Towards a Sustainable Maritime Transport Corridor: How Could Security and Safety Help Attain This Goal?

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Abstract:

In a fast moving world where maritime transport corridors play a major role in the movement of people and goods, there are significant sustainability issues with these operations. This paper considers the sustainability of these corridors and the contribution of security and safety measures to achieve sustainability. The research commences with a literature review and practitioner survey on sustainability, security and safety of maritime transport, then develops the analysis using the Framework for Strategic Sustainable Development (FSSD) and causal loop diagrams to analyze and evaluate measures and actions that could lead towards a sustainable maritime transport corridor - education and training, energy alternatives, waste management, dematerialization, efficient land and sea use, standardized operations between ports and community engagement. The Baltic Transport Corridor is used for analysis. Further recommendations are made in order to facilitate the path for future research and study.

Keywords: Sustainability, Maritime Transport Corridor, Baltic Transport Corridor, Framework for Strategic Sustainable Development, Security, Safety.
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Executive Summary

Introduction

The volume of maritime transport has grown at high rates in the past few decades in Europe and worldwide. The increased demand for consumer and industrial products, with supplies and manufacturing globally sourced, and shipped to end consumer destinations worldwide has resulted in the need for transportation corridors. In addition, the expansion of the recreational and tourism industry has resulted in increased pressures on these same corridors as increasing numbers of tourists travel to more destinations. The result is an increased volume of aircraft, trucks, buses, railcars, and ships being used to move more people and goods. These activities increase the pressures on natural and social systems to accommodate these activities and like most systems, the growth cannot continue indefinitely without adverse social and environmental impact.

The fundamental issue facing these systems is the long-term viability and sustainability of these activities with transportation corridors acting as conduits. The transportation and activities supporting these corridors, as currently constituted, combined with the pace of expansion, is considered to be unsustainable. The impact on sustainability of these activities and corridors has perhaps not received the attention it deserves.

The purpose of this study is to examine this expanding maritime transport and its related infrastructure in terms of its sustainability. In addition, the analysis considers whether security and safety could help attain sustainability in maritime transport corridors.

The analysis of sustainability, security and safety of maritime transport corridors is applied to the Baltic Transport Corridor (BTC) as a case study. The BTC is used as the specific corridor for analysis - it is a global east-west trade corridor linking China, through Russia and the Black Sea region.
via the Baltic ports of Klaipeda and Kaliningrad to European destinations including Sweden and Denmark.

Primary Research Question:

How could one move towards a sustainable maritime transport corridor?

Sub-Questions:

How could security and safety help attain this goal?

Methods

The research begins with a background literature review of the issues of sustainability, security and safety for maritime transport. This provides the context for the research and the basis for analysis. In addition, a survey questionnaire was developed and sent during the study process to numerous stakeholders and practitioners in the Baltic Transport Corridor. The objective was to canvas their views on the issues of sustainability, security and safety in the Baltic Transport Corridor. This provided the necessary basis for the next step of the research – a specific analysis of the Baltic Transport Corridor in terms of a sustainability analysis.

The research then analyses sustainability of transport in maritime corridors using the Framework for Strategic Sustainable Development (FSSD). A vision of a sustainable maritime transport corridor is identified and through the process of backcasting, a strategy to move maritime transport corridors towards sustainability is developed. The results of the research identify sustainability violations (gaps) of the four (4) principles of sustainability (FSSD framework: SPI – SP IV). The research is incorporated into causal loop diagrams (CLDs) to provide a visual understanding of the linkages between the constituent components that compose maritime transport systems. Specifically, the FSSD uses the A-B-C-D planning process - a series
of analytical steps is applied to arrive at possible actions and measures that could lead the maritime transport corridor towards the vision of success – a sustainable maritime transport corridor. Through the mechanism of “back-casting” from the vision of success, a series of strategic steps are identified to achieve sustainability in maritime transport corridors.

Finally, the causal loop diagrams visually identify linkages and causality relationships between components and identify areas for further research and leverage points for action to bring maritime transport to a state of sustainability. Through the use of the diagrams (CLDs), the constituent sustainability, security and safety elements of maritime transport were visually mapped out and the linkages between the elements are determined.

**Results**

The literature survey of maritime transport generally and the Baltic Transport Corridor specifically, provided a basis of understanding of the issues of sustainability, security and safety. This provided a basis for the remainder of the research by providing a context for the research.

Through the application of the FSSD and specifically, the ABCD process, the study identified a number of actions that could lead the maritime transport corridor towards a vision of sustainability. These actions and measures will help close the sustainability gap - violations of the sustainability principles. In addition, security and safety measures necessary to move maritime transport corridors towards sustainability are identified.

Education, sustainable energy alternatives and waste management practices are a few examples of actions and groups of actions identified. The actions close the sustainability gap and address immediate sustainability violations of the Baltic Transport Corridor.
The survey results identified gaps in sustainability, security and safety from the point of view of practitioners in the Baltic Transport Corridor. In addition, the results provided an operational sense of what could be missing in terms of sustainability in the corridor.

Finally, the use of causal loop diagrams provided a visual conceptualization of the relationships of the constituent components that make up maritime transport systems. The diagrams highlighted the causality of the elements of the maritime transport in terms of sustainability, security and safety.

The study identified seven recommended areas of action to be applied to maritime transport corridors generally and the Baltic Transport Corridor to move corridors towards sustainability and thus address the primary research question:

- Education and training
- Energy alternatives
- Waste management
- Dematerialization
- Efficient Land and Sea use
- Standardized Operations between ports
- Community Engagement

Concluding Discussion

The fundamental research questions of this study to be answered are:
How could one move towards a sustainable maritime transport corridor?

How could security and safety help attain this goal?

The analysis of the activities of the Baltic Transport Corridor revealed there are significant sustainability gaps in the corridor operation. The study identified seven recommended areas of action that can be applied to maritime transport corridors and the Baltic Transport Corridor that can move corridors towards sustainability: education and training, energy alternatives, waste management, dematerialization, efficient land and sea use, standardized operations between ports and community engagement. These areas of action address the primary research question of how to move towards a sustainable maritime transport corridor through an identification of the action and its impact on achieving the vision of a sustainable transport corridor.

In terms of the second research question – how could security and safety help attain the goal of a sustainable transport corridor, the research determined that the inter-linkages of security and safety measures to sustainability provide comprehensive coverage of sustainability in transport corridors. These linkages and synergies include laws, policies, operations, education, training, management and computer systems, and community engagement. These security and safety measures were identified as synergistic to sustainability and provided complete coverage of sustainability in transport corridors with specific emphasis on the Baltic Transport Corridor.

The result is a complete and comprehensive programme of coverage that enhances sustainability in maritime transport corridors through the tight integration of sustainability, security and safety measures. It ensures the integrity of policies and ensures operations are maintained to a high standard to enhance sustainability and mitigate against risk conditions that result in the deterioration of operations resulting in the undermining of sustainability.
Finally, the research identifies areas of future sustainability, security and safety research to enhance sustainability in maritime transport corridors with specific emphasis on the Baltic Transport Corridor.

**Statement of Contribution**

This thesis is a result of a collaborative process between the three authors. It is the result of six months of work, investigation and analysis.

We thank our advisors, fellow students and all the parties of the East West Transport Corridor for their patience, participation and assistance.

*Andria Benner  
James McDonald  
Abderrahim Sallak*

*Karlskrona, Sweden – June 2008*
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<td>ABCD</td>
<td>A-B-C-D Process (a four-step strategic planning process used for backcasting from sustainability principles)</td>
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<tr>
<td>BTC</td>
<td>Baltic Transport Corridor</td>
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<td>BTH</td>
<td>Blekinge Institute of Technology</td>
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<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CEC</td>
<td>Commission for European Communities</td>
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<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<tr>
<td>EMS</td>
<td>Environmental Management System</td>
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<td>EMSA</td>
<td>European Maritime Safety Agency</td>
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<td>EU</td>
<td>European Union</td>
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<td>EWTC</td>
<td>East West Transport Corridor</td>
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<td>FSSD</td>
<td>Framework for Strategic Sustainable Development</td>
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<td>FP</td>
<td>Flexible Platform</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GNP</td>
<td>Gross National Product</td>
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<tr>
<td>IPCC</td>
<td>Inter-governmental Panel on Climate Change</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>LCA</td>
<td>Life Cycle Assessment</td>
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M tonnes  Million tonnes
MEPC  Marine Environment Protection Committee
NGO  Non-Governmental Organization
NOx  Nitrogen Oxides
PSSA  Particularly Sensitive Sea Area
PV  Photovoltaic
RD  Right Direction
ROI  Return on Investment
Safety  Maritime Safety
SC  System Condition
SCLM  Strategic Life Cycle Management
Security  Maritime Security
SOx  Sulphur Oxides
SP I  Sustainability Principle 1
SP II  Sustainability Principle 2
SP III  Sustainability Principle 3
SP IV  Sustainability Principle 4
SWOT  Strength, Weakness, Opportunity and Threat Analysis
UNFCCC  United Nations Framework Convention on Climate Change
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1 Introduction

1.1 The Challenges of Sustainable Development

The world continues to change, grow, and evolve faster and faster in almost all sectors of life. Can we sustain this fast pace? What is happening now and what will happen in the future? What legacy are we leaving for our children? These questions are now being asked more urgently because until very recently, mankind lived within the constraints of nature’s available resources. In earlier nomadic or agrarian societies, one had no choice but to use the resources that were immediately available within a reasonable distance for food, water, dress and shelter. However, during the last 200 years since the industrial revolution, we are now seeing what appears to be serious damage to the natural world (Meadows, et al. 1972; Steffen, et al. 2004; MA 2005). During the industrial revolution, mankind began moving into new unexplored territories and remote parts of the world due to the invention of steam engines and the use of coal for trains and boats, and now the large scale use of fossil fuels to power trucks, tankers and airplanes. As a result, the natural world or biosphere, as we know it, has suffered. As Paul Hawken points out,

“as more people and businesses place greater strain on living systems, limits to prosperity are coming to be determined by natural capital rather than industrial prowess... Today, continuing progress is restricted not by the number of fishing boats but by the decreasing number of fish, not by the power of pumps but depleting aquifers, not by the number of chainsaws but by the disappearance of primary forests.” (Hawken 1999)

He goes on to state that -

“Humankind has inherited a 3.8 billion-year store of natural capital, but at present rates of use and degradation, there will be little left by the end of the next century. This is not only a matter of aesthetics and morality, it is of the utmost practical concern to
society and all people.” (Ibid.)

He concludes with -

“A healthy environment automatically supplies not only clean air and water, rainfall, ocean productivity, fertile soil, and watershed resilience but also such less-appreciated functions as waste processing (both natural and industrial), buffering against the extremes of weather, and regeneration of the atmosphere.” (Ibid.)

The year 1970 is often cited as the beginning of the environmental movement - this is the year of the first Earth Day celebrations. Shortly afterwards, in 1972, the United Nations (UN) held the first conference on the Human Environment in Stockholm. However, the definition of “sustainable development” was not coined until almost 20 years later with the publication of the Brundtland Commission Report in 1987. The Brundtland Commission (formerly known as the World Commission on Environment and Development) was set up in the early 1980s by the UN as an independent body on the environment and development. The Commission, headed by the former President of Norway, G. H. Brundtland, defined sustainable development as:

“Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.” (Brundtland 1987)

This definition was later adopted at the Earth Summit conference in Rio de Janeiro in 1992, and its “Agenda 21” (an action plan for the 21st century) was initiated as a challenge to the world to move in a more sustainable direction (Ny 2006).

Today sustainability is often discussed from the perspective of three pillars: environment, society and economics. In Sweden, sustainability is often associated with the ground-breaking work done by Dr. Karl-Henrik Robèrt, his research colleagues and The Natural Step (Holmberg and Robèrt 2000; Broman et al. 2000; Robèrt 2000; Robèrt et al. 2002). Since 1989, many institutions are engaged with the concepts and principles of sustainability.
These institutions range from governments at all levels (national, regional, local), NGOs, corporations and small businesses. Terms such as “sustainable development,” “corporate social responsibility” (CSR), “sustainable practices,” “triple bottom line” (social, environmental, economic), and “corporate responsibility” are now commonly seen in many government and business reports.

Within the last 20-30 years, these opening sustainability questions have become topics of conversation at all levels of society ranging from government, to universities and schools, to cities, towns and groups of concerned citizens. This question of what does it take to reverse this destructive trend and move towards a sustainable society is an issue that is now widely discussed. The issue is often described in the terms of “sustainability” or “sustainable development.” But one clear answer on how to move towards a more sustainable society has not been agreed upon.

1.2 The Challenges of Sustainable Maritime Transport

To evaluate this overarching issue of sustainability or sustainable development, one sector of society that can serve as a microcosm for analyzing the issue is maritime transport and its related infrastructure. The maritime transport sector is undergoing continued growth, as more and more goods and people are being transported worldwide. The increasing desire and demand for consumer products, often attributed to increasing globalization, means that more trucks, rail cars, and ships are used to move these goods. In addition to the transport of goods, the vacation cruise industry is also rapidly expanding to move more and more tourists around the globe in larger and larger vessels. The maritime sector is not sustainable at its current pace of expansion and its impact on sustainability has perhaps been ignored or unnoticed. A draft report prepared by the United Nations Intergovernmental Panel on Climate Change (IPCC) indicates that “annual emissions from the world’s merchant fleet have reached 1.2 billion tonnes of carbon dioxide (CO2), or nearly 4.5% of all global emissions of the main greenhouse gas.” (The Guardian, April 13, 2008) The emissions from
transport are one key factor that impacts sustainability - there are other factors as well.

The primary reason for expanding maritime transport and its related infrastructure is to move more people and more goods from place to place. The continual consumption of new goods is a major element of contemporary society. Consumerism is not the topic of this study, but it plays a key role in the world becoming more unsustainable. As William McDonough and Michael Braungart point out:

“Imagine what you would come upon today at a typical landfill: old furniture, upholstery, carpets, televisions, clothing, shoes, telephones, computers, complex products and plastic packaging ... Most of these products are made from valuable materials that required effort and expense to extract and make, billions of dollars’ worth of material assets.” (McDonough 2002)

The globalization of the world economy has seen a shift in manufacturing from western countries to Asia and China. Raw materials are globally sourced, sent to China for conversion into manufactured goods and then shipped world-wide to end retail and industrial customers. The system consists of a global logistical supply network consisting of the collection of input materials, the manufacture and production of the raw materials into finished products and the world-wide distribution of these products to end consumers.

The majority of these products and goods are manufactured in one location (most often far away from the consumer) and then transported via maritime transport and other transport methods to the user and eventual recycler, or more likely “disposed of” into the local landfill.

Traditionally, the shipment of goods from Asia to Europe followed shipping routes involving the movement of containers on a long journey to the end consumer in Europe (Figure 1.1). However, with the demise of the Soviet Union, and the development of the transportation network of countries that were formerly part of this entity, a new trade route has emerged. The
advantage of this new network is time-to-market and cost – the intermodal network is significantly faster and less costly. This new trade route involves the intermodal transport of goods using a combination of ship, train, and truck transport.

This study considers the movement and shipment of people and goods in the context of maritime transport. Specifically, the focus of the research is on the East West Transport Corridor - more commonly referred to as the Baltic Transport Corridor (BTC). It is an intermodal transportation network from China to Europe. The path it follows is one of two routes. One route starts in China, transits via railway through the trans-Siberian railway to the ports of Klaipeda or Kaliningrad in Europe. The second route initially uses sea transport from Asia to the Black Sea; the goods are then put on rail transport to Klaipeda or Kaliningrad (Figure 1.1). Once the goods are at these destination ports, the goods are further transported to other destinations in Europe and beyond through an intermodal combination of ship, rail and truck transport.

