/s13437-017-0126-z

Given, L. (2008). The SAGE Encyclopedia of Qualitative Research Methods. doi:10.4135/9781412963909

Gjølberg, M., Longva, T., & Kjersti, A. (2017). *Sustained development goals: exploring maritime opportunities* Retrieved from Høvik:

Glave, T. J., M; Saxon, S. (2014). The hidden opportunity in container shipping. *Our Insights*. Retrieved from http://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/the-hidden-opportunity-in-container-shipping

Governments, U. C. a. L. (2010). *Culture: Fourth Pillar of Sustainable Development*. Retrieved from http://www.agenda21culture.net/sites/default/files/files/documents/en/zz_culture4pillarsd_eng.pdf

Grammenos, C. T. (2010). *The Handbook of Maritime Economics and Business*: Lloyd's List.

Grech, R. H., T; Koester, T. (2008). *Human factors in the maritime domain*: CRC press.

Grober, U. (2007). *Deep Roots: A Conceptual History of "Sustainable Development" (Nachhaltigkeit)*: WZB.

Hawkes, J. (2003). *The fourth pillar of sustainability : culture's essential role in public planning*. Melbourne, Vic.: Cultural Development Network : Common Ground.

House, T. W. (2017). Statement by President Trump on the Paris Climate Accord [Press release]. Retrieved from https://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord

IMO. (2013). *World Maritime Day: A Concept of a Sustainable Maritime Transportation System*. Retrieved from http://www.imo.org/

James, P. (2015). *Urban Sustainability in Theory and Practice: Circles of Sustainability*: Taylor & Francis.

Jones, S. A., Michelfelder, D., & Nair, I. (2017). Engineering managers and sustainable systems: the need for and challenges of using an ethical framework for transformative leadership. *Journal of Cleaner Production, 140, Part 1*, 205-212. doi:http://doi.org/10.1016/j.jclepro.2015.02.009

Jorgensen, P., & Farrag, A. (2010). *Sustainability Trends in the Container Shipping Industry*. Retrieved from http://www.bsr.org/

Kates, R. P., T; Leiserowitz, A. (2005). What is Sustainable Development? Goals, Indicators, Values, and Practice. *Environment: Science and Policy for Sustainable Development, 47*(3), 8-21. doi:10.1080/00139157.2005.10524444

Kim, W. C. M., Renée. (2004). Blue Ocean Strategy. *Harvard Business Review*, 12.

Lam, J. S. L. (2015). Designing a sustainable maritime supply chain: A hybrid QFD–ANP approach. *Transportation Research Part E: Logistics and Transportation Review, 78*, 70-81. doi:http://dx.doi.org/10.1016/j.tre.2014.10.003

Lorange, P. (2009). *Shipping Strategy : Innovating for Success*: Cambridge University Press.

Lun, Lai, K., & Cheng, T. (2010). *Shipping and Logistics Management*: Springer London.

Lun, Y. H. V. e. a. (2016). *Green Shipping Management*. London: Springer.

Mason, J. (2002). *Qualitative Researching*: SAGE Publications.

McKenzie-Mohr, D. (2013). *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing*: New Society Publishers.

Meho, L. I. (2006). E-mail interviewing in qualitative research: A methodological discussion. *Journal of the Association for Information Science and Technology, 57*(10), 1284-1295.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*: SAGE Publications.

Mukherjee, P. K. B., Mark. (2013). *Farthing on International Shipping* (4th ed.). Berlin: Springer.

Myers, M. D. (1997). Qualitative research in information systems. *Management Information Systems Quarterly, 21*, 241-242.

Nattrass, B. F., & Altomare, M. (1999). *The Natural Step for Business: Wealth, Ecology and the Evolutionary Corporation*: New Society Publishers.

NBS. (2012). *Making Sustainable Choices: A Guide for Managers*. Retrieved from http://www.nbs.net/knowledge/

O'Leary, Z., & Hunt, J. S. (2016). *Workplace Research: Conducting small-scale research in organizations*: SAGE Publications.

Parthibaraj, C. S., Subramanian, N., Palaniappan, P. L. K., & Lai, K.-h. (2016). Sustainable decision model for liner shipping industry. *Computers & Operations Research*. doi:http://dx.doi.org/10.1016/j.cor.2015.12.005

Pettersen, S. (2015). How does cost cutting affect safety? *Oil & Gas*. Retrieved from http://blogs.dnvgl.com/oilgas/safety/how-does-cost-cutting-affect-safety/

Rasmussen, J. (1994). Risk Management, Adaptation, and Design for Safety. In B. Brehmer & N.-E. Sahlin (Eds.), *Future Risks and Risk Management* (pp. 1-36). Dordrecht: Springer Netherlands.

Rasmussen, J., & Suedung, I. (2000). *Proactive risk management in a dynamic society*: Swedish Rescue Services Agency.

Robinson, J. B. (1982). Energy backcasting A proposed method of policy analysis. *Energy Policy, 10*(4), 337-344. doi:http://dx.doi.org/10.1016/0301-4215(82)90048-9

Rothaermel, F. T. (2015). *Strategic management* (2nd ed.): McGraw-Hill Education.

Rubin, J. D. (2012). Fairness in business: Does it matter, and what does it mean? *Business Horizons, 55*(1), 11-15. doi:http://dx.doi.org/10.1016/j.bushor.2011.08.005

Saldana, J. (2009). *The Coding Manual for Qualitative Researchers*: SAGE Publications.

Sampson, H. A., I; Ellis, N; Tang, L; Turgo, N. (2016). *The relationships between seafarers and shore-side personnel: An outline report based on research undertaken in the period 2012-2016*. Retrieved from Cardiff:

Saris, W. E., & Gallhofer, I. N. (2014). *Wiley Series in Survey Methodology : Design, Evaluation, and Analysis of Questionnaires for Survey Research*. New York, US: John Wiley & Sons, Incorporated.

Senge, P. M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*: Doubleday/Currency.

Sipp, C. M. E., E. G. (2013). *Real Options and Strategic Technology Venturing: A New Paradigm in Decision Making*. New York: Springer.

