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Review future greenhouse gas impacts

The International Maritime Organization (IMO) adopted the first set of international mandatory measures to improve ships' energy efficiency on July 15, 2011. In the last ten years, the IMO has taken many actions, including regulatory measures and the adoption of the IMO's initial Greenhouse Gas Strategy. To ensure its implementation, the IMO is implementing a comprehensive program of capacity building and technical assistance, including a range of global projects. Since the adoption of the Strategy, IMO has approved a Program of follow-up actions of the Initial Strategy up to 2023 and made good progress with the consideration and implementation of some of the short-term GHG reduction measures.

The European Union followed suit, when it exceeded its 2020 greenhouse gas reduction target of 20%. According to official data reported by member states in 2022, greenhouse gas emissions in the EU were 32% lower in 2020 than in 1990, exceeding the EU's climate target by 12 percentage points. The sharp drop in emissions observed in 2020, which was a result of the COVID-19 pandemic, contributed significantly to this overrun. Hence, emissions levels have been below the 2020 target since 2018. This includes emissions from international aviation and does not take into account carbon sinks from the land use, land use change and forestry sector. The Commission’s proposal to cut greenhouse gas emissions by at least 55% by 2030 sets Europe on a responsible path to becoming climate neutral by 2050

Based on a comprehensive impact assessment, it has been proposed to increase the EU's ambition on reducing greenhouse gases and set this more ambitious path for the next 10 years. The assessment shows how all sectors of the economy and society can contribute, and sets out the policy actions required to achieve this goal.

National GHG reduction targets are governed by the Effort Sharing legislation. The national targets cover sectors, such as transport, buildings, non-ETS industry, agriculture and waste. By 2030, EU projections submitted by Member States point to a 29% reduction in Effort Sharing emissions and a 47% reduction in ETS emissions compared to 2005 levels. Updated GHG projections will be reported by Member States in 2023.

Editorial Board

PROS AND CONS OF PRIVATIZATION IN THE MARITIME SECTOR IN EGYPT

Prepared By
Capt. Samy Ismail A. M. Youssef

المستخلص

الخصخصة هي نقل الملكية من القطاع العام إلى القطاع الخاص. بدأت الخصخصة فى مصر في أوائل التسعينيات. اعتمدت مصر مجموعة متنوعة من الأساليب لتنفيذ برنامج الخصخصة ، تختلف كل طريقة عن الأخرى. كشف تطبيق الخصخصة في مصر عن العديد من المزايا والعيوب. وقد أوضحت هذه الورقة الجوانب الإيجابية والسلبية. كما تم استعراض خصخصة القطاع البحري في مصر وما هي إيجابيات وسلبيات الاقتصاد المصري من جراء الخصخصة وأثر هذه الخصخصة على كفاءة وأداء القطاع البحري. وخلصت هذه الدراسة إلى أن التخصيص سيزيد من رؤوس أموال الشركات ويزيد السيولة المالية في الخزانة العامة للدولة ويخفف العبء المالي عن الموازنة العامة للدولة. اعتمد البحث فى جمع البيانات على الاستقصاء لمعرفة إيجابيات وسلبيات الخصخصة على القطاع البحري في مصر بعد تحليل نتائج المسح ، خلص الباحث إلى أن الخصخصة لها تأثير إيجابي على القطاع البحري في مصر.

Abstract

Privatization is the transfer of ownership from the public sector to the private sector. In Egypt, began privatization in the early 1990s. Egypt has adopted a variety of methods to implement its privatization program, each method being different from the others. The implementation of privatization in Egypt has revealed many advantages and disadvantages. This paper clarified the positive aspects and the negative aspects. Also, reviewed the privatization of the maritime sector in Egypt and what are the pros and cons that will be reflected on the Egyptian economy as a result of privatization, as well as the impact of this privatization on the efficiency and performance of the maritime sector. Opposition to the idea of privatization concluded through this study that privatization will increase the capital of companies as well as will increase the financial liquidity in the state`s public treasury and also reduce the financial burden on the state`s general budget. In collecting data, the research relied on the survey to find out the pros and cons of privatization on the maritime sector in Egypt After analyzing the results of the survey, the researcher concluded that privatization has a positive impact on the maritime sector in Egypt

Key words: Privatization – Pros & Cons – Efficiency – Performance

1. Introduction

This paper reviewed the concept of privatization in general, the history of privatization around the world, the different ways of implementing privatization, and global experiences in privatization, for example in the United Kingdom and the United States of America. In addition to discuss Egypt`s experience in privatization according to the government's privatization strategy, and the different forms and ways to implement privatization in Egypt, moreover the exposure to the pros and cons of privatization, and reviewed privatization in the maritime

transport sector, especially seaports in the world, focusing on Egyptian maritime transport. Furthermore, reviewed the opinions in favor and opposition to the idea of privatizing seaports by presented the reasons for support and opposition to privatization, The research relied on the review of previous researches, the method of data collection by conducting a survey.

2. Definition of privatization

Privatization, in its general and comprehensive concept, is to transfer public ownership to the private sector, partially or completely, including all laws, procedures and activities according to which the transfer process is conducted. Privatization has taken its scope within the economic reform and restructuring policies that developing countries seek to adopt as a response to the failure of comprehensive development policies based on state intervention to mobilize economic development mechanisms based on a comprehensive planning approach on the one hand and the reduction of external debts on the other hand. This reform is based in its fundamentals on liberating the economy from the domination of the public sector and relied on market mechanisms to allocate resources on the basis of competition within the framework of economic freedom (Starr, 1988).

3. History of privatization in the world

Since the early 1970s, the world has become aware of a new economic phenomenon called 'privatization'. To this end, several common definitions have emerged, centered on the state's renunciation of private sector ownership, or the transfer of ownership from the public sector to the private sector. Privatization began as a global economic phenomenon during this period. Between 1980 and 1992, more than 15,000 companies were privatized during this period, 3,800 of which were in countries that borrowed from the World Bank, and 85% of these operations were in Europe, Central Asia and Latin America in the former socialist economic zone (Megginson, 2003).

4. Global experiences in privatization

Many researchers emphasized that the number of privatized companies in the world increased significantly in his 1970s. Privatization has become a pervasive approach in all geographic regions of the world, also pointed out that the first part of the privatization process is the proportion of large developed countries such as the UK whose economies are predominantly capitalist, driven by a desire to increase corporate productivity.

4.1 Privatization in the United Kingdom

The UK privatization experience, which began with the Conservative government is considered successful is truly one of his pioneering experiences in terms of legislative, political and economic preparation. With stock market and tax structure reforms, privatization will cover all goods and services sectors of the economy, and promotional activities will focus on the use of intensive media and advertising campaigns aimed at all target market sectors .

This was done to convince, encourage and persuade them of the feasibility of privatization. For example, the media and advertising campaigns he continued to market for British Telecom for a year and a half, implemented a step-by-step method of privatization and start-up (Yarrow, 2002).

The UK government has taken a number of steps to expand its ownership base. The state encouraged founders to purchase state stock or a portion thereof, and gave to managers and workers in preference to purchasing stock**.** Finally, the UK government offers her two ways of controlling the selling price of companies proposed for privatization. This is either by direct decision or by auction. In any case, the relevant banks and relevant valuations are carried out prior to pricing. Professional accounting firm of the Ministry of Finance, then the issue ends with setting the price to be taken directly in the privatization business

4.2 Privatization in the United States of America

Although the United States of America is primarily a private sector country, there are some leaders in the capital who oppose the privatization of many federal government agencies, but the trend towards privatization is stronger at the state level. There are some states who have accomplished the privatization of public goods until the prison administration, processing government data, caring for children and many others, and one of the best examples is the state of Michigan. To fire prevention and some parts of police protection, sewage treatment, street lighting, street tree pruning, snow removal, parking sites, railways, hospitals and prisons, and even cemeteries management, and waste collection, and some states subjected more than. A public service to compete in the market, and companies advanced to accomplish these tasks with high efficiency and at low cost, which led to a reduction in the fees paid by the citizen for the services provided to him. In a special experience, the Teachers Union in Michigan took advantage of private sector facilities in the field of obtaining products food, postal and security services for its members instead of being provided by its agencies (Qanu', 2005).

5. Privatization in Egypt

The experience of privatization in Egypt began with the government's signing of an agreement with the World Bank in May 1991 to set up a corrective program for the structure of the Egyptian economy. The privatization program is a pivotal part of this correction. However, the real beginning of giving the private sector an influential role and importance was with the economic openness. According to the experience of privatization in Egypt Procedures Manual for the Government Program, (1996) was aimed at restructuring companies, increasing the rates of use of available energy, expanding the ownership base and providing the opportunity to contact foreign markets, obtaining modern technologies, attracting capital for investment, stimulating capital markets, as well as reducing Government support and ridding public institutions of their accumulated large losses.

An office for the business sector was also established, and then a ministerial committee was formed headed by the Prime Minister with the participation of the Minister of Public Business and the technical office of the Ministry, to approve and follow up the implementation of the privatization program. As for undertaking the implementation of the privatization program, it is entrusted to the holding companies - in accordance with the program approved by the Minister of Public Business Sector - which may seek the assistance of the expertise of local and foreign financial advisory institutions (Hindi, 1996).

5.1 Methods of implementing privatization programs in Egypt

A method of partial public offering of the company's capital included in the program, which is often within 10% of the number of shares due to fear of full public offering (Government Program Procedures Manual, 1996) large shares have a negative impact on the market value of the stock, and issuing the first part of a subscription at a small rate gives the opportunity to issue at a lower price than the actual price (Mohammed, 2012). It leads to the achievement of capital gains and gives a positive first impression of national investors participating in privatization programs. The Ministry of Public Economics has relied on selling some or part of its facilities through private subscription methods (saiah, 2012).

Employees of a company offered to privatize are given the opportunity to acquire a stake in capital at a discount of 20%, which is equivalent to 5% of the number of shares and their own (Government Program Procedures Manual, 1996). One share union is sold to workers (they consider it a private investment fund). The profits earned from the shares are distributed to the workers, who are members, and the workers' union members either leave the company or many workers dispose of the shares to generate capital gains at the end of the service. Therefore, it is advisable to ask for storage for at least one year (Wehbe, 1996).

Egypt's privatization program methods include encouraging negotiations to conclude a lease of available capacity that can be operated by the private sector, facilities and asset management contracts, and some idle assets have been effectively liquidated. Several steps have been taken and some legislation has changed to accommodate the privatization program. However, full legislative and legal preparations have not yet been completed, slow bureaucracy and long legal proceedings still make it difficult to implement court decisions, and capital is inherently timid. Egypt's privatization program lacks information and data to help investors decide whether to participate in the program, and the media and publicity of the privatization program is minimal and very limited. Therefore, the public's negative attitude toward privatization. Egyptian investors, foreigners, and all citizens of privatization have in mind the lifting of subsidies, rising prices, and the transformation of the nation from a social class with limited income. Many due to the lack of a limited rehabilitation and capacity building program for workers in projects where privatization was proposed, and a prepared plan to address the consequent shrinkage issues of the privatization program (Bon, 2012).

Corporate workers and executives have developed a dark situation of privatization, led by a privatization program leading to opposition from these corporate executives and workers, this resistance to citizens, investors, businesses, politics and it is exacerbated by the lack of programs to raise awareness of privatization issues among government leaders and workers (Fayez, 1996).

In addition, due to the nationalization process on Egypt's privatization program, inadequate media and advertising efforts, and the steps introduced into the black image crouched in the heart of the experience, previous among domestic and foreign investors. (According to the Ministry of Business, Department of Technology, 1993, 1996)

Considering the Egyptian government's privatization strategy, there were several forms of implementation of the privatization process in Egypt, for example, the first full sale. The property owned the government in the private sector. In most cases, the company has fired most of its existing employees. Second, it seeks to expose some of the value of the enterprise, build partnerships between the public and private sectors, enjoy the benefits of the private sector and overcome the shortcomings of the public sector. There are other ways to privatize, each with its own strengths and weaknesses. Therefore, the government needs to study the various forms of

privatization and choose the appropriate method in order to maximize the benefits of privatization and avoid the economic damage that may be inflicted on it.

6. pros & cons of privatization

Privatization means that state-owned companies become owned by private companies. For example, if the government needs money, can sell a piece of land to a private company, and the private company can build a house then sell. Privatization can have many different pros and has become very popular recently. However, privatization also has cons.

6.1 Pros of privatization

The privatization of the government sector aims to achieve many productive advantages and services provided by institutions, and it will be summarized as follows:

- Raising the country's economic growth rate.
- Exploiting government institutions that do not bring profit to the state and reducing the financial burdens borne by the state's general budget to support institutions to ensure their continuity and compensate for their losses.
- Facing the budget deficit by providing resources to the state's public treasury through the proceeds from the sale of public institutions.
- Activating the role of the private sector in developing the economy through the services or products it provides.
- Reducing financial and administrative corruption, as the government sector is more vulnerable to corruption than the private sector.
- Achieving the inverse relationship between the profits made due to the strength and efficiency of the services provided by the private sector and the tax.
- Activating many projects, activities or other practical offices such as advertising, performance evaluation and other projects related to commercial activity (Bholane, 2014).

6.2 Cons of privatization

The privatization process has negative effects on many segments of society, including the following:

- The high rate of poverty and the high rate of monopoly on projects due to their privatization and the sums of money spent in running their activities.
- Neglecting the public interest because the private cares about money, which leads to the deterioration of some public services for citizens of the middle and lower categories.
- High rates of inflation.
- The absence of democracy and the state of social and economic equality. (Tetteh, 2013).

7. Privatization of maritime sector in Egypt

In recent years, since ports are an industry that requires a large amount of capital, countries around the world are moving toward port reform through privatization, which can improve the performance and efficiency of ports and reduce the financial burden on governments. A view in favor of privatization is that the transfer of ownership from the public sector to the private sector leads to improved port performance and efficiency (Cullinane, 2002).

Most countries in the world are responding to the global trend of government privatization (airports, highways, water supply and sanitation) in developed and developing countries by

handing over operational responsibility for ports and port facilities to private companies. Following the public sector retains responsibility for basic regulatory functions such as maritime safety regulation, contract monitoring and enforcement. (Research on Factors Affecting the Development and Modernization of Arab Ports, Arab League Report, Cairo, 2006), many reports argue that the concept of privatization in ports is a means, not an end. It points to a trend toward privatization. It was primarily intended to increase port productivity. A feature of the privatization application is that the port authority relies on its own funds and does not rely on financial support from the state. The Port Authority can be considered as one of the most prevalent applications of the privatization concept in the world, a property rights system that has fulfilled the aforementioned mechanism. The experience of international ports proves that huge leaps have been made in developing port productivity and reducing the cost of services as a result of the application of private sector trust systems in port management and, at various transshipment stations, as a result of tracked commercial assets and integrated information systems that contribute to the speed of procedures and regulations to be followed and the security of planning, execution, follow-up and correction at all stages of work Use Port. Privatization should not be a sale of assets, but a privatization of public administration and liberation from rigid rules and regulations .

Therefore, it can be said that the application of port privatization will enhance the competitiveness of ports. Privatization programs should include promoting competitiveness within the port. The purpose of privatization is to break the monopoly of government agencies that cannot adequately manage their burdens and to continuously develop their services for better results. In less time and at the lowest cost. Ports using modern technology and equipment with the aim of providing workers with strong and superior superstructures and infrastructure to reduce accidents, casualties, ship waiting times and revenues. By increasing the frequency of ships entering the port and the amount of goods circulated, the goods will pass through the port and a portion of the profits will be used for necessary work has entered into several Public private partnership projects and has shown strong performance. In the case of a private station operator, (the port authority enters into a concession contract with the operator).

In 1999 Egypt's Sokhna Port Development Company (SPDC) was awarded the first construction, operations and relocation program for 25 years. His second Build, Operate and transfer (BOT) 49 year program was awarded at the Suez Canal Container Terminal (SCCT). Since then, Egyptian port authorities have viewed his BOT as a standard program for public-private partnership planning. The aim was to create a key hub port, improve port efficiency, expand port capacity, attract foreign investment, and create jobs (JICA, 2012). Egyptian experience in the privatization of ports and container terminals such as Ain Sukhna Port, SCCT and AICT. Some views agree and strongly support the idea of privatization, which has been noted as the best solution to all the problems that Egyptian ports are suffering from. An unloading that needs to be replaced and evolved to keep up with global developments .

Private sector has the financial and technical capacity to respond to global advances in the shipping industry and to partner with the private sector to reduce the financial burden on governments. All of this will have a positive impact on improving the efficiency, performance and competitiveness of Egyptian ports. In general and the maritime sector in particular, believing that Egyptian ports are part of Egypt's national security and cannot be abandoned .

The government should study to develop ports to keep up with the global development of the shipping industry. This will be done through studying and analyzing previous experiences of privatization forms and methods and choosing the form that suits the Egyptian situation, through the government's use of the best economic experts.

8. Development of Questionnaire

Questionnaire is one of the most well-known and most frequently used analyzing methods. It provides a convenient way to collect information from specific population groups (Rojas, 2007). Questionnaires are defined as "tools for gathering information to explain, compare, or explain knowledge, attitudes, behaviors, and / or socio-demographic characteristics. The methodology is fairly flexible when measuring different types of data (subjective, objective, qualitative, and quantitative). In general, there are several types of questionnaires that can be used when conducting a survey By Mail surveys, group management surveys, household approvals, face-to-face interviews, and telephone interviews (Westers, 2006).

Nonetheless, respondents who respond to the questionnaire often want to limit their answers, which can cause the questionnaire to lose its point. However, researchers can overcome this problem to some extent by providing ample space for comments. On the other hand, low response rates for written surveys, especially mail surveys, are the most common problem and can dramatically reduce the credibility of survey results. Needless to say, postal surveys may not be answered by the data subject, which further adversely affects survey results.

The following equation was used to calculate the sample size, where the number of the study population was about 900 employees, and through the use of this equation, the research sample was determined, which amounted to 265.

$$n = \frac{X^2 * N * P * (1-P)}{(ME^2 * (N-1)) + (X^2 * P * (1-P))}$$

Where:

n = sample size.

X^2 = Chi-square for the specified confidence level at 1 degree of freedom.

N = Population Size.

P = population proportion (.50)

ME = desired Margin of Error (expressed as a proportion)

An opinion poll was conducted for Egyptian maritime sector, by taking a sample of workers at the middle and senior management level.

Questionnaire questions were selected to find out whether privatization has a positive or negative impact on the maritime sector in Egypt. By collecting and analyzing the results of the questionnaire, found that privatization has a positive impact on the maritime sector in Egypt.

8.1 Descriptive Analysis

1. Privatization has a positive impact on productivity of maritime sector in Egypt.

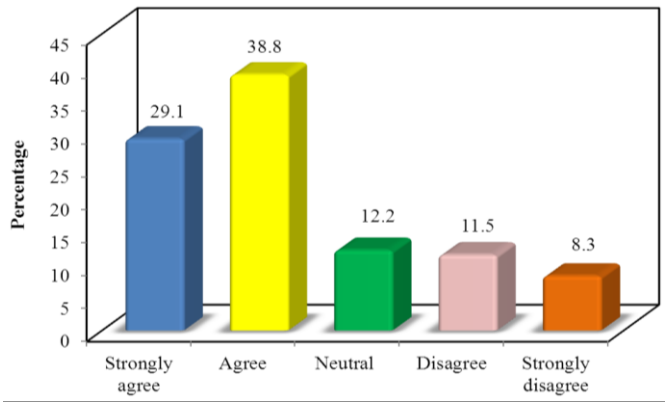

Figure (1.1): Privatization has a positive impact on productivity of maritime sector in Egypt.

Figure (1-1) shows that 67.9% agree that 1- Privatization has a positive impact on productivity of maritime sector in Egypt, there are 19.8% not agree and 12.2% neutral.

2. Privatization has a positive impact on performance of maritime sector in Egypt.

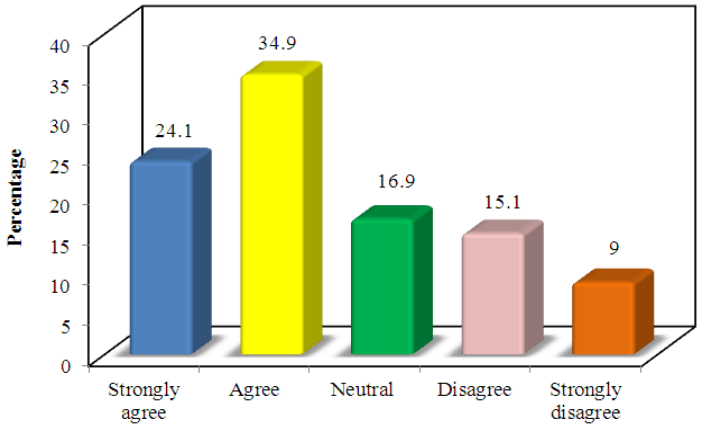

Figure (1.2): Privatization has a positive impact on performance of maritime sector in Egypt.

Figure (1-2) shows that 59% agreed that Privatization has a positive impact on performance of maritime sector in Egypt. There are 24.1% not agree and 16.9% neutral.

3. Privatization has a positive impact on efficiency of maritime sector in Egypt.

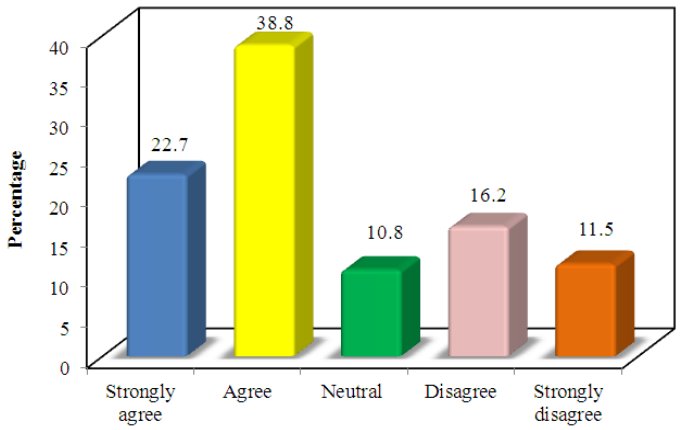

Figure (1.3): Privatization has a positive impact on efficiency of maritime sector in Egypt.

Figure (1-3) shows that 61.5% agree that Privatization has a positive impact on efficiency of maritime sector in Egypt. And 27.7% not agree and 10.8% neutral.

8.2 Hypothesis Test

Table (1.1): Multivariate Linear regression for privatization

	B	SE	Beta	t	p
(Constant)	0.137	0.112		1.225	0.222
Performance	0.660	0.105	0.557	6.296*	<0.001*
Efficiency	0.372	0.073	0.342	5.074*	<0.001*
Productivity	-0.058	0.084	-0.052	-0.684	0.494
R^2=0.675,adjustedR^2=0.671,SE=0.75,F=189.524*,p<0.001*					

F,p: f and p values for the model
R^2: Coefficient of determination
B: Unstandardized Coefficients
SE: Estimates Standard error
Beta: Standardized Coefficients
t: t-test of significance
*: Statistically significant at $p \leq 0.05$

Table (1.1) shows the multiple regression analysis for the impact of the three variables under study together on privatization. It was found out that performance has the most significant positive impact on privatization followed by efficiency in the presence of other variables (P-value< 0.05). While productivity has insignificant positive impact on privatization.

9. Conclusion

This paper reviewed the concept of privatization in general, its history around the world, and the different methods of implementing it, in addition to presenting some international experiences in privatization. In addition to reviewing the pros and cons of privatization in the maritime sector in Egypt. The research relied on data collection on the survey and then analyzed by a program to a statistician. Through analyzing the results of the survey data, it was reached that privatization has a positive impact on the maritime sector in Egypt**.**

10. References

- Rahman; A., (1992), "The Privatization of Public Tele- communication Services: The Malaysian Experience", Conference on Privatization in Developing Countries, Islamabad, Pakistan, 2-6 March.

- Suleiman; E., (1990). "The Politics of Privatization in Britain and France" in E. Suleiman & J. Waterbury, eds.

- Baer; Werner & Mc Donald; Curt, (1998). "A return to the Past? Brazil's Privatization of Public Utilities: The case of the electric Power Sector", Quartetly Review of Economics and Finance, fall, Vol, 38, No., 3, PP., 503 – 523".