Figure 1.1 East West Transport Corridor World Context (EWTC 2007b)
As shown in Figure 1.1, maritime transport corridors play a major role in the world transportation map. The Baltic Transport Corridor – the subject of this study, encompasses a global east-west trade corridor between several countries (Russia, Ukraine, Belarus, Lithuania, Sweden, Denmark and Germany). It is strategically located in the centre of Europe and ideally located for the transshipment of goods and passengers from the Far East to European destinations.

1.3 Case Study: The Baltic Transport Corridor

The Baltic Transport Corridor (BTC), often referred to as the East-West Transport Corridor (EWTC) in European Union planning documents, will be used as a case study for this thesis to provide specific examples and a more in-depth analysis of the sustainability issues facing maritime transport. It provides the opportunity to demonstrate methods or planning steps, including the incorporation of “security and safety” measures to move society and the Baltic Transport Corridor towards sustainability. The projected growth of trade volume, from 2003 - 2020 in the Baltic Sea region is estimated to increase by 54 percent (EWTC 2007b). This trade increase is presenting unanticipated challenges as globalization of the world economy expands. The Baltic transport corridor encompasses a global east-west trade corridor between Sweden, Denmark, Germany and Lithuania that ultimately links via Russia to the Black Sea Region and China (Figure 1.2). Its central location in Europe acts as a unique connection linking these regions.

The role of the Baltic Transport Corridor as a major route linking east and west is increasing. In a future sustainable world, the Baltic Transport Corridor can play a leading role due to the volume of trade, but also as a strategic passage and leverage point for sustainable hubs and ports.

The Baltic Sea itself has a finite capacity to absorb or cleanse pollutants because it is bounded on three sides by landmasses and only has a narrow opening for flushing - similarly our biosphere is equally finite. The fact that
the Baltic Transport Corridor has pollution and sustainability issues and subject to future challenges makes it necessary to find solutions now and for the future of the Baltic Transport Corridor; to avoid catastrophes, increasing pollution and other aspects of unsustainable activities.

In other words, from the perspective of the funnel metaphor, the Baltic Transport Corridor is part of a future sustainable transport system. The current unsustainable operations result in more declining resources and increasing negative impacts on the biosphere. The goal is to reverse the trend and rehabilitate the corridor – to make it sustainable.

![Figure 1.2 East West Transport Corridor (EWTC 2007b)](image)

Currently, transportation, planning and infrastructure decisions are made on a national basis, although the trade transport routes are international and cross several countries between Western and Eastern Europe extending to Asia. The ability of the Baltic Sea region to create and maintain a sustain-
able and secure maritime transport corridor is a significant challenge. Transport corridor planning documents and reports discuss this need, however, the planning and management systems to make such a sustainable corridor have not yet been developed.

The European Union (EU) recognizes the importance of integrating the various policies, disciplines and technologies that relate to the oceans and the many activities occurring in the oceans. In October 2007, the European Commission issued an Action Plan (CEC 2007d) outlining numerous projects to move the EU towards an “integrated maritime policy.” The Action Plan was the result of a year-long consultation process in July 2006 with the thought-provoking Green Paper entitled “Towards a Future Maritime Policy for the Union: A European vision for the ocean and seas” (CEC 2006). The Green Paper boldly stated

“So far our policies on marine transport, industry, coastal regions, offshore energy, fisheries, the marine environment and other relevant areas have been developed separately.”

(CEC 2006)

After receipt and synthesis of all the responses on the Green Paper, the European Commission’s October 2007 Action Plan outlined the following projects:

- A European Maritime Transport Space without barriers.
- A European Strategy for Maritime Research.
- National integrated maritime policies to be developed by Member States.
- A European network for maritime surveillance.
- A Roadmap towards maritime spatial planning by Member States.
- A Strategy to mitigate the effects of Climate Change on coastal regions.
- Reduction of CO₂ emissions and pollution by shipping.
- Elimination of pirate fishing and destructive high seas bottom trawling.
- A European network of maritime clusters.
A review of EU labour law exemptions for the shipping and fishing sectors.
- The East West Transport Corridor.
- Baltic Master.

These projects focus on the most important and urgent transport projects for the South Baltic Sea area as a whole. The projects are a regional complement to the Trans-European Networks (TEN) – priority transportation projects agreed upon by the European Commission.

Globally, sustainability has a high level of visibility and importance for governments – particularly the European Union. In addition, the Baltic Sea region is particularly vulnerable in terms of sustainability due to its unique characteristics of being enclosed by industrialized nations and a limited ability to re-circulate its waters with the larger Atlantic Ocean.

There are multiple European Union initiatives under way with multiple recommendations, action plans and programs. However, the Framework for Strategic Sustainable Development is a more comprehensive and strategic tool for identifying and addressing sustainability challenges in the Baltic Transport Corridor or any maritime transport corridor.

### 1.4 Definition of Maritime Security and Safety

Since one of the objectives of this study is to determine whether maritime security and safety could help attain sustainability in the Baltic Transport Corridor, and maritime transport corridors generally, it is of interest to give a clear definition of security and safety.

In terms of sustainability, a robust, scientifically validated definition of sustainability is used for this research - the Framework for Strategic Sustainable Development (FSSD). In the English dictionary, security is defined as “the quality or state of being secure as (a) freedom from danger; (b)
freedom from fear or anxiety. Safety is defined slightly differently, as “the condition of being safe from undergoing or causing hurt, injury, or loss” (Merriam Webster On-Line Dictionary).

In terms of maritime security, the operative definition is the working definition of safety and security presented at the Karlshamn Conference.

“Maritime Security can simply be defined as protection of shipping by sea and in the ports against external as well as internal threats. Threats against the society can consist of terrorist acts, organized crime, trafficking in different ways etc. Safety, can be from all environmental pollution to accidents as the Estonia disaster.” (EWTC 2007)

For the purposes of this thesis, security is defined using the following framework which provides a comprehensive perspective on maritime security and safety.

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Figure 1.3 Security Framework for Maritime Security (Villemin, 2005)
Specifically, security is the defence, protection and control of citizens, assets, shores, borders, littoral areas, offshore areas, maritime control areas and ships against crisis, war, aggression and trafficking. Safety is the search and rescue function, traffic management and control of shores, littoral areas, sensitive sea areas, vessels, platforms and port areas against trafficking, emergency conditions and risks.

1.5 Thesis Objectives and Research Questions

There are many objectives to this thesis. First, to complete an in-depth analysis of maritime transport and its related infrastructure to address the question of how to move towards a sustainable maritime transport corridor; and second, to apply the Framework for Strategic Sustainable Development (FSSD) to the Baltic Transport Corridor as a case study that could be extended to other transport corridors in future research. A further objective is to identify whether maritime security and safety could help attain this goal.

These questions have not previously been fully answered at an integrated, overarching systems level, nor specifically by looking at maritime transport through a sustainability planning lens.

There are numerous separate studies and reports on maritime sustainability, maritime transport and maritime security and safety. There are also separate sets of laws, regulations and policies that cover various aspects of each area. However, little research or analysis has been done on what measures, including security measures could serve as motivating factors to help solve some of the sustainability challenges facing society as maritime transport continues to grow at an accelerated rate.

The focus of this thesis is to complete an analysis of maritime transport corridors and the Baltic Transport Corridor as a case study, and also to address the need of a sustainable and secure and safe maritime transport corridor. In addition, security and safety are addressed in Chapter 4 (“Dis-
discussion”) of this paper as measures that could help move society and the transport corridor to a state of sustainability.

The following thesis research questions have been developed:

Primary Question:

*How could one move towards a sustainable maritime transport corridor?*

Secondary question:

*How could security and safety help attain this goal?*
2 Methods

2.1 Background Theory: The Framework for Strategic Sustainable Development

A structured, strategic systems planning approach, known as the Framework for Strategic Sustainable Development (FSSD), was the primary method used to answer thesis questions and to complete this study. The FSSD is a framework used to identify and evaluate actions that could be used to move the Baltic Transport Corridor towards a “sustainable” state. The following five levels comprise the FSSD.

Systems Level. At this first level, the fundamental characteristics of the complex system are described, including a clear definition of the parts, processes, interrelationships, and functions. When considering sustainability, within the context of the FSSD, the system is society within the biosphere.

Success Level. At this second level, the definition of success is determined by using the principles of the system under consideration. Principles define a generic condition for something specific (Robèrt, et al. 2000), and there will be adverse impacts on sustainability as long as these principles are violated. For the purpose of sustainability, there are four major principles: three principles are based on the natural laws of thermodynamics and conservation of resources (Robèrt 2004); and the fourth principle is based on human needs (Robèrt 2004).

These four sustainability principles (SPs) are the following:

In a sustainable society, nature is not subject to systematically increasing...

(I) Concentrations of substances extracted from the Earth’s crust;

(II) Concentrations of substances produced by society;

(III) Degradation by physical means;
And in that society...

(IV) People are not subject to conditions that systematically undermine their capacity to meet their needs.

![The Funnel Metaphor](image)

**Figure 2.1 The Funnel Metaphor, describing society in its current unsustainable state (Adapted from Robèrt, et al. 2005)**

**Strategy.** This level describes the process for developing strategies in order to arrive at sustainable (success) future. The strategic principles for achieving success in the system determine the strategy. In terms of the FSSD framework, it is necessary to systematically approach the goal of a successful (sustainable) system by using the technique of backcasting - looking back from the future. Backcasting from basic principles of sustainability starts from a future point of success, taking into consideration the four sus-
tainability principles and backcast back to the present to determine what steps need to be taken to reach the future successful state. This is different than forecasting – projecting the current reality into the future (extrapolation).

Backcasting is an essential planning methodology when the system is complex, and when current trends, actions and planning are part of the systemic problem. Backcasting means that the starting point of any planning is the envisioned, successful future outcome, and then strategic planning is directed towards this outcome from the present.

The actual process to arrive at a strategy is through the use of the ABCD process to systematically backcast from the future.

Figure 2.2 The ABCD Process – The Framework for Strategic Sustainable Development (Robert, et al. 2004)

A: Awareness of the problem and the construction of a shared mental model
B: **Baseline** of the system. Analyze the current status of the system today by listing the current flows, practices and conditions that violate the sustainability conditions. This level of the analysis assists in defining the scope of the system and focuses attention on the areas requiring remediation.

C: **Visioning**. This step involves visioning a sustainable successful future (open the walls of the funnel). It is accomplished by applying the sustainability constraints of the sustainability conditions and considering the alternatives that would achieve success for the system under consideration. In this case, the process is to apply the sustainability constraints to the Baltic Transport Corridor and consider the alternatives that would achieve a sustainable corridor.

D: **Prioritization**. Setting and managing priorities from the ‘C’ list and creating action plans. The strategic guidelines for prioritizing measures from the ‘C’ list are:

- Return on Investment (ROI) - both in monetary and non-monetary terms, to sustain future progress?
- Step in the right direction?
- Flexible platform for future progress?

**Actions.** At this fourth level, one decides which tangible measures or concrete steps should be taken to achieve success that is consistent with the strategic guidelines.
Tools. At this fifth level, one determines the strategic tools and concepts used to most effectively follow up and implement the actions that have been strategically selected to attain the vision of success within the system. There are a wide range of tools that can be used to ensure that the selected actions lead towards the vision of a sustainable maritime transport system. These tools range from: metrics to measure the relevance, quality or quantity of various activities; teaching measures to increase educational capacity; laws, policies and agreements; new surveillance technologies, and other monitoring devices; and environmental and security management systems using indicators or other devices to track and monitor progress towards one’s goals and vision.

2.2 Methodology

The methods used to conduct this research were initially designed to answer the research questions in a linear fashion for the Baltic Transport Corridor, as follows (Figure 2.3):

- Literature survey of sustainability, security and safety in maritime transport and specifically in the Baltic Transport Corridor (see 2.2.1 Literature Review)

A review of the current body of knowledge on the topics of sustainability, security and safety in the Baltic Transport Corridor.

- The Framework for Strategic Sustainable Development (FSSD) Analysis (see 2.2.2 Application of the FSSD to Research Questions)

The application of the five level (FSSD) framework to analyse sustainability, security and safety in the Baltic Transport Corridor.

- Causal Loop Diagram (CLD) analysis (see 2.2.3 Causal Loop Diagram)
The application of Casual Loop Diagrams to visually analyse and communicate the cause – effect relationships of elements of sustainability, security and safety in the Baltic Transport Corridor.

- Linkage Analysis - Identification of Linkages and Synergies (see 2.2.4 Linkage Analysis)

An analysis and visual communication of the linkages and synergies of elements of the Baltic Transport Corridor.

- Survey questionnaire (see 2.2.5 Survey Questionnaire)

A survey sent to practitioners in the Baltic Transport Corridor (BTC) canvassing their views on sustainability, security and safety in the BTC.

This linear approach was first decided upon because the initial topic for this thesis was the potential use of security and safety as measures to accelerate sustainability for maritime transport. This idea was generated after the authors of this thesis attended several conferences on the Baltic Sea transport corridor and observed conference participants raising the issue of a need for a green transport corridor for the Baltic Sea. Therefore, the first stage of research focused exclusively on the history and operations of the Baltic (Sea) Transport Corridor; specifically from a sustainability, security and safety perspective.

Thus, the resulting analysis became much more iterative than was originally anticipated (see Figure 2.3). In addition, certain methods of analysis were not as fruitful as hoped, such as the survey. However, as the research progressed and knowledge was gained, the research programme was redirected to incorporate the findings and extend the analysis. Other planning methods, such as the identification of linkages and synergies and causal loop diagramming were more productive analytical tools than originally anticipated to answer the three research questions.

In the end, multiple phases of research and analysis were conducted, as
shown in figure 2.3. The analysis phase, especially to establish the dynamic relationship between maritime transport, sustainability and security-safety relied primarily on the identification of linkages and synergies, and the FSSD planning method. But due to the complexity of the overall system and the various sub-systems, the analysis also relied heavily on causal loop diagramming and linkage analyses. These visual, multi-dimensional planning methods were used to identify and synthesize the key sustainability issues and potential measures to help move towards a more sustainable maritime transport corridor. While all the methods were initially used, the FSSD analyses and templates, combined with causal loop diagramming and linkage analyses were the most fruitful tools for evaluating, organizing, and developing an initial list of sustainability measures for this complex topic.

Figure 2.3 Diagram Showing Thesis Methodology
The results of the analysis of the Baltic Transport Corridor using the FSSD framework are expected to provide an initial working level of knowledge of sustainability issues for the Baltic Transport Corridor. The use of the FSSD methodology provided a method of providing structure to the understanding of such a complex system and a basis for moving towards a sustainable transport corridor generally and specifically a sustainable Baltic Transport Corridor.

Finally, the use of causal loop diagrams (CLDs) provided a visual integration of the research methodology. The development of a CLD diagram of maritime transport systems provided a visual representation of the interrelationships sustainability, security and safety in maritime transport systems.

2.2.1 Literature Review

The initial starting point was a literature review – a survey of the issues of sustainability, security and safety in maritime transport generally and the Baltic Transport Corridor specifically. The literature review was conducted in several phases over a period of five to six months as the thesis topic and thesis questions evolved. During the initial stages of developing the thesis proposal, the initial research was conducted on-line by using Internet search engines. The focus was to research whether the disciplines of "security" and "sustainability" had been linked together in terms of being mutually synergistic. Initial results of the literature review conducted in late 2007 indicated "security" was considered a separate and unrelated discipline from "sustainability." However, beginning in early 2008, a much more extensive literature review was conducted on-line, as well as by researching publications available through the library at the Blekinge Technical Institute (BTH). This second phase was done as part of a report prepared by the thesis team for the East-West Transport Corridor (EWTC) (Johnson, et al. 2008).
The results of this second review revealed that "security" and "sustainability" had already been linked for planning purposes by both the European Union in various white papers and by the U.S. Environmental Protection Agency in guidance documents for managing port operations. A final round of literature review was conducted while drafting the thesis in the spring of 2008. The purpose of this effort was to learn more about systems analysis, life cycle analysis of port operations, and to provide a deeper understanding of sustainability issues related to train, truck, maritime transport and port operations. The final review phase was conducted on-line and through the review of books, published articles and other Masters' theses available from the Blekinge Technical Institute's library. By conducting the research in an iterative manner during three separate phases over approximately six months, it was possible to ensure the search result was sufficient and representative of the latest research on the topic.