Step, T. N. (2016). Our ABCD process. http://www.thenaturalstep.org/.

Sterman, J. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World*: Irwin/McGraw-Hill.

Stopford, M. (2009). *Maritime Economics 3e*: Taylor & Francis.

Strange, T., & Bayley, A. (2008). *Sustainable Development*: OECD Publishing.

Tepper, B. J. (2010). When managers pressure employees to behave badly: Toward a comprehensive response. *Business Horizons, 53*(6), 591-598. doi:http://dx.doi.org/10.1016/j.bushor.2010.07.002

Theotokas, I., Lagoudis, I. N., & Kotsiopoulos, N. (2014). Leadership Profiling of Ocean Going Ship Masters. *The Asian Journal of Shipping and Logistics, 30*(3), 321-343. doi:http://dx.doi.org/10.1016/j.ajsl.2014.12.004

Treher, E., Piltz, D., Jacobs, S., & Carr, T. (2010). *A Guide to Success for Technical Managers : Supervising in Research, Development, and Engineering*. Hoboken: Wiley.

UNCTAD. (2013). *Recent developments and trends in international maritime transport affecting trade in developing countries*. Retrieved from

Virapat, C. (2011). *Relationship between the Oceans and the Three Pillars of Sustainable Development*. Paper presented at the The 12th Meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea, The United Nations Headquarters.

Wall, M. (2014). *The Role of Marine Engineer Superintendent*. London: Imarest.

WCED. (1987). *Our common future*. Oxford; New York: Oxford University Press.

Wijnolst, N., Wergeland, T., & Levander, K. (2009). *Shipping Innovation*: IOS Press.

Yin, R. K. (2009). *Case Study Research: Design and Methods*: SAGE Publications.

Yuan, Z., Li, Y., & Tetrick, L. E. (2015). Job hindrances, job resources, and safety performance: The mediating role of job engagement. *Applied Ergonomics, 51*, 163-171. doi:http://dx.doi.org/10.1016/j.apergo.2015.04.021

APPENDIX A – Sustainable Development Goals

Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote wellJbeing for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Source: adapted from (Assembly, 2015)

APPENDIX B – Informed consent

Consent to Participate in a Research Study
University College Southeast Norway

Introduction

- You are being asked to be in a research study of about The Role of Sustainable Development in Maritime Technical Management.
- You were selected as a possible participant because you are part of the crew of the vessel in study.
- The interview will take place on period from 25 September 2017 until 30 September 2017.
- The date for project completion is 01.10.2017 and by this date all data will be made anonymous
- We ask that you read this form and ask any questions that you may have before agreeing to being interviewed.

Confidentiality

- The researcher took the necessary measures to guarantee the anonymity of the company, the vessel and the person interviewed.
- This interview is anonymous. We will not be collecting or retaining any relevant information about your identity, only age, sex and ranking will be collected.
- The records of this study will be kept strictly confidential. Research records will be kept in a locked file, and all electronic information will be coded and secured using a password protected file.
- By the end of the project (01.10.2017) all direct personal data (such as names/lists of reference numbers), indirectly identifiable data (i.e. an identifying combination of background variables, such as residence/work place, age and gender) and digital audio files will be permanently deleted.
- We will not include any information in any report we may publish that would make it possible to identify you.

Purpose of Study

- The main goal of this interview is to understand the relation between the Technical Superintendent and the crew in the container business.
- Ultimately, this research will be published as part of a master thesis.

Description of the Study Procedures

- If you agree to be in this interview, you will be asked about conflicting goals arising from the relation with Technical Superintendents.

Risks/Discomforts of Being in this Study

- There are no reasonable foreseeable (or expected) risks.

Benefits of Being in the Study

- The person interviewed is participating with his/her view for research in the area of technical management.

Right to Refuse or Withdraw

- The decision to participate in this interview is entirely up to you. You may refuse to take part in the interview *at any time* without affecting your relationship with the investigators of this study or University College of Southeast Norway. You have the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, you have the right to request that the interviewer not use any of your interview material.

Right to Ask Questions and Report Concerns

- You have the right to ask questions about this research study and to have those questions answered by the researcher before, during or after the research. If you have any further questions about the study, at any time feel free to contact *Bruno Madaleno* at *bruno.madaleno@student.hbv.no* or by telephone at +4794295667. If you like, a summary of the results of the study will be sent to you.
- Additionally, you can contact the project supervisor Kjell Ivar Øvergård, Professor of Maritime Human Factors, Department of Maritime Operations at the University College of Southeast Norway (address: Postboks 4, 3199 Borre, Norway) by Mobile Phone: (+47) 98 64 82 33 or by the email koe@usn.no.

Consent to Participate in a Research Study
University College Southeast Norway

Consent

- Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the study investigators.

Title of Study: The Role of Sustainable Development in Maritime Technical Management

Investigators: Bruno Madaleno

I, the undersigned, confirm that (please tick box as appropriate):

1.	I have read and understood the information about the project, as provided in the Information above.	☐
2.	I have been given the opportunity to ask questions about the project and my participation.	☐
3.	I voluntarily agree to participate in the project.	☐
4.	I understand I can withdraw at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.	☐
5.	The procedures regarding confidentiality have been clearly explained (e.g. use of names, pseudonyms, anonymization of data, etc.) to me.	☐
6.	If applicable, separate terms of consent for interviews, audio, video or other forms of data collection have been explained and provided to me.	☐
7.	The use of the data in research, publications, sharing and archiving has been explained to me.	☐
8.	I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	☐
9.	My name will not be used in this project.	☐
10.	I wish to have a copy of the research results by electronic mail: _____	☐
11.	I, along with the Researcher, agree to sign and date this informed consent form.	☐

Participant:

_____	_____	_____
Name of Participant	Signature	Date

Researcher:

_____	_____	_____
Name of Researcher	Signature	Date

APPENDIX C - Email interview with a TS

What conflicting goals do you list as important on the relation TS-Ship?

