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Assessing the limitations of integrating energy and environmental standards into seaports of small island developing states

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ASSESSING THE LIMITATIONS OF INTEGRATING ENERGY AND ENVIRONMENTAL STANDARDS INTO SEAPORTS OF SMALL ISLAND DEVELOPING STATES

By

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): .....

(Date): .....

Supervised by: .....

Supervisor's affiliation:.....

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Abstract

Title of Dissertation: Assessing the Limitations of Integrating Energy and Environmental Standards into Seaports of Small Island Developing States (SIDS)

Degree: Master of Science

This dissertation is a baseline study that uses secondary sources of information to assess the limitations of integrating energy and environmental challenges into seaports of Small Island Developing States (SIDS). With the incoming IMO sulfur cap regulation to be in full effect in 2020 together with the ratification of conventions pertaining to the reduction to the use of fossil fuel as primary energy sources and with the growing environmental threats that are affecting people's livelihoods around the world, certain organizations such as the International Organization for Standardization has over the years developed energy and environmental management standards that can assist in mitigating these growing organizational challenges.

The use of these standards were proven to have major impact on decreasing an organization's energy consumption and increase environmental consciousness and ultimately maximizes returns to an organization by reducing energy costs. Adopting and implementing these globally recognized standards also boost an organization's image and thus increasing its market presence in the global market. However, the need to adopt, integrate and implement the energy and environmental management standards in seaports of SIDS is still lacking in progress due to several challenges which translates into limitations for seaport authorities and likewise, the nature of the management standards itself.

This study identifies the challenges that hinders seaports of SIDS to adopt and implement these standards and it also discusses the nature of these standards that acts as a barrier to its smooth application in the context of seaports of SIDS. The study concludes by recommending future actions that needed to be taken by seaports and their relative stakeholders in order to mitigate the limitations to the integration of these standards into seaports of SIDS.

KEYWORDS: ISO 50001, ISO 14001, Plan-Do-Check-Act (PCDA), Small Island Developing states (SIDS), small-to-medium-sized enterprise (SME), seaports, maritime seaborne trade.

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List of Abbreviations

EMS – Energy Management System

ESPO – European Sea Ports Organization

GDP – Gross Domestic Product

IMO – International Maritime Organization

IPCC – Intergovernmental Panel on Climate Change

ISO – International Organization for Standardization

ISO 14001 – Environmental Management System

ISO 50001 – Energy Management System

KPIs – Key Performance Indicators

NASA – National Aeronautics and Space Administration

PDCA – Plan-Do-Check-Act analysis framework

SIDS – Small Island Developing States

SMEs – Small-to-medium-size enterprise

UNCTAD – United Nations Conference on Trade and Development

UNDRR – United Nations Office for Disaster Risk Reduction (formerly known as UNISDR)

USGS – United States Geological Survey

UN SDGs – United Nations Sustainable Development Goals

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The increase in global trade of goods and services has improved tremendously over the past few decades. Majority of the global trade is largely attributed to seaborne trade where goods are shipped from producers to customers through maritime transportation. Currently, the global maritime seaborne trade is responsible for over 95% of the global trade volumes. This increasing trade volume is a result of the relatively efficient and cheaper mode of transportation through the shipment of goods over the world's oceans. The maritime industry has experienced various changes to the vast array of goods transported over seaborne trade and the evolution of various vessel types that are used to transport these goods including the recent incorporation and heavy use of technological advancement both for handling the increasing logistical needs throughout the overall supply chain and also in ensuring the safest and most efficient ship operations on the shipowner's and ship operator's viewpoint. These changes in the advancement experienced in the maritime industry exist to complement the changing nature of global trade. Globalization has also been accredited for the increase in global trade accompanied by other economic factors such as the global supply and demand dynamics. From humble beginnings with the use of steam ships to the current high capacity vessels with increasing use and reliance on heavy and highly toxic fuels, the maritime industry's operations is sending an alarming signal to the global community calling for a worldwide review of the heavy fuels used in the industry due to its detrimental effects to people and marine life health and also the atmospheric components.

Moreover, in the advent of the increasing impact of climate change and the need to minimize the global carbon footprint, the global community is looking to the maritime sector to take the lead in decreasing its carbon footprint by using alternative energy options and to focus more on clean and renewable energy choices especially in shipping and cargo handling operations. Value added chain is also an increasing component of world trade mechanisms as it allows avenues for value addition of a given product in different countries of the world where the producers or manufacturers can send the raw product over to an importing country and complementary components of that particular product can then be added later to that product in the exporting country. This value added aspect of the supply chain is seen to be more practiced in seaports of the world where seaports are facilitating value added activities in association with manufacturers. Increasing trade activities coupled with the growing involvement of seaports in the global supply chain network resulted in the efficiency of manufacturers in meeting customers' demands and coping with the increasing diversity in customers and end-users' preferences.

However, as seaports are more involved in the global trade and supply chain network, they allow more activities to be concentrated within the vicinity of ports where huge amounts of both energy and environmental considerations are becoming some of the resultant drawbacks from their increasing involvement in the increasing global supply chain network. As a result, most of the attention of global environmental movements and global advocates of sustainability and climate change are currently centred on the maritime industry and in particular the seaports to ensure that their operations are kept within sustainable and energy efficient levels to mitigate the cascading impacts that can emerge if certain energy and environmental thresholds are being exceeded. But, in order to fully understand the wide array of risks and challenges posed by seaport operations that currently sparks global attention on energy and environmental considerations in the global seaport chain, a preliminary background discussion has to be made in order to contextualize the issues surrounding the need for seaports to transition into a more sustainable operation. The next section provides a background

discourse to growing seaport operations that came about as a result of the increasing involvement in the ever-expanding global supply chain network.

1.1 Background & Issues

Seaports have always been integral in the overall supply chain mechanisms especially with regards to the global seaborne trade. The various activities that are carried out in Seaports also vary from one country to another. The trading nature of a country to its global trading partners in the import and export of goods dictates, to an extent, the type of seaport and the port activity that is carried out in a particular port. As seaports expand in their operations to accommodate the increasing traffic and volume of goods and products that are traded on a daily to an annual basis, they invest more on increasing certain aspects of their operations in order to cope with the changing economic trends in both local and international trade. The operational aspects of seaports that are crucial for adapting to and meeting the local and international trade dynamics are often expressed by both the physical and technological infrastructures that are the major driving factors behind almost all seaport operations in the world today.

As seaports are expanding in their overall operations, keeping track of both the internal and external flow of operations and other logistical matters concerning the handling of cargoes into and out of vessels from seaborne trade onto the terminal and into the hinterland trade routes requires advanced technologies to handle the amount of data needed to facilitate and monitor these activities. Therefore, seaports are currently incorporating specialized software into their operations to handle certain complex tasks such as simulating truck moves within the terminal to find the most efficient routes for truck movement within the seaport terminals to using specialized software for controlling and monitoring the movement of vessels in and out of a seaport to ensure maximum berth productivity. These technological advances, though costly, are becoming a standard norm in seaport operations. The technological or soft infrastructures such as information technology platforms that are installed by seaport

operators help to govern the movement, monitoring and control of seaport operations while collecting and storing data in the process for performance checks and review purposes and other additional seaport performance maximization and for safety and quality control measures. Data obtained from such technological advances in seaports have proven to be very useful in the future planning and other planning-related interventions in seaports. Although some school of thoughts on seaport productivity might dispute the use of technological advances in seaports on the grounds of employment loss for many seaport workers, these technological advances also have a fair share of advantages such as improving safety standards in seaports and decreasing operational costs on seaport gang employment are some of the counter arguments that can be made on that matter. Hence, the use of technological infrastructures in seaport operations have so far produced high yielding outcomes.

Physical seaport infrastructures are determined by the type of trading activities that are usually carried out in that particular seaport. This may differ from one country to another and is an essential aspect of improving seaport operations while at the same time increases seaport efficiency in cargo handling operations. Both the physical infrastructure and the superstructures that are found in any seaports of the world serves to ensure maximum performance and increasing trade facilitation in the various cargo types handled by the seaport operators. As seaports develop in both size and the scope of business such as harbouring other value added and logistic related operations within the seaport vicinity, more resources in terms of energy is required in order to sustain these seaport operations. The high usage of fossil fuel in operating vehicles in a seaport including the increase truck movements between the seaport and the hinterland connection is alarming as increasing trade and economic activities will definitely have a positive correlation with the higher emissions from the vehicles that operate using fossil fuels. Other specialized cargo such as refrigerated containers including backup generators and other seaport operational equipment that are heavily dependent on high energy consumption demands a continuous supply of energy and this is usually in the

form of fossil fuel sources in many seaports of the world today. This again contributes to the continuous increase usage of non-renewable energy sources.

All seaport infrastructures and superstructures have varying life cycles where most of these infrastructures will one day be replaced by a whole new set of new and perhaps more advanced and sophisticated ones. Maritime seaborne trade is highly dependent on the trading activities that are happening between countries and is ultimately governed by social, political, and economic forces. Any disruption in any of the drivers of economic activity will eventually affects the trade volumes imported or exported out of a country. Hence, if there is a decline in trading activities which means there is less or no activity in the seaports, seaport superstructures become dormant and this will lead on to the high maintenance costs of these infrastructures and superstructures which over a prolonged period, may lead to these superstructures and infrastructures in seaports to be of no use. The waste that will be generated from the old seaport equipment will also be an issue as most of these seaport equipment and facilities are only designed for a one-off use and cannot be reused again which will eventually accumulate to more waste. This leads on to the cradle-to-grave concept. The cradle-to-grave concept aids the discussion on waste management due to poor and unsustainable seaport management and operational practices. This cradle-to-grave concept in waste management from seaports is of prime importance in seaports of countries with a much smaller and fragile economies.

Physical alternations to coastal land such as the clearing of land and the heavy use of pavement in seaports was also proven to have considerable effect on the environment. As seaports develop and expand, more geographical space is needed in order to cater for the extension and as such, more pressure is exerted on both flora and fauna of both terrestrial and marine ecosystems. Seaport expansion to cater for increasing economic activity through seaborne trade has in itself created a wide spectrum of challenges to both the life on land and at sea. Human displacement and other destruction to plant and animal ecosystems and habitat is evident as seaports expand in size. Further, as seagoing vessels that engage in seaborne trade expand in size, so is the need for seaport

expansion in order to cater for berthing requirements for larger vessels. These huge vessels operate large engines which are louder and use more toxic fuels. Increasing concerns have been speculating the maritime industry with regards to the use of such huge vessels as the noise emitted from such vessels are detrimental to life under the sea. Additionally, in the event of an oil spill, the highly toxic fuels that are currently used in such vessels are too poisonous for any given life forms in both terrestrial and marine ecosystems. Although the increasing size of vessels is important in seaborne trade, the negative impacts of having such huge vessels still outweighs the current advantages that it has with regards to maritime trade.