This provided a basis of understanding of the issues confronting transport corridors. In addition, the knowledge and understanding were valuable inputs to the next level of analysis – the application of the Framework for Strategic Sustainable Development (FSSD).

2.2.2 Application of the FSSD to Research Questions

Backcasting strategically from a sustainable society and a sustainable Baltic Transport Corridor is the key focus of the analysis. It will help answer the sustainability questions and issues in the Baltic Transport Corridor and maritime transport corridors generally.

The Framework for Strategic Sustainable Development will be used as the primary method to analyze sustainability in the Baltic Transport Corridor. Specifically, a vision for a sustainable maritime transport corridor is developed and then the ABCD process is used to clearly identify gaps and possible solutions and determine actions that could help fill the sustainability gap. The process will be used to lead to the vision of success – a future sustainable Baltic Transport Corridor.
Since the FSSD framework is such a strategic systems approach that has been established purposefully for “sustainability,” as previously mentioned, it forms the basis for the thesis analysis (Robèrt 2000; Holmberg and Robèrt 2000; and Broman, Holmberg and Robèrt 2000). Recently, researchers at the Blekinge Institute of Technology have expanded the application of the FSSD’s five level planning model to include life-cycle assessments (Ny, et al. 2006) and sustainable product development (Byggeth, et al. 2006). Some of this later research also has applications to this thesis study. As previously mentioned, the FSSD is a five level model.

However, when trying to identify the key sustainability issues and applying the FSSD planning process, it was necessary to look more closely at both the overall maritime transport system and the various sub-systems or sub-modes of transport and transport operations (truck, train, ship, and port) to get the proper “bird’s eye perspective” to complete the analysis.

The results of the analysis of the Baltic Transport Corridor using the FSSD framework are expected to provide an initial working level of knowledge of sustainability issues for the Baltic Transport Corridor.

The FSSD was originally developed to be used for planning for sustainability, as previously discussed. However, for the purposes of this thesis analysis, one of the initial steps was to develop the following “double-template” of the five-level framework to initiate an evaluation of the relationships between sustainability and security and safety.
Table 2.1 Hypothetical Relationships between sustainability and security

<table>
<thead>
<tr>
<th>Five level planning framework</th>
<th>Framework for Strategic Sustainable Development (FSSD)</th>
<th>Strategic Security Planning Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM</td>
<td>Maritime transport in Baltic Sea Region within society, within the biosphere.</td>
<td>Maritime transport in Baltic Sea Region within society, within the biosphere.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transport corridor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marine environment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information technology and communication network.</td>
</tr>
<tr>
<td>Five level planning framework</td>
<td>Framework for Strategic Sustainable Development (FSSD)</td>
<td>Strategic Security Planning Framework</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>SUCCESS</td>
<td>Activities do not systematically:</td>
<td>Activities do not:</td>
</tr>
<tr>
<td></td>
<td>- Increase concentrations of materials extracted from the earth (i.e., fossil fuels).</td>
<td>- Undermine ability to maintain a secure and safe transport corridor for movement of ships, goods &amp; people</td>
</tr>
<tr>
<td></td>
<td>- Increase concentrations of persistent man-made substances (i.e., release of harmful chemicals).</td>
<td>- Undermine ability to maintain a secure and safe marine environment (protection of natural resources)</td>
</tr>
<tr>
<td></td>
<td>- Degrade nature by physical means (i.e., damage marine ecology).</td>
<td>- Undermine ability to maintain a secure information technology and communication network</td>
</tr>
<tr>
<td></td>
<td>- Restrict people’s ability to meet their human needs.</td>
<td>- Undermine ability to maintain physical security</td>
</tr>
<tr>
<td>Five level planning framework</td>
<td>Framework for Strategic Sustainable Development (FSSD)</td>
<td>Strategic Security Planning Framework</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>STRATEGIC GUIDELINES</td>
<td>Backcasting using the ABCD process and its three prioritizing questions:</td>
<td>Application of prioritizing questions to security and planning:</td>
</tr>
<tr>
<td></td>
<td>1. A step in the right direction?</td>
<td>1. A step in the right direction?</td>
</tr>
<tr>
<td></td>
<td>2. A flexible platform for future actions?</td>
<td>2. A flexible platform for future actions?</td>
</tr>
<tr>
<td></td>
<td>3. A sufficient return on investment (ROI)?</td>
<td>3. A sufficient return on investment (ROI)?</td>
</tr>
<tr>
<td>ACTIONS</td>
<td>Actions to move maritime transport towards sustainability.</td>
<td>Actions to move towards a secure and safe maritime transport corridor.</td>
</tr>
<tr>
<td>TOOLS</td>
<td>Tools to move maritime transport towards sustainability.</td>
<td>Tools to move towards a secure and safe maritime transport corridor.</td>
</tr>
</tbody>
</table>
The above five level framework for security and safety is strictly a hypothetical model. It is provided as a means for comparison and structuring the understanding how security and safety could relate to sustainability. The Framework for Strategic Sustainable Development was not applied to security and safety. Rather, security and safety were analyzed from the perspective of whether they can help or hinder sustainability.

A basic and working understanding of security and safety is necessary for analysis - the definition of safety and security outlined in Figure 1.3 (Security Framework for Maritime Security) provides a working definition of these topics. Further detailed study, outside the scope of this research, is necessary to refine these definitions. However, by applying the Framework for Strategic Sustainable Development to maritime transport and the Baltic Transport Corridor and incorporating elements of security and safety to the analysis, sustainability of the corridor is enhanced. A safe and secure corridor is, in turn, a more sustainable corridor.

### 2.2.3 Causal Loop Diagram

The use of causal loop diagrams (CLDs) provided a visual integration of the research methodology. The development of a CLD diagram of maritime transport systems provided a visual representation of the interrelationships sustainability, security and safety in maritime transport systems.

Additional systems analysis and causal loop diagrams played an important backup role to the application of the FSSD to evaluate and identify measures for moving towards a sustainable maritime transport corridor. Maritime transport is a conceptually complex system with multiple sub-systems. The thesis initially evolved from a specific hypothesis that “security/safety” measures were necessary or could enhance the objectives of creating a “sustainable” maritime corridor, additional systems analysis and causal loop diagramming were very helpful tools for seeing the larger picture versus just one specific aspect. This additional analysis clarified the role that “security/safety” can play to address specific sustainability issues, but not the
full suite of variables, as presented in Chapter 3 (Results) and discussed in Chapter 4.

2.2.4 Linkage Analysis - Identification of Linkages and Synergies

“Systems thinking” is an interdisciplinary field of science that investigates the principles common to complex entities and studies their relationship in nature, society and science. It usually involves establishing a framework that can be used to analyze and describe how a group of goals, ideas, tasks or other objects may work in concert to produce a specific result. Systems thinking requires looking at a complex entity or entities holistically, not as separate parts or disciplines, because these entities can be influenced and can interact with each other creating a dynamic system or something other than what one sees if one only looks at one part in isolation (Senge 1990; Jackson 2003).

A strategic systems thinking approach was applied to the thesis research questions resulting in the identification of linkages and synergies. Linkage analysis was applied to identify the interconnections of sustainability, safety and security elements. The linkages involved the interaction of policies, operations and elements of transport corridors to the research questions. Subsequent analysis was applied to determine synergies of characteristics of transport corridors to determine a comprehensive coverage of sustainability, security and safety to the application of transport corridors and the Baltic Transport Corridor in particular.

2.2.5 Survey Questionnaire

A noteworthy feature of sustainability issues in the Baltic Transport Corridor is the large stakeholder group and overlapping European Union competencies that impact sustainability. The use of the FSSD methodology provided a method of providing structure to the understanding of such a com-
plex system and a basis for moving towards a sustainable transport corridor generally and specifically a sustainable Baltic Transport Corridor.

A survey questionnaire on both sustainability and maritime security and safety was developed based on the initial FSSD analysis and was sent (emailed) to practitioners in the Baltic Transport Corridor including port authorities, transportation authorities, shipping companies, academics and other interested parties. The expected outcome of the results of the survey was to provide an initial identification of the sustainability issues facing the Baltic Transport Corridor. In addition, it was expected the survey would provide a level of confirmation or validation of prior study research. A further expected outcome of the survey was to provide an identification of sustainability issues requiring further research and analysis - based upon practitioner experiences and day to day operations. A final expectation of the practitioner survey was to identify any gaps in the research study that had not been considered.
The result of the research study involved the use several research methodologies to answer the research questions (Figure 2.4). The research methodology was iterative and dynamic in nature. The research started with a literature review and participation in conferences to provide background for the study. The Framework for Strategic Sustainable Development was developed to analyze sustainability in a structured manner and to determine the ‘gap’ and develop a ‘vision’ for a sustainable Baltic Transport Corridor. As the research progressed, security and safety elements were added to the research and developed through literature research and analysis. Subsequently, Causal Loop Diagrams and linkage analysis were developed to integrate the study topic and provide a graphical understanding of the inter-relationships. Finally, a survey questionnaire was developed that provided a limited practitioner feedback on the topics of sustainability, security and safety.
3 Results

The purpose of this chapter is to summarize the results and findings from the literature research, FSSD analyses, practitioner survey and causal loop diagram analysis that were undertaken as part of this thesis study.

This chapter also identifies key focus areas and actions that could be taken to answer the research questions and move maritime transport towards a sustainable state in the future.

The Framework for Strategic Sustainable Development will be applied to the analysis of maritime transport corridors and specifically the Baltic Transport Corridor. The power of the framework is to provide a mechanism to strategically analyze the sustainability of an activity and determine a vision and process to achieve the vision of sustainability. The vision for a sustainable Baltic Transport Corridor and thus a maritime transport corridor in the future is:

*In a future sustainable society, maritime transport in the Baltic Transport Corridor complies with all four sustainability conditions (SP I – IV). In addition, transportation of goods is rationalized to ensure goods and people are transported efficiently.*

A further feature of the vision for a sustainable maritime transport corridor is one which is both safe and secure. The contribution of security and safety to the sustainability of the corridor is the subject of this research. This chapter also identifies key focus areas and actions that could be taken to answer the research questions and move maritime transport towards a sustainable state in the future. The use of strategic backcasting from a vision of a successful sustainable future will help identify measures and actions to move the Baltic Transport Corridor towards a sustainable future state. This is the success of the system and the objective of the research.
Strategically, the ABCD process will guide and help identify actions to be implemented to fill the gap between the current reality and the vision of a future sustainable Baltic Transport Corridor. In addition, the analysis is of general applicability to maritime transport corridors.

The following research activities and analyses are given separate sub-sections:

- Acknowledgement of the System
- Maritime Transport Conferences
- Literature research
- The Success in the Baltic Transport Corridor system
- Identifying Recommended Strategic Actions and Tools
- Survey Results and Analysis
- Results of Causal Loop Diagram Analysis

It is important to note the need to first identify the subject system of the study - the Baltic Transport Corridor (as a case study to other maritime transport corridors) and its boundaries. It is also important to define the success level in the system - to comply with the FSSD sustainability principles.

### 3.1 Acknowledgement of the System

For the purpose of this thesis, the first step was to identify the primary system being analyzed, the maritime transport system, and specifically the system for the Baltic Sea transport corridor (the case study for this thesis). This involved identifying goods and people are moved within the transport corridor works (the flow patterns) and what strategic changes are needed to decrease potential negative impacts on natural resources and the social network as trade and transport demands increase. It also meant identifying the security and safety systems that operate within the transport corridor and their relationship to the transport systems and sub-systems because one of the initial primary objectives of this thesis was to evaluate whether security and safety can lead towards a more sustainable transport corridor.
In terms of this study, the general assessment is that the Baltic Transport Corridor is considered as whole system – the corridor within society, within the biosphere.

Four subsystems were identified as main components representative of all subjects for subsystem analysis:

- Train transport
- Truck transport
- Ship transport
- Port transport operations

These modes of transport exclusively represent the possible means of transportation currently in use in the Baltic Transport Corridor.

The analysis involved identifying the movement (transportation) of people and goods within the transport corridor flow (the flow patterns). The next step was to identify what strategic changes are necessary to bring transport corridors generally and the Baltic Transport Corridor specifically towards a vision of sustainability; decrease potential negative impacts on natural resources and the social network as trade and transport demands increase.

To conceptualize the transportation system, imagine shipping a container from Gothenburg, Sweden travelling via truck or train to Karlshamn, Sweden, then via ship to Klaipeda, Lithuania or making the reverse trip. This transport corridor is a complex system. Within this overall transport system, there are multiple sub-systems, each with their own individual characteristics, relationships and processes. Each of the main transfer points for the shipping container is a specific sub-system: the warehouse in Sweden, the train system, the trucking system, the port in Sweden, the ship, the port in Lithuania, and the process repeats itself depending on the shipping direction and the start point (Figure 3.1).
While these sub-systems operate somewhat autonomously, there is a growing trend for a transport coordinator (which can be a trucking or container company or an independent management entity) to take responsibility for the movement of a specific container or cargo shipment from the point of origin to the final destination.

On the other hand, the size and geography of the Baltic Transport Corridor means there is a large constituent group of stakeholders: individuals, communities, regions, international organizations, the European Union and the Russian Federation. In addition, there are stakeholders outside of the Baltic region that need to be considered – including points of origin and points of termination of the passengers and cargo that transits the corridor. Specifically, much of the cargo originates in the Orient, transits through Russia, Ukraine, Belarus and other land-sea transportation routes - finally terminating at points in the Baltic, the European Union and beyond. As such the constituent stakeholders need to be rationally organized into logical groupings and their needs assessed from that point of view (Appendix F.2: BTC - Maritime Transport Corridor Stakeholders).
It becomes much more complex when one integrates the maritime transport system (with its multiple subsystems of train, truck, ship and port) with the security and safety system, and then ultimately integrates these two separate systems into the biosphere (Figure 3.2). The entire transport system is contained within a security and safety system, which in turn is contained within the planet’s environment, and then the biosphere. In addition, to the physical shipping and transfer points and their relationship to each other, there are also organizational and societal systems that relate to these systems, including the social system, the ecological system, and the economic system, to name a few. As this thesis attempts to answer the research questions, various analytical techniques such as FSSD templates and causal loop diagrams will be used to identify the dynamic relationship between these various systems and the potential synergies or impacts of one action to influence another action or response.
This stage of systems analysis was undertaken as an adjunct step to validate and further assess various focus areas and sustainability measures that were identified during the FSSD analysis, the literature review, the linkage analysis and the survey results. Measures were identified to lead towards a vision of sustainability - including security and safety measures that formed the baseline hypothesis for this thesis study. Further causal loop diagramming conducted as part of this later analytical effort helped resolve some of those issues.

Figure 3.2 Factors of the Maritime Transport System
In terms of sustainability, three major stakeholders have been identified for analysis and consideration. The three major groups are governments & authorities, corporate entities (business) and residents (local community) impacted by the activity in the Baltic Transport Corridor (Figure 3.3). While other stakeholders are important, for the purposes of analysis, their sustainability issues are considered to be incorporated in the three primary stakeholder groups.

In terms of governments, they are responsible for representing the constituents of their respective region and they are the interface between the public (and their constituent interests) and activities of the corridor. They influence decision making in terms of regulation and finance and the interests of the community at large. Specifically, they are the representatives for the local community.

The corporate (businesses) represent the major users of the Baltic Transport Corridor since they are the major financial constituents and generate the economic activity of the corridor. There is an expected rise in economic activity of the corridor due to the ongoing political and economic integration occurring in the European Union. In addition, the trade in the corridor is expected to significantly increase in volume in the coming decade.