1. Most superintendents were at sea for many years. There has always been a divide between shore staff and sea staff so suddenly changing from sea to shore is difficult. The Superintendent is in the middle, trying to implement shore rules but also he understands the dislike that the seafarers have with those rules. Therefore, his goal of remaining connected to his ships and the feeling of being part of them is continually reduced.
2. Trying to understand office staff who have never been to sea is hard. Seafarers think fast, they have to think fast daily and become used to it. That is why many seafarers marry nurses, as they understand each other. Both get used to emergencies and changing environments. Working ashore can be difficult as decision making slows down and routine sets in. A superintendent's goal of quickly achieving projects is diminished as pointless discussions and delays continually block output.
3. The loyalty of a seafarer tends to remain with the crew but he has to face reality that he is the face of the company. His goal of always being connected to the crews is often lost or at least diminished.
4. Superintendents want perfect ships and this costs money. The office don't want to spend money and this causes a conflict between the ideal and the reality. Many years ago ships were built with perfection and money was spent on aesthetics and in the best equipment. Today the opposite exists. Ships are built without pride or additional cost and built to serve a single purpose - to make money. A superintendent's goal of having pride in his ship is often lost as he has to realise the importance of minimal expenditure.
5. A Superintendent wants his ships to work perfectly and safely but thus is often hindered by paperwork that he may not see the point of.
6. A Superintendent always wants the best crew on his ship but he is restricted by who is available and the human resources department who perhaps do not share his view on who should be on the ship.

APPENDIX D - Design of the web survey

Nº	Question:	FFSD Stage	Conflicting goal	Implications for TS-Ship relation	Concept-by-postulation	Coding method
1	How old are you?	A: Awareness and success		How age, sea time and experience as TS influence the answers to the questionnaire.	Managerial Wisdom	Attribute coding
2	About how long have you been in your current position and how long have you worked on-board?					
3	The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)	A: Awareness and success		What aspects TS valorizes more on SD.	TS mind-set SD knowledge	Values Coding
4	How much trust do you have in your sea staff ability to make the right decisions?	B: Baseline assessment	Shore demands vs Ship Independence	How is the trust level in the relation?	TS as a middle manager	Evaluation coding Versus coding
5	How strong is the pressure on sea staff coming from your department in times of economic pressure?	B: Baseline assessment	Efficiency vs Safety	Impacts of cost cutting on safety. How much of the economic pressure is transferred to the sea staff? TS view on pressure to sea staff.	Ethics of care Business strategy	Evaluation coding Versus coding
6	Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?	B: Baseline assessment	Very fast pace of change of technology vs Safety	TS role on the communication links with other parts of the chain Sea staff relation with new technology.	Shared knowledge between actors Training of sea staff	Evaluation coding Versus coding
7	To what extent is environmental compliance a source of increased workload to sea staff?	B: Baseline assessment	Environmental compliance vs Work-related stress levels	TS view on effects of increased regulation on sea staff How pressure to comply with regulations from TS side are handled by sea staff. Consequences of increased bureaucracy in the workforce.	Ethical framework Sustainability of the marine transportation system	Evaluation coding Versus coding
8	How do you evaluate your transition from technical/operational to management level?	B: Baseline assessment	Technical Manager vs Engineer	How prepared he was when transited to TS. How this will affect the way he performs as TS. In which stage of transition is he now?	TS management capabilities	Evaluation coding Versus coding
9	What are your thoughts about sea staff contributions when solving challenges concerning	C: Creative solutions	-	Is sea staff part of decision making or brainstorming to identify possible solutions?	TS as a middle manager	Emotion coding

	to both sides (TS and ship crew)?			How ideas from sea staff are handled by TS?	Ethical framework Shared solutions, brainstorming	Evaluation coding
10	How do you evaluate the results coming from your relation with sea staff regarding the objectives of Sustainable Development?	D: Decide on priorities	-	How positive is the relationship outcome for the company objectives? How positive is the relationship outcome for SD.	What the relationship outcomes says about priorities?	Evaluation coding

Source: Author

APPENDIX E- Interview to be performed with sea staff

Nº	Question:	FFSD Stage	Conflicting goal	Implications for TS-Ship relation	Concept-by-postulation	Coding method
1	How old are you?	A: Awareness and success		How age, sea time and experience as manager influence the answers to the questionnaire.	Managerial Wisdom	Attribute coding
2	About how long have you been in management level and how long have you worked on-board?					
3	The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)	A: Awareness and success		What is the awareness of Sea staff regarding the SD principles? What are the principles they value more.	Sea staff mind-set SD knowledge	Values Coding
4	How much trust you have in TS abilities to make the right decisions?	B: Baseline assessment	Shore demands vs Ship Independence	How is the trust level in the relation? How the life onshore is accurately perceived by the sea staff? Conclusions about transparency, communication	TS as a middle manager	Evaluation coding Versus coding
5	How strong is the pressure on sea staff coming from TS in times of economic pressure?	B: Baseline assessment	Efficiency vs Safety	Impacts of cost cutting on safety. How much of the economic pressure is transferred to the sea staff? Sea staff view on how they feel pressure.	Ethics of care Business strategy	Evaluation coding Versus coding
6	Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?	B: Baseline assessment	Very fast pace of change of technology vs Safety	TS role on the communication links with other parts of the chain Sea staff relation with new technology.	Shared knowledge between actors Desire to be trained in new technologies	Evaluation coding Versus coding
7	To what extent is environmental compliance a source of increased workload to sea staff?	B: Baseline assessment	Environmental compliance vs Work-related stress levels	Sea staff view on effects of increased regulation. How pressure to comply with regulations from TS side are handled by sea staff. Consequences of increased bureaucracy in the workforce.	Ethical framework Sustainability of the marine transportation system	Evaluation coding Versus coding
8	How do you evaluate your transition from technical/operational to management level?	B: Baseline assessment	Technical Manager vs Engineer	How difficult it will be for management engineers level to transitioning from Engineer to Technical manager.	Management capabilities	Evaluation coding Versus coding

9	Do you feel your contributions valued when solving challenges concerning to both sides (TS and ship crew)?	C: Creative solutions	-	Is sea staff part of decision making or brainstorming to identify possible solutions? How ideas from sea staff are handled by TS?	TS as a middle manager Ethical framework Shared solutions, brainstorming	Emotion coding Evaluation coding
10	How do you evaluate the results coming from your relation with TS regarding the objectives of Sustainable Development?	D: Decide on priorities	-	How positive is the relationship outcome for the company objectives? How positive is the relationship outcome for SD.	What the relationship outcomes says about priorities?	Evaluation coding

