NAVAL & MARITIME ACADEMY

THE PORTHOLE

December 2024

Third Edition

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The Porthole is an annual testament to the academic prowess and maritime expertise fostered by the Naval & Maritime Academy, unveiled each year in conjunction with the celebrated Navy Day. Its inaugural edition, launched in 2022, marked a milestone achievement in fulfilling the long-standing aspiration of the NMA, which serves as an arena for individuals immersed in the academic realm to showcase their research, thoughts, and arguments across specific subject fields.

With the advent of its **Third Edition**, Porthole ascends to new heights by providing a centralised platform for individuals deeply engaged in academia. This edition beckons contributors to share their expertise by publishing research papers and scholarly articles across diverse subject disciplines. The primary objective of this edition is to fortify academic writing abilities and cultivate a voracious reading habit among naval personnel. The journal strives to maintain the community abreast of developments in diverse subject areas in the dynamic landscape of constantly evolving knowledge.

Inside the pages of Porthole, a diverse blend of scholarly articles unfolds as a collective effort contributed by a spectrum of individuals. The authors include members of the faculty, student officers, sailor instructors, and sailor under trainees, each providing insights within specific disciplines or fields of study.

The views expressed by the authors are personal and do not necessarily align with the official stance of the NMA editorial policy. However, the copyright for all published articles rests firmly with the editorial board. Reproduction in whole or part is permissible only with the written concurrence of the Chief Editor.

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FOREWORD

As the Commandant of the Naval and Maritime Academy, I am delighted to extend my heartfelt congratulations to everyone involved in the publication of the **Third Edition** of our annual journal, **'The Porthole'**. This achievement is a testament to our commitment to academic excellence and the vibrant intellectual community we have fostered within our institution.

The release of this journal not only highlights our accomplishment over the past year but also underscores the critical role that research and academic writing play in shaping the future of naval education. It is through rigorous research that we can address contemporary maritime challenges and innovate our training methodology. I am proud to see our faculty and Officer Under Trainees actually engaging in research initiatives that contribute valuable insight to both our academy and the broader maritime field.

Research is essential for developing informed leaders who can navigate the complexities. It allows us to explore new strategies, technologies and practices that enhance our effectiveness. This year, many officer under trainees have under taken interesting topics, demonstrating their ability to apply theoretical concepts to practical situations. Their work not only enriches their own learning experience but also contributes to the collective knowledge of our institutions.

Moreover, writing is a vital skill that empowers our personnel to communicate complex ideas clearly and effectively. In a field where precise communication can be a matter of life and death, honing these skills is paramount. Our curriculum emphasizes writing as a core component, ensuring that every officer and sailor can articulate their thoughts with clarity and confidence.

As we launch the **Third Edition** of our journal let us remain committed to advancing our knowledge and skills. Together, we can ensure that the NMA continues to lead in naval training and education, preparing naval personnel for the challenges ahead.

R JOSEPH, RSP, USP, NWC, psc
Rear Admiral
Commandant
Naval & Maritime Academy

MESSAGE FROM THE EDITORIAL BOARD

The editorial board appreciates the significant effort taken by the Naval & Maritime Academy to promote research among its faculty and trainees by launching a journal titled **'The Porthole'**. This initiative aims to cultivate a research-oriented culture within the academy, encouraging both officers and sailors to engage in scholarly activities under faculty guidance. It is with great pleasure that the NMA presents the third edition of **'The Porthole'**, a result of the collaborative efforts of both faculty and trainees.

To maintain high academic standards, ethics, and integrity; a rigorous process of double-blind review of research papers was followed along with screening of plagiarism of each manuscript received. The research work published in this **'The Porthole'** is original and not published or presented at any other public forum.

The editorial board congratulates all the officers and sailors whose research papers are published in this issue of **'The Porthole'** and expresses its sincere thanks to their mentors and supervisors.

Finally, the editorial board extends heartfelt gratitude to all authors, reviewers, and those who contributed unanimously from the very first draft to the final print for the success of publishing the third edition.

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HOW TO IMPROVE SUPPLY WATER QUALITY IN EASTERN NAVAL AREA

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Abstract

This paper explores strategies to enhance water quality for the Eastern Naval Area, focusing on the ageing water supply infrastructure originally developed by British engineers in the 1930s and 1940s. It examines the current water purification plant at Anandakulam highlighting their strength and limitations. Recommendations for modernising these systems are proposed, emphasising the need to address challenges like agricultural chemical contamination and outdated technology.

Keywords: Sedimentation, Aeration, Coagulation, Ecosystem, Osmosis

Introduction

"Water is the driving force in nature."

-Leonardo da Vinci-

From the beginning of life on earth, every living thing has been using water to fulfill their daily needs. Hence, since that era, they have been very keen on the cleanliness of water and have used many purging methods.

As per the United Nations records in 2015, One billion people did not have access to the pure water resources on the earth's surface. Each year nearly 3.5 million people die from diseases spread through drinking water.

During the British colonial era, Naval power was expanded along the coastal area of Sri Lanka. British clearly identified Trincomalee which is the second largest Natural Harbour in the world as not only a British Naval Headquarters in Ceylon but also Regional Naval Headquarters of East India British Naval Fleet.

In 1936, the British used the geographical position in the Naval Camp at Trincomalee and suburb of Trincomalee and designed a tank "Kalamatiyanakulam" as the fleet main water reservoir, which is about 13 miles away from the Trincomalee town. An earthfill dam is built across "Palampoddar Aru" to have the storage reservoir. The storage is increased by diverting "Mora Oya" partially. Water was channelled to "Andankulam" from the tank using the gravitational force through a pipe system which was fabricated using a polymer of asbestos. Water is purified by a separate purification system at "Andankulam", which was designed by British Engineers. Then purified water is distributed all over the Trincomalee town and to the Naval base. All water distribution system is powered by the gravitational force. This project was completed in 1942.

Aim

The aim of this paper is to improve the quality of supply water in the Eastern Naval Area.

Present Water Supply System of Eastern Naval Area

Water Storage System of Kalamatiayanakulam Tank

The British decided to establish the water supply system to the Trincomalee Naval base, other government establishments and local lives in Trincomalee. In 1936, the construction of a water tank and purification system was started in the Thambalagamuwa area. The construction was done by Mumbai Peterson Company; it took six years to complete the project. The British Engineers considered the following facts when they designed the Kalamatiyanakulam tank at Thambalagamuwa.

a. Rainy season
b. Low rainy season
c. Composition of soil
d. Wetness of soil
e. Situation of land

Palampoddar Aru was restricted by the earth-fill dam and a Kalamatiyanakulam tank was constructed. Characteristics of the Kalamatiyanakulam tank is as follows:

a.	Depth of the tank	-	41 feet
b.	Total area of the tank	-	315 acres
c.	The capacity of the tank	-	10,345,500,000 gallons
d.	Length of the dam	-	162 meters
e.	Elevation to bottom	-	123 ft from Mean Sea Level (Deep)
f.	Elevation to top	-	162 ft from Mean Sea Level (Top of Bunt)

The Kanthale water tank is another source of the Kalamatiyanakulam tank. Excess water of Kanthale tank was released to the Vendrasakulam tank. That excess water is brought to the Morawewa via a channel and it is diverted into two directions at the “Diversion Point”. A special dike was created near to the Diversion Point and it is able to control the water flow along the channel to the Kalamatiyanakulam.

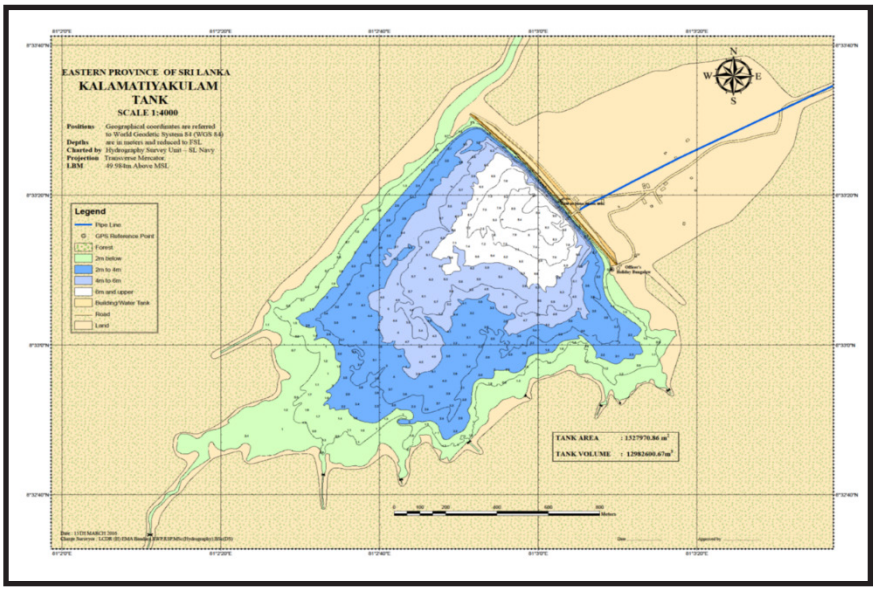

Figure 1: Map of Kalamatiyanakulam tank

Figure 2: Present view of Kalamatiyanakulam tank

Water Purification System of Andankulam

The distance between Kalamatiyanakulam tank and Andankulam is 17.5 km. Discharged water from the tank is flown up to the purification plant at Andankulam through the lined layout underneath the ground by gravitational force. The water is purified by under mentioned six steps.

Aeration

This is the first step of purification process and it removes unwanted gases like Methane, Ethane, Ammonia and unhealthy bacteria which are diluted in water throughout the distribution process. Same time water is adequately mixed with Oxygen during this process. Generally, a powerful water pump is used for the aeration process, but here it is done by the use of gravity. The pH value of the entered water is maintained in the 6.5 to 8.5 range.

Figure 3: Aeration tank at Andankulam

Coagulation

The raw water is treated with chemical coagulation such as Alum for the first time in the purification process. The amount of chemical is varied in the range of 5 mg to 40 mg per litre depending upon the turbidity, colour, and temperature and pH level of the raw water. Then Chlorine, Pre lime, and Aluminium Sulphate are added.

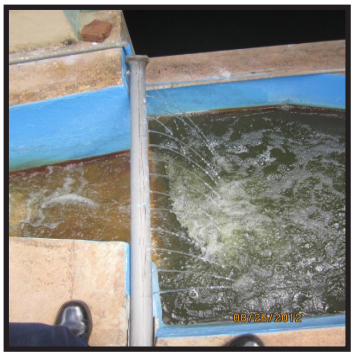

Figure 4: Coagulation Tank at Andankulam

Chlorination (Lime Boiled)

Chlorine is added to aerated water. Algae are destroyed due to Chlorination. 1:100 concentrated chlorines are used for this process.

Aluminium Sulphate

About 95% of impurities and mud particles which were bonded with aluminium Sulphate during the flocculation are settled down at the bottom of tanks. It takes a minimum of four hours for sedimentation. Those sediments are removed every six hours.

Flocculation

The next phase involves slow and gentle stirring of the treated water in a flocculation chamber for about 30 minutes. The mechanical type of flocculation is the most widely used method. It consists of several paddles and the paddle rotates with the help of a motor. This slow and gentle stirring results in the formation of thick, white flocculants precipitate of Aluminium Hydroxide.

Figure 5: Flocculation Tank at Andankulam

Sedimentation

The flocculated water is now let into sedimentation tanks where it is retained for periods varying from 2 to 6 hours when the flocculants settle down together with impurities and the bacteria in the tank. At least 95% flocculent precipitate is removed before the water is admitted into the rapid sand filters. The precipitates or sludge is removed from time to time without disturbing the operation of the tank. The tanks should be cleaned regularly to avoid the breeding grounds for Mollusks and Sponges.

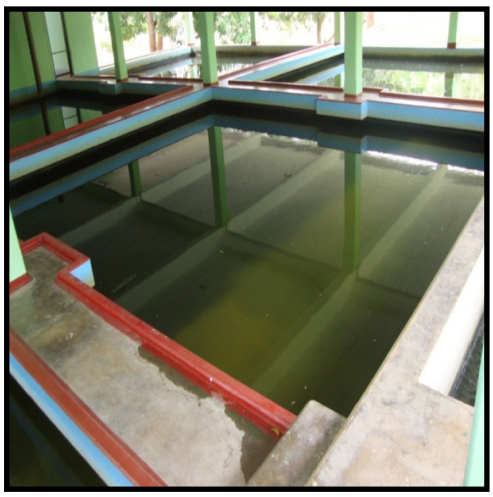

Figure 6: Sedimentation Tank at Andankulam

Filtration

There are two tanks for this operation called sand filtration. Water is properly filtered and the same filters are daily cleaned using fresh water and a high-pressure air stream. The cleaning process is called as Back Wash method.

Figure 7: Filtration Tank at Andankulam

Disinfection

Chlorine is added according to its standard and then water is sent to stock tanks for distribution. There are two stock tanks for purified water. This purified water is distributed to Trincomalee town and Naval Dockyard using gravitational force.

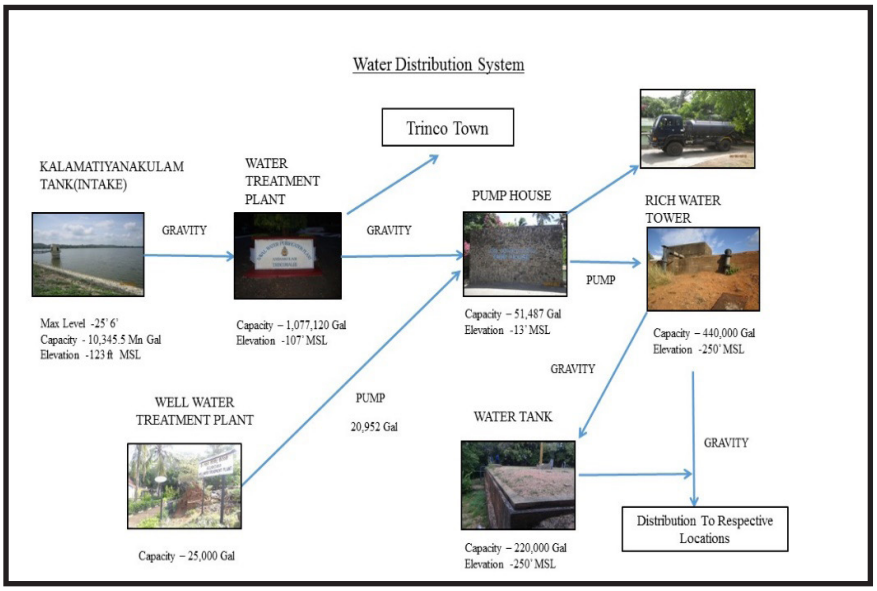

Figure 8: Water distribution system in Eastern Naval Area

Water Quality Inspection

The following specific equipment is used to check the various qualities of purified water at the Anadakulam purification plant. Application of those equipment are also indicated below:

a. Turbidimeter - To check the turbidity in purified water. The standard international value should not be more than 5 NTU (Nephelometric Turbidity Unit).
b. Tintometer - This equipment is used to check the colour of purified water.
c. Chloroscope - To measure the residual chlorine in purified water.
d. Jar test - To determine the coagulation level in purified water.

What are the Factors Affecting the Water Quality?

The quality of water is easy to define in terms of the chemical, biological and physical content of the water. Water quality is highly affected by the activities of humans. Sometimes water quality may be changed due to the geographical location. The quality of water in North Western, North Central and Eastern areas of Sri Lanka is having a developed irrigation system. The uncontrolled use of fertilizers and various chemicals in the agriculture sector has destroyed the water sources in the above areas. Industrial activities can increase concentrations of metals and toxic chemicals, add suspended sediment, increase temperature, and lower dissolved oxygen in the water.

Substances present in the air affect rainfall. Dust and natural gases in the air, such as Carbon Dioxide, Oxygen and Nitrogen are all dissolved or entrapped in rain. When other substances such as Sulphur Dioxide, toxic chemicals or Lead are in the air, they are also collected in the rain as they fall to the ground. Rain reaches the earth's surface and as runoff, flows over and through the soil and rocks, dissolving and picking up other substances. For instance, if the soils contain high amounts of soluble substances, such as limestone, the runoff will have high concentrations of Calcium Carbonate, where the water flows over rocks high in metals, such as ore bodies, it will dissolve those metals.

Industrial, farming, mining, and forestry activities also significantly affect the quality of rivers, lakes and groundwater. For example, farming can increase the concentration of nutrients, pesticides and suspended sediments. Each of these effects can have a negative impact on the aquatic ecosystem and or make water unsuitable for established or potential uses. The following factors are recognized by the international bodies as the main affected factors for water qualities,

a. Sedimentation
b. Runoff
c. Erosion
d. Dissolved oxygen
e. pH
f. Temperature
g. Decayed organic materials
h. Pesticides
j. Toxic and hazardous substances
k. Oils, grease, and other chemicals
l. Detergents
m. Litter and rubbish

Good quality drinking water is not easy to produce without interference from the environment and man-made impediments. Good drinking water is free from disease-causing organisms, harmful chemical substances, and radioactive matter. It tastes good and is free from unpleasant colour or odour. The guidelines for drinking water quality specify limits for substances and describe conditions that affect drinking water quality.

Recommendations to Improve the Supply of Water Quality

Improvement in the Aeration Process

Tank gets much of their oxygen from the atmosphere. Artificial circulation increases oxygen contained in a unit of water in a tank forcefully. This forceful circulation exposes the water to the atmosphere. There are several types of artificial circulation systems are available. They are,

a. Destratifiers (Air Injection System, Mechanical axial flow pumps)
b. Surface spray
c. Impeller aspirator
d. Pump and cascade
e. Oxygen booster system

Improvement in Coagulation and Flocculation Process

The suspended material in waters mostly arises from land erosion, the dissolution of minerals and several domestic and industrial waste discharges. Such material may comprise dissolved organic or inorganic matter, as well as several biological organisms, such as bacteria, algae or viruses. This material needs to be removed, as it causes deterioration of water quality by reducing the clarity (e.g. causing turbidity or colour), causing infection and eventually carrying toxic compounds, absorbed on their surfaces. In addition, organic matter is the main cause of the formation of disinfection by-products, when chlorine is applied as a disinfection agent.

It is an important step in surface or underground water treatment. Typical applications are the removal or separation of colloids and suspended particles, of natural organic matter or metal ions. The commonly used metal coagulants fall into two general categories: those based on Aluminium and Iron. Presently purification plant at Andankulam uses an Aluminium-based chemical powder known as Alum (Aluminium Sulphate).

Clay minerals may be used as coagulant aids in the flocculation step. It forms small flocs into larger particles when Aluminium or Iron salts are used as the primary coagulant. Coagulation with clay minerals is followed by sedimentation. It can clean up industrial waste when the flocs formed are dense enough. The removal efficiencies of clay minerals and polyelectrolytes were similar to each other. Clay minerals are natural and local sources, so when clay minerals and polyelectrolytes are used as coagulant aids, if the removal efficiency of each coagulant aid is close to each other, the operation cost of treatment with clay minerals may be lesser than polyelectrolyte.

Improvement for Filtration

Much of the suspended material can be removed by simply allowing the water to stand and settle for some time. The retention time is required to settle particles in bottom. It may take from one hour to two days.

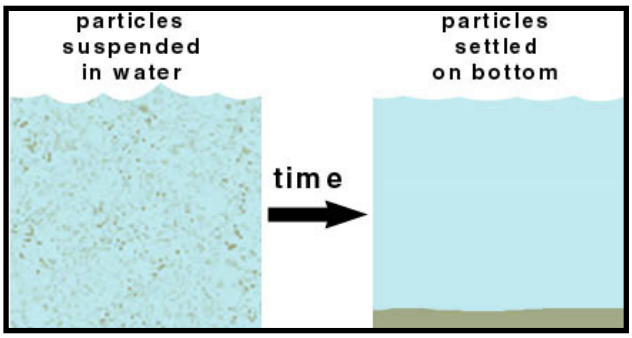

Figure 9: Sedimentation process

Instead of this basic method of sedimentation system of simple pleated paper sedimentation filters can be used. These filters trap relatively large particles which may be present in the water like dirt, sand, slime and grit. Then use harder filters and cartridges to trap particles less than 10 microns scale. The pressure drop through the second series of filters needs to be monitored and according according to the situation filter clogging would be identified.

Improvement for Disinfection

Ion Exchange: Next water is directed to the Ion exchange. During this process, various metallic elements are removed. Ion exchange includes a large tank with a special negatively charged resin. Generally, metallic ions carry strong positive charges and after the contact with resin beads, those displace weaker-charged Potassium and Sodium ions. The metallic ions are trapped via electromagnetic attraction to the resin particles. The ion exchange beds are then automatically cleansed and regenerated at prescribed time intervals based on water volumes.

Activated Carbon Towers

Once the water passes through the ion exchange system, it moves into oversized granular activated carbon beds. Carbon filtration (also known as charcoal filtration), which utilizes a process known as absorption, is a particularly effective technique for chlorine removal. Further, pesticides, herbicides and other organic contaminants are also removed at this stage.

Ultraviolet Light

This ultraviolet light acts as a powerful sterilizing agent. If any bacteria, viruses, or other microbiological contaminants are present in the water, the ultraviolet light at this particular wavelength destroys the genetic material within these organisms, eliminating the possibility of bacterial or viral reproduction and proliferation. The organisms quickly die and are captured and removed during the pre-filtering before the reverse osmosis purification process.

One Micron Filter

Anything that would be killed by the ultraviolet light, would be picked up by the micron filters. This filter holds any particle which is larger than 1 micron. A micron filter is capable of removing viruses, bacteria, cryptosporidium and various other deleterious bugs.

Reverse Osmosis Process

Osmosis is the process where the more concentrated solution will tend to become more diluted, and the more diluted solution will tend to become more concentrated. Osmosis is the process by which living cells receive nutrients and excrete wastes.

In reverse osmosis, high pressure is used to force water across a membrane while impurities are left behind. In other words, the high pressure causes the impurities to become more concentrated on one side of the membrane. Only the pure water can cross the membrane; even the dissolved impurities which cannot be removed by conventional filtration are captured and eliminated by this method.

Ozonation

Ozonation relies on oxygen to ensure that purified water remains free of any possible microbiological contamination during the storing. Ozone is a very powerful sanitizer and is capable of oxidizing a very broad range of contaminants. In fact, ozone is highly effective against many types of impurities and organisms, such as sources of diarrhea, that are not affected by chlorination.

Conclusion

Polluted water is bad for humans, but clean water is key to a healthy life. Water has so many health benefits that the U.S. Centre for Disease Control & Prevention (CDC) recommends drinking eight 8-ounce glasses of water every day. If water is contaminated with organic and inorganic matter, bacteria and viruses and other pollutants, it may be harmful to the human body. World-leading researchers believe that water has a direct relationship with physical and mental development. Sometimes water may be a cause for short attention spans, and learning difficulties in children. There is evidence that arsenic in drinking water can lead to nerve, heart, skin, and blood vessel damage. Cryptosporidium (a microbiological animal which can cause respiratory and gastrointestinal illness) is responsible for potentially life-threatening diarrhea. The human body is, after all, 70% water. Although a human being can survive a month or more without food, a week without water can be fatal.

Eastern Naval Area is the most valuable and prominent military organization in the maritime nation. Naval Dockyard, SLNS Thissa, and NMA are located inside the premises of Easter Naval Headquarters. As per the Sri Lanka Navy point of view, the Security of Eastern Naval Headquarters is the most vital. During the overrun of Elephant Pass in the year 2000, the Liberation Tamil Tigers of Elam (LTTE) destroyed two drinking water wells by adding poison and another was captured. Those were the water sources for the military complex which is expanded on 23 km long and 8 - 10 km wide. Soldiers were fighting under the direct sunlight in August of 2000 and water automatically became the most valuable item for Sri Lanka Army troops. It was the main factor to overrun the forward defence line.

Kalamatiyanakulam tank and Anadakulam water purification plant provide water not only to the naval camp but also to civilians in Trincomalee town. Since the 1990's Sri Lanka Navy and National Water Supply and Drainage Board. Hence it is a partial responsibility of the Sri Lanka Navy to ensure the safety and quality of supplied water.

The purification plant of Anadakulam consists of a few steps which are well known among the public as Aeration. Coagulation, Flocculation, Sedimentation, Filtration, Disinfection and then carry out the water quality test.

The quality and standard of purified water can be developed by introducing new technology and good practice in the modern world. Developed methods for all steps of the purification process at the Andankulam plant are introduced in this document. It is also capable of minimizing all kinds of sabotage activities. A lot of harmful organic, inorganic and other particles can be identified and removed by this process. Various type of agricultural lands is spread around the Kalamaiyanakulam tank. Pesticides and weedicides are combined with Sri Lankan Agriculture. All these chemicals are lastly stored in tanks and water sources in the area. Britain designed this project in the 1930s and that time this kind of agricultural culture was not popularized at that time. Hence, it is required to develop the available water purification system at Andankulam.

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IMPACT OF FOREIGN REMITTANCES ON POVERTY REDUCTION IN SRI LANKA: A STATISTICAL ANALYSIS

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Abstract

In Sri Lanka, remittances may make up between 20-30% of the recipient's total household income. It also represents a more stable source of poverty reduction than other capital flows. However, the foreign remittances flowing into Sri Lanka need attention and demand greater policy transparency, information dissemination, and data monitoring and to move away from micro-management of foreign exchange transactions to macro management in order to improve the living standard of the recipient families. Some empirical studies have explored that a positive impact played by migrant remittances on poverty reduction in various countries. Many researchers in literature have examined the channels through which migrant remittances can affect poverty in origin countries. The main channel enlightened is the growth. The effect of remittances on growth may pass through the balance of payments, the exchange rate, the private investment through alleviating the credit constraint of households or through the multiplier effect" they can have on the households which do not receive remittances. This research examines the impact of foreign remittances on poverty reduction in Sri Lanka. While exploring the main objective, the researcher has to understand the trends of foreign remittances and to find out the foreign remittance distribution among the national, urban, rural, estate, poorest, richest and the middle income group of the people in Sri Lanka. Also, a researcher expects to measure the relationship between foreign remittances and its impact on alleviating poverty in Sri Lanka. However, the researcher was used eight multiple linear regression models to measure the impact of foreign remittances on both absolute and relative poverty. Among them, GDP Per capita income has used as one other alternative variable to minimize the disturbance error of the equations. The researcher finds foreign remittances as a contributor to reducing the absolute poverty level by up to 98% through the statistical analysis. Further, it proves that we need to design a policy or a set of policies with transparency in order to enhance the living standards of the poor.

Keywords: Household Income, Foreign Remittance, Foreign Exchange, Balance of Payment, Absolute Poverty, Relative Poverty, Gross Domestic Product, Economic Growth, GDP per Capita Income.

Background of the Study

Recent analysis demonstrates that an increase in international migration is positively linked to a decline in the number of people in poverty. Some studies indicate that a 10% increase in the share of foreign remittances in a country's GDP leads to, on average, a decline from 1.6 to 3.5% in the proportion of people in poverty. Despite heterogeneous effects across the country in various places, foreign remittances have reduced the incidence and depth of poverty at the household level in Sri Lanka. The researcher creates the research framework to measure the impact of foreign remittances on poverty reduction in Sri Lanka.

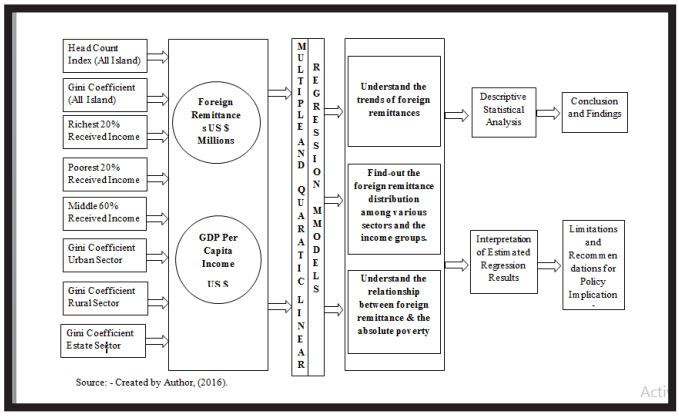

Figure 1: Research framework

The total amount of foreign remittance has been increasing rapidly and the level of absolute poverty has been decreasing in Sri Lanka during the past two decades. It is important to verify the relationship between these two variables considering the level of impact made by increasing foreign remittances on absolute poverty reduction in Sri Lanka. As well as in the meantime during the past two decades relative poverty level has been increasing in Sri Lanka. Therefore it is important to verify the relationship among these two variables considering the level of impact generated to reduce the relative poverty level in Sri Lanka. The main objective of this research is to study the impact of foreign remittances on poverty reduction in Sri Lanka.

Review of Literature on Remittance and Poverty

Some empirical studies have explored and proved migrants' remittances constitute a supplement of income for households, it is logical to consider that these flows can have a direct negative effect on poverty in countries of origin. For example, the macroeconomic studies of Adams and Page (2005) show the positive role played by migrant remittances on poverty reduction. Similar results have been obtained by country case studies: Egypt (Adams 1991), Lesotho (Gustafsson and Makonnen 1993), Burkina Faso (Lachaud 2004), and Ghana (Adams, Cuecuecha and Page 2008). Many researchers examined the channels through which migrant remittances can affect poverty in origin countries. The main channel of enlightenment is growth. The effect of remittances on growth may pass through the balance of payments, the exchange rate, the private investment by alleviating the credit constraint of households, or through the multiplier effect" they can have on the households which do not receive remittances.

Sometimes foreign remittances can have an impact on the receiving economy in different ways. Glytsos (2001) describes the channels through which foreign remittances can affect the receiving country. There is no consensus in the literature as to whether the foreign remittance inflows give a positive or negative effect on poverty. In the current thinking on migration and development, two opposing perspectives can be seen: the Migrant syndrome perspective, and the Develop mentalist perspective. The reality will probably lie in between the two extremes, and depend on the characteristics of the country. Generally, there are two major channels through which foreign remittances can have an impact on the receiving economy on a macroeconomic level, as described by Glytsos, 2002. Firstly, as foreign exchange through the balance of payments, and secondly, as income that is either saved or consumed. However foreign remittances can also make households dependent on the extra source of income. This is a risk for the households, particularly if the foreign remittance flows are unpredictable. The implications concern the households involved, but can also affect the economy in total, considering that foreign remittances often constitute more than 50% of household income used for consumption. Therefore, a decline in foreign remittances implies that consumption would decrease drastically.