The final constituent group is the residents (local community) who have family, social, economic and political interest in the activities of the Baltic Trade Corridor.
The major stakeholders are key agents in moving the Baltic Transport Corridor towards sustainability. They represent constituents with major vested interests in the corridor and have positional, social, economic and political power to influence the outcome of sustainability initiatives in the corridor.

3.2 Maritime Transport Conferences

As part of the research for the study, the authors attended two conferences on the East West Transport Corridor (EWTC) for the Baltic Sea Area. The purpose of attending the conferences, listening to the presentations and talking to the conference participants and speakers was to gather background information about the transport corridor, to identify and meet key stakeholders and researchers connected to the transport corridor, and to learn about planning efforts by the officials responsible for the corridor (both military and civilian) in regards to both “sustainability” and “security and safety.”
The first conference attended by the thesis authors was the “Maritime Security with Focus on Harbour Safety” Seminar hosted by Blekinge Institute of Technology held in Karlshamn, Sweden, on October 16-17, 2008. The conference was the first introduction to the challenges facing the EWTC regarding security and safety, including an overview of the latest in security technologies used to provide state-of-the-art surveillance of port activities. The presentations about port operations, including sustainability challenges, from port representatives of Rostock, Germany and Karlshamn, Sweden were of particular interest.

The thesis authors first became aware, after attending this conference, of the large-scale planning efforts underway for the Baltic Sea area, including the support and involvement of the European Union (EU), and the need for a green transport corridor.

The East-West Transport Corridor Final Conference – Vilnius, Lithuania 10 – 11, December 2007 highlighted a number of challenges and opportunities facing the Baltic Transport Corridor. The first challenge is the poor transportation infrastructure of the member states of the corridor – including bottlenecks, congestion in the transportation systems and a lack of modernized rail systems. A further challenge is pollution and increased CO2 emissions in the corridor. The low economic growth of the region needs to be addressed in terms of sustainable economic growth in the region and facilitate its integration into the global economy by improving the transport and logistics systems. (EWTC, “Challenges of the Corridor Development”)

Therefore, the attendance at the conferences provided a valuable opportunity to meet practitioners and develop a first-hand knowledge of the issues facing the corridor development. In addition, it provided an understanding of the degree of awareness and incorporation of the issues of sustainability, security and safety in decision making.
3.3 Current Reality based upon Literature Review

The literature review was conducted in various stages. An initial literature review (survey) was completed very early in the thesis study as the topic was being developed and discussed. An in-depth, first stage of literature review was conducted for the first phase of the Framework for Strategic Sustainable Development (FSSD) analysis and sustainability principle (SP) analysis was conducted and the first two chapters of the thesis were drafted. Several months later, in order to answer unresolved issues or questions about what other measures including “security and safety” should be considered, a second phase of deeper research and literature review was conducted. The results of this comprehensive literature review revealed the following findings about the current state of “maritime transport” in relation to moving towards “sustainability,” with or without the help of “security/safety,” as summarized below.

3.3.1 EU Maritime Policy and Planning

The EU is concerned and places a high value on both sustainability and security and safety for maritime transport. However, as mentioned previously, the integration of various maritime activities, policies and plans is still a plan for the future. In July 2006, the Commission of the European Communities (CEC), presented a provocative Green Paper entitled “Towards a Future Maritime Policy for the Union: A European vision for the ocean and seas” (CEC 2006). The CEC received over 490 responses (an unprecedented amount) to the Green Paper from stakeholders (Ibid). The paper did not identify safety and security as major topics. However, safety/security linkages were identified when discussing the following areas: sustainability (Ibid.), risk assessment (Ibid.), managing the land/sea interface (Ibid.), data management systems (Ibid.), spatial planning (Ibid.), financial support (Ibid.), and overall maritime governance (Ibid.).
After receipt and synthesis of all the responses, the European Commission’s October 2007 Action Plan (CEC 2007) outlined the following projects:

- A European Maritime Transport Space without barriers
- A European Strategy for Maritime Research
- National integrated maritime policies to be developed by Member States
- A European network for maritime surveillance
- A Road map towards maritime spatial planning by Member States
- A Strategy to mitigate the effects of Climate Change on coastal regions
- Reduction of CO2 emissions and pollution by shipping
- Elimination of pirate fishing and destructive high seas bottom trawling
- An European network of maritime clusters
- A review of EU labour law exemptions for the shipping and fishing sectors

Prior to the issuance of the Green Paper, many stakeholders in the Baltic Sea Region had already begun to research and study various maritime transport issues. Many of these studies are still continuing today. A large amount of individual, but connected studies, regarding marine transport and its potential economic, logistical, environmental, safety and social impacts on the Baltic Sea have been underway since the late 1990s, and especially beginning in 2000. These studies are the Interreg IIC (1997-1999) and Interreg IIIB (2000-2006) Community Initiatives, and the recently started, third joint co-operative undertaking, the Baltic Sea Region Programme 2007-2013 (BSR 2007), with eleven countries around the Baltic Sea.

However, in terms of the Baltic Transport Corridor, the EWTC project developed the following conceptual long-term vision for the corridor that states:

“the East West Transport Corridor is an efficient Transport Corridor with close co-operation between interlinked hubs; meeting the market demands for growing freight transports to and from Scandinavia and Lithuania in more environmentally-friendly transport solutions. The
corridor stands out as a green corridor and is part of the Trans-European Network.” (EWTCb).

Interestingly, although the terms “green corridor” and “environmentally-friendly” are included in this “vision” for the future, the picture painted is one of “efficient development” or increased and more effective transport, not necessarily embracing or acknowledging the broader and more sustainable objectives outlined in the recently published 2007 EU Action Plan for an integrated maritime policy.

3.3.2 Social Sustainability

As the EU points out “more and more Europeans wish to live and to work in our coastal regions and islands, because of the growing economic opportunities they offer and the attractiveness of the coastal environment . . . however, only if we can strike the right balance between economic development and environmental sustainability can we ensure that the quality of life in our coastal regions continues to grow along with their GDP” (CEC 2007b)

Another potential impact on social sustainability is more insidious – the predicted severe impact that climate change (CEC 2007a) is likely to have on coastal regions with rising sea levels, erosion, coastal flooding, and storms (CEC 2006).

Port consolidation could also have social impacts by effecting income and employment. State-of-the-art port operations will be the trend in the future as a result of evolving environmental and security requirements. There will also be increased emphasis on “efficiency” of intermodal transport to ensure ports are economically competitive. Those ports with superior infrastructures (ship, rail, truck) for managing smooth traffic flows will receive preferential financial and infrastructure support to expand the scope of their
operations – largely to the detriment of smaller ports by diverting resources and trade away.

3.3.3 Security and Safety

The current focus in security is not just on potential risks from unlawful acts or terrorism impacting maritime operations, but also on “safety” and protection of the maritime environment (CEC 2006). In response to the Erika disaster (sinking of an oil tanker off the west coast of France in 1999), the European Maritime Safety Agency (EMSA) was created in 2002. The purpose of the agency is “to reduce the risk of maritime accidents, marine pollution from ships and the loss of human life at sea” (Swedish Maritime Administration 2006). However, safety at sea in regards to pollution has been a concern since the 1970s. The International Convention for the Prevention of Pollution from Ships (MARPOL) was adopted by the IMO in November 1973 to cover pollution by oil, chemicals, and harmful substances in packaged form, sewage and garbage. In response to several tanker incidents in 1976-1977, the Convention was modified by the 1978 MARPOL Protocol (which was adopted at a 1978 Conference on Tanker Safety and Pollution Prevention). Measures relating to tanker design and operation were also incorporated into the 1978 MARPOL Protocol (IMO 2008).

Another new type of security risk facing the Baltic Sea is “biosecurity.” A risk assessment report was recently completed on the discharge of ballast waters from ships into the Baltic Sea and the corresponding risk of introducing “aggressive invaders [invasive alien species] … that “represent a threat to the biosecurity (emphasis added) of most coastal countries of the world” (Leppakoski 2006). The report recommends a “basin wide early warning system for taking rapid and effective action” (Leppakoski 2006), if a release should occur, and identifies the need for a method to “identify high-risk ships or shipping routes through risk assessment” (Leppakoski 2006).
The Baltic Region also experiences some of the same security issues facing other parts of the EU. Again, the EU points out “the growing need to identify, intercept and indict individuals engaging in smuggling, trafficking of human beings, illegal fishing, clandestine immigration and terrorism” (CEC 2006). To combat these issues, considerable resources need to be spent on “surface, air and satellite surveillance and vessel tracking systems” (CEC 2006). The EU’s 2001 White Paper also mentions other security/safety issues related to globalization and requiring international solutions, such as “abuses of flags of convenience on ships or social dumping in the road transport sector” (EU 2001).

In the future, research and development of new and emerging technologies will have an important role to play in security/safety and other management aspects of maritime transport, according to the EU. Devices such as the digital tachograph (records speed and driving time over longer periods of time) or other tracking devices used in GSM cell phone technology can be employed to ensure goods and people are being moved when and where they are supposed to be. Other devices such as the Galileo satellite surveillance programme also can perform tracking functions for vehicle and ship transport (EU 2001).

3.3.4 New Research and Technology

In the area of marine and maritime transport-related research, the EU identified research as a key element in its future “all-encompassing” maritime policy. It considers research “the cornerstone that supports competitiveness and sustainable development in line with the three pillars… (economic, social and environmental)” (CEC 2006b). Implementation of an integrated maritime transport policy needs to be “supported by excellence in marine scientific research, technology and innovation” (Ibid.).

The EU also has developed lists of needs and activities related to security and safety. The EU’s 2006 Green Paper recommends increased resources
are allocated for surface, air and satellite surveillance and vessel tracking systems (CEC 2006a).

### 3.3.5 Operations Planning, Education and Training

The literature review also revealed that planning efforts are well underway in some countries to begin to incorporate not only “sustainability” planning and management into day-to-day maritime transport operations, but also “security and safety” management. Perhaps most notable is the maritime operations planning work, including education and training efforts underway in Sweden at the World Maritime University in Malmo. In conjunction with the Swedish Maritime Administration and the International Association of Maritime Universities (IAMU), Sweden is making good strides in this direction. In 1999, the IAMU was established by 7 universities from the five continents of the world, and today 47 universities are now cooperating in various IAMU activities. The IAMU embraces the overarching framework of United Nations activities, including its goals of sustainable development and human rights. Its goals include “the establishment of a comprehensive global maritime education system and standardized undergraduate curricula” (IAMU 2008). The IAMU has held annual conferences in Malmo since 2000 and the title of its 6th Annual General Assembly conference was “Maritime Security and Maritime Education and Training.” Extensive research and publications are generated by the IAMU with direct application to this study.

### 3.4 The Success in the Baltic Transport Corridor system

In terms of sustainability, the success for the Baltic Transport Corridor is that it complies with the four sustainability principles (SP I – IV) and contributes to sustainability in society in the biosphere.
Activities in the Baltic Transport Corridor then should not systematically:

(I) Increase concentrations of materials extracted from the earth’s crust (i.e. fossil fuels).

(II) Increase concentrations of substances and persistent materials produced by society (i.e., release of harmful chemicals).

(III) Increase nature degradation by physical means (i.e. damage marine eco-systems).

(IV) Undermine and restrict people’s ability to meet their needs.

The vision of a sustainable Baltic Transport Corridor and thus a secure and safe maritime transport corridor should conform to the constraints of the four sustainability principles described above (section 2.1 and section 2.2).

The vision for a sustainable Baltic Transport Corridor and thus a maritime transport corridor in the future is:

In a future sustainable society, maritime transport in the Baltic Transport Corridor complies with all four sustainability conditions (SP I – IV). In addition, transportation of goods is rationalized to ensure goods and people are transported efficiently.

The objective of the analysis in this chapter is to determine the sustainability deficiencies and gaps of the Baltic Transport Corridor for attaining the vision of a future sustainable Transport Corridor. This discrepancy (gap) will provide focus to the actions necessary to move the Baltic Transport Corridor to a sustainability state.

In terms of the contribution of security and safety measures to enhance sustainability in maritime transport corridors and towards this vision of a sustainable Baltic Transport Corridor, the “double” five-level framework (Table 3.1) template was only used initially. Further systems analysis and causal loop diagramming identified other causal relationships and measures
for sustainability besides just security/safety. However, the advantages of using this “double” template five-level planning framework to evaluate the relationship between sustainability and security and safety were multi-fold, as follows:

- At the first level, the template highlights that both sustainability and security/safety could be applied to the Baltic transport corridor, the case study;
- Identifies that the definition of “success” for both sustainability and security/safety is very similar - each objective is concerned with the welfare of mankind and the environment;
- At the third level of “strategy,” it shows that both sustainability and security/safety are very intertwined with using similar strategic questions and decision points to decide whether specific measures will be effective or not to reach goals.

The analysis indicates that at the “action” and “tools” levels, there are policy options in terms of linkages and synergies that can enhance sustainability in maritime transport corridors.

### 3.5 Identifying Recommended Strategic Actions and Tools

Backcasting strategically from a sustainable society and a sustainable Baltic Transport Corridor is the key aspect of the analysis that will answer the questions raised in this study – sustainability of the Baltic Transport Corridor.

The ABCD process will be used as the analytic tool of the Baltic Transport Corridor (Figure 1.2). The ABCD process is a structured tool to guide the analysis process towards success - a sustainable Baltic Transport Corridor.

“A” step analysis
The first step was to take a high level assessment (‘A’ step) of maritime transport corridors with specific emphasis on the Baltic Transport Corridor (BTC). In addition, the authors of this study attended the final conference of the East-West Transport Corridor, Vilnius December 10 -11, 2007. The conference provided a high level overview of the current reality and level of awareness of sustainability issues on the part of conference attendees and the need for a shared mental model of sustainability in the Baltic Transport Corridor. The objective of the analysis is to develop and communicate a shared mental model – a vision of a sustainable corridor to the stakeholders of the Baltic Transport Corridor.

Table 3.1 FSSD applied to Maritime Transport Corridor

<table>
<thead>
<tr>
<th>System</th>
<th>Maritime Transport Corridor (case study – Baltic Transport Corridor) within society within the biosphere including truck, train, ship and port subsystems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>Maritime Transport Corridor contributes towards a sustainable society by eliminating contributions to violations of the sustainability principles. Maritime Transport Corridor complies sustainability principles I – IV.</td>
</tr>
<tr>
<td></td>
<td>Activities do not systematically:</td>
</tr>
<tr>
<td></td>
<td>– Increase concentrations of materials extracted from the earth (i.e., fossil fuels).</td>
</tr>
<tr>
<td></td>
<td>- Increase concentrations of persistent man-made substances (i.e., release of harmful chemicals).</td>
</tr>
<tr>
<td></td>
<td>– Degrade nature by physical means (i.e., damage marine ecology).</td>
</tr>
<tr>
<td><strong>Strategy</strong></td>
<td>Use of backcasting from the vision of success — a sustainable maritime transport corridor, the three prioritization questions (return on investment, step in the right direction, flexible platform) and other relevant guidelines to select strategic actions to achieve success.</td>
</tr>
<tr>
<td><strong>Actions</strong></td>
<td>Actions identified through the application of the strategic guidelines that will help move society towards achieving a sustainable maritime transport corridor.</td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td>Tools and recommendations identified by each stakeholder involved in the maritime transport corridors (including the Baltic Transport Corridor) that will help move society towards achieving sustainable maritime transport corridors.</td>
</tr>
</tbody>
</table>

The system level in the context of this study is maritime transport in society in the biosphere. Maritime transport is an economic and societal construct to facilitate the movement of people and goods for social and economic utility. In turn, maritime transport and society itself are part of the larger biosphere or “living earth”. Therefore, the system needs to consider the constraints of the biosphere and how society, and in turn, how maritime transport exist within this larger system.