Source: Author

APPENDIX F - Web survey

Informants:

Technical Superintendent 1 (TS1)

Technical Superintendent 2 (TS2)

Questionnaire:

1. How old are you?

   TS1: 50

   TS2: 58

2. About how long have you been in your current position and how long have you worked on-board?

   TS1: current position: 10 years, onboard: 20 years

   TS2: current position: 15 ; onboard: 15

3. The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)

   TS1: Economy: 5, Society: 4, Environment: 3

   TS2: Economy: 3 , Society: 5 , Environment: 4

4. How much trust do you have in your sea staff ability to make the right decisions?

   TS1: Currently, less and less. It is my opinion that standards have dropped over the last ten years and it is harder to find the right staff who can carry responsibility. So the answer is; not much trust nowadays. However, there are some good seafarers out there, but even they complain that they can't trust the seafarers they work with.

   TS2: That depends on staff professional qualification - there is no fixed rule. Some I trust in limited way some I do not trust at all.

5. How strong is the pressure on sea staff coming from your department in times of economic pressure?

   TS 1: Quite allot - most of the pressure tends to be from the engineering department or in regard to the purchase of spares. They always want more but the money is not there. It is such a waste of money to have spares sitting around on shelves when they are never used.

   TS2: Safety first is main principle Vessel should be run safely staying within approved Budget.

6. Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?

TS1: Advancement in technology has been rapid: and it is notable that machines and equipment tend to perform better and fail less than before. However, when equipment does fail it tends to be a large failure that the crews struggle to fix. The issue is that the sea staff are not trained well enough in electrical / electronic problems. The design of equipment is complex and made more difficult by the amount of electronics that control them. What manufacturers should attempt is to make things simpler not more complex - electronics is great but when people don't know how to fix them then the failures can be costly.
TS2: Very difficult since manufactures are protecting their business in the way which restricts important information needed for proper Operation or maintenance

7. To what extent environmental compliance is a source of increased workload to sea staff?
   TS1: It encroaches more and more into daily life and work; but on an over-all scale I would say the workload due to compliance is not more than ten percent. The largest volume of the work is in the paperwork and survey side - ensuring that the authorities are satisfied that compliance has been met.
   TS2: Substantial since technical solution are still not reliable and requires a lot of maintenance.
8. How do you evaluate your transition from technical/operational to management level?
   TS1: It was quite difficult. I find that there is a misunderstanding of what seafarers do all day. Many management think that the seafarers just sit there with nothing to do - they don't appreciate that it is a full time job. When I moved ashore and into management I had to change the way people think and view seafarers, to tell them that it is not always easy and that they have to consider that they are trying their best. Their best may not always be right, but as long as they try. I feel that I have done well, that I managed to keep the understanding of the sea and to move into management positively. I feel that I have helped many people ashore to learn more about the sea.
   TS2: I have not met any problems. Good technical Background allows to make right decisions quicker.
9. What are your thoughts about sea staff contributions when solving challenges concerning to both sides (TS and ship crew)?
   TS1: Not much. Sea staff do not tend to contribute much at all.
   TS2: Cooperation is limited.
10. How do you evaluate the results coming from your relation with sea staff regarding the objectives of Sustainable Development?

TS1: Unfortunately, I don't feel that ship's staff have much to contribute towards sustainable development. Most seafarers feel that they are being asked too much and that all procedures and systems are simply designed to make office life better - not ship life.
TS2: Sea staff I focused mainly on keeping Equipment running and operating vessel within mandatory rules.

APPENDIX G - Structured interviews

Chief Engineer (C/E)

How old are you?

C/E: 64

About how long have you been in management level and how long have you worked on-board?

C/E: management level 20 years and on board: 40 years

The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)

C/E: 4-4-4

How much trust you have in TS abilities to make the right decisions?

C/E: Good, 4 (in a scale 1 to 5)

How strong is the pressure on sea staff coming from TS in times of economic pressure?

C/E: Strong pressure, but is not coming from the TS but from the owner. TS is only a man in the middle.

Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?

C/E: Is ok is good, in case I have any problems I ask TS, he asks the owner and is giving feedback, communication is good otherwise the ship will be drifting.

To what extent is environmental compliance a source of increased workload to sea staff?

C/E: too much, this ... your brain. Most important is not car about it too much. Read all these papers. We are only human beings here; we have to run this ship.

Interviewer: for example, US environmental laws?

C/E: No, US is ok now, China is getting worst

How do you evaluate your transition from technical/operational to management level?

C/E: 50/50, I cannot explain all… in case you have problems or questions everybody will help you.

Do you feel your contributions valued when solving challenges concerning to both sides (TS and ship crew)?

C/E: It's a good cooperation if not he will be removed by the owner.

How do you evaluate the results coming from your relation with TS regarding the objectives of Sustainable Development?

C/E: All sides its ok yes.

Interviewer: don't you think is more on the economy side?

C/E: No, no, all sides.

Captain

How old are you?

Captain: 59

About how long have you been in management level and how long have you worked on-board?

Captain: 27 years on management and 35 years onboard

The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers

Captain: economy – 5, society – 4, environmental – 3

How much trust you have in TS abilities to make the right decisions?

Captain: It depends on the superintendents, in this company I have no problem, but in other company as C/M I have no relation I cannot say… In this company I met many TS and relation is very good. Because at the beginning in the school I had very good relationships with engineers, I had a lot of friends from the engineer departments that's why maybe I understand their problems. As I hear from others guys who are coming to this company from other companies they have problems. But in this company I feel free to ask questions. Some days ago I had a discussion and he agreed with my point of view.

Interviewer: don't you think it depends on the level of the company?

Captain: I joined in 1998, I have no idea how it was in other companies.

How strong is the pressure on sea staff coming from TS in times of economic pressure?