- Feldman; Roger, D., (1997), "Privatization Options for Capital attraction by the Brazilian Power Industry", Journal of Project Finance, spring, Vol., 3, No., 1, pp., 31-40.

- Makler; Harry. M., (2000), "Bank Transformation and Privatization in Brazil: Financial Federalism and some lessons about bank Privatization ", Quarterly Review of Economics and Finance, spring, Vol., 40, No., 1, PP., 45-69.

- Milman; Claudio, (1996),: "Attitudes Towards debt - equity- swaps and Privatization of State-owned enterprises in Chile, Public Budgeting and Financial Management, Summer, vol., 8, No., PP., 170-187.

- Ramirez; Miguel D., (1998), “Privatization and Regulatory Reform in Mexico and Chile: A critical Overview”, Quarterly Review of Economics and finance, fall, Vol., 38, No., 3, PP., 421 - 439.

- Aspe; P., (1994), "Thoughts on the Mexican Privatization Experience", the Mckinsey Quarterly, No., 2.

- Newell; R., (1994), "Learning from Mexican Privatization", the Mckinsey Quarterly, No, 2.
- World Bank; (1992), "(Malaysia: Country Memorandum) Country Development, East Asia and the Pacific Region", Report No., 10758 (Restricted), World Bank, Washington D.C., USA.

- Bishop; M. & Thompson; D., (1993), Privatization in the UK: Regulatory Reform and Public Enterprise Performance" in M. Ramanadham ed., Privatization: A Global Perspective. England, Routledge.

- Cragg; Michael Ian and Dyck; I.J. Alexander, (1999), “Management Control and Privatization in the United Kingdom”, Rand Journal of Economics, autumn, Vol. 30, No., 3, PP., 475 - 497.

- Grimsone; G., (1990), "The British Privatization Programme", in J. Richardson ed., Privatization and Deregultion in Canada and Britain, United Kingdom: Dartmouth

- Grout; P., (1995), "Popular capitalism", in M. Bishop Elt, al., eds., Privatization and Economic Performance, London: Oxford University Press.

- Hindi, Dr. Mounir, "The Egyptian Experience in Privatization", in Ashour, Dr. Ahmed Saqr (Editor), "Transformation to the Private Sector, Arab Experiences in Privatizing Public Enterprises", Cairo: Arab Organization for Administrative Sciences, 1996 AD.

- Wehbe, Salem, Fayez, Manal, the capital market and privatization and between them the investors, Al-Ahram Al-Iqtisadi Series, Dar Al-Ahram, 1996 AD, Cairo.

- Starr, P. (1988). The meaning of privatization. Yale Law & Policy Review, 6(1), 6-41 Megginson, W. L., & Netter, J. M. (2003). History and methods of privatization. International handbook on privatization, 25-40.

- Yarrow, G. (2002). Privatization in the UK. In Constraints and impacts of privatisation (pp. 80-96). Routledge.

Using Multiple Criteria Decision Making Application to Select Subpar Ships Accordance To Challenges of Modern Technology

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المستخلص

تهدف هذه الورقة إلى التحقيق في الابتكار التكنولوجي ، وأهمية استخدام قاعدة البيانات الرقمية ، في تسهيل مراقبة دولة الميناء PSC لتسهيل ورقمنه الاتفاقيات والمدونات الحالية ، بعد تعديلها لتتوافق مع الابتكار المستقل لتطوير نظام PSC للتفتيش علي السفن المطبقة لمعاهده SOLAS ودعم التكنولوجيا الجديدة القادمة للسفن الحديثة وتجنب أوجه القصور في الإطار الحالي ، وتوفر نموذجًا متكاملًا قادرًا على اختيار السفن دون المستوى القياسي ، ويعمل كإجراء مكمل لنظام PSC.

تم اختيار عملية التسلسل الهرمي التحليلي (AHP) وطريقة تفضيل الطلب بناءً على نماذج تشابه الحل المثالي (TOPSIS) لاتخاذ القرارات ، باستخدام طرق معايير متعددة. تم استخدام هذه الطرق لترتيب السفن البديلة التي سيتم فحصها وفقًا للمتغيرات المستهدفة المعتمدة. العناصر التالية هي جزء من نظام اختيار السفن للتفتيش المقترح في هذه الدراسة: العوامل التي يجب مراعاتها تشمل تاريخ البناء ، والسفينة المحددة ، وبلد التسجيل ، وعدد العيوب ، هيئه الاشراف التابعة لها السفينة ، وعدد أوجه القصور التي لم يتم حلها ، والفترة الزمنية منذ آخر تفتيش ، ومشغلي السفن ، والمستثمرين ، وكمية الضحايا والمخالفات.

يشكل شكل استراتيجية الاتفاقية تحديًا في استخدام هذا الشكل الجديد من التكنولوجيا. ويتجلى ذلك ، في ظل عدم وجود لوائح ، بذكر معدات السفن الحديثة ، وكذلك استراتيجية استخدام التكنولوجيا الجديدة ، من خلال PSC ، لإدارة وفحص عملية الشحن الآمن لتجنب الحوادث البحرية وحماية البيئة. تم الجمع بين التحليلات الكمية والنوعية لتحقيق الأهداف الرئيسية للدراسة.

الكلمات الرئيسية: مراقبة دوله الميناء وعملية التسلسل الهرمي التحليلي وطريقة تفضيل الطلب على أساس تشابه الحل المثالي.

Abstract

This paper aims to investigate the technological innovation, and the importance of using the digitalized database, in facilitating the Port State Control (PSC)asks and digitalizing the current conventions and codes, after being amended to cope with the autonomous innovation to develop a (PSC) pointed-SOLAS ships-for-inspection system and support the upcoming new technology **Modern s**hips which avoids the deficiencies of the existing framework, provides an integrated model capable to select the substandard ships, and acts as a complementary measure to PSC system.

The Analytic Hierarchy Process (AHP) and Method for Order Preference Based on Ideal Solution Similarity (TOPSIS) models for Making Decisions, Using Multiple Criteria methods were chosen. These methods were used to rank the alternative ships that would be examined in accordance with the adopted targeted variables. The following elements are part of the system for choosing ships for inspection that is proposed in this study: Factors to take into account include the Kell laid, the ship specific, the country of registry, the number of flaws, the overall number of claims, the classification society, the number of unresolved deficiencies, the interval since the last inspection, the ship operators, the investors, and the quantity of casualties and violations.

The form of the convention's strategy poses a challenge in using this new form of technology. This is apparent, in the absence of regulations, mentioning the Modern ships equipment, as well as, a strategy for using the new technology, through the PSC, to manage and inspect the safe shipping operation to avoid marine accidents and protect the environment .Quantitative and qualitative analyses were combined to achieve the main objectives of the study.

Keywords: Port State Control , Analytic Hierarchy Process and Method for Order Preference Based on Ideal Solution Similarity .

1. Bckground

Stakeholders with an interest in the shipping sector have support the goals and aspect for PSC role . Many of those parties have stated that the alliances between fleets and the modifications to market processes are the root causes of this issue. Numerous other factors, including the general inability of those developing nations to implement and adhere to the most recent and frequent technical amendments to International Maritime Organization (IMO) instruments, the use of tacit acceptance techniques to bring the technical amendments into force, and the widespread implementation of PSC around the globe, all significantly contributed to the decline in the global fleet.

The IMO has created a number of regulations , conventions and instruments to decrease the loss of life, shipping losses, and environmental disaster that are frequently linked to maritime casualties. Marine casualties have always been a major problems . Numerous strategies to prevent the conditions that cause accidents have been developed as a result of these international treaties. While some are used on land to promote navigation safety, others are implemented at sea to ameliorate the situation, and some are used on ships to assure operational effectiveness, casualties still happen with worrying regularity.

By putting the ships under some forms of control, further measures are thought necessary to guarantee the proper application of international conventions and treaties. Then, it has been acknowledged that ports may contribute to the promotion of maritime safety and environment protection to complete the safety system as nodes in the supply chain for seaborne trade. Flag State Control (FSC) and PSC are the two aspects of ship control, respectively PSC. The IMO has established the standards for putting into practice the appropriate processes for both by the administrations to eradicate the substandard ships.

2. Introduction

Modern ship technology, Robotics, Drones, and E-certificates are already used in marine sectors and approved by port authorities under regulatory framework. The legal concern is understandable given that the autonomous shipping market, which was estimated in 2018 to be worth USD 6.1 billion, is now projected by some to be worth a staggering $136 billion by 2030 (koscielecki, et al., 2019).

There are numerous autonomous features and benefits for maritime shipping, including not only the reduction or elimination of human errors and crew claims, but also the accuracy of using AHP-TOPSIS model for data analysis to achieve and determine corrective action.

The exciting development of a "smart ship" will transform the landscape of ship design and operations, but this revolution will be fraught with difficulties. This briefing defines autonomous ships while focusing on the International Conventions and Regulations that will need to be updated to accommodate this new technological revolution.

The integrated model, which is the primary contribution of this effort, attempts to improve the effectiveness of the ship-selection system, i.e. increasing both stability and efficiency, within the existing PSC framework, and solves the ship-selection problem associated with the three approaches used herein.

In the following sections, the structure of the integrated selecting-ship-for-inspection system is outlined. Then it is applied to the case study and results obtained are presented and analyzed.

Finally, the findings of this paper are that, booming of SOLAS ships and new Autonomous technology and the integration with the AHP-TOPSIS modeling, with the benefits of transparency and cost-efficiency, facing major problems in working at sea will be minimized, also, there will be a scheme to follow in the updated conventions & the PSC inspections, that will update the new effective standards, in the maritime industry, that will diminish marine accidents.

3. Method Use And Tools .

There are several different Multi-Criteria Decision Making (MCDM) strategies, each of which can be used to a variety of challenges in fields like education, the environment, risk assessment, and decision-making. Since each of the MCDM approaches has its own benefits and drawbacks, and because the choice of the best strategy largely depends on the problem being studied, it is difficult to determine which approach is the most efficient and appropriate.

In order to increase the effectiveness of the PSC programme, the current research introduced the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) approach. This strategy has the advantage of successfully identifying the optimal alternative and addressing challenging decision-making issues. The TOPSIS approach makes the assumption that each factor has a tendency to monotonically increase or decrease utility, which makes it easy to define the ideal solutions that are both positive and negative. However, this approach needs to determine the weights of selected factors, and it does so by asking experts for their opinions. *[Lai, et al (1994); Deng, et al (2000); Opricovic and Tzeng (2004); Srdjevic, et al (2004); Haisha (2008); Hung and Chen (2009); Fouladgar, et al (2011) and El Syaed, et al (2014)].*

It would be more acceptable to employ a strong and relevant technique such as Analytic Hierarchy Process to address the TOPSIS approach's weakness of the difficulty to weigh considerations and maintain consistency of judgement (AHP). The latter approach has many benefits, including the following: (a) it makes use of the preferences of the experts based on their knowledge and experiences; (b) it checks the consistency of the information before eliminating any inconsistent information accordingly, reducing uncertainties in the results; and (c) it derives the factor weights by using pair-wise comparisons in accordance with the preferences of the experts. *[McCaffrey (2005); Berrittella, et al (2007); Behzadian, et al (2012); Nasim, et al (2013); El Syaed, et al (2014) and Pangsri (2015)]*

These findings led to the conclusion that the TOPSIS and AHP techniques make up two solid options for the current study. It was sought to blend the two approaches in order to create a hybrid strategy that would lessen their weaknesses while combining their strengths. The challenges encountered when applying the TOPSIS and AHP techniques separately may be overcome by the hybrid approach. The weight of each individual element was initially determined using the AHP method. The study was then finished using TOPSIS until substitute ships were ranked.

4. Structure of The Proposed Selecting Ship For Inspection System

This section describes the detailed methodology which includes three steps to construct the integrated selecting-ships-for inspection system as follows:

Step 1: The expert's judgments are used to evaluate the eleven factors, (f_1, f_2, f_3, f_4, …., f_{11}), includes the following factors: Kell laid, ship specific, nationality of registry, a number of shortcomings, total number of claims, classification society, number of outstanding deficiencies, time since last inspection, ship operators, investors, and number of casualties and violations are all factors to consider.

Step 2: The AHP approach is used to check consistency of the experts' judgements, then assign weight to each factor, (w_1, w_2, w_3, w_4 ...., w_{11}), which represents the importance of the factor.

Step 3: The alternative vessels to be checked are marking using the TOPSIS method.

Figure (1) shows the structure of the proposed selecting-ship-for inspection system.

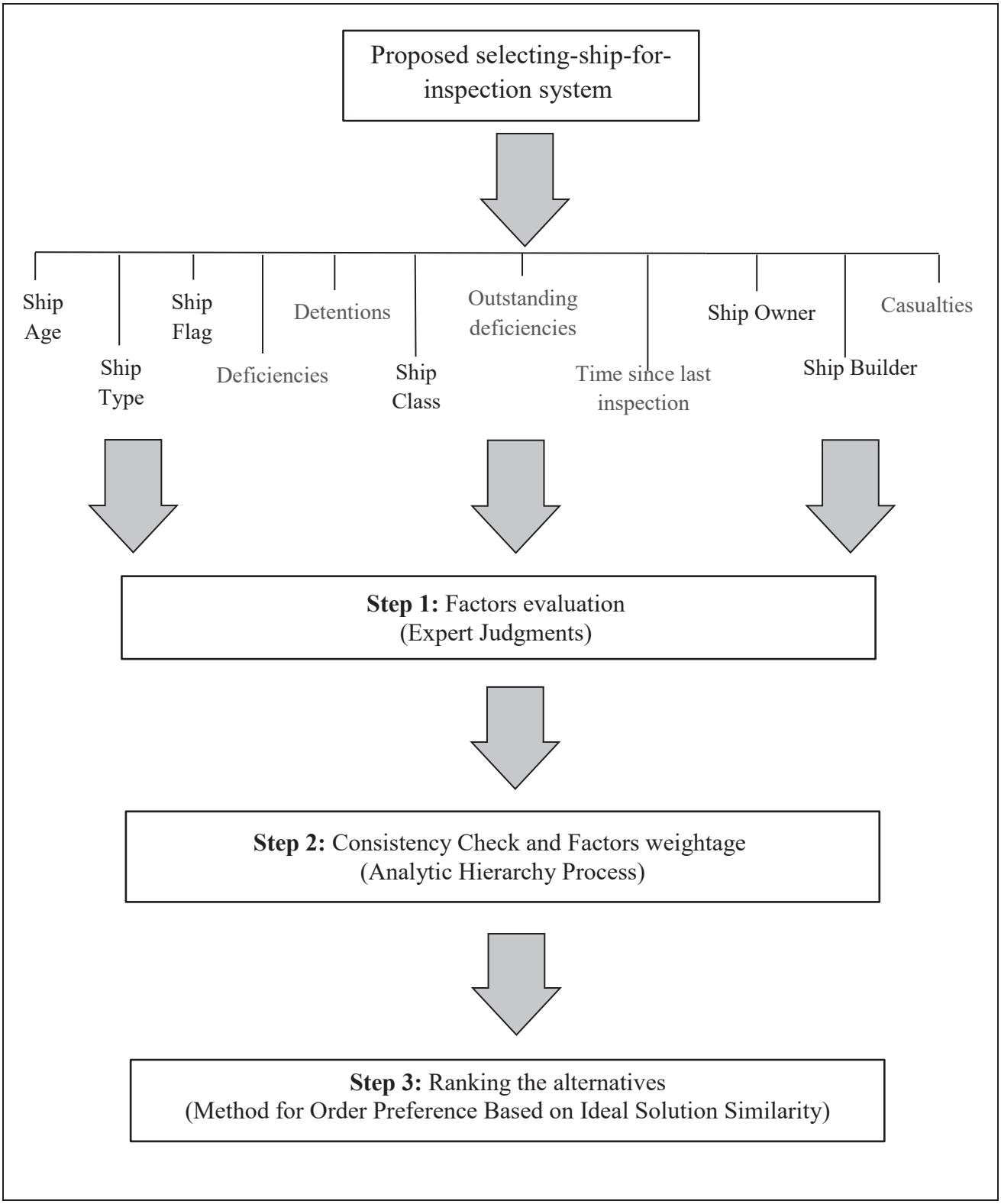

Figure (1) Structure of the proposed selecting-ship-for-inspection system

5. Data Collection

The main tenet of the PSC order is that inspect foreign ships in their national ports to ensure that they are manned and operated in accordance with the relevant international laws and that their hull, machinery, and safety equipment comply with maritime regulations and conventions. The PSC has the authority to demand that flaws be fixed and, if necessary, to imprison ships for this purpose.

Ten ships are thought to be stopping at a fictitious port in the case study under discussion; for the sake of discussion, the ships will be coded S1, S2, S3,..., S10. Only four inspectors from the PSC office are in charge of conducting on-board inspections.

One ship may be inspected every day by each inspector. The challenge here is how to choose these 4 ships properly since there are 4 ships that need to be inspected out of the10 that need to be inspected. To achieve this, the Hybrid technique was used to rank the 10 ships.

6. Application of The Proposed Selecting Ship For Inspection System

One of the objectives of PSC is to set targeting factors to help identify what priority a particular foreign ship should be given for inspection in the region. The proposed structure of the selecting-ships-for-inspection model in this study includes the three main groups of factors as follows: firstly, the ship's characteristics such as ship age and ship type; secondly, the performance of the flag state, ship owner, classification society and ship builder; and thirdly, records from previous inspections such as number of detentions, number of deficiencies, number of outstanding deficiencies, number of casualties/violations, and time since last inspection.

As such, this study proposes an integrated AHP-TOPSIS model; AHP technique is concerned with the calculation of the weight of the selected factors, whereas TOPSIS technique is employed to rank the alternative ships based on their overall performance.

Figure (2) shows the flow of the processes of the proposed hybrid approach combining AHP and TOPSIS for the selecting-ships-for-inspection system.

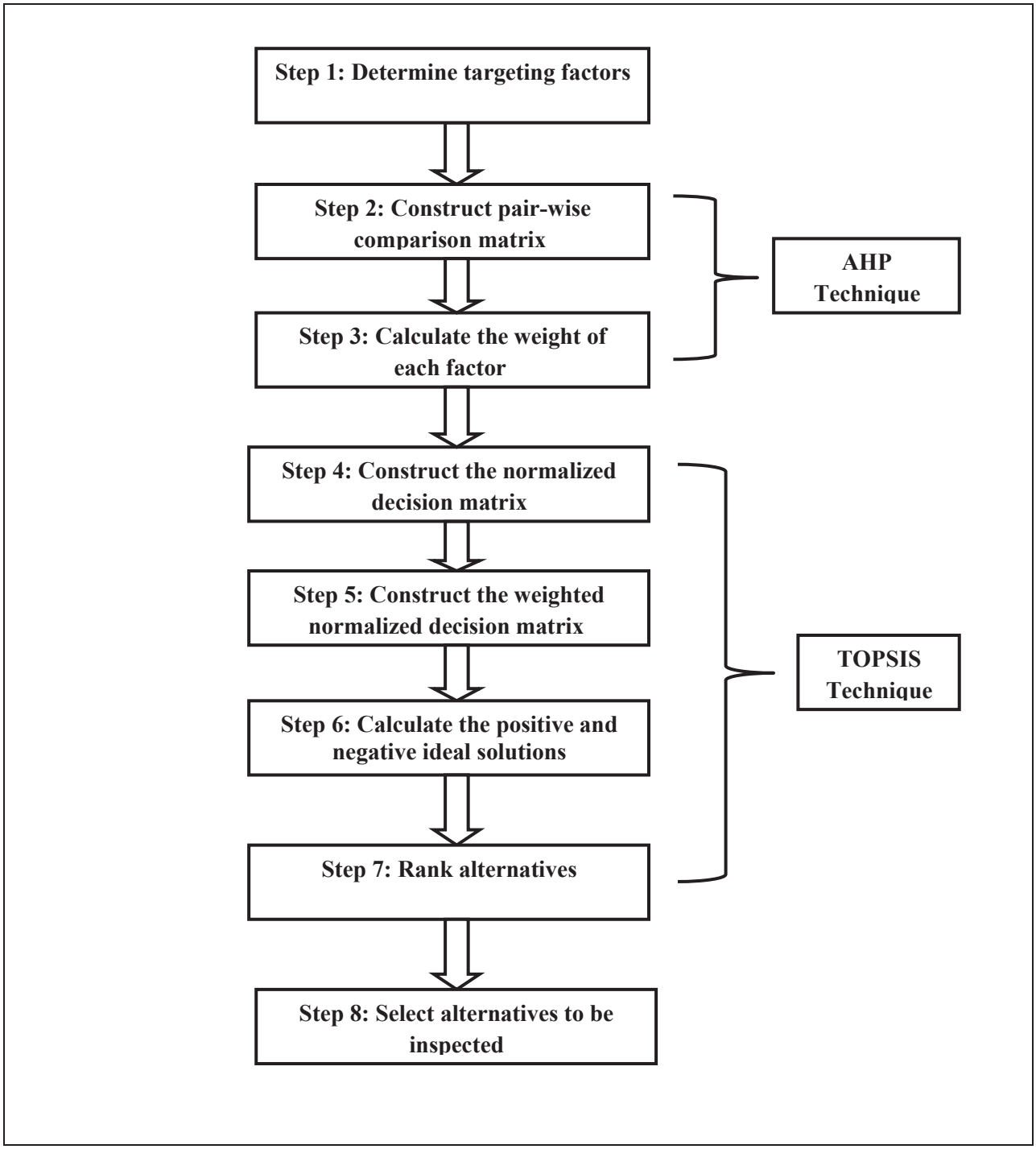

Figure (2) Research flowchart

The statistical technique (Excel sheet) has been used to calculate the variance and standard deviation for the eleven factors. The standard deviation results ranged from (0.0637) to (2.1088), and the variance from (0.0041) to (4.4470), as shown in Table. The relative importance of each factor indicated in Figure (3).