**3.5.1 Current reality – “B” step analysis**

As the Baltic Transport Corridor is currently constituted, there are significant violations of the sustainability principles (SP I – SP IV) (Appendix A,
B – Step current reality - Appendix A.1, B - Step Common violations). In addition, the analysis provides guidance for correcting the sustainability deficiencies to ultimately reach the goal of sustainable maritime corridors and specifically a sustainable Baltic Transport Corridor - C and D step of the analysis.

The transportation subsystems and port operations were analyzed in terms of their sustainability violations. The common violations were grouped according to the principle violated and the common characteristic of the violation (Appendix A.2, B Step specific deficiencies). The result was a current reality sustainability analysis.

3.5.2 Possible Actions to attain the vision - “C” step analysis

The development of the “C” step was the result of a high level analysis of the sustainability deficiencies of the Baltic Transport Corridor. At this stage, the analysis focused on the system level of the corridor – a high level overview. The result of this step was a candidate list of actions to move the corridor towards sustainability (Appendix B, C-step, Possible actions). The thesis team’s attendance at the Vilnius conference reinforced this issue – there was a lack of a coherent definition and framework for addressing sustainability issues.

The following actions have been identified as areas of major significance for sustainability improvement – they take into consideration the ability or capacity of the given stakeholder group to move strategically towards sustainability.

*Education and Training.* One of the largest groups of actions or focus areas identified is the need for education and training of the local community and Baltic Transport Corridor personnel – including passengers, tourists. There is a need for better awareness of sustainability issues and the port operations provide an ideal opportunity to provide leadership in this area. The port is a centre of transport activity in the Baltic Sea for both land and
sea operations. The leadership includes the Baltic Transport Corridor itself and the communities that are impacted by its operations. The high profile of such an activity is important to build trust and awareness.

*Energy.* To address key areas of sustainability violations identified in the B-step, actions such as conservation, efficiency of energy use, and substitution of non-renewable fuels with renewable energy sources are recommended solutions.

*Waste.* In terms of waste control, actions need to be developed to move the Baltic Transport Corridor towards sustainability. The requirement is to ensure best materials practices are implemented to ensure material inputs of the transport corridor are managed in a sustainable manner.

*Dematerialization – Decarbonisation.* A specific measure that has been identified for the Baltic Transport Corridor is to reduce and eliminate, where possible, the use of materials and material flows. The objective is to move the port and port operations to a future which requires fewer material inputs and eliminate the use of non-sustainable materials altogether. Fossil fuel usage is a key area in terms of sustainability violations.

*Efficient land and sea use.* An area of sustainability concern identified is the impact of port, road, rail and sea operations on the territorial waters (littoral) and land areas of the Baltic Transport Corridor. Many of these activities, by their very nature violate sustainability criteria and are thus an area of focus. Destruction of natural spaces – land and sea areas by the operation of the corridor need to be identified and corrected. Parking areas, new rail track to port, new rail terminals, extension of berth capacity, gates holding areas and the sea areas used by shipping need to be considered.

*Procedures, methods and practices.* The management and administration of the Baltic Transport Corridor requires harmonization and consistency of policies and procedures with the incorporation of sustainability criteria. Port operations, and transport operations require consideration in terms of flows (systems) in and out of ports and sea zones. Specific actions include -
government regulations and conformance with EU directives, transportation and vehicle load factors, frequency of transports, load consolidation, back loading (return of empty containers), and harmonization of transport operations, computer systems, and management systems.

Standardized Operations between ports. The ‘C’ step resulted in the identification of the need to have standardized and uniform actions across the Baltic Transport Corridor. The objective of standardization is to ensure comprehensive coverage of waste management for control and reporting purposes. The result will be a management mechanism to assess and control waste - both the generation of waste and the understanding of the necessity to reduce the waste stream through iterative improvements. The expected outcome is to move the corridor towards sustainability through the identification, control and elimination of waste.

Improved computer management systems, information systems and environmental monitoring systems. The next step, after the identification of the functional business process of sustainability, is to operationalize the function or measure. To accomplish this, processes need to be developed for performing the function. In addition, management controls and reporting mechanisms need to be developed to manage the sustainability functions. Computer management information systems and environmental management systems need to be developed to assist management to perform this function.

Community aspects of sustainability. The ‘C’ step analysis identified the need for a greater degree of community involvement in the activities of the Baltic Transport Corridor. The community has a vested interest in the corridor and a direct interest in the sustainability of the corridor itself. Therefore, it is important to engage the community in the corridor activities and sustainability. The expected outcome is to raise the level of awareness in the community of sustainability issues and to give the community a leadership role in sustainability issues. In addition, it creates a forum for a dialogue between the community and the parties in the Baltic Transport Corridor.
*Human aspects* (Appendix D, Max Neef Human Needs). The ‘C’ step analysis identified the need to explicitly consider the human and societal aspects of the Baltic Transport Corridor. Specifically, the need for employment, subsistence, security in the community, participation and the right to have a ‘voice’ in the corridor activities and associated rights needs to be considered. To be sustainable, the corridor needs to be consistent with sustainability condition IV (SP IV) and must therefore ensure the activities of the Baltic Transport Corridor do not undermine the capacity of people to meet their needs.

### 3.5.3 Prioritized actions - “D” step- Applying the Strategic guidelines

In terms of processes and operations, the sustainability principles and the vision of success should be given significant consideration. The three guidelines for prioritizing measures (D step of ABCD) should be respected in every operation or process within the transport operation, and every stakeholder’s point of view and interest given consideration.

The return on investment (ROI) strategic guideline is the most sensitive in terms of moving passengers and goods. There are financial thresholds and considerations that determine if a mode of transport is financially viable or not. The strategic guidelines, in particular the ROI guideline, is necessary to ensure activities, including sustainability activities are financially successful.

The strategic guideline of “step in the right direction” provides guidance to ensure actions are positive steps towards sustainability.

The strategic guideline of a “flexible platform” provides the basis of assurance that a sustainability programme is sufficiently flexible to ensure contingencies can be handled and steps taken are versatile enough to move to future steps while ensuring the overall goal of sustainability is maintained. It also ensures that the prioritized actions could provide a basis for future improvements and future possible actions and solutions.
Together the three strategic guidelines provide direction to a programme of sustainability development.

A final consideration is that the strategic guidelines need to be considered in the context of international and national priorities, rules and regulations and specific practices of the jurisdiction. The specific sustainability study under consideration is the Baltic Transport Corridor which encompasses several jurisdictions.

_Prioritized actions “D” step - Common actions._ The following actions and group of actions have been identified as immediate priorities to move the Baltic Transport Corridor towards sustainability (Appendix C.1, D step prioritized actions for BTC).

_Education._ One of the key areas identified to move the Baltic Transport Corridor towards sustainability is the education function. The goal would be to support a comprehensive educational program from raising the general awareness of sustainability through to complete sustainability programs.

Education is a key strategic leverage point in terms of moving society and transport corridors towards the goal of sustainability. The range of training would be tied to the group targeted for the training. The objective for the local community training would be to build awareness. Education and training then represent a step in the right direction.

The objective for workers would be to provide an enhanced level of understanding of sustainability issues to support their work. In terms of management and community leaders, the training would be directed at leadership and management issues of sustainability, education then provides a good return on investment.

Specific educational measures include:

- Awareness building.
- Community workshops.
- Ongoing sustainability campaigns.
- Decision maker awareness.
- Integration of sustainability criteria with policies and procedures.
- Local academic, civic and community organizations included in programmes.

The survey results confirmed this need for better awareness and training on the issue of sustainability.

*Energy.* Energy was identified as a major area of attention – both in the short term and longer term. It is a key action area due to its absolute impact as a contributor to sustainability violations. In addition, it provides an opportunity to strategically address issues of energy usage, efficiency and the impact on the biosphere.

Specific sustainable energy solutions:

- Energy monitoring and control tools.
- Conservation measures – insulate buildings, retrofit buildings.
- Switching to renewable sources of power, such as electricity from solar, wind or water.
- Education and awareness of energy use and conservation.
- Turn off ship engines while in port and hook up to the local grid.
- Port area wind turbines.
- Roof top solar panels.
- Biofuels.
- Ship kites to reduce fuel usage.

These actions respond to the strategic guidelines of a step in the right direction, and flexible platforms for future improvements.

A further strategic objective of addressing energy consumption and sourcing is for the reduction CO2 and other greenhouse gas (GHG) emissions. The objective is to switch to alternative fuels, such as biodiesel or other biofuels and thus eliminate the use of mined fossil fuels. In addition, the switch to wind and other sources of renewable energy provides the opportunity to have a sustainable transport corridor.
A further action area is to support research and development (R&D) initiatives for new technologies and management mechanisms that support sustainability. The objective is to look for and deploy best practices and techniques in the corridor infrastructure through policies and procedures, thus making such actions flexible platforms for further improvements.

Switching to renewable energy sources and more efficient and effective use of energy sources are steps in the right direction, as well as being a flexible platform for future improvements.

**Waste.** A significant area of concern is waste generation and management. The objective is to reduce or eliminate use of toxic substances and other hazardous materials that pose a risk to human health & environment.

For example, to reduce the impact of dredged materials (e.g. acute chemical toxicity due to contaminated sediments, reduced water quality due to suspended particulates, release of organic matter and nutrients). The goal is to reduce the volume of the waste stream and to ensure waste products are recycled and hazardous materials are handled in closed loop waste management processes.

Specific recommendations include:

- Standardized procedures of waste collection and processing across ports.
- Waste management systems.
- Storage and recycling areas in ports.
- Training.
- Procedures, practices, regulations with the requisite controls and enforcement.
- Employment policies – sustainability as employee selector criteria.
- Community policies – port becomes sustainability leader in the community.
- Education policies for the port chain and the community.
- Development of a sustainability business culture.
- Media packages to ensure all ports have a consistent understanding
of sustainability.

Dematerialization. A further area of concern is the issue of dematerialization - the reduction and elimination of unnecessary materials both in transport modes and in port infrastructure. For example, a switch to lighter trucks, trains, ships made of new composite materials or other alternatives materials not requiring extraction and introduction of materials in concentrations greater than they naturally occur - into the biosphere.

Specific recommendations include:

- Identification of heavy metals and hazardous materials and the elimination of these materials from operations.
- Reduce the absolute volume of material flows.
- Eliminate the use of fossil fuels from the transport function and port operations of the Baltic Transport Corridor.
- Replace non-sustainable energy sources with sustainable energy.

Efficient land and sea use. The implementation of efficient sea and land use policies was identified as an action to strategically address the violation of sustainability principle III; the systematic degradation of nature by physical means. The objective is to use space efficiently with the minimum impact on nature.

Specific policies include:

- Public policies of smart-growth to identify optimum roadways and arteries for truck versus rail transport and to integrate ship transport most effectively.
- Efficient use of port and transport corridor land usage to minimize land in use.
- Efficient transport development (by-passes and underpasses) to minimize the impact of traffic on local communities.
- Land offsets programmes to offset the land used by the Baltic Transport Corridor by sponsoring reforestation projects.
- Sustainability criteria incorporated in the decision making for new-
build and restorative projects that impact the land and sea areas.

- Integration of policies and planning to optimize and make preference for rail and ship transport in lieu of road transport.

*Standardized Operations between ports.* The standardization of management processes was identified as a mechanism for management to assess and control activities of the transport corridor. In addition, the establishment of integrated operating procedures, methods and practices is important to ensure sustainability is a management function and receives appropriate attention.

The objective of implementing the prioritized actions is to fill the sustainability gap and move transport corridors and the Baltic Transport Corridor towards the vision of sustainability.

Specific recommendations include:

- Standardized computer operations.
- Efficient transport corridors, traffic management and control including intermodal container management.
- Coordination of operations between ports – policies, procedures, legal framework, equipment, technologies and interoperability of technologies throughout the corridor.
- Interoperability (harmonization) of technologies along the routes (technologies to control both sustainability and security).
- Cooperation of industries in terms of transport.
- Increased sustainability qualifications of personnel.
- Creation of formal and informal communication structures.
- Harmonization – in terms of tariffs for services, legal frameworks, network of logistics, coordination of science and research.

*Community engagement.* Specific recommendations include:

- Community safety and security.
- Traffic management.
- Economic welfare of the community - stable and good paying jobs.
• Support of local education institutions.
• Use the port as a hub for regional development and policies including leadership in the community.

In practical terms, it should be considered that the recommended actions and groups of actions are applicable to specific Baltic Transport Corridor stakeholder groups (transport companies, shipping companies, port authorities, etc.). Some of these actions will be of most interest to port authorities due to the key function of the Baltic Transport Corridor – linking land and sea transportation. In addition, due to the nature of a port – as a staging area for the collection and transfer of people and goods from one mode of transport to another (sea – land - sea), the recommendations will provide full coverage of the activities of the corridor.

Prioritized actions (D Step): D step - Sub-systems specific actions.

The prioritized actions of the D step analysis:

• Education
• Energy:
  o Switch to alternative fuels such as biodiesel - biofuels.
  o Switch to renewable sources of (electrical) power.
  o Support Research and Development (R&D) for new energy alternatives.
• Waste:
  o Reduce or eliminate the use of toxic substances and other hazardous materials.
  o Reduce the impact of dredged materials.
• Dematerialization:
  o Reduce or eliminate unnecessary usage of materials in transport.
  o Reduce or eliminate unnecessary usage of materials in port infrastructure.
• Efficient land and sea use:
  o Embrace public policies of “smart-growth” to optimize modes of transport.
  o Integrate ship transport operations for improved efficiency.
• Standardized Operations between ports.

The ‘D’ step analysis took the measures identified in the ‘C step and extended the analysis one step deeper - to consider each sub-systems of the Baltic Transport Corridor in terms of modes of transport. The strategic guidelines (return on investment, step in the right direction, flexible platform) were applied to the recommended measures to prioritize the measures as steps towards achieving sustainability (Appendix C.1, D step prioritized actions for BTC).

In addition, the measures were grouped according to the transport mode – train, truck, ship and port operations and grouped into short, medium and long term measures. There were commonalities identified for the modes of transport and these were grouped according to the sustainability principles (SP I – SP IV) (Appendix C.2.1, D step – Common actions). Finally, specific actions were recommended for each transport mode (Appendix C.2.2, D-step – Specific actions).

3.6 Survey Results and Analysis

A survey questionnaire (Appendix E) was sent out (emailed) to approximately fifty (50) practitioners of the Baltic Transport Corridor from a list of participants at the East-West Transport Corridor Final Conference in Vilnius, Lithuania December 10 – 11, 2007 (Appendix F). The conference participants represented a good cross-section of business, academia, government and other interested parties. Specifically, the conference had representation from the entire Baltic Transport Corridor chain: China – Russian – Ukraine – Belarus – Lithuania – Latvia – Kaliningrad – Sweden – Germany – Denmark. Representation included the respective government and business port, rail and road transport authorities, the European Union, academics, businesses and other interested parties. It was an opportunity to canvas from a wide cross-section geographically and in terms of stakeholder interest. The response rate, however, was relatively low (approximately
Subsequent enquiry, however, determined that due to ‘spam’ control (email filtering) on email systems, unsolicited email often does not reach its intended audience. This is especially the case when using the group ‘BCC’ feature of email to protect survey participants’ confidentiality.

Despite the low response rate, however, the respondents provided useful insights into their knowledge of sustainability, security and safety in the Baltic Transport Corridor. In terms of the study research, the survey was an inspirational tool during the thesis project to help direct the thesis. In addition, it was used as an exploratory tool to gather practitioner information on the topics of sustainability, security and safety in the Baltic Transport Corridor.

The survey results provided an opportunity for practitioners in the Baltic Transport Corridor to provide feedback on the issues identified. The personnel of the corridor are best positioned to describe their knowledge and awareness of the issues of sustainability and security and safety in the Baltic Transport Corridor. Specific areas of concern were recorded and identified in the survey results and are presented.