Captain: I want you to understand one thing, there is not such a pressure now. There is proposal and advices, this is not a kind of pressure. He explains his point of view, he is right, his budget for this year is this and this, so please keep in the range. If you are not able to order for this year something, he advices us: "gentleman its almost final of the year we have not budget, this is not priority…" I'm not talking about urgent spare parts, I'm talking about normal order procedures, I cannot say this is a pressure. This is a very deep explanation about their position and their budget, how much pressure? I cannot say this is a pressure, from one to five it is one or two. The pressure is from the management, from the company, TS are not talking with us like slaves.

Interviewer: Is the pressure coming from the owner?

Captain: Ok maybe… I don't know, maybe the new guys need some pressure from TS but for me I don't feel that pressure.

Interviewer: By pressure we mean for example, budget cuts that reflects on quality of life of seafarers.

Captain: I can give an explanation from a vessel ago. I've got an info from TS and sent my ships order regarding the stationary, regarding Overalls, shoes and he asked me if I really need so much. It was second half of the year: "if you can please reduce", if you can. So I reduced, I discussed with CM, it was maybe too much then I reduced. I send reply: "this is my proposal this is what we really need". Fixed, no more question. It was a question; "do you really need this?" Because people can order without imagination.

Interviewer: It's to avoid waste, right?

Captain: Exactly.

Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?

Captain: I think it works quite well, last time we change the monitors, the email system, also viasat install… I cannot really answer and evaluate, if I have some questions I send to IT department with a copy to superintendent because he must be informed if something is wrong. There's a lot of new programs last year… difficult to say there was no problem, in the beginning we have a problem with accounting system, but the company employed a person only to QM department to ask a question, all question should send to her. She was in touch and the link between us and shore.

To what extent is environmental compliance a source of increased workload to sea staff?

Captain: Yes, it is. Answer is very clear. Yes, it is.

How do you evaluate your transition from technical/operational to management level?

Captain: Since 1998 I was a captain I don't remind. There was a different time. They provided at the time a mobile phone in case we need to ask TS.

Do you feel your contributions valued when solving challenges concerning to both sides (TS and ship crew)?

Captain: I already answered, I didn't have a problem it was always gentle discuss, never shouting never crying, just gentle discussion. It can take few days but finally we have an agreement. Sometimes there are very strong problems, from a friend he had a serious problem but he followed the company rules. Involved QM (Quality Management) and superintendent, finally they solved this. But as I know happened in the ground of discussing, everybody was involved and informed and they got a final agreement.

How do you evaluate the results coming from your relation with TS regarding the objectives of Sustainable Development?

Captain: Definitely number one is economy, next is society and environmental it is because it must be, but I feel also in my private opinion environment is the last one. We tried to combine

all of them but starting from economy. I feel by the relation from office and me that they have the same priorities (as pointed in question 1). Maybe sometimes they are talking environment is the first, this is some show and good looking in internet, newspaper, TV, port authorities, but it's a kind of show. They make a lot of noise, if they start dividing the money: first for economy, second safety (society) and remaining to environment.

Chief Mate (C/M)

How old are you?

C/M: 39

About how long have you been in management level and how long have you worked on-board?

C/M: 7 on management and 14 onboard

The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)

C/M: Environment – 5; society – 5; economy – 5; but what I feel the company believes is Environment – 4; society – 3; economy – 5.

How much trust you have in TS abilities to make the right decisions?

C/M: I don't know this TS who's coming now in (name of the port), I don't know exactly what he wants from us, what is expected. It depends from their skills. I found some TSs not so good on their job. Maybe they have theory, but no idea about practical. I found this situation on few vessels, but on this company on previous vessels he was quite good, if you ask something he starts telling by his own experience, he has knowledge not only from the book. You know, Superintendents today rarely have experience at sea. Most of them are hired from shore.

How strong is the pressure on sea staff coming from TS in times of economic pressure?

C/M: The first example is regarding requisition, is common to every company this issue. You order some spare parts in your opinion needed onboard to safe sailing and proper working of equipment and somehow your request is deleted. Now, we are having a problem with heeling system, it's getting worse and now is off completely. I ask before to run some service and because of the cost or I don't know what, first of all they send message to the maker of this equipment they send some ideas how to solve the problem which didn't work, we order some spare parts but now the problem is when and where to send due to the high cost of freight. Now, the final decision is that TS is coming onboard and brings the spare parts himself. This very often piss me off because you have to deal. If you have the spare parts all supposed to be fine. You cannot rely on the office because they decide you don't need the spare parts; you have to repair you have to do something else. For me, this is ignorance of this guys in the office. They

have no idea how the life can be on the vessel, they just think: "ok please do something better, faster, cheaper because we have now economic crisis you have to understand is very expensive to send to …. the spare parts." Finally, when the system like now is completely off: "ok we send you the spare parts", because there is no other choice. I believe this is general, because economic crisis is the answer for everything: "if you want to order ok. But be aware we have the economic crisis."

Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?

C/M: Normally I don't care, until the equipment is in good condition it's fine. But now how it's happening to me the heeling system is collapsed, the TS send messages to the maker, they send some solution which didn't work. Ok, there is communication between designer and TS but (communication between) the TS and us in this particular manner is not great. I mean, I advise to call the service or spare parts to come earlier so it depends on the problems. Sometimes when the company decides it's a big problem …in my opinion they think Heeling system is not a big problem… if something happen in engine room for example with the purifiers, immediately you got some service, plenty questions, assistance. In this case (heeling system) TS have to decide this is important, and with heeling system not so much (was done) the answer is "we can postpone to convenient port" - and this means the money.

To what extent is environmental compliance a source of increased workload to sea staff?

C/M: Years ago it was allowed to throw all kind of garbage except plastics and now because of environmental we have to segregate the garbage. Before, was not obligatory and everything was thrown overboard. Now, I have to do something more, I have to do additional trainings because the crew very often don't know the regulations. I have to increase my awareness to check the trash bins, the garbage room, my attention has to be increased.

Interviewer - Because it can result in some penalties?