Coastal land plays a vital role in the livelihoods of coastal and nearshore species of plants and animals and the continuous growth of seaports along coastlines can eventually lead to increased contamination and increased runoff and the extirpation and eventually total extinction of certain coastal flora and fauna leading to a complete distortion of the food web which will, in time, be destructive to both terrestrial and marine life. Coastal land is also home to a number of the world's population and by engaging in heavy physical coastal alterations for seaports expansions such as embarking on large-scale coastal land reclamation and the longitudinal extensions to seaports have been very destructive to most of these coastal human habitats and livelihoods. Together with the current issues associated with the changing climate, these coastal habitats are very prone to storm surges coupled with increased coastline erosion and increased marine life loss. Hence, as coastal land is being pressured with increased alterations to cater for the growing expansion of seaports to accommodate and facilitate trade activities through the import and export of goods, more destruction is exerted on both flora and fauna of the coastal ecosystems and where these coastal ecosystems are responsible for a number of human livelihoods in coastal communities. All these inter-related and interconnected issues combined calls for a more robust environmental management system to be established and implemented in seaports to ensure the sustainable operations of seaports while still maintaining maximum financial returns to any given seaport authority.

Over the years, governmental and non-governmental organizations and institutions are striving to find innovative ways and strategies to address the emerging issues that are associated with the poor management and use of resources. Seaport authorities who are responsible for the operational aspects of a seaport are also seeking ways to reduce expenditures while maintaining a higher performance and efficient seaport. One of the common reasoning found in almost all management literature is that companies are always aiming for longevity and maintaining relevance in the business arena. Hence, most companies are transitioning into the use of Key Performance Indicators (KPIs) or following a standardized management system in order to measure their productivity as per the amount of resources used to obtain certain results and outputs. One of the most globally recognized institution that has done a tremendous amount of effort and work into developing management standards for any given industry is the International Organization for Standardization (ISO). The ISO is established in 1947 in Geneva, Switzerland and is an international standard-setting body composed of representatives from various organizations.

The ISO has been a global contributor to the development of management standards that are internationally recognized. Together with its respective experts from different recognized authorities on standards, the ISO is the world's largest developer of international standards and this helps in facilitating global trade by setting common standards between countries. Currently, the ISO has developed more than twenty thousand standards covering the areas of manufactured products and technology to agriculture, healthcare and food safety. The two most common ISO standards that are currently used in most seaports of the world are the energy and environmental standards, namely, ISO 50001 and ISO 14001 respectively. The ISO 50001 specifies the requirements for establishing, implementing, maintaining and improving an energy management system so that an organization can follow a systematic approach in achieving continual improvement of energy performance and that includes energy use and consumption. The ISO 14001 specifies the requirements for establishing an environmental management system that an organization can use to enhance its

environmental performance. By introducing these two standards into the seaport operations, seaports are currently improving their energy performance while at the same time improving their environmental performance which altogether reduces the amount of GHGs that are emitted into the atmosphere and abiding by the IMO's sulphur cap mandate.

However, despite the establishment of the ISO 50001 standards and the ISO 14001 standards, some energy and environmental indicators and measures do not fully capture the contextual realities in seaports of Small Island Developing States. The seaports in SIDS play the most vital role in connecting the SIDS to international trade but are still lacking in a lot of seaport operational aspects and most notably in their ongoing struggle to meet energy and environmental requirements and standards. Therefore, this research seeks to address some of the issues involved with the integration of energy and environment standards on seaport operations in seaports of SIDS. The next section outlines the aim and specific sub aims of this research project together with the research questions that this research seeks to answer throughout the course of this research project.

1.2 Aim

The main aim of this study is to assess the limitations of integrating energy and environmental standards into seaports of Small Island Developing States.

1.3 Objectives

The objectives of this study are:

1. To identify and assess the limitations in SIDS that hinders the integration of energy and environmental standards to seaports in SIDS.
2. To discuss the current energy and environment management standards and their limitations to be integrated into the context of the seaports in SIDS.

3. To use the limitations of seaports in SIDS and the limitations of the energy and environmental management standards to propose a better solution for seaports in SIDS.

1.4 Research Questions

The research questions are derived from the objectives and they will be used to guide the overall course of this research project in the attempt of achieving the main aim of this research project. The research questions for this study are:

1. What are the limitations of the seaports of SIDS in integrating energy and environment management systems? How are seaports in SIDS coping with the integration of energy and environment management systems?
2. How efficient are the energy and environment management systems in coping with the contextual differences they are applied to?
3. How best can the energy and environmental management systems be integrated into the seaports of SIDS in the future?

1.5 Research Purpose & Significance

This research seeks to explore the limitations that seaports of SIDS might have that are crucial for the integration of the energy and environmental standards to be fully implemented. As far as the literature on seaports are concerned, no previous study was done in this specific topic and that is to assess the limitations of integrating energy and environmental standards into the seaports of SIDS to improve their ongoing operation so that they can, in the future, achieve sustainable outcomes while improving their efficiency and performance and reducing operational costs that may be incurred if energy and environmental standards are not properly integrated. Another purpose for developing a baseline study on the seaports of SIDS and their limitations to integrate energy and environmental standards is that it helps to motivate aspiring seaport and shipping researchers to understand the growing need of standardization where standardizing processes and procedures not only helps in a business's overall

production output, but it can also be seen as an added advantage to the overall supply chain management where it can gage smoother trade activities between countries via seaborne trade. Moreover, some of the main significance of this study are:

- It acts as a baseline study for further research to build upon,
- It shines light on the pressing issues that are effecting seaports in SIDS,
- It contributes to the overall literature of seaports in SIDS,
- The outcome from this study will help policy makers and port managers in SIDS to make more well-informed decision in their planning interventions.

1.6 Conclusion & Research Discourse

Maritime trade forms an essential part of the global trade and is currently the top contributor to the overall global trade that continues to account for the increasing global trade volumes to date. Despite its contribution to global trade, maritime seaborne trade has been considered one of the most contributing factors to the increased emission of greenhouse gas including its involvement in environmental degradation due to the increased infrastructural and superstructure developments that poses a chain of threats to both terrestrial and marine ecosystems which is deemed unsustainable by the global community. Further, the seaports are currently attracting more activities which altogether contributes to an increased and unsustainable use of energy which is also deemed unfeasible especially for seaports of Small Island Developing States. Hence, this study stems from the problems and issues stated above with the call to ensure the continued sustainable operations of seaports in SIDS.

This study takes on a secondary research approach design where it uses secondary sources of information to deduce valuable contributions to the main discussions in the context of the issues and problems stated above while at the same time attempting to answer the main research questions. This study is outlined as follows:

1. The second chapter of this study starts of by providing a background to the seaborne trade literature that concerns seaports and their operations and putting particular emphasis on seaports of SIDS and the strive to attain energy and environmental standards.
2. Chapter three of this study outlines the methodological approaches and analytical tools that will be used to gather analyse information in the remaining chapters.
3. Chapter four introduces the SIDS and their seaports including the discussion and analysis of the issues that encumber seaports of SIDS in achieving energy and environmental goals.
4. Chapter five discusses and analyses the integration of energy and environmental standards into the seaports of SIDS and the factors associated with these standards that inhibits their smooth implementation. This chapter will also discuss the future of energy and environmental standards in seaports of SIDS.
5. Chapter six makes an overall conclusion to this research and will also provide recommendations for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction to Maritime and Seaborne Trade

Maritime or seaborne trade has a very unique economic concept that explains its economic model. Seaborne trade relies heavily on the interplay between supply and demand mechanisms. In a seaborne trade scenario, the transportation services provided by maritime transport or shipping is only dependent on the volume of trade that is taken out of a country or brought into a country and the overall economic activity within a country. Seaborne trade is also highly dependent on the overall demand and supply for a particular good or product in a given country (Valentine, Benamara, & Hoffmann, 2013). Therefore, if there is more trade activity between countries in terms of imports and exports, then seaborne trade increases as the shipping of these goods is needed in order to facilitate trade from one country to another. If there is less or no economic activity happening between countries of the world, then there would be no need for the shipping of goods from one country to another and hence a decline in global maritime trade (Roa, Peña, Amante, & Goretti, 2013). This explains the economic model of the seaborne trade which is widely known as a trade that is based on "derived demand". The world's resources are not spread evenly among countries and hence the need for trade between countries so that countries can buy goods that are scarce locally and export goods that are in high quantity locally but are scarce internationally but that are high in demand. As the world's population grew, so as the demand for resources globally and hence more foreign trade activities are experienced worldwide (Jung, 2011). In the wake of globalization and the increased need for international trade, countries of the world have invested large sums of money into upgrading and improving their national infrastructures to help facilitate this growing global trade activity(Dwarakish & Salim, 2015; Shi & Li, 2016). The most notable infrastructural activity that is observed globally is the upgrade of a country's seaport

as this is the area of transition between land and sea where goods and produce are unloaded from the sea-going vessels to the shore and where goods and other produces were taken in on-board for export purposes. Hence, it is vital to have a brief overview of seaports, the global seaport network chain, their progress over time, their performance and their importance to the overall understanding of maritime trade.

2.1 Introduction to Seaports

The world's seaports are at the forefront of facilitating seaborne trade which accounts for over 98% of the overall global trade. With the various activities and the scope of operations that are carried out within these seaports coupled with diverse customers they serve on a day-to-day to an annual basis, all Port Authorities (PA) operating these seaports are striving to get maximum efficiency and returns from their operations while at the same time decreasing the costs associated with their operations – a typical business strategy that is easily observed in any business context globally (Montwiłł, 2014; Roa et al., 2013). Traditionally, seaports operate as trade hubs for the trading of goods between countries and it is through these trading hubs that towns and cities began to grow and develop. A study conducted by Dwarakish and Salim (2015) and a more recent study carried out by Fenton (2017) reaffirms the certainty that seaports of the world were once trading hubs and are responsible for the growth and development of early towns and cities. As seaports are increasing in size and transforming from a small scale operation basis to a more business-oriented and major component of the overall value added supply chain process, the overall business focus moves from a merely basic transit hub functions into a more efficient and productivity focused business model (Dwarakish & Salim, 2015; S.-W. Lee, Song, & Ducruet, 2008; Montwiłł, 2014). This overall shift calls for a more robust and efficient measurement system in order to measure efficiency and productivity in seaports operations. Measuring seaport efficiency and productivity is widely done through the use of Port Key Performance Indicators (KPIs).

2.2 Port Key Performance Indicators (KPIs) and UN SDGs

The efficiency and productivity of port operations and processes within a given port is of prime importance to any Port Operators and Port Authorities around the world. Port efficiency and productivity are business cues that signals the overall performance, profit and to an extent the overall status of a given port as compared to other competing ports (Ha, Yang, & Lam, 2019). Port efficiency and performance is usually measured by quantifying measurable attributes of port terminal efficiency and yard throughput. The process of measuring port performance usually entails assigning a measurable attribute to a given port productivity or port efficiency indicator. These measurable attributes are the indicating variables that together acts as indicators for port performance and port efficiency. However, no two ports are the same as different port serves different functions and are affected differently with regards to a country's environment, social, economic and political climate. Hence, the composition of Port KPIs for a particular port may differ from those of another port. Nevertheless, most of these KPIs quantify the same attribute of a given port and therefore they can be applied to any seaports of the world. Having a set of KPIs to measure port performance is vital for a ports long-term operations and development plan as port KPIs determine the efficiency of a port. The data obtained from port KPIs that pertains to any specific aspect of the port operation is used by port managers to make better and well-informed decision as to how to mitigate issues affecting port productivity while at the same time forecasting the opportunities that a given port can dwell or invest on in order to maximize its returns. Ports have moved from their traditional operations into a more central player in the overall supply chain network and with more value added operations taking place within ports that makes port to be a more dynamic and complex and stand-alone business on its own. Adopting and implementing energy and environmental management standards into the operation of seaports will eventually improve Port KPIs in the short and long-term business cycle of seaports.