The survey results indicated there was a need for a better understanding of the issues of sustainability in the Baltic Transport Corridor. The survey confirmed the empirical finding of the East-West Transport Corridor Final Conference (December 2007) where there was mention of the terms “sustainability” and “Green Corridor”, but there was little elaboration of these topics. That is, survey respondents indicated, naturally, a good operational knowledge of their particular discipline or focus – generally business development, security and safety measures. This is what the participants deal with on a day-to-day basis.

However, the respondents indicated a general awareness of issues outside their job or competence -sustainability, but their level of operational understanding of this topic was limited. They simply were not trained in the particular discipline or competence. There was a general feeling of a lack of
understanding of the significance of sustainability issues in the Baltic Transport Corridor.

The survey results indicated there is a greater need for education, training and awareness of the issues of sustainability. In addition, the survey confirmed the understanding - while there are many sources of information on sustainability, there is a lack of consistent knowledge across the Baltic Transport Corridor. In addition, this indirectly indicates there is no standardization in the body of practitioner knowledge on sustainability. Essentially, for practitioners, it is a hit and miss proposition. There are no standardized sources of information - it is a mixture of web sites and (in) formal training knowledge. Therefore, there is a requirement for a standardized, central repository of practitioner information on sustainability for the Baltic Transport Corridor.

In terms of security and safety, there was a higher indicated understanding of security and safety issues in the Baltic Transport Corridor. The awareness was higher due to the direct impact of security – safety and the activities of the Baltic Transport Corridor. Security and safety issues are matters the practitioners deal with on a regular basis.

The survey results indicated the respondents did not see a direct connection between the issues of sustainability and security. One possible explanation was the lack of a good understanding of sustainability generally. Practitioners have operating knowledge of security since it is a matter considered “business critical” to the operation of the Baltic Transport Corridor. In general, sustainability, at present, has not made it into the operational plans of organizations that operate in the Baltic Transport Corridor.

As a result of this survey and in terms of addressing the research questions, the topics of education and awareness of sustainability, security and safety were significantly highlighted by practitioners as well as the need for standardization of knowledge amongst stakeholders and practitioners. In addition, a cross-disciplinary integration of the training and operational under-
standing of the topics of sustainability, security and safety to provide complete coverage would be beneficial.

Unfortunately, due to the limited survey response, there was a lost opportunity to gather additional practitioner information and insight into the issues of sustainability and security in the Baltic Transport Corridor. This is an area that could be explored in future research.

3.7   Results of the Causal Loop Diagram Analysis

This causal loop diagram (Figure 3.4) for the maritime transport corridor drew its inspiration from a diagram created to show the main variables (actors), causal relationships and the system boundaries for a BTH thesis on the stationary power sector (Chacon 2006). Some of the findings are similar to those for the transport sector, while others are unique to this study, in particular the relationship between “security and safety” and “sustainability.”

The core start-point for the diagram is the impact of the maritime transport sector (train, truck, ship or port) on the biosphere. The impact varies depending on what type of power is used to move the trucks, trains and ships, and also what type of power is used to operate the port. The choices of power have different causes and effects. The power choices diagrammed include: diesel fuel, biodiesel, biofuels, electric power (generated by coal), electric power (generated by wind, sun, water) and fuel-cells. It is understood that some of these power sources are still in the development stage. However, it was helpful to diagram the cause and effect relationship of switching to alternative power sources and the net effect on stakeholder awareness, social and environmental benefits, sustainability policy and governance, and economic benefits.
Energy Impacts  The most obvious and expected cause and effect relationship was very observable when diagrammed. This is the clear impact of the use of diesel fuel (today’s fuel of choice for most of the transportation industry). As a result of the combustion of fossil fuels, CO₂ emissions occur and cause the overall atmospheric increase of CO₂. The net effect of increasing CO₂ concentrations then contributes to climate change and overall global warming. As stakeholders become more aware of climate change, as a result of severe storms, drought or other serious impacts, stakeholders begin to question public policy and governance as to why these events are occurring and should something be done to curtail the cause. This in turn leads back to thinking about alternative power sources that could be used instead.

However, the impact varies depending on whether the energy source is non-renewable (i.e. derived from fossil fuels) or renewable (i.e. water, wind, solar, hydrogen fuel cells) is used to move the trucks, trains and ships, and also what type of power is used to operate the port. The choices of power have different causes and effects. The power choices shown in the causal loop diagram include: diesel fuel, biodiesel, biofuels, electric power (generated by coal), electric power (generated by wind, sun, water) and fuel-cells. It is understood that some of these power sources are still in the development stage. However, it was helpful to diagram the cause and effect relationship of switching to alternative power sources and the net effect on stakeholder awareness, social and environmental benefits, sustainability policy and governance, and economic benefits.
Waste Impact The causal loop diagram also shows the negative impact of improper management of waste, in particular hazardous waste. Large quantities of waste are generated at port facilities due to a multitude of activities including: repairs and maintenance of ships; operation and management of port facility buildings, cranes, trucks, forklifts and other heavy equipment; the movement and potential damage to cargo shipments requiring disposal; the end-of-life disposal of the smallest items to huge tanker ships. The types of waste can be in a solid, liquid or gaseous form, but the most toxic are usually associated with the day-to-day maintenance of ships, trucks, and
equipment (solvents, paints, oil, scalents, biocides, etc.) If this waste is not managed properly in closed-loop settings, its mismanagement and release to the environment has direct adverse impacts on sustainability (SP II).

Oil Spills and Other Pollutant Releases Oil spills and the release of other pollutants also impacts sustainability negatively. The causal loop diagram highlights the reinforcing effect if such spills or releases occur, but also the counterbalancing effect of “safety and security” measures if they identify and remedy the problem. As is often commonplace at ports, oil spills can occur dockside or in the harbour during refueling operations. Depending on the size of the release there can be adverse impacts on marine life and water quality, including contamination of the seabed sediments. Additionally, if an oil or toxic chemical spill should occur as a result of an accident or incident in the harbour or at sea, then there is an even more positive reinforcing mechanism that occurs resulting in greater damage to the environment.

Trade Capacity and Consumerism Impacts Another element related to sustainability shown in the causal loop diagram is the reinforcing effect of increasing trade and transport which in turn increases the desire and consumption of more and more goods. The counter-balancing effect on this reinforcing behavior pattern needs to be education about the impact of continually increasing levels of transport and trade to support consumerism and that direct impact on a “sustainable” society.

Education and Training Impact Education and training is identified as one of the key factors capable of balancing the adverse impacts (violations of SP I-IV) of energy, waste, spills/pollution, and trade/consumerism causing maritime transport to become more and more unsustainable.

Stakeholder Awareness Impacts Stakeholder awareness is another balancing factor that plays an important role in helping balance the “positive” (but correspondingly negative) impacts of the maritime transport industry’s operations that do not conform to SP I-IV.
Security and Safety Impacts Finally, the causal loop diagram helps answer the difficult secondary thesis sub-question: “Can security/safety” help society attain “sustainability? The diagram shows the relationship of specific actions, events, and risks, and how “safety and security” can help with the responses to those risks. These relationships are quite dynamic and complex. The advantages of the diagram is that it visually shows how “security and safety” can operate in synergistic way to help balance out negative impacts of an oil or hazardous waste spill or CO2 emissions. Monitoring and surveillance devices can help identify a problem as soon as possible, so actions can be taken to remedy it.

3.8 Sustainability Security and Safety synergies

The use of the Framework for Strategic Sustainable Development as a tool for analysis identified the sustainability gap in maritime transport corridors and was used to develop a vision of a sustainable maritime transport corridor. The following linkages were developed as part of the backcasting from a position (vision) of success of a corridor that complies with the principles of sustainability and also incorporates the criteria of being secure and safe. It is the integration and synergistic effect of a comprehensive programme that moves transport corridors towards a sustainable state.

Laws, Policies, Education, Effectiveness and Efficiency. One of the first synergies identified is between laws, policies, and education and the need to integrate these four areas to create more effectiveness and efficiency in conveying both the sustainability and the security - safety messages. The integration of sustainability, security and safety knowledge into laws, directives, policies and regulations for the European Union would be a significant step forward in the right direction. The EU is the major driver of the overall European maritime policy (including the BTC region); the EU provides a significant portion of the funding to study the expanding Baltic transport corridor.
Integrated policies will then lead to the last step - standardized education and training. This is the most critical link for moving the maritime transport corridor towards improved effectiveness and efficiency - through the implementation of sustainability and the integration of security and safety measures into daily operations.

**Computer Systems, Management Systems and Integrated. Policies and Procedures.** Another important set of synergies identified in this study is that between computer and data management systems, as they relate to implementation and monitoring of policies and procedures. Integration of these areas is essential for moving forward towards sustainability and the use of these systems for security and safety plays an important part. The day-to-day operations of maritime transport including port operations and the movement of goods and passengers to and from ports are all intertwined with data management and computer systems (Figure 3.6). In addition, the effectiveness of emergency response and preparedness is directly linked to
the integrated capacity and coordination of a communication system based on state-of-the-art computer management systems.

Figure 3.6 Linkages between Computer and Management Systems to Integrated Policies and Procedures

Computer information systems need to be integrated with the management systems with the capacity to cover the entire transport corridor. Currently, these data information systems are a manifestation of the policies and procedures of individual EU member nations and the port and transport activities occurring within that nation. In many instances, these systems may overlap with the civilian and military sectors and form part of an electronic command, control and communication (C3) function for the member nation. However, in a sustainable future, these integrated computer and management systems need to be designed to track and manage sustainability, and security and safety policies and procedures for the entire Baltic transport corridor and beyond. A significant security breach or environmental accident can have significant consequences for the entire corridor. The management function is the human “backstop” element to ensure there are ongoing improvements to operations.

Community Engagement, Education Awareness and Leadership Participation. The last set of synergies identified in this study is that of community
engagement, education, awareness, leadership and participation. Further linkages and synergies and ways to optimize resources are identified (Figure 3.7). Local community engagement is an important part of the education and feedback loop for transport corridor operations. Maritime transport stakeholders including transporters, port operators, port management and infrastructure support businesses can provide a forum and mechanism for the local communities to engage in a meaningful dialogue about activities that affect them directly.

The community is a valuable resource for both learning and conveying information about the importance of sustainability and the role security and safety can play in that effort.

The contribution of security and safety to the sustainability of the Baltic Transport Corridor is the result of the integration of these measures to sustainability initiatives and actions. The result will be a comprehensive programme for sustainability.
Therefore, security and safety are matters which need to be integrated in a comprehensive manner to the policies, procedures and operational activities of the Baltic Transport Corridor to enhance the overall sustainability of the corridor.
4 Discussion

The purpose of this chapter is to discuss and respond to the research questions posed at the beginning of the thesis. The discussion considers the analysis and synthesizes the major findings identified in Chapter 3 to answer the following research questions:

Primary Question:

*How could one move towards a sustainable maritime transport corridor?*

Secondary question:

*How could security and safety help attain this goal?*

4.1 How to move towards a Sustainable Maritime Transport Corridor?

When starting this research, it became apparent that sustainability is an issue that needs to be addressed in the Baltic Transport Corridor. Attending the East West Transport Corridor final conference in Vilnius – Lithuania in December 2007 confirmed this understanding.

The programme development of the Baltic Transport Corridor is in the early stages and there is an opportunity to influence the sustainability of the Baltic Transport Corridor as it is developed. Therefore, there is a sense of need for immediacy to include sustainability criteria in the decision making process. In addition, issues of security and safety are similarly of concern. All three issues – sustainability, security and safety are matters under consideration.
A further consideration is the existence of organizations to develop the programme and provide a mechanism for the inclusion of sustainability in the Baltic Transport Corridor programme. The East West Transport Corridor organization and conferences have continuity as a forum for discussing the issues facing the Baltic Transport Corridor. In addition, the European Union has a number of projects covering several competencies in the Baltic Transport Corridor. These policies cover areas of competence including environment (sustainability, climate change), transportation, border control, security, safety and the fundamental issue of European Union integration. Therefore, there is a mechanism to engage the stakeholder groups – including incorporating sustainability into the decision making of the parties.

The application of the Framework for Strategic Sustainable Development (FSSD) to the Baltic Transport Corridor ensures a proper framework for bringing the Baltic Transport Corridor and other maritime transport corridors to a sustainable state. The application of the FSSD facilitates integration in the Baltic Transport Corridor activities at the economic and social levels.

The prioritized recommended actions provide an opportunity to incorporate sustainability criteria in the programme and to be included for discussion by organizations and stakeholders in the Baltic Transport Corridor. Specific prioritized actions and grouped actions to close the sustainability gap were proposed. Inclusive in this is the integration, where applicable of security and safety issues to ensure comprehensive coverage and ensure no gaps in the programme. Specifically, education is a primary tool to move the Baltic Transport Corridor stakeholders and communities towards sustainability in terms of behavior change and sustainability awareness and the ultimate incorporation of sustainability into daily operations. In addition, security and safety issues have sustainability implications and the opportunity exists to integrate these areas to ensure a complete programme.

Dematerialization is a significant identified measure that will result in changing practices towards a more sustainable state – the reduction of ma-
material flows. Daily operational energy and waste issues were identified to bring the corridor to a state of sustainability.

The efficient use of land and sea areas will result in a reduction in the degradation of natural spaces and an improved efficiency in the use of space. The net effect will be an improved compliance with sustainability principle three (SP III).

The standardization of operations between ports will result in assurance that a comprehensive programme incorporating sustainability will be achieved. That is, through the incorporation of sustainability awareness and practices in transport corridor operations, and standardizing those practices across facilities, sustainability will have complete coverage in the corridor - there will be no sustainability “gaps”. Inclusive is the need to ensure security and safety considerations are included in the standardization efforts to ensure complete and comprehensive coverage.

In terms of community engagement, an initiative to bring sustainability to the Baltic Transport Corridor provides an opportunity to engage the communities that compose the corridor in a sustainability dialogue. The communities have vested interests in the operation of the corridor and it is natural they should have a voice. In addition, through engagement of the community on sustainability and the corridor, it provides the opportunity to have sustainability brought back to the homes of community members. In this fashion, sustainability awareness and engagement is increased both in terms of the community being part of the sustainability of the corridor, the community and individuals lives. Further, the community is directly impacted by any negative implications of security and safety shortcomings. Therefore, community engagement needs to ensure these topics are part of the community engagement dialogue.

The corridor is a complex system with many subsystems covering many discrete and overlapping legal jurisdictions and jurisdictions of competency. Therefore, there is a need to ensure the management and administration of the corridor is comprehensive and complete. The organization of these
systems starts at the political level and filters down through laws, regulations, policies and procedures. Ultimately, it is the management, control and reporting systems of the corridor constituent components that controls the activities. Management needs to be aware of and incorporate elements of all three measures – sustainability, security, safety, to ensure comprehensive coverage and oversight.

### 4.2 Overview: How Can Security and Safety Help Attain the Goal of Sustainability?

According to the definition of security and safety (Figure 1.3) maritime security is composed of three elements. The first element is defense – the need to protect citizens and assets from actions of hostile groups or nations. This function is carried out by military organizations. The second element is the need to protect shore, littoral areas and the ships and vessels that transit through these areas. This function is conducted by the police service. The final element is control – the need to protect the borders and maritime area limits. This function is performed by national border guards and services.

In terms of security, it is a risk or contingency of the occurrence or non-occurrence of an event that would violate the sustainability principles. The corollary of this is, if an event or contingency does occur, what is the level of preparation to mitigate the loss due to the occurrence of the event. In terms of the impact on people as a result of the corridor's activities, it is a matter of concern for the communities and workers that constitute the corridor and the people actually impacted as a result of the corridor activities.

Therefore, the enhancement of security is the preparation for a contingency, which, should it occur, will adversely affect the sustainability of the corridor. Similarly, in terms of the movement of goods in the corridor, the enhancement of security is the preparation and prevention of a contingency, should it occur, which will adversely affect the sustainability of the corri-
dor. Finally, by considering security as a sustainability issue, it is a preventative measure to bring cognition and understanding to the issue. It also acts as a control mechanism to prevent the deterioration of the state of the corridor and thus exposing the corridor to a higher risk level.