C/M: Yes, exactly huge penalties. That why in Brazil or US we have to take some precautions like clean up the vessel, check if there is bugs in the cooling chambers, expiring date regulations. The problem is event though you have international regulations, each country has own stricter regulations, especially in Brazil, to keep fruits and vegetable in plastics not in wooden. In US there are special type of bins marked by colours. These are easy examples that compliance with environment is ok but sometimes I have the impression that some countries make the regulations just to catch you and take from you some penalty. This is nice when they care about garbage and but also from their side. For example, when you enter Rio de Janeiro and go ashore for a short time you'll see a lot of garbage outside and the they ask

from you to be so perfect regarding environment but they don't have to be. They push the foreign country with regulations you have to follow if not, you pay penalty. Sanitary inspection also in Brazil, in our hospital area there is a garbage bin, you have to have a yellow plastic bag. This is what drive me crazy, I think this is so stupid and unnecessary… just need to be written "medical waste" and nothing more. It looks like there is someone guy sitting in the office in front of computer thinking in what to do to make our life worst. Ok they give us that and this…. and if there is no argument from our side?... ok, you accepted so we make it force. Unfortunately, the companies do not protest, do not argue, they just get the regulation and they have to follow. They don't ask us what we think about this regulation, they just send information from IMO or Brazilian authorities we have to follow these rules. They don't listen to us, our opinion. Officially they do, but is just on the paper, in reality no. They just want to have quiet day in the office, they just receive regulation and then please send to the vessel.

So, it increases the workload very much, specially C/M and C/E.

How do you evaluate your transition from technical/operational to management level?

C/M: No nothing, I got the promotion 7 years ago I can describe my situation. I joined the vessel as a second mate, after two months they send message: "if the captain agree we can promote you as a C/M". The captain agreed. They send me home form one month vacation and then I came back as a C/M and unfortunately they gave me the worst vessel where nothing was working. It was bulk carrier and I was responsible for loading the cargo and when we load cargo we have to deballast but what can I do if I have the system is collapsed. I believe the company was aware of that, but they just say: "you have to deal with that." They didn't care. They start caring if there is some complain of loader or receiver of the cargo, then they have to react. In this case there was no assistance and I think this is the standard. In engine department I think is better. From my point of view, I think they care more with Engine department. Maybe because they are not familiar with deck procedures or operation because before they were C/E. None of this guys were C/M or captain. I had to solve the problems by myself. If nothing, I can do, I ask others and if no chance I ask the TS.

Can also be my fault because you try to solve a problem and you don't want to inform the company because you think they will say you're a not a good C/M because you cannot solve the problem which supposed to be so easy. Than you are afraid, especially when you are a new C/M. Then you have some doubt to inform the office or not, so you try not to. So that's the problem - you are afraid they complain you're not so good and next time they hire another guy.

Interviewer - Do you think there is a trust relation, transparency or honesty?

C/M: During management level I was working with many TS. From my experience you try to solve the problem by yourself because you don't know the reaction of this guys. They are there to help you and assist you but when you ask, they can tell you: "try this, try that". Officially they advise, but normally its stupid advice that is not working. Because of this heeling problem captain send the message two weeks ago and TS wrote back: "we send spare parts in the first convenient port." Day after day nothing happened, first I asked C/E to ask TS when we can expect this spare parts and C/E, which is not right, said "there is nothing we can do we have to wait for the message". I replied: "Chief and that means what?" Then he said: "... ahh you ask the captain…" I went to the captain, he was quite mad about that and wrote a message. After repeating the question we've got message: "ok, I have the spare parts with me and in joining the vessel in (name of the port)". There is no reaction and they knew you are waiting for this because nothing is working. Then after such a problem you try to contact the TS as less a possible, you don't even want to meet the guy, if you have such approach you want to avoid. Because of this, I had to stay in the office 12 h to manually adjust the list of the vessel. The problem is that he thought is not so important for the vessel which is not true. The main sentence of this topic is: we cannot trust completely this guys. If you can see this situation you start thinking what for TS if you cannot rely on him, if they just send some stupid messages (ideas) that I knew were not working. Because my approach is not to trust them completely, solve the problem by my own and then after that you count on yourself and try to fix. I think all C/M has limited trust to technical department. You try to make some requisition and you don't know if they cancel or no. You put the port and they say: "in this port we not deliver the parts" and then you start getting angry.

Do you feel your contributions valued when solving challenges concerning to both sides (TS and ship crew)?

C/M: In this company we have clearly written who is responsible for what. In the heeling problem is a technical problem, I have not much to do and to say because also engineers don't care about my problem. If doesn't relate to them they don't care. In this case my contribution is not rated. I just have to inform the technical department and then I can only wait.

My responsibilities are not so related to technical department mine is more cargo.

They are happy to hear your ideas for saving money. If you solve the problem by your hand (instead calling service) they can be grateful for that.

How do you evaluate the results coming from your relation with TS regarding the objectives of Sustainable Development?

C/M: In the economy part they are following close the objective, environment I think too. This is what I like in this company, in others companies environmental situation officially in the paper yes, but off the record no. In this company no, you follow strictly the regulation, not only IMO but Brazilian and US regulations. In this matter you can expect some assistance. If you ask for garbage bins by colours they agree.

Society, in this company compared to the other companies I would say they are following the objective, you enter the recreation room you see a lot of movies, the gym, the captain in the meeting asked "we have this amount of money to the crew what can we buy?" I cannot complain, you have internet, email system, recreating room in good condition, tv, dvd players. So they care about the society onboard. In the contract you have in last page the date of sign off, this is not common in other companies. You don't know what to expect, companies can find some trick to keep you longer or shorter. Than at home I can make some plans.

The resume is if you have to count on somebody count on you, this is because I'm so anxious about this heeling problem. It will not change; every time you are expecting something you hear the message: "economic crisis". I ordered paints, 500 litters of paint and they said: "it's too much". I think: "ok, this is not for me. I order this because in my opinion I see the rust, I see the situation, I know how many paint I need". And the very funny statement from them is: "we know you're good in economical area but please do much harder, you know what else to do?" The problem with requisitions is you don't know when you receive. They often cut our orders because they think is too much. This has also pluses, because I know some C/Ms order a lot of cartages for printers and then they are not in use anymore because they dry. They try to reach the balance. I think I'm quite good and I know what I need, if they decide to cut, ok what can I do. Some years ago I was angry now I don't worry anymore.

