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# **Sustainability transitions in the shipping industry**

Analyzing organizational preferences for meeting contextual challenges

Master's thesis in the International Master's Programme Maritime Management

HENRIK VÅGFELT

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Department of Shipping and Marine Technology  
CHALMERS UNIVERSITY OF TECHNOLOGY  
Gothenburg, Sweden 2016



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## **Abstract**

The shipping industry contributes to several environmental problems, e.g. climate change. As any other industry, it is subjected to future restrictions for sustainable development and sustainability. Research on how work on sustainability is effectively integrated into organizations is lacking. Thus, to study the internal preferences of, in this case shipping organizations, concerning sustainability efforts and adoption is vital. The focus of this study is to explore barriers that mitigate shipping organizations to link up with technological advances in logical full-scale sustainability transitions. Semi-structured interviews were used as a qualitative research method for this thesis. Six individual representatives of the shipping industry who held corporate positions within the areas of environmental, technical, CSR and sustainability management were interviewed. Analysis of empirical data yielded four areas of interest asserted as internal organizational barriers towards full-scale engagement in sustainability transitions: tangible metrics versus intangible value adding factors, institutional boundaries and forces, cognitive lock-ins and norming versus conforming towards sustainability. Conclusions comprise tendencies that certain organizational trajectories seem to be present in current operational context, trajectories on which tangible metrics versus value adding factors create differences in conceptualization and issues on how to value work on sustainability. Institutional legitimization towards sustainability tend to shift focus away from solutions, cognitive lock-ins underpin mental models that contradict logical sustainability transitions and norming towards sustainability efforts sacrifices real sustainability adoption. Implications of conclusions suggest that stated barriers might be bridged with a backcasting methodology through collaboration over institutional boundaries with collective learning in a shared systems perspective.

**Keywords:** Change, Backcasting, Behavior, Organization, Sustainable development, Sustainability, Sustainability transitions, System, Transition

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## Preface

This thesis is a part of the requirements for the master's degree in Maritime Management at Chalmers University of Technology, Göteborg, and has been carried out at the Maritime Human Factors division, Department of Shipping and Marine Technology, Chalmers University of Technology between January and June of 2016.

I would take the opportunity to thank my supervisor, Martin Viktorelius, for his continuous input and support during the project. Martin provided me with many interesting perspectives and suggestions on how to take on the subject of study in the best possible manner. Furthermore, Martin provided me with valuable literature suggestions that have helped form the thesis.

I would like to thank the interviewees at the organizations where I conducted my qualitative interviews. With your valuable input, theory has effectively been coupled to reality in fruitful discussions in order to elicit understanding of the subject of study.

I would further like to thank Johan Larsson and David Andersson for their input concerning the backcasting methodology used as theoretical background for the thesis.

Finally, I would also like to thank my fellow study colleagues for their input through discussions in cooperative study sessions and suggestions on applicable literature for this thesis.

I hope that this thesis can help deepen the understanding of how organizations and sustainability interconnects. Further, I hope that the thesis can help pave the way forward for a more sustainable world.

Göteborg, May 2016

Henrik Vågfelt

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*Figure 1: Multi-level perspective on system innovations.*

*Figure 2: The rational of the backcasting methodology.*



# 1 Introduction

As a commercial agent active in a globalized market economy, shipping companies contribute to a certain share of emissions and destruction to the earth by the use of energy and resources, e.g. fossil fuels for propulsion (Holmberg & Robért, 2000; Gilbert & Bowes, 2012). Shipping is considered being a relative environmentally friendly and energy efficient form of transport (Chapman, 2007). However, the amount of emissions from the sector is growing (Gilbert & Bowes, 2012). The industry accounts for a severe amount of environmental problems, among many, e.g. climate change from emissions of greenhouse gases (Chapman, 2007). The shipping industry, as an energy and resource utilizer, is subjected to increasing holistic constraints of reaching sustainability through transitions aligned with sustainable development, i.e. pressure to reduce emissions (Holmberg & Robért, 2000; Eide et al., 2009). It has been established that every sector and industry, and thus shipping, has to decarbonize in order not to impose danger to the earth's climate (Gilbert & Bows, 2012). The transport sector, of which the shipping industry is an inherent component of, is highly dependent on natural ecosystems that can provide energy and resources. Nevertheless, natural ecosystems have inherent thresholds, which Rockström (2009) define in his article as planetary boundaries. These are not to be transgressed if humanity still wants to pursue social and economic development without suffering from disastrous consequences from, e.g. climate change (Rockström, 2009). Furthermore, past scarce proactivity in businesses have contributed to environmental degradation (Holmberg & Robért, 2000). Currently, research indicates that some planetary boundaries are transgressed (e.g. climate change) and a manipulation of industrial activities on natural ecosystems is identified (Holmberg & Robért, 2000; Rockström, 2009). Upon till this day, increased economic development has implied increased use in natural resources and energy (UNEP, 2011). Many inherent "business-as-usual" –processes in organizations (abbreviated 'BAU'), which could be seen as trends, implies an increase in fossil fuel consumption and greenhouse gas emissions from transports (Mattila & Antikainen, 2010). Furthermore, surrounding infrastructural systems contribute to stability due to lock-in effects at various levels in societal systems (Geels, 2005). Companies in the shipping industry conduct most of future operative planning under BAU-processes, processes that are embedded in patterns containing assumptions that the economy is under continued growth in the future (Forum for the future, 2011). A projected global increase in freight transports is supposed to be propelled by traditional economic growth patterns (Mattila & Antikainen, 2010) and relatively high growth is estimated within shipping (Gilbert & Bows, 2012). Hence, if one assumes that the economy develops in a linear or exponential growth pattern through a BAU manner, this will imply an increase in the use of natural resources (UNEP, 2011). Radical changes are needed if the total amount of emissions is to be cut from the shipping industry, one of which is an abrupt decoupling between economic growth and the cargo volume of shipped commodities (Johnsson, 2013). The system conditions for sustainability, defined by Holmberg & Robért (2000), implies what societies must *not do* for reaching and existing in a sustainable society; plan and work with the assumption that there is an increasing rate of physical resources to be used for growth (Holmberg & Robért, 2000). Actors present in an economy that grows under increased resource use mainly through BAU-

processes, without incorporating creative solutions and methods to control the use of the earth's resources that goes in line with sustainable development and inside planetary boundaries, will not be sustainable (Rockström, 2009).

Emissions and environmental impact from shipping can extensively be cut through technological advances and introduction of cleaner fuels (Chapman, 2007). There exist technology for transport systems that can deliver higher performance than that of in present systems. However, actors do not incept these technologies due to, among many, social and cultural reasons (Geels, 2005). One methodology to attain sustainable development and ultimately reach sustainability is through a so-called backcasting methodology. In this methodology, one starts by defining criteria's for a sustainable future, comparing them against present situation for issued problem in order to identify a gap that further is to be bridged with open and creative strategies and solutions (Holmberg & Robèrt, 2000). Previous research illustrates that sustainable futures can be attained in freight transport systems by introduction of new energy mixes and energy efficiency measures by using the rationale of a backcasting methodology (Mattila & Antikainen, 2010). Hickman & Banister (2007) stressed the fact that not only technical measures is needed to mitigate emissions from transport, equally important are behavioral changes (Hickman & Banister 2007). Wangel (2011) outlined two approaches in her study on how to include actors in a backcasting methodology for the development of a sustainable transport structure in a local community in Stockholm. Here, results emphasized that certain sustainability targets could more effectively be attained with social innovation, than by solely technical solutions. For achieving the most optimal solution, both approaches were supposedly needed to obtain maximum leverage (Wangel, 2011).

The International Maritime Organization (IMO) highlights several major areas that need collaborative work and coordination at national and international level for development in order to reach the vision of a sustainable maritime transportation system. Among these are logistics systems, global standards of security and support of sound financial systems. As stressed by Chapman (2007) earlier, so does the IMO emphasize the fact that shipping, as transportation mode, is relatively efficient with ability to deliver high value at a relative minimal cost (International Maritime Organization, 2013). However, according to McGuire & Perivier (2011), the low price of transporting goods at sea is obtained at the expense of environmental values mainly due to lack of internalization of environmental costs and willingness to deal with greater shipping costs. Thus, this allows for cost cutting at the expense of environmental problems, e.g. through flagging out assets, mitigating actors from engaging in measures towards sustainability (McGuire & Perivier, 2011). A fundamental basis in order to set of on a trajectory towards sustainable transitions in shipping, McGuire & Perivier argues, are mainly that shipping actors need to internalize environmental costs, meaning that the external effects is transformed to internal costs for the actor causing e.g. pollution problem. Thus, this will result in greater shipping costs in total. Lastly, it is emphasized that low costs of sea transportation today are offset by future costs coupled to climate change and emissions. According to the authors, this is based largely on behavior of individuals in social groups when making rational choices of what costs to pay in a current cost trade-off of this kind (McGuire & Perivier, 2011). The Swedish Ship-owners



Organization stress in their environmental plan of 2050 (Klimatfärdplan, 2050), as well as IMO does, that a combination of measures will result in sustainability for the shipping industry (Svensk sjöfart, 2015). Yet, the Swedish Ship-owners Organization stresses the institutional factor and its importance both within organization, market and political structures. There are gaps concerning the internal organizational preferences towards sustainability transitions, between how actors actually behave in an organizational environment in relation to what might be the logical and rational manner of handling sustainability issues in shipping (Johnson, 2013). Further, Hind et al. (2013) points out that extensive literature is available on technical measures for sustainability but significantly less research into how one integrates sustainable thinking in organizations exist. Additionally, the authors point out the need for more research on how organizations must change to meet sustainability challenges (Hind et al. 2013). In order to effectively use the resources of an organization, it is vital to know the specific logic of organizational behavior. For organizations in shipping, it has been concluded that barriers that inhibit e.g. energy efficiency is due organizational structures that prevents the emergence of an innovative culture with inherent learning (Johnson, 2013). Further, Venus Lun et al. (2014) highlight in their article that it is key for shipping companies to stress issues regarding environmental performance stemming from institutional pressures, mainly for achieving organizational synergies for environmental preservation, but also for gains in corporate productivity (Venus Lun et al., 2014).