2.3 ISO Management Systems (Standards)

ISO Management Standards and Systems are internationally approved and accepted standards that are used and implemented to safeguard a particular industry or institutional operations and to certify that the operation of an organization or industry is up to bar and fulfils all the requirements needed for a safe, healthy and ethical operation. The ISO management system standards (MSS) helps organizations improve their performance by identifying repeatable steps that organizations should consciously implement in order to achieve their goals and objectives and also to create an organizational culture that involuntarily engages in a continuous cycle of self-evaluation, correction and improvement of operations and processes through enhanced employee awareness and management leadership and commitment (International Organization for Standardization, 2019). This international standard is based on the Plan-Do-Check-Act (PCDA) framework for continuous improvement.

2.4 Energy Management System (International Organization for Standardization)

Energy Management Systems (EMS) such as the ISO 50001 series are energy standards developed by the ISO to ensure companies and industries use a sustainable energy management system in their day-to-day operations. The ISO 50001 is an international recognized energy management standard that provides a framework centred around people, technology and information systems to deliver a sustainable annual carbon savings. It also provides a structure within which industrial plants, commercial facilities and organizations as a whole can adopt, implement and save energy in their operations (see Figure 1). The ISO 50001 has proven to have a positive impact on an organization's efforts in becoming more energy efficient in its daily to annual operations. Hence, adopting this energy management standard in seaports of SIDS will be a fruitful investment in achieving the seaports energy consumption while at the same time cutting down costs related to the current increase in energy consumption.

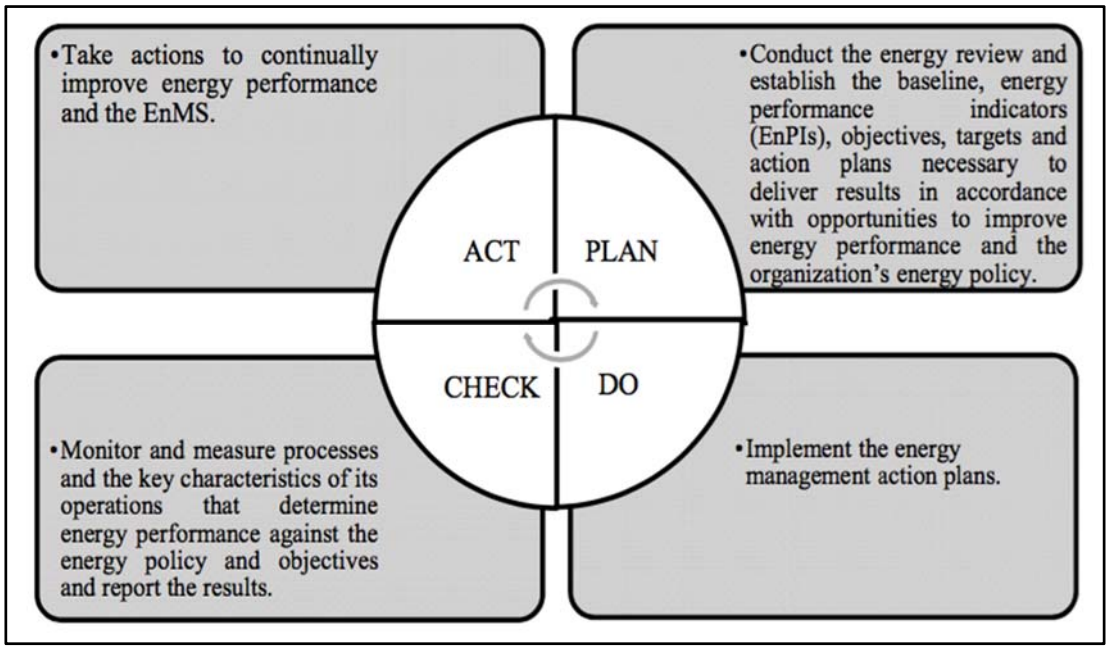

Figure 1: PCDA Cycle of ISO 150001 implementation procedure (Source: Samarakoon and Rajini, 2013).

2.5 Environment Management System (International Organization for Standardization)

Environment Management Systems such as the ISO 14001series are environmental standards developed by the ISO to help organizations improve their environmental performance through the efficient use of resources and the reduction of waste in order to gain a more competitive advantage and trust of their relative stakeholders and business partners (Tarí, Molina-Azorín, & Heras, 2012). By adopting and implementing the environmental management standard, an organization makes a commitment to be a leader in the implementation of proactive initiatives to protect the environment from degradation and harm such as the sustainable use of resources and climate change mitigation approaches and a focus life-cycle thinking to ensure the consideration of environmental aspects from the design to the operational routine of an organization (Gawaikar, Bhole, & Lakhe, 2018; Heras-Saizarbitoria & Boiral, 2013). The ISO standards are designed to help organizations improve on managing their resources and thus cutting down operational costs related to their operations. In

the context of seaports of SIDS, this reduction on costs will be every beneficial to sustain their business operations and it will also be a very useful marketing tool for their organizations.

2.6 Seeking Sustainable Seaports (EcoPorts)

Currently, EcoPorts are the new, innovative and sustainable solution to seaports globally. They are seaports that are certified as having implemented fully the energy and environmental standards and live up to the expectations of sustainable ports. In the context of European ports, EcoPorts is their main environmental initiative. Initiated by a number of proactive European ports in 1997, the EcoPorts initiative was fully integrated into the European Sea Ports Organization - ESPO in 2011 (EcoPorts, 2019). The ESPO has been very instrumental in ensuring that all ports that are accredited as EcoPorts must maintain a certain standard using terms and conditions that they developed. ESPO is also generous in providing free toolkits and resources that seaports authorities of the world can use to educate themselves on the requirements of EcoPorts accreditation.

2.7 EcoPorts as a Solution for Future Seaport Operations

Green ports are viewed as a marketing strategy and a means of having comparative advantage over other ports and to attract more vessels and business partners that are also implementing sustainable business strategies. This incentive not only helps to attract shipping agencies and companies that are also implementing green shipping strategies within their organizations, but they are contributing to the global fight against greenhouse gas emissions and other toxic pollutants that degrade the environment (P. T.-W. Lee, Kwon, & Ruan, 2019). Therefore, even though the management standards presented some strict rules, guidelines and regulations that may seem a bit difficult for seaports stakeholders and seaport operators of SIDS to adjust and adapt to, they have been proven to be well reputable standards and have helped organizations to be more efficient in their operations.

2.8 Conclusion

The energy and environmental standards are some of the premier management standards that are currently being adopted and implemented within organizations of varying scale of operation and in different global context. They offer a promising criteria and accreditation that will be very effective for any small to medium and large scale enterprise. Despite the continuous design and refinement of these management standards, seaports of SIDS still do not adopt such standards and this is partly due to their design that does not fit well within the context of seaports of SIDS. Also, their adoption by seaports of SIDS is challenged by the inherent shortcomings of the nature of SIDS. The following chapters will disclose and discuss in significant detail the challenges that limits the integration of energy and environmental management standards into the seaports of SIDS.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This study will be carried out using a secondary research approach which uses a qualitative approach in order to fully achieve the aim and research questions posed earlier. As such, the whole study is carried out solely using secondary research methodological approach using selected secondary sources to make further analysis and deductions. Most secondary sources of information will be derived from:

- Journal articles,
- Books,
- United Nations Conference on Trade and Development (UNCTAD) reports and publications,
- International Organization for Standardization (ISO) reports and publications,
- Relevant organization websites,
- International Maritime Organization (IMO) reports and publications,
- Intergovernmental Panel in Climate Change (IPCC) assessment reports,
- Other United Nation's reports, documents and publications.

3.1 Research Limitations

Being a secondary or desktop research, this study will encounter several limitations. Firstly, desktop studies will, to some extent, lack quantitative sources to verify the realities observed on the cases used. Secondly, such studies might further provide certain information that one may consider incomplete. Lastly, secondary researches such as this, are likely to be subjected to the use of outdated sources. However, this study is one of the first studies in the maritime field to assess the limitations of integrating energy and environmental management standards to seaports of SIDS and

as such, the literature pertaining to this topic is rare and so embarking on a secondary research approach justifies well the intention to pursue this research using a secondary research approach. Using this approach, this research will be the first of its kind in this specific maritime-related theme in assessing the energy and environmental management standards in seaports of SIDS and will be valuable in the future as it can be used as a baseline study that pioneered this research niche.

CHAPTER FOUR

CHALLENGES AFFECTING SEAPORTS OF SMALL ISLAND DEVELOPING STATES (SIDS)

4.0 Introduction

Small Island Developing States (SIDS) can be defined as a distinct group of developing countries facing specific social, economic and environmental vulnerabilities (UN-OHRLLS, 2011). Land area, population, economic and environmental characteristics have all been used to define SIDS (Pantin, 1994). They were also recognized as a special case for their environment and development at the United Nations Conference on Environment and Development (UNCED), which was also known as the Earth Summit that was held in Rio de Janeiro, Brazil (3-14 June 1992). This recognition was also made specifically in the context of the Agenda 21 (Chapter 17G). Some common challenges facing SIDS include:

- Narrow resource base limiting the benefits of economies of scale;
- Small domestic markets and heavy dependence on a few external and remote markets;
- High costs for energy, infrastructure, transportation, communication, and servicing;
- Long distances from export markets and import resources;
- Low and irregular international traffic volumes;
- Little resilience and high exposure to natural disasters;
- Rapidly growing populations;
- High volatility of economic growth; and
- Limited opportunities for private sector and a proportionately large reliance on the public sector (UN-OHRLLS, 2011).

4.1 Challenges Affecting Small Island Developing States

The wave of urbanization has been phenomenal and is one of the defining features of our time. Urban population has increased to nearly fivefold between 1950 and 2011 and since 2008, more than half of the global population resides in cities (UN-Habitat, 2015). Current estimates have predicted that urban population will rise to 60 percent of the global population by 2030 (UN-Habitat, 2006). Urbanization in SIDS is currently a rapid phenomenon and requires urgent attention. Of the 65 million people that are currently living in SIDS, 38 million (59%) are living in urban settlements with the highest urban growth observed in Haiti (3.9 percent), Trinidad and Tobago (2.2 percent) and Cape Verde (2.1 percent) (UN-OHRLLS, 2012). The term 'urban' in the context of SIDS can refer to a relatively small town connected by villages and stretching a coastal boundary, a small town that is connected by villages on a single island, or a series of islets (ADB, 2012).

It has to be noted also that with this specific definition of SIDS in mind, the global trend towards urbanization is also clearly visible in SIDS (UN-Habitat, 2015). Despite the global urbanization trends that are commonly coupled with increases in gross domestic products (GDP), this is not the case in SIDS as urbanization in SIDS is attributed largely to and driven mostly by the informal sector such as agriculture and tourism as in the case of Cook Islands, Samoa and Vanuatu (ADB, 2012).

