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**APPLIED SCIENCE FOR ENVIRONMENT
SUSTAINABILITY**

**CORE CLIMATE CHANGE RISKS,
THE IMPACT OF COSTS ON MAESRK LINE
AND
SEVERAL STRATEGIES TO REDUCE THIS IMPACT**

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Introduction

Climate change is essentially affecting all aspects of human life, including the shipping and maritime industry. Impacts are already noted in ports and ship channels, due to; the rising sea levels and changes in erosion and sedimentation patterns, extreme weather events such as hurricanes and storms, changes in key variables such as prevailing winds, waves, currents, precipitation rates and higher temperatures. There are completely new routings being planned at sea due to the melting of ice in the sea, especially around the North Pole. The decreasing polar ice will also enable several other maritime activities such as mineral exploitation and fishing in polar areas. The assignment will review how the maritime industry will be affected technically and economically due to the climate change.

However, these climate risks are caused through modes of transportation that use fossil fuels. Ships produce carbon dioxide emissions that significantly contribute to global climate change and ocean acidification. Besides carbon dioxide, ships also release other pollutants that also contribute to the problem. To make matters worse, these ships also burn the dirtiest fuel on the market, a fuel that is so unrefined that it can be solid enough to be walked across at room temperature. Both have negative impacts on one another actions. The company I have chosen to examine is Maersk, because of its excellent status as the

world's largest container shipping company. They are known for reliable, flexible and eco-efficient services. In this assignment, I plan to provide an overview of how climate change is affecting the ocean and inevitably the maritime industry. Once the climate change risks have been identified, new and different strategies and techniques on how to deal with and reduce the impacts on our company (adaption and mitigation).

Maersk

Ninety percent of world trade is transported by sea. This translates to over 5,000 massive container vessels transiting the vast, salty sea lanes annually. Maersk Line, a business unit of Maersk, is the largest provider of these shipping services world-wide. Shipping companies such as Maersk are intimately linked to climate change in two major ways.

The first way climate change affects Maersk is through the related environmental changes, such as the increase in frequency of severe weather, that Maersk must endure to remain competitive. These challenges present a significant threat to Maersk's operations and must not be ignored. While the reduction of CO₂ equivalent emissions is vital to the sustainability of our planet, the climate changes that come with greenhouse gas effects is inevitable. As per scientific and economic journals, the increasing arctic temperatures and rising sea levels are "virtually certain" and increased weather intensity is "likely." Shipping companies are particularly exposed to these effects given their global port distribution, 72 ports and terminals in 69 countries on five continents, and their ability and tendency to move vast distances around the globe. These effects will have multiple implications on the operating model of Maersk.

The most obvious implication is the physical risk of the ship and its cargo associated with traversing the high seas in extreme weather. The greater the frequency, the higher the probability of damage to ships or cargo. This equates to higher costs for Maersk. At a strategic level, Maersk must make capital investments to insure against such events. For example, it may prove beneficial for Maersk to invest in state-of-the-art weather systems that provide real-time, global weather coverage with associated severity estimates to assess the riskiness of a given shipping route that Maersk intends to execute. Secondly, the increase in frequency of major natural disasters will significantly impact the logistics of Maersk. When a natural disaster hits a port, it could potentially cause so much damage that the port becomes inoperable.

For example, Hurricane Katrina caused over \$250 million dollars of damage to the Port of Gulfport and the in-port ships and cargo. Port closures or damages could have rippling negative effects in the global supply network because the movement of ships, which move the massive supplies of basic economic staples such as oil and food, would be curtailed.

Maersk must be equipped to deal with these crises more frequently. Finally, rising sea levels could potentially cause more frequent port flooding and threaten the existence of the current infrastructure. Although Maersk does not own port logistics, the costs associated with having to deal with these complications (e.g. delays, loading inefficiencies, risk of damaging goods, maritime accidents, etc.) will be a substantial. As in the maritime industry everything tends to be urgent and time sensitive. Below is a detailed description of some of these complications.