In order to engage an organization in long-term change processes that go under the notion of sustainable development and sustainability, a twofold transitional pathway is suggested (Holmberg et al., 2015). First, there is a need to deploy solutions that can allow the organization to evolve, thrive operate in a society that is defined by planetary boundaries and principles for sustainability through integrated system and design thinking (Holmberg & Robèrt, 2000; Lozano, 2014). This does for example cover, among many, all major technical solutions needed in order for a shipping organization engage in sustainable development for sustainability. Second, the processes described above need to be intertwined with a force of will to change, stemming from inside the organization itself, in order to tune, change or transform organizational preferences that create trajectories of organizational behavior which does not support logical sustainability transitions. These processes include the notion of challenging mental models and applying creative and entrepreneurial thinking for organizational renewal in a continuous process where learning and dialogue are integrated into the core of the organization (Lozano, 2014). Holmberg et al. (2015) defines these two main areas of change as outside-in perspective and inside-out perspective (Holmberg et al., 2015).

Sustainable Shipping Initiative, SSI<sup>1</sup>, has concluded that tackling environmental problems is necessary in order to survive as a shipping actor in a future economy and shipping companies recognize the need for rethinking operational structures in order to reach sustainability (Forum for the future, 2011; SSI2040, 2016). It is further yielded that change can effectively emerge from inside companies with effective

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<sup>1</sup> Sustainable Shipping Initiative was initiated by the two non-governmental organizations Forum for the future, a sustainability organization, and World Wildlife Fund, as a project with the aim to bring the biggest companies in the maritime sector together in order to create a sustainable shipping sector by the year of 2040.

leaders that can recognize opportunities in transitioning towards sustainability. It is estimated that companies able to effectively transition to e.g. a non-fossil fuel fleet through well trained leaders is likely to have competitive advantage in a future shipping market and economy. SSI further emphasizes the need to engage leaders in relevant positions to act as change agents for sustainability transitions. Further, the report highlights that leadership is needed in order to drive complex industrial change for meeting contextual challenges, whether under incremental or radical change. Nevertheless, there exist no linear process (which for this study concerns BAU processes for future planning, assuming a growing economy in need of increased use of physical resources) that can drive this transition (Forum for the future, 2011). For accomplishing logical sustainability transitions, breakage of current trends with radical change is needed (Johnsson, 2013; Höjer, & Matsson, 2000; Lozano, 2014.) By aligning economy with ecology through providing creative solutions and business strategies for sustainable development, one might ultimately engage the shipping industry to be embedded within the restrictions of sustainability through customized sustainability transitions. Additionally, sustainability is assumed to be a vital part of future value chains meaning that engagement in sustainability efforts increase chances of healthy economic performance and customer satisfaction in the future (Holmberg & Robèrt, 2000). Consequently, business development might still be pursued under planetary boundaries and aligned with restrictions for sustainability (Rockström, 2009). Thus, to analyze organizational preferences and mechanisms to map limitations and explore possibilities is emphasized through exploring values, norms and culture both on organizational and societal levels (Svensk sjöfart, 2015). Likewise, it is vital to try to explain the role of institutions in dynamic developments contrary to what usually is equated with institutions: providing stability with inherent inertia (Geels, 2004).

## **1.1 Problem description**

The problem background introduced above yield the detailed formulation that constitutes the problem description for the study: Shipping organizations operating in current institutional landscape are situated in certain work processes and strategies that are fueled by institutional boundaries, certain mental models and specific cognitive inputs. Current work processes is constituted by a BAU – environment, were future business development implies trajectories that are not aligned with logical restrictions of sustainable development and sustainability. The current business environment is supposed to create certain mechanisms or factors, which stem from inside the organization, that hinder logical sustainability transitions to occur. Thus, the organization as such seem to contain a number of, what is defined as barriers, that hinder logical sustainability transformations to occur.

## 1.2 Objective

As can be supported with the information provided in the introduction above, as well as in the subsequent logics of problem formulation, studying the possibilities of internal change is needed to effectively align an organization with the logic of sustainability transitions in order to ultimately engender sustainability. Nevertheless, by to the highest extent provide transparency and generalize the results and conclusions of the study, the aim is to derive suggestions on possible underlying explanations of organizational behavior that seem to counteract sustainability transitions to occur. Findings will be discussed under applicable theory added to enhance understanding of findings and further in the light of the backcasting methodology, which is a rational, natural and logical path of thinking for sustainability challenges. This approach might help incubate the organizational environment and pave the way for reaching sustainability. Furthermore, this approach can be translated into a force that enables the interrelationship between current reality and an ideal future to be reduced, or ultimately eliminated through effective leadership of the seemingly irrational pattern of forces that affect organizational behavior.

## 1.3 Research question

Derived empirical data has the goal to answer following research questions:

- *Which are the tangible barriers that hinder organizational mental conceptions of sustainability to be realized and engaged in sustainability transitions and how can these be explained?*
- *How can identified barriers effectively be analyzed through stressed background theory, applied theory and further be bridged by utilizing the notion of a backcasting methodology as a natural way to handle complex sustainability challenges?*

## 1.4 Limitations

This study does exclusively use the principles of sustainability applied under a backcasting methodology as a basis for defining sustainability and sustainable development. No other framework, model or methodology will be used to define sustainability and sustainable development. When referring to sustainable criteria's throughout this study, the current levels of which the analysis refers to sustainable criteria's will be equal to a holistic macro level for the earth as a complete and integrated ecosystem. The macro level of analysis is supposed to be valid for every actor, that has the goal to exist in a sustainable future, and is in need for the type of resource utilization that ecosystems of the earth provide. Thus, thorough analysis with specifics of what constitutes a complete sustainable process for the organizations subjected to the study, together with their unique context and conditions will not be

made. This study will only focus on investigating the internal organizational barriers that seem to counteract sustainability transitions in shipping organizations. It will solely be limited to conducting analysis of gathered data towards the backcasting methodology as a suggestive approach to manage sustainable issues for an organization as such. The study will assume an application of the backcasting methodology in general, without being too specific about details on how the method is to be applied for the specific type and size of problem or challenge. Thus, what type of sustainability challenges faced will not be analyzed in this study, but rather the fact that there exist problems and challenges for a shipping actor present in the markets of today, with a presumed need to transition into being a sustainable actor in a future green shipping economy. The study will not highlight or suggest what type of problems/challenges and furthermore applicable solutions towards these found under a conceived implementation of the backcasting methodology to the shipping business. Rather, focus is on the problems and issues found under the scope of the organization as a behavioral agent in current structure and systems, towards full realization of logical sustainability transitions. The study is limited to examining a number of shipping companies based in Scandinavia with shipping operations worldwide.

## **1.5 Method**

For answering stated research questions a qualitative method is used. A number of key individuals, acting as industry representatives for the shipping industry, is selected and engaged in qualitative interviews around the subject of sustainability transitions in the shipping sector.

## **1.6 Key results**

The main results derived from the qualitative interviews in this study mainly consist of an identified difference in how organizations in the shipping industry view work on sustainability transitions and sustainability. The process of conceptualizing sustainability transitions is supposed to be affected by underlying perceptions, motivators and understanding towards the process of engaging in sustainability transitions and what this implies for the organization as such. Results are presented in four main areas, areas that hold indications of internal barriers that supposedly hinder sustainability transformations to occur.

## **1.7 Thesis outline**

The introduction delivered the basic background to provide the reader with a fundamental perspective of why this type of study is particularly of interest to conduct. Formal sections defined the highlighted problem, the objective for the study

and stated research questions with applied scientific method. Limitations highlighted objectives that are effectively included and excluded from the scope of the study.

Theoretical background on which this thesis is built upon and continuously argued against in later analysis and discussion is subsequently presented. Moreover, key findings from empirical results derived from the qualitative interviews are presented.

Finally, the empirical results are elucidated into discussions for deriving final conclusions. Discussions will be coupled back to background theory and empirical results. Moreover, applicable theory will be added to this section for enhancing understanding of empirical data in order to accomplish consistent analysis and draw conclusions.