The definition of safety (figure 1.3) includes two elements. The first element is the search & rescue function. It is for the protection of shores, vessels and platforms and is performed by public security organizations. The second function is traffic management for the protection of sensitive sea areas, restricted areas and the movement of vessels. It is performed by maritime affairs organizations.

Safety, in the context of sustainability, is the management and control of a risk or contingency for the occurrence or non-occurrence of an event. In addition, it is the awareness, process and control to ensure general conditions or circumstances do not deteriorate to the point where the safety of people is compromised.

The corridor involves the movement of people and goods with the inherent risks of this activity to the people being moved, workers and the communities that the corridor transits. In terms of sustainability, it is the cognition and manifestation of the issues of safety in policies, procedures and controls to ensure adverse contingencies do not arise. In addition, it is a realization that the state and operation of the corridor needs to be maintained to a high standard to guard against the occurrence of these negative contingent events. This includes a gradual deterioration of health and safety standards which do not constitute a discrete temporal event but a "cumulated effect" of deterioration over time.
5 Conclusion

This study has shown the power of the Framework for Strategic Sustainable Development to assess the sustainability of a system and make constructive suggestions to guide a system to sustainability. In this study, the system under consideration was maritime transport corridors generally, with a specific analysis of the Baltic Transport Corridor. The framework provides a five level model for conceptually understanding and defining a sustainable success for the corridor - a vision of a maritime transport corridor that complies with the four sustainability principles. Next, the framework provides the mechanisms for developing a strategy to achieve success in maritime transport corridors through the application of the ABCD process. The use of the “backcasting from a position of success” to identify strategic steps for achieving sustainability in the corridor are part of the power of the process. To complete the process, the framework contains the structural elements to determine tools and actions to achieve success in the system under consideration.

The application of the Framework for Strategic Sustainable Development applied to the Baltic Transport Corridor identified multiple actions to move maritime transport corridors and the Baltic Transport Corridor towards a vision of a successful state of sustainability. The study identified actions including:

- Education and training
- Energy alternatives
- Waste management
- Dematerialization
- Efficient Land and Sea use
- Standardized Operations between ports
- Community Engagement
The study highlighted these prioritized actions as mechanisms to move maritime transport corridors and the Baltic Transport Corridor to a state of sustainability.

In practical terms, when considering the sub-systems of the Baltic Transport Corridor, specific action and recommendations were identified to move daily operational practices towards sustainability. The central logistical function of ports creates the opportunity to utilize ports as leverage points for moving society generally towards sustainability. The port as an authority has the capacity to influence the local community, governing bodies, the media and other stakeholders towards sustainability.

Finally, the study highlighted the importance of security and safety as measures to enhance sustainability in maritime transport corridors and the Baltic Transport Corridor. Security and safety have the capacity to operate synergistically with sustainability, through operational systems integration to bring maritime transport towards a vision of sustainability and thus move society towards sustainability.

5.1 Recommendations for further research

The Baltic Transport Corridor is a complex system in terms of political, business and social stakeholders and networks. The study analysis identified the issues of sustainability confronting the Baltic Transport Corridor. In addition, prioritized actions are recommended to move the corridor towards a vision of sustainability.

However, the study highlighted a number of areas of further research that would be valuable to move the corridor towards a state of sustainability. The first initiative for further research is to take the analysis deeper into the level of the subsystems considered in this study – transport modes, port operations. The goal would be to consider the specific aspects of each sub-
system. In addition, port authorities are to be given more focus in future studies as major stakeholders and as catalysts for global action on inter-modal transport and sustainability.

Second, further research could be focused on the local communities in terms of sustainability and community engagement – particularly in a transport corridor. Communities have an important role to play in the Baltic Transport Corridor and other transport corridor and as political catalysts for change.

The final area of further research is the joint engagement of practitioners and policy makers in sustainability, security and safety issues in transport corridor operations. This is particularly significant in the Baltic Transport Corridor – considering the corridor transits many jurisdictions and has multiple levels of legislative authority regulating its operation.

The Framework for Strategic Sustainable Development analysis has proven to be powerful in addressing sustainability issues in the Baltic Transport Corridor. It is considered that applying the FSSD strategy will open the path to other studies, resources and projects to be implemented – in addition to current projects and operations. The expected outcome is to change the operations, practices and conceptual understanding of maritime transport corridors towards sustainability.
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Appendix A: B – step current reality

Appendix A.1: B - step common violations

| Sustainability Principle I: | ● Mined metals.  
|                           | ● Fossil fuels.  
| Sustainability Principle II: | ● Emissions from the combustion of fossil fuels (CO2, CO, NO2, SO2).  
|                           | ● By-products of the manufacture of materials that constitute components or tangible assets that constitute.  
| Sustainability Principle III: | ● Destruction of natural spaces for the placement of the physical assets of the transport corridor.  
| Sustainability Principle IV: | ● Public health and pollution related to emissions, noise.  
|                           | ● Safety concerns as a result of operations.  

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### Appendix A.2: B - step specific deficiencies

#### Train Transport Current Reality / Risks

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Train Transport</th>
</tr>
</thead>
</table>
| **SP I:**                     | ● The use of mined materials (oil, metals, alloys, etc.) to manufacture trains.  
                                  ● The use of mined materials to power trains (diesel fuel for combustion engines).  
                                  ● Coal to generate electricity for electric trains.  
                                  ● Resultant CO2 emissions from combustion of fossil fuels for power generation. |
| **SP II:**                    | ● Air emissions from fossil fuel combustion - CO2, NO2, SO2, CO, particulates, and organic compounds.  
                                  ● Released to air, soil and water by the manufacture of rail cars, track including solid, liquid and vapour forms of chemical compounds, metals, plastics, solid & liquid wastes. |
| **SP III:**                   | ● Rail road tracks and rail stations encroach on land space, cause road traffic congestion, pollution.  
                                  ● Increase train use to reduce cars use and thus reduce paving of landscape, reduce congestion and pollution. |
| **SP IV:**                    | ● Diesel-powered engines produce particulate matter, GHG and other organic emissions harmful to health and environment.  
                                  ● Trains create unacceptable noise in populated areas.  
                                  ● Safe design of railcars, tracks, safe operation of trains to avoid accidents. |
## Truck Transport Current Reality / Risks

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Truck Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SP I:</strong></td>
<td>● Reliance on mined materials including oil, metals, alloys, etc. to manufacture trucks. &lt;br&gt;● Reliance on mined materials (oil) to power trucks resulting in GHG emissions causing global warming and climate change.</td>
</tr>
<tr>
<td><strong>SP II:</strong></td>
<td>● Air emission from combustion of fossil-fuels including CO2, NO2, SO2, CO, particulates, organic compounds. &lt;br&gt;● Released to the air, soil and water by manufacture of trucks and fuel to power trucks (including bio-fuels), in solid, liquid and vapour forms of chemical compounds, metals, plastics and other types of solid and liquid wastes.</td>
</tr>
<tr>
<td><strong>SP III:</strong></td>
<td>● Increased pavement of earth’s surface to create roads, increased demands to move goods and people. &lt;br&gt;● Congested roadways in cities, ports, airports due to increasing traffic.</td>
</tr>
<tr>
<td><strong>SP IV:</strong></td>
<td>● Health impacts from exposure to emissions containing particulates and carcinogens. &lt;br&gt;● Risk of injury - death by truck accidents. &lt;br&gt;● Adverse health effects of noise - dust.</td>
</tr>
</tbody>
</table>
# Ship Transport Current Reality / Risks

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Ship Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SP I:</strong></td>
<td>● Reliance on mined materials: oil, metals, alloys, etc. to manufacture ships and the fuel used to power ships.</td>
</tr>
</tbody>
</table>
| **SP II:**                    | ● Air emissions from combustion of fossil-fuels in ship engines: CO2, NO2, SO2, CO, particulates, organic compounds.  
                               ● Released to the air, soil and water from manufacturing of ships - ship components: solid, liquid and vapour forms of chemical compounds, metals, plastics and other types of solid and liquid wastes.  
                               ● Water pollution due to spillage during refuelling and cargo handling, discharge of ballast waters, etc.  
                               ● Water pollution due to discharges (bilge and ballast waters).  
                               ● Damage to oceans and marine life due to pollution - CO2 sink. |
| **SP III:**                   | ● Air emissions from GHG and water pollution from spillage during refuelling, cargo handling, discharges (bilge, ballast waters) damage oceans and marine life resulting in ocean warming, leading to climate change and atmospheric global warming, and degradation of marine resources/water quality. |
| **SP IV:**                    | ● Health impacts due to exposure to emissions containing particulates and carcinogens.  
                               ● Risk of death or injury due to ship transport accidents.  
                               ● Workers facing poor labour and working conditions due to long periods at sea, exposure to toxic compounds, air emissions, and dermal contact with paints, solvents and chemicals. |
## Port operations transport Current Reality / Risks

<table>
<thead>
<tr>
<th>Sustainability Principles</th>
<th>Port operations Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SP I:</strong></td>
<td>• Reliance on mined materials - oil, metals, alloys, etc. to produce materials, fuel used to create port buildings and transport infrastructure.</td>
</tr>
</tbody>
</table>
| **SP II:**               | • Air emissions from combustion of fossil-fuels in diesel engines and release of other pollutants (solid or gaseous) through stacks, vents, stockpiles, transport and materials handling.  
• Water pollution due to spillage during refuelling, cargo handling, and discharge of ballast waters, etc.  
• Waste management, pollution problems related to port transport, movement - storage activities (oil and oily waters, solid and hazardous wastes, noxious liquids, chemical compounds and other wastes).  
• Water pollution due to discharges (bilge and ballast waters).  
• Dust from movement of solid materials and industrial activities.  
• Loss of marine habitat in harbour.  
• GHG emissions, waste management issues upstream during manufacturing of construction materials to build port infrastructure (buildings, roads, etc.). |
| **SP III:**              | • Dredging and disposal of ocean sediments (seabed) for ship channels results in damage to marine life, water quality, release of toxins in contaminated sediments.  
• Hazardous and solid waste discharges (during refuelling, discharge of ballast, bilge waters). |
| **SP IV:**               | • Industrial noise exposure.  
• Dust exposure from movement of solid materials and port activities.  
• Unsafe working conditions due to heavy equipment, chemicals.  
• Unfair labour and wage practices. |
Appendix B: C - step possible actions

<table>
<thead>
<tr>
<th>Groups of actions</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td>Awareness building, Workshops</td>
</tr>
<tr>
<td></td>
<td>Workers training</td>
</tr>
<tr>
<td></td>
<td>Community awareness, Advertisement</td>
</tr>
<tr>
<td></td>
<td>Decision makers awareness</td>
</tr>
<tr>
<td></td>
<td>Operations modifications</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>Conservation, (Eco) Efficiency, Biofuels</td>
</tr>
<tr>
<td></td>
<td>Green Goat Trains (battery hybrid train)</td>
</tr>
<tr>
<td><strong>Waste</strong></td>
<td>Dematerialization, Substitution</td>
</tr>
<tr>
<td></td>
<td>Closed loop on hazardous materials</td>
</tr>
<tr>
<td></td>
<td>Education, Procedures</td>
</tr>
<tr>
<td></td>
<td>Standardization of waste management</td>
</tr>
<tr>
<td></td>
<td>Separation of waste</td>
</tr>
<tr>
<td><strong>Dematerialization &amp; Decarbonisation</strong></td>
<td>Eco-efficiency, Retrofitting</td>
</tr>
<tr>
<td><strong>Efficient land and Sea use</strong></td>
<td>Offsetting measures, Sponsor reforestation, Marketing and communication</td>
</tr>
<tr>
<td></td>
<td>Sustainable Transport development</td>
</tr>
<tr>
<td><strong>Standardized Operations between ports</strong></td>
<td>Efficient traffic management, Coordination of operations</td>
</tr>
<tr>
<td><strong>Procedures, Methods and Practices</strong></td>
<td>Harmonization, Coordination</td>
</tr>
</tbody>
</table>
| **Computer Management Systems** | Standardized computerized operations, C3 – Command, Control, Communication  
Improved communication & coordination |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Action</strong></td>
<td>Education, Leadership-Engagement</td>
</tr>
<tr>
<td><strong>Human Aspects</strong></td>
<td>Max Neef</td>
</tr>
</tbody>
</table>
Appendix C: D - step prioritized actions

Appendix C.1: D - step prioritized actions for BTC

[Scale from one (+) recommended to three (+++) very much recommended]

<table>
<thead>
<tr>
<th>Actions</th>
<th>Right Direction?</th>
<th>Flexible Platform?</th>
<th>ROI?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Energy</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Energy: Switch to alternative fuels such as biodiesel - biofuels.</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Energy: Switch to renewable sources of (electrical) power.</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Energy: Support R&amp;D for new energy alternatives</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Waste</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Waste: Reduce or eliminate use of toxic substances - other hazardous materials.</td>
<td>+++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Waste: Reduce impact of dredging.</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Dematerialization: Reduce - eliminate unnecessary use of materials in transport. (i.e. switch to lighter trucks, trains, ships, new composite material or alternatives to materials requiring extraction of metals).</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Reduce - eliminate unnecessary use of materials in port infrastructure.</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Efficient land use: Smart-growth policies to optimize modes of transport.</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Efficient sea use: Integrated ship transport operations for improved efficiency.</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Standardized Operations between ports</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>
### Appendix C.2: D - step prioritized actions for sub-system

### Appendix C.2.1: D step – common actions

| Sustainability Principle I: | ● Alternative energy – biofuels.  
|                           | ● Long-term, sustainable energy sources including renewable electrical energy (wind, solar). |
| Sustainability Principle II: | ● Alternative energy – biofuels.  
|                           | ● Renewable electrical energy (wind, solar). |
| Sustainability Principle III: | ● Efficient use of natural spaces (land, sea) used in the Baltic Transport Corridor activities. |
| Sustainability Principle IV: | ● Safety.  
|                           | ● Exposure to noise, air, water pollution. |
## Appendix C.2.2: D step – specific actions

### Train Transport Actions

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Train Transport</th>
</tr>
</thead>
</table>
| **SP I**                      |近期：
|  | • 列车使用生物柴油-生物燃料。 |
|  | 长期：
|  | • 列车使用电力（生物燃料），随着技术的发展。燃料单元的燃料单元。 |
|  | • 较轻的车厢使用更少的材料。 |
| **SP II**                     |近期：
|  | • 高效的柴油引擎使用生物燃料。 |
|  | 长期：
|  | • 将铁路、卡车运输整合以减少道路使用。 |
|  | • 使用先进的材料来减少GHG。 |
| **SP III**                    |近期：
|  | • 抵消用于走廊活动的空间使用通过通过恢复破坏的栖息地。 |
|  | 长期：
|  | • 电动高速铁路来减少GHG。例如，日本的子弹列车（Shinkansen），法国的TGV（TGV），德国的ICE（Intercity Express）、MagLev（Germany）使用磁力来提升和推动列车。 |
| **SP IV**                     |近期：
|  | • 可再生能源（来自太阳能、风能、水力）来减少污染物和排放。 |
|  | • 列车安全标准和人员培训以减少事故。 |
|  | 长期：
|  | • 尽可能减少或消除有毒物质的使用。
## Truck Transport Actions

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Truck Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SP I</strong></td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Trucks powered by alternative fuels (biodiesel, biofuels), hybrid vehicles.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Renewable power sources not relying on mined materials.</td>
</tr>
<tr>
<td></td>
<td>• Lighter trucks using composite materials and alternatives to mined materials.</td>
</tr>
<tr>
<td></td>
<td>• Offset use of spaces for corridor activities by reclamation of habitats.</td>
</tr>
<tr>
<td><strong>SP II</strong></td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Alternative fuels and electric hybrids.</td>
</tr>
<tr>
<td></td>
<td>• Integrate truck &amp; rail to reduce distance goods are transported on roadways.</td>
</tr>
<tr>
<td></td>
<td>• Substitute state-of-art materials and to reduce GHG emissions.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Renewable sources - electricity (solar, wind, water) and fuel-cells.</td>
</tr>
<tr>
<td><strong>SP III</strong></td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Smart-growth policies to optimize transport.</td>
</tr>
<tr>
<td></td>
<td>• Maximize efficiencies as feasible.</td>
</tr>
<tr>
<td></td>
<td>• Integrate truck - rail to reduce road congestion and pollution.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Offset use of spaces for corridor activities through the reclamation habitats.</td>
</tr>
<tr>
<td><strong>SP IV</strong></td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Renewable energy sources (electricity - solar, wind, water) to reduce emissions.</td>
</tr>
<tr>
<td></td>
<td>• Truck safety standards &amp; training to reduce accidents.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Reduce or eliminate use of toxic substances, as feasible.</td>
</tr>
</tbody>
</table>
## Ship Transport Actions

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Ship Transport</th>
</tr>
</thead>
</table>
| **SP I**                      | **Near Term:** Ships powered by biodiesel or electric-hybrid technologies.  
|                               | **Long Term:** Fuel-cells or renewable power sources.          |
| **SP II**                     | **Near Term:** Efficient diesel engines using biodiesel.  
|                               | Reduce sulphur-based fuels (bunker oils).  
|                               | Integrate ship, rail, and truck transport to reduce roadway congestion.  
|                               | **Long Term:** Renewable fuels and fuel cells.  
|                               | Lighter, efficient ships requiring less fuel.  
|                               | Use state-of-art materials & methods in ship building to reduce GHG emissions.  
|                               | Manage, use or substitute harmful chemicals to minimize potential harm. |
| **SP III**                    | **Near Term:** Maximize ship transport efficiencies to reduce impacts on marine environment.  
|                               | Manage operation and maintenance effectively to minimize pollution.  
|                               | **Long Term:** Smart growth policies to integrate ship, rail, and truck transport to reduce pollution and congestion.  
|                               | Offset used spaces for corridor activities by reclamation of damaged habitats.           |
| **SP IV**                     | **Near Term:** Renewable energy sources (electric - solar, wind, water) to reduce pollutants.  
|                               | Support ship safety standards - training to reduce accidents.  
|                               | **Long Term:** Reduce or eliminate use of toxic substances.  