Implications of Climate Change

Delay in freight delivery: This is the most obvious disruption. Dealing with severe weather can not only impede travel times, but it can make travel impossible altogether. Blizzards are one example of seriously slowing down travel times. Ice on roads can also stall travel times and even make driving along some paths not feasible. More extreme weather such as floods can also impact travel through tunnels and to airports, which reverts trucks from connecting their freight.

Risk of damaging goods: Weather plays kind of a double role when it comes to how it can damage goods. First, the actual weather itself can impact freight depending on what is being transported. So, if a truck is carrying food products and travelling through an area of extreme heat or cold, it must be properly equipped to deal with these temperatures. If it is not, then the quality of the food can be degraded and part of or the entire load wasted. The second way weather can damage goods is its effect on driving. Extreme weather can present dangerous conditions that can lead to accidents. An accident, if serious enough, can damage the freight being transported.

Marine accidents: As mentioned, shipping by sea accounts for 90% of global world trade by volume. With climate change making sea levels and the weather more volatile, the chances of marine accidents increase. If marine accidents increase, international shipments can make it to their ports where trucks then take over.

Other potential implications include: higher risks of spills and accidents involving dangerous goods; possibility of pollutant dispersion, if the contaminated sites on land are affected by rising sea level; increased sedimentation rates and the consequent increased need for dredging; climate change enhances habitat disturbance, which facilitates the establishment of invasive species

These implications, due to climate change, also negatively impacts the wealth and stability of the company. Maersk would have to invest a high amount of money to protect its large establishment from potential impacts. The industry should form a climate change fund that will be used for adaptation and mitigation of climate change event.

Several strategies to reduce the impact within the South African logistics industry and supply chain

Maersk and the entire shipping industry should develop some adaptive measures to adjust with the upcoming situation. Right mitigation and adaptation initiatives are necessary to keep the stability of the industry.

Mitigation

To minimize the emission, the industry must find the exact way. Improved fuel quality and use of energy efficient engines is the task of ship owners to cut down the emission. At the same time, international communities need to formulate policies and implement those effectively to have a lower emission.

Shipping sectors must find the perfect clean energy for its sustainability and should develop strategy to adapt with the new energy regime. The industry should conduct research to see whether Hythen is a viable source of energy for its future activities

Global transport as well as shipping sector has passed a long way to reach to today's modern system. Today's modern and gigantic ships have taken over wooden boat for international water transportation. Oil regime has already started to decline and will be ended by the middle of this century. Therefore, there needs to be new alternate fuel sources for the shipping industry researched. Search for the new power should have to be green to keep the emission target at a lower volume.

Adapting the shipping industries to the gas energy is a possible solution, that has long term energy assurance and is cleaner, in comparison with other fossil fuels like oil. The main problem with gas, is that it demands an extensive pipe network throughout the world.

But, once the pipe infrastructure is developed, it will become a semi-permanent energy supply-chain, because this pipe network could be used for hydrogen energy supplies, which will probably be the next energy source of the globe.

Ship designers and builders should think this issue critically as ship builders build the ships per the demand of the shipping companies. To have sufficient supply to that demand, ship building industry should plan the future needs. However, the production of hydrogen energy is not as clean as the energy itself. Its production method is responsible to producing CO₂, which is equivalent to the use of conventional fuel as well. But it is possible to produce this gas from natural gasses, other fossil fuels and from nuclear powered electricity. Almost 80% of the world commercial fleets are run by residual fuel that contains sulphur, asphalts, ash and other contaminants. Due to the high concentration of contaminants, emissions by ships contain higher level of pollutants. The use of clean fuel can reduce this pollution level. Designing of efficient engines is also necessary to reduce emission. Sulphur content of ship fuel should be 4.5% m/m or lower. IMO is monitoring sulphur content of fuel and found that sulphur content in bunker was 2.6% in 2004. To lower down the sulphur emissions, some area specific initiatives naming SO_x emission control areas (Secas) were taken by IMO. Similar methodology could be used to emit lower levels of carbon dioxide emissions from ships.