## 2 Theoretical background

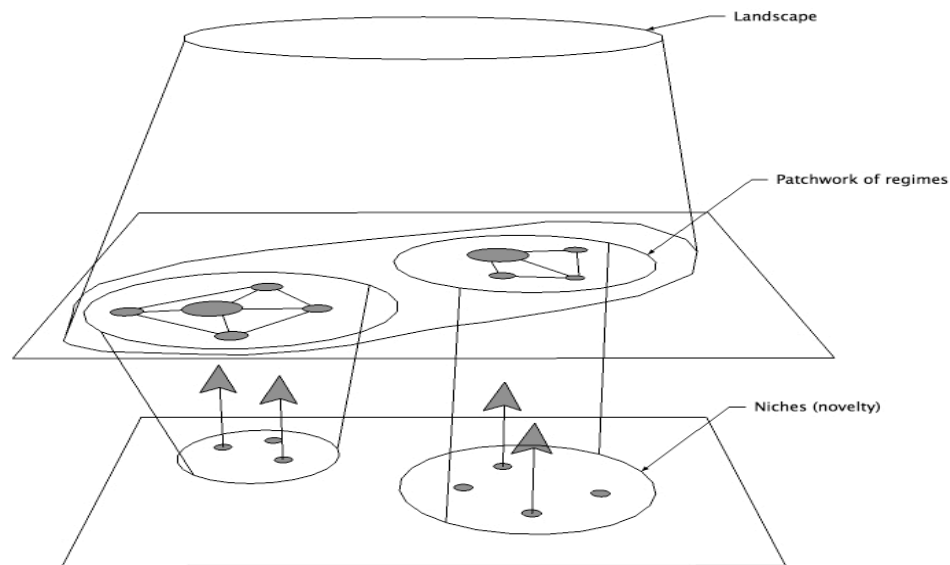
Presented in this part are the logics and rational behind the background theory used for the study. The theoretical background comprises two main areas of theoretical frameworks, emphasized in the subsequent section. First, theory on socio-technical systems and innovation is used to explain the role of the organization and processes of change in a system perspective. Second, the sustainability perspective in this study originates its theory from non-overlapping principles defined under a backcasting methodology. Theory on socio-technical systems will provide an explanatory theory on how large-scale systems, where organizations are embedded, naturally change. Theory on backcasting is solely the methodology for trying to attain desired change. A clarification is to be made before the backcasting methodology is introduced; it is important that one differentiates between sustainable development (which is the process of development) and sustainability (which is the actual state of a sustainable existence). Further, it is vital to distinguish between outside-in (e.g. technical solutions) and inside-out (e.g. organizational behavior) perspectives as to how the methodology is utilized and where it is applied.

### 2.1 Socio-technical systems in a multi-level perspective

A theoretical framework on how to understand large-scale system change processes is provided by Frank Geels (2005). For example, it can be used to explain transitions in the transport sector, which can be defined as a societal function (Geels, 2005). The framework emerges from the fusion between social systems and technology, so called socio-technical systems. The theoretical basis consists of a platform illustrating how complex systems are created through intertwining of technology and society, where functions of the socio-technical system are outcomes of human activities (Geels, 2004). According to Geels, actors in socio-technical systems are present at various system levels involving landscape, regimes or niches (see figure 1). The landscape can be illustrated as the overall institutional landscape where specific branches constitute an industry, i.e. patchworks of socio-technical regimes that entail stability in the overall landscape through certain paths and trajectories of incremental development. Technological niches, on the other hand, act as incubator rooms that can plant seeds for radical change in the socio-technical regime or landscape. Structurally, socio-technical regimes are embedded within the overall landscape and certain niches are embedded within socio-technical regimes, as figure 1 illustrates (Geels, 2005). Niches might have a difficult time to incubate the socio-technical regime or landscape, due to stability imposed from lock-ins and what Geels argue for, misalignment between the processes on different levels. According to the theory, processes on different levels have to have aligned dynamics and logical linkages for a system innovation to occur. Thus, this suggests that not only matured technology that can answer to the restrictions of sustainability is enough to solve complex challenges; internal organizational change processes have to link up and reinforce with a new suggestive technological solutions in order to generate large-scale system innovations. An organization, such as a shipping company, is surrounded by an array of different

stakeholders that to a certain extent can influence structural components (e.g. networks, structures and institutions) and functions (e.g. knowledge development) of an organizational system (Bergek et al., 2008). In the context of sustainability transitions for shipping companies, one can define surrounding stakeholders affecting above stated factors from an outside-in perspective. For example, stakeholders can be R & D institutions, consultancy firms within e.g. technology, suppliers and manufacturing firms or legal institutions. Theoretically, change can be invoked by any of these actors depending on many factors. Either change can be invoked from an R&D institution providing an innovative technology that benefit the operational actors using it. On the other hand, organizational actors might identify new business potentials through new competences and knowledge development, by demanding a novel technology to be requested and thus generate change. Geels argues in his article (2005) that system innovations come about when many simultaneous processes are aligned on different levels, i.e. when a technological innovation from a certain niche is susceptible by a regime actor in a matured overall organizational landscape (Geels, 2005). Cognitive rules determine certain paths of thinking and limit interpretations from outside the scope of focus. Adding to this is unconscious mental processes that enforce bounded rationality (Lozano, 2014). Moreover, these cognitive processes shape the perceptions of the future and do guide actions in the present. Cognitive rules are created by what one can define as cognitive capital consisting of knowledge, skills and competencies that are rigid and are generated over long time. Thus, these rules create stability, which is embedded into deep organizational structures of cognitive frameworks that shape human actions. Further, this creates normative rules in the social and organizational networks based on what type of behavior that is expected, i.e. what is seen as norms on how to act and how not to (Geels, 2004). Likewise, Holmberg et al. (2015) stress that normative lock-ins tend to isolate thinking into silos, leading to adaption of only a few or a narrow perspective(s) (Holmberg et al., 2015). Shipping companies are an actor in a socio-technical system, and according to Geels perspective on system innovation in a multi-level perspective for a transitional pathway, processes on various levels have to link up and reinforce each other for system innovation, suggesting that internal change processes inside organizations are needed (Geels, 2004). Adding to this is the fact that an organization seeking to engage in systems of sustainable development and sustainability, must realize that change has start with the recognition of the organization as a part that future system, in a shared system perspective (Holmberg, et al., 2015; Holmberg & Robèrt, 2000; Senge et al., 2015). Internal change might be intertwined with the push force invoked by e.g. R & D institutions or technological suppliers/manufacturers on other system levels, resulting in system change in a sectorial system, a change process which many actors are engaged in (Geels, 2004). The effect of this trade-off between push and pull of willingness to change might thus result in a continuous integration of sustainable development through system innovations for transitioning towards sustainability, e.g. engaging actors in large-scale landscape change. According to Geels (2004), for analyzing how system change come about, it is of interest to analyze how organizational renewal stemming from inside companies can help transition, e.g. in this case the shipping industry, towards sustainable development and sustainability, i.e. investigating the role of the institutions in dynamic developments since they coordinate perceptions and activities (Geels, 2004).

Organizational fields comprise different actors within the same branch and are coupled to each other through value chains (Eriksson-Zetterqvist, 2012). Geels (2007) argue that, although different pathways of change are unique with different combinations and dynamic of mechanisms, they tend to have an internal logic that is recognizable. Certain social groups have different inherent perceptions, leading them to choose one solution to a certain problem and thus excluding decipher of other pathways of solutions. For example, when knowledge is exchanged through human interaction, competitions between different pathways in the institutional environment occur. Nevertheless, the common denominator under a pathway towards sustainability and sustainable development is the valuation of earth and nature as something of great importance. Thus, this becomes a core value; leading regime actors to modify direction of the innovations that can create change. In turn, this enables social groups to directly change regime rules due to social-institutional dynamics. This effect is of great importance in a transitional path. Sequential patterns of transitional pathways are supposed to be developed through awareness of climate change in the transport sector (Geels, 2007).



*Figure 1. Multi-level perspective on system innovations.*

## 2.2 Backcasting

Following section describes the fundamentals of the backcasting methodology.



### 2.2.1 Introduction and rationale

Robinson (1982) provided, as a measure towards the commonly used forecasting methods for ‘soft energy paths’, a general outline of backcasting as an approach in 1982 (Robinson, 1982). Soft energy paths in this context implied measures to counter the energy problem in terms of introducing conservation policies and renewable energy. Nevertheless, backcasting should be viewed as a complementary methodology towards traditional forecasting (Holmberg & Robèrt, 2000), or as Höjer & Mattsson define it: an *attitude* towards the task of researching a future state (Höjer & Mattsson, 2000). Basically, the nature of backcasting lies in the initial point of analysis start; instead of trying to forecast accurate numbers to build decision making and solutions on, possible future scenarios is conceived and defined by criteria’s for sustainability, leaving subsequent strategies with underlying processes and applied decision making open for input (Robinson, 1982; Vergragt & Quist, 2011). Backcasting was later on shifted to work as a natural method for managing issues relating to sustainability. Many definitions of sustainability and sustainable development are available, however in the context of this study, and as used by Vergragt & Quist (2011), it is argued that the definition as a start encompasses the three classic areas of economic, social and environmental, where human well-being, human development and equity is further incorporated (Vergragt & Quist, 2011). Both Holmberg & Robèrt (2000) and Dreborg (1996) highlights the fact that backcasting as a methodology is efficient for aligning work and planning processes with sustainable development for ultimately reaching sustainability. This is due to the fact that problems of such kind is encompassed under circumstances where there is a need for major change, when the nature of the problem to tackle is complex, span over a long time horizon and dominant trends and externalities shape the operational context (Holmberg & Robèrt, 2000). If summarized, this implies major societal problems that need to be solved (Dreborg, 1996). Knowing what mitigation strategies and creative solutions to apply to large and complex societal problems is problematic due to the characteristics of the problems. For example, environmental problems possess a level of scientific uncertainty. Thus, this often result in that processes are formed based on conclusions at hand and optimized in isolated silos, extruding the specific solution and the influence of system dynamics in a holistic system perspective for a sustainable society. Rather, Backcasting as a method is initiated from a holistic system perspective, where the conditions of the whole ecosphere is considered and defined under specific system conditions for sustainability, explained subsequently. Moreover, it is emphasized that knowledge is to be effectively communicated in a shared system perspective between related actors (Holmberg & Robèrt, 2000; Lozano, 2014). This can be facilitated through leadership with inherent system’s perspective and dialogue between relevant stakeholders (Isaacs, 1999; Senge et al. 2015).