Table 1: Standard Deviation and Variance

Standard Deviation	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
F1	**0.0000**	0.7111	0.2351	1.2673	0.7638	0.5947	1.2792	1.5050	0.6536	0.8559	1.0104
F2	0.4624	**0.0000**	0.1187	0.6686	0.6495	0.2024	0.6030	1.1645	0.2406	0.5014	0.6696
F3	1.8320	1.6765	**0.0000**	1.6143	1.6214	1.3790	1.7495	2.1373	0.7217	1.3790	1.6214
F4	0.2209	0.2508	0.0637	**0.0000**	0.2344	0.2285	0.4330	0.5823	0.0981	0.1386	0.2709
F5	0.5810	1.0028	0.1454	0.9374	**0.0000**	0.1306	1.3371	1.4355	0.3026	0.2419	0.5365
F6	0.9415	1.0000	0.2941	1.6765	1.0445	**0.0000**	1.2401	1.8809	0.4866	0.8010	1.3671
F7	0.2258	0.2171	0.0663	0.3693	0.2706	0.1107	**0.0000**	0.5691	0.0996	0.1444	0.2828
F8	0.2369	0.2655	0.0637	0.4438	0.2679	0.1257	0.4330	**0.0000**	0.1050	0.1527	0.2937
F9	2.0835	1.9752	0.4576	1.6765	2.1088	1.0967	1.6765	2.1088	**0.0000**	0.9374	1.7838
F10	1.0208	1.2454	0.3087	1.7123	0.9653	1.0285	1.8320	1.8007	0.2983	**0.0000**	1.0731
F11	0.4891	1.0188	0.1222	0.8348	0.4981	1.0624	1.3484	1.5050	0.2396	0.2491	**0.0000**
Variance	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**	**F11**
F1	**0.0000**	0.5057	0.0553	1.6061	0.5833	0.3537	1.6364	2.2652	0.4272	0.7325	1.0208
F2	0.2138	**0.0000**	0.0141	0.4470	0.4219	0.0410	0.3636	1.3561	0.0579	0.2514	0.4484
F3	3.3561	2.8106	**0.0000**	2.6061	2.6288	1.9015	3.0606	4.5682	0.5208	1.9015	2.6288
F4	0.0488	0.0629	0.0041	**0.0000**	0.0549	0.0522	0.1875	0.3390	0.0096	0.0192	0.0734
F5	0.3375	1.0057	0.0211	0.8788	**0.0000**	0.0170	1.7879	2.0606	0.0915	0.0585	0.2879
F6	0.8864	1.0000	0.0865	2.8106	1.0909	**0.0000**	1.5379	3.5379	0.2367	0.6416	1.8688
F7	0.0510	0.0471	0.0044	0.1364	0.0732	0.0122	**0.0000**	0.3239	0.0099	0.0208	0.0800
F8	0.0561	0.0705	0.0041	0.1970	0.0718	0.0158	0.1875	**0.0000**	0.0110	0.0233	0.0863
F9	4.3409	3.9015	0.2094	2.8106	4.4470	1.2027	2.8106	4.4470	**0.0000**	0.8788	3.1818
F10	1.0421	1.5511	0.0953	2.9318	0.9318	1.0579	3.3561	3.2424	0.0890	**0.0000**	1.1515
F11	0.2392	1.0379	0.0149	0.6970	0.2481	1.1287	1.8182	2.2652	0.0574	0.0620	**0.0000**

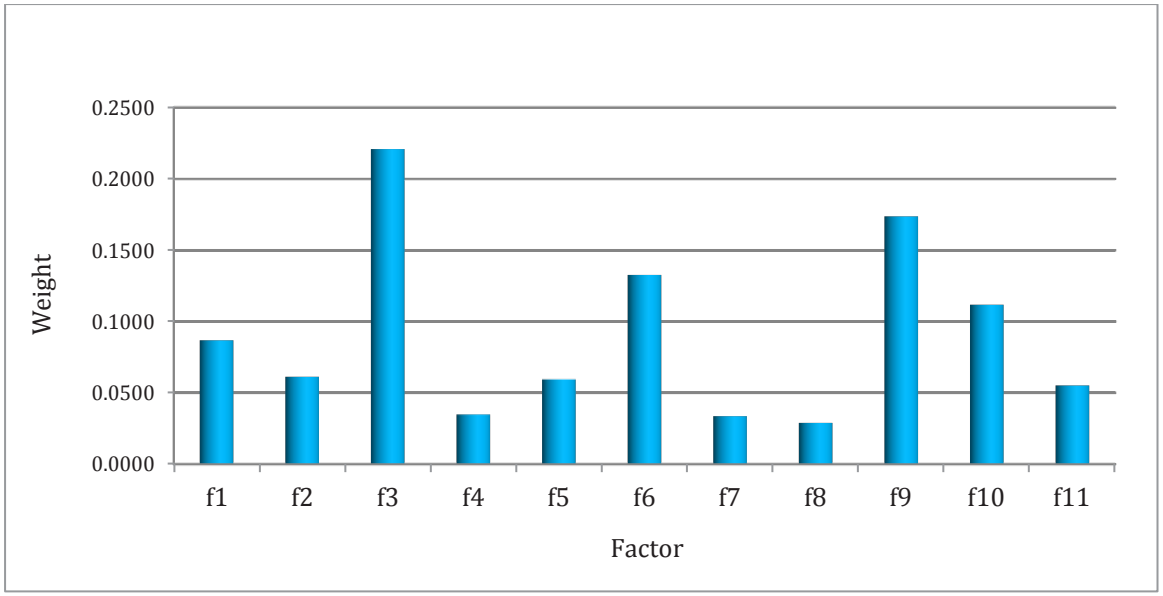

Figure (3) Weight of factors using AHP approach

Finally, the TOPSIS approach was applied in order to rank the ships. The weights of factors, which were calculated using AHP, were used as the input to TOPSIS. The proposed system was applied to rank the ten ships according to their targeting priority.

The results shown in Figure (4) indicate that ship S_5 has a rank of 1, while ship S_4 has a rank of 2. Ship S_2 and ship S_{10} possess ranks of 3 and 4, respectively. The results obtained from the proposed system reflected the importance of the factors weights and its impact on selection of the four ships.

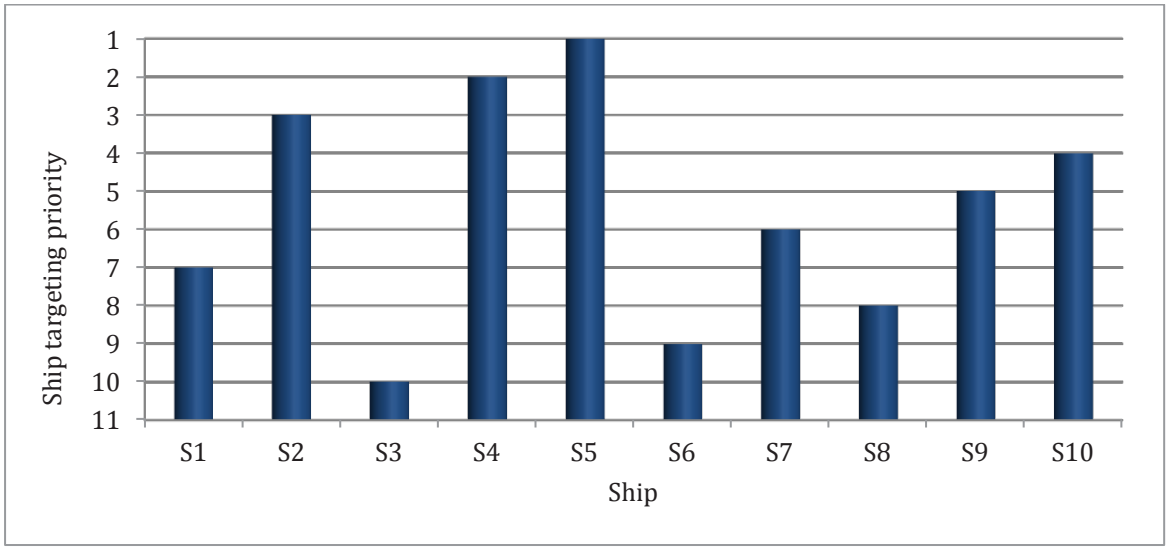

Figure (4) Ship targeting priorities based on the proposed system

According to the previously explained PSC strategy, the following can be deducted

- Using the AHP-TOPSIS Model contributes to managing and securing the PSC targeting evaluation through various cons. PSC inspectors can easily trace the history of any ship's data.
- Model is resistant to cyber-attacks and that would be helpful in preventing any access to PSC database especially by hackers.
- Model provides PSC numerous criteria of the data which can select.

7. Discussion

In recognition of PSC's importance in enforcing national and international ship safety standards, port states invest a great deal of time, effort, and resources to promote effectiveness in the implementation of their regional inspection regime. Assessments serve as a periodic review of the regime's purpose, an encouragement to its continued implementation, an instrument in identifying success and failure, as well as a tool to distinguish one from the other. In this regard, the current research offers a twofold contribution to PSC. Firstly, it gives a substantial contribution to the determination of new targeting factors that may lead to an enhanced implementation of PSC. Secondly, it presents a way to tackle the issue of the effectiveness of controls within a hybrid AHP-TOPSIS model, in order to enhance the effectiveness of the PSC inspections.

The TOPSIS technique was included in the recent study to increase the PSC program's efficacy. This strategy has the advantage of successfully identifying the optimal alternative and addressing challenging decision-making issues. The TOPSIS approach assumes that each factor tends to monotonically increase or decrease utility, which makes it easy to define the ideal solutions that are positive and negative. However, this approach needs to establish the weights of chosen factors, which it does by asking experts' opinions.

To overcome the TOPSIS approach shortcoming of the difficulty to weight factors and keep consistency of judgement, it would be more appropriate to use a powerful and suitable technique such as AHP. The latter approach has many advantages as follows: (a) it uses the experts' preferences depending on their knowledge and experiences; (b) it checks consistency of information then inconsistent information is eliminated accordingly, and uncertainties in results are diminished and (c) the factor weights are obtained by using pair-wise comparisons according to preferences of the experts.

8. Conclusion

The technological achievement brought the vision of fully autonomous shipping to life, while supporters of autonomous shipping are working hard to implement the technology as quickly as possible and put it into force. This paper has shown the importance of the AHP-TOPSIS Model in the maritime field currently , especially in the mechanism of PSC, to select data; this will result in changing the maritime conventions and codes. There are many marine entities, which have used this technology in different ways, which proved its success in marine ports and marine companies, and support the PSC to handle the select target with the upcoming technology .

References

- Aarushi, S. and Sanjay, K. (2014), "Major MCDM Techniques and their application - A Review", Journal of Mathematics and Computer Science Research, Vol. 4, PP. 14-25.
- Behzadian, M., Khanmohammadi, S., Yazdani, M. and Ignatius, J. (2012), "A state-of the-art survey of TOPSIS applications", Expert Systems Applications, Vol. 39, PP. 13051-13069.
- Berrittella M., Certa, A., Wnea, M. and Zito, P. (2007), "An Analytic Hierarchy Process (AHP) for the evaluation of transport policies to reduce climate change impacts", Fondazione Eni Ennico Muttei, Milano.
- Datta, S., Saha, D., Ray, A. and Das, P. (2014), "Anti-islanding selection for grid-connected solar photovoltaic system applications: A MCDM based distance approach", Solar Energy, Vol. 110, PP. 519-532.
- Deng, H., Yeh. C. H. and Willis, J. (2000), "Inter-company comparison using modified TOPSIS with objective weights", Computers and Operations Research, VOL 27, Issue 10,
- Deng, X., Hu, Y. and Deng, Y. (2014), "Supplier selection using AHP methodology extended by D numbers", Expert Systems Applications, Vol. 41, PP. 156-167.
- Egyptian Authority for Maritime Safety (EAFMS), Maritime safety information center and ships inspection head office, *@eafms.com*, and Annual reports of PSC inspections (2021), PSC matters, *psc@eams.gov.eg*
- El Sayed, T., Marghany, K. and Abdelkader, M. (2014), "Risk assessment of Liquefied natural gas carriers using fuzzy TOPSIS", Journal of Ship and Offshore Structure, Vol.9, PP. 355-364.
- Elwakeel, M. (2011), "Rules of Port State Control to enhance the maritime safety standards", Journal of the Arab Institute of Navigation, Issue 27, PP. 8-22.

- Elwakeel, M. (2013), "The concept of state control on ships and its implementation", Journal of the Arab Institute of Navigation, Issue 29, PP. 18-29.
- Elwakeel, M. and Elnoury, A. (2018), "Effectiveness of Port State Control inspections within the framework of the Mediterranean memorandum of understanding", International Journal of Research in Engineering & Technology, Issue No. (6), June 2018.
- El Sayed, T., Marghany, K. and Abdelkader, M. (2014), "Risk assessment of Liquefied natural gas carriers using fuzzy TOPSIS", Journal of Ship and Offshore Structure, Vol.9, PP. 355-364. PP. 963-973.
- Fouladgar, M., Abdolreza, Y. and mohammad, B. (2011), "Risk Evaluation of Tunneling Projects by Fuzzy TOPSIS", International Conference on Management Tehran, Iran.
- Georgiou, D., Mohammed, E. and Rozakis, S. (2015), "Multi-criteria decision making on the energy supply configuration of autonomous desalination units", Renew Energy, Vol.75, PP. 459-467.
- Gratl, F., Egger, P., Rauch, W. and Kleidorfer, M. (2017), "Comparison of Multi-Criteria Decision Support Methods for Integrated Rehabilitation Prioritization", Water Journal, Vol. 9, PP. 1-28.
- Haisha, Z. (2008), "Maritime safety policy and risk management" Ph. D. Thesis, Hong Kong Polytechnic University.
- Hung, C. and Chen, L. (2009), "A Fuzzy TOPSIS Decision Making Model with Entropy weight under Intuitionistic fuzzy Environment", International Multi Conference of Engineers and Computer Scientists, Hong Kong
- Jiasheng, W., Liu, M., Zhang, W. and Cheng, L. (2014), "Safety assessment of shipping routes in the South China Sea based on the fuzzy analytic hierarchy process", Journal of Safety Science, Vol. 62, PP. 46-57.
- Kabir, G., Sadiq, R. and Tesfamariam, S. (2014), "A review of multi-criteria decision-making methods for infrastructure management", Journal of Engineering, Vol. 10, PP. 1196-1210.
- Kara, E. (2016), "Risk Assessment in the Istanbul Strait Using Black Sea MOU Port State Control Inspections", Maritime Transport Management Engineering, Faculty of Engineering, University of Istanbul.
- koscielecki,et al.2019 "Legal Briefing Sharing'' the Club's legal expertise and experience. UKP&I www.ukp&i.com
- Kolios, A., Mytilinou, V., Minguez, E. and Salonitis K. (2016), "A Comparative Study of Multiple-Criteria Decision-Making Methods under Stochastic Inputs", Energies Journal, Vol. 9, PP. 1-21.

- Kolios, A., Rodriguez, A. and Salonitis, K. (2016), "Multi-criteria decision analysis of offshore wind turbines support structures under stochastic inputs", Ships Offshore Struct, Vol. 11, PP. 38-49.
- Lai, Y., Liu, T. and Hwang, C. (1994), "TOPSIS for MCDM", European Journal of Operational Research, Vol. 76, PP. 486-500.
- Martin, A., Spano, G., Küster, J., Collu, M. and Kollios, A. (2013) $_{b}$, "Application and extension of the TOPSIS method for the assessment of floating offshore wind turbine support structures", Ships Offshore Struct, Vol. 8, PP. 477-487.
- McCaffrey J. (2005), "Test Run the Analytic Hierarchy Process", MSDN Magazine, Vol. 6, PP. 23-30.
- Nasim, K., Hamidreza, J. and Bahram, M. (2013), "Appling ldexing Method to Railway Risk Assessment by using AHP and Mamdani Fuzzy Algorithm MATLAB: a case study in Iran, Qazvin- Zanjan Railway", Global Journal of Biodiversity Science and Management, Vol. 3, Issue 1, PP. 26-33.
- Opricovic, S. and Tzeng, H. (2004), "Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS", European Journal of Operational Research, Vol. 156, PP. 445-455.
- Pangsri, P. (2015), "Application of the Multi Criteria Decision Making Methods for Project Selection", Universal Journal of Management, Vol.3, PP. 15-20.
- Pangsri, P. (2015), "Application of the Multi Criteria Decision Making Methods for Project Selection", Universal Journal of Management, Vol.3, PP. 15-20.
- Qiao, Q. and Niu, Y. (2014), "The Naval Performance evolution approach to marital arts teachers based on TOPSIS method", Journal of Chemical and Pharmaceutical Research, Vol. 6, PP. 482-488.
- Srdjevic, B., Medeiros, Y. and Faria, A. (2004), "An objective Multi-Criteria Evaluation of Water Management Scenarios", Water Resources Management, Vol. 18, PP. 35-54.
- Trstenjak, B. and Danko, D. (2014), "Quality Evaluation of Erasmus Student Mobility using Fuzzy TOPSIS Framework", JPEDR Vol. 70, Issue 2, PP. 11-21.

The Impact of the internet on Seafarer's performance Onboard Ships

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المستخلص

لم يعد الاتصال بالإنترنت على متن السفن يمثل مشكلة بعد الآن لأن معظم السفن متصلة بالإنترنت، مما يتسبب في ضعف دعم حياة البحارة من قبل مجموعات الأقران، ويمكن أن يؤدي الإفراط في استخدام وسائل التواصل الاجتماعي إلى جعل البحارة أكثر وحدة وعزلة. وبالتالي، يتأثر أداء البحارة لأن الإفراط في استخدام الإنترنت يمكن أن يؤثر على ساعات راحة الطاقم ويسبب التعب، من بين آثار سلبية أخرى.

تهدف هذه الدراسة إلى تحديد كيفية تأثر أداء البحارة على متن السفن بالإفراط في استخدام الإنترنت ومعرفة ما إذا كان البحارة يدعمون فكرة الحد من استخدام الإنترنت على متن السفن من أجل تجنب العوامل التي تؤثر سلبًا على البحارة "الأداء الذي سيساعد البحث في تقديم توصيات لمزيد من البحث والتطبيق.

تم تصميم مسح من قبل الباحثين من أجل التحقيق في الآثار السلبية للبحارة "باستخدام الإنترنت على متن السفن على أدائهم، ممثلة في مختلف المتغيرات، أي ساعات راحة الطاقم، ومدة عقود البحارة، افتقار الطاقم إلى التركيز، وقدرة الطاقم على اكتشاف المخاطر، وسلامة الملاحة، العلاقات الاجتماعية بين أفراد الطاقم، والإلهاء، والحالة النفسية لأفراد الطاقم.

تم تحليل ردود المشاركين في الاستطلاع إحصائيًا باستخدام ("SPSS" الحزمة الإحصائية للعلوم الاجتماعية)، وهو برنامج برمجي يستخدمه الباحثون في مختلف التخصصات للتحليل الكمي للبيانات المعقدة.

أثبتت نتائج المسح أن الاستخدام المفرط للإنترنت له تأثير سلبي على جميع المتغيرات السابقة، وفقًا لردود ٢٠٣ بحارة من مختلف الفئات العمرية والخلفيات. وخلص إلى أنه ينبغي أن يكون هناك وقت محدود للبحارة لاستخدام الإنترنت على متن السفن من أجل التخفيف من هذه الآثار السلبية.

Abstract

Getting online onboard ships is not a problem anymore since most ships are connected to the internet, causing seafarers' lives to be poorly supported by peer groups, and overuse of social media can make seafarers even more lonely and isolated. Consequently, the performance of seafarers is affected as the overuse of the internet can affect the crew's resting hours and cause fatigue, among other negative impacts.

This study aims at determining how seafarers' performance onboard ships is affected by the overuse of the internet and finding out if seafarers support the idea of limiting the use of the

internet onboard ships in order to avoid the factors that negatively affect the seafarers' performance, which will help research offer recommendations for further research and application.
A survey was designed by the researchers in order to investigate the negative effects of seafarers' using the internet onboard ships on their performance, represented in various variables, namely crew's resting hours, the duration of seafarers' contracts, crew's lack of focus, crew's ability to detect hazards, safety of navigation, social relations among crew members, distraction, and crew members' psychological state.
The responses of the survey respondents were statistically analyzed using SPSS (Statistical Package for the Social Sciences), a software program used by researchers in various disciplines for quantitative analysis of complex data.
The results of the survey proved that the use of internet has a negative effect on all the previous variables, according to the responses of 203 seafarers from different age groups and backgrounds. It was concluded that there should be a limited time for seafarers to use the internet onboard ships in order to mitigate these negative effects.

Keywords: using the internet, onboard ships, seafarers' performance, resting hours, lack of focus, duration of contract, distraction, social relationships, psychological state

1- Introduction

The phrase "The internet onboard is a good thing" has become one of the uncontested tenets of modern maritime transport. After all, social media, particularly on the internet, allows seafarers to stay in touch with their loved ones and the outside world.

All people have an intrinsic desire to connect with the people in their lives. Indeed, the internet has developed into a potent tool for linking individuals across distances and time zones. However, the capacity to quickly inform mariners thousands of miles away from home was a drawback. This is not to suggest that sailors should be left alone at sea. They ought to have access to social media and the internet. However, making use of these effective communication techniques ought to be a part of a larger training process that encourages seafarers to accept personal responsibility of rationalizing using the internet.

One of the most common reasons is that seafarers were allowed to use their laptops and mobile devices for an indefinite period of time whenever they were not working a shift. When sleep time is factored in, this "non-work time" period on board comes to a large number of hours.
As can be seen, spending a lot of time on mobile devices has decreased the amount of "community" time spent on ships and also negatively impacted the crew's performance in several ways, as it affected resting hours, the crew's focus, hazard detection, safety of navigation, and the crew's psychological state.

It is because of these factors that operators and managers have to be proactive in terms of educating seafarers in how they use the internet – as well as setting rules and regulations to limit the time allowed for using the internet onboard ships.

Unrestricted internet access for sailors has, of course, been heavily promoted recently, and this is for business purposes. Such a step would benefit service providers who cater to seafarers. However, before this occurs, the more responsible owners and managers will sit down and give it some additional thought, for the reason that enhancing seafarers' quality of life on board may not be as simple as offering them limitless internet access.

In conclusion, the responses of the seafarers participating in the study show that using the internet without limits affects their performance; therefore, there should be a limit to that use. The study recommends further research to be conducted to confirm that conclusion.

2- Literature Review

Although there are several research studies that investigate the relationship between Internet access and other variables concerning the seafarers' wellbeing, such as stress, social relationships, and job satisfaction, among others, there is limited previous research that has results confirming the negative impact of using the internet onboard ships.

In their study that investigates the effect of work-family conflict on seafarer performance, An J. et al. (2020) found out that work–family conflict negatively affects seafarer self-reported performance as seafarers spend a long time away from their families, which leads to their feeling of isolation and stress.

A very recent and effective study was conducted by Raut R. and Saxena A. (2021) examined the relationship between achievement motivation and availability of internet on-board ships among seafarers. The findings concluded that the ability of seafarers to phone home whenever they want also implies that the seafarer will have less time to react to the numerous crises at home, which could prove to be a huge distraction. This could potentially result in bizarre incidents and provide a threat to the onboard security. The overexposure to every little detail in the daily operations of the household life may divert the seafarer from his professional aims in contrast to the period before the internet era in shipping when the seafarer was not in direct communication with his family and friends. This could increase stress and end up being one of the main causes of declining mental health on board. The research also suggested that limiting internet use during set hours and promoting more interpersonal interaction among the crew members on board are the solutions to this issue.

According to Sampson, 2003, working in the maritime industry is linked to unique psychosocial stressors, such as extended separation from family, loneliness, and isolation in multicultural crews.

This suggests that effective channels of contact with family and friends back home are crucial for lowering stress levels on board. In line with this, a negative relationship between social support at work and work-related stress has frequently been noted (Mett et al, 2018).

Slišković, & Penezić, (2016) in their study assured the significance of two particular psychosocial work factors in the explanation of satisfaction and self-rated health measures in seafarers, namely the employment contract and internet access. In general, shorter contracts and regular shifts were associated with better mental health. Only gastrointestinal symptoms were impacted by the contract parameters of the two physical health indicators. There were fewer gastrointestinal and cardiovascular problems in seafarers with free, unlimited onboard internet access.

Papachristou et al, (2015) found out that, according to the analyses of the data, respondents believed that the most significant problems preventing retention in the maritime industry are the separation from family and ineffective communication with friends and family while at sea. While seafarers appear to be happy with their decision to enter the industry, when asked what would cause them to leave, they cite poor communication with friends and relatives as the main reason. This demonstrates unequivocally how communication contributes to the profession of seafaring's increased retention rate.

In conclusion, as proved by previous studies, there is a positive correlation between using the internet onboard ships to communicate with family and friends and the psychological state of seafarers and even job satisfaction and job retention. These effects cannot be denied or ignored; however, controlled use of the internet is essential in order to avoid the negative effects on seafarers' performance, as shown through the results of this study.

3- Methods and tools

Quantitative research methods- which according to Payne and Payne (2004) seek regularities in human lives by dividing the social world into empirical components called variables that can be numerically represented as frequencies or rate, whose associations with each other can be explored by statistical techniques, and accessed through researcher-introduced stimuli and systematic measurements- were applied to collect data and test the relationships between variables. After academic discussions with experts in the field and searching the literature, a group of variables were selected as dependent variables. A five-point Likert scale was used as it is a simple to understand and use for both researchers and respondents. It takes less time and effort to complete than higher point scales.

A Google form was designed with nine questions and was sent to as many seafarers as possible. It can be claimed that the research sample is randomly chosen as it can be seen. Within the first three days, more than 150 responses were filled, and by the end of a week, the respondents reached 203. The responses were statistically analyzed using SPSS (Statistical Package for the Social Sciences),

a software program used by researchers in various disciplines for quantitative analysis of complex data, yielding frequency, percentage, Chi-Square and Consent Percent of the questions under consideration for the research sample. The following table presents the frequency and analysis of socio-demographic variables.