In Sri Lanka, foreign remittances are part of a private welfare system that transfers purchasing power from relatively richer to relatively poorer members of a family or community. They reduce poverty, smooth consumption, affect labour supply, provide working capital, and have multiplier effects through increased household spending. The researched evidence suggests that most often women head the recipient households. For the most part, foreign remittances seem to be used to finance consumption or investment in human capital, such as education, health, and better nutrition. In Sri Lanka, for instance, households with migrants have less cultivated land but tend to have slightly better education. Researchers also found that migrant remittances to Sri Lanka are in fact countercyclical and are effective in helping smooth household consumption and welfare, over time, especially for food crop farmers, who are typically the most disadvantaged socioeconomic group. Similarly, using data from a large household survey Adams (2006) finds that international remittances significantly relieved poverty among the "poorest of poor households." Ratha (2003) suggests that foreign remittances that raise the consumption levels of rural households might have substantial multiplier effects because they are more likely to be spent on domestically produced goods.

It has been empirically tested and proved that foreign remittances have a significant impact on all three measures of poverty. According to the researchers, they empirically tested and found a summary of channels through which international remittances are put to productive uses for the benefit of the household, community and nation at large.

Methodology

Regression Models

For this purpose, the researcher used separate equations to measure the impact of foreign remittances on both the absolute and the relative poverty of Sri Lanka. Along with them, the researcher used one other alternative variable to measure the relationship between absolute and relative poverty and minimize the disturbance error of the equations. The variable is the GDP per capita income of Sri Lanka. To analyses that, the researcher fitted eight multiple linear regression models. However, the main focus of this study is to measure the relationship between foreign remittances and absolute and relative poverty in Sri Lanka.

The Quadratic and Multiple Linear Regression Models

Since the data on the gini ratio of the entire island, the urban, the rural and the estate sectors and the share of income of the poorest, the richest and the middle group of the people were not available for the whole period of this study. Hence, the researcher substituted the estimated values for the missing values. The researcher used the following quadratic regression models to find out the missing values.

$P_A = \beta_o + \beta_1 X_1 + \beta_2 X_2 + U$ P_A = Head count index nation-wide

$GR_N = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ GR_N = Gini coefficient nation-wide

$GR_U = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ GR_U = Gini coefficient - the urban sector

$GR_R = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ GR_R = Gini coefficient - the rural sector

$GR_E = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ GR_E = Gini coefficient - the estate sector

$IS_p = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ IS_P = Share of income- the poorest 20% of the people

$IS_R = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ IS_R = Share of income- the richest 20% of the people

$IS_M = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2^2$ IS_M = Share of income - the middle 60% of the people

X_1 = Period (specific year) X_2 = Squared value of the specific year

Summary, Conclusion and Findings

Regression Model	Coefficient	"R^2" Value	"F" Ratio
$P_A = \beta_o + \beta_1 X_1 + \beta_2 X_2 + U$	32.40350309*	0.88	78.74*
$GR_N = \boldsymbol{\beta}_o + \boldsymbol{\beta}_1 X_1 + \boldsymbol{\beta}_2 X_2 + U$	0.458749597*	0.21	2.85®
$GR_U = \boldsymbol{\beta}_o + \boldsymbol{\beta}_1 X_1 + \boldsymbol{\beta}_2 X_2 + U$	0.527244372*	0.05	0.56®
$GR_R = \boldsymbol{\beta}_o + \boldsymbol{\beta}_1 X_1 + \boldsymbol{\beta}_2 X_2 + U$	0.437189484*	0.35	5.73*
$GR_E = \boldsymbol{\beta}_o + \boldsymbol{\beta}_1 X_1 + \boldsymbol{\beta}_2 X_2 + U$	0.29392903*	0.27	3.92®
$GR_E = \boldsymbol{\beta}_o + \boldsymbol{\beta}_1 X_1 + \boldsymbol{\beta}_2 X_2 + U$	16.61182164*	0.72	27.16*
$IS_R = \theta_0 + \theta_1 X_1 + \theta_2 X_2 + U$	52.19115673*	0.12	1.40®
$IS_M = \theta_0 + \theta_1 X_1 + \theta_2 X_2 + U$	32.8568394*	0.66	20.50*

Table 1: Estimated regression results
Source : Created by the author based on estimated regression results

*	Significance at the 10% level	***	Significance at the 01% level
®	Insignificant variables	**	Significance at the 05% level

As a result of increasing labour migration, remittances have come more and more into focus as a contributor to development and poverty reduction in Sri Lanka. In Sri Lanka, remittances may make up between 20-30% of the recipient's total household income. They also represent a more stable source of poverty reduction than other capital flows. Flows can last for one generation or more, and usually, go to more or less the same family members. Sri Lanka is one of the major beneficiaries of remittances. The large inflows of money to Sri Lanka from the Sri Lankans who live and work abroad, mainly in the Middle East, Europe, and South East Asia have made remittances an important part of the Sri Lankan Economy. Almost one in four households in Sri Lanka has remittance income, which makes Sri Lanka more dependent on remittances than any other South Asian country. As the researcher mentioned earlier, the most important source of foreign earnings for decades has been migrant worker remittances, largely sent by women employed as domestic labour in the Middle East. Migrant remittances as a percentage of the export earnings were very high and Sri Lanka has witnessed a steady increase of inflow of remittances.

However, the major part of remittance inflows is often used for current consumption; it has been argued that remittances are an unproductive source of income. Remittance-receiving households spend more money on consumption than non-remittance-receiving households. However, since remittance-receiving households often have a larger income in total, it should be expected that their consumption would be higher. Accordingly, it is important to compare the difference in proportions of the spending patterns between remittance-receiving and non-remittance-receiving households when studying the impacts of remittances. Indirectly it has effected to reduce the poverty level of the country or else improved their standard of living. The way in which remittances are used can produce wide multiplier effects in the reduction of poverty. While there are differences among

countries on how remittances are spent, evidence shows some similarities in the order of priorities that recipient families and sending migrants. Household consumption represents 70% of the amounts transferred. Then it strongly helps to increase their living standard and as well as the reduction of poverty. They use those transferred remittances to satisfy their various purposes.

Considering the estimated regression results it can be concluded that there is a close relationship between the foreign remittance and the poverty in Sri Lanka (especially foreign remittance and absolute poverty). On the other hand, the result of the qualitative study on income distribution is true for Sri Lanka, to a certain extent. However, these Results can be used as evidence for future researchers. The government of Sri Lanka introduced some favourable policy changes to absorb more foreign remittances to Sri Lanka. Apart from that, the government introduced some poverty alleviation programmes to enhance the living standard of the people. The result of this study shows that recent policy changes helped to reduce the absolute and relative poverty levels in Sri Lanka. However, the gradual inflow of foreign remittances contributed to decreasing, both the absolute and the relative poverty during the particular period. But, in some recent years, there was a considerable increase in relative poverty in Sri Lanka, which implies that there were some certain weaknesses in the practical application of policies such as corruption and bribery.

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COOPERATIVE MARITIME SECURITY: STRATEGIC OPTIONS FOR SRI LANKA

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Abstract

This journal explores the importance of cooperative maritime security for Sri Lanka, emphasising the nation's strategic location in the Indian Ocean and its critical role in regional and global maritime security. It examines the various maritime threats Sri Lanka faces, including piracy, smuggling, terrorism, and environmental challenges, while analysing existing cooperative frameworks. By engaging in bilateral, regional, and global security initiatives, Sri Lanka can strengthen its Maritime Domain Awareness (MDA) and contribute to Indian Ocean Region (IOR) stability. This paper reviews critical cooperative security frameworks and outlines strategic options for enhancing Sri Lanka's maritime security capabilities, supported by current research and international security perspectives.

Keywords: Cooperative Maritime Security, Maritime Domain Awareness, Regional Security, Bilateral Cooperation.

Strategic Location and Regional Importance

Sri Lanka's geographical position at the center of the Indian Ocean makes it crucial for regional maritime security. The island is located along one of the world's busiest maritime trade routes, linking East Asia, Africa, and the Middle East. Consequently, securing its maritime domain is not only in Sri Lanka's interest but is also critical to regional and international security, with implications for the uninterrupted flow of global trade (Bueger, 2015). As Sri Lanka navigates the challenges of piracy, smuggling, terrorism, and non-traditional threats like climate change, cooperative maritime security offers a viable solution to enhance its limited maritime resources.

Evolving Security Landscape

According to maritime strategist Geoffrey Till, safeguarding the sea's attributes, i.e. resource, transportation, information, and dominion (see Figure 1), is essential for collaborative maritime security strategies (Till, 2004). For small states like Sri Lanka, which have limited naval resources, multilateral and bilateral maritime security arrangements are necessary to bolster Maritime Domain Awareness (MDA) and defense capabilities. This journal explores Sri Lanka's strategic options in cooperative maritime security and examines the benefits and challenges of these initiatives.

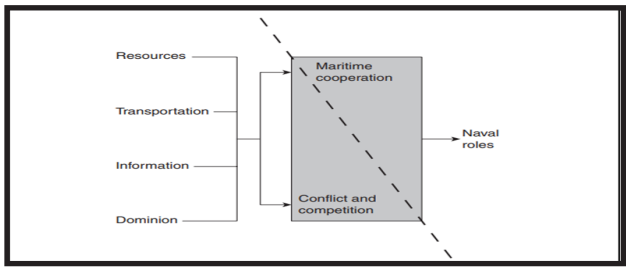

Figure 1: Attributes of the Sea
Source : Extracted from Seapower (2004)

Aim

This journal aims to explore and analyse the cooperative maritime security options available to Sri Lanka, focusing on its strategic role in the Indian Ocean Region while examining the benefits and challenges of engaging in bilateral, regional, and global maritime security frameworks.

Threat Perception in Island's Maritime Security

As Premarathna (2021) highlighted maritime security is tied to the island's national security, which influences the strategic location of Sri Lanka. With that as the background, the author evaluates the following threats perceptions in the present context:

a. **Geopolitical Position and Economic Importance.** Island's location at the crossroads of major East-West shipping lanes makes it a critical player in the Indian Ocean. Over 80% of the world's maritime oil trade passes through the Indian Ocean. Particularly, Sri Lanka's proximity to these shipping lanes has a pivotal influence on maritime security (Premarathna, 2021). Further, the Colombo and Hambantota ports are vital international trade and commerce hubs. Correspondingly, the island claim, by the United Nations Convention on the Law of the Sea (UNCLOS), has granted Sri Lanka rights to a vast Exclusive Economic Zone (EEZ), which includes significant resources such as fisheries, minerals, and potential offshore oil reserves (UNODC, 2005). Hence, Sri Lanka's maritime security is about safeguarding its waters and ensuring the uninterrupted flow of global maritime trade. Accordingly, securing the sea lanes that traverse its waters is essential for the stability and growth of the global economy. As a result, the country's role in regional maritime security extends beyond national defense and is increasingly seen as a critical player in ensuring the safety of international sea routes (Bueger, 2015).

b. **Emerging Maritime Threats.** In Sri Lanka's contemporary security environment, non-traditional maritime security challenges ranging from piracy and terrorism to illegal fishing, smuggling, and environmental hazards are most prominent (Joseph, 2017; Kumara, 2020, 2021). Piracy in the Indian Ocean remains a persistent threat, although it has reduced in recent years. Sri Lanka's proximity to piracy hotspots, such as the Horn of Africa and the Gulf of Aden, means it must remain vigilant and capable of contributing to regional anti-piracy efforts (Joseph, 2017). Moreover, transnational organized crime, particularly drug trafficking, has become a significant issue in Sri Lanka's maritime domain. Illegal, unreported, and unregulated fishing (IUU) poses substantial economic and environmental challenges due to poaching by Indian trawlers, which threatens both local livelihoods and marine biodiversity (Bueger, 2015).

c. **Modern Non-Traditional Treats.** Modern challenges like climate change and natural disasters can disrupt maritime operations. Further, rising sea levels, severe storms, and changing weather patterns can significantly impact ports, shipping routes, and coastal communities. Hence, addressing these threats requires a cooperative regional approach, as no single state can effectively mitigate the effects of climate change and natural disasters in isolation (Ahmed, 2019).

The Concept of Cooperative Maritime Security

Most significantly, Joseph (2017), Abewardhana et al. (2020), and Premarathna (2021) concurrently identified that cooperation can take various forms, including bilateral agreements, regional frameworks, and participation in international maritime organizations. For Sri Lanka, cooperative maritime security provides a means to enhance its maritime capabilities, improve domain awareness, and contribute to regional and global stability. Hence, the author stresses the concept of cooperation as follows:

a. **Defining Cooperative Maritime Security.** As Bueger (2015) stressed, cooperative maritime security refers to collaborative efforts between nations to enhance the security of their maritime domains through shared resources, intelligence, and operations that are essential for small states, which may need more resources to secure their maritime borders unilaterally. Accordingly, cooperation in maritime security allows countries to pool their resources and expertise, enabling them to address shared challenges more effectively. Most significantly, Geoffrey Till (2004) argues that cooperative maritime security is essential for maintaining good order at sea (see Figure 2), especially in a globalized world where maritime threats often transcend national borders.

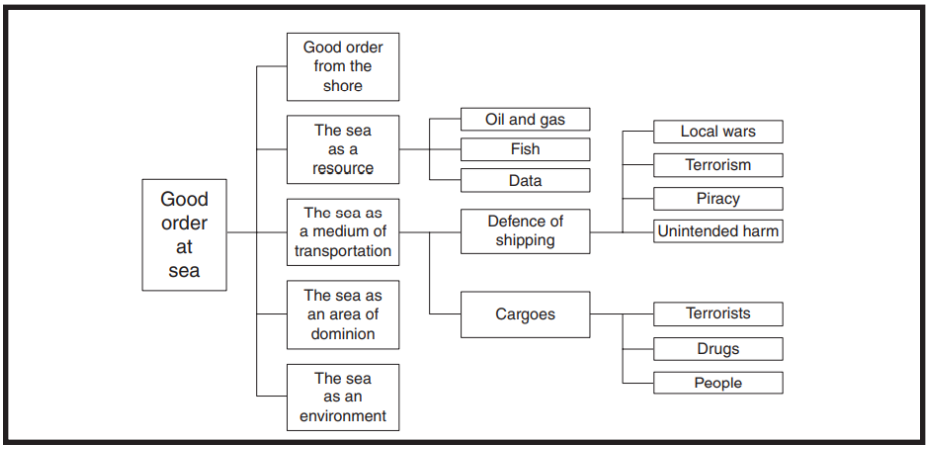

Figure 2: The Attributes for Good Order at Sea
Source : Extracted from Seapower (2004)

b. **Theoretical Foundations.** The theoretical foundation of cooperative maritime security is rooted in recognizing that maritime threats are increasingly transnational and asymmetric. Hence, the rise of non-state actors, such as pirates and terrorists, makes it difficult for individual states to address these challenges alone (Kumara, 2021). Subsequently, this necessitates a cooperative approach, where states work together to share information, conduct joint patrols, and respond to maritime incidents.

Moreover, Geoffrey Till's concept of the "virtuous maritime circle" highlights the interconnectedness of maritime security, economic prosperity, and naval power. He argues that cooperative maritime security can enhance a country's economic and security interests by ensuring the safety of sea lines of communication (SLOCs), protecting maritime resources, and preventing maritime crime (Till, 2004). Thus, for small states like Sri Lanka, cooperation with regional and global partners can compensate for limited naval capabilities and provide access to advanced technologies and intelligence-sharing mechanisms.

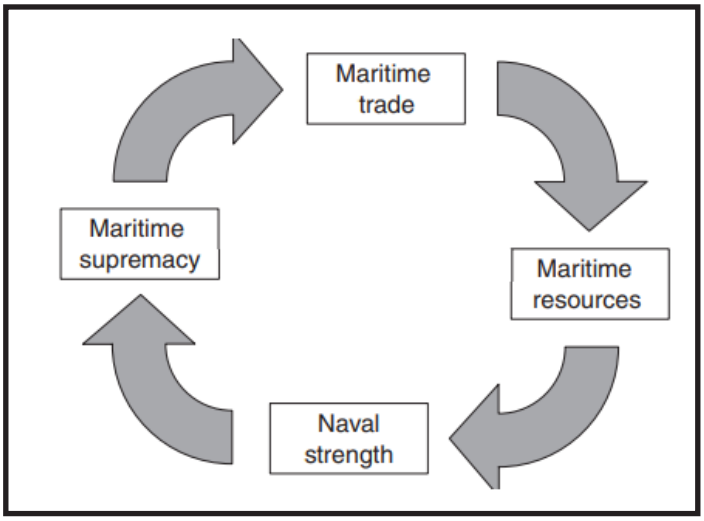

Figure 3: Virtuous Maritime Cycle
Source : Extracted from Seapower (2004)

Existing Cooperative Maritime Security Frameworks

The cooperative maritime security frameworks allow nations to collaborate and share resources, intelligence, and capabilities to enhance MDA that include multilateral agreements, task forces, and regional alliances, offering smaller nations like Sri Lanka opportunities to strengthen their maritime security posture by leveraging collective efforts (Bueger, 2015). By participating in these frameworks, Sri Lanka can enhance its MDA and contribute to regional stability. Hence, the author can list out the following existing cooperative maritime security frameworks that Sri Lanka actively participates in;

a. Indian Ocean Rim Association (IORA)
b. Indian Ocean Naval Symposium (IONS)
c. Colombo Security Conclave
d. Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP)
e. Galle Dialogue
f. South Asian Association for Regional Cooperation (SAARC)
g. United Nations Peacekeeping Maritime Missions
h. United States-led multinational military operations, i.e., Operation Prosperity Guardian
j. Indian Ocean Regional Information Sharing (IORIS) platform
k. South Asia Cooperative Environment Programme (SACEP)
l. Indian Ocean Tuna Commission (IOTC)
m. UNODC Global Maritime Crime Programme (GMCP)

These frameworks offer Sri Lanka opportunities to leverage collective resources, intelligence, and capabilities to strengthen maritime security.

Challenges to Cooperative Maritime Security in Sri Lanka

Small states face the following challenges while trying to engender a cooperative maritime security framework:

a. **Geopolitical Rivalries in the IOR.** The growing presence of China in the region, mainly through its Belt and Road Initiative (BRI), has raised concerns among India and the United States about the strategic implications of Chinese investments in Sri Lankan ports (Kumara, 2020). This geopolitical competition can complicate Sri Lanka's efforts to balance its relationships with vital maritime powers while pursuing cooperative security initiatives.

b. **Limited Naval and Surveillance Capabilities.** Despite its growth, SLN's capacity is still limited compared to other regional powers. Likewise, the country's lack of advanced maritime surveillance technology and insufficient infrastructure for monitoring its vast EEZ presents significant challenges (Kulatunga, 2017). Hence, while bilateral and multilateral cooperation has provided some support in addressing these gaps, more investment is needed to fully equip the SLN with the necessary tools to secure its maritime domain.

c. **Domestic Political Constraints.** Domestic political instability and differing foreign policy priorities can also impact Sri Lanka's ability to engage in cooperative maritime security initiatives. Perhaps shifts in government policies may affect the continuity of long-term security agreements and collaborations with foreign partners. Additionally, balancing domestic economic priorities with the need for investment in maritime security can be a challenge, particularly in times of financial hardship (Wickramasinghe, 2015).

Strategic Options for Sri Lanka in Cooperative Maritime Security

From the nature of contemporary maritime security threats and the island's challenges, cooperation should be the core concept in formulating the maritime strategy for maintaining the states' maritime security. Hence, Sri Lanka can participate in cooperative maritime security in the manners stated in the subsequent paragraphs, which are the recommendations.

a. **Strengthening Bilateral Partnerships.** Strengthening bilateral partnerships with key regional players, such as India, Japan, and Australia, can significantly enhance Sri Lanka's maritime security. Joint naval exercises, technology transfers, and intelligence-sharing agreements are essential to address regional threats effectively (Colombage, 2015).

b. **Deepening Regional Cooperation through IONS and ReCAAP.** Sri Lanka can deepen its engagement with IONS and join ReCAAP, which has effectively combated piracy and armed robbery through shared information and coordinated patrols (Bueger, 2015). Joining ReCAAP would grant Sri Lanka access to resources and expertise for addressing regional maritime crime.

c. **Expanding Engagement in Global Maritime Security Frameworks.** Sri Lanka's engagement with international frameworks, such as CTF-151 and the International Maritime Organization (IMO), should be expanded. These platforms allow Sri Lanka to participate in combating piracy, illegal fishing, and other maritime threats. Additionally, Sri Lanka can advocate for more stringent international regulations on marine pollution and IUU fishing, which impact its economy and environment (De Araújo Ribeiro De Ceita, 2020).

Conclusion

Towards an integrated approach to maritime security, cooperative maritime security is essential for Sri Lanka to navigate the complex security environment of the Indian Ocean. Through bilateral, regional, and global partnerships, Sri Lanka can enhance its maritime capabilities and address traditional and non-traditional threats. However, geopolitical challenges, limited resources, and domestic constraints must be carefully managed to ensure the success of these cooperative initiatives. Continued engagement with regional partners and international organisations will enable Sri Lanka to secure its maritime domain while contributing to peace and stability in the Indian Ocean Region.

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GLOBAL CHALLENGES IN MARITIME INDUSTRY

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Abstract

The global maritime industry faces many significant challenges that impacts its operations, safety, and sustainability. One of the foremost concerns is environmental sustainability. Stringent regulations and public pressure to reduce greenhouse gas emissions have prompted the maritime sector to adopt cleaner and more energy-efficient technologies. The industry must also address issues related to marine pollution and the conservation of marine ecosystems. Safety and security remain paramount. Piracy, cyberattacks, and geopolitical tensions can jeopardize the security of vessels and crew. Effective measures to enhance maritime security are essential. Another challenge is the efficient movement of goods, as trade volumes continue to grow. Ports and waterways face congestion, necessitating infrastructure improvements and innovative logistics solutions. Additionally, global economic fluctuations and trade disputes can impact shipping demand and profitability. Labor and workforce challenges, including crew shortages and the need for skilled personnel, are also significant concerns. Overall, the maritime industry must continually adapt to evolving environmental, economic, and security challenges to ensure its sustainability and growth.

Keywords: Global Challenges in the Maritime Industry, Synchronous Challenges, Solutions to Global Challenges in the Maritime Industry

Global Challenges in Maritime Industry

"The sea, the great unifier, is man's only hope. Now, as never before, the old phrase has a literal meaning: we are all in the same boat."

-Jacques Yves Cousteau-

Introduction

The maritime domain, historically a center of global trade and cultural exchange, continues to play a vital role in connecting global goods, resources, and economies. This research examines current challenges in the maritime industry that impact goods availability, energy resources, and economic stability. Although these issues may seem subtle, they significantly shape modern life. Naval forces and maritime agencies worldwide are key to address these complexities and securing critical sea routes.

The modern maritime sector faces significant challenges, including environmental pollution, geopolitical tensions, and regional instability that threaten trade routes and promote illicit activities. Events like the Suez Canal blockage reveal vulnerabilities in key choke points, while overfishing endangers marine ecosystems. Addressing these issues requires international cooperation and sustainable practices to ensure the resilience of global trade, environmental policies, and maritime security.

Figure 1: Oil Spill by Commercial Liners in the open sea

This study examines modern challenges in the maritime sector, emphasizing their impact on daily life and global stability. Beyond historical context, it explores these issues in-depth and urges action from policymakers, industry leaders, and the public. Highlighting the sector's vital role in our interconnected world, the research stresses the importance of addressing these challenges to ensure stability and resilience.

Navigating the Complex Seascape: Understanding Global Challenges in Maritime Industry

The maritime industry, rooted in historical significance and global trade, faces an increasingly complex landscape today. This section provides a thorough analysis, beginning with a historical overview and exploring the recent multifaceted challenges shaping the industry.

a. **The Evolution of Maritime Industry: From Seafaring Beginnings to Modern Transformation.** The maritime industry, with ancient origins, has long been a hub for cultural exchange, trade, and exploration. From early seafarers to modern containerization, it has evolved significantly, adapting to technological advances and regulatory frameworks like the IMO's standards for safety and environmental protection. This adaptability has preserved its central role in global commerce.

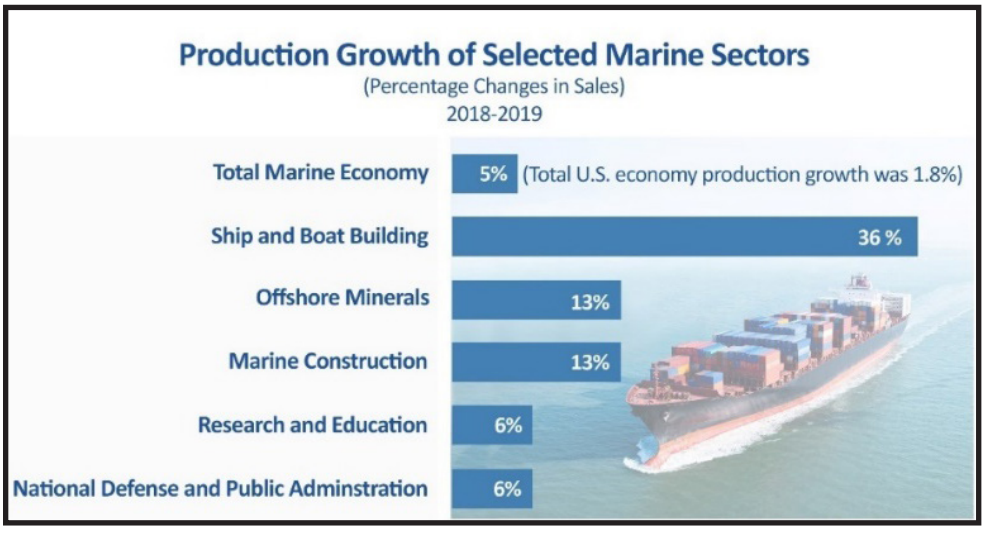

Figure 2: Production Growth

b. **Turbulent Tempests in Maritime Horizons and Chronicles of Transformation.**
This section delves into specific case studies that exemplify the multifaceted nature of challenges in the maritime industry, providing real-world examples drawn from notable incidents, international agreements, and industry developments.

(1) It is undeniable that the maritime industry plays a pivotal role in the global economy, responsible for transporting 90% of the world's trade. The maritime sector stands as the backbone of the shipping industry and is a primary driver of worldwide growth. However, like any other industry, the continuity within the maritime sector can be threatened or disrupted by a range of challenges and issues.

(2) The challenges currently faced by the maritime industry pose exponential risks to the global economy. Consequently, ensuring continuity in the day-to-day operations of the sector is of utmost importance.

(3) Traditionally, the challenges confronting the maritime industry have been evident. Threats from natural disasters, human error, and downtime caused by mechanical failures have always posed risks. However, in recent years, with the rapid expansion of international trade and the implementation of new technologies, the maritime industry now faces a new and less predictable array of risks that significantly threaten its continuity.

(4) By definition, the maritime industry consists of three main components: people, environment, and technology. Each of these components has its own unique characteristics and must be managed as effectively as possible to avoid potential difficulties. In the maritime system, "people" encompass the ship's crew, pilots, dock workers, Vessel Traffic Service operators, and others. Their performance is influenced by a range of traits, including innate and learned abilities, as well as factors such as motivation and alertness.

(5) The design of technology plays a pivotal role in human performance. For example, equipment meant to be used outdoors should consider factors such as ease of operation with gloved hands, and critical information should be presented in an easily interpretable manner. Poorly designed automation can lead to inadequate comprehension of the system's state and poor decision-making.

(6) The environment also affects performance, including physical aspects like weather, lighting, noise, and temperature, as well as regulatory and economic conditions. The physical work environment directly impacts performance, with extremes of temperature or sea state affecting performance. Economic conditions can influence risk-taking behavior.

(7) The third component, technology, holds paramount importance in the maritime industry. Technological advancements in maritime fields have accelerated over the past decade, imposing new criteria for seafarers' competencies and training requirements.

In this contemporary era, what new and existing challenges does the maritime sector face? And how can continuity be preserved while minimizing risks? The subsequent sections of this paper will put light on these questions as well as the courses for overcoming them.

a. **Challenges in Maritime Industry: A Nexus of Advancements and Complexities.** n the present day, the maritime industry faces an array of challenges that have emerged due to advancements in technology, scientific discoveries, globalization, geopolitical shifts, and international conflicts. These challenges are multifaceted, interconnected, and demand a holistic approach to address effectively.

b. **Technological Advancements.** The maritime industry faces a transformative yet challenging era with technological advancements like autonomous vessels and block chain logistics promising efficiency gains. However, these innovations also heighten cybersecurity risks. The IMO's focus on Maritime Cyber Risk Management highlights the urgency of safeguarding vessels, ports, and supply chains from cyber-attacks. Balancing innovation with security is essential as the industry navigates these digital challenges, aiming to harness progress while managing cyber vulnerabilities.

Figure 4: Technological Advancements

c. **Environmental Sustainability.** Stringent regulations to reduce emissions, prevent marine pollution, and protect marine ecosystems have become a focal point. Compliance with regulations like the International Maritime Organization's (IMO) sulfur cap and ballast water management presents challenges for the industry.

d. **Globalization and Trade.** The industry's reliance on global supply chains makes it susceptible to disruptions, such as the COVID-19 pandemic, which highlighted the need for resilient supply chains and risk management.

e. **Geopolitical Tensions.** Maritime territorial disputes, like those in the South China Sea, pose risks to regional stability and trade routes. Geopolitical tensions influence shipping routes, affecting global trade dynamics.

f. **Safety and Security.** Piracy, terrorism, and the safety of seafarers remain pressing concerns. The maritime industry must address evolving security threats and enhance safety measures.

The subsequent sections of this paper will provide a comprehensive understanding of the modern maritime challenges in greater depth, offering insights into their origins, implications, and potential solutions. Additionally, it will examine the chronological steps and international initiatives in place to mitigate these challenges and ensure the industry's continued resilience and sustainability.

Synchronous Challenges in the Maritime Sector

a. **Economic Conundrums: Technological Genesis and Commercial Calamities.**

(1) Economic challenges loom large in the maritime industry. The shipping sector, for instance, grapples with overcapacity issues as technological advancements lead to the construction of larger and more efficient vessels. This has resulted in downward pressure on freight rates and financial instability for shipping companies. The Baltic Dry Index, which measures global shipping rates, serves as a barometer of the industry's susceptibility to economic fluctuations.