### 2.2.2 Methodology

By defining what constituents sustainability should encompass, and adding the thresholds of planetary boundaries, one can effectively design the criteria’s and conditions of sustainability as restrictions. The holistic restrictions are based on a set

of what Holmberg & Rob  rt (2000) define as *first-order-principles*. These are constructed in order to be able to utilize the backcasting methodology to its fullest potential in terms of ecological and economic measures. Naturally, the inherent manner to conduct work in a backcasting methodology is to continuously work against the criteria's defined. Thus, criteria's will be constant under a conceived full-ended backcasting process. Consequently, what first-order-principles then imply in this context is that they describe the system in a holistic picture. Every subsequent part or for that matter other principles should be able to relate to the first-order-principles defined by the system. The first-order-principles are:

- *Based on complexity due to the nature of problems, but allows for simplicity since it consolidates what underpin constant criteria's*
- *As stressed above, subsequent constituents of a system can always be related to the first-order-principles, thus making them valid at various scales*
- *They provide ability to horizontally share a mental framework for how to approach a problem over the vast span of different actors that might be involved in the work processes*
- *Even though these principles set out the agenda for restrictions, they have the ability to provide relative autonomy under the backcasting methodology and can thus facilitate intrinsic motivation and creativity*
- *The principals enable actors to attack the problem upstream at the source were it is created from the very start*

Thus, the first-order-principles stated above define the restrictions that become the limits of where one can operate when designing sustainable solutions. According to these restrictions, sustainability is achieved when use of physical resources are in within planetary boundaries (Rockstr  m, 2009), without any form of ecosystem manipulation. The restrictions are defined as the *system conditions of sustainability* and do, together with the specific logic and conditions of the problem being addressed, create the criteria's for sustainability. The system conditions define the overall restrictions of how a society should act to be sustainable in a macro perspective and will thus apply to any actor using natural resources in the society of which it is a part of:

- *A society should not regularly increase its extraction of substances from earth*
- *Not regularly increase its contribution of substances produced by society to natural ecosystems*
- *Not regularly realize any type of ecosystem manipulation*

Based on this reasoning, the fourth and last system restriction is thus created, which consequently imply the internal turnover of a society's resources:

- *Available resources should be distributed and used fairly at a global scale.*

The rationale of the backcasting process is that the criteria's set up at an initial stage in the process, all conform to the system conditions defined above. The specific solution

to the problem should attain the rationale of these system conditions, many times formulated as a vision. Thus, the initiating starting point of the backcasting methodology is formed and encircles four main steps (see figure 2):

1. *The vision addresses the holistic target image of the specific solution to the problem issued, expressed in specific criteria's of sustainability (Step 1 in figure 2)*
2. *The gap between the future criteria's and current preferences for similar problem is addressed, yielding a concrete picture of inherent differences (Step 2 in figure 2)*
3. *A non-linear design process is initiated with subsequent solutions, tools and methods to attain criteria's stressed in point number one, for ultimately closing the identified gap (Step 3 in figure 2)*
4. *The four and last step is to shape the strategies that yield sustainable development of the solutions provided in step three, effectively closing the gap and reaching a state of sustainability (Step 4 in figure 2)*

(Holmberg, 1998).

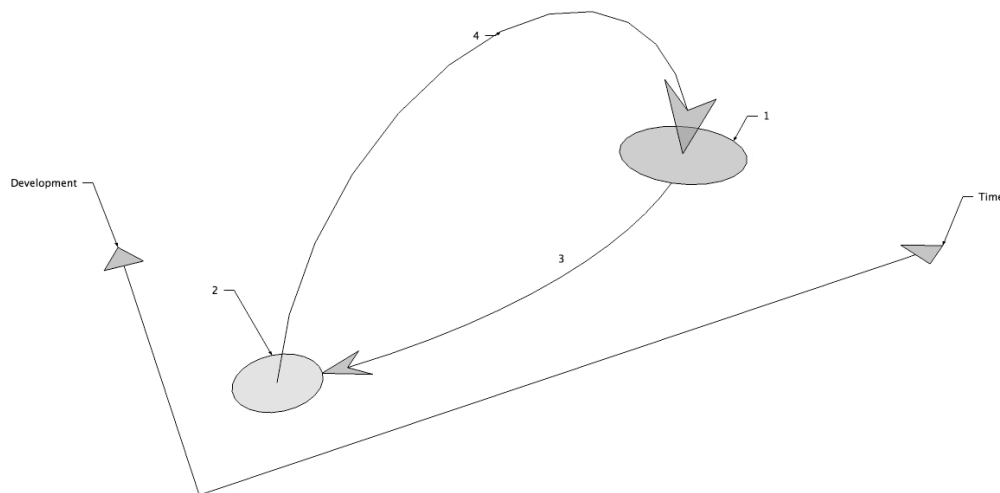


Figure 2. The rational of the backcasting methodology

### 2.2.3 Applicability

One of the most salient strengths of the methodology has proven to be its inherent degree of which to customize it to the nature of problem being addressed. The approach has been applied for various types of studies and specific backcasting methodologies have evolved. Consequently, it depends on an array of different factors since the nature of the problem have specific stakeholder dynamics with various degree of involvement. Furthermore, the problem is unique of its kind and can thus be categorized into one of a certain scale, implying a need for unique methods and tools to be used under a backcasting methodology (Vergragt & Quist, 2011). Besides research, the backcasting methodology has proven its intrinsic abilities to be

customized and applied to a variety of different sectors such as strategic planning in businesses and communities (The Natural Step, 2016). For this study, the backcasting methodology will be used in later discussion of findings as a suggestive tool embrace shipping organizations in sustainability. Argumentation is made that by applying this type of methodology, one might bridge conceived work patterns that seem to hamper sustainability transitions.

## **3 Method**

### **3.1 Research methodology**

In this section, description of the type of research methodology used to answer the stated research questions is made. First, vital constituents of qualitative methodology, used as research method in and relevant for this study, are described. Second, a description of the logic behind the study is presented.

### **3.2 Research design**

Qualitative research is used to capture what one can identify as ‘soft’ data. It can be designed in many fashions, and predetermined models for data analysis do seldom exist: the researcher develops own tools of analysis with applied strategies (Ahrne & Svensson, 2015). What characterizes an interview is the process of trying to understand a phenomenon through asking questions and interpreting the answers generated (Sandy & Dumay, 2011). When conducting qualitative interviews it is of great importance to be aware of how much one’s own interpretations and ‘retelling’ of the answers/narratives affect how the answers are illustrated. The ability to act as an objective listener and interpreter in order to find salient cues that will lead to wanted results, and maintain them constant without latter influence, is a delicate skill (Kvale, 1996). Furthermore, in order not to exert too much bias from the interviewers side, it is vital for the interviewer to constantly remain open to any kind of input derived from the interviewee. That is, instead of categorizing every bit of data into predetermined categories or frameworks, the data should be open to interpretations with the mindset that the information can have a completely different inherent meaning that what is mentally predetermined (Sandy & Dumay, 2011).

For this study, semi-structured interviews are used. Specifically, this implies that a set of themes is organized of which certain questions are defined under. This is done in order to be able to steer the conversation and answers of which the individual interviewing wants to derive answers about. Semi-structured interview questions are usually characterized by the fact that the questions are open-ended, allowing for elaboration on the responses provided by the interviewee. What effectively categorizes a semi-structured interview type is the degree of inherent flexibility and accessibility to the subject being studied. The ability to reveal concealed factors, attitudes and mechanisms behind human and organizational behavior is particularly fruitful with this type of questions. Moreover, this type of questions can incubate an idea of how an individual make sense of the specific environment in which their job is conducted in order to understand their specific creation of meaning. This requires such skills within the interviewer that implies the ability of being sensitive in responses towards how the interviewee perceives the world (Sandy & Dumay, 2011). Mainly, qualitative methods have the ability to target key individuals and their unique intentions, feelings, knowledge, motivation & decision-making processes in the subject of study. These unique personal factors can be assumed to reflect how the

organization act as a behavioral agent, with underlying motivators for certain decisions/actions and how the organization perceives itself. Thus, qualitative interviews are supposed to capture these factors in the most effective fashion, as noted by (Ahrne & Svensson, 2015). Ultimately, the interview questions in this study have the goal to answer stated research questions, however indirectly. Furthermore, they are phrased in such a way that answers is supposed to yield qualitative empirical data that can be analyzed together with the background theory used as theoretical basis for the study. Thus, the conceived gap that constitutes the initiating problem formulation formed in the introduction is supposed to be answered effectively through merging of background theories with relevant questions for capturing specific factors indirectly.