Table (1) Frequency and Percentage of Socio-demographic Variables of the Research Sample

Socio demographic data	Frequency (N=203)	Percent
Age between		
▪ 20 to 29	68	33.5%
▪ 30 to 39	89	43.8%
▪ 40 to 49	34	16.7%
▪ 50 to 59	6	3.0%
▪ 60 and more	6	3.0%
Gender		
▪ Male	189	93.1%
▪ Female	14	6.9%
Nationality		
▪ Egyptian	171	84.2%
▪ Syrian	9	4.4%
▪ Emirates	1	0.5%
▪ Netherlands	1	0.5%
▪ Jordanian	15	7.4%

▪ Indian	1	0.5%
▪ Saudi	1	0.5%
▪ Sudan	1	0.5%
▪ Nigerian	2	1.0%
▪ Polish	1	0.5%
Sea service duration by year		
▪ Less than 5 years	79	38.9%
▪ 5 to 9 years	37	18.2%
▪ 10 to 14 years	38	18.7%
▪ 15 to 20 years	29	14.3%
▪ more than 20 years	20	9.9%
Your Ship's type?		
▪ Bulk carrier	32	15.8%
▪ Container ship	59	29.1%
▪ General cargo ship	31	15.3%
▪ Passenger ship	4	2.0%
▪ Supply ship	32	15.8%
▪ Tanker	21	10.3%
▪ Other type	24	11.8%

Results

The respondents' opinions regarding the relationship between the independent variable, using the internet onboard ships, and eight dependent variables are presented in Table 1, followed by their responses for the suggestion that seafarers should have a limited time using the internet onboard ships.

Table (2) Frequency, percentage, Chi-Square and Consent Percent of the questions under consideration for the research sample

Questions	Answers	Frequency (N=203)	Percent	Chi-Square	Sig.	Consent Percent
Using the internet onboard ships decreases the crew's resting hours.	▪ Strongly Disagree	16	7.9%	28.946*	0.000	66.19%
	▪ Disagree	50	24.6%			
	▪ Neutral	36	17.7%			
	▪ Agree	62	30.5%			
	▪ Strongly Agree	39	19.2%			
Using the internet onboard ships reduces the duration of seafarers' contracts.	▪ Strongly Disagree	15	7.4%	72.739*	0.000	55.00%
	▪ Disagree	82	40.4%			
	▪ Neutral	39	19.2%			
	▪ Agree	49	24.1%			
	▪ Strongly Agree	18	8.9%			
Using the internet onboard ships leads to the crew's lack of focus.	▪ Strongly Disagree	18	8.9%	35.547*	0.000	64.29%
	▪ Disagree	48	23.6%			
	▪ Neutral	45	22.2%			
	▪ Agree	66	32.5%			
	▪ Strongly Agree	26	12.8%			
Using the internet onboard ships affects the crew's ability to detect hazards.	▪ Strongly Disagree	17	8.4%	55.251*	0.000	68.33%
	▪ Disagree	48	23.6%			
	▪ Neutral	28	13.8%			
	▪ Agree	78	38.4%			
	▪ Strongly Agree	32	15.8%			
Using the internet onboard ships affects safety of navigation.	▪ Strongly Disagree	17	8.4%	29.044*	0.000	62.38%
	▪ Disagree	62	30.5%			
	▪ Neutral	32	15.8%			
	▪ Agree	50	24.6%			
	▪ Strongly Agree	42	20.7%			

Using the internet onboard ships affects social relations among crew members.	▪ **Strongly Disagree** ▪ **Disagree** ▪ **Neutral** ▪ **Agree** ▪ **Strongly Agree**	**12** **48** **26** **73** **44**	**5.9%** **23.6%** **12.8%** **36.0%** **21.7%**	**52.887***	**0.000**	**69.52%**
Using the internet onboard ships communicates bad news with family, which leads to distraction.	▪ **Strongly Disagree** ▪ **Disagree** ▪ **Neutral** ▪ **Agree** ▪ **Strongly Agree**	**12** **44** **38** **68** **41**	**5.9%** **21.7%** **18.7%** **33.5%** **20.2%**	**39.094***	**0.000**	**68.10%**
Using the internet onboard ships negatively affects the crew members' psychological state.	▪ **Strongly Disagree** ▪ **Disagree** ▪ **Neutral** ▪ **Agree** ▪ **Strongly Agree**	**36** **61** **31** **49** **26**	**17.7%** **30.0%** **15.3%** **24.1%** **12.8%**	**20.030***	**0.000**	**56.43%**
The seafarers should have limited time to access the internet onboard ships.	▪ **Strongly Disagree** ▪ **Disagree** ▪ **Neutral** ▪ **Agree** ▪ **Strongly Agree**	**23** **34** **15** **71** **60**	**11.3%** **16.7%** **7.4%** **35.0%** **29.6%**	**56.877***	**0.000**	**70.24%**

*** p value <0.05**

It is clear from Table (2) of Frequency, percentage, Chi-Square and Consent Percent of the questions under consideration for the research sample. The value of Chi-Square ranged (20.030: 72.739)>0.05, The Consent Percent ranged (55.00 %:70.24%).

As for the first question, almost half the respondents believe that using the internet onboard ships reduces the crew's resting hours, with a consent percentage of 66.19%. The responses to the second question reveal that about one third of respondents either agree and strongly agree that using the internet onboard ships reduces the duration of seafarers' contracts, with a consent percent of 55%.

The third question was about whether the use of internet onboard ships leads to the crew's lack of focus, and the responses show that more than half the respondents believe it does, with a consent percent of 64.29%. Responses to the fourth question show that 54% of respondents agree and strongly agree that using the internet onboard ships affects the crew's ability to detect hazards, with a consent percent of 68.33%.

The fifth question investigated whether using the internet onboard ships affects safety of navigation, and responses demonstrate that about 45% of respondents agreed and strongly agreed that it does, with consent percent of 62.38%. In response to the sixth question, 58% of respondents agreed and strongly agreed that using the internet onboard ships affects social relations among crew members, with a consent percentage of 69.52%.

In response to the seventh question, 54% of respondents agreed and strongly agreed that using the internet onboard ships communicates bad news with family, which leads to distraction, with a consent percentage of 68.10. As for the eighth question, 37% of respondents agreed and strongly agreed that using the internet onboard ships negatively affects the crew members' psychological state, with a consent percentage of 56.43%.

Regarding the respondents' opinion whether the seafarers should have limited time to access the internet onboard ships, about 67% agreed and strongly agreed that the use of internet onboard ships should have a limited time.

4- Discussion and recommendations

Based on the above results, it can be concluded that using the internet onboard ships negatively affects the seafarers' performance as it reduces their resting hours, reduces the duration of their contracts as they feel they need to be among families and feel homesick, leads to their lack of focus, affects their ability to detect hazards, and impacts the safety of navigation. In addition, it can affect the social relationships among crew members and communicate bad news with families, which leads to seafarers' distraction, in turn affecting their psychological state.

The results of this study answers the call of other studies, such as Raut, R. and Saxena, A. (2021), that the effect of using the internet by seafarers onboard ships should be researched in diverse population, for example, considering sailors from various classes, positions, and ships as well as from various regions, cultures, and educational backgrounds. Another topic that can be investigated for research is mental health and wellness, given the unpredictable atmosphere on ships.

This study recommends further research to confirm the negative effects of the limitless use of the internet by seafarers onboard ships on the overall performance of seafarers and the psychological effect as well. In addition, future research should investigate the best solutions to these negative effects rather than limiting the use of the internet for seafarers onboard ships.

Therefore, as companies are very concerned about the safety of their ships and their transported goods, it is highly recommended that the use of internet onboard ships should be limited to a certain time daily. The limitations of using the internet onboard ships could be imposed by either the captain of the ship or set as company regulations that must be properly adhered to by all employees. Agreed-upon penalties should be applied in case of not complying with regulations in order to guarantee the safety of all stakeholders.

References

- An J, Liu Y, Sun Y, Liu C. (2020). Impact of Work–Family Conflict, Job Stress and Job Satisfaction on Seafarer Performance. International Journal of Environmental Research and Public Health 17(7):2191. https://doi.org/10.3390/ijerph17072191.

- Connolly, P. (2007). Quantitative data analysis in education: A critical introduction using SPSS. London & New York, NY: Routledge.

- Davies, A. J., & Parfett, M. C. (1998). Seafarers and the Internet, E-mail and Seafarers' Welfare. Cardiff,, UK: Seafarers International Research Centre, Cardiff University.

- Kelle, U. (2006). Combining qualitative and quantitative methods in research practice: purposes and advantages. Qualitative Research in psychology, 3(4), 293-311.

- Lefever, S., Dal, M., & Matthíasdóttir, Á. (2007). Online data collection in academic research: advantages and limitations. British Journal of Educational Technology, 38(4), 574-582.

- Mette J, Velasco Garrido M, Preisser AM, Harth V, Mache S. (2018) Linking quantitative demands to offshore wind workers' stress: Do personal and job resources matter? A structural equation modelling approach. BMC Public Health.;18(1):934.

- Nemoto, T. & Beglar, D. (2014). Likert-scale questionnaires. In JALT 2013 conference proceedings (pp. 1-8).

- Papachristou, A., Stantchev, D. & Theotokas, I. (2015). The role of communication to the retention of seafarers in the profession. WMU J Marit Affairs 14, 159–176.

- Payne, G., & Payne, J. (2004). Key concepts in social research. London: Sage.

- Raut, R.& Saxena, A. (2021). The relationship between achievement motivation and availability of internet on-board ships among seafarers: Implications for maritime industry development. International Journal in Management and Social Science, 9 (10), 29-37.

- Sampson H. (2003) Transnational drifters or hyperspace dwellers: an exploration of the lives of Filipino seafarers aboard and ashore. Ethnic Racial Stud.;26(2):253–77.

- Slišković, A., & Penezić, Z. (2016). Testing the associations between different aspects of seafarers' employment contract and on-board internet access and their job and life satisfaction and health. Arh Hig Rada Toksikol 2016; 67:351-361.

"The use of Augmented Reality technology to enhance maritime Safety of Navigation" case study Training ship Aida 4

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المستخلص

نظرا لطبيعة عمل السفينة عايدة/٤ من حيث إمداد الفنارات المعزولة بالبحر الأحمر وخليج السويس، ولضمان كفاءة عمل المساعدات الملاحية فى هذه المناطق ونتيجة للعدد الكبير لسفن الصيد ومنصات وحفارات البترول وكذلك حركة المرور الكثيفة للسفن فى خليج السويس والتى تؤثر على سلامة الإبحار للسفينة عايدة/٤ وكذلك نتيجة الكم الهائل من المعلومات المرئية المتوفرة من الأجهزة الملاحية بالسفينة عايدة/٤ والتى تؤدى إلى تشتيت انتباه ضباط السفينة. ونتيجة لذلك تبحث هذه الدراسة استخدام تقنية الواقع المعزز (AR) على السفينة عايدة/٤ من خلال مراجعة النظام واختباره مع استخدام استبيان لضمان كفاءة عمل المنظومة لزيادة مستوى سلامة الملاحة البحرية وكذلك تدريب الطلبة البحريين.

Abstract

Due to the nature of work of M/V Aida 4 in terms of supplying isolated lighthouses in Red Sea and the Gulf of Suez, as well as ensuring the efficiency of navigational aids in such areas, these tasks necessitate sailing in areas that may affect the safety of the ship due to the complexity of the surroundings in terms of large number of fishing vessels, oil platforms, rigs and heavy traffic in Gulf of Suez. Also, as a result of large amount of visualized information available from different devices, this leads to the distraction of the officers of the watch of Aida 4. According to our findings, This study examines the application of Augmented Reality (AR) technology onboard Aida 4, by reviewing and testing the system and using a questionnaire to ensure the efficiency of the cadets training system, as well as increasing the maritime safety of navigation.

1. Introduction

Augmented Reality is a type of technology that allows digital images and information to be displayed onto the physical environment and direct superimposition of digital content over a user's actual view (TSB, 2020). In modern bridge systems, there are unlimited number of navigational information such as Global Navigational Satellite System (GNSS), echo sounder, speed log, radars, gyro, and magnetic compass. Among the challenges of AR is to determine the most beneficial information to display and what types of visual representations are best for conveying that information. (Bandara, Woodward, Chin and Jiang, 2020).

A multitude of digital technologies have emerged on ship bridges over the past decades. Many are meant to help with navigation and avoid collisions when visibility is low, but because they are shown on different screens and in different ways, operators may get too much information.

Running into a 'big data' problem, the ever-increasing volume of information that is also not well organized may result in information overload for the operator. The information is displayed on a variety of different screens and monitors and to read it, the officers of the watch must turn their attention away from the surrounding physical environment. This becomes even more difficult when a ship enters or leaves a harbor or restricted / congested waters.

In 2020, the most common forms of maritime accidents were collision (43%), grounding (21%), and fire/explosion (16%) (TSB, 2020); making it important to try to mitigate factors that may cause these accidents. Furthermore, accident analyses have shown that human error is a dominant factor (Bandara, Woodward, Chin and Jiang, 2020). It is important for the navigator to sort out the information for planning a safe navigation path and that is difficult when attention is divided between digital displays and the outside world. Although much effort is taken to minimize the risk of collision, accidents still happen. Accident investigations show that fatigue and human error play an important role in the cause of accidents.

This research paper aims to survey the latest advances in AR technology to be applied onboard Aida 4 to increase the level of safety of navigation and preserve the marine environment, as well as improve the training of cadets.

2. Required Navigational Aids

The International Maritime Organization (IMO) has been concerned with the safety of navigation. Despite the tremendous development witnessed by the technology of navigational devices, as well as the training methods for officers and captains of ships, it was noted that many maritime accidents have been caused by human-error including mistakes in ship handling and inadequate watch keeping. The most significant issue with existing navigational technology is the supply of excessive and superfluous information or incorrect data delivery techniques. Specifically, the alert functionality for emergency situations that is now supplied by radar and Electronic Chart and Display Information System (ECDIS) (Procee, Borst, Paassen, and Mulder, 2017), (Jahn, 2021), (Hareideand, and Porathe, 2018).

Captains and Officer of the Watch (OOW) on the bridge must deal with the increasing amount of visualized information accessible through several devices, including:

- The Electronic Position Fixing System (EPFS), utilizing GNSS, provides the ship's absolute position.
- The Heading Control System (HCS), which controls the ship's heading.
- The Speed and Distance Measuring Equipment (SDME), which tells how fast the ship is going and, by extension, how far away it is.
- The ship's echo sounding system (ESS), which provides the ship's depth data.
- Navigational assistance sensors
    - Wind sensors that measure the speed and direction of the wind.
    - The Automatic Identification System (AIS), a ship-based automatic tracking

- Use of Communication channels such as Global Maritime Distress Safety System (GMDSS), which uses for example the NAVTEX to receive navigational messages, or other communication channels for distributing data such as satellite communication (SATCOM) or mobile broadband.
- ECDIS is utilized for displaying charts and pertinent information to the OOW.
- System utilizing radar for terrestrial navigation.
- The Conning application provides engine and maneuvering status information.

This information is not well organized, especially during critical situation, which need quick decisions to maintain the safety of navigation of the ship, as well as the multitude of tasks that OOW has to deal with, as listed below:

- Avoid collision (overhead objects, ships, floating and fixed objects).
- Avoid grounding (checked planned track, contingency plane, Under Keel Clearance (UKC) control, safety contour line).
- Comply with ETA.
- Safeguard own ship (react to alarms, generate alarm).
- Communicate and report (other ship, company, authorities, and manufacturers).
- Check integrity (GPS, gyro, log, radar, ARPA, communication equipment, visibility, ECDIS safety settings and mode of operation).
- Preplan cargo operation.
- Avoid damage to own ship and cargo.

Finally, as the output of information becomes too much and more detailed, it is important to provide the OOWs with a way to minimize the amount of data or a way to visualize important data.

3. AR Projects Features

Several AR projects took place in different organizations and institutions such as; European e-Navigation project (ACCSEAS), UNH/NOAA Joint Hydrographic Center AR project, Porathe 3D chart application, VISIPORT Project. In addition, AR was practically used in accident avoidance.

A. European e-Navigation project (ACCSEAS)

Between 2012 and 2015, Accessibility for Shipping, Efficiency Advantages and Sustainability (ACCSEAS) EU-funded project, demonstrated the potential for e-Navigation in the North Sea Region (IALA, 2022). Among the fourteen ACCSEAS candidate solutions, Augmented Reality / Head-Up-Displays (HUDs). AR was used in two ways; pointing directly visually in the direction of the dangerous target, thus induce an immediate focus of the OOW on the dangerous, displaying operational information such as intended or suggested tactical routes or Marine Safety Information MSI or No-Go-Area.

Figure (1) illustrates the first approach, showing dangerous target, and Figure (2), illustrates the second approach, showing operational information (Accseas, 2013), (Williams, Shaw and Ward, 2015)

Figure 1, Highlighted target, using red box, is projected into the bridge window.
Source: (Accseas, 2015)

Figure (2) Projected suggested route, and a No-Go-Area on into the bridge window.
Source: (Accseas, 2015)

B. UNH/NOAA Joint Hydrographic Center AR project

Dynamic and flexible bridge simulation for experimenting with a range of possible AR devices and information overlays across different times-of-day, visibility, and sea-state/weather. This simulation allows for safe evaluation in a more diverse set of conditions. The project's goals include identifying which technical specifications are required for future AR devices to be useful

for navigation, what information is most beneficial to display, and what types of visual representations are best for conveying that information.
Figure (3) shows the simulated projected nautical chart information (UNH/NOAA Joint Hydrographic Center, 2019)

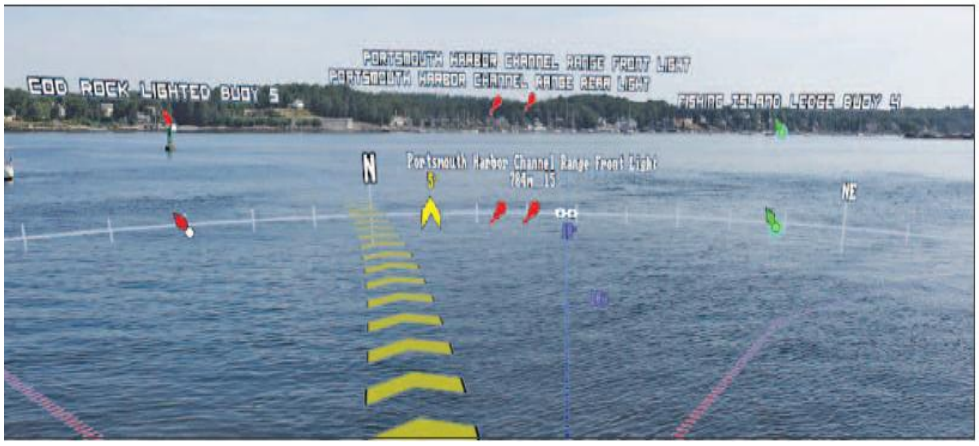

Figure (3) Simulated augmented reality overlay of nautical chart information
Source: (UNH/NOAA Joint Hydrographic Center, 2019)

C. Porathe 3D chart application

Porathe offers an application that draws 3D charts (Porathe, 2006) with the land, No-Go-Area, indicates boats from AIS data and other objects from radar in order to help users to make the right decision in a very short time. All data are displayed in the bridge view, with the help of the course from a GPS, on LCD screen. A representation of the prototype application is visible in Figure (4) (Morgère, 2015).

Figure (4) Prototype and photo of the Gothenburg approach
Source: (Morgère, J., 2015)

D. VISIPORT Project

Visual Information system for Protection (VISIPROT) is a project introduces a specialized AR collaboration approach based on a "visual situation" shared by multiple users. This visual situation correlates to the tactical and nautical situations depicted on the 360-degree on-board surveillance sensor's video. It facilitates coordination between local, remote, and distant users. It makes it possible to share information about the situation, follow engagement standards, and put decisions into action. (Moulis and Larminat, 2015)

4. AR application in accident avoidance

On the morning of 16 August 2012, the container ship VEGA SAGITTARIUS departed from the port of Nuuk, Greenland, heading for Aasiaat in the north-western part of Greenland. The navigators lost awareness of their surroundings, as a result the ship ran aground on an underwater rock. A practical experiment was carried out using AR through a bridge similar to a container ship VEGA SAGITTARIUS bridge. Through the AR panel the navigator can see the most important information, as a result the navigator doesn't have to shift their attention between environment outside and AR screens inside. When the ship approach icebergs, AR system identifies the objects outside and provides relevant status information, finally, the system informs that the ship approaching an underwater rock. The result indicate that these features could help prevent such accidents. (Danish Maritime Accident Investigation Board, 2013)

5. Proposed AR on board M/V Aida 4

The navigational aids onboard M/V Aida 4 consists of a set of devices that determine the ship's position, speed, course, and ensure safety during navigation in shallow waters or when meeting other vessels. All bridge equipment onboard M/V Aida 4 checked and tested regularly. The list of shipborne navigational equipment depends on the tonnage of the vessel, its destination and date of construction. It is defined by SOLAS Chapter V, Regulation19. So, an overview of the navigational aids used on M/V Aida 4 (MIHO SHIPYARD CO., LTD, 2010),

Captain and officers of M/V Aida 4 monitor the data of the electronic navigational devices through a set of screens in the bridge so that these data can be used to maintain the safety of the ship's navigation as well as to preserve marine environment in the sailing areas. As a result of the multiplicity of sources of navigational devices data, as well as alarms and warnings, this leads to the distraction of the OOWs and captain of M/V Aida 4. (MIHO SHIPYARD CO., LTD, 2010)

5.1 Aids to Navigation on board Aida 4

M/V Aida 4 has all the required aids to navigation for both safe navigation and support cadet training. All Aids to Navigation are according to IMO SOLAS convention. The purpose is to integrate all appropriate equipment in the AR project. Table 1 lists aids to navigation equipment on board M/V Aida 4.

Table (1) M/V Aida 4 ship Aids to Navigation

Type	Equipment
ECDIS	Transas Navi-Sailor 4000 ECDIS MFD
Heading Data Interface	Navitron System
Automatic Identification System	FURUNO FA-150
GPS	FURUNO GP-37 Receiver
Echo Sounder	FURUNO FE-700
Speed Log	FURUNO Doppler Speed Log DS-70
Wind speed and direction	FURUNO FI-50
Radar	FURUNO FAR-28x7

5.2 Proposed presentation

The proposed AR Navigation Furuno System to be installed onboard M/V Aida 4 superimpose digital information over the physical world and aims to contribute to the safety and security of the voyage by offering visual support to maneuvering and navigation during any operation, especially during supplying the isolated lighthouses in the Gulf of Suez and the Red Sea. AR navigation standard system equipment consists of Processor, IP camera, Adapter, ENC dongle and Trackball mouse.

The AR system overlays relevant information on stabilized video images from a forward-facing camera such as (azimuth, AIS, heading, radar target tracking, route, waypoint, user chart and ENC symbols) as shown on Figure (5). Just as navigators can choose which information layers to display on an ECDIS, AR navigation users can choose to display AIS, radar, ECDIS, gyrocompass and route information on their AR system. AIS and radar targets change colour according to their threat level, and users can increase or decrease range and take bearings, just as with a radar or ECDIS.

The systems alert the Master and/or OOW of the M/V Aida 4 to buoys, ships, and other targets of interest; display shallow water, no-go zones, and the planned track; and even include information from other navigational instruments. Additionally, the Master and/or OOW can check vital voyage information such as the speed of other ships, the Closest Point of Approach (CPA), and the Time of Closest Point of Approach (TCPA) of targets. Figure (6) shows that when visibility is low or when there is a lot of coastal traffic at night, AR navigation systems greatly improve situational awareness by making it clear which lights are likely to be ships and which are likely to be shore lights, as well as where to look for targets in fog.