(2) The transition from oar-powered boats to sailing vessels in ancient times enabled longer and more efficient voyages, fostering international trade. Technological advancements, such as sailing vessels, the invention of the compass, and steam-powered ships, revolutionized maritime transportation. However, these innovations often came with substantial costs for ship owners, requiring heavy investments and causing disruptions in established maritime trade routes and practices.

(3) During World War II, naval warfare had a devastating impact on maritime commerce, with technologically advanced submarines, like German U-boats, causing significant losses to merchant fleets. The economic calamity resulted from the immense financial burden placed on nations due to the loss of ships, cargo, and the need to build new vessels to sustain wartime logistics.

b. **Shipping Containerization**. In the mid-20th century, standardized shipping containers revolutionized global trade. This technological advancement dramatically reduced the time and labor needed to load and unload cargo, boosting efficiency and reducing costs for many. However, it led to economic challenges for smaller ports and cities unable to adapt quickly, facing declining maritime traffic and impacting local economies.

Figure 5: Shipping Containerization

c. **Digitalization and Automation.** The maritime industry's adoption of digital technologies, including autonomous vessels and smart ports, aims to improve efficiency but also brings economic challenges. Significant investments and skilled labor are needed, while automation may lead to job displacement. Although autonomous tech is reshaping global freight, safety concerns and lack of regulation hinder full automation of maritime operations.

Figure 6: Digitalization and Automation

d. **Global Economic Downturns.** Periodic economic downturns, such as the 2008 financial crisis and the COVID-19 pandemic, have had profound impacts on the maritime industry. Reduced consumer demand, supply chain disruptions, and shifts in trade patterns have led to shipping overcapacity. This oversupply of vessels has resulted in decreased freight rates, impacting shipping companies' profitability and causing financial challenges.

Figure 7: Global Economic Downturns

e. **Environmental Regulations.** Heightened environmental concerns have led to stricter regulations in the maritime industry, including the IMO 2020 Sulphur Cap. These regulations mandate emissions reduction, often requiring costly exhaust gas cleaning systems (scrubbers) or the use of low-sulfur fuels. Compliance with these regulations can significantly increase operating costs for shipping companies, affecting their financial performance.

Figure 8: Environmental Regulations

Navigating Real-World Challenges: Notable Incidents in the Maritime Industry

Since the inception, the maritime industry has encountered numerous challenges across the globe, of which few were natural where most were man made causes. Notable of the same are articulated in the following segments.

a. **Suez Canal Blockage (2021).** The grounding of the Ever-Green container ship in the Suez Canal disrupted one of the world's busiest maritime trade routes. This incident underscored the economic vulnerability of global supply chains and the potential for significant financial losses when such disruptions occur.

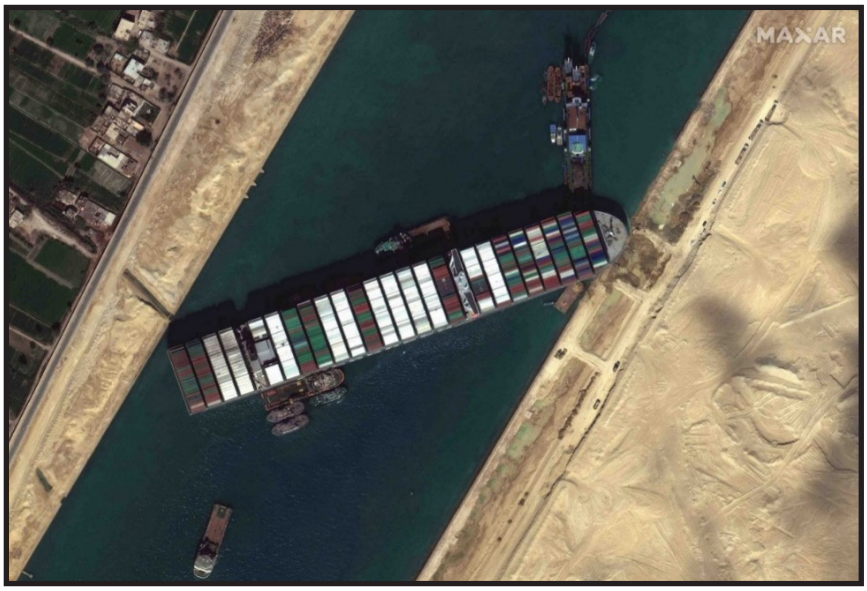

Figure 9: Suez Canal Blockade by Container Carrier EVER GIVEN

b. **COVID-19 Impact.** The COVID-19 pandemic disrupted maritime trade in various ways. While demand for certain goods, such as medical supplies, surged, demand for others, like consumer goods, declined. This fluctuation in demand affected shipping routes, container availability, and freight rates, impacting the financial stability of shipping companies.

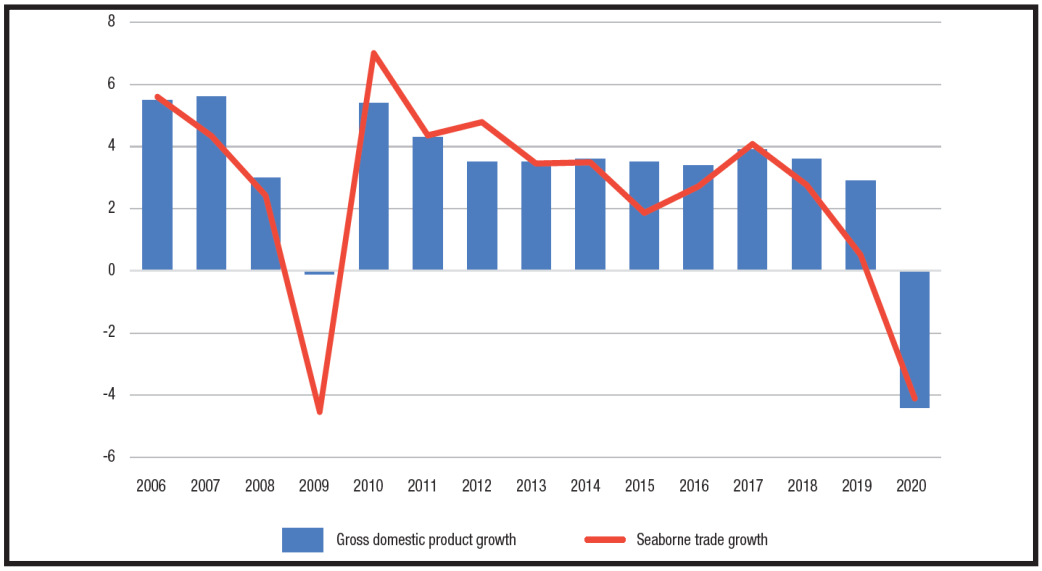

Figure 10: Statistical Graph Showing the Drastic Reduction in Seaborne Trade

c. **Digitalization Investments.** Major ports, including the Port of Rotterdam and the Port of Singapore, have been investing in digital technologies and automation to streamline operations and enhance competitiveness. These investments involve substantial capital outlays, and their economic returns depend on factors such as increased efficiency and reduced labor costs.

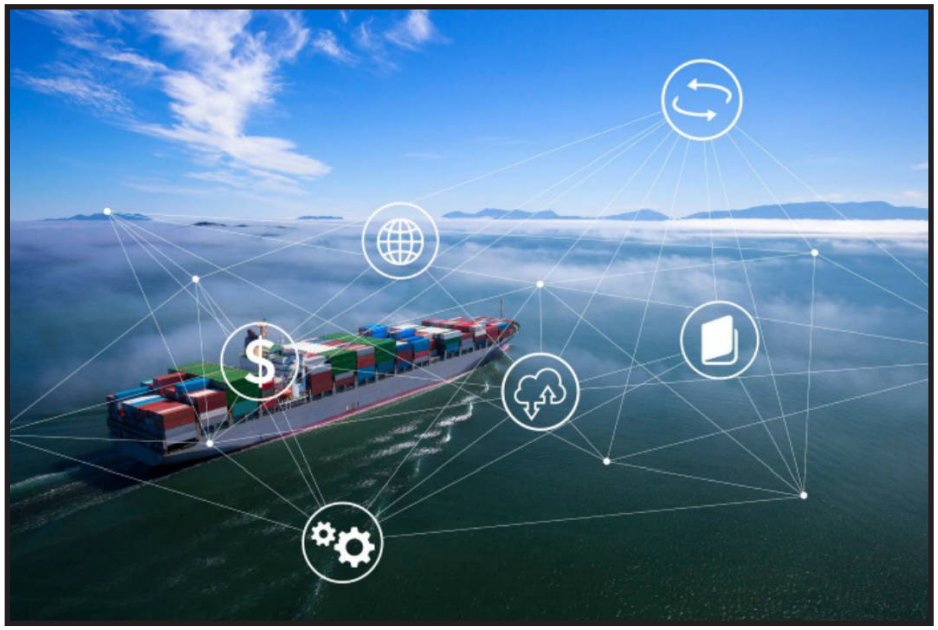

Figure 11: Digitalization of Shipping

d. **IMO 2020 Sulphur Cap Compliance.** Shipping companies worldwide have had to invest in technologies like scrubbers or switch to low-sulfur fuels to comply with the IMO 2020 Sulphur Cap regulations. These compliance measures have increased operating costs and affected the economic performance of shipping companies.

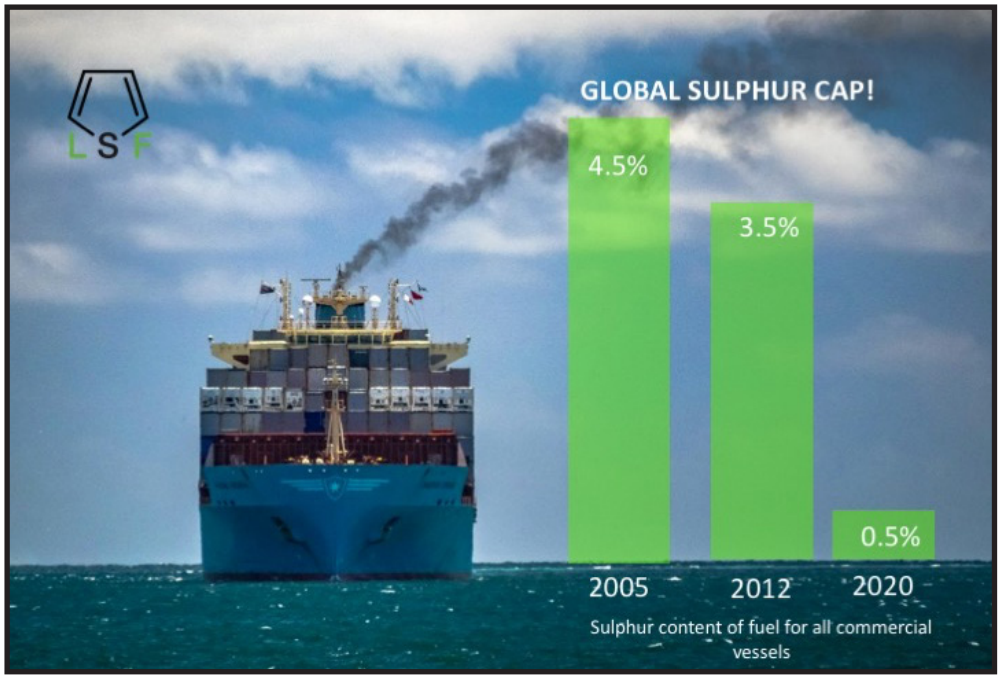

Figure 12: Graph Showing the Sulphur Content of Fuel for Commercial Vessels

e. **Shipping Overcapacity.** The maritime industry, particularly container shipping, has witnessed significant overcapacity due to the construction of massive container vessels. This overcapacity can lead to price wars and financial troubles for shipping companies. For instance, the bankruptcy of Hanjin Shipping in 2016 demonstrated the fragility of some players in the industry.

Figure 13: Shipping Overcapacity

f. **Trade Tariffs and Geopolitical Tensions.** Geopolitical tensions and trade disputes can lead to economic conundrums in the maritime industry. For example, the trade tensions between the United States and China resulted in tariff impositions on various goods, affecting shipping volumes and routes. These tensions can create uncertainty and have ripple effects throughout the industry.

Figure 14: Trade Tariffs and Geopolitical Tensions

The Origins Of Maritime Industry Turmoil: Unveiling The Key Triggers

a. **Cybersecurity Vulnerabilities and Digital Integration.** The integration of digital technologies into maritime operations has significantly enhanced efficiency and navigation precision. However, this digital transformation has also exposed the maritime sector to an array of cybersecurity threats. The industry's growing reliance on interconnected digital systems, including condition monitoring, data analytics, and global positioning systems (GPS), has rendered it susceptible to cyberattacks and data breaches. Cybercriminals target critical maritime infrastructure, aiming to disrupt vessel operations and compromise sensitive data, highlighting the urgent need for robust cybersecurity measures. The evolving landscape of cyber threats has necessitated the adoption of comprehensive cybersecurity frameworks, such as the International Maritime Organization's (IMO) Interim Guidelines on Maritime Cyber Risk Management, to fortify the industry's digital frontiers against potential breaches.

b. **Complexities of Crew Safety and Well-being.** The maritime industry has witnessed an unprecedented technological revolution, enabling more sophisticated vessels and advanced operational capabilities. While these advancements have augmented operational efficiency, they have simultaneously introduced intricate challenges related to the safety and well-being of seafarers. The complexity of modern maritime infrastructure demands a highly skilled workforce capable of effectively navigating sophisticated equipment and intricate operational protocols. Consequently, ensuring the physical and mental well-being of crew members has become a paramount concern for the industry. Addressing these challenges requires comprehensive measures, including the implementation of rigorous training programs to equip seafarers with the necessary skills to handle sophisticated technologies, promoting healthy and nutritious catering services to maintain crew vitality during long voyages, and prioritizing accessible medical solutions to attend to the diverse health needs of seafarers at sea.

Figure 15: Safety of Personnel Engaged in Shipping Industry

Geopolitical Tensions and Trade Dynamics.

a. The maritime industry faces challenges from geopolitical tensions, territorial disputes, and global sanctions, which threaten the safety of shipping routes and disrupt trade patterns. The industry's reliance on global supply chains, as shown during COVID-19 disruptions, highlights the need for strong risk management to remain resilient amidst shifting trade dynamics and geopolitical pressures.

b. Rising geopolitical tensions, trade protectionism, cyber threats, and climate change responses increasingly threaten maritime trade. These forces impact shipping, requiring shipowners and organizations to actively understand and manage geopolitical risks to ensure resilience.

c. This panel touched on most of the world's strategic 'choke points' for maritime trade, which are incredibly vulnerable to the vagaries of geopolitics. The Strait of Hormuz, in particular, was considered the most dangerous, given the expected escalation of hostilities between Iran and Saudi Arabia. Maintaining freedom of navigation through these narrow chokepoints is crucial to prevent disruptions.

d. According to Jens Martin Jensen, CEO of the Athenian Group Inc., the biggest geopolitical impact on shipping in his lifetime was the closure of the Suez Canal from 1967-75. This event changed ship types, led to the rise and fall of the tanker market, and prompted the development of new oil fields. The recent Ever Green grounding in the Suez Canal mainly affected the container shipping market. Had the blockage continued, it would have changed tanker routings, increasing tonne-miles and costs.

e. From chokepoints to potential flashpoints, the panel singled out China's ongoing activities in the South China Sea and the emerging Western response as a worrying trend that could impact one of the world's busiest trade corridors. China has long claimed the territorial waters of the expansive South China Sea as its own, dismissing similar claims from neighboring countries such as The Philippines, Vietnam, and Malaysia.

f. China introduced rules requiring all foreign vessels transiting the South China Sea to identify themselves. Critics, including Asian and Western nations, argue that adherence to those rules would tacitly recognize China's authority over the Sea and potentially allow it to manage access to the area.

g. Japan has actively warned its allies about China's intentions in the region, and in September 2023, the U.S., the U.K., and Australia announced the formation of a 'security and defense' partnership as well as a new fleet of nuclear submarines for Australia in response to Beijing's expansionism. Given that up to a third of the world's maritime trade transits the South China Sea, many shipowners are nervously watching developments.

h. The South China Sea remains a challenging area, and while intentional escalation is not expected, it is a highly contested and increasingly militarized region. Intimidation regarding freedom of navigation and the new rules could lead to miscalculated or accidental use of force.

Global Sanctions

Global sanctions can have significant implications for the maritime industry, as shipping and trade are closely connected to the movement of goods and resources worldwide. The interaction between global sanctions and the maritime industry can be complex and may lead to various challenges:

a. **Disruption of Trade Routes.** Sanctions can disrupt established trade routes and patterns, forcing ships to avoid certain ports or regions. This can lead to longer voyages, increased fuel costs, and delays in the delivery of goods.

b. **Insurance and Financing.** Ships that operate in sanctioned areas or engage with sanctioned entities may face difficulties in obtaining insurance coverage and financing. Insurance companies and financial institutions may be hesitant to underwrite or fund operations that could potentially violate sanctions.

c. **Compliance Burden.** The maritime industry must invest in compliance measures to ensure that they do not inadvertently violate sanctions. This may involve extensive due diligence to verify the legitimacy of cargo, customers, and partners.

d. **Vessel Blacklisting.** Specific vessels or shipping companies linked to sanctioned entities may be added to blacklists, making it illegal or difficult for them to conduct international trade. This can tarnish a company's reputation and financial viability.

e. **Risk of Seizures and Confiscations.** Ships engaged in sanctioned activities may face the risk of seizure or confiscation by authorities enforcing the sanctions. This can result in financial losses for ship owners and operators.

f. **Impact on Ports and Terminals.** Ports and terminals in sanctioned regions may experience reduced trade volumes, leading to economic challenges for the local maritime industry and related sectors.

g. **Supply Chain Disruptions.** Sanctions can disrupt global supply chains, affecting not only the maritime industry but also industries reliant on the timely and cost-effective movement of goods.

h. **Regional Instability.** In some cases, sanctions can exacerbate regional instability, which may affect the safety and security of maritime routes and operations.

It's essential for the maritime industry to stay informed about global sanctions regimes and compliance requirements. Companies operating in this sector often have compliance departments dedicated to ensuring that their activities align with international sanctions regulations and do not unintentionally violate them. Additionally, industry associations and organizations may provide guidance and support to navigate the complexities of sanctions compliance in the maritime industry.

The obstacles that the maritime industry has encountered in the past have been evident. Natural calamities, for example, as well as human error and downtime due to technical breakdowns, all represent a threat. However, with the rapid expansion of international trade and the installation of new technologies and infrastructure in recent years, the marine industry today faces a new, less predictable set of dangers that threaten the sector's long-term viability.

Solutions to Global Challenges in the Maritime Industry

Climate Change Mitigation

a. **Weather-Resilient Shipping Strategies.** Extreme weather events can disrupt maritime trade routes, causing cargo loss and delays. To address this challenge, shipping companies can implement various weather-resilient strategies, including optimized ship designs and enhanced weather monitoring systems.

Figure 16: Ship encountering Rough Sea

b. **Renewable Marine Energy.** The maritime industry is exploring renewable energy sources to reduce its carbon footprint. The integration of renewable marine energy, such as wind and solar power, into ships' propulsion systems is gaining traction.

(1) **Wind-Powered Propulsion**. In 2021, the Enercon E-Ship 2030, equipped with Flettner rotors, showcased the potential of wind-powered propulsion. This innovative technology reduced the vessel's reliance on traditional fuel, demonstrating the feasibility of renewable energy in maritime transport.

(2) **Solar Energy Adoption.** Recent studies have shown that the integration of solar panels on ship decks can generate a significant portion of onboard energy needs. The Royal Caribbean International's Symphony of the Seas, with its solar-panel-covered decks, achieved substantial energy savings during its voyages in 2022.

Enhancing Maritime Security

a. **International Security Regulations.** In response to evolving security threats, the International Maritime Organization (IMO) introduced SOLAS Chapter XI-2 and the International Ship and Port Facility Security Code (ISPS Code). These regulations aim to enhance maritime security and protect global transport by sea.

b. **The Impact of ISPS Code - A Success Story.** The implementation of the ISPS Code has led to a notable decrease in security incidents in recent years. According to the IMO's 2021 report, security breaches and attacks on vessels and ports declined by 30% globally compared to the previous decade, demonstrating the effectiveness of international security regulations.

Long-Term Security Measures

Apart from immediate security concerns, IMO resolutions address long-term maritime security issues, emphasizing technical cooperation, early implementation, and the security of ships and port facilities.

a. **Collaborative Security Initiatives.** The collaborative efforts of governments, local administrations, and industry stakeholders have resulted in improved maritime security. In a recent exercise conducted in 2023, multiple countries collaborated to respond to a simulated terrorist threat in the Strait of Hormuz, showcasing the effectiveness of international security cooperation.

b. **Promoting Information Sharing and Intelligence Exchange.** To fortify long-term maritime security, the International Maritime Organization (IMO) encourages member states to establish robust mechanisms for information sharing and intelligence exchange. This collaborative approach involves the continuous flow of security-related data and insights among governments, maritime agencies, and industry stakeholders.

c. **The Role of Maritime Fusion Centers.** Maritime fusion centers are essential for aggregating and analyzing security information. The 2022 launch of the Global Maritime Security Intelligence Network (GMSIN) exemplifies this, enabling real-time intelligence sharing among maritime nations to better anticipate and respond to security threats.

Conclusion

The maritime industry, essential to global trade, faces complex challenges requiring urgent solutions. This paper examines key issues, including the Suez Canal blockage, COVID-19 disruptions, climate change impacts, and cybersecurity threats, within the rapidly evolving maritime landscape.

The maritime industry faces numerous challenges, including disruptions like the 2021 Suez Canal blockage and COVID-19's impact on trade patterns. Ecological issues, such as climate change and pollution, threaten sustainability, while cybersecurity risks and geopolitical tensions require strong defenses and international cooperation.

Technological advancements and large container vessels have caused overcapacity, leading to price wars and financial instability. Environmental regulations, like the IMO 2020 Sulphur Cap have raised operating costs. Geopolitical tensions, including trade disputes and tariffs have disrupted shipping routes. Additionally, increased reliance on digital systems has exposed the industry to cybersecurity risks, requiring stronger defenses.

To overcome these ever-emerging challenges, the maritime industry must adopt proactive measures and collaborative strategies. Weather-resilient shipping strategies, renewable marine energy sources, and enhanced maritime security regulations offer pathways to address climate change, energy efficiency and security concerns. Compliance with global sanctions and efforts to improve the mental and physical well-being of seafarers can contribute to smoother operations. Moreover, the industry must continue to adapt, invest in technology, and strengthen international cooperation to navigate the unpredictable waters of global challenges successfully. In a rapidly evolving world, the maritime industry's ability to innovate and adapt will be critical in ensuring its resilience and continued contribution to the global economy.

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MARITIME CHOKE POINTS AND THEIR IMPACT ON GLOBAL TRADE IF DISRUPTED

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Abstract

This article explores the pivotal role of maritime choke points in facilitating global trade, particularly in the transport of energy, food, and industrial goods. The growth of global trade, driven by population increase and rising energy demands, has made these narrow maritime passages crucial for international commerce. Choke points such as the Strait of Hormuz, Strait of Malacca, and the Suez Canal are essential for the uninterrupted movement of goods, and disruptions in these regions could severely affect global supply chains for food and energy. The paper traces the historical development of maritime trade, from ancient trade routes to contemporary shipping paths, and highlights advancements in navigation, shipbuilding, and infrastructure. It also examines the vulnerabilities of these choke points, which are subject to threats like piracy, political instability, and climate-related disruptions. The article categorizes choke points into primary and secondary based on their influence on global trade. It concludes by stressing the importance of protecting these vital maritime routes to maintain the stability of global trade and mitigate risks that could lead to price hikes, shortages, and economic turmoil worldwide.

Keywords: Maritime Choke Points, Global Trade, Maritime Security, Shipping Routes, Geopolitical Threats.

Introduction

Growth of the world's population and increasing demand for energy has expanded the global economy and global trade. Maritime trade has proven that it is the best option to cater to the world's food and energy requirements. Therefore, maritime trade has been mastered by humans throughout the centuries as the ocean connects most of the countries. Thus, ocean-based transportation grew rapidly. Maritime Traffic is increasing gradually with the rapid expansion of the shipping industry. The concept of 'Maritime Choke Points' has been brought up to describe the more crucial shipping corridors all over the world. Maritime choke points are extremely important for the smooth flow of marine transportation. Maritime Trade is strongly dependent upon the security of maritime choke points. Disruption of any will lead the world's food and energy supply into grave danger.

Maritime Trade

Maritime trade was not developed overnight. It has a long history and its roots extend up to more than 2000 BC. The first major shipping routes were formed during the 'Indus Valley Civilization' to transfer goods between India and Pakistan. Simultaneously in Europe, Romans were keen to develop their maritime trade. Eventually, they crossed the Mediterranean Sea and expanded their shipping routes up to the Indian Ocean. In comparison to land-based trade routes, ancient merchants understood that marine trade routes are safer, cheaper, and quicker. Land-based trade routes were more vulnerable to bandit attacks and they were time-consuming. The invention of the *Astrolabe* (an instrument used to identify stars, planets and measures the altitude of celestial bodies) enhanced marine navigation drastically. Arabian traders were instrumental in developing

trade routes to Asia, Africa, and Europe. In the latter part of the Medieval Age, (between the 15th -19th century) with the development of navigation and shipbuilding Europeans were allowed to stretch their shipping routes to the North and South American continent. Moreover, the establishment of trade companies such as "Dutch East India Trade Company'' improved the trade between Asia and Europe. The 'Revolution of Maritime Trade' occurred after the construction of the Suez Canal and Panama Canal in the 19th and 20th century respectively, as it created new shipping routes. The new chapter of maritime trades has begun after the introduction of container shipping and it leads to the development of maritime trade what we see today.

Maritime transportation has become the most reliable and common means of transportation during the last few decades. Moreover, it is considered the most economical mode of transporting goods due to various reasons. When economical perspective is concerned, there are many advantages of maritime trade. Large cargo capacity, considerably low cost for transportation and less infrastructure requirements are some of them. Consequently, the rapid expansion of maritime transportation lowers the prices of commercial goods. In addition, freight transportation was motivated by globalization and population growth. The shipbuilding industry, infrastructure development for shipping and sea-based services are also developed in parallel and spearheaded the economic growth of many coastal and industrial nations. Maritime transportation created open economic avenues for many countries such as Singapore, Netherlands, and Spain. Besides, many other countries in the world mainly depend on maritime freight transportation. Thus, the protection of maritime shipping routes or Sea Lines of Communication (SLOCs) has become the greatest responsibility of many countries.

Maritime Choke Points

Maritime choke points are one of the most important geographical features that directly affect global maritime trade and maritime navigation. This concept has been brought up to secure the important shipping routes because smooth functioning of global maritime trade is heavily reliant upon the few maritime choke points around the globe. Disruption of any of them will lead global maritime trade into considerable confusion. A maritime choke point is defined as the narrow water body along the important shipping routes that limits the circulation of shipping. There are few significant features in maritime choke points. For example,

a. Commonly used narrow shipping lanes that can be closed for shipping.
b. Maritime choke points cannot be bypass easily. If disturbed, there are no readily available shipping routes to use.
c. Security of maritime choke points is a great concern of several countries in the world.

There are few 'Primary Maritime Choke Points' in the world that achieve the above three requirements and they are Strait of Malacca, Strait of Babe El Mandeb, Strait of Hormuz, Strait of Gibraltar, Turkish strait, Suez and Panama Canal. Furthermore, some narrow straits are identified as 'Secondary Maritime Choke Points' as they lack at least one of the above requirements. Namely, 'Strait of Bering, English Channel and Magellan Strait'

Primary Maritime Choke Points

a. **Strait of Hormuz.** The Strait of Hormuz is located between the Gulf of Oman and the Persian Gulf. It is surrounded by Iran and the United Arab Emirates. It is considered as one of the most important maritime choke points as it is the only shipping access to the Persian Gulf. The Strait of Hormuz is approximately 90 nautical miles (162 km) in length and its narrowest point has a width of nearly 21 nautical miles (38 km). One third of the world's Liquefied Natural Gas (LNG) and more than 30% of the world's crude oil trade passes through the Strait of Hormuz annually by making it the most sensitive geographic location for maritime trade. During the last few years, shipping in the Strait of Hormuz was disturbed few occasions due to terrorist activities and increasing political and military tension in the Gulf region.

b. **Strait of Malacca**. The Strait of Malacca is a narrow shipping lane located between Malaysia and the Island of Sumatra with an approximate length of 520 nautical miles (935 km). It is the shortest shipping route for the Middle East to East Asian countries. The Strait of Malacca is often used as the main shipping route of economic superpowers in the region by number of countries such as Singapore, Japan, China and South Korea making it one of the busiest waterways in the world. Moreover, the Strait of Malacca handles more than 20% of the world's grain supply annually. However, it has noticeably vulnerable for shipping threats, as few incidents were reported of hijacking, piracy and theft in the recent past.

c. **Strait of Bab El Mandeb.** Locating in between the Horn of Africa and the Red Sea, bordering Oman, Eritrea and Djibouti, the Strait of Bab El Mandeb plays a vital role in global maritime trade in the world. The Strait of Bab El Mandeb is the key entry point to the Mediterranean Sea through Suez Canal. It is often used by the oil tankers which depart from the Persian Gulf to reach Europe. Not only that, 70% of provisions is imported by Northern African countries such as Libya, Tunisia and Egypt. Furthermore, 30% of the world's potassium chloride (raw material for commonly used fertilizer) passes through the Strait of Bab El Mandeb every year. Piracy attacks launched from the 'Failed States' in the region are one of the main threats for shipping in the Strait of Bab El Mandeb.

d. **Gibraltar Strait.** The Strait of Gibraltar is the gateway to the Atlantic Ocean from the Mediterranean Sea and this is one of the busiest shipping routes that passes nearly 350 ships per day. The Strait of Gibraltar is located between the topmost point of Morocco and the southernmost point of Spain also a very narrow strait with a width of nearly 9 nautical miles. The majority of the world's container cargo and food supply between Europe and Asia travels through the Strait of Gibraltar.

e. **Turkish Straits.** Turkish Straits are the combination of two narrow straits named Bosporus Strait and Dardanelles Strait, that are located on either side of the 'Sea of Marmara' in Turkey. In addition, the Turkish Straits divides Asia from the European continent. Turkish Straits are the only shipping route for the Black Sea, Azov Sea and the Crimean Peninsula. They connect the Black Sea to the Mediterranean Sea through the Aegean Sea. Furthermore, the Turkish Straits hold a very significant strategic important maritime choke due to rising political, defence and economic unrest in the Black Sea region.

f. **Suez Canal.** Suez Canal is a man-made artificial waterway in Egypt and it connects the Mediterranean Sea to the Red Sea. It was constructed between 1859-1869 and controlled by Europe owned company till Egyptian president 'Gamal Abdul Nasar' nationalized it in 1956. The main requirement for constructing Suez Canal is to provide easy access to the

'Northern Atlantic Ocean' from the 'Indian Ocean'. It reduces the total distance of sea passage between India and England by approximately 6000 nautical miles. Presently, one-third of world container cargo and more than 10% of ship-based cargo pass through Suez Canal every day.

g. **Panama Canal.** One-third of Panama Canal is located in the Republic of Panama. Its construction started in 1904 and opened for shipping in 1914. The 51 nautical miles long waterway connects the Atlantic Ocean to the Pacific Ocean by reducing more than 12000 nautical miles from the previous shipping route around the South American continent.