This study adopts a micro perspective on the interrelations between sustainability transitions and organizational behavior, applied to shipping organizations. In order to derive the empirical data needed for effectively answering stated research questions the fundamental base of the study is rooted, as stated above, in qualitative interviews. Two organizational actors in the shipping industry are chosen as subject of study and individuals in key positions act as industry representatives. Barriers that seem to hinder logic and rational mental conceptions of sustainability transitions to be realized in effective transitional methodologies are identified and mapped through qualitative interviews with selected key individuals. The aim is to identify gaps, by ultimately make them tangible and define these as barriers. Analysis of empirical data through applicable theory will try to explain possible reasons behind observed barriers, both on individual and on an organizational level. Subsequently, barriers that do supposedly counteract mental conceptions of sustainability transitions to be realized and engaged, is to be leveraged into the rational and logic of the multi-level perspective of system innovation and the backcasting methodology. The backcasting methodology, at any scale or offset, for any issue in the organization relating to sustainability transitions, is used in order to embrace such macro issues of complexity which sustainability transitions entails. By qualitatively study two types of organizations, the aim is to the highest extent possible derive generic patterns of barriers that oppose realization of sustainability transitions from an inside-out perspective. The use of the backcasting methodology is twofold; first, it is used as a basis to define theoretical operating space for sustainable development and sustainability under a logical methodology to approach these types of complex issues. Second, it is used as a framework methodology to naturally approach and engage ‘soft parts’ of organizations in complex challenges in order to initiate change for effective transitions through sustainable development in order to finally meet criteria’s of sustainability. The backcasting methodology is further used, together with identified barriers, to create discussion on what is needed for an effective steering of organizational behavior for driving change internally and engage organizations in sustainability transitions.

### **3.3 Empirical work process**

Six interviews were done in total. Four of them were conducted in March 2016 and remaining two in April 2016. Five interviews were held at the corporate headquarters

of each organization participating in the study. One interview was conducted via telephone. Some interviews were, when opportunity was given, recorded. The reason why remaining interviews were not supported with recordings is explained by a natural emerging discussion that was able to answer the stated questions naturally, supposedly reflected in the notes derived from these interviews. Additionally, empirical results obtained from interviews are supported with information derived from public documents (e.g. annual sustainability reports) and documents shared by interviewees taking part in this study. The empirical data was gathered in digital notes during each interview. A retyping of the notes were embedded into a continuous text, which was used as a basis to extract main findings.

### **3.4 Data selection**

Two larger privately owned shipping companies based in Sweden were chosen as case studies for this thesis project. The companies are conducting operations within various disciplines of shipping with global operational coverage. The selection of empirical investigation material was mainly restricted by time, costs and geographical limitations. Nevertheless, the organizations chosen is supposed to invoke great influence in the shipping industry in general, and within their respective branch in the shipping industry.

### **3.5 Corporate description**

The specific organizations chosen for this study constitutes an array of different companies within the one and same group. The groups are both family owned businesses. Specific persons were of interest to select for qualitative interviews due to their specific role in the company, namely within sustainability, environmental, corporate social responsibility (CSR) and technology management.

### **3.6 Interviewee description**

As stated above, four persons from one of the organizations were selected for qualitative interviews:

- One individual working as environmental manager with responsibilities of managing environmental work within one company of the group
- One individual working as head of sustainability with responsibilities of managing sustainability work within one company of the group
- One individual working as CSR-coordinator with responsibilities of coordinating work horizontally in the group as a whole

- One individual working as technical director with responsibilities of managing the technical work within the area of new buildings and projects within marine technology for the group as a whole

For the second organization, individuals with following corporate roles were interviewed:

- One individual working as environmental manager with responsibilities of managing environmental work within the area of new buildings and projects within marine technology for the group as a whole
- One individual working as head of sustainability within one company of the group

Selection of the specific individuals and their organizational roles are supposed to reflect a holistic picture of how the organizations work and plan in terms of sustainable development and sustainability.



## 4 Results

Following findings are extracted from the primary data set. Stated findings below are vital in order to answer stated research question through subsequent discussion. Remaining data has been excluded due to its irrelevance for the purpose of the study.

### 4.1 Primary findings

Through initial analysis of the empirical data it was possible to find some distinct areas of interest that seem to influence the process of realizing mental conceptions of sustainability in fully engaged change processes stemming from inside the organization. In summary, these areas of interest defined as barriers, constitute a main difference on how organizations conceptualize sustainability and transitional paths to achieve it. Current inherent organizational conceptions of sustainability and sustainability transitions found in the data will not be valued as wrong or right. Rather, focus is to discuss what factors or mechanisms that lie behind barriers and seem to counteract initiation of full-scale change processes. All types of barriers were found in the empirical data of the cases, however through different expressions. Nevertheless, there are indications in the empirical data suggesting that there are certain organizational conceptions towards sustainability that are present; conceptions that seem to be better intertwined and aligned with logical and rational methodologies for effective commitment to sustainability challenges, e.g. applicable to backcasting. Equally, there are indications on certain conceptions that might as well in the end lead to sustainability, however under a longer time period and on different trajectories with processes that are continued under incremental change.

Findings that do not directly fall into the four areas, defined as barriers, yet still relevant for discussion, are lifted here. One individual shared the perspective that when it comes to work on sustainability, it all comes down to an individual level. The perception of this individual was that some engage in sustainability work and some do not; there did not seem to be a uniform level of engagement in the area. Lifted together with this was the fact that sustainability cannot solely be based on numbers, since sustainability in itself is hard to measure effectively. Thus, it was argued that sustainability work in the environment of today requires a sort of ‘gut’ feeling in sustainability decisions. It was additionally concluded by another interviewee that the biggest motivator for sustainability work is the personal attitude of every individual. Additionally, it was stated that every department and individual has to realize his or her contributive part to sustainability transitions. Further, it was explicitly stated that communication and increase of awareness was of great importance to engage the organization in sustainability work. According to some interviewees, perception was that a genuine interest in sustainability from the owner of the group was being mirrored in the high degree of sustainability commitment inside the organization. In connection to this, perception of the interviewees was that work on sustainability for their specific organization did not need to be proven explicitly since it occurs naturally and is inherent in the organizational environment.

## **4.2 Findings relating to background theory**

Stressed under this section are some further key findings that is vital to mention prior to analysis of the background theory, mainly on backcasting, but also for theory on system innovation. Explicitly stated was a hope on that alternative propulsion technologies would arise. Furthermore, a sustainability strategy that one organization currently had under design was perceived as a vision that ultimately would be broken down into tangible criteria's. Moreover, it was emphasized that there has to exist individuals in the organization that can roam freely on ideas in order to foster creativity for sustainability; of importance is to let go and try out new ideas, in the perspective seen as a complementary factor towards management practices of today in the organization. Further, interviewees from another organization showed the ambition and stressed the importance of take risks and try out new ideas. Specifically, the organization had made collaborations with different NGO's and had explicitly made a visionary project with use of a backcasting methodology. Furthermore, the interviewees shared the perceived perspective that recognition of being part of a larger society is very important in order to engage in sustainability transitions.

## **4.3 Barrier categorization**

Following areas of interest, defined as barriers, is exposed to further analysis under theoretical background and additional applied theory:

- Tangible metrics and intangible value adding factors
- Institutional boundaries and forces mitigating change engagement
- Cognitive lock-ins imposed by causal BAU-patterns
- Norming and conforming towards sustainability (i.e. legitimization in the institutional landscape versus real sustainability adoption)

Subsequent main findings are based on the interpretation and perception of the data made by the researcher.

### **4.3.1 Tangible metrics and intangible value adding factors**

Two main pathways of thinking, what one might refer to as 'valuation methods' on sustainability were identified in the empirical data. First, concrete tangible metrics relating to sustainability initiatives entails the organization to the highest extent possible measure every effort of sustainability initiative respectively, e.g. energy efficiency measures or waste management, which was explicitly lifted as examples in the interviews. On the other hand, intangibles were not explicitly elicited or mentioned by interviewees in the conducted interviews as a factor. However, both

cases contains what can be referred to *visionary projects* which also was mentioned by several interviewees; innovative projects involving new technology, spanning over a distant time horizon, developed in parallel with e.g. energy efficiency measures. Examples are a zero-vision vessel concept, electrified vessel concept and zero-emission port facilities. The empirical data thus illustrated examples where the conception of sustainability seems not only to be valued in tangible, but also intangible value creating thinking. Some individuals emphasized the need for putting measures on sustainability and the importance of making sure to measure what one set out to measure. Also, visionary concepts with “out-of-the-box thinking” were argued giving benefits as since it could “prove what could be achieved”. Some individuals advocated the importance of one valuation method, however not excluding a mutual importance of both, for effectively engaging in sustainability transitions. A difference could be identified in how organizations worked with tangible and intangible measures, respectively. While individuals continuously lifted visionary concepts as a way to move forward towards sustainability measures in one organization, others highly valued the use of tangible metrics to be able to measure sustainability and improve work on the subject.