AR navigation systems allow easy access to all relevant electronic information on a single screen. This improves situational awareness, improve decision making support to the officers, decreases cognitive load, and makes validating and cross-checking navigational information easier than ever. Improved situational awareness leads to preserve the safety of navigation and the marine environment in the sailing areas. (Furuno Product Solutions, 2022)

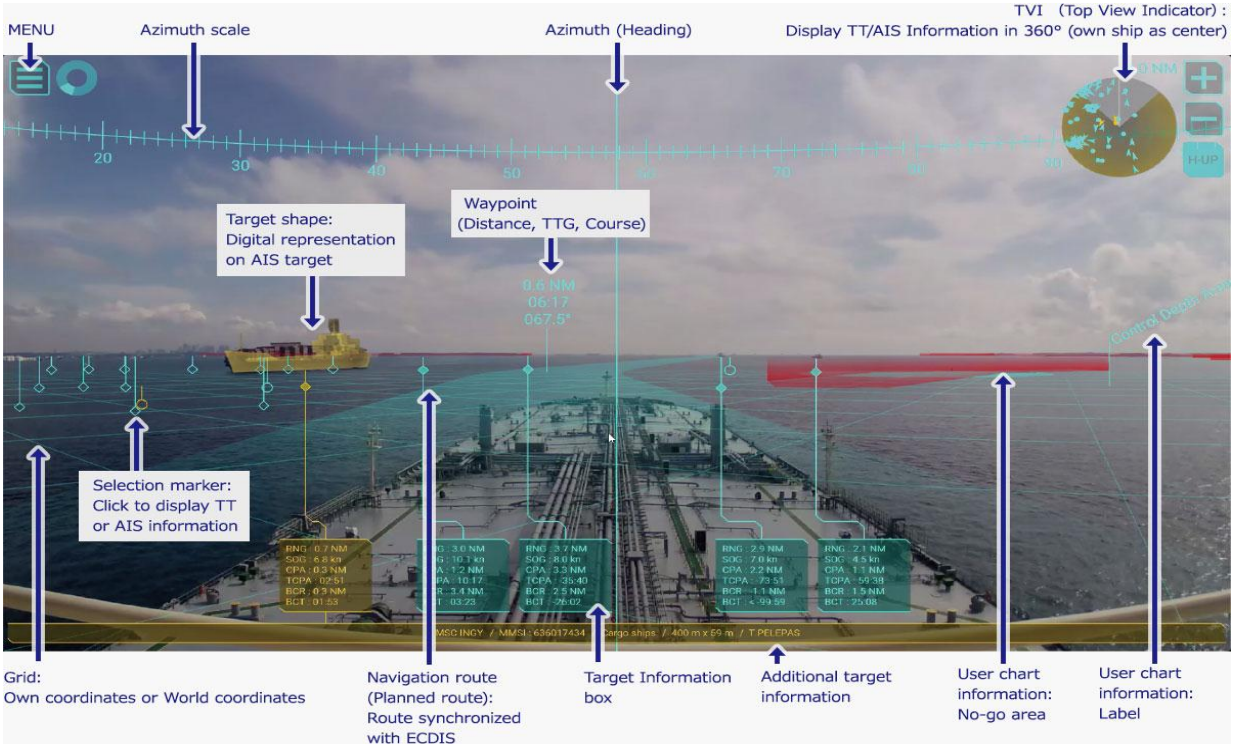

Figure (5) AR Navigation System overlay
Source: (Furuno Product Solutions, 2022)

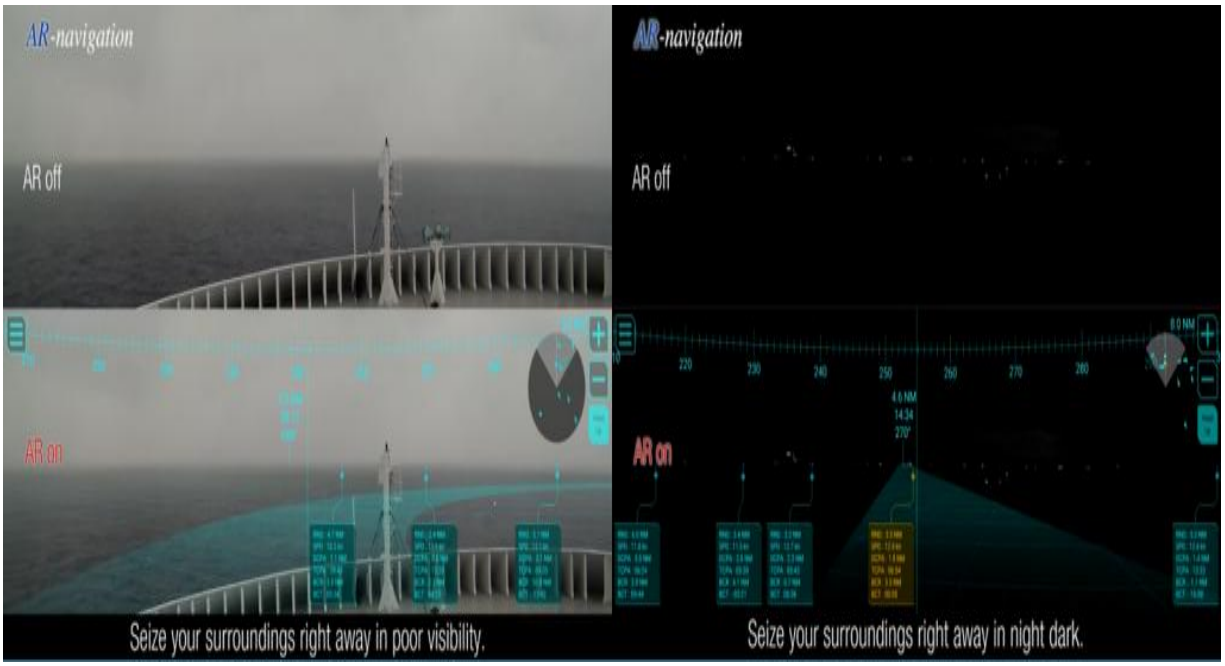

Figure (6) AR Navigation System in poor visibility and night dark
Source: (Furuno Product Solutions, 2022)

5.3 Improve cadets' skills

M/V Aida 4 is used to train AASTMT cadets to provide them with practical and hands-on training while sailing in the Mediterranean, Red Sea and Gulf of Suez by using coastal, celestial navigation and electronic navigational devices to maintain the safety of navigation of the ship. The proposed AR Navigation System onboard M/V Aida 4 will enhance the training of cadets, as a new technological tool which displays information on other vessels sailing on a vessel's planned route and surrounding sea areas and other ocean conditions, such as shallow waters as shown on Figure (7), (Furuno Product Solutions ,2022). AR system aiming to increase their safety and operational effectiveness and can provide them by a direct view of the ship's movement and a path with the current rudder position and speed orders and provides visual support during their watch-keeping by integrating information from AIS and radar target tracking (TT) with real-time video images from the bridge camera . (Frossinis, Anaxagora and Chatzopoulou, 2021), (Correia and Goncalves, 2019), (Maritime Conference in Dubai, 2019)

AR system is capable of teaching cadets onboard M/V Aida 4 how the system notify warnings to navigation, dangers in the area and meteorological warnings, in order to guarantee the safety and facilitate the crossing of the ship, especially in hazardous situations such as approaching Al-Ashrafi Islands and the Strait of Jubal in the Gulf of Suez, as well as the Gulf of Aqaba While sailing M/V Aida 4 to supply the isolated lighthouses in the Red Sea.

Figure (7) AR Navigation System onboard Aida4 ship.
Source: (Furuno Product Solutions, 2022)

5.4 Trial of Augmented Reality (AR) System

As a form of trial which will be carried out onboard M/V Aida 4, AR System is reviewed and tested by 20 respondents, which are 13 lecturers from AASTMT (Sea Training Institute) and 7 officers onboard M/V Aida 4. After testing the AR system, each respondent will fill in a questionnaire as a form of input to evaluate the AR system. The respondent assessment questionnaire consists of 6 questions listed in Table (2). By using Likert scale questions which is provides more granular information on respondent's attitudes towards a subject than a simple

yes/no question type, each respondent gives a value for each question from one to five with the value of one is the lowest value and the value of five (5) is the highest value. With the result explained in Table (2), the questions are

Table (2): AR questionnaire

1	Is the AR display easy to understand?
2	Is the AR system capable of displaying navigation warnings, targets and support track control in sailing?
3	Is sailing using AR System more interesting, more helpful and easier to understand by cadet's onboard M/V Aida 4 Ship?
4	Is this AR application very helpful for learning purposes about bridge Navigation devices?
5	Can sailing using AR onboard M/V Aida 4 ship provide better experiences than sailing through bridge simulator?
6	Can learning using augmented reality increase the Cadet's ability to react by making quick decisions in critical situations?

Figure (8) explains the overall score of AR System onboard M/V Aida 4 based on the questionnaires. The highest score is 89 out of 100 in question number 2, which means AR system is capable of display navigation warnings, targets and support track control in sailing. The lowest score is 78 out of 100 in question number 6, which means AR needs further study and evaluation in order to ensure that the AR system is able to learn Cadets and How to increase their ability to react by making quick decisions in critical situations.

However, the total score of user assessment questionnaire is 498 out of 600 with average Score 83%.

To evaluate the overall results of the questionnaire, there are several values that need to be determined first. Those value are:

1. The maximum value =largest answer value ×total questions× total respondents

$$5 \times 6 \times 20 = 1200$$

2. The minimum value = smallest answer value× total questions× total respondents

$$1 \times 6 \times 20 = 120$$

3. The median (Q2) = (maximum value + minimum value) ÷2

$$(600+120) /2 = 360$$

4. The first quartile (Q1) = (minimum + median value) ÷ 2

$$(120 +360) /2 = 240$$

5. The third quartile (Q3) = (maximum value + median value) ÷ 2

$$(600+360) /2 = 480$$

By using a box plot which is a method to summarize a set of data that is measured and also used in explanatory data analysis, the AR System onboard M/V Aida 4 ship will be categorized based on the minimum value, Q1, Q2, Q3, and the maximum value. Score between Q3 and the maximum value will be excellent (480-600), score between Q2 and Q3 will be very good (360-480), score between Q1 and Q2 will be good (240-360), and score between minimum value and Q1 will be fair (120-240). Based on the results of the questionnaire, consisting of 6 questions with 20 respondents, AR system is excellent because the total score is 498 which is between the Q3 and the maximum value (480-600).

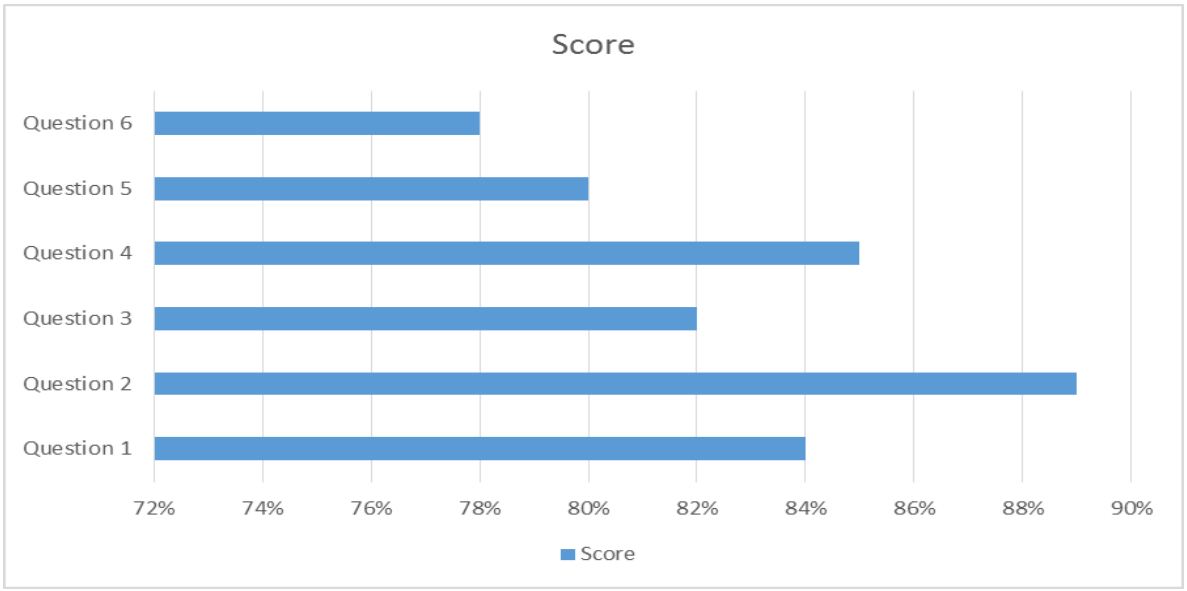

Figure (8) Questionnaire Results

6. CONCLUSION

The objective of the research paper can be concluded that AR onboard M/V Aida 4 can be especially useful for the OOW on the bridge where the risk of information overflow is very high and the loss of situational awareness can lead to extremely dangerous situations. AR System is able to be used as a supporting device to increase the level of safety of navigation and the marine environment as well as in practical training for cadets onboard M/V Aida 4 while sailing.

The paper presents a study on the use of AR System onboard M/V Aida 4 to enhance maritime safety by strengthening officers' situational awareness and improve decision making support to the officers as well as add value to education and training Cadets.

Based on the results of an assessment questionnaire that was carried out by 20 participants By asking 6 questions, the Augmented Reality (AR) System is in the excellent category because it has total value of ٤٩٨, which is between ٤٨٠ and ٦٠٠ (maximum),. However, A R System needs further study and evaluation in order to ensure that AR system is able to learn Cadets to increase their ability to react by making quick decisions in critical situations.

7. References

- Accseas (2013), Accseas Baseline and Priorities Report, (Online), Available: https://www.iala-aism.org/content/uploads/2016/08/accseas_baseline_and_priorities_ report_v3.0.pdf (24 May 2022).

- Bandara, D., Woodward, M., Chin, C. and Jiang, D. (2020), Augmented Reality Lights for Compromised Visibility Navigation, Journal of Marine Science and Engineering, 8(12):1014.

- Correia, A. and Goncalves, A. (2019), Using Augmented Reality for Learning Naval Operations,(Online), Available: https://www.researchgate.net/publication/332104890. (10 June 2022).

- Danish Maritime Accident Investigation Board (2013), marine accident report (Vega Sagittarius Ship grounding report),(Online), Available: https://dmaib.com/reports/2012/ vega-sagittarius-grounding-on-16-august-2012. (14 May 2022).

- Etienne, G., Kjetil, N., Olav, E. and Odd Sveinung, H. (2020), A review of augmented reality applications for ship bridges, Necesse, Vol. 5.

- Frossinis, D.–Anaxagora, N.and Chatzopoulou,E.(2021), Augmented Reality Technology As a Training Tool,(Online),Available: https://www.qjoest.com/index. Php/qjoest/article/view/22/19 (30 Mar. 2022).

- Furuno Product Solutions (2022) furuno envision, (Online), Available: https://www. https://www.furuno.com/special/en/envision(11 May 2022).

- Gillis, A.(2022), augmented reality,(Online), Available: https://www.techtarget.com /whatis/definition/augmented-reality-AR/,2022. (19 Apr. 2022).

- Hareideand, O. and Porathe, T. (2018), Maritime Augmented Reality, International Navigation Conference, Bristol, U.K.

- IALA (2022), E-Navigation Testbeds, (Online), Available: https://www.iala-aism.org/technical/e-nav-testbeds/accseas (28 May 2022).

- Jahn, C. (2021) White Paper: Increasing Maritime Situational Awareness by Augmented Reality Solutions, Hamburg: Fraunhofer Center for Maritime Logistics and Services CML.

- Maritime Conference in Dubai (2019), MOL Introduces AR Navigation System, (Online), and Available: https: //www.mol.co.jp/en/pr/2019/19069.html. (22 Mar. 2022).

- Morgère, J. (2015), Mobile augmented reality system for maritime navigation, France: Southern Brittany University.

- MIHO SHIPYARD CO., LTD, (2010), Navigation Equipment's Instruction Manual, Japan: S, NO.1399.

- Moulis, G.and Larminat, V. (2015), How Augmented Reality can be fitted to satisfy maritime domain needs, Virtual Reality International Conference April 2015 Article No.: 27 Pages 1–7, (Online), Available: https://doi.org/10.1145/2806173.2806200 (18 Jun.2022).

- Porathe, T. (2006), 3-D Nautical Charts and Safe Navigation, Sweden, Malardalen University Press dissertations. Mälardalen University.

- Procee, S., Borst, C., Paassen, M. and Mulder,M. (2017), Toward Functional Augmented Reality in Marine Navigation: A Cognitive Work Analysis,UK, Conference.

- The Transportation Safety Board of Canada (TSB). (2020), Marine transportation occurrences in 2020, (Online), Available: https://www.bst-tsb.gc.ca/eng/stats/marine/2020/ssem-ssmo-2020.html (22 Aug 2022).

- UNH/NOAA Joint Hydrographic Center (2019), Performance and Progress Report, Durham, UK.

- Williams, A., Shaw, G. and Ward, N. (2015), Accseas: The Innovative North Sea E-Navigation Demonstration, (Online), Available: https://mycoordinates.org/vol-xi-issue-7-july-2015 (15 Jun 2022).

The Red Sea Fisheries - Threats and Proposed Solutions

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المستخلص

تقسم البحار والمحيطات في العالم الي ٦٦ نظام بيئي والبحر الاحمر رقم ٣٣ وتوفر هذة الانظمة البيئية البحرية ملايين فرص عمل للناس وتنتج ثلاثة ارباع انتاج السمك سنويا. والبحر الاحمر يعتبر واحد من املح وادفئ الانظمة البيئية الموجودة.

الهدف الرئيسي من هذة الورقة البحثية هو اقتراح حلول سياسية للتخطيط الاستراتيجي الملائم لدول البحر الاحمر وذلك لاستعادة المخزون السمكي الطبيعي المستنفذ وكذلك لاستدامة المخزون السمكي الطبيعي وذلك لتحقيق الاهداف الاجتماعية-الاقتصادية والبيئية في السنوات القليلة القادمة.

ومنهجية البحث المستخدمة هي مزيج من النهج التحليلي والوصفي. والنهج التحليلي بيوضح الاسباب الرئيسية التي ادت الي استنفاذ المخزون الطبيعي من الثروة السمكية في البحر الاحمر علي سبيل المثال (الصيد الجائر , الصيد الغير قانوني والغير منظم والغير مقرر , التنمية الساحلية وتغير المناخ). وباستخدام SWOT التحليللي والبيانات المجمعة لتحديد الوضع الراهن والحلول البديلة المقترحة لاستعادة للثروة السمكية المستنفزة في البحر الاحمر.

Abstract

The global oceans and seas are broadly balkanized into 66 large Marine Ecosystems (LMEs), and the Red Sea is the number 33 of these LMEs. Moreover, they provide job opportunities for millions of people and generate about three-quarters of the world fish production annually. The Red Sea (LME#33) is believed to be the saltiest and warmest sea among these LMEs.

The main aim of this paper is to suggest policy solutions as proper planning strategies for the Red Sea countries to restore the depleted naturally fish stocks and to sustain natural fisheries stocks to achieve socio-economic and environmental goals in the coming years.

The methodology used in this research is a merge of descriptive and analytical approach. The analytical research focusses on the main causes and losses that led to depleting natural fisheries stocks in the Red Sea such as (overfishing, Illegal, Unreported, and Unregulated (IUU) fishing, coastal development, and climate change). This research analyses the data collected from the literature and the SWOT analysis outcomes to investigate the current status-quo and to propose alternative solutions for the natural fish stock depletion in the Red Sea.

Keywords: The Red Sea, Fisheries, SDG 14.4, Socioeconomic, Overfishing, IUU fishing.

1. Introduction

Oceans represent almost three-quarters of the total fish production globally, and they yield about $13 US trillion yearly (Sherman, 2019).

The Red Sea is number 33 (LME #33) and it is one of the youngest, warmest, and saltiest seas in the world due to the high evaporation rate, also because no rivers flow into it, and the low rainfall quantity (Sheppard, 2019). In addition, it is a semi-enclosed basin, also located between Africa and the Arabian Peninsula, the length of the Red Sea is approximately 2250 km, and its maximum width in the South about 355 km, and its average depth about 500 m (Binnaser, 2021). Moreover, in the South of the Red Sea is linked with the Indian Ocean via Bab al Mandeb, whereas in the North, it is separated by the Sinai Peninsula to the Gulfs of Aqaba and Suez. Also, there are eight countries located along the Red Sea, namely Djibouti, Egypt, Eretria, Israel, Saudi Arabia, Sudan, and Yemen (See Figure 1). About 28 million people live along the Red Sea Coastline, which is deemed as a low population rate. While, Jeddah is the highest city of the Red Sea in terms of population density with about 4 million people (Zeeshan Habib & Thiemann, 2022).

Fisheries in the Red Sea have existed for thousands of years. In addition, the Red Sea is characterized by low fish productivity or oligotrophic ecosystem and has about 1200 species of fish (Al-Rashada et al., 2021). Furthermore, the fish production in the Red Sea is distributed according to the variations of water salinity and temperature (Maiyza et al., 2022). Moreover, it has high biodiversity and a relevant environment for many marine species because the LME #33 has coral reefs and mangroves forests (Gardens, 2021). In addition, natural fisheries play a significant role in raising countries' Gross Domestic Product (GDP), food security, and saving job opportunities. Furthermore, the Red Sea natural Fisheries are divided into three main fishing types, small scale fishing where fishers use small fishing boats and fish near the coastline (artisanal), commercial (purse seiners, and trawling), and sport or entertainment fishing.

On the other hand, human activities such as overfishing, IUU Fishing, marine pollution, and climate change has a significant impacts in depleting the natural fisheries stocks in the Red Sea. Furthermore, the world economic crisis may lead to some Red Sea countries to change their priorities and policies from fisheries economy to shipping and harbors optimization industry (Fine et al., 2019) .

This research analyses the data collected from the literature. Moreover, the SWOT analysis is a strategic tool in hand decision-makers to evaluate the natural fish stocks of the Red Sea. In addition, SWOT analysis determines the internal and external impacts that are depleting the natural fish stocks of the Red Sea and making it a healthy and more productive ecosystem to meet the objectives.

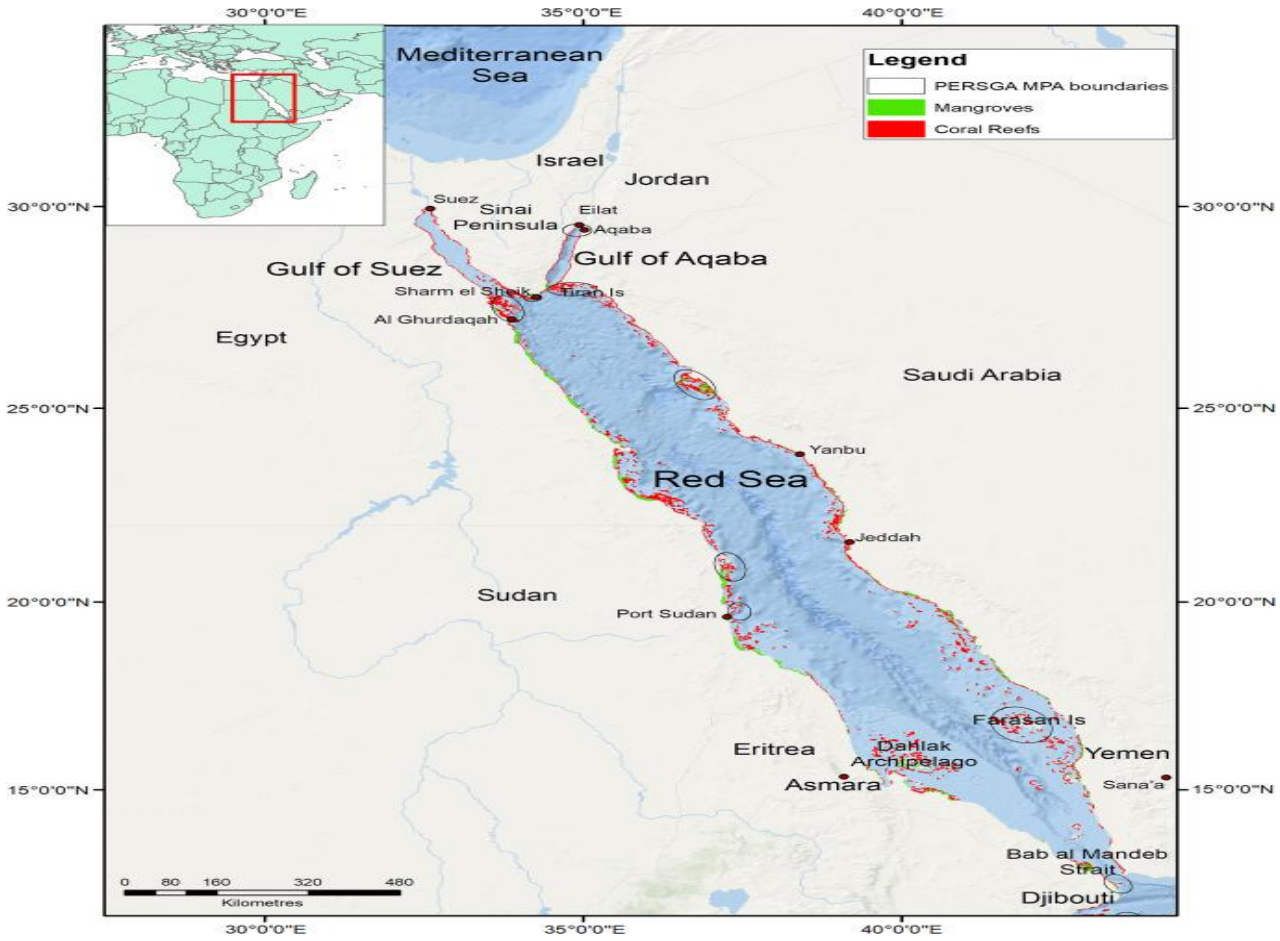

Figure (1): The Red Sea
Source: (Sheppard, 2019).