How Maritime Choke Points Get Disturbed?

Maritime choke points around the globe frequently get disturbed due to various reasons. Disturbance for transnational maritime food and energy supply caused inevitable damage to the world's economy. Most of the time maritime trade routes get disrupted by minor reasons, but major disruptions are very unpredictable and rectifying those are challenging. Both natural effects and man-made issues directly involve the disruption of the smooth functioning of maritime choke points. Considering the above reasons, the disruptive hazards for the maritime choke points can be broadly categorized under the following reasons.

Climate and Natural Threats

Various climatic and weather conditions pose multiple threats to the proper functioning of maritime choke points. Sudden climatic changes will have various effects on the shipping industry. Panama Canal frequently suffered from water level changes as a result of irregularities in rainfall in the region. In 2016, Panama Canal authority has imposed depth restrictions on ships as a rapid drop in water level in Gutan Lake. Tropical storms are another challenging natural phenomenon for global maritime trade. Gulf and Red Sea regions are prone to tropical cyclones. In 2015, Suez Canal closed owing to heavy winds. Not only that, in March 2021, 'MV Ever Given' grounded at Suez Canal due to strong winds creating huge losses on global trade.

Institutional and Political Impact

Proper and efficient infrastructure management are essential requirements for uninterrupted operations of global maritime trade. Poor management, labour strikes and inefficiencies at choke points such as Panama and Suez Canal will increase the shipping cost and restrict cargo transportation. Apart from institutional impact, geopolitics also has a considerable impact on global maritime trade at choke points. During the 'Crimean Crisis' in 2014, the Turkish Strait is restricted for ships that proceeded towards Ukrainian ports. During the last few months in 2024, Shipping in the Strait of Hormuz is often disturbed by the Houthi rebels with the escalating political unrest with western countries.

Impact on Global Trade

Disruption of maritime choke points directly affect global trade. Almost all transnational shipping routes lies through at least a single chokepoint. Maritime commerce totally depends upon food, energy and industrial cargo. world energy demand grew sky-high with the 'Industrial Revolution', population growth and repaid technological development during the 19th-20th century, Gulf regional countries are the main suppliers for global energy demand. Saudi Arabia is the world's largest oil exporter with over 3.7 billion barrels per day, while Qatar has become the world's largest LNG (Liquified Natural Gas) exporter by exporting over 107 billion cubic meters annually (2023

figures). Main maritime access for both Saudi Arabia and Qatar is through the Strait of Hormuz. In the event of any disturbance, there is no alternative shipping route. Even land-based oil pipeline unable to yield the global demand. This will cause to increase in oil and gas price all over the world. Subsequently, it will affect the prices of various products. Increasing demand and limited supply of petroleum products are huge challenges in the global energy market. However, geopolitics, terrorism and interdictions by naval forces at the choke points are remaining unanswered.

Transnational Maritime shipping is one of the key elements of global food security. Wheat, rice and maize are 60% of the global food consumption while soya beans are accountable for 65% of the world's protein demand. Few significant maritime choke points directly involve the global food supply. Eastern Europe is nicknamed as the 'Europe's Bread Basket'.one-quarter of wheat production in the Black Sea region passes through the Turkish Straits each year. Southeast Asian countries including China are the world's biggest importer of animal feed. Hence, 25% of global soya bean production reaches Southeast Asia through the Strait of Malacca. Not only that, annually 180 million tons of fertilizer that is used for the farmland is also distributed through ships. Growing international trade on food-based commodities creates huge traffic at maritime choke points. Serious disturbance for global food supply at the choke points will trigger consequences such as shortages in supply, increase in transportation cost, decomposition of food items and ultimately these factors will lead to the increase of food prices. Further, same effects will cause the other maritime freight cargo trades all over the world.

Conclusion

Maritime trade had been a popular mode of goods transportation for thousands of years. Today it has been one of the keystones of globalisation. Moreover, Maritime shipping and Globalization have a significant relationship. Globalization increases the demands for maritime trade while maritime trade empowered globalization. Today maritime transportation has extended its arms through the entire maritime space and dominate the international cargo circulation. Transnational shipping routes are runs through specific locations such as harbours, passages, oceans and straits. Maritime choke points are key locations with significant strategic importance. Furthermore, they are narrow waterways with large maritime traffic. Another important feature is maritime choke points cannot be easily bypassed if disturbed. Maritime choke points are categorized as 'Primary Maritime choke points' and 'Secondary Maritime choke points' considering the impact on global trade.

Ironically, most of the Maritime choke points in the world are located in regions where Terrorism, Piracy and Political instability are being taken place. International Shipping in the above regions is often disturbed by terrorist activities, interdiction of naval powers and piracy. In addition to that, security issues such as taxations, diplomatic restriction and labour strikes are also disturbing maritime choke points for shipping. Apart from man-made issues, few weather hazards hinder the maritime trade at choke points. In the recent past, most of the maritime choke points interrupted as a result of tropical storms, heavy rainfall and drought. Primarily disruption of maritime choke points is directly affected global trade by mitigating material, food and energy supply. Simultaneously, it threatens the reliability of global maritime trade creating more negative consequences. In conclusion, security and the smooth functioning of maritime choke points are of the utmost importance for effective and efficient global maritime trade.

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LONG LOGISTICS MANAGEMENT COURSE AT THE NAVAL AND MARITIME ACADEMY

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Abstract

The Logistics Branch of the Sri Lanka Navy (SLN) plays a critical role in ensuring operational readiness by providing essential support during both wartime and peacetime. Key to this is the training of logistics officers, demonstrated by the Long Logistics Management Course (LLMC), which combines theoretical and practical knowledge. Endorsed by General Sir John Kotelawala Defense University while expanding the diversification in sister services and friendly navies, the LLMC enhances professional expertise and offers pathways to an MBA in Logistics Management. This initiative underscores the SLN's commitment to innovation, professional excellence, and maintaining agility in the face of evolving logistical challenges.

Keywords: Logistics Branch, Professional Excellence, State-of-the-Art, Supply Chain Management

Motto

"Perfection through Professionalism"

Quality Policy

"Facilitate Officers of the Logistics Branch to develop their professional competency in the field of Logistics Management to perform duties in an effective and efficient manner in the Sri Lanka Navy".

Introduction

Effective logistics support is fundamental to the successful execution of military operations. It is well established that without healthy logistical support, no war can be fought effectively. This principle applies universally across military organizations, and the Sri Lanka Navy (SLN) is no exception. The Logistics Branch in the SLN plays a critical role in ensuring seamless operational readiness, providing a silent but essential service in both wartime and peacetime. By efficiently mustering all available resources, the branch supports the execution of battle designs and other naval operations, enabling the Navy to maintain its operational effectiveness.

During wartime, the Logistics Branch emerges as the backbone of the Navy's operational capability. It ensures the availability of critical supplies, such as fuel, ammunition, spare parts, and other logistical necessities. Without this unwavering support, even the most well-conceived battle strategies would falter due to the lack of operational sustainability. The Logistics Branch does not unprejudiced support ongoing operations but also anticipates future needs, ensuring that every contingency is covered.

In addition to material support, the branch is responsible for coordinating the transportation of ration, fuel, equipment, and essential supplies across maritime and terrestrial domains. This coordination requires precision planning and a thorough understanding of both strategic objectives and the operational landscape. The ability to execute such tasks efficiently highlights the Logistics Branch as a cornerstone of the Navy's war fighting capability.

Training and Development of Logistics Officers

To achieve excellence in their responsibilities, officers in the SLN Logistics Branch undergo various training programmes designed to equip them with the necessary skills and professionalism. The Navy recognizes that logistics officers need a strong foundation of theoretical knowledge and practical expertise to perform their roles. As a result, most logistics officers receive extensive exposure both locally and internationally, acquiring valuable insights into advanced systems and modern logistical concepts.

These training programmes are tailored to address both the immediate needs of the Navy and the broader strategic requirements of national defence. Officers are trained to adapt to rapidly changing scenarios, leveraging innovative solutions and state-of-the-art technologies to overcome logistical challenges. This ensures that the Logistics Branch remains a dynamic and responsive entity, capable of meeting the demands of modern naval operations.

The Long Logistics Management Course (LLMC)

Among the various training programmes offered to logistics officers, the Long Logistics Management Course (LLMC) stands out as the pinnacle of professional specialization. Recognized as the highest professional course for logistics officers in the SLN, the LLMC represents a significant milestone in the career development of logistics professionals.

Historically, the LLMC was conducted through collaboration with friendly foreign navies, with limited births available for SLN officers. However, the growing number of logistics officers requiring this specialised training prompted the SLN to establish its own LLMC. This initiative reflects the Navy's commitment to fostering professional excellence within its ranks and underscores the importance of logistics in achieving operational success. The LLMC, conducted at the prestigious Naval and Maritime Academy, spans eleven months of intensive training. The curriculum is meticulously designed to provide officers with a comprehensive understanding of Logistics Management Principles, Supply Chain Management, and Strategic Planning. By integrating theoretical knowledge with practical applications, the course ensures that graduates are well-prepared to tackle the complexities of modern naval logistics. The very first Long Logistics Management Course was commenced on 03rd February 2014 and terminated on 18th January 2015. Up to now, 08 courses were successfully terminated and nearly 150 officers have been decorated with the title of LLMC from the NMA. Sri Lanka Navy has unveiled the opportunity to follow LLMC for sister services and friendly Navies and currently, officers from Sri Lanka Air Force and Royal Malaysian Navy are following the course.

One of the defining features of the LLMC is its accreditation by General Sir John Kotelawala Defense University. Officers who complete the course are awarded an LLMC certificate, which serves as a testament to their expertise in logistics management. Moreover, the course is integrated into KDU's academic framework, allowing officers to pursue a Master of Business Administration (MBA) in Logistics Management upon completion.

This academic accreditation enhances the professional standing of logistics officers and provides them with opportunities for further career advancement. It also underscores the Navy's commitment to aligning its training programmes with global academic standards, ensuring that SLN officers remain at the forefront of professional development.

The establishment of the LLMC within the SLN is not merely a response to a backlog of officers requiring specialised training, it is a proactive measure to address the evolving challenges of naval logistics. In today's dynamic security environment, logistics officers must contend with issues such as resource optimization, supply chain disruptions, and the integration of advanced technologies. The LLMC equips officers with the skills and knowledge needed to navigate these challenges effectively, ensuring that the Navy remains agile and resilient.

The Logistics Branch of the Sri Lanka Navy exemplifies the strategic importance of logistics in modern military operations. Whether in wartime or peacetime, the branch plays a pivotal role in supporting the Navy's mission and enhancing its operational readiness. Through initiatives like the Long Logistics Management Course, the SLN has demonstrated its commitment to professional excellence and innovation in logistics management.

As the Navy continues to evolve in response to emerging challenges, the Logistics Branch will undoubtedly remain a cornerstone of its success. By investing in the training and development of logistics officers, the SLN ensures that it is well-prepared to meet the demands of the future, serving the nation with confidence and efficiency. The LLMC, with its blend of professional specialization and academic accreditation, embodies the Navy's vision for a robust and dynamic logistics capability, enabling the SLN to uphold its strength.

STUDY ON EXISTING EXPLOSIVE ORDNANCE DISPOSAL CAPACITY AND WAY AHEAD FOR ENHANCED CAPABILITIES IN SRI LANKA NAVY

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Abstract

This study examines the current Explosive Ordnance Disposal (EOD) capabilities of the Sri Lanka Navy, identifying gaps in training, equipment, and inter-force collaboration, and proposing strategies to enhance operational effectiveness. EOD plays a crucial role in national security by detecting and neutralizing threats from unexploded ordnance (UXOs) and improvised explosive devices (IEDs). Historically, Navy EOD operators have made significant contributions, particularly during the Sri Lankan civil war and post-conflict incidents like the 2019 Easter Sunday attacks. However, limitations in advanced equipment, training infrastructure, and cross-force coordination impact readiness and response capabilities.

The research highlights the disparity in EOD training and resource allocation across the Sri Lanka Navy, Air Force, and Army, with a focus on operational challenges faced by naval EOD teams. Recommendations include improving training facilities, acquiring modern equipment, implementing advanced EOD courses, establishing a Naval Research Wing (NRW), and enhancing collaboration with other military forces. Strengthening these areas will ensure the Navy's preparedness to respond effectively to evolving explosive threats and safeguard national interests in both inland and maritime environments.

Key Words: Explosive Ordnance Disposal (EOD), Improvised Explosive Devices (IEDs), Unexploded Ordnance (UXOs)

Introduction

The explosive industry has evolved from its rudimentary beginnings into a sophisticated and highly researched sector that provides powerful tools used across various fields. While initially developed for military applications, explosives have found extensive use in civilian industries, such as mining, construction, and infrastructure development, making them integral to modern society. This evolution has been particularly marked by rapid technological advancements during the world wars, where explosive technology saw unprecedented development. From the production of military weaponry to commercial blasting operations, the explosive industry has continually adapted to meet the growing demands of safety, effectiveness, and efficiency.

This study aims to evaluate the existing Explosive Ordnance Disposal capacity of the Sri Lanka Navy and propose strategies for enhancing its capabilities to address evolving threats effectively. The research focuses on two primary areas: Training and Operations, ensuring a comprehensive approach to improving the Navy's EOD framework. The Training aspect emphasizes assessing the current state of EOD education and skill development within the SLN. It explores opportunities to modernize training methodologies, upgrade infrastructure, and incorporate technological advancements to ensure personnel are equipped to handle complex explosive threats. The operational aspects addresses the strategic alignment of EOD roles and responsibilities with maritime security needs. It analyses operational gaps and identifies ways to enhance readiness, safety, and efficiency in EOD practices. By focussing on these key areas, the study aims to provide

actionable recommendations that strengthen the Navy's ability to safeguard national and regional security in an increasingly dynamic threat landscape. Finally, the recommendations will consider the Sri Lanka Navy's budget constraints, ensuring practical and cost effective solutions are proposed.

Explosive Ordnance Disposal (EOD) is a critical process conducted by EOD operators using specific equipment and scientific methods. EOD operators neutralise various explosive hazards and threats with critical vulnerabilities. An EOD operator is a well-qualified individual equipped to detect, identify, render safe, and dispose of munitions and explosives, such as unexploded ordnance (warheads that have not been activated) and all improvised explosive devices (IEDs). EOD also involves chemical, biological, and nuclear weapons. During the war in Sri Lanka, explosions caused by enemy forces led to significant community damage, often resulting from the LTTE conflict. As security forces advanced into enemy territory, EOD operators deactivated booby traps and conducted mine clearance operations without delay. The service rendered by Sri Lanka Navy EOD operators during the three-decade war was immense, benefiting both the navy and the nation.

Due to the dedication and sacrifices of navy EOD operators, many munitions and explosives were detected and disposed of, and a large number of IEDs were disarmed and demolished. If these unexploded ordnance (UXOs) and IEDs had not been detected and neutralized, they could have tarnished the navy's image, caused economic damage, and resulted in loss of life. Navy EOD operators were engaged in active duty during the 2019 Easter Sunday attacks. Although visible threats in Sri Lanka are currently limited, IED detonations have occurred occasionally, presenting a significant threat due to their difficulty in detecting and deactivating. Detecting IEDs in a normal environment is challenging, making it essential to learn about them through proper training modules. This has highlighted the importance of EOD operations.

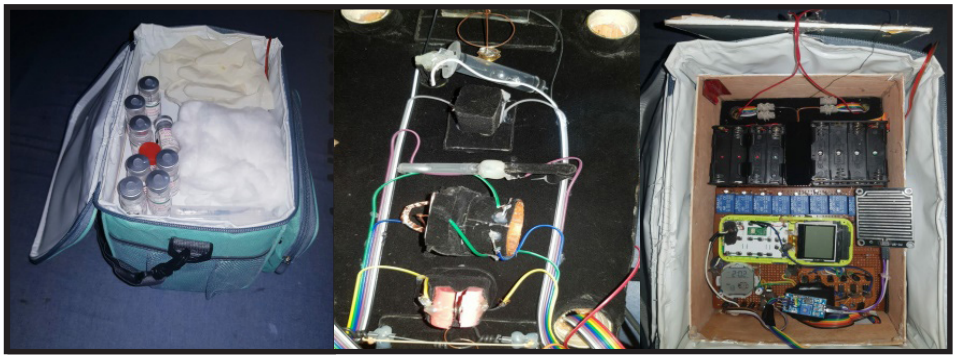

Figure 1: Model of Improvised Explosive Device (Vaccination Career)
Source : Developed by the Author

EOD operations within the Sri Lanka Navy have a long history. Presently, the SL Navy has EOD operators qualified from various branches. Officers and sailors from the Naval Infantryman, Diving Officers of the Executive branch, Special Boat Squadron, and Marines are trained in EOD based on their interests. Sailors from the Infantry, Rapid Action Boat Squadron, Diving, SBS, Marines, and Gunnery branches have the opportunity to become EOD-related operations. Although SL Navy EOD operators undergo rigorous training with SLAF and SLN, do they perform EOD duties or training similar to those conducted by the Army, Air Force, and Special Task Force? There's a saying among EOD operators: "Your first mistake is your last mistake". This illustrates the high-risk nature of EOD works, where mistakes can lead to fatal outcomes, economic damage, and a potential loss of reputation for the Sri Lanka Navy. Hence, the Sri Lanka Navy's EOD capabilities must be at the highest level in terms of role, human resources, and physical resources.

Task and Role of Sri Lanka Navy

EOD teams are currently attached to all commands in the SLN, with each team under an Area EOD Officer performing EOD duties as needed. Sri Lanka Navy EOD teams respond to bomb threats, incidents involving blind or misfired ammunition, and the discovery of explosives. Additionally, they are responsible for protecting Sri Lanka's main harbors and can counter underwater threats.

Figure 2: Preparing to Demolish an Anti-Tank Mine by SL Naval Personnel
Source : Developed by the Author

Comparison of General Aspects of SL Air Force and SL Navy EOD Training

In the Naval Deployment Maho EOD specialization course is conducted per year. Additionally, they conduct EOD refresher courses which are essential for refresher courses which are essential for refreshing the knowledge of EOD Operators in SL Navy. Although, the courses have been implemented, the required training facilities still need to be developed, particularly classroom facilities for trainees which is a major concern. Additionally, Maho required suitable explosive transfer vehicles and well developed explosive storage armories, as the Air Force has promptly met these needs for their training. The Air Force is equipped with advanced facilities and resources, whereas the Navy has limited equipment to support EOD training and operations. This display highlights the urgent need for the Navy to enhance its capabilities to match the standards required for effective EOD operations.

EOD operators face significant risks, which justifies the need for salary allowances as a motivational factor. The EOD allowance provided by the SLAF is five times higher than that of the SL Navy. Recently, SL Navy personnel have been involved in post-war mine clearance and demolition activities in rural areas, as well as other demolition tasks. Therefore, it is essential to consider the risks they face. Additionally, the SLAF offers training opportunities to both SLN personnel and foreign nations due to their high standards. If the Navy develops similar standards, it could also offer such training opportunities (Dananjaya, 2024).

Involvement of Security Forces in EOD Operations in Sri Lanka

The Sri Lanka Army has bomb disposal teams covering the entire island, capable of rapid deployment due to efficient resource use. They have historically been recognized for EOD duties, including humanitarian operations. Recently, the SLA has offered training berths to SLN Officers (Capt. Nilanga, 2024).

The Sri Lanka Air Force has deployed EOD teams across its 24 camps and conducts routine checks at all Sri Lankan airports. These teams ensure airport security and inspect aircraft compartments. However, it is uncertain whether similar EOD checks are consistently conducted on ships and crafts within the SL Navy. Considering the critical value of both personnel and equipment, it is essential to prioritize EOD clearance operations on ships and crafts. The potential for EOD threats exists even within naval vessels, making these checks vital for safety and security.

The STF handles most EOD disposal operations due to legal requirements, particularly involving the preservation of evidence after disposal. However, the three armed forces often lack proper procedures for collecting and preserving evidence, which could be beneficial for legal decisions. Instead, the forces primarily focus on war-scenario training and operational practices. Additionally, STF EOD teams provide security for VIPs and VVIPs, addressing this requirement as a priority. Nevertheless, Navy EOD operators must adopt evidence-collection and recording practices. By seeking guidance and advice, the Navy can enhance its capabilities in this area, ensuring both operational effectiveness and compliance with legal standards.

Foreign navies, particularly those of the United States and the United Kingdom, are extensively trained in both land and sea EOD operations, with a strong emphasis on underwater mine clearance and demolition. These navies prioritize addressing marine threats, recognizing the significant risks posed by underwater explosives to vessels, personnel, and infrastructure. The Sri Lanka Navy must similarly enhance its focus on marine EOD operations, as the country's strategic location and dependence on maritime trade make it vulnerable to such threats. Developing expertise in underwater mine clearance and demolition would not only improve the Navy's operational readiness but also strengthen national security and align its standards with those of leading global navies.

In Sri Lanka, the Army, Air Force, and STF play a more active role in inland bomb disposal operations, handling the majority of explosive threats on land. These forces are well-equipped and trained to manage such scenarios effectively. However, as a coastal nation with extensive maritime boundaries, the Sri Lanka Navy has a unique responsibility to ensure the safety and security of its coastal waters. The Navy's role extends beyond traditional EOD operations to include safeguarding the coastline against smuggling activities, illegal fishing, and potential maritime threats such as IED attacks. The increasing global trend of maritime terrorism and the use of explosive devices in ports and waterways further highlight the importance of the Navy's involvement in specialized EOD training and operations. By strengthening its capabilities in these areas, the Navy can play a pivotal role in maintaining national security and protecting vital maritime trade routes.

Explosive Ordnance Disposal Equipment

EOD equipment is essential for effective and efficient operation. Teams must be equipped with the latest tools to handle threats swiftly. Without adequate equipment, even the most skilled EOD operators are at risk, as are those around them. Currently, the SL Navy lacks several critical EOD tools. Although some equipment is available, the quantities fall short of operational requirements, especially for sea-based EOD tasks. The navy possesses only one mine lifting balloon for sea-based recovery. Globally, militaries employ advanced EOD technology that protects both operators and surrounding assets.

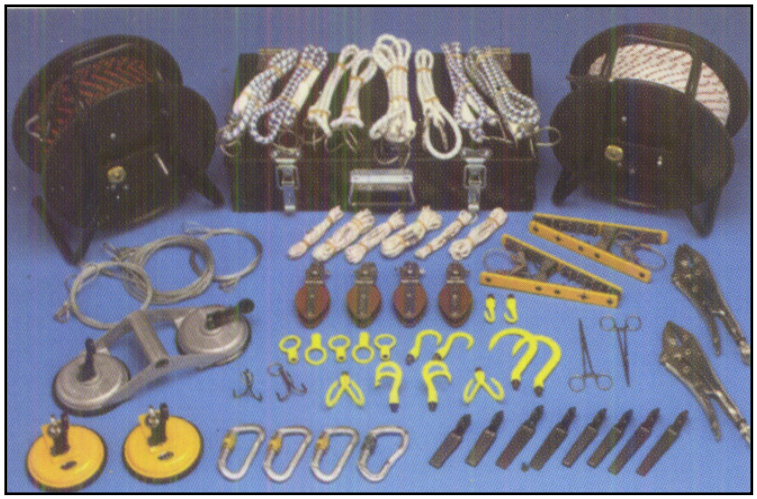

Figure 3: Hook and Line Set
Source : Developed by the Author

Conclusion

The Sri Lanka Navy must take decisive steps to address existing equipment shortfalls, training gaps, and the need for improved cross force collaboration to strengthen its EOD capabilities. By investing in state of the art resources, including advanced detection tools, disposal equipment, and specialized training programs, the Navy can significantly enhance its ability to handle explosive threats in both land and maritime environments. Additionally, refining training practices to align with international standards and fostering collaboration with other forces, such as the Army, Air Force, and STF, will ensure a unified and efficient approach to EOD operations.

By addressing these critical areas, the Sri Lanka Navy will not only mitigate the risks associated with explosive ordnance disposal but also bolster its strategic role in safeguarding national security. A more capable and well-equipped Navy will be better positioned to protect vital infrastructure, secure the nation's coastline, and support regional and international efforts to combat maritime threats. This investment in EOD expertise will ultimately contribute to the Navy's readiness, operational effectiveness, and ability to respond to emerging security challenges in an increasingly complex global landscape.

Recommendations

The Sri Lanka Navy should reassess and realign its EOD responsibilities to focus more on specialized Naval EOD operations. This shift would involve prioritising the development of expertise in maritime explosive ordnance disposal, including underwater mine clearance, demolition, and the protection of naval assets. By doing so, the Navy can enhance its capability to address unique maritime threats, safeguard vital coastal infrastructure, and ensure the security of its fleet and strategic maritime routes. This realignment of tasks will strengthen the Navy's operational readiness and its contribution to national and regional security.

To enhance the quality of EOD training, it is essential to provide improved facilities and a diverse range of diving equipment at the EOD training school at ND Maho. By upgrading the training infrastructure and ensuring the availability of specialised diving gear, the Navy can better equip EOD personnel to handle both surface and underwater explosive threats effectively. This investment in training resources will not only improve the skill set of Navy EOD operators but also ensure that they are well-prepared to address the evolving challenges in maritime security.

It is essential to acquire the relevant EOD equipment to enable the SL Navy to effectively handle explosive ordnance disposal situations. Additionally, the SL Navy should invest in modern EOD technologies and equipment to further enhance its capabilities. This acquisition will improve operational efficiency, ensure the safety of personnel, and strengthen the Navy's ability to address both land and maritime explosive threats. By keeping up with technological advancements, the Navy can better safeguard national security and maintain readiness in the face of evolving challenges.

It is recommended to conduct basic EOD training at the Naval and Maritime Academy that focuses on theoretical education, including the fundamentals of explosive ordnance disposal, safety measures, and risk management. However, practical training should be carried out at specialized EOD training schools such as NDep Maho.

It is recommended to establish a Naval Research Wing dedicated to conducting research on Explosive Ordnance Disposal and exploring innovative solutions to enhance the capabilities of EOD operators. This wing should focus on integrating new technologies, methodologies, and best practices to improve the safety and effectiveness of EOD operations. Additionally, the research wing could develop new training programs that incorporate advancements in technology, ensuring that EOD personnel remain well-equipped to address emerging threats. This initiative will contribute to the continuous improvement of the Navy's EOD capabilities and maintain operational readiness in an evolving security landscape.

It is recommended to train explosive sniffer dogs for Explosive Ordnance Disposal at Naval Deployment Maho, consolidating efforts to enhance EOD capabilities. Currently, explosive sniffer dog units are located at various locations within the Navy, which may limit efficiency and coordination. Establishing a centralized explosive sniffer dog unit under the supervision of Naval Deployment Maho, utilizing experienced and resourceful naval personnel, will ensure better management, training, and deployment of these specialized dogs for EOD operations. This initiative will improve detection capabilities and streamline operations, thereby enhancing the overall effectiveness of the Navy's explosive ordnance disposal efforts.

Given the high expenditure and complexity associated with the EOD course, it is recommended that the Navy select personnel for EOD training based on their willingness and voluntary selection during the recruitment process. This approach will ensure that only motivated individuals are chosen, reducing the risk of attrition and ensuring that resources are allocated effectively. By focusing on willing candidates, the Navy can minimize unnecessary costs and optimize the training process, ensuring that personnel are committed to the demanding nature of EOD duties. This strategy will also help address economic constraints by ensuring that investment in training is directed toward those who are genuinely prepared to pursue EOD roles.

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DIRECTED ENERGY WEAPONS IN MODERN WARFARE

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Abstract

Maintaining peace in the Indian Ocean Region (IOR) is crucial for global trade, economic growth, and strategic balance. It ensures stability amidst Middle East conflicts and South China Sea tensions, involving the existing world power (USA) and emerging world power (China), preventing escalation and supporting regional and international stability. As global tensions rise, the need for robust defense mechanisms becomes paramount. Since ability to defend aerial threats is important to protect the territory, population, and forces of a country from any air or missile attack. Directed Energy Weapons (DEWs) utilize concentrated electromagnetic energy instead of kinetic energy. They provide a more cost-effective, high-speed, and highly accurate method to counter aerial threats compared to the use of expensive missiles. Sri Lanka is open to adopting new technologies, and DEWs are among the most viable solutions due to their cost-effectiveness. Moreover, this system can be integrated with existing air defense systems.

Keywords: Directed Energy Weapons, Electromagnetic Energy, High-Energy Lasers, Indian Ocean Region (IOR), Aerial Threats

Introduction

The 'Mirrors of Archimedes' is a concept that has been in science fiction and historical anecdotes, a series of mirrors focused on a common point to focus sunlight on ships setting them on fire.