The majority of the population in SIDS are concentrated in their largest urban agglomeration hence creating the "primacy of capitals" – the dominance of a single urban centre, as a distinct feature in most SIDS (Connell & Lea, 2002). This has resulted in a 'skewed' concentration of political systems and administrative services, concentration of labour, centralization of the development of regional centres and the blurring of urban and rural boundaries due to extensive sprawl (Arthur, 2013). For example, in Trinidad and Tobago, 3 percent of the country's residents live in the capital city – Port of Spain with a density of 3,966 persons per square kilometre (UN-Habitat, 2015). The smallness of the size of islands in the Caribbean as well as in most SIDS means that there is little space available for development and so development pressure on coastal land is a necessity in most SIDS. UN-Habitat (2015) reported that the city

of Port of Spain has had a history of land reclamation so to make more available space for the city expansion. This has however led to the increased growth of informal settlements with a recorded total population of 65,000 persons living in informal settlements making up for approximately one-fifth of the population of the Greater Port of Spain (Beard, 2012; UN-Habitat, 2012).

The rapid and unplanned nature of urban expansion in both the Caribbean and Pacific islands means that a growing number of residents will be denied access to urban services and also the basic needs and increased exposure to industrial hazards (Pelling & Uitto, 2001). The inadequately constructed and highly dense dwelling forms together with the growth of informal settlements in vulnerable locations especially on steep slopes or adjacent to hazardous industrial settings will generate similar risk. Pelling and Uitto (2001) have also stressed that these are the principle reasons for the large loss in urban fringe settlements following Hurricane Mitch that devastated large tracts of the Caribbean coast in 1999.

Briguglio (1995) have pointed out that Small Island Developing States, due to their small size are economically disadvantaged for the following reasons:

1. They have limited natural resource endowments and high import content;
2. There are limitations on import-substitution possibilities;
3. They have small domestic market and dependence on export markets;
4. They are dependent on a narrow range of products;
5. They have limited ability to influence domestic prices;
6. They have limited ability to exploit economies of scale;
7. They have limitations on domestic competition; and
8. They have problems associated with public administration.

4.2 Challenges Affecting Seaports of Small Island Developing States

The seaports of SIDS are considered as the gateway to the world of trade where most of the incoming trade from overseas countries are usually transported over seaborne trade and via the seaports to the hinterland areas. Previous and current conditions of most seaports in SIDS are deteriorating especially when it comes to meeting

international safety standards and coping with safe trade rules imposed by international organisations such as IMO and UNCTAD. This poses another set of challenge for governments and port operators of SIDS. Seaports infrastructure and superstructure require expensive investments which needed more years of strategic planning and preparation together with a good financial backing in order to embark on such large-scale investments which are somewhat risky as they are largely determined and driven by the fluctuating inbound and outbound trade volumes as per the principles of derived demand that is evident in the maritime industry. In the third session of the multi-year expert meeting on transport, trade logistics and trade facilitation of the UNCTAD's trade and development board report (2014), several challenges in transport and trade logistics in SIDS were discussed and few of the challenges are categorized in the four major arguments listed below:

1. Shipping,
2. Seaport infrastructure and equipment,
3. Tourism: Air transport and cruise-ship transport,
4. Natural hazards: Geological hazards and extreme weather events, and
5. Climate change.

As a diverse group of island countries, SIDS share common features, challenges and vulnerabilities such as smallness of economies, population and area, geographic remoteness, and insularity. These factors have contributed to determine the continued function of a reliable, sustainable and resilient transportation system in SIDS. The five main categories of challenges that seaports of SIDS are currently facing clearly shows the multifaceted challenges that each seaport of SIDS brings within its own context. Thus, a more thorough approach has to be taken in order to interpret the underlying mechanisms that contribute to these five main challenges. Therefore, in order to fully understand the underlying details that surrounds the five challenges that seaports of SIDS are currently facing, a general discussion will delve into what each of these challenges entails.

1. **Shipping**

- **Small cargo volumes:** although SIDS are currently experiencing an overall economic and population growth, the current volume of cargo in SIDS is relatively small and thus it only attracts smaller vessels to be used and investors. Smaller vessels are calling on seaports of SIDS which results in the relatively higher costs per 20-foot equivalent units (TEUs) compared to the much cheaper cost per TEUs from larger vessels. The remoteness of SIDS coupled with their low import and export values which results in the indirect and long transport routes also affect the transportation costs for cargoes entering SIDS. Other considerations such as a vessel's required service frequency, vessel's total time berth time in ports, vessel size in relation to volume of cargo transported, vessel's speed, route length, physical constraints to vessel size calling into seaports of SIDS, and additional costs related to port charges have all contributed to the increasing transport and import costs which eventually affects the competitiveness of exports from SIDS in comparison with other overseas markets of the same or similar goods and products. In the review of maritime transport report by UNCTAD (2014), it was estimated that in 2013, the volume of goods unloaded in Pacific SIDS stands at 13.1 million metric tons which is nearly twice the weight of the goods loaded which stands at 7.5 million metric tons. Trade imbalances that exists in SIDS also creates operational challenges in higher costs for handling incoming cargo volumes. Domestic shipping also contributes to transporting produce to main international trading ports but at the cost of increasing fossil fuel consumption and varying domestic freight rates mainly due to scattered islands that require frequent ship visits and a lack of standard in domestic freight rates.
- **Accessing global shipping networks:** a country's location plays a vital role in ensuring its accessibility to global shipping markets. The UNCTAD's liner shipping connectivity index in 2004 ranks SIDS very low

on the index (UNCTAD, 2018). SIDS participation in global trade is largely hindered by individual countries position in the regional and global shipping network which is mainly dependent on factors that determine the varying levels of transportation costs. These factors include a country's geographical location, the strength of the hinterland connection and cargo base, port physical and administrative processes, and the underlying regulatory and legal framework that governs ports and port processes within SIDS. SIDS are also very geographically isolated from major global markets that are located in Asia, Europe and North America. The UNCTAD's liner shipping connectivity index (2004) estimated that the Caribbean SIDS are located 8,200 kilometers (km) from major global markets where as the Pacific SIDS are located 11,500 km away from major global markets. This remoteness to major global markets is again another factor contributing to the higher transportation costs. Further, as SIDS are not located closer to the major shipping lanes, they are served by smaller vessels through transhipment hubs but with higher costs per TEUs.

- **Domestic and inter-island shipping:** most islands in SIDS are scattered over vast distances from the main national hubs and trading centers and rely heavily on local inter-island shipping for the ease of connectivity to boost local economies within these remote islands. However, most inter-island shipping services are not so reliable and their services are also infrequent (UNCTAD, 2018). This unreliability and infrequency of inter-island shipping services have resulted in a much weaker service productive sectors such as in tourism, agriculture and fisheries to be evident in these remote islands. It also has negative consequences to income generation and production possibilities of remote islands as regular access to the main national markets is a very critical factor. Moreover, the inadequate shipping services in SIDS also resulted in islanders not having sufficient financial backing to pay for shipping services and the unreliable shipping services also creates a growing concern for produces and goods that have a shorter

shelf life and potential risks to passengers. The unreliable shipping schedules to the remote islands coupled with their infrequent calls to local ports also resulted in the increase prices of essential goods that were brought in from the major local trade centers and it further deters the production and marketing of local products such as handicrafts, vegetables, fruits, fish and copra. Although governments of SIDS are striving to implement subsidized shipping services to these remote islands and islanders, the extent and degree of success for this services still varies from one country to another (ESCAP, 2011).

- **Increasing dependency on energy imports:** the geographical setting of SIDS is a major contributor to the increasing consumption of fossil fuel and therefore higher freight rates. A report by SIDS DOCK (2010) posited that SIDS are highly dependent on imported fossil fuel consumption that costs more than 30 per cent of their foreign exchange annually. For the Pacific region alone, it is estimated that maritime transport consumes around 70 per cent of the total fuel imported (Newell, Nuttall, & Holland, 2015). In the same study, Newell et al. (2014) revealed that in Tuvalu, 64 per cent of fuel imports in 2012 was used by maritime transport which is 38 per cent of the total fuel imports for that same year. Increasing consumption of imported fossil fuel for maritime transport does not only affect a country's foreign exchange earnings, but, it also exposes SIDS to the growing volatility in energy prices. This will eventually lead to the increasing and fluctuating maritime transportation costs and other logistics-related costs which will ultimately lead to affecting the productive sector in SIDS. With the increasing attention of the global community on implementing sustainable solutions to the use of alternate fuel sources, SIDS have recently been engaged in testing and transitioning into renewable sources of energy such as wind, biomass and solar in various sectors to provide a more sustainable approach to energy generation. While new sources of energy generation and use is still finding its place in

SIDS, most countries in SIDS are still heavily dependent on fossil fuel for energy generation especially in the maritime transport sector and that includes the seaports and seaport operation in SIDS.

- **The structure of shipping markets:** liner shipping is a highly concentrated industry especially at the global level where over 10 per cent of the top ten companies are responsible for 60 per cent of global container carrying capacity (refer to Figure 2) with 20 companies controlling almost 80 per cent (UNCTAD, 2014). This means that freight rates are determined entirely by these mega shipping companies and SIDS would have less to no impact in negotiating changes in freight rates. This led to the creation of shipping commissions where certain governments of SIDS enacted restrictions to the shipping market to encourage local and regional economies that are safe, economical, reliable and coordinated that meets international commercial shipping demand. An example of this can be seen in the Pacific where the Governments of Palau, Marshall Islands, the Federated States of Micronesia, together with Saipan and Guam have formed the Micronesian Shipping Commission to safeguard the continued commercial shipping services within these island countries while ensuring a controlled competition throughout.

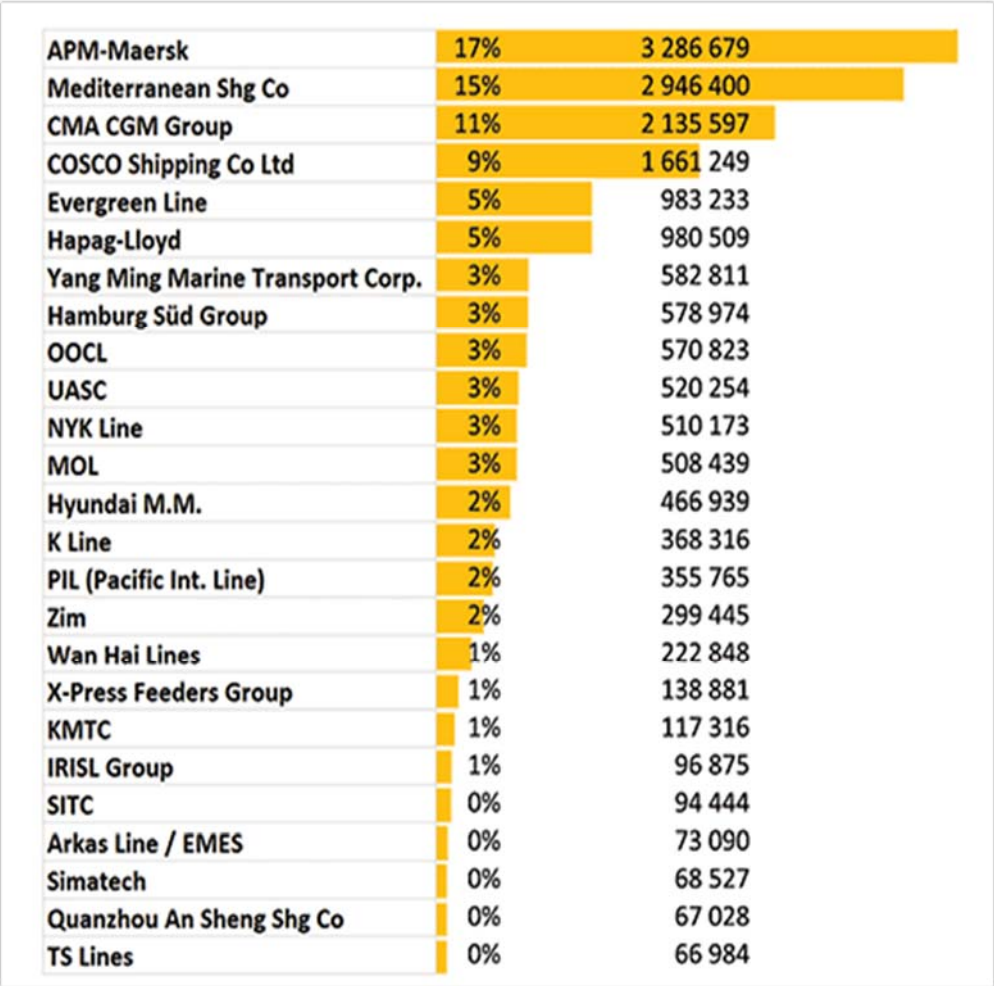

Figure 2: Top 25 container operators in 2017. (Source: Lloyd's Loading List, 2017).