2. Fisheries

There are five countries of the Red Sea operate fisheries fleet in the region namely Egypt, Eritrea, Saudi Arabia, Sudan, and Yemen. Moreover, the fish production increases in the direction of the South. Egypt and Yemen have the oldest fleets and represent about two-thirds of the total Red Sea fish catching, Saudi Arabia has the most modern fleet. Furthermore, Eritrea and Sudan are not exploiting their marine resources optimally (Sheppard, 2019).

Artisanal fishing (small scale fishing) in comparison to commercial fishing (trawling and purse seiners) where the artisanal fishing enhances the sustainability of marine resources, and the economic return is almost the same for the Red Sea countries (Sheppard, 2019).

On the other hand, blast fishing using dynamite or destructive fishing methods, especially along the Egyptian coastline, has affected coral cover, and reduced fish quantity and biomass. Moreover, shark finning is endangered sharks in the Red Sea because fishers take shark's fins, and through the rest to the sea. Moreover, bycatch threatens sea turtles in the Red Sea despite the fact they are not targeted by fishers, and all of these practices have affected food chain and damaged biodiversity of the Red Sea (Sheppard, 2019).

There are some threats that cause adverse impacts on fisheries stocks they are as following:

2.1 Overfishing

In the beginning of the 1990s, the issue of overfishing has begun in the Red Sea due to the absence of states control, and noncompliance to fishing laws by fishers including the use of modern fishing techniques. Moreover, they use destructive methods such as dynamite or bombing fishing and they use poison in fishing such as cyanide so fishing rates are quicker than reproduction. On the one hand, some marine species have slow growth rates and late sexual maturing such as serranidae and sharks (Shellem et al., 2021). In addition, sea cucumber has been reported as overexploited in the Egyptian Red Sea coastline and along Saudi Arabia western coastline and in the gulf of Aqaba (Hasan, 2019), also overfishing deplete fisheries resources from reefs ecosystem (Solami, 2020).

On the other hand, Marine Protected Areas (MPAs) are one of the most powerful techniques for protecting vulnerable fisheries resources from human activities, but they are not sufficient in all the Red Sea regions. Furthermore, they are not suitable for highly movement marine species (Akhmadeeva, 2021). Thus, all of the mentioned reasons have depleted the natural fisheries stocks in the Red Sea.

However, concerned authorities can use some methods to habilitate the exhausted natural fisheries stockpiles in the Red Sea such as by determining the catch size and quantity, and using specific fishing methods, as well as detecting no take zones and seasons.

2.2 Illegal, Unreported and Unregulated (IUU) fishing

IUU Fishing represents about 20 percent and may reach 50 percent of the total fish catch in some regions globally due to the absence of the political will for law enforcement and monitoring. In the last decade, the illegal fishing has increased in the Red Sea especially in the Southern region (Djibouti, Eritrea, and Yemen) as a result of the Yemeni civil war and due to the absence of Yemeni state control over its fisheries resources. Therefore, the conflict in the southern region over fisheries stocks between alien fishing boats and global navy ships have increased (Devlin et al., 2021).

The main function of MPAs in the Red Sea is to protect marine species from extinction either targeted or non-targeted (Gajdzik et al., 2021). However, the size of MPAs in the Red Sea is insufficient and the absence of enforcement to fishing laws are significant hindrances to guard all endangered or threaten marine species (Akhmadeeva, 2021).

In this regard the Egyptian authorities seek to protect its fisheries stock and endangered or threatened marine species in the Red Sea such as (Dugong, shark, and sea turtles) by expanding mesh sizes of trammel nets to prevent bycatch in the Gulf of Suez (Saber et al., 2022), preventing fishing during spawning season (Gewida et al., 2021) and detecting no-take zones (Akhmadeeva, 2021), preventing issuing new licenses for fishing boats and preventing fishing for 3 months in the Red Sea. However, there is a regional issue regarding fisheries laws enforcement and management to sustain natural fisheries stock (Sheppard, 2019).

According to IUCN Red List, some marine species in the Red Sea such as dolphins (Mahdy et al., 2021) and dugongs are listed as vulnerable due to sharks, rays attacks, and gill nets (Nasr et al., 2019).

3. Climate Change

The LME#33 is situated between the Arabian Peninsula and the North of Africa and both of them accounts for approximately seventy percent of world dust emissions. Moreover, the whole LME#33 is located in the world dust belt region. Furthermore, the Red Sea receives almost six million tons of storms dust yearly. Therefore, the LME#33 warms three folds faster than the world oceans warming average. The central area of the Red Sea suffers from nutrients scarcity. So, the dusts play key roles in nutrients enrichments that may support biological productivity. Meantime, the global dust belt bears heavy loads of microbes, virus, and bacteria cells that discharge over the LME # 33 (Aalismail et al., 2020) especially over the southern region and during summer season (Osipov & Stenchikov, 2018).

The LME#33 coral reefs suffer of impacts of both climate change and extreme dust storms and which increases the bleaching (all corals turn to white) and mortality. On the other hand, the coral in the northern region (Gulf of Aqaba) experienced high tolerance to high temperature and no registered huge bleaching cases and mortalities (Blanckaert et al., 2022).

3.1 Harmful Algal Blooms (HABs)

In recent years, Harmful Algal Blooms (HABs) or Red Tide have expanded in the Red Sea especially in the Southern part and in summer season as a result of marine pollution and climate change. Moreover, HABs have damaged ecosystem services and caused biodiversity loss. HABs have increased fish mortality, expel native species, and changed food chain (Gokul et al., 2020).

Human activities such as overfishing and eutrophication have increased Filamentous algae (Sheppard, 2019). Furthermore, climate change has boosted the concentration of nutrients such as ammonium, nitrate, phosphate, and silicate contributing to the growth of the Red Tide that appear at the water surface. In addition, climate change has facilitated the expansion of some phytoplankton species which rendered unfavorable effect on fisheries, socioeconomics, and harm the important and valuable shore habitats because dinoflagellate is detrimental and poisonous (Mohamed, 2018).

3.2 Coral Reefs

Coral reefs provide beneficial ecological benefits to the fisheries. Moreover, it protects the coastline from wind storms and ocean level rise. Furthermore, it prevents thriving toxic algal blooms such as dinoflagellates (Fine et al., 2019).

Coral reefs are expected to decrease from 70% to 90% globally by the end of the twenty-first century if temperatures rise 1.5^0C higher than the usual and the coral reefs will completely disappear at 2^0C warming. While, samples taken from the northern Red Sea region have proved that coral reefs are able to tolerate temperatures up to 6°C higher than normal without bleaching or mortalities (Kleinhaus et al., 2020).

However, coral reefs in the LME #33 suffers from human activities impacts such as dredging activities, overfishing, runoff, oil pollution, and climate change impacts(Smith et al., 2021). In addition, the LME#33 water surface temperature is about 32º C in the summer and salinity more than 40 ppt in the Northern region. Moreover, the potential interactions and conflicts between coral reefs and the Red Sea coasts may occur in the future due to the expected increase in population and urbanization along the coastline (Fine et al., 2019).

Even though the coral reefs in the LME#33 adapt and live in these harsh environment and exaggerated conditions, the coral reefs in the central and southern regions suffer from coral bleaching and mass mortalities after exposed to El Niño Southern Oscillation (ENSO) event in 1997–1998, followed by a heatwave in 2010 and which prolonged for ten weeks and have registered high expanded mortalities in Farasan banks and extended to Farasan Island in Saudi Arabia in the southern area (Berumen et al., 2019).

Coral reefs suffers from local stressors such as pollution and about 55% of all coral reefs are affected by overfishing (Fine et al., 2019). In addition, coral reefs in the LME #33 are encompassed by three arid desserts namely Arabian, Negev, and Sinai that witnessed multi dust storms yearly (Blanckaert et al., 2022).

Threats either indirect or direct cause severe impacts on coral reefs. Moreover, tourists sports such as diving and snorkeling have indirect impacts on many tourist regions for example Eilat, Aqaba, Jeddah, Sharm El Sheikh, Hurgahda, Marsa-Alam, Musha, and Maskali islands (Romaniv & Yarmolyk, 2021).

Secondly, direct impacts, for instance, overfishing, shipping, eutrophication, oil explorations, desalination plants, resorts, plastic debris, and man-made lagoons along the shoreline. Thus, all of which have raised predators species, and increased coral bleaching and mortality especially in the center and south areas of the LME#33 (Genevier et al., 2019). Furthermore, the LME #33 sea surface temperature (SST) warming rate is very fast and has gradual increased by approximately 0.5ºC every ten years especially in the Northern areas in the Gulfs of Aqaba and Suez (Chaidez et al., 2017).

3.3 Mangroves Forests

The Red Sea has only two types of mangroves (Avicennia marina and Rhizophora Mucronata), which are located along the Egyptian and Sudanese borders, also on Saudi Arabia (Farasan Islands), and Yemen (Kamaran Island) coasts. The majority of mangroves bushes are situated in the southern region of the Red Sea (Gajdzik et al., 2021). Moreover, mangrove trees could thrive in extremely harsh conditions such as high levels of salinity above 40 ppt, and in ocean surface temperatures of more than 31ºC in the summer season (Aljahdali et al., 2021). In addition, mangroves trees sequestrate the Carbon (El Hussieny et al., 2021), and it is a more convenient ground for the nursery and shelter of fish larvae (Gajdzik et al., 2021).

Despite climate change, saline water, coastal development, and overfishing, mangrove forests in the LME # 33 increase and thrive at a very low average compared to its other regions of the world. This is due to the interest of some the Red Sea countries such as Egypt, and Saudi Arabia in planting mangrove forests and protecting them from external factors such as logging, and overgrazing. Moreover, mangrove forests work as a green barrier protecting the ecosystem and people's health, and shelter, spawning ground, and nursery for different types of fish. It also, protect coral reefs, reduce overfishing impacts, filtering the water of marine pollution, and mangrove bushes as traps for marine pollution (plastic, solid wastes, and oil) (Martin et al., 2019)

On the other hand there are many major factors that cause negative impacts and degradations of mangroves bushes productivity and the Red Sea ecosystem such as deforestation, fish farms (shrimp), overgrazing by camels, pollution, and coastal development along the Egyptian coastline (Afefe, 2021) and Saudi Arabia coasts (Aljahdali et al., 2021). In addition, the degradation of mangroves forests in Eritrea is due to logging (wood cutting) and in Yemen due to cattle grazing (overgrazing) (Chanda et al., 2022).

4. Marine Pollution

Marine pollution is one of the most serious threats from human activities on the marine environment. Despite tremendous efforts to eliminate plastic debris from the oceans, and preventing people dumping it at sea, quantities of plastic litter is are still increasing in some regions. Furthermore, it is expected to be more than the fish after 2050 in terms of weight (Dabrowska et al., 2021).

The sources of plastic in the Red Sea come from fishing gears, tourists' activities, and approximately eighty percent of plastic at sea come from land-based sources (See Figure 2). Moreover, in 2010, Egypt was ranked seventh globally, representing about 3 percent of the discharge of plastic debris into seas (*World Bank Group*, 2022). In addition, some of marine species such as marine turtles consume them because they cannot differentiate between plastic and their natural food. So, they harm sea turtles' gut and become main reason of their death (Al-Tawaha & Geiger, 2019).

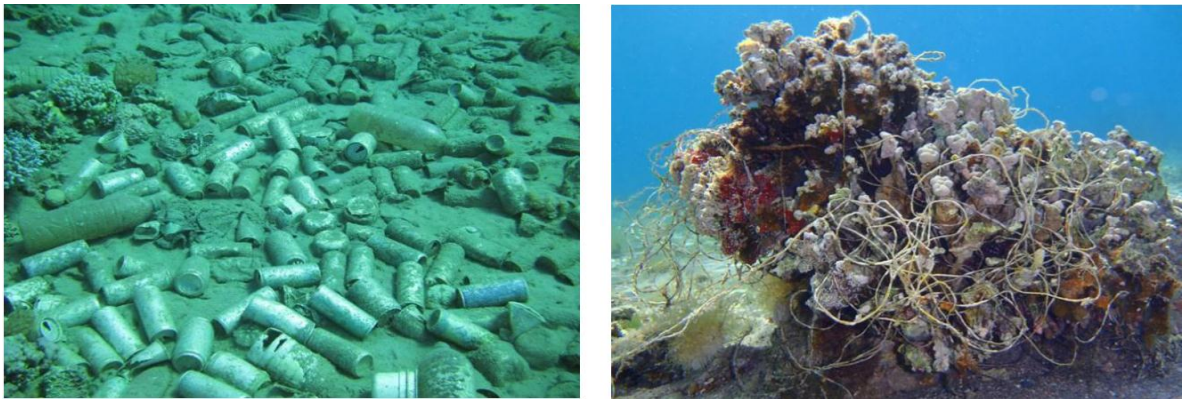

Figure (2): Plastic Bottles & Cans at the Red Sea Bottom
Fishing Lines Attached To Coral Reefs at The Aqaba Gulf
Source: (Al-Tawaha & Geiger, 2019).

The micro plastics pollutants (MPs) considered as a modern environmental pollution. Furthermore, the MPs are generated at the Red Sea from sewage treatment plants because of the growing number of inhabitants along the coastline, engaged in aquaculture, and discarding fishing gears. In addition, MPs come from coastal development along the Red Sea coasts at the Gulf of Suez in Egypt, at Asseb in Eritrea and at Yanbu, Jeddah, Rabigh, and Jazzan in Saudi Arabia. Also, MPs are generated from desalination plants in Dahab, Sharm Elshiekh, and Hurghadha in Egypt and at Yanbu, Jeddah and Rabigh in Saudi Arabia as a result of the quick population growth along the coastlines recently. Moreover, plastic waste at the Red Sea comes

from ships because the Red Sea has a heavy vessels traffic due to the Suez Canal (Zeeshan Habib & Thiemann, 2022) (See Figure 3).

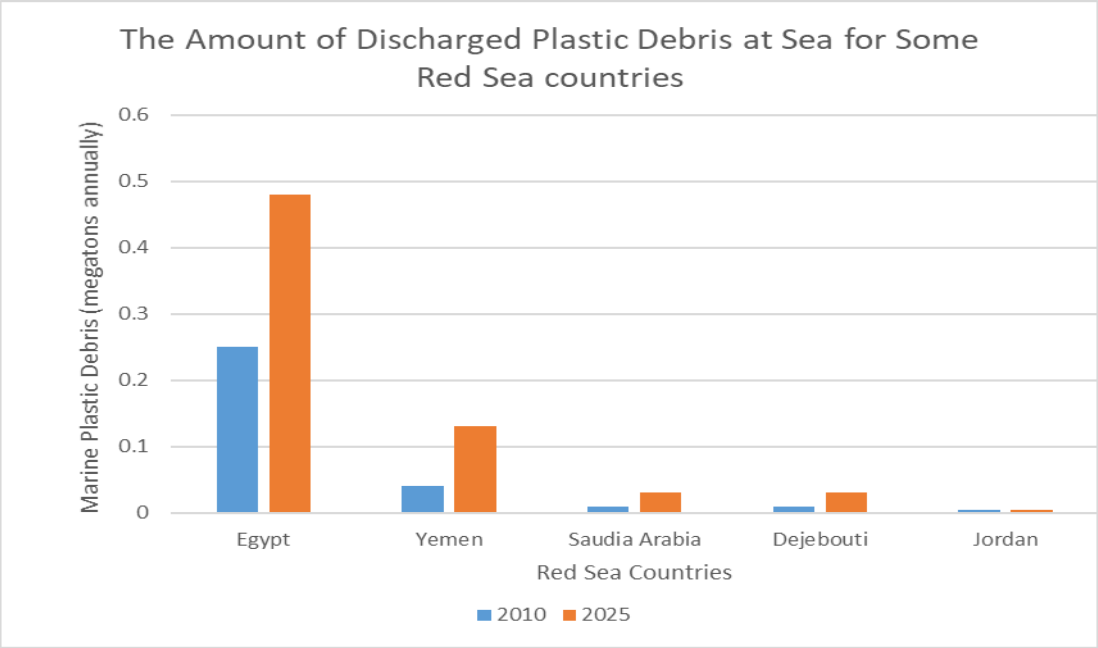

Figure 3: The Amount of Discharged Plastics Debris at Sea for Some Red Sea Countries. Source: (*World Bank Group*, 2022).

On the other hand, the Red Sea has the lowest quantities of floating MPs globally. In addition, both coral reefs and mangrove forests eliminate micro plastics from the water column. Furthermore, there are no rivers flowing into the Red Sea, and there is a relationship between the quantity of micro plastics and population along the Red Sea shoreline (Zeeshan Habib & Thiemann, 2022).

Solid waste is a critical issue with large amounts of plastic bags, fishing lines, and plastic bottles being found in Saudi Arabia's coastline, salt marshes, mangroves, coral reefs, and seagrass regions. One of the main problems is the fact that there is little awareness among the people and so, there are not interested in recycling their waste. Approximately 15 percent of the plastic waste is recycled, and the rest goes to the landfills (Sheppard, 2019). In addition, about 80 percent of sea pollution comes from the shore side (Bates, 2020).

The MPs have been found in fish larvae and sediment samples along Saudi Arabia's coastline because the MPs were generated from human activities on the coast and densely populated coastal areas such as Jeddah and Jazan (Zeeshan Habib & Thiemann, 2022). Moreover, the quantity of accumulated plastic in the marine environment is caused by human activities, the wind and sea direction, and recreation facilities along the coastline at for instance, Hurghadha Egypt and Jeddah in Saudi Arabia. Furthermore, the entangled and ingested MPs cause harm to marine species (Hassan et al., 2022). Subsequently, when marine litter associates with other human activities impacts, they harm people and collapse marine environment biodiversity.

5. Aquaculture

In last decades, some Red Sea countries such as Egypt, and Saudi Arabia have constructed fish farms. Moreover, aquaculture industry have decreased the gap between supply and fish demand, mitigate overfishing impacts, and increased the fish production per capita with reasonable prices for needy. In addition, Egypt is a successful example of aquaculture production, where Egypt annual production of aquaculture is about 1.6 million tonnes represents about 80 percent of the total fish production and it is expected to set on growth and the average rate of aquatic food consumption in Egypt is approximately 20 kg per capita and close to the world average 20.2 kg in 2020. Moreover, Egypt comes in the first place in Africa in aquaculture production, sixth globally, and the third place in the world in the production of tilapia fish (FAO, 2022). On the other hand, fish farms are considered the main reason for coastal eutrophication, and marine invasive species. In addition, it has increased viruses, bacteria, protists, and metazoans which have damaged natural fisheries stocks and habitat loss of the Red Sea.

6. Desalination Plants

Some countries of the Red Sea such as Egypt, Jordan, Israel, and Saudi Arabia rely on desalinated water to fill the gap between the increase in water need and natural water supply sources. Furthermore, in recent years, the need for freshwater along the Red Sea coastline has increased to meet the population increase, coastline development, and tourism sector activities. In addition, according to the United Nations report by 2050 more than 60 million people from the Red Sea countries will rely on desalinated water so the amount of desalinated water produced will be more than 12 billion m^3 (BCM) yearly (Chenoweth & Al-Masri, 2022).

Saudi Arabia is the world lead in desalinated water production by approximately 12 million m^3 per day and produces about a quarter of desalinated water annually. Moreover, about two-third (65 percent) of drinking water comes from desalination plants in Saudi Arabia (Alobireed, 2021)

On the other hand, the brine water disposed at the Red Sea of the desalination plants have caused severe environmental impacts because they have increased the water salinity. In addition, the brine water disposed of desalination plants may equal twice the salinity of standard seawater (Aljohani et al., 2022), and have increased seawater toxicity, and temperature. Furthermore, the desalination plants increased the harmful algal blooms. Moreover, HABs have attached on the desalination plants' drainage pipes is channeled to the coral reefs ecosystem (Nasr et al., 2019). Therefore, depending on desalination plants as an optimal alternative to solve the scarcity of fresh water inputs will negatively impact the coastal ecosystem services and goods of the Red Sea with influences on biodiversity, fisheries, shoreline communities, and the possibility of habitats loss and death of marine species from the LME#33.

SWOT Analysis:

SWOT	
STRENGTHS	**WEAKNESSES**
❖ Coral reefs ❖ Mangrove forests ❖ Artisanal Fishing ❖ Low population rate	❖ Overfishing ❖ IUU Fishing ❖ Harmful Algae Blooms ❖ Entertainment Fishing ❖ Political instability ❖ Oil pollution and sewage ❖ Climate Change
OPPORTUNUITES	**THREATS**
❖ Remote sensing and satellite telemetry ❖ Marine Protected Areas ❖ Regional cooperation ❖ National and international fisheries Law	❖ Coastal development ❖ Commercial fishing (trawling and purse seine) ❖ Increasing Desalination Plants numbers ❖ Coral reefs bleaching ❖ Mangrove forests logging and overgrazing ❖ Aquaculture

Table.1. SWOT analysis diagram, showing the main reasons for natural fish stock sustainability of the Red Sea

Strengths elements such as coral reefs and mangroves forests have been identified in the Red Sea, they suitable grounds for fish productivity and thermal refuge of climate change impacts.

In addition, the low population rate along the red sea coastline produce a low pressure of human activities impacts on fish stocks. Moreover, using artisanal fishing method in fish catching (small fishing boat and low technology) decrease stresses on fish stocks.

Weakness elements such as overfishing and IUU fishing represent the main reasons of the natural fish stocks depletion in the Red Sea, as a result of political instability especially in the last decade. Moreover, a legally binding regarding decreasing oil pollution and climate change impacts is needed because a lack of regional coordination.

Opportunities of an effective regional cooperation, a legally binding of fisheries laws both national and international, effective marine protected areas, and using modern technologies in fishing boats tracking, all of which can limit and mitigate fish stock depletion in the Red Sea.

Some threats put natural fish stocks in the Red Sea at risk Such as coastal development, coral reefs bleaching, and mangrove forests logging. However, a regional cooperation, and proper strategies can limit and mitigate these future threats.

7. Discussion and Potential Solutions

The population of the eight countries bordering the Red Sea benefits from the services and goods that the Red Sea possesses. Therefore, LME#33 provides great opportunities for socio-economic progress and prosperity. While, the natural fish stock of the Red Sea suffers from significant impacts such as climate change impacts, IUU fishing, overfishing, marine pollution, coral reefs bleaching, mangrove forests (overgrazing and logging), population growth, tourists' activities, political instability, and coastal development, all of these impacts have depleted the fishery stocks in the red sea and endangered some marine species and made them on the brink of extinction.