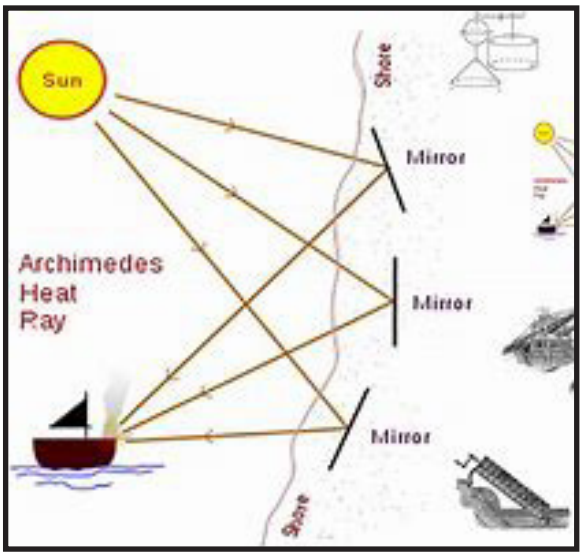

Figure 1: Mirrors of Archimedes

The concept of DEWs dates back to the early 20th century, but significant advancements have been made in recent decades. Research agency like Defense Advanced Research Projects Agency (DARPA) and the Missile Defense Agency (MDA), have played a pivotal role in DEW research. DARPA's high-energy liquid laser area defense system (HELLADS) and MDA's airborne laser (ABL) program were critical milestones in laser-based DEW development. Concurrently, research into high-power microwaves and particle beam weapons has expanded, exploring their applications in various domains.

DEW concentrated electromagnetic energy, rather than kinetic energy, to "incapacitate, damage, disable, or destroy enemy equipment, facilities". DEW includes high-energy laser (HEL), high-powered microwave (HPM) weapons, particle beams, and sound beams.

HPM weapons could provide a non-kinetic means of disabling adversary electronics and communications systems. These weapons could potentially generate effects over wider areas disabling any electronics within their electromagnetic cone than HEL weapons, which emit a narrower beam of energy (see Figure 2) some analysts have noted that HPM weapons might provide more effective area defense against missile salvos and swarms of unmanned aircraft systems. HPM weapons in an anti-personnel configuration might provide a means of nonlethal crowd control, perimeter defense, or patrol or convoy protection.

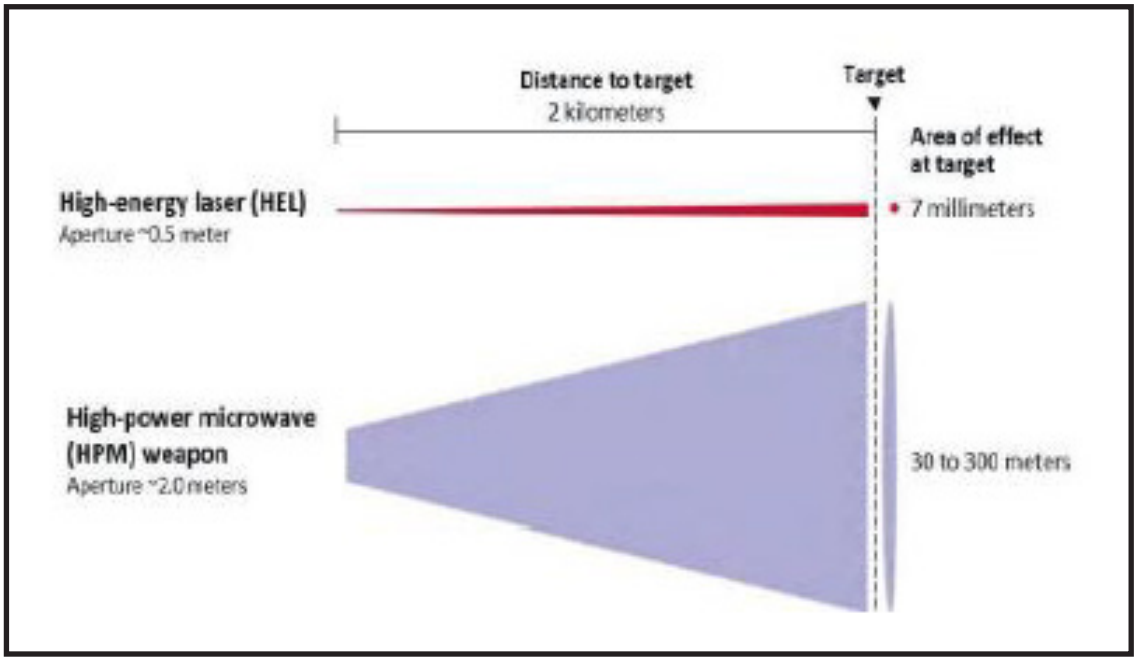

Figure 2 : HPM weapons theory

A particle beam is a stream of charged or neutral particles. In particle accelerators, these particles can move with a velocity close to the speed of light. Particle beam weapons have not been demonstrated yet, but they could be used for missile defense or other purposes.

Sound beams, also known as sonic weapons or acoustic weapons. These weapons operate on the principle of directing focused sound energy at a target to achieve various effects.

Basic Concepts

High-Energy Laser (HEL)

High-Energy Laser (HEL) weapons are a subset of Directed Energy Weapons (DEWs) that use concentrated beams of laser light to destroy enemy targets. These weapons rely on the principles of laser technology to project high-energy photons over long distances.

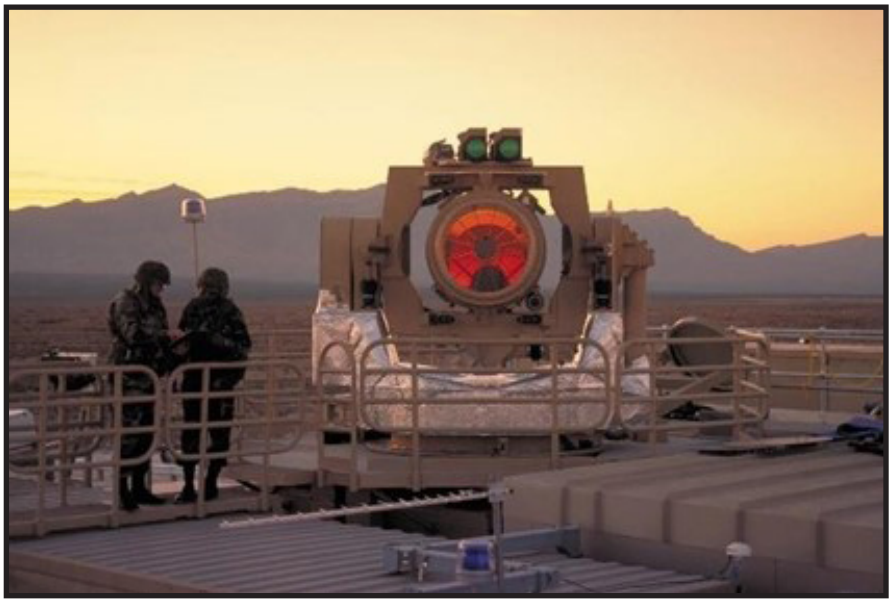

Figure 3 : High-Energy Laser (HEL) weapons

Laser Sources utilized for DEWs are categorized into three parts as follows,

a. **Solid-State Lasers**. Solid-state lasers use solid crystals or glasses as the gain medium. They are known for their high efficiency, compact size, reliability, and ability to generate high-energy beams.

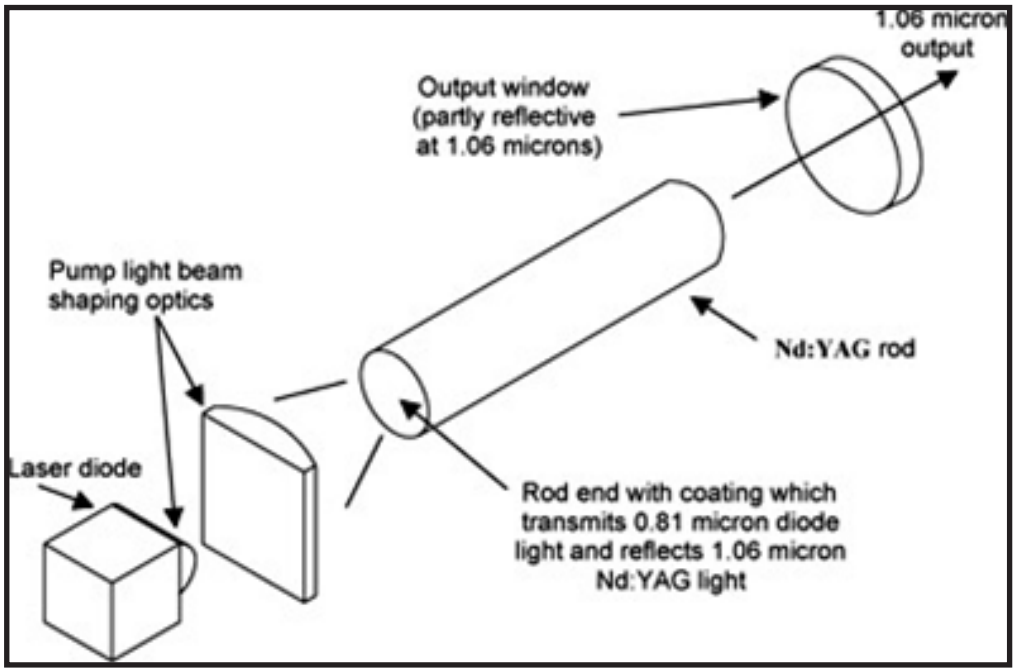

Figure 4 : Solid-State Lasers

b. **Fiber Lasers.** Fiber lasers use optical fibers as the gain medium. They are known for their high-power output and beam quality. Fiber lasers are used in some HEL systems for their efficiency and compactness.

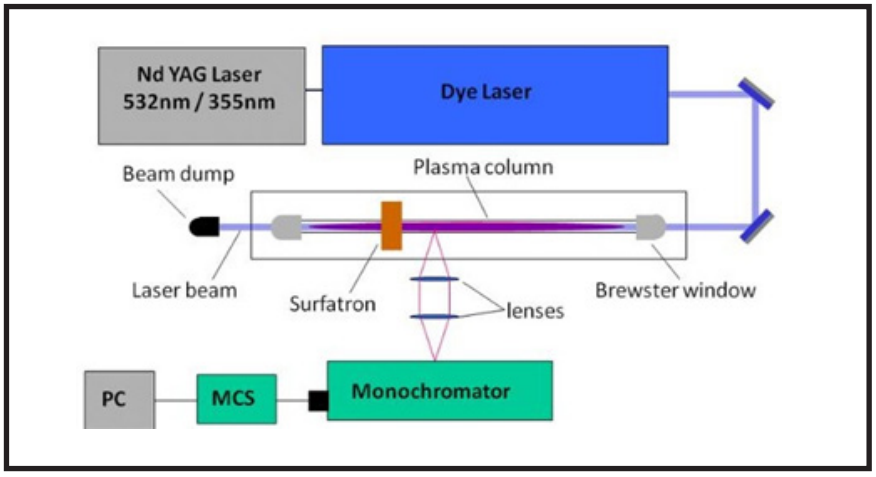

Figure 5 : Fiber Lasers

c. **Gas Lasers.** Gas lasers use gases like Carbon Dioxide (CO2) or Hydrogen Fluoride (HF) as the gain medium. While they can generate high-power beams, they are less common in HEL weapons due to their bulk and complexity.

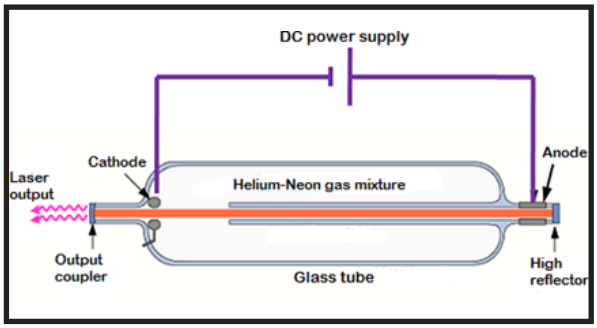

Figure 6 : Gas Lasers

Laser Amplification in HEL systems employs methods to amplify the laser beam's intensity. In the case of chemical lasers like the Chemical Oxygen Iodine Laser (COIL), chemical reactions are used to amplify the laser's power. Solid-state and fiber lasers may use optical amplifiers or multiple gain stages to achieve high-energy output.

The choice of laser wavelength is important in determining the HEL's effectiveness. Different wavelengths have varying degrees of atmospheric absorption and scattering. Infrared wavelengths are commonly used in HEL weapons due to their ability to penetrate the atmosphere over longer distances. Beam control and optics in HEL systems use specialised optical components and adaptive optics to control and shape the laser beam. Adaptive optics help compensate for atmospheric distortions that can affect the beam's accuracy and focus. Beam control systems ensure that the laser beam is precisely directed at the target.

Cooling systems in high-energy lasers generate a significant amount of heat. Cooling systems, such as liquid cooling or advanced materials with high thermal conductivity, are employed to dissipate this heat and maintain the laser's efficiency. Power source for HEL weapons requires a reliable power source to energize the laser. Depending on the type of laser used, this can range from chemical reactions (for chemical lasers) to electrical power (for solid-state and fiber lasers).

High Powered Microwave (HPM)

High Powered Microwave (HPM) weapons are a subset of Directed Energy Weapons (DEWs) that use electromagnetic radiation in the microwave range to engage and disrupt enemy targets. These weapons generate and emit high-energy microwave pulses to disable or destroy electronic systems, such as communication devices and computer systems. HPM weapons are designed to exploit vulnerabilities in electronics and can be used for various military and non-lethal purposes.

Figure 7 : High Powered Microwave (HPM) weapons

High Powered Microwave weapons use powerful microwaves to emit bursts of high-energy waves. These microwaves have wavelengths that are longer than light but shorter than radio waves. Typically operating in the gigahertz (GHz) frequency range, HPM weapons can deliver these waves in short bursts or continuous streams, depending on their design. Their main purpose is to disrupt or damage electronic systems like integrated circuits, microprocessors, and communication devices. When the high-energy pulses hit these systems, they can cause voltage spikes and electric currents, leading to malfunctions, data corruption, or even physical damage. Simply put, HPM weapons can seriously mess up modern electronic equipment.

HPM weapons have several military and non-lethal applications, including. Disabling enemy communication systems and radar. Jamming and disrupting the functionality of Unmanned Aerial Vehicles (UAVs) or drones. Disrupting or damaging enemy vehicles' electronic systems. Providing non- lethal crowd control options by incapacitating electronic devices. The effective range of HPM weapons depends on factors such as the weapon's power output, antenna design, and atmospheric conditions. HPMs can operate at short to medium ranges, making them suitable for localised engagements.

Particle Beam Weapons

Particle beam weapons are a category of Directed Energy Weapons that use charged or neutral particles, such as electrons or protons, accelerated to high speeds to engage and damage enemy targets. These weapons harness the kinetic energy of fast-moving particles to inflict damage, disrupt, or disable various types of targets. Here are key points about particle beam weapons.

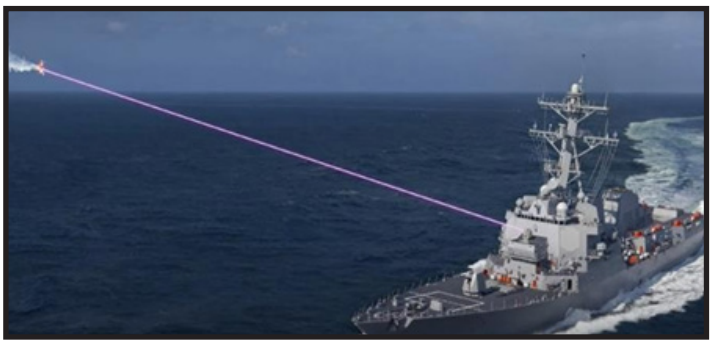

Figure 8 : Particle Beam Weapons

Charged Particle Beams consist of charged particles, typically electrons or ions, which are accelerated to high velocities using electromagnetic fields. Examples include electron and ion beam weapons. Neutral particle beams consist of neutral particles, typically atoms or molecules, accelerated to high speeds. One example is the Neutral Particle Beam (NPB) weapon.

Particle beam weapons employ particle accelerators, such as linear accelerators or cyclotrons, to impart high kinetic energy to the particles. Magnetic and electric fields are used to accelerate and focus charged particles along a beam path. When charged particles in a beam strike a target, they transfer their kinetic energy to the target material, causing damage through ionization, heating, and mechanical effects. Neutral particle beams can also cause damage by ionizing and heating the target material, despite the neutral nature of the particles.

Particle beam weapons have been considered for various military and defense applications, including Anti-satellite (ASAT) weapons. Particle beams can damage or disrupt the electronics and sensors of satellites. Anti-missile and anti-aircraft systems: High-velocity particles can engage and destroy incoming missiles or aircraft. Anti-ship systems: Particle beams can target and damage enemy ships' electronic systems and sensors. The effective range of particle beam weapons depends on the particle's velocity and the target's composition. Particle beams travel at nearly the speed of light, enabling rapid engagement and high accuracy.

Sound Beams Weapons (SBW)

Sound Beam Weapons, also known as sonic weapons or acoustic weapons, are a category of non-lethal weapons that use sound waves to harm, incapacitate, or disorient individuals or disrupt equipment. These weapons emit high-intensity sound waves, often in the form of focused acoustic beams, to achieve various effects. Here are key points about sound beam weapons.

Sound Beam Weapons generate intense sound waves, typically at specific frequencies and amplitudes, which can affect the human body or electronic systems. The choice of sound frequency and amplitude determines the weapon's effects. Different frequencies can induce various physiological responses in humans.

Sound Beam Weapons can have different effects on targets, including auditory disruption its intense, high-pitched sound can cause discomfort, disorientation, and pain. In communication, Disruption Sound Beams can interfere with electronic communication systems, such as radios or cell phones.

Sound Beam Weapons are often used for non-lethal crowd control and perimeter security. They can be employed in situations where the use of lethal force is not warranted but where incapacitating or deterring individuals is necessary. The effective range of sound beam weapons depends on the weapon's power, frequency, atmospheric conditions, and target characteristics. They are typically designed for short to medium-range engagements.

Advantages of DEWs

a. **Speed-of-Light Engagement.** DEWs travel at the speed of light, enabling near-instantaneous targeting and engagement.

b. **Precision and Accuracy.** DEWs offer unparalleled precision, minimizing collateral damage and reducing the risk of civilian casualties.

c. **Reduced Logistics Burden.** Unlike traditional ammunition-based weapons, DEWs rely on energy sources, reducing the need for resupply.

d. **Extended Range.** Some DEWs have the potential for extended engagement ranges.

e. **Cost Efficiency.** Over the long term, DEWs can be more cost-effective due to reduced ammunition and maintenance costs.

Challenges and Limitations

a. **Power Generation and Efficiency.** DEWs require substantial power sources and face challenges related to energy conversion and efficiency.

b. **Atmospheric Conditions.** Weather conditions can affect the effectiveness of DEWs, particularly laser-based systems.

c. **Countermeasures.** Adversaries may develop countermeasures to mitigate the impact of DEWs.

d. **International Law and Ethics.** DEWs raise ethical and legal questions, particularly regarding the proportionality of their use.

Deployments and Future Trends

The US Department of Defence has been actively researching and developing DEW systems for various applications. Other countries, including China and Russia, have also demonstrated interest and advancements in DEW technology. DEW integration into naval and airborne platforms is an ongoing area of development.

Advancements in power generation and energy storage technologies will likely improve the efficiency and effectiveness of DEWs. DEWs are expected to play an increasingly significant role in missile defense systems. International agreements and regulations will need to adapt to address the proliferation of DEW technology.

Applications

Anti-Aircraft and Anti-Missile Defence

a. Airborne Laser Systems

b. Ground-Based Laser Systems

Counter-UAS (Unmanned Aircraft Systems)

a. Disabling and Neutralizing Drones

Ground-Based Defence

a. Counter rocket

b. Artillery

c. Mortar (C-RAM) systems

d. Counter-IED (Improvised Explosive Device)

Non-Lethal Crowd Control

a. Active Denial Systems

b. Dazzler Device

Conclusion

Directed Energy Weapons represent a disruptive technology in modern warfare, offering numerous advantages and posing unique challenges. As research and development efforts continue, DEWs are likely to become more integrated into national defence strategies, potentially reshaping the landscape of future conflicts. Balancing technological advancements with ethical considerations and international norms will be crucial in the evolving era of Directed Energy Weapons in modern warfare.

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MODERN GREEN BUILDING CONCEPTS THAT ARE POSSIBLE TO IMPLEMENT DOMESTICALLY

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Abstract

The world is currently facing a significant reduction in the capacity of material resources due to the usage of various types of requirements. These resources are mainly used for energy production processes and the manufacturing of ready-made items. As a result, a considerable amount of raw materials is consumed annually without adequate provisions for regeneration, which disrupts the ecological balance. Therefore, various methods exist to mitigate these issues. Among them, green building practices lead in many aspects. The aim is to introduce these prevailing methods into domestic settings, as even small changes at the individual level can make a huge difference globally. This document first explores the level of awareness among the population regarding these techniques, the prevailing norms for green building implementations, and the global and Sri Lankan energy consumption patterns based on data from several studies. The document covers topics such as energy efficiency, renewable energy integration, water conservation and management methods, the use of sustainable materials, reduction of Volatile Organic Compounds (VOCs), sustainable use of ready-made materials, indoor air quality, waste management and reduction, as well as building design and site selection. Implementing these methods is crucial for maintaining a sustainable community. Additionally, future generations will benefit from these implementations, gaining value from the positive impacts they bring.

Keywords: Green Building, Domestic Appliances, Energy Conservation, Sustainable Material, Water Conservation, Waste Management.

Introduction

The modern world is facing huge challenges such as environmental impacts, economic crises, social attributes, and many various challenges with the time flow. To mitigate such issues, there are many methods that exist around the world. And the green building concept takes a higher level out of them in different factors such as sustainable development, energy efficiency, reducing environmental impacts, and many more. Furthermore, developing green building concepts even at the domestic level is important in order to contribute to the effort to meet global goals against man-made disasters. Not only that, but also there are many sub-factors that exist as categories to improve the well-being of the earth.

The modern world usually practices the applications of green building appliances in their day-to-day lives for better purposes of future inconveniences. As an example of research carried out by (Sichali & Banda, 2021) in Zambia shows how the various professions know about the green building concept and their knowledge level in relevant subjects.

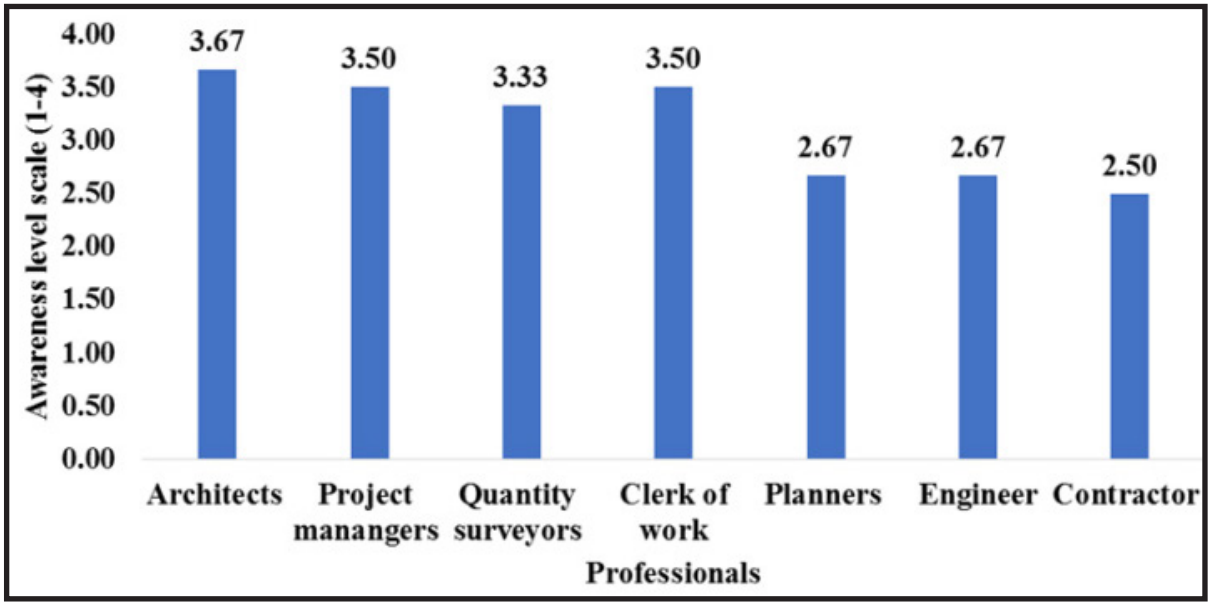

Figure 1: Awareness level for the professionals

All stakeholders involving in construction field aware about the significance of green building concepts. It is more valuable to implement in our communities as well.

Since the modern world is very concerned about net-zero energy consumption, being a developing country, Sri Lanka needs to meet the net-zero energy conservation methods to be a part of the world. For that, contributions must be raised individually. The research conducted by Piao and Managi (2023) has revealed that countries with high income tend to consume more energy than low income countries. Following figure further describe the situation.

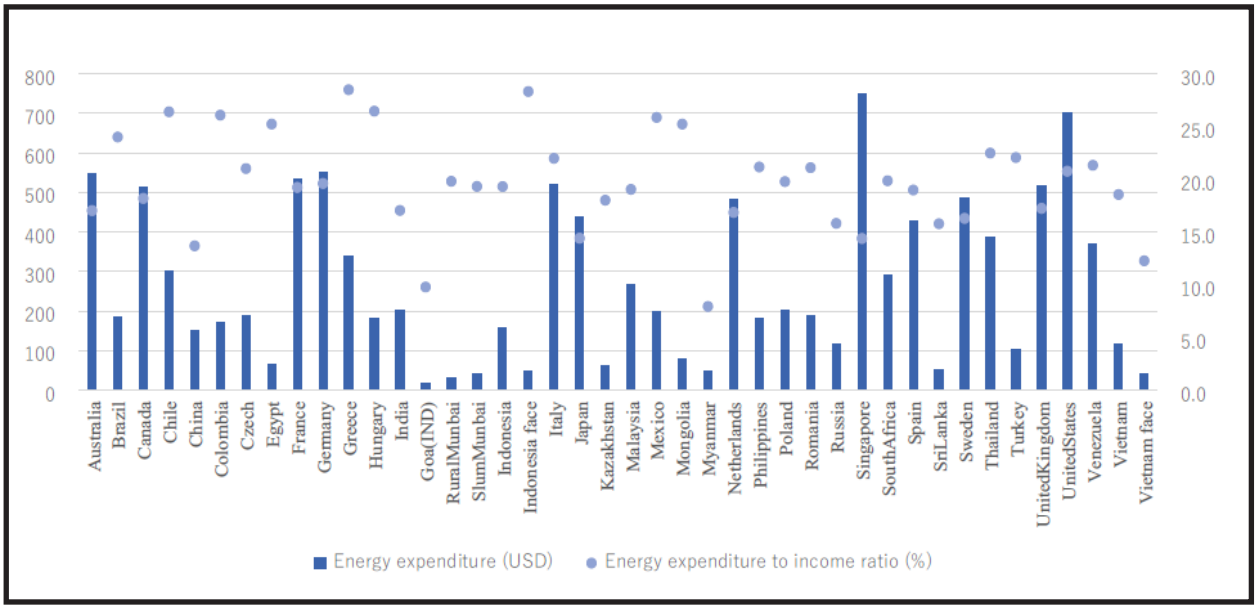

Figure 2: Average monthly energy expenditure at the household level across the 37 surveyed countries

According to the subjected research, 37 countries have been examined by the research team, with Singapore being the country with the most energy expenditure among them. Singapore is limited to a small land area with very few material resources, but they manage the situation by strictly adhering to the 3R principle. Even the daily generated waste will not last more than 48 hrs. Because Singapore uses modern techniques of manufacturing recycled material inside the 24/7 functioning factories. Furthermore, many appliances have been implemented in various methods in different subjects around the world to mitigate prevailing energy issues. Domestically applied green building concepts in the world mainly divide as follows:

a. Energy efficiency

b. Renewable energy integration

c. Water conservation and management

d. Use of sustainable material

e. Volatile Organic Compounds (VOC)

f. Sustainable readymade material usage

g. Indoor air quality

h. Waste management and reduction

i. Building design and site

Energy Efficiency

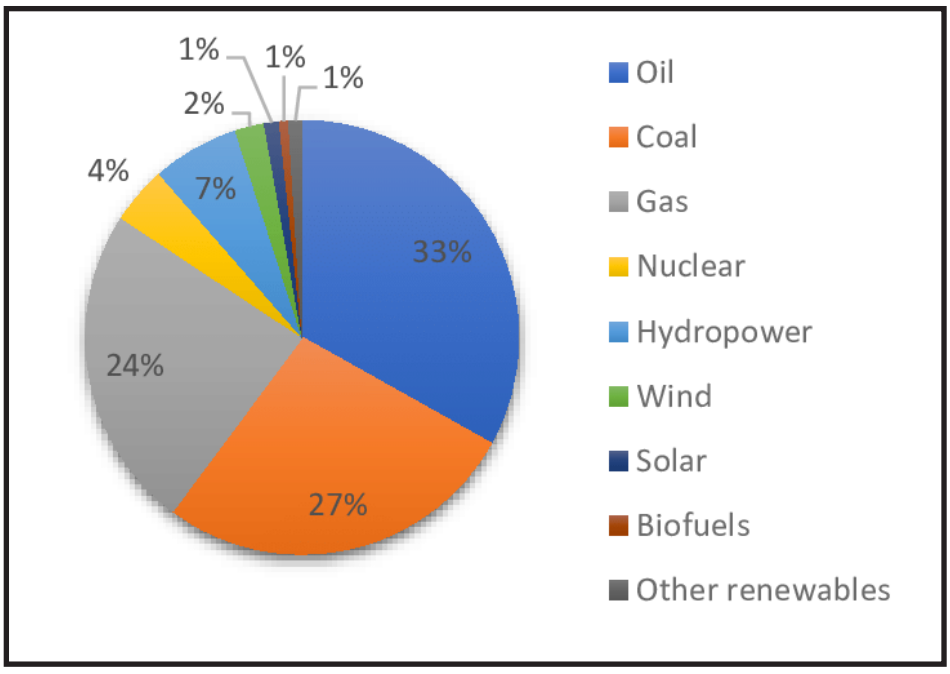

Figure 3: Global energy usage on various material

According to the survey conducted by Khan et al. (2021), paired with the harmful environmental effects of fossil fuels, it has triggered the search for alternative, renewable energy sources. Biofuels are arguably a potential renewable energy source in the transportation industry, as they can be used within current infrastructures and require fewer technological advances than other renewable alternatives, such as electric vehicles and nuclear power. The literature suggests biofuels can negatively impact food security and production; however, this is dependent on the type of feedstock used in biofuel production. Advanced biofuels, derived from inedible biomass, are heavily favoured but require further research and development to reach their full commercial potential. Replacing fossil fuels with biofuels can substantially reduce particulate matter. Extracted graph above shows that global energy usage is based on various materials, and the below graph shows the energy consumption of the world based on several sub-researches.