- **Transportation costs and freight rates:** freight rates and transportation costs are still high in the context of SIDS. Although low shipping costs are deemed critical for facilitating trade, this is not the case for SIDS and other developing countries as international transport costs usually exceed custom duties which is another factor hindering international trade (UNCTAD, 2014). In the UNCTADs review of maritime transport (2014), it was observed that the expenditure of international transportation costs for SIDS was 10 per cent which is higher than the world average of 8.1 per cent where the top three highest values being 20.2 per cent for Comoros, 17.9

per cent for Seychelles, and 17.4 for Solomon Islands. The same report continues to state that the overall cost of freight paid by SIDS in 2013 was USD 4.1 billion which is 60 per cent higher than the 2005 total.

2. **Seaport infrastructure and equipment:**

- **Infrastructure and superstructure:** most SIDS have constructed their seaports even before the age of containerization. This means that the current seaport infrastructure and superstructures are old and their conditions are deteriorating. This is a result of poor maintenance and also likely due to a lack of qualified personnel specifically trained and tasked to perform specific maintenance checks to the current infrastructures and superstructures. The higher costs involved with infrastructure and superstructure maintenance is also another factor that hinders the frequent maintenance of seaport infrastructure and superstructure, even though frequent maintenance is needed for these assets to perform flawlessly and provide services that they were designed to perform. Restrictions to the capacity of port infrastructures and superstructures should be imposed in all seaports of SIDS to ensure that the seaports only cater for the certain vessel sizes in order to prevent the rapid deterioration of the current seaport infrastructures and superstructures. Outdated version of maritime charts and inadequate navigational aids is also a problem in SIDS as it may potentially contribute to increasing maritime accidents and is a concern for the growing cruise calls into most SIDS. There are also no dedicated cruise terminals in seaports of SIDS which leads to a higher rates of passenger safety incidents when embarking on the port terminals. This also delays berthing and cargo-handling for containerized cargo vessels which then lead to poor port performance and increased import costs. SIDS also pose a threat to navigation due to smaller and congested approach channels that are inherent in SIDS which usually lead to the obstruction and grounding of vessels which contributes to other serious maritime incidents such as oil

spills which is further exacerbated by the limited technical knowledge and financial resources to mitigate oil spill incidents and remove sunken vessels. Wreckage and other maritime collisions within SIDS will also have major economic repercussions especially those that are associated with oil spill risks from bunkers or cargo vessels (UNCTAD, 2012).

- **Seaport equipment:** seaport equipment is vital for enhancing seaport performance. Container handling facilities and equipment are necessary for the safe unloading and loading of containers onto vessels and for stacking containers at the stacking area. The efficiency of a port is highly dependent on the working conditions and the overall performance of these equipment. These seaport facilities and equipment are again very costly to maintain and spare part prices are very high. Changing the brand of equipment is also a costly practice as some brands would require a different set of spare part brands which may not be readily available and thus increasing spare parts compatibility issues for seaports of SIDS in the future. The costs of operating seaport equipment such as the cranes and winches are highly dependent on energy that are costly. Seaport equipment is also dependent on the type of cargo a particular seaport is importing or exporting. Hence, investing on seaport equipment that is specifically for a certain cargo type is not so beneficial if the market changes and there is a need to shift to purchase another seaport equipment that will be used for handling a different cargo type. Thus, more technical expertise on the nature of market is a much needed resource as forecasting future trade is essential and also a pre-requisite before seaport operators decide on which seaport equipment to purchase to ensure its feasibility for long-term use. An equipment that is not in operation is a liability to seaport operators and is costly to maintain. Furthermore, as these seaport facilities and equipment reach their maximum lifespan, most government agencies and public entities in SIDS has no capacity to recycle such mega structures and

therefore they create an added constraint to the environment which is not sustainable and jeopardizes sustainability efforts in SIDS.

- **Financial constraints in SIDS:** when it comes to developing seaports of SIDS, finance plays an integral role in ensuring that the port operators have sufficient financial backing to embark on new infrastructure and superstructure developments for upgrading seaports. The overall operations of seaports in SIDS is highly dependent on their financial capacity to ensure the proper running of daily port operations and the frequent maintenance of port facilities and infrastructures. Limited and inadequate financing of seaports operations in SIDS is evident in their substandard infrastructure and superstructure investments coupled with the employment of less technical staffs. This can be feasible for the seaport operators, but, will eventually he costly once the infrastructures and superstructures are deteriorating and when major maritime incidents occur that needed the assistance of a more technical personnel. Financial constraints can also lead to less competitive advantage in marketing as the seaport operators will not have enough financial backing to cater for marketing its services. Another important aspect of seaport operations is the ability to attract more shipping companies into their ports and by having inadequate finance and higher seaport charges, seaports of SIDS are not in a good position to influence market prices such as setting lower freight rates to attract more vessels which thus lowers their competitive advantage in the market. Other reoccurring problems such as corruption in the seaport operations is also a factor that is likely to contribute to misuse and mismanagement of operation funds. Seaport concessions and governance type is another aspect of seaports that need strengthening as public funds for capital expenditure and operations in seaports is very limited and seaport operations has to be very cautious on their investments and spending in both short and long term periods. Finally, maintaining seaport reputation is also beneficial for the marketing of port services and charges.

If a seaport operator has some records of the poor management of seaport assets and resources, then it will likely cause shipowners to redirect their vessels to other port of calls to avoid any potential and failed business deals with a given seaport which will further lead to a decline in overall revenue to the seaports.

3. Tourism: Air transport and cruise-ship transport:

Tourism is highly dependent on both air transport and cruise-ship transport and is the major contributor to SIDS economies. The tourism industry has both advantages and disadvantages to island ecosystems. For example, exports in the form of travel services in SIDS amount to USD 24 billion in the year 2012 which represents more than 50 per cent of the total services in SIDS (UNCTAD, 2014). The constant inflow of tourists from varying origins with the high frequency of tourists' arrivals by air and cruise-ships have caused an increase in the use and consumption of fossil fuel by both air and cruise-ship transport. Cruise-ship arrivals are increasing and the sizes of cruise-ships are getting bigger which requires more infrastructural changes and expansions to be put in place to accommodate the growing number of incoming visitors and the increasing vessel sizes. This would require more investment in infrastructure to accommodate the number of vessels calling into seaports of SIDS and the increasing vessel sizes. Moreover, all these investments will increase demand for energy consumption from the land-based hubs which are operated mostly by fossil fuel and infrastructural expansion such as expanding the port terminals to cater for these large cruise vessels is an added pressure to the surrounding maritime and coastal environment. With lack of local technical expertise to carry out energy and environmental audits for seaports in SIDS, there still exist the need for standards in order to ensure the feasibility of the tourism industry especially with regards to air transport and cruise-ship transport on energy consumption and environmental thresholds in SIDS. Therefore, as much as air transport and cruise-ship transport contributes to the tourism in SIDS, they are also one of the largest contributors to

increasing greenhouse gas (GHGs) emissions and a threat to the fragile coastal ecosystems surrounding seaports of SIDS.

4. Natural hazards: Extreme weather events and Geological hazards:

SIDS are at the forefront of extreme weather events and tectonic hazards. This is mainly attributed to their location relative to major tectonic zones of the world with most Pacific and Caribbean SIDS to be located within major hurricane belt of the world (see Figure 3). Most SIDS are located within the hotspot for hurricane or tropical cyclone activity and the incidents of hurricanes are also linked to other extreme hydro-meteorological events such as extreme precipitation that lead to flooding and storm surges. SIDS are also highly exposed to prolonged droughts, monsoon periods, sudden temperature changes and heat waves as was reported in the Synthesis Report by the Intergovernmental Panel on Climate Change (2007). Figure 4 below shows the intensive cyclone activity and the vicinity of ports within 50km from tropical cyclone storm track from the year 1960 to 2010. A UNDRR study in 2009 also confirmed that SIDS were attributed for their relative GDP exposure to cyclones.

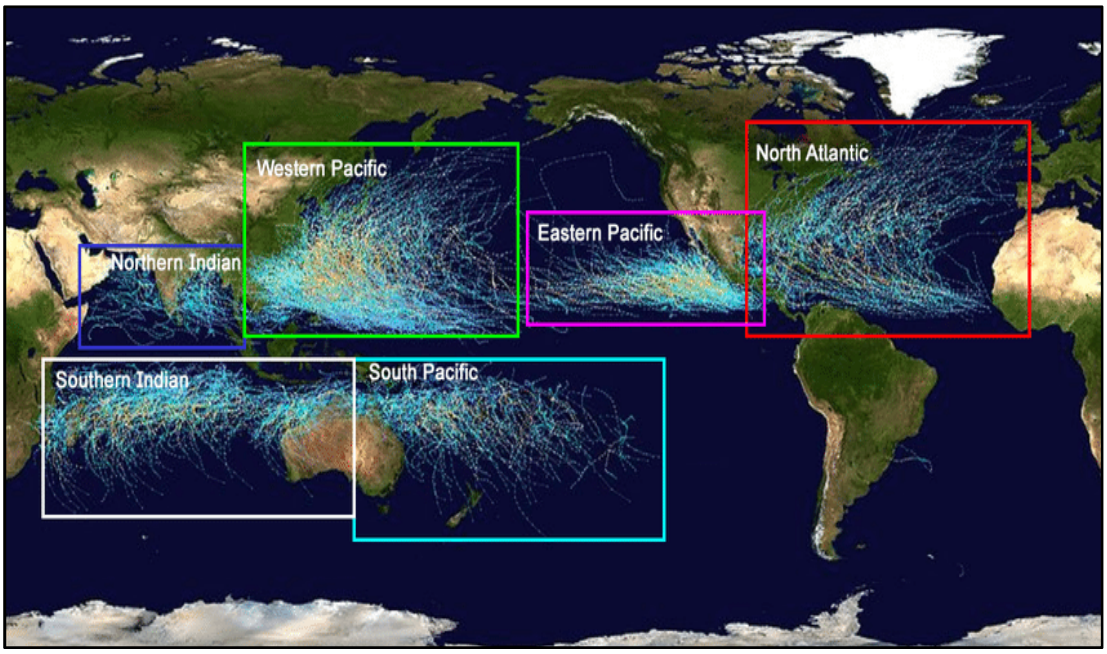

Figure 3: Major hurricane belts of the world (Source: Biondi, 2015).