### **4.3.2 Institutional boundaries and forces**

What can be extracted from the empirical data, as an area of interest for this study and defined as a barrier towards change engagement in sustainability transitions, are institutional boundaries and institutional forces invoking on the nature of organizational behavior and organizational change processes. This is the researcher’s interpretation of the explicit statement being made by several interviewees; the main reference point towards decision making for sustainability issues is influenced and guided by how other actors conduct equal work in the institutional landscape. Additionally, what was also explicitly stated through interviews was the fact that there is an overall focus on issues relating to climate change within shipping as industry, explained as “being on the agenda now”. Empirical results showed a generally high awareness of present environmental problems stemming from shipping, ones that e.g. effect climate change. Further, every interviewee showed an awareness of the fact that change is needed with new solutions to the complex issues that the shipping industry is subjected to. Lastly, it was explicitly stated in the empirical data that the shipping industry needs to come together on all major issues in order to handle the complex challenges that sustainability transitions implies for an organization in the industry. It was highlighted that rules and regulations have to be equally valid for every actor in the industry.

### **4.3.3 Cognitive lock-ins**

Elucidated by the interviewees in this study was the fact that one, when conducting decisions, is many times stuck in the same way of doing things and little room is left for real reflection on what is done. This is interpreted by the researcher as BAU-

processes that are maintained through cognitive lock-ins, e.g. by incremental energy efficiency improvement processes in shipping, disclosing new work processes to be introduced. Hence, cognitive lock-ins tends to become a barrier towards full engagement in sustainability transitions. However, one interviewee stressed the importance of letting go and try out new ideas in order to get the organization engaged in sustainability transitions. One main vital argument for achieving this was communication and learning between groups within the organization in order to try to break loose ordinary work processes and mental models.

#### **4.3.4 Norming and conforming towards sustainability**

What could be extracted from the empirical data was certain statements on the fact that sustainability is good for business purposes, however in this perspective, mostly not interpreted as a main reason for future economic performance but rather for marketing and branding in current business context. The argument was that by explicitly illustrating one's sustainability efforts towards customers and stakeholders, one could increase the trust of existing customers in the organization as such and further enable acquisition of more customers. Further, the perspective from both organizations was that it all comes down to the business case; some customers of the shipping organizations do not care so deeply about commitments and responsibilities for sustainability in relation to current business goals. Mainly, of highest importance is the fact that the service they buy delivers what it has set out to deliver. This, one of the organizations in the study argues, contributes to a fairly low degree of sustainability incentives. Tendencies to engage in norming, i.e. legitimization efforts, in work towards sustainability efforts could be found in the empirical data.

#### **4.3.5 Commentary**

Stressed areas, or barriers, will be analyzed through continuous text in discussion and relevant coupling to empirical data will be made. Onwards, for subsequent discussion sections, the barriers will be highlighted with applicable theory in an effort to get a deeper understanding of the findings. Further, empirical data will be lifted into the background theory stressed in the study. Lastly, the different conceptions expressed through identified barriers will be coupled back to the backcasting methodology for suggestion of transitional pathways for shipping companies to embark on sustainability transitions.

## 5 Discussion

### 5.1 Tangible metrics and intangible value adding factors

Defined under the introduction of this thesis is the fact that shipping organizations of today conduct long-term planning in what is referred to BAU-processes with applied causal models or tools. Further, the empirical data in this study indicated that the representing industry organizations used the same type of processes for conducting long-term planning. In a BAU-climate fueled by traditional models and tools, metrics help define the operational space and provides guidance of decision-making in sustainability, as indicated in empirical data. One should, as a starting point, be aware that the process of valuing sustainability does not always imply effective practice of sustainability (Caprar & Neville, 2012). Nevertheless, standardizing reference data in a social system has shown to increase level of action and contribution, since the data is based on facts rather than subjective cognition fueling specific judgments or opinions within certain individuals in specific organizational power roles (Sandow & Murray Allen, 2005). Projects that to the outset seem to yield intangible benefits also implies lower degree of control and outcome due to their abstraction (Hopkins et al., 2011). Further, as Hind et al. (2013) point out, sustainability initiatives can be put into action when these can be made tangible for the organization through realization of practical value for the business (Hind, et al. 2013). This can be discussed in the light of radical innovation or change for sustainability adoption; one tend not to act when one have little behavioral control over the outcome (Gifford, 2011). Hence, findings from empirical data indicate on a conflicting trade-off between tangible metrics and intangible value adding factors that might be translated into a mental barrier that hinders sustainable initiatives. For example, explicitly stated by one organization was the fact that costs of investments that are not tangible are difficult to legitimize. However, for embarking on sustainability transitions in current context, one needs decisions that are not entirely based on numbers. This was also lifted as a main point in empirical data. Furthermore, another organization highlighted the fact that energy efficiency measures in place today are merely temporary. Findings indicate that there is a lack of consistent road maps for how to conduct sustainability work since intangible value adding factors are hard to identify and tangible metrics do not seem to be enough for effective sustainability adoption. Thus, either one try to the highest extent craft metrics to make decisions on; or, one makes judgments aligned with a subjective feeling that intangible effects of a sustainability measures will add value to the organization. As theory indicates, tangible metrics can yield action towards sustainability adoption. Still, metrics alone might not imply effective sustainability adoption. Further, empirical data illustrates examples aligned with theory stressed above; first, it is difficult to identify intangible benefits; second, one tend to have little control over what the outcome of these are. Thus, this suggests that current work structures might benefit from new perspectives e.g. imposed by new methodologies to look upon issues relating to sustainability. The trade-off between tangible metrics and intangible value adding factors and how actors in the study conceptualize this cannot effectively respond to a valuation of a certain level of sustainability adoption in each case. Rather, for this study, it indicates on different conceptualization of the level of importance of tangible metrics versus intangible value adding factors for driving work

on sustainability. The issue instead becomes focused on how the work is done, how sustainability incentives are integrated and what type of work that tends to yield the highest value in line with sustainability conformation aligned with current methodologies in present context. Tangible metrics might, as stated above, yield efficiency in driving employee contribution towards sustainability. Nevertheless, a visionary concept creating intangible benefits is difficult to put a value on since enthusiasm, motivation and intellectual curiosity is difficult to value in terms of physical money, but might on the other hand drive work towards sustainability transitions in terms of e.g. employee engagement or innovation propensity (Hopkins et al., 2011).

## **5.2 Institutional boundaries and forces**

What became evident in initial analysis of the empirical data is that for issues on sustainability within shipping, there is a fairly high tendency to view, compare and exploit what other actors are doing within the area of sustainability. Further, it was explicitly stated that the industry as a whole need to come together to solve complex sustainability issues, indicating on perceptions that the industry has inherent institutional boundaries that mitigate logical sustainability transitions. As stated by Senge (2015), in order to invoke real systematic change, people have to work across boundaries that define their comfort zone (Senge, et al. 2015). Further, in the age of knowledge, value is created by collaborative relationships (Sandow, & Murray Allen, 2005). People working with sustainability have to share knowledge through engagement in collaborations with different societal sectors (Lozano, 2014) in collective networks (Hind, et al. 2013). Kiron et al. (2015) also emphasize the importance of collaboration, as a way to explore new market opportunities (Kiron, et al. 2015). The organizations constituting the empirical data have a number of different companies within the same group responsible for different business areas. Thus, tendencies are that the different companies are also to some extent steered by, within the group, institutional boundaries and forces due to inherent goal conflicts. This was asserted in the empirical data due to the fact that there seemed to be no holistic work with sustainability on a group level; some individuals/departments were engaged to a large extent and some to a less extent. Since there exist no common denominator for sustainability work in the organization, inherent business goals of a department might thus becomes more important than conducting work for sustainability measures, acting as institutional forces that mitigate collaborative sustainability work. This creates silos of mental models, ones that can be dismantled by merging emotional and rational processes within individuals in creative thinking (Lozano, 2014). However, the empirical data indicted on internal boundaries or forces being of a very low importance compared to institutional boundaries and forces towards other actors within the shipping industry as whole. In an institutional point of view, the fact that sustainability issues is on the agenda forces shipping organizations as an institution also to engage in stressed issues in order to build legitimacy towards other actors in the organizational landscape in which they operate (Eriksson-Zetterqvist, 2012). Thus, the issue might become too focused on legitimization towards other actors concerning sustainability issues, resulting in a disclosure of the core methodologies, solutions or

processes inherent in effective sustainability trajectories. Another effect might be observed; Institutional boundaries or forces might fuel cognitive lock-ins, since it enables cluster of organizations to develop in certain trajectories, trajectories that might not have the inherent openings for logical sustainability transitions to occur, since it these are built on current trends fueled by certain cognitive rules (Geels, 2005). A mixture of seemingly irrational forces affects the behavior of an institution, albeit the general assumption that one is acting rationally under causal models (Eriksson-Zetterqvist, 2012). It has been concluded that people are less rational than once believed (Gifford, 2011). For example, people do compare to one another and this is revealed on several levels, be it in social comparison between individuals and social norms and networks, which lies in embedded in our natural social behavioral order in terms of legitimacy (Gifford, 2011; Sandow & Murray Allen, 2005). Also stated by the interviewees in was that fact that the shipping industry must be subjected to regulations and changes that applies to all actors equally. This is further aligned with what is stressed by Gifford, illustrating what he calls perceived inequity, which can act as a barrier towards inaction in sustainability transformations with underlying behaviors (Gifford, 2011). The sense of being active in a field that is subjected to unequal rules of the game might fuel institutional forces to be exerted to a higher extent than of a fair, transparent and communicative institutional landscape.