Hence, each individual has a responsibility to contribute with maximum effort to mitigate such situations, and some examples are as follows:

a. Use thermal resistance foils in between walls, doors, windows and even for roofs, to reduce heat coming into a building and heat with the proper implementation, reducing the cool coming into a building.

b. Use isolated, south-oriented roofs for solar power generation and use excess solar energy through transparent media in order to illuminate inside buildings during daytime.

c. Use a roof as a plant vegetation. The basic purpose is to reduce heat flow into a building through the roof and make a comfort zone. Prior to that, the roof needs to be properly insulated in case of a water seepage condition.

d. Vertical gardening also take place to reduce heat coming through side walls and color washing is not required to do very often since. But need to make sure do the plantation at the out most layer from insulating material installed in between walls.

Renewable Energy Integration

Solar panels are vastly used by many nations to meet daily electricity demand (Kaur et al.,2017). Following graph depicts the amount of solar energy is being used by the continents:

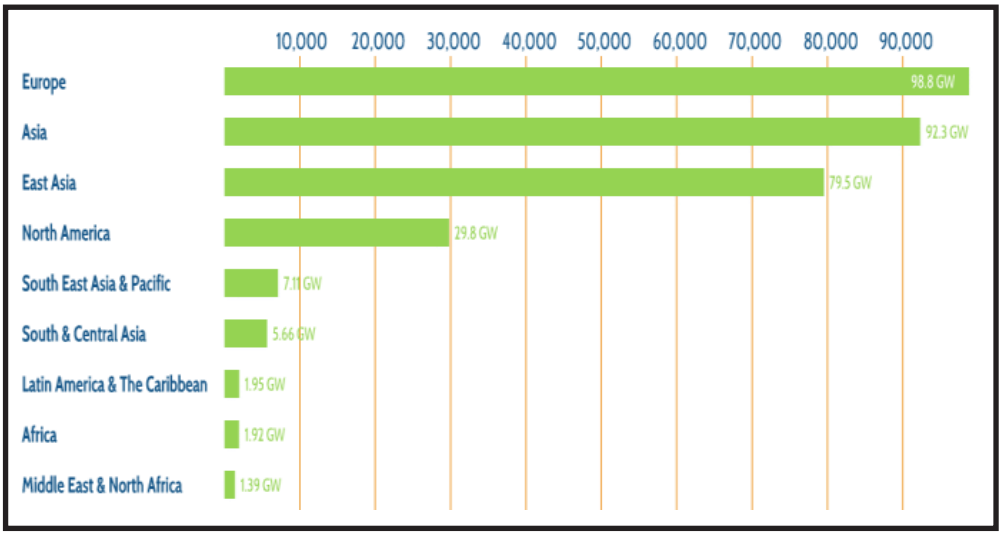

Figure 4: Solar energy usage by continents

Moreover, solar energy production has taken the 4th place as per the following graph considering the energy generation amount:

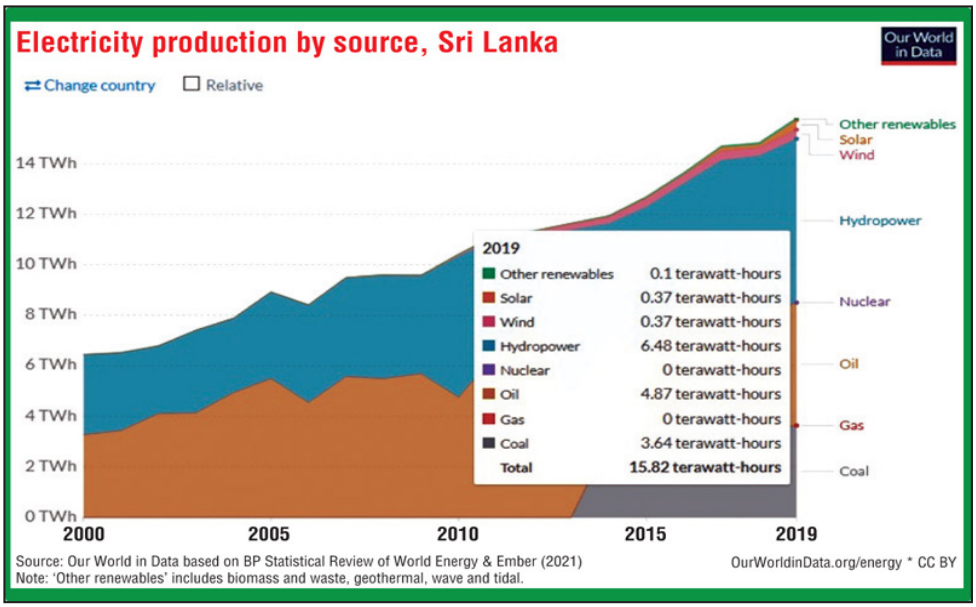

Figure 5: Electricity production by source in Sri Lanka

Further, instead of using separate water heaters, instant water heaters, dissipated solar energy possible to direct to heat up water without using electricity when needed to use in cold times.

Wind power is another major renewable energy source, even if it is not practiced widely in Sri Lanka. The implementation of domestically sized wind power plants will affect the reduction of significant cumulative amounts of energy consumption, and it is also possible to use illuminated eco-friendly bulbs, machineries.

Water Conservation and Management

Rainwater harvesting is important since Sri Lanka faces rainy seasons even though it belongs to the tropical zone. With proper purification, this rainwater is within manageable limits for drinking purposes as well. The rainwater harvesting method is as follows:

a. Confined by underwater concrete or PVC tanks.

b. Overhead tanks. (Might require pumping facilities).

c. Collect into a lake.

d. Collect in the wetland.

Thereafter, this water may be utilized for drinking, vegetation, plantation, cleaning, and washing purposes effectively.

a. **Use of Low-flow Fittings.** Basically, this is used on water-based fittings in order to mix the water with airflow to satisfy the user with airflow but mix it up with air bubbles. Currently, Green Building Council of Sri Lanka (GBCSL) certified manufacturers are there who manufacture certified green fittings according to the standards.

b. **Recycle Grey Water.** Greywater is generated from kitchens, bathrooms, or such washing areas. After subjecting to several recycle processes, such as screening, coagulating, oil/grease removing/trapping, and maintaining the correct BOD/COD levels, this grey water is also usable for other valuable usages other than wasting fresh water. The well-known latest scenario is Singapore, which does recycle daily-generated black water and grey water, and they named it as 'Newater,' which is available in the markets for consumption. Possible to introduce oil grease traps, wetlands, and aeration on cascade methods domestically.

c. **Irrigation Management**. The above-mentioned water categories are useful even for irrigation appliances for use prior to plantation and afterward also. An example of an excess amount of water from refrigerators, AC plants, and chiller units can be used for flower gardening purposes.

Use of Sustainable Material

Recycled or repurposed materials are sustainable products that are manufactured using recycled material, used material, and even from the municipal solid waste also. With a couple of experiments, final products may be used for very valuable appliances in the domestic field.

Examples of metal, wood, plastic, polythene, and many more industrial wastes are fairly generating domestic wastes. Furthermore, the GBCSL provides a grading system based on the usage of these recycled products in the construction field.

Such as offcut tor steel used for nonstructural appliances. Also sell to outside organizations. Wood particles may be used to reproduce partition walls and eco-friendly plywood. Further, plastic material is directed to recycling locations rather than incinerated at domestic premises. Also, when using such recycled products, it is considered by the GBCSL as a green rating eligibility.

Furthermore, collecting used items, and waste at the generating point itself into separated bins is an effective way to dispose of such waste from the domestic premises and is also easy to direct to recycling locations. Not only that, if it is possible to gradually improve the recycling facilities within the domestic premises it would create self-employment opportunities and additional outcomes will be received.

Volatile Organic Compounds (VOC)

These are included in the painting material. When this happens, it may pollute the indoor and outdoor air which causes severe cancer diseases. Currently, many paint manufacturers manufacture paint items without VOCs and they have obtained GBCSL certification for their products. SLN purchases such VOC less or zero VOC paint material in ongoing constructions.

Sustainable Readymade Material Usage

Sustainable readymade materials denote eco-friendly, cost-effective products manufactured according to sustainable aspects. Such as reducing the weight, and dimensions, increasing the strengths, increase the effectiveness. Example for hollow block solid cement is a sustainable product. It has its unique strength and less weight. Likewise, using of metal elements has a higher second moment of inertia about its cross sections. Examples for I-beams, C-channels, Hollow box bars etc.

Indoor Air Quality

a. **Cross Ventilation.** The main requirement is to circulate the indoor contained air. It continuously refreshes contained air by replacing naturally purified air from outside. It is healthier than confining air within a compartment by closing doors and covering by air impermeable material. Many mechanical methods exist around the world to improve indoor air quality. As a simple method, it is possible to design the building according to cross-ventilated plans, place the buildings or openings in the correct orientation of the building or make openings according to the wind directions. Also installing heat-exhausted turbines may improve indoor air quality.

b. **Green Walls.** Green walls are built using existing walls by improving the planting mechanism with a wooden or steel frame mounted vertically along walls. Plants such as Farns, Syngonium, Coral Bells, and Nephrolepis very often selected for vertical vegetation. These kind of plants absorb exhausted CO from the living being and makes the indoor air quality high.

c. **Using Nontoxic Material.** Toxic materials emit radiation and harmful gases which may lead to polluting indoor air quality. Such as using batteries, uncertified cleaning gears, and uncertified painting material. Reducing the usage of this kind of materials is good for improving the indoor air quality.

Waste Management and Reduction

All humans activities generate various types of waste. At industrial levels, there are more opportunities to get certificates through GBCSL for the waste management category. Since it is not practical to use a vast range of machinery equipment, mainly need to focus on the proper discharge of generating waste by considering the 3R principles. Domestically applicable waste management methods are as follows:

Figure 6: Waste collection bins types and colours

a. Collets the waste at generation locations by separately indicating the global signs and colors for the respective type of waste.

b. Dispose of or sell waste such as paper waste, metal waste, wooden waste etc.

c. Recycle the plastic waste by using the plastic melting mechanism available within the organization.

d. Direct hazardous waste to hazardous waste management plants (Authorized hazardous waste management facilities are further described on the attached annexure)

Building Design and Site

The main focus is to retain the native vegetation or plantation as it is to avoid the soil erosions, and to maintain the moisture level of the land. Native plants (such as draught-resisting plants) can remain safely in their respective grounds by keeping the balance of eco system and may lead to a balance of groundwater availability in a constant level.

ANNEXURE

මධ්‍යම පරිසර අධිකාරිය
மத்திய சற்றாடல் அதிகாரசபை
Central Environmental Authority

Authorized Hazardous Waste Management Facilities in Sri Lanka

Healthcare /Clinical Waste Management Facilities

No.	Name & Address of the Industry	Telephone/ Contact	E- mail Address
01	Sisili Hanaro Encare (Pvt) Ltd 85 B, Waste Management Zone, Kerawalapitiya	011-2575175	encare@sisiliprojects.com
02	G.F.C.Waste Management (Pvt) Ltd Keliyapura, Hambantota	011-2637636	sumith@gfcwastemanagement.com
03	Sanicare (Pvt) Ltd 25/11, Aarther's Place,Kalde- mulla, Moratuwa	011-2638585 077-3350355	sani_caresl@yahoo.com

Industrial Hazardous Waste Management Facilities

No.	Name & Address of the Industry	Telephone/ Contact	E- mail Address
01	Insee Ecocycle (Pvt) Ltd Siam City Cement Lanka Limited P.O. Box 1, Palavi, Puttalam	011-2030200 011-7800800	inseeecocycle@siamcitycement.com

Plastic Containers Contaminated with Chemicals/Hazardous Wastes Recycling Facilities

No.	Name & Address of the Industry	Telephone/ Contact	E- mail Address
01	Policar PVC Industries No.06/01/A, Mahadeniya Road, Oruwala, Athurugiriya	071-8280037	polykar1949@gmail.compaligamage@ gmail.com
02	Ruhunu Agro Silver Dale Watta, Thalpawila, Kakanadura	077-3177411	wijeweeranalin@gmail.com

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MESS NIGHTS - EVOLUTION OF CUSTOMS AND TRADITIONS

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Naval & Maritime Academy

Abstract

Mess Nights are deeply rooted in naval traditions, reflecting the rich customs, discipline, and camaraderie of sea service. Originating in the British Royal Navy during the era of Admiral Nelson, these events have been adopted and adapted by the Sri Lanka Navy, during the British rule embodying both military protocol and cultural heritage. They serve to commemorate history, foster unity, and maintain the time-honoured practices passed down through generations. The traditions of Mess Nights include formal attire, such as the Dinner Dress, and structured rituals, such as toasts, often accompanied by port wine, symbolizing respect and remembrance. The roles of Mess President and Vice President ensure order and adherence to tradition, while the guest experience is carefully curated to honour distinguished attendees. Beyond the formalities, elements like fine dining, music, and historical symbolism enrich the experience, creating an atmosphere of elegance and reverence. These events also reflect the evolving nature of naval customs, balancing heritage with modern adaptations. However, the diminishing focus on traditions in contemporary society underscores the importance of preserving such ceremonies. Mess Nights stands as a testament to the pride, discipline, and unity of naval service, ensuring that its legacy is carried forward for future generations.

Keywords: Mess Dinners, Traditions, Customs, Mess Nights

Introduction

Sri Lanka's rich customs and traditions trace back more than 5000 years and have been passed down from generation to generation to date. The customs and traditions that are followed today by the Sri Lanka Militaries were passed down during the stay of the British Crown in Ceylon. During World War II in the year 1938 gave birth to the Ceylon Royal Naval Volunteer Reserve and later in year 1950, it transformed into the Sri Lanka Navy. The roots of the Royal Navy date back to the reign of King Henry VIII (1509-1547), which made us who we are today.

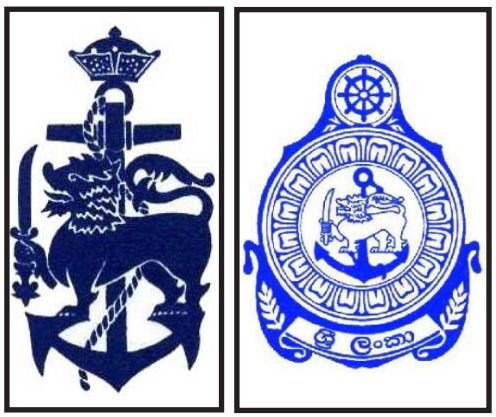

Figure 1: Right – Emblem of the Ceylon Royal Navy
Left – Emblem of Sri Lanka Navy

The influence on human behavior is determined by traditions, ceremonies, and customs. These are mainly highlighted in the military profession. These customs and traditions bring and uphold the pride of a normal person. Whereas the customs are laws and regulations to people, they may change, but we follow and take on to the next line of generations. In contrast, traditions are passed down from sailor to sailor through experience 'both in memory and reality'.

This year, the Sri Lanka Navy celebrates its 74th Anniversary, but it has a long history of customs and traditions that dates back to 86 years. The prominent customs and traditions are depicted in 'Mess Nights'.

Mess Night is a time-honoured event, rich with the history and heritage of sea service. The navy Mess Nights procedure differs from the army, and air force procedures. It is designed to strengthen the bonds of military personnel, and it keeps order, protocol, and the discipline of military life. But in our community, these customs and traditions are diminishing or being eliminated, it continues for future generations to come.

During the late 1800s/early 1900s, these dinners were kept at midday on the days of sail. It is an event to celebrate the past and carry on the past to the future. Vikings celebrated home - returns from sea and victories with food and drink, seated in long dining halls as per their rank and battle valor. The warriors who had been marked as distinguished and valorous were named as 'guests'. These guests were seated close to the leader, then toasts were made with cups made of skulls of enemies, toasts named 'skol' (Swedish toast). Even in the myth of Viking heaven, Valhalla also had such customs and traditions.

In the year 1805, the greatest naval hero of England, Admiral Horatia Nelson was born. During that time, Nelson had a dining table with a seating capacity for twenty-four (24) on HMS Victory. He had dinners with officers to break the monotony, cement unity among the fleet staff, to communicate, for camaraderie, fun, and enjoyment during life at sea. Before the Battle of Trafalgar, Nelson with his major officers toasted their forthcoming victory and pronounced the Loyal Toast to their king at Port. This marked the beginning of the Loyal Toast with Port, which is followed even today as the final event of a Mess Night.

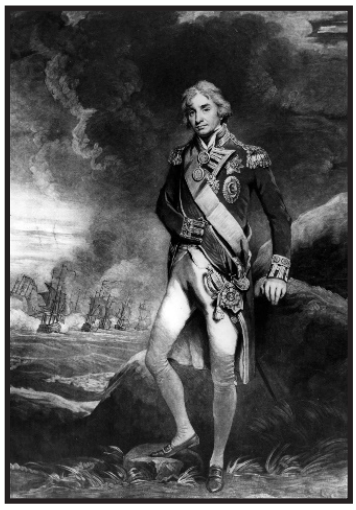

Figure 2: Admiral Horatio Nelson, Viscount Nelson of the Nile and Burnham Thorpe (1758 - 1805)

The Two Officers

Onboard Naval ships, it maintains traditional wardroom with a Mess President. But shore establishments have a different procedures, as the concept of closed messes on shore was only common until the mid-1900s, which is a thing of the past now. It is necessary for the command to create the mess organization and mess regulations for a Mess Night. The two officers of Mess were the Mess President and the Mess Vice President.

The Mess President became the most senior officer, while the Mess Vice President was the most junior officer. Traditionally, the Mess President onboard vessels was the second in command who is the Executive Officer. The Mess President signifies the ship's captain. He is the all-powerful ruler during the Mess Night and must decide when it is time to eat and to ease springs. Only he is responsible for initiating the loyal toast, rejecting, and permitting other toasts. This was an influence on the civilian world during the 18th century in England, and the ship's captain or base commander is not always the Mess President. But in history, it was evident that the First Lieutenant, today's Executive Officer, hold president of mess. The title of the Mess President is depicted as 'Mister President'.

'Vice' is nominated by the Mess President, who is well-qualified to perform important tasks and the role of Mister/Madam Vice, to help in organizing and to a person who is confident, keen and has a fine sense of repartee. Till the 1960s, officers below the rank of Lieutenant Commander were addressed as 'Mister'. This had long been a Navy title. Keeping aside the captain, sailing men-of-war officers were referred to as 'Mister', and today it is only used during the Mess Nights. The Vice is with authority, responsible for inviting attention to the President on violations of any Mess Member or Guest, ability to judge the procedures, advise, warn, and even fine the President for any infractions of the Rules of the Mess by the President. He is the only member of the Mess who can address items of interest to Mess members without the President's permission. He sits opposite the table in front of the President for ease. Mister Vice diplomatically silences any disturbance, declares or seconds the toasts initiated by the President, and announces any offenses committed, identifying and fining the wrongdoers. Vice is the first to arrive and the last to leave.

The Guest

The Mess is only open to its members and guests in attendance. According to the regulations, there are two types of guests, to accompany guests in a mess is normal even when dinner is closed. It is called an officer-only affair and during the Guest Dinner an individual member guest is included. Mess members are all hosts and should extend the amenities of the mess to the guests.

The Guest of Honour is a distinguished senior officer in military service, any government official higher than the Commander in protocol, and any foreign delegation or Head. He will be guided by two junior officers traditionally and must ensure he is engaged in an interesting conversation and cannot make the glass go dry.

All members should be made to meet with the honoured guest and other officials. A receiving Line is formed where it allows this and, if not formed, officers should make an effort to present hospitality to officials and unofficial guests. This line facilitates introductions on the arrival of the guest.

The Dress

Evening dress dates back over 135 years. It is a formal dress that is often called 'Black Tie'. It included a jacket with a rolling collar, five buttons, a waistcoat, and single-breasted buttons. In contrast, the evening dress is equal to a civilian tuxedo with braided cuffs.

'Full fig and dressed to nines', as the British said, the Dinner Dress of Navy to a Mess Night. Civilians may wear a formal 'Black Tie' if invited. This dress was categorized into two colours, Dinner Dress Blue Jacket or Dinner Dress White Jacket, whereas Lieutenant and below officers without the formal jackets wore Dinner Dress Blue or White. Today, the jacket is worn with a bow tie and miniature medals. It was an offense when clip-on bow ties were worn. This was given equal consideration for both male and female officers; female officers were only allowed to wear suitable dress to dining out. Mess Dress is the norm for Mess Night. The Sri Lanka Navy uses its No. 03 as the Mess Dress.

Figure 3: Left to Right – Mess Dress of (Sri Lanka Navy, US Navy, Royal Navy and Royal Marines)

Rum in Navy

In 1655, the first rum was issued, and it was when the British captured Jamaica. Rum was a substitute for beer onboard ships of the Royal Navy. It is derived from a Latin word, saccarum, which means sugar. Rum was easier to procure than beer or wine, and it is at least four times as strong as rum today. The seaman drank the equivalent of two bottles per day, undiluted and unmixed. This became an alcohol problem that turned into a plague in the British Navy. Later, the issue of rum rations was terminated to control the plague, but it was only issued for medical purposes and for Port.

Experts in wine determine which wines are best fit for which food, and as the menu is planned, the correct wine is selected. Wine is mainly used to enjoy food, and to accentuate and supplement the flavor of dishes served. During Mess Nights, wines are selected to match its various courses, such as Sauvignon Blanc, Chardonnay, Chenin Blanc, Merlot, etc. Mess Night is not an occasion for 'three sheets in the wind', it is an old sailing term used for being tipsy.

The Menu

The finest meal is served at Mess Night. During the time of Nelson, 'A lordly lion of beef surrounded by a coronet of Yorkshire pudding' is served. According to the traditions of the Navy, roast beef is served as entrée, then salad, and with the other courses, followed by a dessert. Port will be served after dessert with any kind of cheese, to avoid the play with the sweetness of the dessert. Mess Nights are all about fine food, fine wine, refinement, and elegance. As a customary act, a printed souvenir menu is placed on the dinner table or on the plate, to give some information on the origin and traditions of a Mess Night, program notes, and a small biography of the Guest of Honour.

In honour of Admiral Horatia Nelson, each October his favorite dessert, chocolate pudding, is added to the menu to celebrate Trafalgar Nights. When a chocolate dessert is mentioned on the menu, it is traditionally called 'Ships of the Line'. The dessert is made using heavy chocolate, and the chocolate pudding is served in the shape of a sailing ship.

The Port

Tarshish is a distant nation founded by the great-grandson of Noah, of Arc Frame. The land was uncivilized and was beyond the west. Today it is called Portugal.

Porto was a city on the sea in northern Portugal near the border of Spain. Porto in the Portuguese language means 'port' and o means 'the'. This developed the name 'The Port'. The city made its name over two centuries due to its role played in the wine industry and wine bears its name. The Crusaders were the very first the Englishmen to have tasted Portuguese wines as they had to stop in Porto en route to the Holy Land.

Portuguese wine was not as famous as French wine, but it changed as the war between France and England continued. It blocked supplies of French wine, so Britain had easy access to Portuguese wine, which made their trade.

The Port is unique as it does not only use grapes for Port wine. Its uniqueness came by fortifying grapes with brandy. The addition of brandy neutralizes the yeasting process and disrupts the conversion of grape sugar into alcohol. Port is a gentleman's drink, and it is fashionable among the aristocracy, politicians and military officers. Traditionally, the Port was used for Sea Services Toast, it was even used for dinners by Admiral Nelson. The Port glasses are traditionally tulip - shaped, slightly tapered in rim, to retain the Port wine aroma.

During Mess Nights, the Port decanters will be placed in front of the President after the last course of the day. Then the steward or Vice reports the President, 'The wine is ready to be passed, Sir!' Is it passed to the right or left? The President will pass the Port to the left, and if any lady guest at the left, before passing, the lady's glass should be filled. In naval terms, Port is left. As it is said, when ships are approaching each other they always pass 'port to port' for safety reasons. The other reason is that the Guest of Honour will be seated to the right of the host, so he/she will be the last person to be served.

Historical traditions depict that the Royal Navy passed the decanter by sliding on the table, mentioning that the decanter must not leave the table as it is passed. Decanter is passed to the edge of the table while keeping the glass below the edge of the table, then the pour must be made. Sliding was a practical reaction to the motion of the sailing vessels. The vessels tend to rock in heavy seas, so the easier ease to handle the decanter was to slide along the table. This was the best way to

maintain one's own stability and control over the decanter at sea in a rocking man-of-war. If at any time the Port passing was delayed by someone, two terms were used back in the day: 'Do you know the Bishop of Norwich?' or 'Excuse me, is your passport in order?'

Figure 4: The Port wine bottle back in the day

The Toast

The significant act of a toast is so drunk – with honour. A Toast is a diplomatic gesture, earning proper notice, respect and not to be belittled. This word comes from the Latin word tostus, which means roasted or parched, and it evolved into a salute with a drink. Back in the day, Vikings drank minni, which translated into Old Norse to 'love, memory and thought of the absent one'. In Roman times, the act of placing toast or burnt bread into wine was a traditional act which was later followed by English as a solution to poor wine tasting in Britain. With this habit, toasting wine, drinking the 'toast, highlighting the ladies or gentlemen to whom one was drinking made the drink enhance or added flavor to the wine. Loyal Toast or Royal Toast is a tradition within the British Military, to show loyalty and respect to their sovereign. Whereas the toasts are made while standing in the Royal Navy, which makes it a unique privilege to make the Loyal Toast when seated at a few historical events. This privilege was only limited to Royal Navy officers.

The toasts are done in honour of one or more individuals, events, or organizations, but making toast for places or things is improper. Toasting to an individual must be done for the individual's position and not for the person's name. The toasts below are made after the Loyal Toast mentioned in the chapter 9 Royal Navy Regulations for Stewards, Item 0926.

Sunday	1.	Absent friends
	2.	Absent friends and those at sea
Monday	1.	Our ships at sea
	2.	Our native land
Tuesday	1.	Our men
	2.	Our mothers
Wednesday	1.	Ourselves
	2.	Ourselves – Our swords

Thursday	1.	A bloody war or a sickly season
Friday	1.	A willing foe and sea room
	2.	Fox-hunting and Old Port
Saturday	1.	Sweethearts and wives

Toast is just sipped not fully drunken. All should participate in toasting, even a non-drinker should lift the glass to the lips as everyone else does without actually drinking. Water is never used as toast.

Figure 5: Admiral Nelson raising a toast to victory with his fellow officers the night before the Battle of Copenhagen, 01st April 1801

Initially, the President rises, informs the Vice 'Very well, Mister/Madam Vice', gravels for attention, and calls the toast to the Commander in Chief. Later, Vice seconds it by announcing the mess. 'Ladies and Gentlemen, the Commander in Chief of Sri Lanka'. All members stand and raise the glass and repeat, while the band plays the National Anthem and others follow. At the conclusion of the music, all members and guests take their seats. After the formal toast, it will continue with the informal toasts, with the initial informal toast, then the President gives an introduction of the Guest of Honour to the mess. If the toast is justifiable, then the President directs the Vice to second the toast like a formal toast. When all suffices, the President will tap thrice with the gravel and commence the legal business by asking the Vice to read the list of offenses and offenders who have violated the rules of the mess. The president offers suitable fines and punishments as fit. Finally, at the conclusion of legal business, the President would call for a toast without raising the 'Country's Navy' (Sri Lanka Navy) and the President would stand as the Vice Second. All would rise and respond in unison, 'Sri Lanka Navy'. Finally, the President invites all to the bar and brings the meeting to a conclusion. All will remain in place until the head table has left the room.

The Smoking Lamp

The life of a sailor was hard during the times of sailing with little to occupy them after work. Therefore, the new fad of smoking brought them some relief. This was a hazard as they drank on wooden sailing vessels. With time, the unlighted lamp was the signal that smoking was not permitted. It made some expressions like 'The smoking lamp is light' or 'The smoking lamp is out'. The British used 'Out pipes'. These expressions remain to this day and have been used in Sea Service orders.

On Mess Nights, the President will decide whether or not a Smoking Light is lit during the event. If Smoking Light was included in the event, then cigars will be passed among both male and female officers (only for those who desire) and will be lit at a designated location. These cigars are only lit when the President announces, 'The smoking lamp is lit'.

Figure 6: The Smoking Lamp

The Melody

It is a Sea Service tradition to have music during Mess Nights. Bands help the atmosphere of formal elegance, and ceremony, pomp and should not only be a band but the Mess Night participants themselves can provide music by singing. A few of the songs sung at Mess Nights in the old days.

ANCHORS AWAY

Anchors away my boys, anchors away!

Farewell to college days,

We sail at break of day, day, day, day

Through our last night ashore Until we meet once more

Here's wishing you a happy voyage home.

NAVAL HYMN

O Trinity of love and power,

Our brethren shield in danger's hour;

From rock and tempest, fire and foe,

Protect them whereo'er they go.

And ever let there rise to thee

Glad hymns of praise from land and sea.

The Violations and Rules

The President of the Mess Night will assist with gravel and use for the following instances:

One tap – seats (all take their seats)

Two taps – rise (all stand)

Three taps – attention (all stop chatting and pay attention)

The President has the sole responsibility to discipline any member if the mess or any guest for misconduct. The following action could be taken:

a. Warn the culprit.

b. Fine the culprit.

c. Order the culprit to perform some task.

d. For serious issues, order the culprit to leave the mess.

In any case, if an officer is late for dinner, his/her excuse must be accepted and publicly fined or will not permit him/her to dine. All monetary fines shall be recorded by the Vice and to maintain a register. The Vice can warn or fine the President, he/she is the only can do so. If any guest calls the attention of the President for a misdemeanor, he/she should get permission from the Vice. The prohibited acts and violations can lead to penalties:Untimely arrival at the proceedings.

a. Untimely arrival at the proceedings.

b. Carrying a cocktail into the dining room.

c. Commencing a course before the President.

d. Haggling over dates of rank.

e. Spilling food or beverages.

f. Throwing any articles.

g. Flatulence, etc.