Adaptation

Adaptation is necessary to adjust with the climate change impacts. The ability to adapt and cope is a function of wealth or income, technology, scientific and technical knowledge and skills, information, infrastructure, policy and management institutions and equity (Chatterjee & Huq, 2002). Shipping sectors has to consider all the factors to adapt with the situation. Some factors to be considered within the industries and some should be adapted with other stakeholders.

Shipping sector is responsible for the movement of the significant part of global trade. It is very difficult to quantify the financial involvement of the sector. As the financial involvement of the sector is huge, it has to invest a high amount of money to protect the industry from potential impacts. The industry should form a climate change fund that will be used for adaptation and mitigation of climate change event.

Firstly, part of the fund would be used to meet the extreme event of climate change. The fund will be used for affected unit, in addition to the claimable insurance. If the climate change fund remains unused, it could be used for the development of the sector. But money invested for the increased premium will go to the insurance companies and will not be available to shipping sector, if not used.

Part of the fund will be used in innovation and technology development. The technology will find out the way to increase maritime security by developing speedy and disaster tolerate able ships. Increased maritime security will increase shipping activities Technology search using the fund will be able to find out the way to navigate in the polar region in an efficient way. Navigability in the polar region will increase shipping activities with minimum cost. Research will also find out the way to explore oil in the polar region. More and more oil production in the region will increase shipping activities as well.

Climate change fund will be used partly to develop technology for searching clean energy for shipping sector. One option could be hydrogen fuel development. Hydrogen fuel is clean fuel and hydrogen fueled

ships have a speed of two and a half time more than the conventional ships. Therefore, hydrogen fueled ships will offer a quick and reliable service to the shipping service users. Increased ship speed will increase shipping activities as well. As hydrogen is a clean energy, it will emit zero carbon dioxide. Greenhouse gases emission by shipping sector will be verbally zero that will mitigate climate change. If shipping sector emits zero level of greenhouse gases, there will be no pressure from the international community to the industry to minimize the emission that will decrease the operational cost of the sector.

Maersk line are already dedicated to finding ways to decarbonize logistics, while improving our CO₂-efficiency and developing low-carbon offerings to our customers

Maersk is committed to reduce CO₂

We strive to promote energy efficiency and CO₂ reductions across the industries in which we work and focus our efforts on where we can reap the greatest benefits, namely within our shipping activities, which are responsible for more than 80% of the Maersk's CO₂ emissions.

Partnerships and positions

A.P. Moller - Maersk participates in the Clean Cargo Working Group, the Caring for Climate initiative, the UN high level advisory panel on sustainable transport, and are active in the IMO debate on regulation of CO₂-emissions from shipping.

CONCLUSION

In my opinion, the most thought-provoking effect climate change will have on the shipping industry comes in the form of changing economic trade landscape and shifting shipping lanes. As climate changes around the globe, the local suitability of food production will substantially shift from equatorial climates to higher and lower longitudinal climates. Since food is a major product transported by Maersk, this could vastly alter their economic trade channels. Furthermore, looking far into the future, as polar ice caps melt, new arctic shipping lane openings may become available that could potentially significantly reduce the distance needed to travel between continents, again further altering the economic trade channels. According to the

US Navy's Arctic strategy, the Arctic's Northern Sea Route could be ice free for a couple of months per year as early as 2030. Thinking long-term, Maersk needs to have a pulse on the changing shipping lane landscape. To continue to be the leading container ship company, it needs to be where the activity is, it needs to know where the activity will go on a macro scale, and it needs to capitalize on opportunities for innovative shipping lane changes associated with climate change.

Once the maritime industry invests and work towards these strategies through adaption and migration the overall impact of climate change risk will barely effect their development and stability of their companies. Therefore, it is crucial for companies to recommend these strategies in order to operate business efficiently and effectively.

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Word Count: 2780