Interviewer: do you think these problems creates more distance between the worker and the company?

C/M: Each problem that make me angry and I cannot understand the decisions from the office I lose my trust and confidence in the company. Because they don't trust I make the proper requisition and proper volume and amount. Than we fall apart. When I join next vessel I just do my job and nothing more. You don't want to give something more because you are not appreciated for your job. of If order something and they don't care or they cut, for sure this cause the separation to become bigger. They don't care I don't care neither. Always the big issue is the money. Ok, the vessels are sailing for the money so it means we are separated. They try to save money and you need something more. You need two paint brush not only one, because you need to do this job again latter. I think it will never be an understanding because

they are not here and they don't see what is going on exactly. They just sit and see the excel the final amount and start cutting. We care about the prices but what can you do if you need something.

If you want the vessel to run smooth and safe you have to order parts. Now, because of heeling problem I sent message to planner to advice terminal to prepare the plan to extend period in the port because the vessel is to slow to change his list which can costs expenses. The company supposed to know what happen with the vessel like this. I believe I did everything what I could do, the engine department not so much. Because I believe we are one team and we have to cooperate. But when you see you ask for something and from the other side nothing I get nervous because you try to be ok and right and they not so much and this is similar to the office. If you try hard to do something and you don't have nothing back, you can ask yourself how do you feel.

2nd Engineer

How old are you?

2nd Eng: 28

About how long have you been in management level and how long have you worked on-board?

2nd Eng: 3 months on the management level, onboard 9 years.

The sustainable development is based in three pillars: Environment, Society and Economy. On a scale from 0-5 rate each one of the pillars. (you can repeat numbers)

2nd Eng: 5, 5, 5

How much trust you have in TS abilities to make the right decisions?

2nd Eng: it depends in which matter, cause every time they have a problem they actually ask the supplier and they have a professional answer. Most of the times is not the answer of the superintendent but of the supplier.

How strong is the pressure on sea staff coming from TS in times of economic pressure?

2nd Eng: the same.

Interviewer: because they are trying to save all the time?

2nd Eng: A good technical department is not necessary evil, when they start cutting the money on the engine department, something is wrong. Sometimes you just wait more for the spare parts.

Regarding new technology on board, how do you evaluate the communication between the design and manufacturing communities, the Technical Superintendent and the staff onboard?

2nd Eng: I have no experience with this.

Interviewer: The objective of the question is to know if the sea staff is left alone when is coming new technology and find by themselves.

2nd Eng: Usually the normal stuff, when you are new on the ship this is also new electronics for you, you go by the manuals and yourself, when you reach the point you don't know you ask the TS. TS is just the guy who's redirecting the answers, he knows the same like the ship staff.

To what extent is environmental compliance a source of increased workload to sea staff?

2nd Eng: for me its normal to take all these precautions.

Interviewer: because you were educated on this mentality?

2nd Eng: Yes, to maintain safety

How do you evaluate your transition from technical/operational to management level?

2nd Eng: 2nd engineer is never asking the TS, only to the chief. Regarding the questions of TS I cannot say nothing.

Interviewer: and regarding to the C/E?

2nd Eng: Yes.

Do you feel your contributions valued when solving challenges concerning to both sides (TS and ship crew)?

2nd Eng: Normally the thing is, the proper way to ask a TS is to say what is the problem and also to put a solution inside and how you plan to handle this problem, and the TS always say or write just go ahead like you think or I will ask supplier and figure out another option.

Interviewer: is this the standard?

2nd Eng: Yes

How do you evaluate the results coming from your relation with TS regarding the objectives of Sustainable Development?

2nd Eng: they just check how much money they can save on the different pillars, they only do what is necessary to achieve limitations specially for the environment, everything could be cleaner. But Why? Because much more money and more work.

APPENDIX H – Ship level observations

During the observation period it was possible to experience three classification society surveys. Weeks before the survey, crew is noticed by the management level officers. In engine room each officer looks to keep his machinery in good condition, when is not possible to fix oil leakages due to lack of spare parts crew should be on standby to remove rags or leaking boxes just before surveyor is passing by. The days before crew is engaged on intensive cleaning which can take severe intensity depending on management officers. In one of the surveys, surveyor requested to change all oils stored in steering gear room. When asked where to put them, he refused to give advice and reported to regulations. The officers felt confused since no location is written on regulations. The TS was informed and start a complaint against the surveyor. During the process four crew members were engaged moving ten 200L barrels from steering gear room and hundreds of 20L buckets. According to officers, actual classification society is worse than previous one since they are not giving any explanation or advice and surveyors are eager to find minor malfunctions that later require extra job from crew. When asked about why company changed classification society, all officers responded that actual offered a big discount.

It was possible to observe spare parts were delayed as much as possible every time a moderated risk was associated. Engineers showed stress and anxiety every time email from TS reported they are going to delay. When three generators are running and one is out of order waiting for turbocharger, the engineer is faced with additional stress when some unexpected even occur in one of the three generators. This situation is evaluated as moderated risk, but if a serious malfunction occurs, extra stress and workload is on the crew side since the ship cannot manoeuvre safely at port with only two generators available. This case was observed and extra hours were needed, additionally the temperature conditions inside engine room increased fatigue levels. Some fresh engineers during informal conversations shared they wanted to leave industry due to management concern about the money neglecting social and human side.

Observations onboard one vessel having a dry dock period, showed TS is perceived by officers as a seafarer in the top of career. In casual conversations, some officers showed lack of trust in their TS because was hired after some contracts as 3rd Engineer. As a manager, management skills should supersede technical, but engineer officers showed no agreement with this perspective.

About half of the engineers on management level observed in two vessels showed a lack of basic emotional skills to work on such position. They showed the use of prejudices, lack of awareness regarding behaviour in multicultural organizations, rude communication and poor self-control. During conversation with ratings, it was observed a tendency to hide/cheat results in order

to avoid questions. Authority in this group was only formal. During conversations performed with ratings they showed no endorsement of management style. On the other side, engineers on management level who gave enough degree of independence for ratings to organize their work and showed care for their staff easily got endorsement from lower levels. It was observed the change for a positive atmosphere everytime a new manager is coming onboard with this approach. We could observe the work was efficient, more productive and motivation levels higher. Authority on this group of engineers was formal and informal.