### 5.3 Cognitive lock-ins

The empirical data provided information that seemed to constitute a barrier, which for this thesis is defined as a cognitive lock-in. Interviewees explicitly stated an inherent perception saying that individuals are currently not located in the same mental reality, thus making it hard to collectively decide on which factors that e.g. drive innovation for sustainability most effectively. Moreover, it was explicitly stated that a change of mindset is needed for the shipping industry in order to effectively engage in sustainability transitions. Current work structures in organizations are steered by, among many, cognitive rules, which is the creation of unique sense making and meaning for an organization (Geels, 2005). Inevitably, cognitive rules will steer individuals and thus affect organizational behavior. However for this study, the issue arises of to what extent cognitive rules that guide individuals in the organizations subjected to this study become cognitive lock-ins towards engagement in logical sustainability transitions. Hence, question arises concerning the misalignment between inherent cognitive rules that constitute logical sustainability transitions and current cognitive rules that guide the organizations. Gifford further argues that limited cognition about environmental problems through different mechanisms act, at least on and individual level, as a barrier towards sustainability adoption (Gifford, 2011). Throughout the empirical data, interviewees suggested that learning and communication is of vital nature in order to break loose from current work structures, i.e. cognitive lock-ins. In order to mitigate inaction towards sustainability adoption Lozano (2014) states that by engaging in learning, one is constantly challenging mental models, which further affects behavior. By challenging mental models, sustainability can be fostered through new creative processes in previously untapped cognitive channels. Learning occurs in units ranging from individual learning to

group, organizational and societal learning. Group learning plays a significant role in modifying mental models. Therefore, significant factors that will help engage organizations in sustainability transitions are constant learning on a group level (Lozano, 2014).

## **5.4 Norming and conforming towards sustainability**

The degree of norming versus conforming towards sustainability, i.e. sustainability branding versus sustainability adoption, interpreted from empirical data seem to become a barrier towards full engagement in sustainability transitions. For example, efforts to show the current work on sustainability that the company conducts might capitalize on real conforming toward sustainability; real sustainability practices that adds value is preferably to be inherent in the business case and does not have to be proven to contextual actors, not at least to the same extent or through the same communications channels or strategies as norming actions. The issue that specifically arises is to what extent a company actually engage in sustainability adoption versus to what extent the initiatives are merely a valuation of sustainability, e.g. used deliver business growth through the window of sustainability. As De Lange et al. (2012) points out, organizations may value sustainability but not conform to its inherent principles (De Lange et al., 2102). Consequently, of interest to conduct future research on is the motivation that steer organizational behavior, since motivation is either steered by intrinsic valuation of an activity or by strong contextual pressure (Ryan & Deci, 2000). Additionally, it is of interest to analyze this trade-off in an individual perspective. Gifford describes what he refers to as spatial discounting of environmental problems, essentially meaning a disclosure of a problem since effects are not located within immediate attention. This, together with undervaluation of distant future risk, referred to as judgmental discounting by Gifford, might yield higher degree of norming towards sustainability efforts than real adopting of sustainability measures (Gifford, 2011). Factors that seem to play vital roles in the trade-off of between norming and conforming towards sustainability are leadership style and organizational culture. E.g., explicit CSR is being associated with a leadership style that is autocratic and implicit CSR is more related to emergent or authentic leadership styles (Caprar & Neville, 2012). Also, a leadership style that provides supportive autonomy through learning is vital for getting people motivated and engaged through commitment and effort (Ryan & Deci, 2000). Lozano (2014) emphasize the vital importance of change agents that can adopt new ideas and turn them into new mental models that can be adopted by groups, organizations and society (Lozano, 2014). Organizational culture can help explain variation in sustainability adoption (Caprar & Neville, 2012). Thus, exploring intrinsic constituents of organizational culture and leadership is vital for understanding level of sustainability adoption. Nevertheless, the scope of the empirical data is too narrow, firstly to analyze leadership style or organizational culture, secondly to analyze the implications of this on sustainability adoption for the specific cases.



## 5.5 Barriers and system innovation in a multi-level perspective

When analyzing the empirical data in the light of Geels theories, many of the identified barriers can be conceptualized as barriers acting towards full-scale realization, or to some extent affecting maturing of landscape and regimes, of sustainability transitions in the specific system of the multi-level perspective; shipping industry (landscape), shipping organizations (regimes) and e.g. technology consultancy companies (niches). When analyzing the empirical data in the light of Geels multi-level perspective on system innovation, tendencies can be found suggesting that the inherent process that is needed for a system innovation to occur are not aligned on the three levels in a multi-level perspective. Seen from a macro perspective, it is difficult to determine what level in the model that has reached the highest level of maturity towards system innovation for the shipping industry. Organizations subjected to this study can be argued to be located within patchworks of regimes that constitute the overall landscape, i.e. specific shipping branches making up the global shipping industry. There exist certain technological niches and concepts trying to invoke change into the industry, e.g. DNV GL ReVolt concept vessel (DNV GL, 2015). However, throughout this study and with further support from empirical data, it is suggested that there are several internal barriers within shipping organizations that hamper organizational change to link up with technological niches trying to invoke change to the landscape. Further, as far as this study notes, there exist a difference in how technological innovations are received inside shipping organizations. Thus, this implies that certain patchworks of regimes and thus the overall landscape has not reached the high level of maturity to assimilate any technological niche that has to goal to invoke system innovation.

Specific normative and cognitive rules affect dynamics of organizational behavior through many factors; normative rules consist of norms, values, and role expectations and cognitive rules are defined by the perceptive reality of individuals through which meaning and sense making is made (Geels, 2005). In the empirical data, barriers and identified differences between barriers can certainly be linked to differences in normative and cognitive rules, which guides organizational behavior towards sustainability adoption and conceptualization. For example, one organization stressed the importance of generating tangible metrics in order to base decision-making on these, albeit stating the aim to be an environmental front-runner in their specific regime. Another organization emphasized the importance of being an active creator in visionary projects in order to drive innovation and development towards sustainability in the shipping industry as a whole. Hence, to a larger extent for the latter example of valuation method, acknowledging intangible value adding factors through visionary projects believed to drive work in sustainability forward through an organizational collective belief. Thus, this illustrates a difference in the normative rules present in the organizations on which role to possess and the expectations on these roles in connection with certain responsibilities; one actor was to a higher degree stating their role as industry drivers for sustainability than the other. Further, it also points on differences in the mental composition of cognitive rules in the organizations subjected to the study; tangible metrics yielded a specific reality where sense making of sustainability was made and visionary projects made up another reality to a larger

extent based in intangible value adding factors which could not be identified or defined at current state.

Further, there were indications in the empirical data on various institutional forces which supposedly affected conceptualization and adoption of sustainability. Data indicated on tendencies for, specially for a certain organization but applicable for both, to enlist what other equal actors in the institutional landscape did for engaging in sustainability challenges by listing this as the most important reference point to compare against for work on sustainability. On the other hand, another organization listed the very solution as the main reference point for driving work in sustainability challenges. Again, this point out differences in the conceptualization of sustainability were one organization show higher tendency to engage in sustainability efforts to legitimizes their work in the institutional landscape whereas the very solution is the focus of others, albeit not excluding the fact that both organizations still legitimize their stand towards sustainability in the institutional landscape. Both organizations subjected to the study showed tendency to align themselves with norms derived from the institutional landscape consisting of pressures to engage in sustainability issues. This was explicitly stated in the empirical data; the fact that there is an overall focus on climate change for the shipping industry and that actor's engage in institutional comparisons. Now, this does not answer the question whether or not and to what extent the organization(s) actually engage in sustainability efforts, but it raises the question; what is the trade-off between to what extent shipping organizations are explicitly norming to sustainability pressures mainly for institutional legitimization strongly guided by normative rules, or actually conforming towards implicit sustainability adoption, driven by intrinsic organizational motivation fueled by inherent cognitive rules.