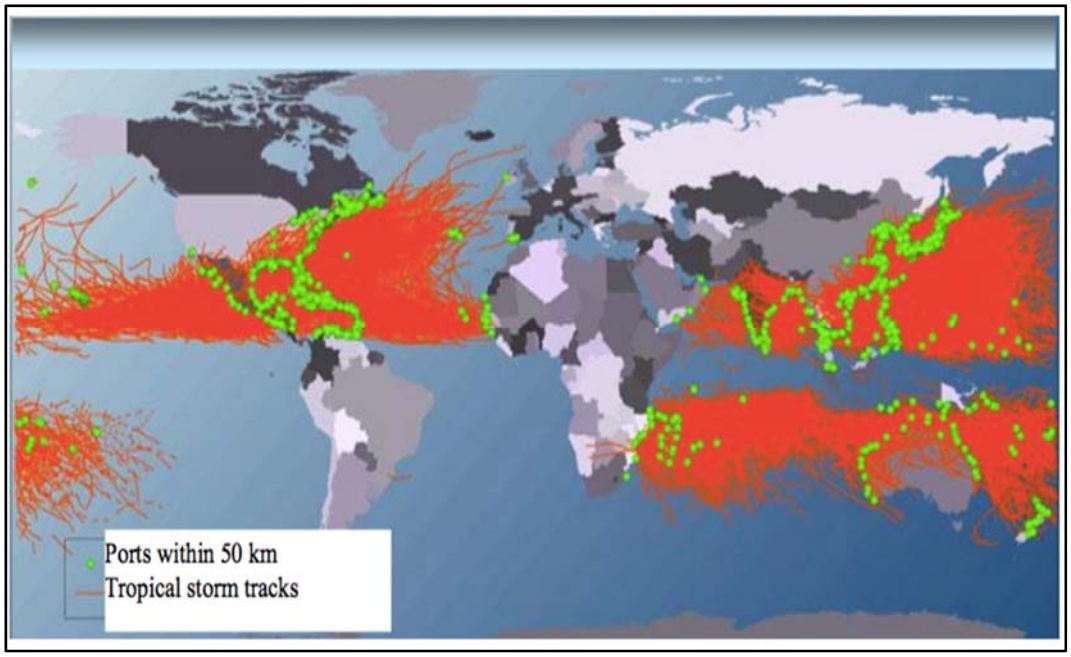

Figure 4: Ports within 50km of Tropical Storm Tracks 1960-2010. (Source: Austin H. Becker et al. 2013).

With the typical low-lying nature of most SIDS, storm surges are one of the most destructive events that was reported to have the greatest impact to not only the coastal communities but also to some of the only infrastructural developments that most of these island countries have. For example, severe infrastructural damage was reported by a study that was carried out by ESCAP (2011) as the major cause of coastal inundation and rapid coastal flooding in SIDS. Temperature changes and high precipitation levels in SIDS occurs mainly due to the presence of the El Niño – Southern Oscillation cycle which have proven to have negative implications for both the natural and built up coastal areas. This may lead to coral bleaching episodes and a shift and distortion of the marine life cycle.

This exposure of SIDS to natural hazards is detrimental not only to people's livelihoods, but it brings about additional economic challenges as it disrupts the day-to-day business cycle where a dedicated budget for economic development can be fully diverted to disaster recovery and rehabilitation of damaged sectors

such as agriculture, education, and health. With the common centralized governing system in SIDS with less decentralization efforts being made, the channel of allocating and accessing the national budgets for different sectors is quiet complicated and this can have an adverse effect to the financing of seaport operations.

Tectonic activity coupled with tsunami incidents is a destructive natural phenomenon and is troublesome for seaport infrastructure and superstructure in SIDS. Located on major tectonic plate subduction zones where the plates are tectonically active, most SIDS are vulnerable to volcanic eruptions, earthquakes, and tsunamis. Most Pacific SIDS such as Papua New Guinea, Fiji, Solomon Islands, Tonga, Vanuatu and Timor-Leste are located in the tectonic plate collision zone where the Pacific plate and the Australian plate meets. In the Caribbean region, most Caribbean SIDS are located on the edge of the Caribbean plate close to the Puerto Rico Trench. The location of SIDS on these high tectonic activity zones exposes them to a number of earthquakes, tsunamis and volcanic eruptions. For example, the devastating earthquake in Haiti on 12 January 2010 that registered a 7.0 magnitude on the Richter scale is responsible for the death of 316,000 people, causing injury to at least 300,000 people, displacing 1.3 million people destroying 97,294 houses and damaging 188,383 houses in the Port-au-Prince area (USGS, 2019). Tsunami-related casualties in SIDS during the period of 1990 and 2012 recorded more than 2,500 deaths, with an estimated total of USD 660 million to asset and infrastructural loss where Samoa and Maldives suffered the most damages of approximately USD 150 million and USD 470 million respectively in the overall damage (UNCTAD, 2014). Volcanic crisis is another costly and deadly disaster that SIDS encounter and can have harmful effects and experience for island countries. With a small land size, volcanic eruptions can threaten the entire country making it difficult for planning risk management measures where permanent evacuation is sometimes the only option. For example, the volcanic eruption of the *Manaro Voui* shield volcano in Vanuatu during the 2017 – 2018 period that resulted in the entire evacuation of the people from the

island of Ambae. During the eruption, over 400,000 tons of sulfur dioxide was reported to be injected into the upper troposphere with a total of 600,000 tons of sulfur dioxide for the year 2018 making it three times the amount released from all the global volcanic eruptions in 2017 (NASA/Goddard Space Flight Center, 2018). Seaport operators and These extreme weather and geological events have, over the years, proven to be the constant source of destruction to the overall social, economic, and environmental pillars of life in SIDS.

5. Climate change:

Climate change is a current threat to all SIDS. Temperature changes, a shift in rainfall patterns, and changes in sea-level are some of the obvious indicators of the changing climate. Altogether, these changes bring about certain challenges for island ecosystems in SIDS. Table 1 below summarizes the potential climate change impacts from different climatic factors on transportation and infrastructure in SIDS.

Table 1: Summary of potential climate change impacts of different climatic factors on transportation in SIDS.

Temperature	Road	Ports and airports
Higher mean temperatures; Heat waves and droughts; Increased variability in extreme temperature	Thermal pavement loading and degradation, asphalt rutting, thermal damage of bridges, increased landslides on mountain roads, asset lifetime reduction, increased cooling needs (passenger/freight), increased construction and maintenance costs; changes in demand	Damage to infrastructure, equipment and cargo; higher energy consumption for cooling cargo; air transport payload restrictions

Precipitation	**Road**	**Ports and airports**
Changes in intensity and frequency of extremes (floods and droughts)	Inundation; increase landslides and slope, earthwork and equipment failures; impacts on critical transport nodes (e.g. bridges); poor visibility and delays; changes in demand	Land infrastructure inundation; damage to cargo and equipment; port navigation channel silting
Winds and thunderstorms	**Road**	**Ports and airports**
Changes in frequency and intensity of events	Damages to fences; road accidents	Problems in vessel navigation and berthing in ports; air transport cancellations and delays
Sea-level rise and storm surges (King tides)	**Road**	**Ports and airports**
Increases in sea-levels and mean high tide; Increase in frequency and intensity of storm surges with the onset of King tides.	Damage to coastal roads, increased inundation of low-lying coastal roads, and damage to utility lines alongside coastal roads.	Erosion of port infrastructure and superstructure at an increasing rate; inundation and erosion of coastal airstrips; erosion and rutting of seaport and airport infrastructure and superstructures located within close proximity

		to the coast. King tides are naturally occurring and predictable events and they occur once or twice every year and are triggered by the combined effects of the gravitational forces exerted by the Sun, Moon and the rotation of the Earth which is manifested in the local rise and fall of sea levels. King tides are the highest tides and they cause more damage to both seaports and airports infrastructures and superstructures than the normal tides.

Note. Adapted and modified from "Small island developing States: Challenges in transport and trade logistics," by UNCTAD, 2014. Adapted with permission.

A further example of climatic impacts on the infrastructure and transportation in SIDS was mentioned in the UNCTAD study that was carried out by Isavela Monioudi in 2017 on the island country of St. Lucia. In that particular study, it was revealed that increasing temperatures are found to have an immense impact on aircraft operations and seaport operations in SIDS where it impedes the ability of workers and employees to work safely outdoors as well as contributing to

increasing energy costs. Table 2 below shows the climate stressor and in this case extreme heat and its disruption to airport and seaport operations together with the conventional thresholds of extreme heat and the projected disruptions in a given year for different time periods.

Table 2: Days of disruptions for the airports and seaports of St. Lucia.

Climate stressor	**Sensitivity**	**Thresholds**	**Disruptions (average days/year)**		
			2000-2019	**2040-2059**	**2080-2099**
Airports					
Extreme heat	Employee ability to work safely outdoors	Heat index (NOAA) over 39.4°C (103°F), resulting from 30.6°C (87.1°F) and 80% relative humidity presents 'high' risk	2.05	13.2	53.7
		Heat index (NOAA) over 46°C (115°F), resulting from 32.5°C (90.5°F) and 80% relative humidity presents 'very high risk'	0	1.05	11.8
		Boeing 737-500 aircraft would not be able to take off from HIA in the temperature exceeds 31.2°C without reducing aircraft loads	1.1	12.1	67.5
		Boeing 737-400 aircraft would not be able to take off from HIA in the temperature	1.7	12.25	67.9

		exceeds 31°C without reducing aircraft loads			
Ports					
Extreme heat	Energy costs	1°C warming = 5% increase in energy costs if temperature exceeds 27.8°C (mean temperature for the period 1986-2005: 26.8°C)	N/A	221	351.5
		3°C warming = 15% increase in energy costs if temperature exceeds 29.8°C (mean temperature for the period 1986-2005: 26.8°C)	N/A	47.6	179
		6°C warming = 30% increase in energy costs if temperature exceeds 32.8°C (mean temperature for the period 1986-2005: 26.8°C)	N/A	1	15.4

Note. Retrieved from "Climate change impacts on coastal transportation infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States," by I. Monioudi, 2017. Retrieved with permission.

The impacts of climate change as presented in Table 1 above and the case of extreme temperatures in the case of St. Lucia in Table 2 all point to the fact that SIDS will no longer be safe from these impacts in the future and this calls for increased adaption and mitigation measures and efforts. A presentation that was made by Dr. Leonard Nurse at the Ad hoc expert meeting on addressing the transport and trade logistics challenges of the small island developing States

Samoa conference and beyond in July, 2014 outlined some of the adaptation options for seaports of small island developing states (see Table 3).

Table 3: Adaptation options for seaports in small island developing States.