The LME #33 sea surface temperature (SST) and salinity vary between the North (Gulf of Suez and Aqaba) and the south (Bab-el-Mandeb) where the highest SST in the North is considered the minimum in the South region. Furthermore, overfishing, and IUU fishing represent the bulk of the fish stock deterioration in the Red Sea, as a result of political instability in the last decade, especially in the southern region, due to the absence of fishing vessels tracking, and fisheries laws enforcement. Moreover, both low quantity and quality of fish stock near the coast have enforced commercial fishing vessels such as (trawling and purse seiners) to fish away from the coastline, and fish transshipment overseas. In addition, the assessment of aquaculture and desalination plants impacts on the natural fish production degradation in the Red sea are still very limited. Actions to restore the depleted naturally fisheries stock in the Red Sea, the following suggested solutions are categorized as follow:

7.1 Environmental Solutions

MPAs play an important role in sustaining marine environment resources and decreasing climate change impacts. Moreover, Ras-Mohamed MPA in Egypt is considered as one of the best marine protected area in the globe and it is characterized as no-take zone and located away from shipping lines. However, establishing MPAs need continuous monitoring and special care by concerned authorities. Furthermore, MPAs do not cover large areas of the Red Sea, which means that unprotected marine areas can be damaged or depleted by fishers In addition, some developed countries such as England and Scotland use MPAs in generating wind energy but this process needs a regional cooperation, and how wind farms affect marine species.

7.2 Socioeconomic Solutions

Catching large quantities of fish has an economic return and a high profit for fishers but at the expense of damage to the ecosystem and biodiversity of the Red Sea. Moreover, the natural fish stock in the Red Sea populations is not managed according to scientific advice and best practices. Therefore, tracking fishing boats from port- to-port, preventing transshipment at sea, and report the amount of catch all of which actions to mitigate IUU fishing and overfishing impacts.

7.3 Political Potential Solutions

The length of the coastline for the Red Sea countries also varies from country to another. Furthermore, there is a lack of regional coordination between the Red Sea countries regarding environmental issues. Therefore, the Red Sea countries' policies and agendas in protecting their marine environment resources are quite different (there is no one size fits all). Thus, third parties such as the United Nations Environment Program (UNEP), nonprofit organizations, and the Programme for the environment of the Red Sea and Gulf of Aden (PERSGA) have a good opportunity in activating and monitoring the regional coalitions between the Red Sea countries to mitigate marine environment regional issues.

7.4 Technological Solutions

the Red Sea countries can achieve the united nation agenda for sustainable development especially SDG 14.4 regarding eliminating overfishing, IUU fishing, and using destructive methods in fish catching. Depending on modern technology in monitoring and surveillience fishing boats by using the combination between satellite remote sensing and synthetic aperture radar (SAR). Moreover, it provides digital images with spatial resolution from 30 cm to 50 cm per pixel. Therefore, it will restore the depleted natural fish stock in appropriate time. However, this application needs High-Resolution Satellites such as Worldview, GeoEye, and QuickBird.

The remote sensing can locate small fishing vessels position in high seas with more details and high resolution images while in case of darkness, heavy weather, and clouds cover, the SAR can survey wide regions and not affected by weather conditions. While, the most optimal way to surveillance IUU fisheries is using SAR in targets detection, and remote sensing for visual recognition, and with Automatic Identification System (AIS), Vessel Monitoring System (VMS), and Long Range Identification and Tracking (LRIT) onboard fishing boats. However, the regional cooperation and coastal states political will are required

Satellite telemetry: depending on modern technology in eliminating IUU fishing , for example, satellite telemetry can provide the concerned authorities with data for tracking endangered marine species, and evaluating their movements, seasonal dispersal, and spawning positions (Baridi et al., 2021). Furthermore, remote electronic monitoring installed on board purse seiners to mitigate IUU fishing and control fish catching in Europe countries

Conclusion

To sum up, there are many threats combat the natural fish stock sustainability of the Red Sea such as overfishing, IUU fishing, marine pollution, and lately the global warming and coastal development.

However, the Red Sea which is one of the lowest oceans in the world has micro-plastics quantities because there are no river inputs and low population rate along the coastline. In addition, coral reefs, and mangrove forests work as a trap for marine pollution. Moreover, they are considered a nursery ground for spawning and fish larvae. Therefore, they play a significant role in sustaining the food chain protecting biodiversity and preserving the balance in the red sea ecosystem.

There are significant discrepancies between the Red Sea countries because the red sea includes the wealthiest, poorest, and lower-middle-income countries of the globe. Therefore, fisheries

management plans and policies in terms of fisheries sustainability will not be the same. Moreover, fisheries law enforcement either national legislation or international conventions will be quite different between them. Thus, the united nation intervention is required to prevent the improper exploitation of fisheries resources. Furthermore, regional cooperation and coordination between the Red Sea countries are required to maintain marine resources in the Red Sea for now and coming generations.

References

- Aalismail, N. A., Díaz-Rúa, R., Ngugi, D. K., Cusack, M., & Duarte, C. M. (2020). Aeolian Prokaryotic Communities of the Global Dust Belt Over the Red Sea. https://doi.org/10.3389/fmicb.2020.538476

- Afefe, A. (2021). Linking Territorial and Coastal Planning: Conservation Status and Management of Mangrove Ecosystem at the Egyptian - African Red Sea Coast. Aswan University Journal of Environmental Studies, 0(0), 0–0. https://doi.org/10.21608/aujes.2021.65951.1013

- Akhmadeeva, I. A. S. (2021). Fish Movement in the Red Sea and Implications for Marine Protected Area Design.

- Al-Rashada, Y., Al-Saady, A. B., & Hassanien, H. A. (2021). Status of commercial fisheries in the Umluj, Red Sea, Saudi Arabia. Fresenius Environmental Bulletin, 30(1), 494–503.

- Al-Tawaha, M. S., & Geiger, C. (2019). THE EFFECT OF MARINE LITTER ON MARINE LIFE IN THE RED SEA. http://www.ncbi.nlm.nih.gov/pubmed/27548788%5Cnhttp://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00124278-20160800000010%5Cnhttp://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00124278-900000000-96763%5Cnhttp://con

- Aljahdali, M. O., Munawar, S., & Khan, W. R. (2021). Monitoring mangrove forest degradation and regeneration: Landsat time series analysis of moisture and vegetation indices at Rabigh Lagoon, red sea. Forests, 12(1), 1–19. https://doi.org/10.3390/f12010052

- Aljohani, N. S., Kavil, Y. N., Shanas, P. R., Al-Farawati, R. K., Shabbaj, I. I., Aljohani, N. H., Turki, A. J., & Salam, M. A. (2022). Environmental Impacts of Thermal and Brine Dispersion Using Hydrodynamic Modelling for Yanbu Desalination Plant, on the Eastern Coast of the Red Sea. https://doi.org/10.3390/su14084389

- Alobireed, A. N. (2021). Global Water Desalination: A Comparison Between Saudi Arabia and The United States of America.

- Baridi, F. R., Sea, R., Al-mansi, A. M., Sambas, A. Z., Abukaboos, B. A., Zahrani, A. H. Al, Abdulaziz, A. S., Almasabi, A. A., Alkreda, R. S., Miller, J., Hays, G. C., Hart, K. M., & Esteban, N. (2021). Satellite Tracking of Post-nesting Green Sea Turtles (Chelonia mydas). 8(November), 1–12. https://doi.org/10.3389/fmars.2021.758592

- Bates, A. (2020). Dark Side of the Ocean: The Destruction of Our Seas, why it Matters, and what We Can Do about it.

https://books.google.com.eg/books?hl=en&lr=&id=81D4DwAAQBAJ&oi=fnd&pg=PT5&dq=overfishing,+shipping,+eutrophication,+oil+exploration,+desalination+plants,+resorts,+plastic+debris,+and+man-made+lagoons+coral+reefs+red+sea&ots=W4lMgFwi8M&sig=wDqwO-2eKZK-0k2H

- Berumen, M. L., Arrigoni, R., Bouwmeester, J., Terraneo, T. I., & Benzoni, F. (2019). Corals and Coral Reefs of the Red Sea. In Red Sea. https://doi.org/10.1016/b978-0-08-028873-4.50012-8

- Binnaser, Y. S. (2021). Global warming, marine invertebrates, and saudi arabia coast on the red sea: An updated review. Egyptian Journal of Aquatic Biology and Fisheries, 25(4), 221–240. https://doi.org/10.21608/ejabf.2021.187702

- Blanckaert, A. C. A., Omanović, D., Fine, M., Grover, R., & Ferrier-Pagès, C. (2022). Desert dust deposition supplies essential bioelements to Red Sea corals. Global Change Biology, 28(7), 2341–2359. https://doi.org/10.1111/GCB.16074

- Chaidez, V., Dreano, D., Agusti, S., Duarte, C. M., & Hoteit, I. (2017). Decadal trends in Red Sea maximum surface temperature. August, 1–8. https://doi.org/10.1038/s41598-017-08146-z

- Chanda, A., Das, S., & Ghosh, T. (2022). Blue Carbon Dynamics of the Indian Ocean. In Blue Carbon Dynamics of the Indian Ocean. https://doi.org/10.1007/978-3-030-96558-7

- Chenoweth, J., & Al-Masri, R. A. (2022). Cumulative effects of large-scale desalination on the salinity of semi-enclosed seas. Desalination, 526, 115522. https://doi.org/10.1016/J.DESAL.2021.115522

- Dabrowska, J., Sobota, M., Swider, M., Borowski, P., Moryl, A., Stodolak, R., Kucharczak, E., Zieba, Z., & Kazak, J. K. (2021). Marine Waste — Sources , Fate , Risks , Challenges and Research Needs.

- Devlin, C., Glaser, S. M., & Lambert, J. E. (2021). The causes and consequences of fisheries conflict around the Horn of Africa. 2017. https://doi.org/10.1177/00223433211038476

- El Hussieny, S. A., Shaltout, K. H., & Alatar, A. A. (2021). Carbon sequestration potential of Avicennia marina (Forssk .) Vierh . and Rhizophora mucronata Lam . along the Western Red Sea Coast of Egypt. Rendiconti Lincei. Scienze Fisiche e Naturali, 32(3), 599–607. https://doi.org/10.1007/s12210-021-01005-0

- FAO, . (2022). World Fisheries and AquacultureFine, M., Cinar, M., Voolstra, C. R., Safa, A., Rinkevich, B., Laffoley, D., Hilmi, N., & Allemand, D. (2019). Coral reefs of the Red Sea — Challenges and potential solutions. Regional Studies in Marine Science, 25, 100498. https://doi.org/10.1016/j.rsma.2018.100498

- Gajdzik, L., DeCarlo, T. M., Aylagas, E., Coker, D. J., Green, A. L., Majoris, J. E., Saderne, V. F., Carvalho, S., & Berumen, M. L. (2021). A portfolio of climate-tailored approaches to advance the design of marine protected areas in the Red Sea. Global Change Biology, 27(17), 3956–3968. https://doi.org/10.1111/GCB.15719

- Gardens, B. (2021). Environment, Biodiversity & Soil Security (EBSS). 5, 221–234.

- Genevier, L. G. C., Jamil, T., Raitsos, D. E., Krokos, G., & Hoteit, I. (2019). Marine heatwaves reveal coral reef zones susceptible to bleaching in the Red Sea. Global Change Biology, 25(7), 2338–2351. https://doi.org/10.1111/gcb.14652

- Gewida, A. G. A., Yassien, M. H., Hussein, M. S., Mamoon, A., & Branch, S. (2021). Some reproductive aspects of the Indian squid Loligo duvauceli in the Gulf of Suez, Egypt. 25(3), 367–382.

- Gokul, E. A., Raitsos, D. E., Gittings, J. A., & Hoteit, I. (2020). remote sensing Developing an Atlas of Harmful Algal Blooms in the Red Sea: Linkages to Local Aquaculture. https://doi.org/10.3390/rs12223695

- Hasan, M. H. (2019). Destruction of sea cucumber populations due to overfishing at Abu Ghosoun area, Red Sea. 6.

- Hassan, I. A., Younis, A., Al, M. A., Almazroui, M., Basahi, J. M., El-sheekh, M. M., Abouelkhair, E. K., Haiba, N. S., Alhussaini, M. S., Hajjar, D., Abdel, M. M., & El, D. M. (2022). Contamination of the marine environment in Egypt and Saudi Arabia with personal protective equipment during COVID-19 pandemic : A short focus. Science of the Total Environment, 810, 152046. https://doi.org/10.1016/j.scitotenv.2021.152046

- Kleinhaus, K., Al-Sawalmih, A., Barshis, D. J., Genin, A., Grace, L. N., Hoegh-Guldberg, O., Loya, Y., Meibom, A., Osman, E. O., Ruch, J. D., Shaked, Y., Voolstra, C. R., Zvuloni, A., & Fine, M. (2020). Science, Diplomacy, and the Red Sea's Unique Coral Reef: It's Time for Action. Frontiers in Marine Science, 7, 90. https://doi.org/10.3389/FMARS.2020.00090/BIBTEX

- Mahdy, A., Ghallab, A., Madkour, H., & Osman, A. (2021). Status of indo-pacific bottlenose dolphin, tursiops aduncus (Family delphinidae: Order cetacea) in the northern protected islands, hurghada, red sea, Egypt. Egyptian Journal of Aquatic Biology and Fisheries, 25(1), 681–697. https://doi.org/10.21608/EJABF.2021.149307

- Maiyza, S. I., El-Geziry, T. M., & Maiyza, I. A. (2022). Relationship between Temperature and Salinity Variations and the Fish Catch in the Egyptian Red Sea. Egyptian Journal of Aquatic Biology and Fisheries, 26(1), 273–286. https://doi.org/10.21608/ejabf.2022.217474

- Martin, C., Almahasheer, H., & Duarte, C. M. (2019). Mangrove forests as traps for marine litter. Environmental Pollution, 247, 499–508. https://doi.org/10.1016/j.envpol.2019.01.067

- Mohamed, Z. A. (2018). Potentially harmful microalgae and algal blooms in the Red Sea: Current knowledge and research needs. Marine Environmental Research, October 2017, 0–1. https://doi.org/10.1016/j.marenvres.2018.06.019

- Nasr, D., Shawky, A. M., & Vine, P. (2019). Status of Red Sea Dugongs (Issue July). Springer International Publishing. https://doi.org/10.1007/978-3-319-99417-8

- Nasr, H., Yousef, M., & Madkour, H. (2019). Impacts of Discharge of Desalination Plants on Marine Environment at the Southern Part of the Egyptian Red Sea Coast (Case Study). International Journal of Ecotoxicology and Ecobiology, 4(3), 66. https://doi.org/10.11648/j.ijee.20190403.12

- Osipov, S., & Stenchikov, G. (2018). Simulating the Regional Impact of Dust on the Middle East Climate and the Red Sea. https://doi.org/10.1002/2017JC013335

- Romaniv, O., & Yarmolyk, D. (2021). THE RED SEA AS TOURIST DESTINATION. 76–102.

- Saber, M. A., El-ganainy, A. A., Shaaban, A. M., Osman, H. M., & Ahmed, A. S. (2022). Trammel net size selectivity and determination of a minimum legal size (MLS) for the haffara seabream , Rhabdosargus haffara in the Gulf of Suez. The Egyptian Journal of Aquatic Research, xxxx. https://doi.org/10.1016/j.ejar.2022.02.005

- Shellem, C. T., Ellis, J. I., Coker, D. J., & Berumen, M. L. (2021). Red Sea fish market assessments indicate high species diversity and potential overexploitation. 239.

- Sheppard, C. (2019). World Seas: An Environmental Evaluation (Vol. 4, Issue 1).

- Sherman, K. (2019). Large Marine Ecosystems. Encyclopedia of Ocean Sciences, 709–723. https://doi.org/10.1016/B978-0-12-409548-9.11117-0

- Smith, G., Id, A., Shore, A., Jensen, T., Ziegler, M., Work, T., & Voolstra, C. R. (2021). A comparative baseline of coral disease in three regions along the Saudi Arabian coast of the central Red Sea. https://doi.org/10.1371/journal.pone.0246854

- Solami, L. Al. (2020). Status analysis of the red sea fisheries in the Kingdom of Saudi Arabia. Egyptian Journal of Aquatic Biology and Fisheries, 24(7-Special issue), 825–833. https://doi.org/10.21608/ejabf.2020.129183 World Bank Group. (2022).

- Zeeshan Habib, R., & Thiemann, T. (2022). Microplastic in the marine environment of the Red Sea – A short review. The Egyptian Journal of Aquatic Research, 2025(xxxx). https://doi.org/10.1016/j.ejar.2022.03.002

The Impact of Inadequate Maritime Conventions on Implementing Autonomous Ship Technology

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المستخلص
توضح هذه الورقة كيف تمثل الاتفاقيات البحرية الدولية الحالية عقبة في طريق تنفيذ تكنولوجيا الحديثة المتمثلة في السفن المسيرة ذاتيا . الاتفاقيات واللوائح التي تم التأكيد عليها في هذه الورقة هي MLC SOLAS , STCW, وكيف يمكن أن تخلق عوائق أمام قرار الاستثمار الإيجابي. بالإضافة إلى اعاقه أصحاب السفن عن تكييف هذه التكنولوجيا الجديدة. مع وضع هذه النتائج في الاعتبار تمت مناقشة الاقتراحات بدقة التي من شأنها قد تساعد في التغلب على المشاكل المحددة.
الهدف الرئيسي من هذه الورقة هو التحقيق فيما إذا كانت التكنولوجيا المطبقة حديثًا سيكون لها تأثير إيجابي على تطور النقل البحري وكذلك تحسين سلامة السفن ، ومدى فعالية المعاهدات والاتفاقيات البحرية الدولية بشأن التعامل مع مثل هذه التكنولوجيا و مقترحات لتعديل هذه الاتفاقيات لعمل هذه السفن ضمن نطاق آمن.
اعتمد البحث على منهجيات وصفية ،تحليلية وتناقضيه.

الكلمات الدالة: سفن بدون طاقم ، السفن المسيرة ذاتيا ،SOLAS, STCW

Abstract
This paper illustrates how the current international maritime conventions presents an obstacle in the path of implementing the new autonomous ship technology. The conventions and regulations that has been emphasized in this paper are SOLAS, STCW, and MLC and how they would create impediments to a positive investment decision. In addition to discouraging ship-owners from adapting this new technology. Putting these findings into consideration, suggestions has been discussed thoroughly that would help overcoming the problems identified.

The main aim of this paper is to investigate whether the newly implemented technology will have a positive impact on evolving the sea transportation as well as improving the ship safety, and the extent of the effectiveness of international maritime treaties and conventions on dealing with such technology and proposals to amend these conventions for the work of these ships within a safe scope. The research depends on descriptive, analytical, and contradictive methodologies.

Keywords: Unmanned ship، Autonomous ship, SOLAS, STCW.

1. Introduction

In recent years, the idea of an autonomous ship has had a significant impact. The EU's funding of the Maritime Unmanned Navigation through Intelligence in Networks (MUNIN) initiative has impressively raised awareness about the potential for a new era in global trade. The main idea behind this project is to provide autonomous ships the ability to make decisions while still being under the direction of a shore-based operator (LR, 2017).

The Finnish Funding Agency for Technology and Innovation supported a partnership led by Rolls-Royce to study the economic, social, legal, regulatory, and technological aspects of autonomous ships in addition to MUNIN's focus on the unmanned ship idea. This initiative also centers on allowing ships to make navigational decisions under the guidance of experts ashore (Unmanned-ship, 2017).

The International Maritime Organization (IMO) has developed rules for assessing the risks to maritime safety posed by autonomous vessels in recent years. A thorough evaluation is necessary to arising the risks that are influenced by the operation when these unmanned ships emerge, since the implementation of the unmanned vessel design will undoubtedly be advantageous to the future growth of technology. An additional IMO E-Navigation concept proposal calls for the Automatic Identification System (AIS) to be expanded to include ships, as well as to display ships' intended paths to the Shore Command Center (SCC) or other reception facilities. The development of the Artificial Intelligence Components (AIC) of unmanned shipping will undoubtedly greatly benefit from this service in terms of vessel interaction. The IMO should carefully consider designating ocean routes for unmanned vessels while also considering the implementation of the procedures that are similar to the traffic separation system that has been implemented in water areas with heavy traffic.

Member States shall register important ocean routes in the Exclusive Economic Zones and on the High Seas. The updated Collision Regulations allow only unmanned vessels operating in the maritime zone to use the authorized ocean routes. In order to ensure the safe operation of autonomous vessels, specific rules and regulations will be implemented in both surface and underwater environments. It is anticipated that hull designs for autonomous vehicles in the future will support both surface and submerged navigation. Thanks to its battery-powered propulsion, the autonomous watercraft is anticipated to be emission-free and reduce environmental air pollution (Wan, 2019).

For hundreds of years, the shipping industry has relied on the knowledge and expertise of ship crews. Autonomous technology is poised to revolutionise the marine industry with unmanned vessels. While larger vessel technology is still being developed, small unmanned vehicles have already started operating. The marine industry needs to embrace autonomy, understand how it will affect the sector's future, and figure out how to use it most effectively. The Maritime Autonomous Surface Ship (MASS) will have an impact on port infrastructure, including services and interfaces, ship design, and shipbuilding. Automation will change onshore aspects of shipping, including port infrastructure, cargo handling, and stowage, as well as the logistics and transportation network on land. Fast service, which enables shippers and customers to alter

dispatches and accept deliveries from this self-contained logistics transport chain on the fly, is one of the goals of the logistics sector (Lloyds Register (LR), 2017). To successfully introduce the MASS to the marine industry, stakeholders must cooperate and communicate based on shared understanding. The primary stakeholders and their relationships are shown in Figure (1). Onboard and ashore seafarers, insurance firms, cargo and bunkering companies, research institutions, universities, and training facilities are some of the stakeholders in the maritime industry.

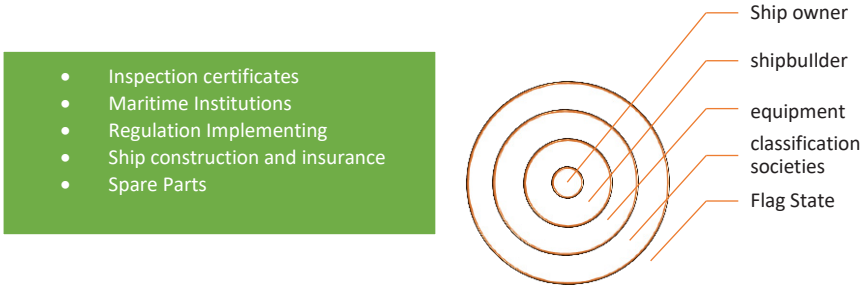

Figure 1: Marine Sector layout

This study's goal is to investigate how international treaties relate to the issue of unmanned ships, to examine the legal challenges to the development of autonomous ships and come up with solutions. The document should be consulted when revising national and international laws and regulations and when deciding whether to change current government policies in this area.

In addition, this paper presents some maritime treaties that must be changed in order to keep pace with the application of the work of automated ships, while clarifying the weaknesses in their current application to automated ships.

2. The Future of Seafarers and Manning Aspects

Globalization's impact on the maritime industry has started to be felt through the quickening pace of technological progress. The role of technology in shipping management operation is expanding however the STCW Manila 2010 safety rules have improved the sector to some extent. Maritime industry introduction of technologies like Internet of Things (IoT), Artificial Intelligence (AI), cloud computing, and blockchain will bring about some irreversible changes to the maritime sector. However, it is not yet obvious what kind of shifts the labor markets for workers will undergo. That indicates how many seafarers will be needed on board in the future, particularly in areas where unmanned ships will operate.

3. The Effect of The Unmanned Ships on The Maritime Labor Convention

There are some aspects of employing crew that are pertinent to the operation of unmanned ships. In the maritime industry, the term "seafarer" is frequently used to describe a ship's crew. The legal definition, however is more complicated than one may think. The term "seafarer" has only recently been used in international accords (ILO, 2017a, b). Most conventions use the term

"seaman." A working group identified 13 more definitions of "seafarer" in the marine labor treaties of the ILO. The definition of the crew is essential for applying the various standards to the "crew" of the Shore Command Center (SCC) because the unmanned ships are managed remotely. The MLC states that "Seafarer implies any individual who is employed or engaged or works in any capacity on board a ship to which the Convention applies" (Lielbarde, 2017).

