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Uncovering Insights: Maritime Shipping's Carbon Footprint

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Assessing the State of Carbon Dioxide Emissions in Maritime Shipping Through Big Data Analysis

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Abstract

This is the abstract.

Acknowledgements

I would like to thank...

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Chapter 1

Introduction

1.1 Background and Motivation

In the 21st century, Climate change is the biggest challenge faced by humanity. It poses a substantial danger to the survival of the inhabitants of our planet. Human activities such as deforestation and burning of fossil fuels have led to a rise in global temperatures. Becuase of this rise, there has been a rise in sea levels, extreme weather events, and loss of biodiversity. There is an urgent need to reduce greenhouse gas emissions and transition to a sustainable, low-carbon future.

Maritime is essential to the global economy, transporting 90% of the world's goods by volume. It is also a major source of greenhouse gas emissions, with the International Maritime Organization (IMO) estimating that maritime shipping accounts for 3% of global carbon dioxide emissions. While 3% may seem small, it is important to note that this is a rapidly growing sector. Without action, maritime shipping contribution to carbon emissions can increase upto 10-13% in the next few decades.. Due to this fact, there is a growing global effort to reduce emissions from this sector. (King, 2022).

In accordance with sustainable Development Goal 13, in 2018, the inital stratergy was adopted by IMO's Environmental Protection Committee (MEPC), during its 72nd session at IMO Headquarters in London, United Kingdom. Accorging to this stratergy, the IMO will work towards reducing the total annual greenhouse gas emissions from international shipping by at least 50% by 2050 compared to 2008 ("UN body adopts climate change strategy for shipping", 2018). In 76th ssssion MEPC in 2021, serval mandatory measures were adopted to reduce greenhouse gas emissions from international shipping, which will help in achieving the goal of reducing emissions by 50% by 2050 ("UN body adopts climate change strategy for shipping", n.d.). One of the important measures is the carbon intensity indicator (CII).

Maritime shipping is a complex and highly volatile system, generating very large data sets. Big data analytics can be used to understand the complex system and make informed decisions. It can facilitate operations such as monitoring of emission and predictive analysis of vessel performance. This can help in reducing emissions and improving the efficiency of

the maritime sector (Zaman et al., 2017).

1.2 Big Data Analysis

Big data analytics is where advanced analytic techniques operate on big data sets. Hence, big data analytics is really about two things — *big data* and *analytics*.

1.2.1 Big Data

As the name suggests, big data is a large amount of data. There are other important attributes of big data. These are: data variety and data velocity.

Thus we can define big data using 3 V's: *volume*, *variety*, and *velocity* as showin in figure 1.1.

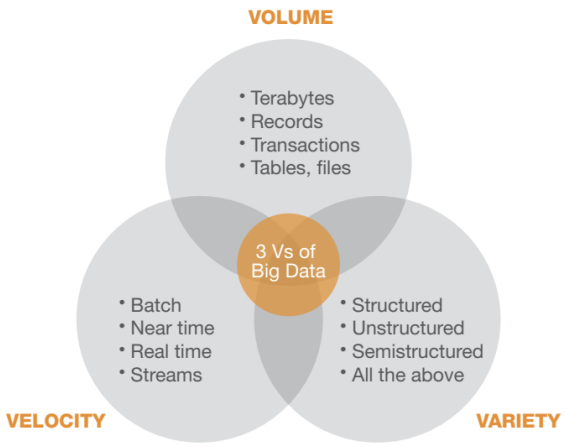

Figure 1.1: Big Data: 3 V's (Lukoianove & Rubin, 2013)

Beyond these three V's, Big Data is also about how complicated the computing problem is. Given the number of variables and number of data points for analysing the maritime shipping data. It is a very complicated problem. Thus, in addition to the three V's identified by IBM, it would also be necessary to take complexity into account as shown in figure 1.2 (Pence, 2014).

1.2.2 What is Big Data Analytics?

Big data analytics is the process of examining large and varied data sets to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful information that can help organizations make more-informed business decisions.

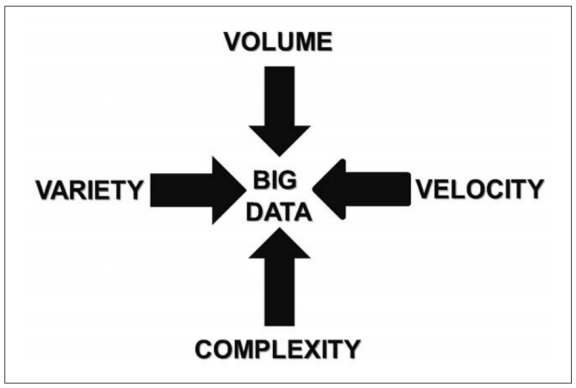

Figure 1.2: Big Data: Beyong 3 V's - volume, velocity, variety, and complexity

1.2.3 Problem Statement

1.2.4 Research Question

Bibliography

King, A. (2022, September). Emissions-free sailing is full steam ahead for ocean-going shipping.

Lukoianove, T., & Rubin, V. (2013). Veracity roadmap: Is big data objective, truthful and credible? *ASIST 2013: 76th Annual Meeting of the Association for Information Science and Technology: Beyond the Cloud: Rethinking Information Boundaries*, *24*. https://doi.org/10.7152/acro.v24i1.14671

Pence, H. E. (2014). What is big data and why is it important? *Journal of Educational Technology Systems*, *43*(2), 159–171.

Un body adopts climate change strategy for shipping. (n.d.). *imo.org*. https://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx

Un body adopts climate change strategy for shipping. (2018). *imo.org*. https://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx

Zaman, I., Pazouki, K., Norman, R., Younessi, S., & Coleman, S. (2017). Challenges and opportunities of big data analytics for upcoming regulations and future transformation of the shipping industry [10th International Conference on Marine Technology, MARTEC 2016]. *Procedia Engineering*, *194*, 537–544. https://doi.org/https://doi.org/10.1016/j.proeng.2017.08.182