Engineering	Enhance the structural integrity of critical facilities including sea defences, berths, mooring facilities, runways and parking aprons, based on design criteria that reflect changing wind, sea-level and wave conditions; recalculation of return periods for major events such as hurricanes and floods, so that more resilient structures can be engineered.
Technology	Invest in more climate-resilient technologies and equipment in planned expansion and upgrade programmes, for example, gantry cranes that can operate at higher wind thresholds; solar power photovoltaics to generate electricity more efficiently for both operations and administration.
Planning and development	Internal capacity-building and retraining that recognizes the magnitude and implications of the threat; building of redundancy into critical operations, wherever feasible; off-site warehousing and storage in less vulnerable areas, and so forth.

Management systems	Various operation systems need to mainstream climate-change considerations into their procedures, for example, shut-down and start-up operations, emergency protocols and evacuation, environmental management systems, occupational safety and health protocols.
Insurance	Some risks cannot be avoided; therefore, they must be insured by third parties; ongoing collaboration with port management, climate scientists and insurance providers will provide a basis for more reliable quantification of exposure and risks that must be covered.

Note. Retrieved from "Ad Hoc Expert Meeting on Addressing the transport and trade logistics challenges of the small island developing States (SIDS): Samoa conference and beyond," by L. Nurse, 2014. Retrieved with permission.

Recently, countries are moving into integrating disaster risk reduction and climate change adaptation into their national development strategies. In the Pacific, there was the Pacific Disaster Risk Reduction and Disaster Management Framework for Action (2005-2015) and the national adaptation plans also the Pacific Islands Framework for Action on Climate Change 2006-2015. Some countries have drafted strategic national action plan for disaster risk reduction and climate change adaptation such as in Maldives (UNCTAD, 2014). Despite the efforts made in attempting to provide solutions for the proper adaptation and mitigation of seaports of SIDS to climate change impacts, the increasing intensity and frequency of these

impacts still outweighs the adaptation and mitigation efforts that were made. Thus, the various impacts of climate change affect all sectors of development within SIDS and seaports are no exception.

Furthermore, in order to ensure the proper integration of energy and management standards into the seaports of SIDS, all development sectors, stakeholders, government line agencies and non-government agencies need to strengthen collaboration and improve their working relationships. Strengthening working relationships among these stakeholders will be very beneficial to the operational aspects of minimizing the challenges that affects the integration of these management standards into seaports of SIDS. SIDS are currently faced up with the growing challenges that were identified and discussed above and there needs to be a sense of urgency when embarking on the various measures to rectify some of these challenges as what is normally written and talked about is not always implemented on the ground. In this case, most international meetings and conferences usually draw up 'roadmaps' and 'ways forward' for SIDS in order to fulfil formalities so that donor agencies can confirm that these meetings and conferences actually have a tangible outcome whereas in reality, most of the outcomes from these meetings are not fully implemented or realized in the local settings in most of the SIDS. Some of the factors that is likely to be the cause of the slow implementation of such programmes in minimizing some of the issues faced in SIDS is the lack of resources and the political climate of individual SIDS. With proper financial backing and expert people working in the field can help improve the rate at which some of these issues can be solved. Further, the implementation of energy and environmental management systems on seaports of SIDS should have a much stringent and operational enforcement component as with most of the ratification of international conventions, a great number of them are ratified nationally but there are no operational mechanisms in place to for enforcement purposes and thus implementation shortcomings in the long run.

4.3 Conclusion

SIDS provides a very unique setting to the study of seaports as it presents a multitude of challenges that should be considered by all government institutions and also the non-government organizations. This chapter has documented to a significant extent, the various challenges that hinders the seaports of SIDS to progress and develop more into more advanced trade and business hubs of the world. Having its own set of challenges as island states, SIDS are exposed not only to challenges within their reach but are also exposed to challenges that are beyond their control and that which needs more attention in order to ensure the sustainability of the seaports in SIDS. The five main categories of challenges to seaports which are discussed in detail herein, namely shipping, seaport infrastructure and equipment, tourism and in particular the air transport and cruise-ship transport, natural hazards mainly geological and extreme weather events and climate change are some of the main challenges to the seaports of SIDS. Thus, this chapter has fulfilled its purpose and that is to identify and assess the limitations in SIDS that hinders the integration of energy and environmental standards to their seaports. The next chapter will review and discuss the current energy and environment management standards and their limitations to be integrated into the context of the seaports in SIDS.

CHAPTER FIVE

INTEGRATING ENERGY AND ENVIRONMENTAL STANDARDS INTO SEAPORTS OF SMALL ISLAND DEVELOPING STATES

5.0 Introduction

Integrating energy and environmental standards into the seaports of SIDS is a very ambitious but challenging exercise. The ambitious aspect of integrating energy and environmental management standards into seaports of SIDS is that it can be a far-reaching exercise where one can only describe it as a "long shot" as looking at the current status of seaports of SIDS, their current challenges, their management and their overall operational capacity, it is evident and obvious that a shift into more energy and environmentally efficient port is simply out of the reach for seaports of SIDS. On the other hand, the challenging aspects of integrating energy and environmental standards into seaports of SIDS are numerous as was previously discussed in chapter four above.

The extent of the impact that energy and environmental management standards has on the seaports was well exemplified by leading seaports and seaport operators of the world including the European Seaports Organization, Port of Genoa and Port of Hamburg to name a few. Adopting the energy and environmental management standards, namely the ISO 50001 and ISO 14001 respectively, is not an easy and straightforward process as it involves not only an overall change to the organizational structure of a particular seaport, but also to its employees to maintain the high professional standards in order to efficiently implement these standards. With the previous and current international conventions that were signed and ratified by countries of the world such as the United Nation's Agenda 2030, International Convention for Safe Containers (CSC) of 1972, Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LC) of 1972 (and the 1996 London Protocol), International Convention on Oil Pollution Preparedness, Response

and Co-operation (OPRC) of 1990, International Convention of the Control of Harmful Anti-fouling Systems (AFS) of 2001, International Convention for the Control and Management of Ship's Ballast Water and Sediments of 2004, the IMO's MARPOL Convention and the fast approaching IMO Sulphur cap or IMO 2020, it exerted an immense pressure on a country's effort to ensure their continuous implementation in order to upheld a country's position as signatories to the convention. This also exert added pressure to seaports and seaport authorities especially in SIDS who are signatories to most of these conventions to strengthen their roles in the implementation and enforcement of the nationally ratified conventions. By adopting and using internationally recognized management standards such as the ISO 50001 and the ISO 14001, organizations such as seaports and seaport authorities in SIDS can ensure a more energy efficient and environmentally friendly service that is attractive in the market and one that has sustainable outputs for a prolonged period of time.

However, to fully understand the dynamics involved in integrating energy and management standards into seaports of SIDS, it is essential to understand the challenges and shortcomings of the two management standards separately so that more detail about their nature can be uncovered and potential solutions can be proposed in order to rectify the issues hindering each management systems to fulfil their potential in seaports of SIDS. This chapter will discuss more in detail the challenges of integrating energy and environmental standards into the seaports of SIDS. It will further discuss the future of energy and environmental standards in seaports of SIDS.

5.1 The Challenges of Integrating Energy Management Standard into Seaports of Small Island Developing States

Energy is a critical aspect of seaport operations and it can be a very costly. Almost all aspect of seaport operations thrives on energy to sustain their daily functions from the administrative buildings that houses most of the information pertaining to port operations, the power outlets that sustain reefer containers, the cranes at the berths and the navigational aids used to guide vessels into the seaports. These individual process

of seaport operations demands a constant and reliable energy supply and in large quantities for the continuous operation of seaport processes. Almost all seaports are striving to maximize their outputs and increase their net returns. One of the main factors that contributes to costing seaports a huge portion of their financial resources is the cost of energy. Therefore, a reduction in the overall energy consumption of an organization or company leads to an overall reduction in their operating cost which this helps improve the profitability of organizations (Jayamaha, 2006). In SIDS, energy is highly backed by non-renewable sources, mainly fossil fuels and as such, the increasing demand for energy outweighs the available supply which is a concern for future developments and increasing operations in seaports as maintaining the growing processes and functions of seaports will require an increasing demand for energy. The constraint in energy supply calls for a more stringent energy management strategy to be developed for the seaports of SIDS in overcoming this growing concern. The internationally recognized energy management standard (ISO 50001) is gaining popularity at a much faster rate as it was proven to have an impact on up to 60% of the world's energy use and with its applicability across national economic sectors (Samarakoon & Rajini, 2013).

However, although the ISO 50001 standard is being widely adopted by many organizations and companies of the world today and despite its numerous contribution to the reduction in energy consumption in many cases and scenarios its development and use in seaports of SIDS is still minor and to some extent, unknown. This is due to several factors that are hindering its development and implementation. Table 4 below tabulates the potential causes of limitations that surrounds the successful implementation of the energy management standards in seaports of SIDS. The major findings from the literature on the barriers to implementing management systems can be categorized into eight categories, namely; 1. institutional problems, 2. the complex nature of the certifying process, 3. financial constraints, 4. less awareness on the importance of its applicability, 5. organizational cultural aspect, 6. lack of support and

guidance, 7. insufficient benefits and outcomes, and 8. inconsistency on top management support.

Table 4: Factors that limits the adoption of energy management standard (ISO 50001).

Factors hindering the adoption and implementation of ISO 50001 in the seaports of SIDS	**Explanation**
Institutional problems (McKane et al., 2009) and (Thollander & Dotzauer, 2010).	There is a sense of low creditability and trust on information.
The complex nature of the certifying process	The certification process and procedure can be time consuming before the accreditation can be obtained or achieved. Also, the large amount of documentation involved when trying to achieve the accreditation is too much for some organizations to handle.
Financial constraints (Rohdin, Thollander, & Solding, 2006).	There exists unbearable certification cost associated with the energy standard certification. Hidden costs from the energy certification are likely to be encountered of which it adds more to the overall cost. A lack of budgeting from the organizations will make it hard to maintain the longevity of the certification.

Less awareness on the importance of its applicability (Siriwardana, 2009).	Some organizations still need more training and exposure to the work of ISO management standards and their effectiveness.
Organizational cultural aspect (Rohdin et al., 2006).	Lack of power to influence decision on adopting energy management standards coupled with the negative attitudes of employees towards energy management standards adoption, implementation and enforcement.
Lack of support and guidance	A lack of support and guidance mainly due to the level of expertise on the adoption of energy management standards.
Insufficient benefits and outcomes	It has never been tested before so limited knowledge about the energy management standards still exists.
Inconsistency on top management support	Adopting a new energy management standard will not be compatible with the current organizational policies and traditional day-to-day business focus. This limits the chances of integrating energy management standards into an organization's operational environment.

Note. Adapted and modified from "Enablers and barriers of implementing ISO 50001 – Energy management systems (ENMS) in Sri Lankan context," by

S.B.R.G.K. Samarakoon and P.A.D. Rajini, 2013. Adapted and modified with permission.

The limitations pertaining to the adoption of energy management standards by seaports of SIDS as was tabulated in Table 4 above clearly outlined the various challenges that seaport authorities and stakeholders needed to take note of if they are planning to venture into the adoption of the energy management standards. In their study, Samarakoon and Rajini (2013) discussed that most organizations regard the adoption and implementation of the energy management standards as a barrier to their market competitiveness as in the case of developing countries. The eight challenges that are were tabulated in Table 4 above are discussed further below:

Institutional problems – institutional problems arise when there are less technical employees with the technical operational knowledge that are trained to continuously monitor and assess the integration and use of the energy management standards. Also, most seaport operators lack energy policies in place for facilitating the implementation of energy management standard (McKane et al., 2009).