Regarding environmental awareness one 2nd engineer showed no enthusiasm every time environmental aspects were raised in weekly drills. Additionally, we observed the same subject trying to send a plastic bag overboard which fortunately didn't happen due to the wind. The same individual during barbecues, together with management level officers threw glass bottles overboard. It was rarely observed ratings or officers of younger generations having the same attitude. Additionally, a third deck officer from a western country and known for being conscious about environmental policies, showed by his face expression disapproval. The legal discharge (far from coastline) of sewage overboard without proper treatment (i.e., without going through sewage treatment plant) is common practice.

On the social side, it was observed racism from European officers towards ratings from Asiatic culture. The atmosphere inside the ship clearly fluctuates depending on the ability of management level to influence it. Some officers clearly showed signs of psychological stress regarding the distance from the loved ones caused by longer contracts. This is worsened by the short time used on ports and impossibility to go ashore. In several situations was possible to observe a separation between deck and engine departments fuelled by prejudices from each side.

APPENDIX I – NVIVO word frequency query to primary data

Word	Length	Count	Weighted Percentage
ts	2	30	1.16%
Problem	7	30	1.16%
think	5	24	0.93%
company	7	24	0.93%
much	4	21	0.81%
ask	3	20	0.78%
just	4	20	0.78%
know	4	20	0.78%
good	4	19	0.74%
send	4	18	0.70%
money	5	17	0.66%
parts	5	17	0.66%
vessel	6	16	0.62%
spare	5	15	0.58%
something	9	15	0.58%
management	10	15	0.58%
now	3	14	0.54%
one	3	14	0.54%
try	3	13	0.50%
care	4	13	0.50%
need	4	13	0.50%
time	4	13	0.50%
order	5	13	0.50%
make	4	12	0.47%
want	4	12	0.47%
staff	5	12	0.47%
office	6	12	0.47%
captain	7	12	0.47%
nothing	7	12	0.47%
society	7	12	0.47%
officers	8	12	0.47%
pressure	8	12	0.47%
department	10	12	0.47%
interviewer	11	12	0.47%

sea	3	11	0.43%
trust	5	11	0.43%
showed	6	11	0.43%
environment	11	11	0.43%
also	4	10	0.39%
crew	4	10	0.39%
feel	4	10	0.39%
ship	4	10	0.39%
side	4	10	0.39%
work	4	10	0.39%
system	6	10	0.39%
economy	7	10	0.39%
problems	8	10	0.39%
seafarers	9	10	0.39%
new	3	9	0.35%
port	4	9	0.35%
years	5	9	0.35%
always	6	9	0.35%
heeling	7	9	0.35%
regarding	9	9	0.35%
regulations	11	9	0.35%
yes	3	8	0.31%
like	4	8	0.31%
many	4	8	0.31%
room	4	8	0.31%
level	5	8	0.31%
engine	6	8	0.31%
message	7	8	0.31%
onboard	7	8	0.31%
equipment	9	8	0.31%
technical	9	8	0.31%
case	4	7	0.27%
maybe	5	7	0.27%
ships	5	7	0.27%
solve	5	7	0.27%
start	5	7	0.27%
answer	6	7	0.27%
garbage	7	7	0.27%
working	7	7	0.27%

observed	8	7	0.27%
question	8	7	0.27%
companies	9	7	0.27%
engineers	9	7	0.27%
environmental	13	7	0.27%
job	3	6	0.23%
two	3	6	0.23%
guys	4	6	0.23%
life	4	6	0.23%
asked	5	6	0.23%
first	5	6	0.23%
never	5	6	0.23%
often	5	6	0.23%
quite	5	6	0.23%
right	5	6	0.23%
since	5	6	0.23%
change	6	6	0.23%
coming	6	6	0.23%
proper	6	6	0.23%
depends	7	6	0.23%
opinion	7	6	0.23%
engineer	8	6	0.23%
possible	8	6	0.23%
difficult	9	6	0.23%
questions	9	6	0.23%
situation	9	6	0.23%
understand	10	6	0.23%
superintendent	14	6	0.23%
superintendents	15	6	0.23%

APPENDIX J – NVIVO word frequency query of basic principles

Word	Length	Count	Weighted Percentage
safety	6	6	1.73%
management	10	5	1.45%
change	6	4	1.16%
cost	4	4	1.16%
demands	7	4	1.16%
onboard	7	4	1.16%
ships	5	4	1.16%
shore	5	4	1.16%
staff	5	4	1.16%
system	6	4	1.16%
balance	7	3	0.87%
compliance	10	3	0.87%
efficiency	10	3	0.87%
environmental	13	3	0.87%
innovation	10	3	0.87%
level	5	3	0.87%
officers	8	3	0.87%
performance	11	3	0.87%
ship	4	3	0.87%
sustainability	14	3	0.87%
water	5	3	0.87%
air	3	2	0.58%
basic	5	2	0.58%
better	6	2	0.58%
capacity	8	2	0.58%
causes	6	2	0.58%
communication	13	2	0.58%
community	9	2	0.58%
culture	7	2	0.58%
cutting	7	2	0.58%
decision	8	2	0.58%
develop	7	2	0.58%
dialogue	8	2	0.58%
effectively	11	2	0.58%

employment	10	2	0.58%
encourage	9	2	0.58%
ensure	6	2	0.58%
find	4	2	0.58%
functions	9	2	0.58%
good	4	2	0.58%
greater	7	2	0.58%
improve	7	2	0.58%
increase	8	2	0.58%
industry	8	2	0.58%
machinery	9	2	0.58%
maintenance	11	2	0.58%
making	6	2	0.58%
manager	7	2	0.58%
people	6	2	0.58%
reduce	6	2	0.58%
regulators	10	2	0.58%
root	4	2	0.58%
sms	3	2	0.58%
using	5	2	0.58%
values	6	2	0.58%
working	7	2	0.58%
workload	8	2	0.58%