JOURNAL OF MARITIME RESEARCH

Vol XVII. No. I (2020) pp 43–51

ISSN: 1697-4040, www.jmr.unican.es

The role of digital economy in the maritime industry and its contribution to the green logistics

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ARTICLE INFO

Article history:
Received 28 January 2020;
in revised form 29 February 2020;
accepted 15 March 2020.

Keywords:
IOT, Big Data, Autonomous vessels, Cyber Security, Digital Economy, Maritime Autonomous Surface Ships MASS, Advanced Autonomous Waterborne Applications Initiative (AAWA).

ABSTRACT

The international shipping industry is responsible for the carriage of around 90% of world trade. Shipping is the life blood of the global economy. Without shipping, intercontinental trade, the bulk transport of raw materials, and the import/export of affordable food and manufactured goods would simply not be possible, The new era in the marine industry moves toward autonomous vessels, remote monitoring and control of vessels , Through IoT and the use of big data analytics the mariners could autonomously monitor and control the workshop machinery, In September 2015, Inmarsat, the industry leader in mobile satellite communications founded by the IMO, began participating in the Advanced Autonomous Waterborne Applications Initiative (AAWA) launched by Rolls-Royce to 'explore the economic, social, legal, regulatory and technological factors which need to be addressed' to make autonomous shipping a commercial reality . The implementation of an autonomous vessel will provide the opportunity to increase the efficiency of ship operation as well as enhance the 'sustainability', which is the greatest driver in any industry. This paper addresses the various effects that may arise upon the introduction and operation of Maritime Autonomous Surface Ships MASS including industry stakeholders, changes in risk factor, legal issues, education and training, ethical concerns, liability and insurance

1. Introduction.

Digitization — the mass adoption of connected digital services by consumers, enterprises, and governments — has emerged in recent years as a key economic driver that accelerates growth and facilitates job creation. In the current environment of a sluggish global economy, digitization can play an important role in assisting policymakers to spur economic growth and employment. Strategy's econometric analysis estimates that, despite the unfavorable global economic climate, digitization provided a US$193 billion boost to world economic output and created 6 million jobs globally in 2011.

The digitization concept is much larger in scope than broadband, as it encompasses the infrastructure of digital services, connectivity of devices, the digital transformation of households and production, the development of digital industries, and the availability of digital factors of production. [1]

Data have become a new economic resource for creating and capturing value. Control over data is strategically important to be able to transform them into digital intelligence. In virtually every value chain, the ability to collect, store, analyses and transform data brings added power and competitive advantages. Digital data are core to all fast-emerging digital technologies, such as data analytics, AI, block chain, IoT, cloud computing and all Internet-based services. Unsurprisingly, data-centric business models are being adopted not only by digital platforms, but also, increasingly, by lead companies across various sectors

The world is getting more connected and the needs of customers are becoming more demanding and dynamic. Shipyards today need to design and produce more innovative and energy-efficient

vessels in order to stay competitive, the maritime indus-

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try moves towards autonomous vessels, remote monitoring and control of a ship's engine. This will be further enhanced by i4-related technologies such as IoT (sensors and communication) and big data analytics for automatic decision- making. Key challenges for implementing these i4 technologies in ship operations include cyber security and integrating different ship systems and equipment into a single operating platform

The International Maritime Organization IMO's Strategic Plan (2018-2023) has a key Strategic Direction to "Integrate new and advancing technologies in the regulatory framework". This involves balancing the benefits derived from new and advancing technologies against safety and security concerns, the impact on the environment and on international trade facilitation, the potential costs to the industry, and finally their impact on personnel, both on board and ashore.

In 2017, following a proposal by a number of Member States, IMO's Maritime Safety Committee (MSC) agreed to include the issue of marine autonomous surface ships on its agenda. This would be in the form of a scoping exercise to determine how the safe, secure and environmentally sound operation of Maritime Autonomous Surface Ships (MASS) may be introduced in IMO instruments.