The complex nature of the certifying process – the ISO 50001 documents contain highly technical terms and this is exacerbated by the large amount of documentation that complement the implementation procedure of the energy standard before accreditation can be granted. With highly specialized employees in the seaport operations that focus only on a limited task during normal seaport operation working hours, these added constraints to their normal day-to-day chores cannot be tolerated. Hence, there needs to be a much simple process in place so to encourage employees and companies to welcome its implementation.

Financial constraints – financial constraint is one of the biggest, if not the biggest contributor to limiting the implementation of ISO 50001 in seaports of SIDS. For seaports of developing countries and SIDS in particular, the cost of implementation

and renewal of the energy management certification is unbearable and not feasible especially for small and medium scale enterprises.

Less awareness on the importance of its applicability – most seaports of SIDS, due to their relatively small scale of their operations has never put more focus and attention on adopting and implementing the energy management standards and although there are resources that are freely available to educate the seaports authorities about energy management, they do not see the importance of its applicability to their current scale of operations.

Organizational cultural aspect – different seaport authorities of SIDS have a different approach to their organizational culture, norms, and values and they act as barriers for the implementation of the ISO 50001. Adopting the energy management standard would demand a whole new change for individual organizations and to some extent distort organizational culture, values and norms which is not a favourable option for certain organizations.

Lack of support and guidance – one of the important barriers to the adoption and implementation of energy management standards to seaports of SIDS is the lack of support and guidance. Most of the seaport authorities in SIDS are not educated about such standards and are not provided with relevant and sufficient information about getting the accreditation of energy management standards within their organizations.

Insufficient benefits and outcomes – this particular challenge is related to the potential risk involved when attempting to invest in the energy management standard. The capital costs involved in investing in this management standard can be known to seaport managers and authorities, but, the uncertainty in the long-term savings in its operational costs would mean that the seaport authorities in SIDS are putting themselves at risk by investing in a certification that they have no awareness or first-hand information about its nature.

Inconsistency on top management support – certain organizations and seaports in SIDS have long been used to their normal day-to-day operations for as long as they existed and this may have an impact in trying to adopt the supposedly new management standard which is outside of their business focus.

The challenges involved in integrating energy management standards to seaports of SIDS presented above takes on a holistic approach in identifying the most common drawbacks associated with the adoption and implementation of the energy management standards in any given seaports in a SIDS context. These barriers and drawbacks involved in integrating energy management standard to seaports of SIDS presents a useful insight into some of the important considerations a seaport authority should consider before attempting to invest in adopting the energy management standard. The next section will discuss more in detail the challenges involved in integrating environmental standards into the seaports of SIDS.

5.2 The Challenges of Integrating Environmental Management Standard into Seaports of Small Island Developing States

With the growing trend of global trade and shipping ports being at the forefront of maritime trade, environmental challenges will surely become a rising concern for seaports of SIDS. SIDS are at the forefront of increasing environmental concerns where threats to their existence is highly dependent on how best they manage their available resources while at the same time finding a balance between development and sustainability in order to ensure the continued livelihoods of its people now and in the future. As environmental laws, international environmental conventions and environmental advocates are gaining global recognition supported by factual evidence from around the world, more companies and organizations of the world are moving towards a more sustainable operations and environmentally-conscious work ethics with the hopes of ensuring a sustainable future by decreasing their impact on the environment. The development and use of the ISO 14001standard is another globally recognized management standard that specifies the requirements for achieving an

environmentally management system that organizations can use to boost or enhance their environmental performance (International Organization for Standardization, 2015). One of the main objectives of the ISO 14001 is to systematically control the adverse impacts exerted on the environment and to ensure that its targets and objectives are met. This environmental management system is designed for any organizations that wishes to demonstrate to customers, regulators and insurers and public and financial institutions, that the organization is committed to effective environmental management (Perera, Weerasinghe, & Narangoda, 2017). The ISO 14001 standard consists of interrelated elements that altogether enables a firm to manage, measure and improve the environmental aspect of its overall operation through the creation of environmental policies, setting up targets and working objectives, implement programs to achieve the targeted objectives, monitoring, measuring and assessing effectiveness of programs, and rectifying and reviewing programs for their continuous improvement (International Organization for Standardization, 2004).

Seaports in SIDS have long been engaged in facilitating maritime trade and most of these seaports have never considered adopting and implementing environmental standards partly due to their relative smaller scale of operations. Further, for most seaports in SIDS, the primary objective is to facilitate seaborne trade and maximize their profits as some of these seaports are the only port of call for an entire country and this monopoly gives them the advantage to be the price setter for the services they provide. Implementing the ISO 14001 into seaports of SIDS will also be a challenging task. Table 5 below are some of the challenges that are likely to be barriers to the adoption, integration and implementation of the environmental management standard into seaports of SIDS:

Table 5: Factors limiting the adoption and implementation of ISO 14001 in seaports of SIDS.

Factors hindering the adoption and implementation of ISO 14001 in the seaports of SIDS	**Explanation**
Change of personal attitudes and practices	Seaport operators are 'used' to their normal way or traditional business culture, values, and norms and are hesitant to adapt to new changes to their organization.
Financial costs involved (3 categories of cost) 1. Design costs related to the specific seaport context, 2. Costs relating to the necessary technical measures for guaranteeing the improvement of environmental performance, 3. Costs relating to the environmental management standard implementation, and 4. Costs to be sustained for obtaining a third party certification. (Biondi et al., 1998).	Financial costs here are categorized into four different categories so to clearly explain the types of costs that a seaport will encounter if they adopt the ISO 14001.

Lack of understanding and practices	Seaport operators and employees may lack the technical know-how of fully implementing the environmental management standards into their operation.

Note: Adapted and modified from "Potential drivers, limitations, and benefits in implementing ISO 14001 Environmental Management Systems for organizations in Sri Lanka," 2017 by Perera, Weerasinghe and Narangoda. Adapted and modified with permission.

From the challenges related to the implementation of the environmental management standards into seaports of SIDS stated in Table 5 above, it can be observed that the costs related to the ISO 14001 adoption and implementation is the most challenging factor that any small-to-medium-sized enterprise (SME) such as the seaports in SIDS are likely to encounter. Other factors such as the change of personal attitudes or the attitudes of the seaport authority as an organization has to change in order to welcome new, innovative and value-added accreditations such as the ISO 14001 to their ongoing operations. Another limitation to adopting and implementing environmental management standards in seaports of SIDS is the lack of technical expertise of the employees to fully implement, monitor and assess ISO 14001 in their daily operations.

However, comparing the limitations from ISO 50001 and ISO 14001, it can be said that there are few challenges related to the implementation of the environmental management standard (ISO 14001) in seaports of SIDS than the ISO 50001 (energy management system/standard). This is mainly due to the benefits of implementing environmental standards in seaports of SIDS that outweighs its barriers and limitations unlike the energy management standard which seaports of SIDS are highly dependent on for as the main energy source as alternatives are still in their trial stages and still

need to convince seaport operators to switch from fossil fuel sources to the newly introduced sources of energy. This brings the discussion of this study to a stage where a proposed outlook must be considered in relation to the future of energy and environmental standards in seaports of SIDS. The next section will discuss the future of energy and environmental standards in seaports of SIDS.

5.3 The Future of Energy and Environmental Management Standards in Seaports of Small Island Developing States

With the limitations and challenges to the adoption and implementation of energy and environmental management standards into seaports of SIDS provided in this chapter, a proposed outlook into the future of these management standards has to be reached in order to mitigate some of the challenges and limitations presented above. Below is a list of the recommendations for the future of energy and environmental standards adoption and implementation in seaports of SIDS:

1. Conduct training and awareness programmes on ISO 50001 and ISO 14001certifications for seaports stakeholders and seaport operators of SIDS, as well as for consumer education in ISO 50001 and ISO 14001.
2. There is a need for supportive know-how for adopting and implementing ISO 50001 and ISO 14001 standard requirements by certification organizations.
3. Governments can impose a reduction or exemption of tariff on the importation of fossil fuel, pollution control and pollution preventative equipments to overcome the design cost of the energy and environmental management standards.
4. ISO 50001 and ISO 14001 certified companies shall be favored within the public procurement process and n service contracts.
5. Resistance to change is often experienced in the employees of any organization and so educational programmes and campaigns must be designed to target these workers and the gradual change of their behaviors and also motivate them to actively participate in implementing energy and environmental management

standards and divide monetary benefits and rewards derived through the improved operational efficiency of these management standards to help overcome this particular limitation.

6. Energy efficiency and environmental protection should not be viewed in isolation and needs to be associated with development and economic growth and financial support from the government will be a motivation for organizations to opt for ISO 50001 and ISO 14001 accreditation.
7. Seaports authorities and operators should engage in feasibility studies such as the SWOT, PESTEL, and cost and benefit analysis (Mu et al.) to fully understand the potential financial costs and other operational risks that they might encounter before engaging in the certification process.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

6.0 Conclusion

Seaports of SIDS have long been the main gateway of SIDS to the outside world in terms of seaborne trade and is also from seaborne trade that SIDS get to have their share of the economic development. Operating in isolation and with limited resources and capacities, seaports of SIDS still manage to strive through their shortcomings and constantly trying to find their place in the global shipping market. Despite their numerous challenges faced in the supply chain and global trade markets, seaports of SIDS are currently presented with new set of challenges and it comes in the form of energy efficiency and environmental management. These new challenges bring more serious threats as it is concerned with the continued existence and longevity of these seaports and their place in the global seaborne trade dynamics now and in the future. Adopting and implementing energy and environmental management standards to seaports of SIDS is considered the most favourable option for seaports to mitigate the new challenges that pertains to energy efficiency and environmental management.

Therefore, while seaports of SIDS are still striving to curb issues related to their internal and external operations, and while this study presents some limitations to the adoption and implementation of energy and environmental standards into seaports of SIDS, it must be noted that the advantages of fully implementing these management standards in seaports of SIDS still outweighs its disadvantages. Hence, adopting and implementing energy and environmental management standards will have very beneficial outcomes and will bring a win-win situation to both the seaports and SIDS now and in the future.

6.1 Recommendations for Future Research

This research has successfully achieved its main aim and has also answered the research questions posed at the introductory chapter. While it is a brief study on the limitations of integrating energy and environmental standards into seaports of small island developing States (SIDS), this research was made possible through the use of the very informative and readily available but limited sources and has been conducted mainly through the use of secondary sources of information and resources as one of its main methodological approach. While it is deemed as the only research option for a topic that is relatively new and least explored in the maritime literature with limited literature on that particular topic, a more quantitative approach should be conducted in the future to investigate seaports of SIDS into more detail to quantify their current energy consumption levels and their impact on the surrounding environment with regards to the scale of their operations. This would provide a more tangible insight into the realities of the seaports of SIDS and would make for a much stronger case to back such desktop studies such as the one carried out herein.

Consequently, another future research recommendation would be that future researchers in this topic should carry out more empirical studies on the public and private partnerships (PPP) in order to assess their impact and roles in the quest for adopting and implementing energy and environmental management standards in small to medium and large scale enterprises from a national perspective in SIDS.

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Appendix

Appendix 1

United Nation's Sustainable Development Goals