Historical Celebrations

The following are some of the Mess Nights that are celebrated annually:

Establishment of US Navy Supply Corps – February 1795

Tripoli Harbor Action – 14th February 1804

Battle of Trafalgar – 12th October 1805

Battle of Midway – 04th & 06th June 1942

Conclusion

The Sri Lanka Navy's traditions and customs, which have their roots in the Royal Navy, are more than just ceremonial activities; they stand for discipline, solidarity, and the core values of naval service. With their elaborate customs and strict observance of etiquette, events like Mess Nights are more than just formalities; they are vibrant representations of naval culture's tenacity, legacy, and togetherness. By upholding these customs, the Sri Lanka Navy strengthens the moral and professional bonds of its members while also paying tribute to its history.

Mess Nights provide an opportunity to commemorate the Navy's rich past, from its beginnings during the British Crown's occupation of Ceylon to its development into the powerful maritime power it is today. Customs like Loyal Toast, doing the elegant Mess Dress, and the careful selection of exquisite food and wine enhance these gatherings. Every ceremony demonstrates the Navy's dedication to upholding its heritage and encouraging camaraderie among its officers.

Beyond glitz and glamour, though, is a more profound goal: fostering the ideals that characterize naval life. These traditions, which instill discipline, difference to authority, and the appreciation of accomplishments, guarantee that the Navy will always be a unified and driven organization. For instance, the positions of Mess President and Vice President instill leadership and accountability, while the presence of visitors emphasizes the value of hospitality and diplomacy.

The Sri Lanka Navy's commitment to maintaining its traditions serves as a ray of hope in a world that is changing quickly and where conventions are frequently in danger of becoming outdated. The Navy's crucial role in defending the country's maritime interests while maintaining the highest standards of professionalism and etiquette is highlighted by these actions. The Navy makes sure that its customs continue to be applicable and motivating for upcoming generations by embracing both its historical foundation and contemporary innovations.

The enduring spirit of naval duty is exemplified by the Sri Lanka Navy's dedication to these timeless traditions. Maintaining these customs is not just a sentimental gesture; rather, it is a conscious attempt to foster pride and a feeling of community among its employees. Every tale told, song performed, and toast made during a Mess Night strengthens the ties that bind sailors from all walks of life.

The Sri Lanka Navy's traditions and customs are more than just ceremonial artefacts; they form the foundation of its power and identity. By valuing and continuing these traditions, the Navy not only pays tribute to its illustrious history but also prepares itself to face the challenges of the future with cohesion, fortitude, and a strong sense of mission. The Navy's steadfast dedication to serving the country with honour, discipline, and distinction is carried with it as it sails forward, in addition to the heritage of its traditions

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EVALUATING SRI LANKA'S POLICIES ON INTERNALLY DISPLACED PERSONS (IDPS) AND REFUGEES

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Abstract

The prolonged civil conflict in Sri Lanka (1983–2009) and the 2004 Indian Ocean tsunami triggered significant displacement crises, posing ongoing challenges. This study reviews Sri Lanka's policies on Internally Displaced Persons (IDPs) and refugees, focusing on resettlement, reintegration, and compliance with global standards. Despite progress in resettling IDPs, particularly in the Northern Province, critical gaps persist, including the lack of a comprehensive refugee law, inadequate infrastructure, land disputes, and limited economic opportunities. Vulnerable groups, such as women and children, face additional challenges due to the absence of inclusive, gender sensitive policies.

The research compares Sri Lanka's efforts with global practices, such as Uganda's refugee frameworks and Colombia's integration strategies, identifying areas for improvement. Recommendations include enacting a national refugee law, adopting gender-responsive policies, and emphasizing long term economic integration. Strengthened international collaboration is crucial for addressing displaced populations' multifaceted needs, fostering reconciliation, and aligning Sri Lanka's policies with global frameworks to ensure sustainable, rights-based solutions.

Key words: Displacement, Resettlement, Refugees, Gender Sensitivity, Reintegration

Introduction

Sri Lanka's internal displacement challenges have been deeply influenced by its prolonged civil conflict, which lasted from 1983 to 2009. The conflict, largely concentrated in the Northern and Eastern Provinces, displaced hundreds of thousands. Though the conflict officially ended with the defeat of the LTTE, the aftermath continues to affect displaced populations. This article evaluates Sri Lanka's policies regarding Internally Displaced Persons (IDPs) and refugees, examining their effectiveness in resettlement, reintegration, and alignment with international standards.

Given the socio-political and economic complexities that arose from the conflict's conclusion, evaluating these policies is crucial for understanding Sri Lanka's efforts to heal and rebuild. This paper will explore how these policies impact the displaced, focusing on their access to essential services, integration into communities, and their alignment with global legal frameworks on displacement.

Literature Review

Historical Context of Displacement

Sri Lanka's internal displacement crisis can largely be attributed to the civil war between the government and the LTTE, which left a significant portion of the population displaced. Estimates suggest that close to a million people were affected by the conflict (Somasundaram, 2014). Following the end of hostilities in 2009, the Sri Lankan government initiated a resettlement pro-gram aimed at returning IDPs to their homes, although challenges remain, with many continuing to live in camps years after the conflict's conclusion (De Mel & Jayaweera, 2019).

In addition to the internal displacement caused by the civil war, the 2004 Indian Ocean tsunami displaced thousands more, creating further complexities for the government in dealing with resettlement and reconstruction efforts (UNHCR, 2021). The long-term impact of these events continues to shape Sri Lanka's approach to managing displacement.

Global Comparisons

When comparing Sri Lanka's approach to that of other post-conflict nations, the challenges are not unique. For instance, Uganda, with its long-standing refugee crisis, has established successful frameworks for refugee protection and resettlement, which could serve as a model for Sri Lanka (UNHCR, 2020). Similarly, Colombia has been noted for its comprehensive integration strategies for IDPs, which prioritize economic empowerment and legal aid (World Bank, 2017). In contrast, Sri Lanka has faced criticism for its lack of a comprehensive long-term integration policy, particularly in the context of refugees, which remains a gap in its humanitarian efforts.

Other countries that have experienced internal displacement, such as Nepal, face similar hurdles regarding economic constraints, limited resource access, and land disputes, which hinder the return and reintegration process (De Mel & Jayaweera, 2019). These comparisons underscore the need for a more systematic and rights-based approach to addressing displacement in Sri Lanka.

Refugee and IDP Legal Frameworks

Sri Lanka has no comprehensive refugee laws and has not ratified the 1951 Refugee Convention or its 1967 Protocol, leaving refugees with limited legal protection. However, existing legal provisions indirectly address displacement issues:

a. **Constitution of Sri Lanka.** Article 12 guarantees equality and prohibits discrimination, offering a basis for refugee rights (Constitution of Sri Lanka, 1978).

b. **Prevention of Terrorism Act (PTA).** Criticized for its impact on conflict affected communities, the PTA has implications for displaced populations (UNHCR, 2020).

c. **Land Laws.** The Land Development Ordinance (1935) and Land Acquisition Act (1950) address resettlement but often fail to resolve land disputes for IDPs and refugees (De Mel & Jayaweera, 2019).

d. **National Policy on Durable Solutions (2016).** Focuses on IDP resettlement and reintegration but provides limited attention to refugees (IOM, 2022).

e. **Immigrants and Emigrants Act (1949).** Governs immigration but lacks refugee-specific provisions, leaving asylum seekers without formal recognition (UNHCR, 2021).

f. **Ad Hoc Mechanisms.** Temporary support from UNHCR and others remains fragmented due to the lack of a legal framework (Somasundaram, 2014).

Developing refugee-specific legislation aligned with international standards is crucial to addressing these gaps and ensuring effective protection for displaced populations.

Methodology

This study adopts a qualitative approach to assess Sri Lanka's policies on displacement, primarily drawing upon secondary data sources. These include government reports, evaluations by international agencies, and assessments by non-governmental organizations (NGOs) published online. The research focuses on publicly available information, including documents from the United Nations High Commissioner for Refugees (UNHCR), International Organization for Migration (IOM), and other credible sources such as the World Bank, which provide insights into the practical challenges faced by IDPs and refugees.

Results

Resettlement Progress

Sri Lanka has made notable strides in resettling IDPs, particularly in the Northern Province, where around 45% of displaced persons were able to return to their homes by 2022 (UNHCR, 2021). However, these efforts have not been without difficulties. Returnees often face significant challenges such as land disputes, inadequate healthcare, and limited educational facilities. The destruction of infrastructure has further hampered the rebuilding process, particularly in agricultural communities where livelihoods are largely dependent on land (Somasundaram, 2014).

While international organizations like the International Organization for Migration (IOM), 2022 have been instrumental in providing basic services, challenges persist in areas like sanitation, water, and health provision. Moreover, economic opportunities for returnees remain scarce, contributing to high levels of unemployment and persistent poverty.

Legal and Policy Gaps

One of the most pressing issues is Sri Lanka's failure to adopt a comprehensive refugee law. Unlike other countries that have ratified the 1951 Refugee Convention, Sri Lanka has yet to establish a legal framework to ensure the protection and integration of refugees. As a result, refugees often face a precarious existence without formal access to the services and legal protections they are entitled to under inter-national law (Somasundaram, 2014).

While the government's work with international organizations has provided some relief, the lack of a cohesive and coherent legal structure for refugees undermines the long-term effectiveness of resettlement and integration efforts (UNHCR, 2020).

Discussion

Evaluation of Effectiveness of Current Policies

Sri Lanka's current policies on displacement have yielded mixed results. The government's efforts have successfully resettled many IDPs, but challenges related to the long-term sustainability of these efforts remain. Inconsistent policy implementation, regional disparities, and delays in providing necessary services have hampered progress, making it difficult for IDPs to fully reintegrate into society (De Mel & Jayaweera, 2019). As noted by De Mel & Jayaweera (2019), the lack of a unified national strategy has led to delays in the provision of services and has hindered the longterm recovery of displaced populations.

The Role of Government and International Aid

The role of government and international aid agencies has been played a crucial role in addressing the immediate needs of displaced persons. The Sri Lankan government has worked with the UNHCR and the IOM to improve infrastructure and provide financial assistance. However, international aid has often been directed towards short-term relief rather than long-term solutions, which has limited its effectiveness in fostering self-sufficiency among displaced populations (World Bank, 2017).

Addressing Vulnerability

Certain groups, particularly women and children, have been disproportionately affected by dis-placement. These populations face additional barriers to accessing resources, such as land and legal protections, which are essential for their recovery. It is critical that policies are adapted to meet the specific needs of vulnerable groups, with a focus on gender sensitive strategies and increased access to healthcare, education, and legal protection (UNHCR, 2021). Therefore, Policies must more inclusive and consider the gendered nature of displacement to ensure equitable access to resources and opportunities.

Conclusion and Recommendations

Sri Lanka has made notable progress in addressing the challenges faced by Internally Displaced Persons (IDPs) and refugees, especially in terms of resettlement. However, critical gaps persist, particularly in legal protections, economic reintegration, and support for vulnerable populations. Addressing these shortcomings is essential for ensuring the long-term stability and well-being of displaced communities. By implementing comprehensive policies and fostering international collaboration, Sri Lanka can enhance its ability to meet global standards, support reconciliation efforts, and promote sustainable development in the post-conflict era.

Recommendations

a. **Adopt a National Refugee Law.** Develop a comprehensive refugee law that aligns with international standards such as the 1951 Refugee Convention. This legal framework would ensure the protection and rights of refugees and streamline their integration into society.

b. F**ocus on Gender-Sensitive Strategies.** Create policies that prioritize the unique needs of vulnerable groups, particularly women and children, by enhancing access to resources such as healthcare, education, and legal assistance. Special attention should be given to a dressing gender based challenges in displacement settings.

c. **Promote Economic Self-Sufficiency.** Implement programs to support the economic empowerment of IDPs and refugees, such as skill-building initiatives, access to microloans, and integration into local labor markets. This will enable displaced populations to achieve long-term financial independence.

d. **Rebuild Critical Infrastructure.** Invest in the development of essential infrastructure in resettlement areas, including housing, education facilities, and healthcare centers, to improve the quality of life for returnees and facilitate sustainable reintegration.

e. **Resolve Land Disputes.** Introduce transparent and fair mechanisms to address land ownership issues faced by displaced persons. Secure land tenure is vital to preventing recurring displacement and fostering a sense of stability among returnees.

f. **Enhance International Partnerships.** Strengthen collaboration with international agencies and donors to gain access to technical expertise, financial resources, and best practices for addressing the multifaceted challenges of displacement.

g. **Develop a Coordinated National Plan.** Create a unified national strategy to address displacement, integrating efforts from the government, non-governmental organizations, and affected communities. Such a strategy would help minimize regional disparities and improve the overall efficiency of policy implementation.

h. **Raise Awareness and Build Capacity.** Organize awareness campaigns to inform communities and local authorities about the rights and needs of displaced populations. Additionally, provide training for stakeholders involved in managing displacement to ensure effective and empathetic implementation of policies.

These recommendations aim to address the findings and discussion points while ensuring a holistic approach to the challenges faced by displaced populations in Sri Lanka.

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නායක නැවි (විපා) පීබීවිල්අයි සිල්වා
නාවික හා සාගරික විද්‍යාපීඨය

21 වන සියවස ලෝකයේ ප්‍රමුඛ ජාතීන් අතර බලය සඳහා සංකීර්ණ සහ බොහෝ විට අස්ථාවර අරගලයකින් සංලක්ෂිත වේ. මෙම අරගලය භූ දේශපාලනික ගතිකත්වය, ආර්ථික අන්තර් රඳා පැවැත්ම, තාක්ෂණික දියුණුව, යුධමය හැකියාවන් සහ මතවාදී බලපෑම් ඇතුළු විවිධ සාධක මගින් හැඩගැසී ඇති සීතල යුධ යුගය එක්සත් ජනපදය සහ සෝවියට් සංගමය අතර බල ද්විධ්‍රැවවාදිකම් නිර්වචනය කරන අතර, පශ්චාත් සීතල යුධ යුගය එක්සත් ජනපදය පමණක් නොව චීනය වැනි නැගී එන බලවතුන් අතර තරඟකාරී අවශ්‍යතා වලින් සලකුණු කරන ලද බහු ධ්‍රැව ලෝකයක් මතු වී තිබේ.

ඒක ධ්‍රැවීයතාවයේ සිට බහු ධ්‍රැවීයතාව දක්වා චෛතිහාසික පසුබිම සලකා බැලීමේදී 1991 සීතල යුද්ධය අවසානයේ ගෝලීය බල ගතිකයේ නිර්වචන අවස්ථාවක් සනිටුහන් කළේය. සෝවියට් සංගමයේ බිඳවැටීම නිසා එක්සත් ජනපදය අවිවාදිත ගෝලීය සුපිරි බලවතා ඉතිරි විය. එය 1990 ගණන්වල වැඩි කාලයක් පැවතුනි. වොෂින්ටනය ගෝලීය දේශපාලන, ආර්ථික සහ යුධමය කටයුතුවල ආධිපත්‍යය දැරූ මෙම කාල පරිච්ඡේදය බොහෝ විට ඒක ධ්‍රැවීයතාව ලෙස හැඳින්වේ. මෙම කාලය තුළ එක්සත් ජාතීන්ගේ සංවිධානය, ජාත්‍යන්තර මූල්‍ය අරමුදල (IMF), ලෝක බැංකුව සහ ලෝක වෙළඳ සංවිධානය (WTO) වැනි ජාත්‍යන්තර ආයතන හැඩගැස්වීමේදී එක්සත් ජනපදය ප්‍රධාන කාර්යභාරයක් ඉටු කළේය. තවද, මෙම කාල පරිච්ඡේදය තුළ ප්‍රජාතන්ත්‍රවාදයේ ගෝලීය ව්‍යාප්තිය සහ නිදහස් වෙලඳපොල ධනවාදය එක්සත් ජනපදය විසින් මෙහෙයවන ලද "ලිබරල් ලෝක පර්යායක්" පිළිබඳ සංකල්පය ශක්තිමත් කළේය. කෙසේ වෙතත්, චීනයේ නැගීම, රුසියාවේ පුනර්ජීවනය සහ ඉන්දියාව සහ යුරෝපා සංගමය (EU) වැනි කලාපීය බලවතුන්ගේ වැදගත්කම සමඟ 21 වන සියවසය මෙම ඒක ධ්‍රැවීයතාවයට සැලකිය යුතු අභියෝගයක් අත්විඳ ඇත. බහු ධ්‍රැවීයත්වය මතුවීම - බහුවිධ රටවල් ගෝලීය වේදිකාව මත සැලකිය යුතු බලපෑමක් ඇති කරයි. ගෝලීය තරඟකාරීත්වයේ නව යුගයක් හඳුන්වා දී ඇති අතර, බලය සාම්ප්‍රදායික බටහිර ආධිපත්‍යය දරන පද්ධති වලින් ඉවත්ව වඩාත් බණ්ඩනය වූ ජාත්‍යන්තර පිළිවෙලකට මාරු වී ඇත.

ආර්ථික බලය සහ භූ දේශපාලන අභිලාෂයන් පිළිබඳව චීනයේ බලපෑම සලකා බැලීමේදී ගෝලීය බල ව්‍යුහයේ වඩාත්ම වැදගත් මාරුවීම්වලින් එකක් වන්නේ චීනයේ නැගීමයි. පසුගිය දශක කිහිපය තුළ චීනය කෘෂිකාර්මික සමාජයක සිට ලෝකයේ දෙවන විශාලතම ආර්ථිකය ඇති රට බවට පරිවර්තනය වී ඇත. වේගවත් කාර්මිකකරණය, තාක්ෂණික නවෝත්පාදන සහ උපායමාර්ගික රාජ්‍ය නායකත්වයෙන් යුත් ධනවාදය විසින් මෙහෙයවනු ලබන සංවර්ධනයකි. මෙම ආර්ථික නැගීම, උපායමාර්ගික හමුදාමය ගොඩ නැගීම, අභිලාෂකාමී යටිතල පහසුකම් ව්‍යාපෘති (එක් තීරයක් - එක් මාවතක් වැනි) සහ ගෝලීය සංවිධානවල වැඩෙන බලපෑම සමඟ එක්ව ඇත. චීනයේ වර්ධනය වන ආර්ථික බලපෑම, විශේෂයෙන්ම ආසියාවේ සහ අප්‍රිකාවට, එක්සත් ජනපදයට සහ යුරෝපයට ප්‍රබල තරඟකරුවෙකු ලෙස ස්ථානගත කර ඇත. චීනයේ "සාමකාමී නැගීම" උපායමාර්ගික හමුදාමය ගැටුමකට නොගොස් එහි බලපෑම පුළුල් කිරීමේ මාධ්‍යයක් ලෙස ආර්ථික ඒකාබද්ධතාවය සහ සංවර්ධනය අවධාරණය කරයි. කෙසේ වෙතත්, කලාපීය ආරවුල්වලදී, විශේෂයෙන්ම දකුණු චීන මුහුදේ, තායිවානයේ සහ හොංකොං හි එහි ස්ථිරභාවය, එක්සත් ජනපදය සහ එහි මිත්‍ර රටවල් සමඟ ආතතීන් වැඩි කිරීමට හේතු වී තිබේ. එක්සත් ජනපදය චීනයේ මිලිටරි නවීකරණය, ව්‍යාප්තවාදය සහ ආසියාවේ විභව අධිපති අභිලාෂයන්, එහි ගෝලීය ආධිපත්‍යය සහ ආරක්ෂක අවශ්‍යතා සඳහා සෘජු අභියෝග යක් ලෙස සලකයි.

එපමණක් නොව, විශේෂයෙන්ම 5G තාක්ෂණය, කෘත්‍රිම බුද්ධිය (AI) සහ සයිබර් ආරක්ෂාව වැනි අංශවල චීනයේ වැඩිවන තාක්ෂණික දක්ෂතාවය බටහිර රටවල් සමඟ තරඟකාරීත්වය තීව්‍ර කර ඇත. ට්‍රම්ප් පරිපාලනය යටතේ උත්සන්න වූ එක්සත් ජනපද-චීන වෙළඳ යුද්ධය, බලවතුන් දෙක අතර ආර්ථික ද්විධ්‍රැවවාදිකම් සංකේතවත් කළේය. වෙළඳ ආතතීන් උච්චාවචනය වී ඇති අතර, චීනයේ ආර්ථික ආකෘතිය ඔරොත්තු දෙන බව ඔප්පු වී ඇති අතර, ගෝලීය සුපිරි බලවතෙකු ලෙස ඔවුන් හට එහි ගමන් පථය එලෙසින්ම පවත්වා ගැනීමට හැකිය.

සංශෝධනවාදී බලයක් තුලින් රුසියාවේ පුනර්ජීවය පිලිබඳව සලකා බැලීමේදී සෝවියට් සංගමය විසුරුවා හැරීමෙන් පසු, රාජ්‍ය වත්කම් පුද්ගලීකරනය, අඩුවන හමුදාමය බලය සහ ජාත්‍යන්තර මට්ටම පහත වැටීම මගින් සනිටුහන් කරන ලද ආර්ථික හා දේශපාලන අස්ථාවර කාලයකට මුහුණ දීමට රුසියාවට සිදු විය. කෙසේ වෙතත්, ජනාධිපති ව්ලැඩිමීර් පුටින් යටතේ රුසියාව ප්‍රධාන ගෝලීය බලවතෙකු ලෙස නැවත තහවුරු කර ගැනීමට උත්සාහ කර ඇති පුටින්ගේ විදේශ ප්‍රතිපත්තිය, විශේෂයෙන්ම 2014 දී ක්‍රිමියාව ඈඳාගැනීමේ සිට සහ සිරියානු සිවිල් යුද්ධයට සම්බන්ධ වීමෙන්, අවස්ථාවාදයේ, ජාතිකවාදයේ සහ හමුදාමය ආක්‍රමනකාරීත්වයේ සම්මිශ්‍රණයකින් සලකුණු කර ඇත. නැගෙනහිර යුරෝපයේ සහ මධ්‍යම ආසියාවේ සිය බලපෑම යථා තත්ත්වයට පත් කිරීමට රුසියාවට ඇති ආශාව බටහිර බලවතුන් සමඟ, විශේෂයෙන් යුක්‍රේනය, ජෝර්ජියාව සහ බෝල්ටික් රාජ්‍යයන් සමඟ ගැටුම් ඇති කර තිබේ. නේටෝවේ නැගෙනහිර දෙසට ව්‍යාප්ත වීම, රුසියාව විසින් සෘජු ආක්‍රමණයක් ලෙස සලකන අතර, බටහිර හා රුසියාව අතර බල අරගලය තව දුරටත් පෝෂණය කර ඇත. 2014 ක්‍රිමියාව ඈඳා ගැනීම සහ නැගෙනහිර යුක්‍රේනයේ බෙදුම්වාදී ව්‍යාපාර සඳහා රුසියාවේ සහයෝගය ජාත්‍යන්තරව හෙළා දැකීම, ආර්ථික සම්බාධක සහ රුසියාව සහ එක්සත් ජනපදය, යුරෝපා සංගමය සහ නේටෝ අතර එදිරිවාදිකම් වලට තුඩු දී ඇත. විශේෂයෙන්ම බලශක්ති සැපයුම, සයිබර් ආරක්ෂාව සහ අභ්‍යවකාශ ගවේෂණ වැනි ක්ෂේත්‍රවල බටහිර බලපෑමට අභියෝග කිරීමට චීන-රුසියානු ඒකාබද්ධ ආර්ථික හා යුධ ශක්තිය යොදා ගනිමින් මෙම භූ දේශපාලනික ප්‍රතිනිර්මාණය වර්ධනය වන චීන-රුසියානු අක්ෂයකට තුඩු දී ඇත. රුසියාවේ හමුදාමය නවීකරණය, එහි න්‍යෂ්ටික හැකියාවන් එහි බල ප්‍රක්ෂේපණයේ ප්‍රධාන අංගයන් ලෙස පවතී.

එක්සත් ජනපදයේ ඒක ධ්‍රැවීයතාව පිරිහීම සහ උපායමාර්ගික මාරුවීම් පිලිබඳව සලකා බැලීමේදී එක්සත් ජනපදය, තවමත් ලෝකයේ විශාලතම ආර්ථිකය සහ බලවත්ම හමුදාව වන අතරම, 21 වන සියවසේ ආරම්භයේ සිට එහි ගෝලීය ආධිපත්‍යය සඳහා අභියෝග කිහිපයකට මුහුණ දී ඇත. 9/11 ප්‍රහාරයෙන් ආරම්භ වූ ත්‍රස්තවාදයට එරෙහි ගෝලීය යුද්ධය, මැද පෙරදිග, විශේෂයෙන් ඉරාකයේ සහ ඇෆ්ගනිස්ථානයේ ගැටුම් දෙසට ඇමරිකානු සම්පත් සහ අවධානය වෙනතකට යොමු කළේය. මීට අමතරව, 2008 ගෝලීය මූල්‍ය අර්බුදය එක්සත් ජනපද ආර්ථිකයේ අවදානම් හෙලිදරව් කළ අතර, ආදායම් අසමානතාවය, මූල්‍ය අස්ථාවරත්වය සහ එහි මූල්‍ය ප්‍රතිපත්තිවල තිරසාර නොවන ස්වභාවය පිළිබඳ ගැටළු ඉස්මතු කළේය. මෙම අභියෝග එක්සත් ජනපදයේ විශ්වසනීයත්වය සහ බලපෑම, විශේෂයෙන් සංවර්ධනය වෙමින් පවතින ලෝකයේ, චීනයේ නැගීම ආර්ථික වර්ධනයේ විකල්ප ආකෘතියක් සැපයීය.

මෙම පසුබෑම් නොතකා, එක්සත් ජනපදය ගෝලීය බල අරගලයේ ප්‍රධාන කොටස්කරුවෙකු ලෙස සිටී. එහි තාක්ෂණික නවෝත්පාදනය, විශේෂයෙන්ම සිලිකන් නිම්නයේ, ගෝලීය ආර්ථිකයේ ගාමක බලවේගයක් ලෙස දිගටම පවතී. මීට අමතරව, එක්සත් ජනපද හමුදාව ගෝලීය සන්ධාන ජාලයක් සහ හමුදා කඳවුරු සමඟින් හැකියාව අනුව සැලකිය යුතු සීමාවක් පවත්වා ගෙන යයි. කෙසේ වෙතත්, එහි ස්ථාවරය වඩ වඩාත් තරඟකාරී වන අතර, ගෝලීය පිළිවෙල හැඩගැස්වීමේ හැකියාව චීනය සහ රුසියාව වැනි නැඟී එන බලවතුන් විසින් මෙන්ම රාජ්‍ය නොවන ක්‍රියාකාරීන් විසින් අභියෝගයට ලක් කරනු ලැබේ. මෑත වසරවලදී, විශේෂයෙන් ඩොනල්ඩ් ට්‍රම්ප් සහ ජෝ බයිඩන්ගේ පරිපාලනය යටතේ එක්සත් ජනපද විදේශ ප්‍රතිපත්තිය මාරුවකට ලක්ව ඇත. ට්‍රම්ප්ගේ "ඇමරිකාව පළමුව" න්‍යාය පත්‍රය සහ පැරිස් දේශගුණ ගිවිසුම සහ ඉරාන න්‍යෂ්ටික ගිවිසුම වැනි බහුපාර්ශ්වික ගිවිසුම් වලින් ඉවත් වීම, ජාත්‍යන්තරවාදයෙන් පසුබැසීමක් සහ ජාතික ස්වෛරීභාවය අවධාරණය කිරීමක් පෙන්නුම් කළේය. අනෙක් අතට බයිඩන්, විශේෂයෙන්ම චීනයේ නැඟීම සහ රුසියාවේ ආක්‍රමණශීලී ක්‍රියා හමුවේ, ජාත්‍යන්තර ආයතන තුළ සන්ධාන යළි ගොඩ නැගීමට සහ ඇමරිකානු නායකත්වය යළි තහවුරු කිරීමට උත්සාහ කර ඇත. එසේ වුවද, එක්සත් ජනපදය සිය අවශ්‍යතා ආරක්ෂා කර ගැනීම සහ රාජ්‍ය සහ රාජ්‍ය නොවන ක්‍රියාකාරීන් යන දෙඅංශයෙන්ම නැගී එන තර්ජනවලට මුහුණ දීම අතර සියුම් තුලනය කිරීමේ ක්‍රියාවකට හසු වී ඇත.

යුරෝපා සංගමය සහ ඉන්දියාව හා බැදුණු කලාපීය බලතල පිළිබඳව අවධානය යොමු කිරීමේදී බල අරගලයේ වැඩි අවධානයක් යොමු වන්නේ එක්සත් ජනපදය, චීනය සහ රුසියාව කෙරෙහි වන අතර, අනෙකුත් කලාපීය බලවතුන් ද ගෝලීය බල තුලනය හැඩගැස්වීමේදී තීරණාත්මක කාර්යභාරයක් ඉටු කරයි. යුරෝපීය සංගමය (EU) නියෝජනය කරන්නේ අද්විතීය භූ දේශපාලනික ආයතනයකි. ගෝලීය කටයුතු කෙරෙහි සාමූහිකව සැලකිය යුතු බලපෑමක් කරන සාමාජික රටවල ආර්ථික හා දේශපාලන සංගමයකි. බහුපාර්ශ්විකත්වය, වෙළඳ ලිබරල්කරණය සහ මානව හිමිකම් ප්‍රවර්ධනය කිරීමේදී යුරෝපා සංගමය පෙරමුණ ගෙන සිටින අතරම, ජනතාවාදයේ නැගීම, බ්‍රිතාන්‍යය යුරෝපා සංගමයෙන් ඉවත්වීම සහ සාමාජික රටවල් අතර ආර්ථික විෂමතා වැනි අභ්‍යන්තර අභියෝග සමඟ කටයුතු කරයි. ආර්ථික බලය සම්බන්ධයෙන් ගත් කල,

යුරෝපා සංගමය ප්‍රධාන ක්‍රීඩකයෙකු වන අතර එය ලෝකයේ විශාලතම තනි වෙළඳපොල වන අතර එක්සත් ජනපදයට පසුව දෙවන විශාලතම ආර්ථිකය වේ. කෙසේ වෙතත්, එක්සත් ජනපදයට හෝ චීනයට සාපේක්ෂව යුධ බලය ප්‍රක්ෂේපණය කිරීමට යුරෝපා සංගමයට ඇති හැකියාව සීමිතය. ජාත්‍යන්තර වෙළඳ ගිවිසුම් සහ පාරිසරික ප්‍රතිපත්තිවල එහි භූමිකාව වැනි රාජ්‍ය තාන්ත්‍රිකභාවය සහ මෘදු බලය හරහා එහි භූ දේශපාලන බලපෑම බොහෝ විට මැදිහත් වේ.