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## Port Management Actions

<table>
<thead>
<tr>
<th>Sustainability Principles (SP)</th>
<th>Port Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP I</td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Biodiesel and non-fossil fuels.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Electricity (solar, wind, water), fuel-cells.</td>
</tr>
<tr>
<td>SP II</td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Efficient diesel engines using biodiesel.</td>
</tr>
<tr>
<td></td>
<td>• Renewable energy sources (electricity for building heating and lighting) - solar, wind, central-heating.</td>
</tr>
<tr>
<td></td>
<td>• Integrate port transfer of goods &amp; people, transport of goods by rail - truck to reduce port, rail and roadway congestion.</td>
</tr>
<tr>
<td></td>
<td>• Manage or substitute harmful chemicals as efficiently and effectively as possible.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Renewable sources of power or fuel-cells.</td>
</tr>
<tr>
<td></td>
<td>• State-of-art materials and methods for port building, infrastructure, operation, maintenance to reduce emissions and contaminants.</td>
</tr>
<tr>
<td>SP III</td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Intermodal transfer efficiencies to reduce impacts on marine environment.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Smart-growth, integrate rail, truck transport, reduce pollution and congestion.</td>
</tr>
<tr>
<td></td>
<td>• Offset spaces used in corridor.</td>
</tr>
<tr>
<td>SP IV</td>
<td>Near Term:</td>
</tr>
<tr>
<td></td>
<td>• Renewable energy to reduce pollutants and emissions.</td>
</tr>
<tr>
<td></td>
<td>• Safety standards &amp; training to reduce accidents.</td>
</tr>
<tr>
<td></td>
<td>Long Term:</td>
</tr>
<tr>
<td></td>
<td>• Reduce - eliminate use of toxic substances.</td>
</tr>
</tbody>
</table>
## Appendix D: Max-Neef Human Needs Matrix

<table>
<thead>
<tr>
<th>NEEDS</th>
<th>Being (qualities)</th>
<th>Having (things)</th>
<th>Doing (actions)</th>
<th>Interacting (settings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsistence</td>
<td>physical, emotional and mental health</td>
<td>food, shelter, work</td>
<td>work, feed, procreate, rest, clothe, sleep</td>
<td>living environment, social setting</td>
</tr>
<tr>
<td>Protection</td>
<td>care, adaptability, autonomy</td>
<td>social security, health systems, rights, family, work</td>
<td>cooperate, plan, help, prevent, cure, take care of</td>
<td>living space, social, dwelling, environment</td>
</tr>
<tr>
<td>Affection</td>
<td>respect, tolerance, sense of humour, generosity, sensuality</td>
<td>friendships, family, relationships with nature</td>
<td>share, take care of, make love, express emotions</td>
<td>Privacy, intimate spaces of togetherness</td>
</tr>
<tr>
<td>Understanding</td>
<td>critical capacity, Receptivity, curiosity, intuition</td>
<td>literature, teachers, education &amp; communication policies</td>
<td>analyze, study, meditate, investigate</td>
<td>schools, families, universities, communities</td>
</tr>
<tr>
<td>Participation</td>
<td>adaptability, receptivity, dedication, sense of humour</td>
<td>responsibilities, duties, work, rights, privileges</td>
<td>cooperate, propose, dissent, express opinions</td>
<td>associations, parties, churches, neighbourhoods</td>
</tr>
<tr>
<td>Idleness</td>
<td>imagination, curiosity, tranquillity, spontaneity</td>
<td>Games, parties, spectacles, clubs, peace of mind</td>
<td>day-dream, play, remember, relax, have fun</td>
<td>landscapes, intimate spaces, places to be alone, free time</td>
</tr>
<tr>
<td>NEEDS</td>
<td><strong>Being</strong> (qualities)</td>
<td><strong>Having</strong> (things)</td>
<td><strong>Doing</strong> (actions)</td>
<td><strong>Interacting</strong> (settings)</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td><strong>Creation</strong></td>
<td>imagination, boldness, curiosity, autonomy, inventiveness, determination</td>
<td>skills, work, abilities, method, techniques</td>
<td>invent, build, design, work, compose, interpret</td>
<td>spaces for expression, workshops, audiences, cultural groups</td>
</tr>
<tr>
<td><strong>Identity</strong></td>
<td>sense of belonging, self-esteem, consistency</td>
<td>symbols, language, religion, values, work, customs, norms, habits, historical memory</td>
<td>get to know oneself, grow, commit oneself, recognize oneself</td>
<td>places one belongs to, everyday settings, maturation stages</td>
</tr>
<tr>
<td><strong>Freedom</strong></td>
<td>autonomy, passion, self-esteem, open-mindedness, tolerance</td>
<td>equal rights</td>
<td>dissent, choose, disobey, develop awareness, be different from, run risks</td>
<td>temporal / spatial plasticity (anywhere)</td>
</tr>
</tbody>
</table>
Appendix E: Survey Questionnaire

(Q1) Do you feel you and your organization are sufficiently aware of the issues of sustainability and security in the Baltic Transport Corridor?

Sustainability? Security?

(Q2) What is your perception of business partners, counterparts or stakeholder’s knowledge or understanding of a sustainable and secure Baltic Transport Corridor?

Sustainability? Security?

(Q3) What is your primary source of understanding of these issues (sustainability and security) – operational documents, EU directives, other sources?

Sustainability? Security?

(Q4) Do you or your organization see a connection (vision) or have a plan for sustainability and security?

Sustainability? Security?

(Q5) Do you feel there is a consistent understanding of these issues (security and security) in the Baltic Transport Corridor?

Sustainability? Security?

(Q6) Do you have any ideas or suggestions you consider relevant to the research into sustainability and security in the Baltic Transport Corridor?

Sustainability? Security?
Appendix F: Stakeholders

Appendix F.1: BTC Stakeholder List East West Transport Corridor

Karlskrona Kommun
Drottninggatan 69
371 83 Karlskrona, Sweden

Klaipeda University
Bijunu g. 17
LT-91225 Klaipeda, Lithuania

Arena/Netport Sweden
Biblioteksgatan 4
374 35 Karlshamn, Sweden

Blekinge Tekniska Hogskola
SE-374 24 Karlshamn, Sweden

Klaipeda State Seaport Authority
J. Janonio Str. 24
LT-92251 Klaipeda, Lithuania

Intelligent Transport Systems
Vagverket, Swedish National Road System

Port of Karlshamn
Karlshamn Hamn
P.O. Box 8
SE-374 21 Karlshamn, Sweden

Skane Region
Bjorkhemsvagen 17
SE-291 25 Kristianstad, Sweden

Region Skane
Vagverket
Isbergsgatan 5
SE-203 13 Malmo, Sweden
Appendix F.2: BTC - Maritime Transport Corridor Stakeholders

The following stakeholder list is a breakdown of constituent stakeholders of the Baltic Transport Corridor. Stakeholders are grouped according to their identification as a stakeholder and the group is then analysed according to how corridor operations impact their needs and how their interests are enhanced or diminished by corridor operations.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Potential Impact</th>
<th>Help</th>
<th>Hinder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>Convenience, alternatives, safety, security</td>
<td>Feel the need to have a safe, secure and sustainable corridor. Determining factor – convenience, safety, security</td>
<td>Costs, lack of care and attention</td>
</tr>
<tr>
<td>Corporate Clients</td>
<td>Convenience, alternatives, safety, security</td>
<td>Determining factor – which port, safety, security</td>
<td>Costs</td>
</tr>
<tr>
<td>European Union</td>
<td>EU integration and EU directives and policies including safety and security</td>
<td>Competiveness, EU integration, Lisbon protocol, GHG emissions, Transportation, rationalization, Common energy policies, Standardization on EU Commission objectives</td>
<td>Lose confidence Competition with other EU ports Violation of EU directives.</td>
</tr>
<tr>
<td>Stakeholder</td>
<td>Potential Impact</td>
<td>Help</td>
<td>Hinder</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>Government</td>
<td>Governance</td>
<td>Restore image of Baltic sea being sustainable, Intergovernmental cooperation, safety, security</td>
<td>Loss of confidence, undermining of authority</td>
</tr>
<tr>
<td>Suppliers</td>
<td>Source of business and stability</td>
<td>Attracts business, Export of business know-how, successful, efficient and reliable operations</td>
<td>Sustainability standards costs – driven out of business, May introduce other competitors to your region.</td>
</tr>
<tr>
<td>General Public</td>
<td>Public Opinion and confidence</td>
<td>Competence and leadership</td>
<td>Neglect and negative operational impact</td>
</tr>
<tr>
<td>Public Authorities</td>
<td>Economic development, Business Infrastructure, Reputation, Confidence</td>
<td>Leadership, visibility, success, positive reputation, safety, security</td>
<td>Contribute to the integrity of public institutions.</td>
</tr>
<tr>
<td>Local Community</td>
<td>Take their interests into consideration.</td>
<td>Economic development and wealth creation, liveable wages, community support, local businesses, safety, security</td>
<td>Disaster, fear, noise, pollution, environmental threats, loss of community</td>
</tr>
<tr>
<td>Fishing and related industries</td>
<td>Loss of income and employment and consequent loss of community</td>
<td>Wages, support fisheries and habitat, work guarantee, long-term viability of the industry</td>
<td>Undermines fisheries, loss of economic base, loss of environment and habitat</td>
</tr>
<tr>
<td>Stakeholder</td>
<td>Potential Impact</td>
<td>Help</td>
<td>Hinder</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Port authorities</strong></td>
<td>Responsible for integrity of port operations. Control and communication.</td>
<td>Major stakeholder and leverage point, good reputation, economically viable, safety, security</td>
<td>Loss of public and political confidence and support</td>
</tr>
<tr>
<td><strong>Financiers</strong></td>
<td>Stranded capital, Sustainable finance, Insurance</td>
<td>Profitability, future investment opportunities</td>
<td>Losses, loss of reputation, stranded capital, compromised operations</td>
</tr>
<tr>
<td><strong>Employees and unions</strong></td>
<td>Respect for union agreements, liveable wages, worker health and safety</td>
<td>Economic viability, respect for worker’s rights and participation, safe and secure workplace, prime implementer of sustainability, security, safety policies</td>
<td>Loss of employment, poor working and wage conditions, poor safety and security</td>
</tr>
<tr>
<td><strong>Illegal immigrants and stowaways</strong></td>
<td>Detection and deterrence, proper treatment, human rights conventions, due process of the law, safety, security</td>
<td>Deterrence of illegal activities, security of corridor, safety of corridor, respect for human rights</td>
<td>Inability to deter and stop illegal activities, trafficking of humans and contraband, smuggling and illegal movement of people undermine sustainability</td>
</tr>
<tr>
<td><strong>Tourists</strong></td>
<td>Image and marketing, safety, viability of the industry, Respect for local culture and community.</td>
<td>Economical, competent, convenient, safety, security, create demand for sustainable transportation</td>
<td>Poor reputation, education of sustainability issues and practices</td>
</tr>
<tr>
<td>Stakeholder</td>
<td>Potential Impact</td>
<td>Help</td>
<td>Hinder</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Media</td>
<td>Reputation, cooperation</td>
<td>Positive reputation, enhance cooperation, help coordinate, catalyst for change</td>
<td>Poor reputation</td>
</tr>
<tr>
<td>Politicians</td>
<td>Integrity of the system, decision making, due process, inter-national relations</td>
<td>Transparency, positive reputation, competence, good governance, complimentary measures between jurisdictions</td>
<td>Lack of transparency, poor reputation</td>
</tr>
<tr>
<td>Universities</td>
<td>Research and development, innovation, lead community, area of discussion</td>
<td>Open to academic research and activities, relations with the community, respect for research, research and develop new technologies and techniques towards sustainable practices</td>
<td>Lack of access and cooperation with authorities, lack of funding</td>
</tr>
<tr>
<td>Competitors</td>
<td>Cooperation, leadership, competitive transport route, reputation, linkages</td>
<td>Open to cooperating in areas of mutual interest, enhancement of industry reputation</td>
<td>Lack of transparency, loss of industry reputation, alternate routes.</td>
</tr>
<tr>
<td>Multi-lateral organization</td>
<td>Integration, cooperation, promotion</td>
<td>Transparency, cooperation, visibility, increased coordination</td>
<td>Lack of transparency, lack of cooperation</td>
</tr>
</tbody>
</table>

xlvii
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Potential Impact</th>
<th>Help</th>
<th>Hinder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Region Blekinge</strong></td>
<td>Welfare and support of local community</td>
<td>Economic (business) opportunities, community involvement, enhancement of community reputation, potential for inter-community cooperation</td>
<td>Loss of reputation, loss of income, loss of relationships within community and between communities</td>
</tr>
<tr>
<td><strong>Region Klaipeda</strong></td>
<td>Welfare and support of local community</td>
<td>Economic (business) opportunities, community involvement, enhancement of community reputation, potential for inter-community cooperation</td>
<td>Loss of reputation, loss of income, loss of relationships within community and between communities</td>
</tr>
<tr>
<td><strong>Other Baltic Regions</strong></td>
<td>Welfare and support of local community</td>
<td>Economic (business) opportunities, community involvement, enhancement of community reputation, potential for inter-community cooperation</td>
<td>Loss of reputation, loss of income, loss of relationships within community and between communities</td>
</tr>
<tr>
<td><strong>Urban Planning</strong></td>
<td>Design efficient transportation systems, consideration for the community</td>
<td>Planned, integrated and efficient design and development. Less pollution, more sustainable communities</td>
<td>Cost of ad hoc development, lack of planning, control coordination, Infrastructure.</td>
</tr>
</tbody>
</table>