## **5.6 Barriers and the backcasting methodology**

Empirical data provide signs that the organizations subjected to the study emphasized new methodologies, method and tools for sustainability work, i.e. issues that might be bridged with a backcasting methodology. Explicitly mentioned was the need to let go of present structure, try out new ideas and freely elaborate on these through creative sessions in collaboration with other actors. A backcasting methodology leaves inherent room for input of idea design in order to solve adopted problems (Holmberg et al. 2015). A design process is not linear (Söderberg, 2015). Thus, the main difference between backcasting and e.g. causal BAU planning models asserts itself; a causal BAU process is fueled and improved by incremental change under continuous improvements, e.g. tangible energy efficiency measures that can be justified and legitimized in the institutional landscape. Backcasting on the other hand, possess embedded thinking where the nature of discovery is perceived as the primary driver (Dreborg, 1996). Thus, discovery implies non-linear creative processes with intangible benefits since future solutions are just that; undiscovered. With a certain problem at hand where a future state is constructed and defined through criteria's limited by restrictions, focus on the trade-off between tangible versus intangible benefits might be reduced, or even eliminated. For example, instead of having to

make the decision of whether or not to make an investment in energy efficiency measures and having to value tangible metrics in relation to intangible benefits, backcasting allows for a certain degree of control for both tangible metrics and intangible benefits; this abstract conflict will mentally be anchored in the very restrictions and criteria's defined for the solution. Thus, focus is shifted towards the solution instead of battling the trade-off. Additionally, the backcasting process does not imply focus on finding current tangible metrics for sustainability improvements in current trends, which essentially implies that one cannot embark on trajectories that are unaligned with the solution to the problem, input remains open. Backcasting might provide mitigating effects towards intense institutional competition in the organizational landscape since focus is shifted towards the very solution itself through collaboration, trust, dialogue and learning (Holmberg et al., 2015). As lifted in the introduction and argued by Geels, institutions should not only be used to explain inertia and stability in a negative sense. One should also elucidate the fact that institutions can be used for dynamic developments; it is a stable social system that has ability to sustain business value and can institutionalize learning (Sandow & Murray Allen, 2005). Learning is an inherent component in going forward in sustainability transitions, highlighted both by interviewees in empirical data and by Lozano (Lozano, 2014).

Furthermore, backcasting might naturally facilitate processes where cognitive lock-ins can be mitigated by working with the inside-out perspective. Backcasting naturally aims at challenging mental models (Lozano, 2014) and it is a process that might effectively promote creativity due to the inherent focus of the process; one focuses on a distant solution instead of present conditions (Dreborg, 1996). Consequently, new cognitive channels previously untapped have the possibility to be discovered and utilized under a backcasting methodology. The nature of the backcasting methodology implies that development and change is facilitated through stakeholder dialogue resulting in widening of cognitive channels when thoughts, experiences and knowledge are shared between concerned stakeholders (Dreborg, 1996).

With inherent room for creativity and challenge of current mental models, perceptions provided by new cognitive channels that constitute conceptions in line with sustainability and sustainable development might be institutionalized through organizational learning and thus become a part of the organizational culture (Lozano, 2014). Thus, by opening up for changes in the organizational culture, one does also have the possibility to affect the degree of sustainability adoption, since culture is supposed to play a vital role in how organizations adopt sustainability, as stressed earlier. Generally, a culture constituting a high degree of dimensions that are aligned with restrictions of sustainability and sustainable development is also more likely to facilitate the process of sustainability adoption, and the other way around (Caprar & Neville, 2012). Consequently, institutions might cultivate an organizational culture with applicable leadership that does not just respond with a norming effect towards sustainability efforts imposed by other actors in the institutional field, i.e. perceptions and expectations on proper behavior (Geels, 2005), but also implicitly work with actual sustainability adoptions through conformation, i.e. actual adoption of sustainability measures (Caprar & Neville, 2012).

Of importance to note is that albeit putting empirical data in the light of a backcasting methodology for attempting to bridge stressed barriers, does not imply that the methodology is the best suitable for the specific industry and in the context of issues relating to sustainable development and sustainability for this specific industry in this point in time. However, the rationale of the methodology is used as a suggestive approach to take on challenges towards sustainability due to its inherent flexibility and natural way of thinking through the merging of industry and ecology. Further, it might help to even out differences in how organizations perceive, make meaning and engage in sustainability transitions for reaching sustainability. Nevertheless, for effectively engaging in complex sustainability challenges in the shipping industry, a completely different approach than that of the backcasting methodology might be more customized for the specific branch. Thus, the method should not be defined as the best practice for the specific issues in the specific industry subjected to the study.

## **5.7 Reference discussion**

A large extent of the reference material used in this study is derived from former academic university courses within the area of leadership, sustainable logistics and sustainability transitions, all held at the Chalmers University of Technology in Gothenburg. Other academic articles are derived from online academic journals mostly accessed through the Chalmers University of Technology and their online library search engine. Additionally, reference material with a more of a commercial approach is also derived through this database. The combination of high quality academic articles in cooperation with commercially angled literature, both from Internet sources and in format of articles, is believed to have consolidated both academic and business perspectives effectively in this thesis.

## **5.8 Method discussion**

This study compiled data from in total six (6) interviews with key individuals. Albeit being the best approach to the subject of study, six (6) interviews in total might not be sufficient to provide such high validity of the results as to draw definitive conclusions. For enhanced validity of the results and increased ability to generalize the results towards a broader scope, the qualitative methodology used in this study might be supported by quantitative statistical data models derived from e.g. questioners. Combining statistical data models with qualitative data add to validity in such a way that derived result is not solely based on subjective interpretations and perceptions of the researcher in question.

## 6 Conclusions

This thesis originated with the notion that shipping organizations present in the institutional landscape, i.e. the shipping industry, conduct work on trajectories that are not aligned with the non-overlapping principles which define the system restrictions of sustainability and further define the safe operating space for sustainable social and economic development. The notion originated from an internal organizational perspective with the assumption that specific mental models and cognitive inputs guide organizational behavior, which hamper the organizations to engage in logical sustainability transitions. A qualitative study was thus designed in order to answer to stated research questions where industry representatives from shipping organizations participated. Empirical results provided indications on answers as to what might lie behind organizational behavior and inherent preferences towards logical sustainability transitions for the shipping industry. However, as noted earlier in this study, the scope of data is too narrow to draw definitive conclusions suggesting that stated barriers also do counteract sustainability transitions. After all, many intertwined factors that affect the work on sustainability, both in technical, legal, economical and political measures from an outside-in perspective, but also in organizational culture, leadership and behavior from an inside-out perspective, seem to be intertwined in hard-to-control structures with unpredictable dynamics.

The results of the study can to a fairly high extent show on tendencies of certain organizational behavioral trajectories with underlying barriers that seem to counteract implementation of full-scale sustainability transitions. For example, sustainability efforts are to a high extent conceptualized through different valuation methods for sustainability (tangible metrics versus intangible value adding factors) and organizational perception of what valuation method that equals consistent sustainability work differs between organizations. A barrier might thus be created where crafted metrics compete with intangible benefits (e.g. innovation propensity) in perceptions of what tend to be the most efficient way forward for sustainability. The shipping industry seems to contain a fairly high degree of inclination to legitimize sustainability efforts in the institutional landscape. Moreover, tendencies to utilize legitimization efforts and institutional comparison seem to yield an internal perceptive climate with beliefs that one is effectively engaged in sustainability efforts. Lastly, current BAU models that steer work and future planning underpin cognitive lock-ins that steer organizational behavior into current trends through BAU-work processes consisting mainly of causal models that predict the future. The backcasting methodology was provided as a suggestive measure that supposedly can help view identified barriers from another perspective and hopefully help organizations to bridge identified barriers and engage in sustainability transitions.

However, more research on the topic is needed in order to get a more consistent picture and derive valid conclusions of inherent change preferences towards sustainability transitions and sustainability for shipping organizations. As was lifted in the discussion, both organizational culture and leadership seem to play vital roles in sustainability adoption, which suggests that further research within these topics for the shipping industry are needed. Furthermore, research on the mechanisms that seem to

steer organizational behavior in shipping organizations can add to the topic of sustainability transitions in the shipping industry. Future studies might stress the topic of this thesis again, however through different methods or empirical work processes. For example, future studies may constitute a higher selection of participants, yielding more consistent and valid results. Furthermore, quantitative statistical data models (for example factor analysis) might add to the validity of results and thus provide more accurate conclusions as to what factors, barriers or mechanisms that seem to counteract sustainability transitions.

The goal with this study is not to provide direct suggestions to stressed barriers and that any suggestions would automatically lead to a higher degree of sustainability adoption within shipping organizations. Every organization is unique, and there are apparently many more factors to consider; leadership, organizational culture and organizational behavior, which interact in advanced dynamics that makes every organizational situation unique. However, this thesis illustrates the importance of future work and research within this area in order to conclude if stressed barriers invoke great influence on sustainability work. Further, it is vital to investigate how barriers interact together with other organizational factors and the business goals of the organization. Sustainability holds many vital constituents, one of which is the behavioral side of organizations and individuals. Thus, in order to embark on full-scale sustainability work through logical transformations, organizations need to be aware that factors like these have strong influence on the nature of organizational behavior for sustainable development and sustainability. Creating awareness of the fact that barriers like this exist and how these affect the organization is the first step in the process of providing future adaption of organizational preferences and behavior.

The results derived from this study suggests that many efforts, from an internal organizational perspective, are needed in order to engage shipping organizations in full-scale sustainability transitions. Hopefully, factors that need scrutinizing are lifted in this thesis, and elaborated on for deeper understanding. Furthermore, the ambition is that this study can help evoke interest to conduct similar studies in other branches or industries with the purpose of contributing sustainable development for ultimately reaching a world of sustainable human existence.

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