ඉන්දියාව, ලෝකයේ විශාලතම ප්‍රජාතන්ත්‍රවාදය සහ වේගයෙන්ම වර්ධනය වන ආර්ථිකයක් ලෙස, ගෝලීය බල අරගලයේ තවත් ප්‍රධාන සාධකයකි. දකුණු ආසියාවේ ඉන්දියාවේ උපායමාර්ගික පිහිටීම, එහි මිලිටරි හැකියාවන් සහ එහි වර්ධනය වන තාක්ෂණික අංශය එය ලෝක වේදිකාවේ වඩ වඩාත් වැදගත් ක්‍රියාකරුවකු බවට පත් කරයි. ඉන්දියාව පකිස්ථානය සමඟ ඇති එදිරිවාදිකම් මෙන්ම චීනය සමඟ එහි මූලෝපායික තරඟය, විශේෂයෙන්ම ඉන්දු පැසිෆික් කලාපයේ ගෝලීය භූ දේශපාලනයේ කේන්ද්‍රස්ථානයක් බවට පත්ව ඇත. සීතල යුධ සමයේදී ඉන්දියාවේ නොබැඳි ප්‍රතිපත්තිය වඩාත් ස්ථීර විදේශ ප්‍රතිපත්තියක් දක්වා විකාශනය වී ඇති අතර, ඉන්දියාව කලාපීය හා ජාත්‍යන්තර හවුල්කාරිත්වයන් සමඟ චතුර්පාර්ශ්වික (එක්සත් ජනපදය, ජපානය, ඕස්ට්‍රේලියාව) ආරක්ෂක සංවාදය (Quad) වැනි බහුපාර්ශ්වික සංසදවල සහභාගීත්වය තුළින් ගෝලීය බලපෑම වැඩි කිරීමට උත්සාහ කරයි. ගෝලීය බල තුලනය වෙනස් වන විට, අනාගත ලෝක පර්යාය හැඩගැස්වීමේ ඉන්දියාවේ භූමිකාව වැදගත් වනු ඇත.

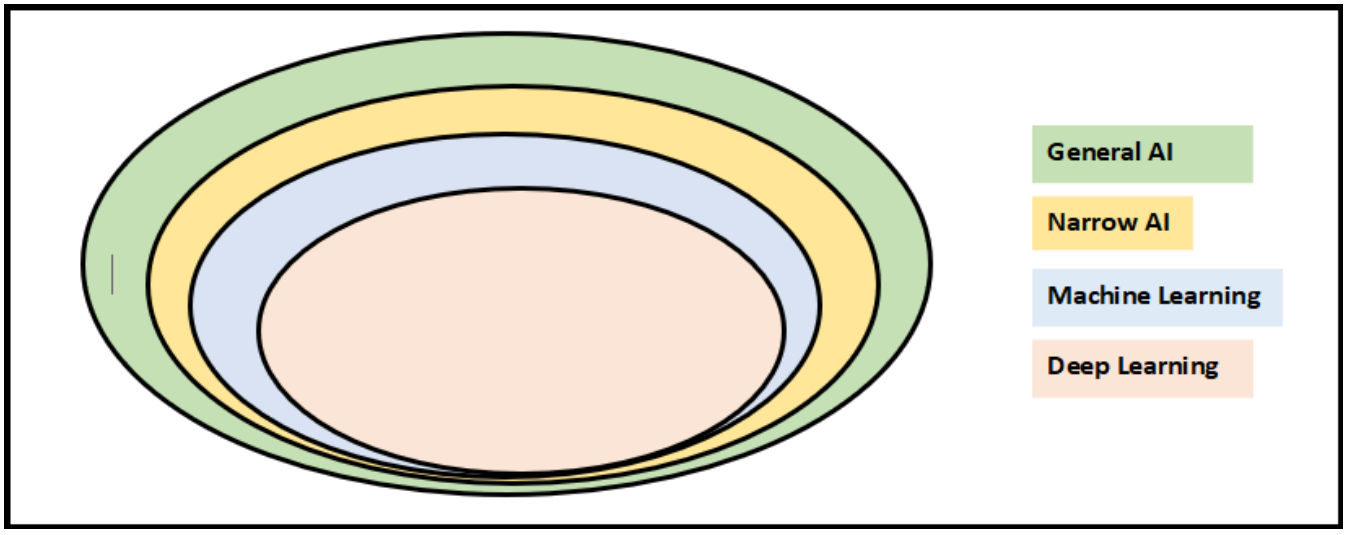
ලෝකයේ ප්‍රමුඛ බලවතුන් අතර විශේෂයෙන් එක්සත් ජනපදය, චීනය, රුසියාව සහ ඉන්දියාව සහ යුරෝපා සංගමය වැනි කලාපීය ක්‍රියාකාරීන් අතර පවතින බල අරගලය ගෝලීය ඉතිහාසයේ තීරණාත්මක අවස්ථාවක් සනිටුහන් කරයි. ඒක ධ්‍රැවීයතාවයේ පරිහානිය සහ බහුධ්‍රැවයේ නැගීම අවස්ථා සහ අභියෝග යන දෙකම ඉදිරිපත් කරයි. එක් අතකින්, බහු ධ්‍රැවීය ලෝකයක් රාජ්‍ය තාන්ත්‍රික ක්‍රියාකාරකම් හරහා වැඩි සහයෝගීතාවයක් සහ බලය තුලනය කිරීම පෝෂණය කළ හැකිය. අනෙක් අතට, විශේෂයෙන්ම නැගෙනහිර යුරෝපය, ඉන්දු-පැසිෆික් සහ මැද පෙරදිග වැනි මූලෝපායික වැදගත්කමක් ඇති කලාපවල ගැටුම් ඇතිවීමේ අවදානම වැඩි කරයි. මෙම බල අරගලයේ අනාගතය රඳා පවතින්නේ දේශගුණික විපර්යාස, සයිබර් තර්ජන (Cyber Threats) සහ ආර්ථික අස්ථාවරත්වය (Economic Instability) වැනි ගෝලීය අභියෝගවලට මුහුණ දීම සඳහා මෙම ජාතීන්ට ඔවුන්ගේ එදිරිවාදිකම් කළමනාකරණය කිරීමට සහ සංවාදයේ යෙදීමට ඇති හැකියාව මතය.

AI තාක්ෂණය

ආධුනික කාන්තා (තොරතුරු තාක්ෂණ) වල්වීකේකේඩි ලියනාආරච්චි
තුන්වන අදියර තොරතුරු තාක්ෂණ පාඨමාලාව 01/2024
නාවික හා සාගරික විද්‍යාපීඨය

හැඳින්වීම

කෘතිම බුද්ධිය [Artificial Intelligence (AI)] යනු සාමාන්‍යයෙන් මානව බුද්ධිය අවශ්‍ය වන කාර්යයන් ඉටු කළ හැකි වන පරිදි කෘතීමව පරිගණක ඇල්ගොරිදමයක් භාවිතයෙන් යන්ත්‍ර සඳහා කෘතීමව ගොඩනගා ගන්නා ලද බුද්ධිය වේ. AI පදනම් වී ඇත්තේ දත්ත විශාල ප්‍රමාණයක් මගින් යම් යම් ඇල්ගොරිදම භාවිතා කර කෘතීම බුද්ධියෙහි මූලික අවශ්‍යතාවයක් වන පරිගණක පුහුණු කිරීම මත වන අතර එමගින් මිනිසාගේ චින්තන ක්‍රියාවලන් හා තීරණ ගැනීම් අනුකරණය කිරීමට හැකියාවක් ඇත. කෘත්‍රිම බුද්ධියේ පියා ලෙස සළකනු ලබන්නෙ"Geoffrey Hinton" නැමැති කැනේඩියානු පරිගණක විද්‍යාඥවරයා වේ.



General AI - බුද්ධිය මෙහෙයවා අලුත් දෑ ඉගෙන ගනිමින් ක්‍රියා කල හැකි කෘත්‍රිම බුද්ධියක් General AI ලෙස හදුන්වයි. මෙය ඕනෑම දෙයක් කලහැකි යන්ත්‍රයක් වේ. මෙවැනි යන්ත්‍ර තවමත් ලෝකයේ නිර්මාණය වී නැත (e.g. Machines in terminator movie).

Narrow AI - යම් කිසි එක් කාර්යයක් පමණක් සිදු කළ හැකි ආකාරයට නිර්මාණය කරන ලද යන්ත්‍රයක් මේ නමින් හඳුන්වයි. ලෝකයේ වැඩියෙන් දකින්නට ඇති කෘත්‍රිම බුද්ධි ආකාරය මෙය වේ (e.g. Tesla's auto driving car" Netflix search engine).

කෘතීම බුද්ධියේ ඉතිහාසය

කෘතීම බුද්ධිය යන අදහස "The Wizard of Oz" සහ "Metropolis" වැනි ප්‍රබන්ධ වල ඇති "The Tin Man" සහ "Robot Mari" යන චරිත මගින් ප්‍රචලිත විය. 1950 දශකය වන විට බොහෝ විද්‍යාඥයින් සහ චින්තකයින් කෘතිම බුද්ධිය පිළිබඳ සංකල්පය හුරුපුරුදු විය.

බ්‍රිතාන්‍ය ගණිතඥයෙකු වන ඇලන් ටියුරින් යෝජනා කළේ මිනිසුන් ගැටළු විසඳීම සඳහා තොරතුරු සහ තර්ක භාවිතා කරන බැවින් යන්ත්‍රවලටද එය කළ හැකි බවයි. 1957 සිට 1974 කාලය තුලදී පරිගණක වේගවත් ලාභදායී සහ වඩාත් ප්‍රවේශ විය හැකි වීමත් සමඟ AI පර්යේෂණ සාර්ථකත්වයට පත් විය. මුල් සාර්ථකත්වයන් තුළ ගැටළු විසඳීමට සහ කථන භාෂාව තේරුම් ගත හැකි වැඩසටහන් ඇතුළත් විය. රජයේ ආයතන, විශේෂයෙන්ම ආරක්ෂක උසස් පර්යේෂණ ව්‍යාපෘති නියෝජිත ආයතනය (DARPA), දත්ත සැකසීමට සහ කථනය තේරුම් ගැනීමට හැකි යන්ත්‍ර සංවර්ධනය කිරීමට බලාපොරොත්තු වන AI පර්යේෂණ සඳහා

අරමුදල් සපයන ලදී. කෙසේ වෙතත්, සීමිත පරිගණක බලය සහ අරමුදල් අඩුවීම හේතුවෙන් AI පර්යේෂණ වල ප්‍රගතිය මන්දගාමී විය.

1980 දශකයේදී නව ඇල්ගොරිතම සහ අරමුදල් වැඩි කිරීම නිසා AI පර්යේෂණ නැවත පණ ගැන්විණි. ජෝන් හොප්ෆීල්ඩ් සහ ඩේවිඩ් රුමෙල්හාට් වැනි ඇමරිකානු විද්‍යාඥයින් විසින් පරිගණක අත්දැකීම් වලින් ඉගෙන ගැනීමට උපකාර වන "ගැඹුරු ඉගෙනුම් (Deep Learning)" ශිල්පීය ක්‍රම දියුණු කළ අතර ඇමරිකානු විද්‍යාඥයකු වන එඩ්වඩ් ෆයිගන්බෝම් මානව තීරණ ගැනීම අනුකරණය කරන විශේෂඥ පද්ධති නිර්මාණය කළේය. ජපන් රජය මගින් AI දියුණු කිරීම සඳහා Fifth Generation Computer Project (FGCP) සඳහා ඩොලර් මිලියන 400ක් ආයෝජනය කළ අතර, එහි සියලු ඉලක්ක සපුරා නොතිබුණද නව පරම්පරාවේ ඉංජිනේරුවන් සහ විද්‍යාඥයින් ප්‍රබෝධමත් කළේය. සීමිත පරිගණක ගබඩා කිරීම සහ සැකසුම් බලය වැනි AI පර්යේෂණවල පෙර තිබූ අභියෝග අවසානයේ ජය ගන්නා ලදී. දළ වශයෙන් සෑම වසර දෙකකට වරක් පරිගණක බලය දෙගුණ වන බවට අනාවැකි පල කරන මුවර්ගේ නීතිය මෙම ප්‍රගතිය සඳහා තීරණාත්මක කාර්යභාරයක් ඉටු කළේය.

1997 දී IBM ආයතනයේහි සුපිරි පරිගණකයක් තුල ධාවනය වූ Deep Blue නැමැති චෙස් ක්‍රීඩා කිරීමේ පද්ධතිය ලෝක චෙස් ශූර ගැරී කැස්පරොව් පරාජය කිරීම සහ Google සමාගමෙහි AlphaGo නැමැති පද්ධතිය 2017 දී Go champion Ke Jie පරාජය කිරීම වැනි සැලකිය යුතු ජයග්‍රහණ කරා මෙම පරිගණක බලය වැඩිවීම හේතු විය.

AI හි වර්ධනය

වැඩිදියුණු කළ ස්වභාවික භාෂා සැකසුම් - ස්වාභාවික භාෂා සැකසුම් (Natural Language Processing - NLP) මෑත වසරවලදී සැලකිය යුතු ප්‍රගතියක් ලබා ඇති අතර, යන්ත්‍රවලට මිනිස් භාෂාව තේරුම් ගැනීමට සහ ප්‍රතිචාර දැක්වීමට ඉඩ සලසයි. මානව සන්නිවේදනයේ හැඟීම් සහ සූක්ෂ්මතාවයන් අවබෝධ කර ගැනීමට යන්ත්‍රවලට හැකි වන පරිදි, AI හි අනාගතය NLP වඩාත් පිරිපහදු වී ඇත. මෙය වඩාත් දියුණු සංවාදාත්මක AI පද්ධති, වැඩිදියුණු කළ භාෂා පරිවර්තන සහ වැඩිදියුණු කළ හඬ සහායකයන් වෙත යොමු කරනු ඇත.

සෞඛ්‍ය සේවය

රෝග විනිශ්චය, ඖෂධ සොයාගැනීම්, පුද්ගලාරෝපිත වෛද්‍ය විද්‍යාව සහ රෝගී සත්කාර සඳහා සහාය වීමෙන් සෞඛ්‍ය ආරක්ෂණයේ විප්ලවීය වෙනසක් කිරීමට AI තාක්ෂණය හට හැකියාව ඇත. අනාගතයේදී, AI බලයෙන් ක්‍රියාත්මක වන තාක්ෂණයන් කලින් රෝග හඳුනා ගැනීම, වෛද්‍ය රූප විශ්ලේෂණය, ප්‍රතිකාර ප්‍රතිඵල අනාවැකි පල කිරීම සඳහා වඩ වඩාත් තීරණාත්මක කාර්යභාරයක් ඉටු කරනු ඇත. AI ඒකාබද්ධ කිරීම වේගවත්, වඩාත් නිවැරදි රෝග විනිශ්චය සහ පුද්ගලාරෝපිත ප්‍රතිකාර සක්‍රීය කරයි, රෝගියාගේ ප්‍රතිඵල වැඩිදියුණු කිරීමට මග පාදයි.

සයිබර් ආරක්ෂාව

අන්තර් සම්බන්දිත උපාංග සහ ඩිජිටල් පද්ධති පැතිරීමත් සමඟ සයිබර් ආරක්ෂණ තර්ජන වඩ වඩාත් සංකීර්ණ වී ඇත. රටා විශ්ලේෂණය කිරීම, විෂමතා හඳුනා ගැනීම සහ තත්‍ය කාලීන විභව අවදානම් හඳුනා ගැනීම මගින් මෙම තර්ජනවලට එරෙහිව සටන් කිරීමේදී AI තීරණාත්මක කාර්යභාරයක් ඉටු කරනු ඇත. නැගී එන තර්ජනවලට වඩාත් ඵලදායී ලෙස අනුවර්තනය වීමට සහ ඒවාට ප්‍රතිචාර දැක්විය හැකි උසස් AI බලයෙන් ක්‍රියාත්මක වන සයිබර් ආරක්ෂණ විසඳුම් සංවර්ධනය කිරීමට අනාගතය සාක්ෂි දරනු ඇත.

පුද්ගලීකරණය

විවිධ වසම් හරහා අතිශයින් පුද්ගලාරෝපිත අත්දැකීම් සබල කරමින් AI ඇල්ගොරිතම අබණ්ඩව විකාශනය වනු ඇත. ඊ-වාණිජ්‍යයේ පුද්ගලාරෝපිත නිර්දේශවල සිට අධ්‍යාපනයේ ගැලපෙන ඉගෙනුම් මාර්ග දක්වා, පුද්ගල මනාපයන්, අවශ්‍යතා සහ ඉලක්ක සපුරාලන පුද්ගලාරෝපිත විසඳුම් ලබා දීම සඳහා AI විසින් විශාල දත්ත ප්‍රමාණයක් භාවිතා කරනු ඇත. මෙම පෞද්ගලීකරණයේ මට්ටම පරිශීලක අත්දැකීම් විප්ලවීය වෙනසක් ඇති කරන අතර පාරිභෝගික තෘප්තිය වැඩි කරයි.

AI තාක්ෂණයේ ධනාත්මක බලපෑම්

දවස පුරාම සේවාව ලබා ගැනීමට හැකි වීම

මිනිසුන් විසින් එදිනෙදා ජීවිතයේදී සිදුකරන විවිධ වැඩකටයුතු කිසිවක් සිදු කිරීමට අවශ්‍ය නොවන බැවින් පැය 24 පුරා අඛණ්ඩ සේවාවක් ලබාදීමට මෙයට හැකියාව ඇත. ඔවුන්ට කිසිදු ආකාරයක විවේකයක් අවශ්‍ය නොවේ. ඔවුන්ගේ කාර්යය වන්නේ සේවාවන් සැපයීමයි, නමුත් මිනිසුන්ට එය කිසිම ආකාරයකින් කළ නොහැකිය. මන්ද ප්‍රබෝධමත් ලෙස වැඩ කිරීමට නිසි වේලාවක විවේකයක් මෙන්ම හොඳ රාත්‍රී නින්දක් අත්‍යවශ්‍ය වේ. මෙය කෘතිම බුද්ධිය මඟින් ලැබෙන ප්‍රධානතම වාසියකි.

මානව දෝෂ නොමැති වීම

මෙය කෘතිම බුද්ධිය භාවිතයේ පවතින ප්‍රධානතම මෙන්ම හොඳම වාසියකි. මන්ද විවිධ වැඩ කටයුතු සිදු කිරීමේදී මිනිසා අතින් දැනුවත්ව හා නොදැනුවත්වම විවිධ වැරදි සිදු වන නමුදු කෘතිම බුද්ධිය යනු කිසියම් විධිමත් ආකාරයකින් සකස් කරන ලද ක්‍රමවේදයකි. කෘතිම බුද්ධිය සමඟ, තීරණ ගනු ලබන්නේ කලින් ලබාගත් තොරතුරු වලින් යම් ඇල්ගොරිතම සමූහයක් යෙදීමෙනි. එම නිසා, දෝෂ අඩු වන අතර සාපේක්ෂව වැඩි නිරවද්‍යතාවයකින් යුතුව සාර්ථකත්වය කරා ළඟා වීමේ හැකියාව මෙය සතුව පවති.

ඉතා වේගයෙන් තීරණ ගැනීමට ඇති හැකියාව

තීරණ ගැනීමට මිනිසා මන්දගාමී ය. ඊට හේතුව වන්නේ තීරණයක් ගැනීමේදී මිනිසාට අන් අය පිළිබඳවද සිතීමට සිදු වීමයි. එමෙන්ම යම් අවස්ථාවන්වලදී අන් අයගේ හැඟීම්, දැනීම් ආදිය පිළිබඳවද සැලකීමට සිදු වේ, නමුත් කෘතිම බුද්ධිය යනු ක්‍රමලේඛිත පද්ධතියකි. එයට කිසිවෙකුගේ හැඟීම් නොදැනෙන අතර කිසිවෙකුගෙන් කිසිවක් විමසීමට ද අවශ්‍ය නොවේ. එය වැඩසටහන්ගත කර ඇති පරිදි සුදුසු තීරණ ගනී.

මිනිසුන් වෙනුවට අධි අවදානම් ගැනීම

මිනිසුන්ට ගත නොහැකි තත්වයේ පවතින ඉතා භයානක අවදානම් දැරීමට හැකිවීම කෘතිම බුද්ධියේ පවතින විශාලතම වාසියකි. කෘතිම බුද්ධියෙන් බල ගැන්වෙන රොබෝවක් නිර්මාණය කිරීමෙන් මිනිසුන්ට ඇති විය හැකි අනතුරු වලින් බේරා ගත හැකි අතර අවදානම් කටයුතු මෙම රොබෝවරුන් ආධාරයෙන් අධීක්ෂණය කළ හැකිය.

උදාහරණ ලෙස න්‍යෂ්ටික බෝම්බ යොදාගෙන කරනු ලබන පරීක්ෂණ, ගිනි කඳු, ග්ලැසියර් වැනි අතිශය භයානක ප්‍රදේශවල අත්හදා බැලීම් කිරීම සහ අධි බලැති බෝම්බයක් අක්‍රිය කිරීම වැනි දෑ දැක්විය හැකිය.

සුවිශේෂී ඩිජිටල් සහයක් ලබා ගත හැකි වීම

මෙය දැනටමත් විවිධ උපාංගවල භාවිතා වන ඉතාමත්ම ප්‍රයෝජනවත් ක්‍රමයකි. එමඟින් මිනිසුන්ට ඔවුන්ගේ දෛනික කාර්යයන් ඉටු කිරීම සහ එම කටයුතු කාර්යක්ෂමව සිදු කිරීම පහසු කරවයි. ඩිජිටල් සහායකයින් සෑම විටම පරිශීලකයින්ට අවශ්‍ය හොඳම තොරතුරු මෙන්ම අප සොයන ඕනෑම දෙයක් පිළිබඳ නිවැරදි තොරතුරු ලබා දීමට සූදානමින් සිටින නිසා මෙයද බොහෝ වැදගත් ප්‍රයෝජනයකි.

AI තාක්ෂණයේ ගැටලු

පුද්ගලයන්ගේ පුද්ගලිකත්වය පිළිබඳ ඇති වන ගැටලු

AI භාවිතා කර ප්‍රසිද්ධ පුද්ගලයන්ගේ අනුකරණය වන ඒ පුද්ගලයන්ගේ රූප හා සමානව ඡායාරූප වීඩියෝ පට නිර්මාණය වීම නම් යථාර්ථය සහ ව්‍යාජය අතර තියෙන සම්බන්ධය මගින් ආරක්ෂාව සම්බන්ධයෙන් විශාල ප්‍රශ්න ප්‍රමාණයක් මතුවී ඇත.

රැකියා අහිමි වීම

ඇමරිකාවේ ටෙස්ලා, ගූගල් ආදී සමාගම් මේ වනවිට කෘත්‍රිම බුද්ධියෙන් යුත් රියදුරු රහිත වාහන පිළිබඳ පර්යේෂණ කරමින් සිටී, එයින් ඇතැම් සේවාවන් මේ වනවිට සාර්ථක වී තිබේ. ඇස්, කන්, නාස මෙන් ක්‍රියාකරන සෙන්සර් මගින් ගත් දත්ත අනුව කෘත්‍රිම බුද්ධිය වාහන වල රියදුරු අසුන ආක්‍රමණය කරන විට, සැබැවින්ම රියදුරු රැකියා දස දහස් ගණනක් අවදානමට ලක් වේ. යන්ත්‍ර නිසා අතින් වැඩ කළ බොහෝ දෙනාට යන්ත්‍ර ක්‍රියාකරුවන් වීමේ හැකියාව ලැබුණි. එහෙත් අනාගතයේ යන්ත්‍ර ක්‍රියාකරවීමද කෘත්‍රිම බුද්ධියටම පැවරුනු කල යන්ත්‍ර ක්‍රියාකරුවන්ටද රැකියාවන් සොයාගන්නට ක්‍රමවේදයක් නොමැති වෙනු ඇත.

එදිනෙදා සේවාවන් අඩාලවීම

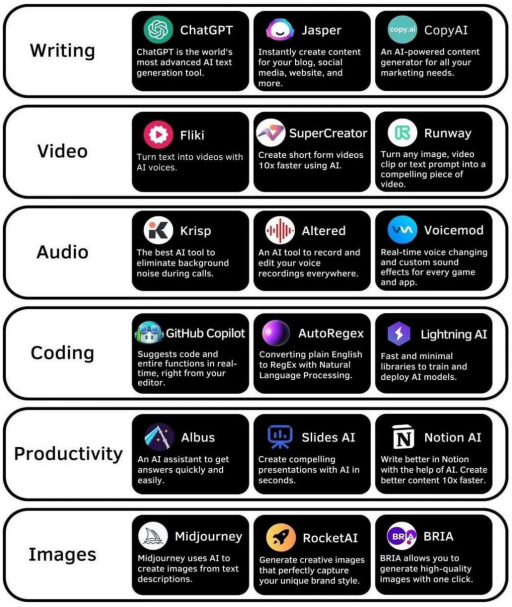
යම් යම් අභ්‍යන්තර පරිගණක පද්ධති දෝෂ නිසා ගුවන් ගමන් පවා හසුරුවාගැනීමට අපහසු වූ අවස්ථා තිබේ. දියුණු රටවල සෑම සියලු පද්ධතියක්ම පවා පාලනය කිරීමට කෘත්‍රිම බුද්ධිය පරිගණක පද්ධති හරහා පාවිච්චියට ගනී. එවැනි පද්ධතියක් අඩාල වූ කල, එය ඒ සමස්ථ සමාජයටම දැඩි බලපෑමකි. උදාහරණ ලෙස කෘත්‍රිම බුද්ධියෙන් පාලනය වන විදුලිබල පද්ධතියක් ගනිමු. එම කෘත්‍රිම පද්ධතියේ යම් අනතුරක් වූ කල එය පාලනය කිරීම පහසු කාර්යයක් නොවේ. මිනිසාගේ මොළය පාදක කරගෙන වැඩකටයුතු කළ යුගයේදී සරල වූ ක්‍රියාදාම රැසක් තවත් එවැනි මිනිස් මොළ වලින් ක්‍රියාත්මක කළ හැකි විය. එහෙත් අද අතිශය සංකීර්ණ පරිගණක පද්ධති වල වාර්තාගත වූ දොසක් මිනිස් මොළ විසින් අධ්‍යනය කොට වරද සොයාගන්නා විට ඇතැම් විට විය යුතු දේ වී හමාර වී තිබිය හැකිය.

සතුරෝ වෛරස් සහ හැකින් ප්‍රහාර සයිබර් ලෝකයේදී සිය සතුරුකම් සඳහා පාවිච්චි කරනු ලබති. සයිබර් ප්‍රහාර මගින් කෘත්‍රිම බුද්ධියේ ප්‍රතිඵල කෙලින්ම වෙනස් කළ හැකිය. කෘත්‍රිම බුද්ධියෙන්, තාක්ෂණයෙන් වැඩ කරන යන්ත්‍ර සහ පද්ධති වලට වෛරස හෝ හැක් කර ප්‍රහාර එල්ල කිරීමෙන් ඒවා අඩපණ වීම මෙන්ම, ඒවායේ ඇති තොරතුරු ආදිය පිටතට යෑම, වැරදි ලෙස ක්‍රියාත්මක වීම වැනි දෝෂ සහගත තත්ත්වයන් ඇතිවිය හැකිය. මිනිසාගේ කෘත්‍රිම බුද්ධිය තවත් මිනිස් කණ්ඩායමක් විසින්ම විකෘති කිරීම හැක් කිරීමේදී සිදු වේ.

කෘතීම බුද්ධිය භාවිතා වන මෙවලම් (AI Tools)

නිශ්චිත කාර්යයක් ඉටු කිරීමට සහ ගැටලු, විසඳීමට කෘතීම බුද්ධිය සඳහා වන ඇල්ගොරිදම භාවිතයෙන් නිර්මාණය කර ඇති මෘදුකාංග AI Tools ලෙස හැඳින්විය හැකිය.

පහත රූපයේ පෙන්වා ඇති දත්ත මගින් යම් යම් කාර්යයන් සඳහා භාවිතා වන AI Tools කිහිපයක් උදාහරණ වශයෙන් පෙන්වා ඇත.



සාරාංශය

කෘත්‍රිම බුද්ධිය මගින් කාලය හා ශ්‍රමය ඉතිරි කරනවා පමණක් නොව, මිනිස් වැරදි අවම කිරීම සහ ආරක්ෂිත වැඩ පරිසරයක් සහතික කිරීම මගින් අවදානම් අඩුකර ගැනීමටද හැකි වේ. ඊට අමතරව, AI සමඟින් සැලසුම් සහ කළමනාකරණයේ පුනරාවර්තන කාර්යයන් ස්වයංක්‍රීය කිරීම වඩාත් සංකීර්ණ සහ නිර්මාණාත්මක අංශ කෙරෙහි අවධානය යොමු කිරීම වැනි කාර්යයන් සඳහා මිනිසුන්ව යොමු කිරීම සිදු කරයි. තවද අපේ මිනිස් සිරුර, පරිසර පද්ධති, පරමාණු අණු, රසායනික පද්ධති ආදිය වඩාත් පහසුවෙන් අවබෝධ කරගැනීමට මිනිස් මොළවලට සහයෝගය ලබා දෙයි. මෙම තාක්ෂණය භාවිතයෙන් එකම උපකරණය වුවද විවිධ කාර්යයන්ට යොදාගැනීමට මිනිසාට හැකිය. එසේම අපගේ බුද්ධියේ සහයට ගත් කෘත්‍රිම බුද්ධිය අනාගතයේ විවිධාකාර තවත් කාර්යයන් වෙනුවෙන් යොදාගැනීමට මිනිසා පෙළඹෙනු ඇත. මෙම තාක්ෂණය සමූහ මිනිස් සංහතියේ සුභසිද්ධිය උදෙසා යොදා ගැනීම අප හට පැවරෙන වගකීමක් ලෙස සැලකිය යුතුය.

පරිශීලක මූලාශ්‍ර

ප්‍රකාශනය සන්නිවේදන හා මාධ්‍ය ඒකකය කැලණිය විශ්වවිද්‍යාලය https://units.kln.ac.lk/nemadala/index.php/fr/visheshanga/gaweshana/279-2022-06-27-04-18-48

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