This explains that seafarers on board the ship will be subject to the MLC. On the other hand, staff at the SCC will be able to successfully command the unmanned ships. According to the United Nations Convention on the Law of the Sea (UNCLOS) 1982, this crew will need to be skilled at navigation and seamanship. As a result, the SCC crew will assist in navigating the ship without actually being on board. This raises the question of whether SCC employees, who will be certified seafarers by all accounts, will be covered by the MLC?

4. Training and Certifications Required for Seafarers on Board Unmanned Ships

The requirements for ship's registration are primarily the responsibility of the flag state. Therefore, in order to allow unmanned ships, each flag state must modify its registration regulations. This process might not be as easy as it seems, though, because of different ships owners related to ship registration.

The UNCLOS 82 puts a number of criteria on the flag state with regard to ship registration. It is unclear if the SCC's crew will be able to fulfil the criteria as Art. 3 (b) mentions ship personnel. The same article further states that the flag state must act in relation to crew training while considering the proper international instruments. The STCW convention, which specifies minimal standards for seafarer training, certification, and watch keeping, is the most fundamental of them all. According to the STCW, seafarer training and certification require a minimum of 12 to 36 months of seagoing service. How this requirement will be met? It is presented as an intriguing question (Imo, 2017b).

In many countries, finding work for marine cadets to do seagoing service has proven difficult. Due to the arrival of unmanned ships, which cannot supply seagoing positions for maritime training, this issue will worsen as the number of positions on board decreases.

From an operational aspect, it is challenging to overcome the training challenges for a ship owner of an unmanned ship. On the one hand, the SCC will need to be manned by experienced seamen. This stipulation is made for flag states under UNCLOS. The ship won't be able to engage in international trade if this condition isn't satisfied. On the other hand, the crew will need to provide seagoing service that an unmanned ship's owner cannot to be certified.

5. Requirements for Specify Minimum Standards for the Construction, Equipment and Operation of Ships, Compatible with their Safety.

According to international convention for safe life at sea (SOLAS 74), a ship must be effectively and sufficiently manned. The convention does not, however establish the minimum number of crew members that must meet these criteria. Similar to this, UNCLOS mandates that flag state adopts all necessary safety measures, such as staffing ships, to preserve maritime security. In

accordance with UK regulations, ships with dangerous cargo must keep a safe deck watch and a safe engineering watch while in port.

From an operational perspective, ship owners are confused by the flag states' latitude on safe staffing requirements. It is more difficult to conduct business and creates barriers to entry when different jurisdictions approach safe staffing regulations in different ways. If several jurisdictions establish various manning requirements for the SCC, this problem could become worse (Carey, 2017).

6. Work Program Concern the Shipboard and Shore-Based Management

Ship owners were required to install a safety management system once the International Safety Management (ISM) Code was incorporated into SOLAS in 1994. According to Section 4 of the ISM, each Company shall designate a person or persons ashore (DPA) with direct access to the highest level of management in order to ensure the safe operation of each ship and to establish a link between the company and personnel on board. In addition to overseeing each ship's operations for safety and pollution avoidance, the authorized person or people should also make sure that there are enough resources and shore-based support available when they are required.

In the case of unmanned ships, the corporation and the crew are both housed on the same property. This could potentially enhance communication and decision-making when a safety and/or pollution prevention measure is required. In this sense, an autonomous ship may more effectively achieve the fundamental objectives of the ISM code.

7. Autonomous Ships in Terms of Seaworthiness.

The seaworthiness of the ship has a direct bearing on the owner's obligations. For instance, if a ship is fully manned, however, the operation of autonomous ships in the near future may present a problem for the aforementioned concept. The operation of autonomous ships may be carried out by computers rather than people, and crew members are no longer required to be on board, but the aforementioned theory is insufficient to address potential legal obligations resulting from on-shore ship operation and AI. Although the seaworthiness of autonomous ships is still in doubt due to the lack of a crew, the ship-owner might find it difficult to secure insurance at a fair price because the risk cannot be calculated. The ship's crew is not the only aspect of seaworthiness.

8. Master’s Role on Board Ship

The master of a ship is in charge only of the ship and is fully responsible for all matters pertaining to the ship or as mandated by laws and regulations. According to maritime law, the Master of a ship is the one in charge of all matters pertaining to the health, security, safety, and environmental protection of the ship. According to the SOLAS, the ship's master is required to perform a different task. The Master of the ship is endowed with duties, powers, responsibilities, or discretions that he must carry out or exercise for the ship's safety under international treaties and domestic law.

The Collision Regulations (COLREG), which stipulate that the action necessary for collision avoidance must be positive, done in adequate time, and with appropriate regard for excellent seamanship, may not be possible for the unmanned ship to follow. The duties and liabilities of the ship's master are transferred to SCC operators when the traditional role becomes vacant. Another issue that might have an impact on how autonomous ships operate is mandated pilotage, as different ports may have different laws or standards.

The IMO has taken on a more assertive and leadership role on MASS as a result of the recent rapid improvements in technology. To ascertain whether, where, and how unmanned ships would fit into current maritime treaties and laws, the Maritime Safety Committee (MSC) and the Legal Committee (LEG) have agreed to regulatory scoping exercises and gap analyses. In order to avoid the use of unmanned ships for illegal maritime transportation, the UN and the IMO should also look at the effects of UN sanctions and embargoes on unmanned ships.

9. Development Autonomous Surface Vessel for Search and Rescue Operations

Search and rescue operation is compulsory for all merchant ships to launched any incident or human victims in water in addition to lowering the risk of injuries and prepare recovery plans and procedures should make it simpler to transfer people from the sea to the ship. the upcoming technology for ships such autonomous ships will face more costs from tools, intelligence, surveillance and sensors on surface and deep-water to complete the search operation, to cope with MSC approved the Guidelines for the development of plans and procedures for the recovery of persons from the water. The operator at the ground station was able to monitor the sensor data and control the vessel's maneuver according to the created path.

10. Autonomous Ships is Getting Ready to Safe and Secure Distressed vessel

Before discussing the Lloyd's Standard Form of Salvage Agreement, it is a good idea to create a working understanding of salvage and salvage services. The voluntary removal of property or boats from a dangerous situation at sea is known as salvage. Services performed to effect salvage are referred to as salvage services. Salvors receive praise for their accomplishments.

The service is typically referred to as pure salvage if a salvor salvages before coming to a comprehensive understanding with the Master of the salved vessel regarding the terms of his service and the specifics of his payment. This just indicates that an admiralty court will settle the issue if the parties are unable to agree on an appropriate salvage reward following the service (Glimore ,1958).

10.1 Contract Salvage Lloyd's Standard Form of Salvage Agreement (LOF)

At this point, it would be helpful to have a fundamental understanding of the LOF concepts. The owner, master, or agent of a distressed vessel signs a LOF on behalf of the ship owner, cargo, and freight. To salvage the ship and its cargo, the salvor is required to do his "best endeavors." The contract requires the salvor to deliver the salved vessel to a secure port or anchorage. Up until a secure harbor is located, the salvage operation will continue. Owners of the salved vessel are guaranteed an early release of their property without the hassles of detention and arrest according to the form's arbitration provision. At Lloyd's, disputes are arbitrated. The salvage

contractor's award is secured by a security deposit at Lloyd's. The provision for early release is impacted by this. Last but not least, LOF was well recognized for being a no-cure-no-pay contract prior to August 1980. No-cure-no-pay is the salvage contractor's equivalent of the contingency fee arrangement used by tort lawyers: if he fails, if he doesn't save anything, he won't be compensated.

11. Survey – Mapping of the Barriers

No.	Conventions	Recommendations
1	UNCLOS	In order to establish a set of universally regarded international norms that would result in flag state and national legislation, autonomous ships should be managed by the International Maritime Organization (IMO).
2	SOLAS-STCW	State control memoranda for unmanned ship ports will need to be changed. The master role's authority, accountability, and missions with regard to port state control are replaced by the ISM Code. The IMO mandated that the lookout and officers' duty to keep watch be removed from the bridge design.
3	COLREG regulations	In the areas of safety culture, risk assessment measurement, and the precision of applying machine learning, new regulations are required. You'll need the following credentials and certificates in order to use and operate the new remote technology; The use of three-dimensional systems in the application of the maneuver with more than one decision to be taken. The responsibilities of the automated ships with bower driven vessels that are flown to it will allow the code to be changed. Using algorithms to develop a program that allows the maneuvers to be implemented safely
4	UNCLOS-MLC for manning and Seafarers	UNCLOS should be given a new scope and role, such as areas of implementing, which types of vessels that be cope with a new technology and the capabilities for the ports the deal with autonomation cycles.
5	Salvage Convention-Insurance	The IMO ought to adopt language making it quite clear that autonomous ships capable of aiding in times of need must comply by the agreement. The proposed amendment would look for technology replacements for those working on ships and hauling cargo.

Table 1: Barriers and Recommendation

12. SWOT Analysis Summaries the Developing Unmanned Shipping

Table (2): SWOT Analysis

Strengths	Opportunities
• Environmentally hazardous emissions are eliminated. • A decrease in the risk of human error and the related accidents. • Reducing fuel prices, which will aid in making up for a possible shortage of sailors. • Improving future marine transport dependability and efficiency while reducing total operating costs	• The idea of autonomous ships has gained popularity recently, and these technologies can be used to the shipping industry. •Rely on pre-programmed or self-learning algorithms to guide your judgments.
Weaknesses	**Threats**
• Work on the technology is ongoing. • There is a chance that seafarers will lose their jobs. • Unknown safety risks brought on the reliance on occasionally dubious technology. • The potential for computer hackers to seize control.	• Because the technology is still being developed, it is too soon to make a conclusion. • In order to gain acceptance of future unmanned shipping, as well as to define routes and set laws to assure their safe operation, the IMO is required. • The adoption of unmanned ships is further hampered by the current regulatory frameworks.

From the aforementioned table we pointed out that the strength and opportunities will boom within a decade ahead, since that the main aspects for the autonomous ships discuss the deduction of seafarers cost which is considered a pro for owners and investors. Therefore, all maritime sectors compete to be one of the digitalized units that make the autonomous ships more applicable. Although there are visible weakness and threats mentioned in Table (2), they no longer pose a challenge, because the maritime institutes, maritime associations and researchers are able to reach and handle a cohesive frame work to implement the autonomous ships.

13. Results

IMO should review the "Principles of Safe Manning," as adopted by IMO resolution A.890(21) and amended by resolution A.955(23), to consider the operation of Shore Command Centers and Shore-based Operators and to allow for further reductions in the number of crew on board. This is due to the rapid development of AI systems and other control technologies. These international legal frameworks won't be taken into consideration unless they are useful and functioning for the maritime sector. The uncertainty around how various jurisdictions will interpret international norms will be one of the biggest obstacles for a ship owner choosing to operate autonomous ships

According to the international regulatory system and legal precedents, seaworthiness is correlated with an adequate and qualified crew. Whether an unmanned ship may be considered seaworthy in a strict legal sense is uncertain given the current state of international maritime law. Given the aforementioned information, there are two options to consider if autonomous ships are to become a reality soon:

- The first is the utilization of the autonomous ship concept rather than an entirely unmanned design, although with a significantly reduced crew. The ability to get beyond legal restrictions is offered by this technique. Additionally, it addresses the issue of a seafarer shortage while also boosting economic sustainability by cutting staffing costs.
- The second tactic focuses on deploying the idea of an unmanned ship in a specific area. Autonomous ships work well in the human or unmanned liner shipping industry. The schedule for the liner business is pretty much unchangeable. This makes it possible to comprehend the regulatory setting at the ports of call better. This technique also reduces the dangers involved in lengthy voyages away from shore side stations.

14. Conclusion

From now on, progress in the use of modern technology has become something that cannot be ignored. The general trend now for all researchers and funders from the industry is how to use this technology to serve the industry and preserve the environment and how to reduce expenses . The most important international conventions that affect the work and continuity of modern technology represented by automated ships have been clarified, so the following have been extracted.

- The International Maritime Organization will consider most international conventions due to the importance of modern technology and its positive impact on marine life and trade.
- It is necessary to amend international agreements to add and modify modern curricula and programs to deal with such ships, and also some treaties will change completely, as shown in table 1.
- The strength and opportunity shown in the analysis confirms the necessity of the maritime transport orientation to change the itinerary to use technology, given that it serves the maritime transport sector as a whole.
- The form and content of marine jobs will change positively in the use and guidance of automated ships, which will increase the qualification of marine workers in reducing marine accidents and optimal use to preserve the environment.

References

- Arnsdorf, I., (2014). Rolls-royce drone ships challenge $375 billion industry: freight. Bloomberg. [online] Available at: https://www.bloomberg.com/news/articles/2014-02-25/rolls-royce-drone-ships-challenge- 375-billion-industry-freight

- Carey L (2017) All hands off deck? The legal barriers to autonomous ships. [ebook] Singapore: National University of Singapore, p.8. Available at: http://law.nus.edu.sg/cml/ pdfs/wps/CML-WPS-1706.pdf

- Chai Wan, 2019 Maritime autonomous surface ships (MASS): implementation and legal issues, Maritime Business Review

- Elnoury ahmad and Farag Salah (2020) ''The Impact of Implementing the Autonomous Ships System on Seafarers'' AIN jan 20 vol 39 http://ainegypt.org/

- Glimore and Black,2nd ed. The Law of Admiralty , the foundation press, Mineola NY,1975 chapter 8-2, Norris, The Law of salvage, 1958 chapter 1-4.

- IMO, (2017a). MSC 98th session. [online] Available at: http://www.imo.org/en/MediaCentre/MeetingSummaries/MSC/Pages/MSC-98th-session.aspx

- IMO, (2017b) Convention C166 - Repatriation of Seafarers Convention (Revised), 1987 (No. 166). [online] Available at: http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_ CODE:C166

- IMO, (2017c) International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). http://www.imo.org/en/About/conventions/listofconventions/pages/international-convention-on-standards-of-training,-certification-and-watchkeeping-for-seafarers-(stcw).aspx International Convention on Standards of Training Certification and Watchkeeping for Seafarers (STCW), including 2010 Manila Amendments, IMO, 2011

- Lielbarde Sandra (2017) Concept of seafarer before and after the Maritime Labour Convention 2016: comparative analysis of the legal effects of defining legal concepts in the shape of legal terminology. RGSL RESEARCH PAPER, [online] 17. Available at: http://www.rgsl.edu.lv/wp-content/uploads/2017/03 /Lielbarde_final.pdf

- Legislation.gov.uk (2017) Carriage of Goods by Sea Act 1971. [online] Available at: https://www.legislation. gov.uk/ukpga/1971/19/schedule

- Lloyds Register (LR), QinetiQ, University of Southampton. 2017. Global Marine Technology Trends *Autonomous Systems*. https://www.lr.org/en/insights/ global-marine-trends-2030/global-marine-technology- trends-2030

- Mark cohen 'Lloyds standard form of salvage agreement and the US salvage industry' Marine policy oct 1982.

- Rolls Royce Marine (2017) Autonomous ships. The next step [online] Available at: http://www.rolls-royce.com/~/media/Files/R/Rolls-Royce/.../rr-ship-intel-aawa-8pg.pdf

- Ryall J (2017) Japanese shipping line to launch unmanned container ships. The Telegraph.[online]available at: http://www.telegraph.co.uk/news/2017/08/25/japanese-shipping-line-launch-unmanned-container- ships/ [Stringer D (2017) Robot ghost ships to extend miner's technology drive to seas. Bloomberg [online] Available at: https://www.bloomberg.com/news/articles/2017-06-06/robot-ghost-ships-to-take-miner-s-technology- drive-on-high-seas

- UNCLOS (1982) United Nations Convention on the Law of the Sea of 10 December 1982. [online] Available at: http://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm

- Unmanned-ship.org (2017) MUNIN | MUNIN – Maritime Unmanned Navigation through Intelligence in Networks. [online] Available at: http://www.unmanned-ship.org/munin/ [Accessed 1 July 2017]

- Ward N, Leighton S 2010 Collision avoidance in the e-navigation environment. In Proc. 17th Conf. Int. Assoc. Marine Aids Navig. Lighthouse Authorities (pp. 4–10)

الجمعية العربية للملاحة

تأسست عام ١٩٧٨م وشهرت برقم ٦٩ / ٦٦٧ وانضمت لعضوية الإتحاد الدولى لجمعيات الملاحة فى ١٩٨٠.

أهداف وأنشطة الجمعية

- إقامة مجتمع ملاحى يضم كل من له إهتمامات بعلوم الملاحة ودعم البحوث العلمية فى مجال الملاحة.
- متابعة أحداث التطورات فى مجال الملاحة والعلوم المرتبطة بها.
- عقد المحاضرات وتنظيم الزيارات والرحلات العلمية والندوات والمعارض وعقد المؤتمرات المحلية والدولية داخل مصر وخارجها.
- إصدار النشرة الإخبارية الربع سنوية "الملاح" والمجلة النص سنوية فى يناير ويوليو من كل عام.

العضـوية

- **العضو العامل**

للعضو العامل الحق فى التمتع بالخدمات العلمية والثقافية والاجتماعية التى تقدمها الجمعية وله حق الترشح لعضوية مجلس الادارة وحضور الجمعية العمومية.

- **العضو المنتسب**

العضو المنتسب له كل حقوق العضو العامل فيما عدا الترشح لعضوية مجلس الادارة او حضور إجتماع الجمعية العمومية.

- **الاشتراكات ورسوم العضوية**

الاشتراد السنوى (١٥٠ جنيها)

- **رسم العضوية للعضو العامل فقط: (يسدد عند تقديم استمارة طلب العضوية)**

(٢٠٠ جنيها) يسدد مرة واحدة فقط.

قواعد النشر بالمجلة العلمية للجمعية العربية للملاحة

ترحب المجلة بنشر الأبحاث باللغتين العربية والإنجليزية، فى حدود ١٠ إلى ١٨ صفحة وبحد أقصى ٤٥٠٠ كلمة شاملة المستخلصات والمراجع والأشكال، وتقدم الأبحاث من ثلاث نسخ مع نسخة الكترونية على عنوان الجمعية.

تكتب الأوراق البحثيه ببنط بحجم ١٢ نقطة عادى للأبحاث باللغة الإنجليزية وحجم ١٤ نقطة عادى للأبحاث باللغة العربية والعناوين الرئيسية بحجم ١٤ نقطة تقيل (Bold) والعناوين الفرعية بحجم ١٢ نقطة تقيل (Bold).

تقبل الأبحاث الأصلية التى لم يسبق نشرها على مسئولية الباحث، وتحتفظ المجلة بحقوق النشر كاملة.

لغة النشر

تقبل الأبحاث باللغة العربية والإنجليزية مع إعداد مستخلص وعنوان البحث باللغة العربية ووالانجليزية فى حدود ١٥٠ كلمة تلخص أهم نقاط البحث وتوصياته.

الجداول والأشكال التوضيحية

يجب ترقيم جميع الجداول والأشكال بالترتيب مع كتابة عنوان ومصدر كل منها وبحد اقصى ١٥ شكل بحالة جيدة بحيث يمكن قراءة محتوياتها عند تصغيرها بعرض ١٠ سم، كذلك يجب تقديم أصول الصورة الملونة.

المعادلات الرياضية

تكتب المعادلات الرياضية بطريقة واضحة على منسق الكلمات مع تعريف الرموز غير الشائعة عند استخدامها لأول مرة.

المراجع

يشار للمراجع فى المتن باسم العائلة والتاريخ فقط، مع إعداد قائمة للمراجع فى نهاية البحث مرتبة أبجديا بحيث تشمل إسم المؤلف، ثم الحروف الأولية ثم سنة النشر وعنوان البحث و إسم المجلة العلمية بدون إختصار و إسم الناشر ومكان النشر.

قواعد التحكيم

- تحال الأبحاث للتحكيم دون ذكر إسم المؤلف حيث تعرض على محكم داخلى (أعضاء هيئة التحرير) ومحكم خارجى وفقا لتخصص كل بحث.
- تعرض الأبحاث على محكم ثالث فى حالة تعارض الرأيين السابقين والذى يعتبر رأيه نهائيا.
- يستند المحكمون فى قرارتهم بشان البحث على معايير موضوعية ومحددة فى نموذج التحكيم.
- تعرض جميع الأبحاث مرفقا لها تقرير المحكمين على هيئة التحرير لتحديد الأبحاث الصالحة للنشر.
- يتم اخطار الباحث بخطاب معتمد بإجازة نشر البحث وذلك بعد تسديد تكاليف النشر.

مراجعة التأثيرات المستقبلية لغازات الاحتباس الحراري

اعتمدت المنظمة البحرية الدولية (IMO) المجموعة الأولى من الإجراءات الإلزامية الدولية لتحسين كفاءة طاقة السفن في ١٥ يوليو ٢٠١١, وفي السنوات العشر الماضية اتخذت العديد من الإجراءات، بما في ذلك التدابير التنظيمية واعتماد تنفيذ استراتيجية خفض غازات الاحتباس الحراري لضمان تنفيذه، وتقوم المنظمة البحرية الدولية بتنفيذ برنامج شامل لبناء القدرات والمساعدة الفنية، بما في ذلك مجموعة من المشاريع العالمية. منذ اعتماد الاستراتيجية، وافقت المنظمة البحرية الدولية على برنامج إجراءات المتابعة للاستراتيجية الأولية حتى عام ٢٠٢٣ وأحرزت تقدمًا جيدًا في دراسة وتنفيذ بعض تدابير الحد من غازات الدفيئة قصيرة الأجل.

وحذا الاتحاد الأوروبي حذوها عندما تجاوز هدف خفض غازات الاحتباس الحراري لعام ٢٠٢٠ بنسبة ٢٠٪. وفقًا للبيانات الرسمية التي أبلغت عنها الدول الأعضاء في عام ٢٠٢٢، كانت انبعاثات غازات الاحتباس الحراري في الاتحاد الأوروبي أقل بنسبة ٣٢٪ في عام ٢٠٢٠ مقارنة بعام ١٩٩٠ ، متجاوزة الهدف المناخي للاتحاد الأوروبي بمقدار ١٢ نقطة مئوية. ساهم الانخفاض الحاد في الانبعاثات الملحوظة في عام ٢٠٢٠ ، والذي كان نتيجة لوباء COVID-19، بشكل كبير في هذا التجاوز. ومن ثم ، كانت مستويات الانبعاثات أقل من هدف عام ٢٠٢٠ منذ عام ٢٠١٨. وهذا يشمل الانبعاثات من الطيران الدولي والأنشطة على الأرض. ويشكل اقتراح المفوضية الأوروبية لخفض انبعاثات غازات الاحتباس الحراري بنسبة ٥٥٪ على الأقل بحلول عام ٢٠٣٠ والذي يضع أوروبا مسؤولة لتصبح محايدة مناخياً بحلول عام ٢٠٥٠.

بناءً على تقييم شامل للأثر الناتج عن الاحتباس الحراري، تم اقتراح زيادة طموح الاتحاد الأوروبي في الحد من غازات الاحتباس الحراري وتحديد هذا المسار الأكثر طموحًا للسنوات العشر القادمة. يُظهر التقييم كيف يمكن لجميع قطاعات الاقتصاد والمجتمع المساهمة، ويحدد إجراءات السياسة المطلوبة لتحقيق هذا الهدف.

وتخضع الأهداف الوطنية للاتحاد الاوروبي لخفض الغازات الدفيئة لتشريعات تقاسم الجهود بين الدول الأعضاء. كما تغطي الأهداف الوطنية قطاعات مثل النقل والمباني والصناعة غير التابعة لـ ETS والزراعة والنفايات. بحلول عام ٢٠٣٠ ، تشير توقعات الاتحاد الأوروبي المقدمة من الدول الأعضاء إلى انخفاض بنسبة ٢٩٪ في انبعاثات "مشاركة الجهود" وخفض بنسبة ٤٧٪ في انبعاثات "خدمات الاختبارات التربوية" مقارنة بمستويات عام ٢٠٠٥. سيتم الإبلاغ عن التوقعات المحدثة لغازات الدفيئة من قبل الدول الأعضاء في عام ٢٠٢٣.

هيئة التحرير

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تأثير الاتفاقيات البحرية غير الملائمة على تنفيذ تكنولوجيا السفن المستقلة
الرُبان/ احمد النورى
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