The MSC recognized that IMO should take a proactive and leading role, given the rapid technological developments relating to the introduction of commercially operated ships in autonomous mode (operating without crew)

The introduction of the Autonomous ship concept to the shipping industry might start a new era and become a game changer in terms of cost efficiency, accident prevention, and human resources. According to Rolls Royce (a leading company in Autonomous ship research) and other supporters of the project, the main advantage of such ships is that they might reduce maritime accidents caused by fatigue and alcohol abuse (RollsRoyce, 2015)

2. Literature Review.

The term "Digital Economy" was popularized by Don Tapscott – a leading global authority on the economic and social impact of technology – in his 1994 book "The Digital Economy: Promise and Peril in the Age of Networked Intelligence." More than 20 years ago, he highlighted that "in the old economy, information flow was physical: cash, checks, invoices, bills of lading, reports, face-to-face meetings, analog telephone calls or radio and television transmissions, blueprints, maps, photographs, musical scores, and direct mail advertisements. In the new [digital] economy, information in all its forms becomes digital - reduced to bits stored in computers and racing at the speed of light across networks." For the OECD, "the Digital Economy is an umbrella term used to describe markets that focus on digital technologies [and which] typically involve the trade of information goods or services through electronic commerce."

According to Waterborne TP an "autonomous ship is described as a next generation modular control systems and communications technology will enable wireless monitoring and control functions both on and off board. These will include advanced decision support systems to provide a capability to operate ships remotely under semi or fully autonomous control.

In the literature autonomous ship usually refers to a ship navigating on its own, without a supervision and intervention of an operator; decisions concerning navigation and other shipboard operations are generated by the system

The IMO's Maritime Safety Committee MSC defined provisional degrees of autonomy for its scoping exercise:

Degree one: ship with automated processes and decision support. Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised, but with seafarers on board ready to take control.

Degree two: remotely controlled ship with seafarers on board. The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.

Degree three: remotely controlled ship without seafarers on board. The ship is controlled and operated from another location. There are no seafarers on board.

Degree four: fully autonomous ship. The operating system of the ship is able to make decisions and determine actions by itself.

Seuring and Müller (2008), defined green logistics as the management of the flow of knowledge, materials and funds between institutions, which aim at growing with emphasis on social and environmental sustainability, while paying attention to the demands of all the stakeholders

Regarding the maritime industry, the term sustainability is often used as a synonym for the environmental aspects of shipping (Cabezas-Basurko et al, 2008). This narrow definition tends to favor the introduction of technological solutions mainly, that may reach one sustainability goal but simultaneously may contradict with another goal (Chatzinikolaou and Ventikos, 2011). Moreover, among all environmental aspects, sustainability often coincides with energy efficiency and CO_2 emissions of ships or the emissions of toxic atmospheric pollutants (Chatzinikolaou and Ventikos, 2011). Atmospheric emissions from all economic sectors.[2]

3. Contingency of autonomous vessels.

In 2017 the EU-funded MUNIN (Maritime unmanned navigation through intelligence in networks) project worked to develop a technical concept for such ships and assess its feasibility. Project partners developed a technical concept for the operation of an unmanned merchant vessel during the deep-sea part of its voyage. The ship is autonomously operated by new systems aboard the vessel. However, the monitoring and controlling functionalities are performed by an operator on land. They also assessed the concept's technical, economic and legal feasibility

The MUNIN team developed prototypes for the subsystems, including both on-board and onshore modules. The systems are not intended for use in harbors or congested shipping lanes.

An advanced sensor module automatically looks out for traffic, obstacles and weather conditions surrounding the vessel by continuously combining sensor data from existing navigational systems with modern daylight and infrared cameras. A shore control center continuously monitors and controls the vessel.

The primary results shows that Unmanned and autonomous vessels can contribute to the aim of a more sustainable European maritime transport industry, as it bears the potential to:

1. Reduce operational expenses,
2. Reduce environmental impact and
3. Attract seagoing professionals.

(Joo Hock Ang et al., 2017) draw our attention to the need to design and produce more innovative and energy-efficient vessels in an increasingly competitive market. "ships are considered engineering structures that are highly customized (high mix) and constructed in low quantities (low volume). From an i4 perspective, consumer products are regarded as a "spatial character" of smart design and manufacturing. On an opposing horizon, ships can be built as a "smart product through-life", which is regarded as a "temporal character" of smart design and manufacturing. "Spatial character" here relates to quantity, while "temporal character" is associated with time (lifecycle).[3]

(C. L. Benson et al., 2018) comes to the conclusion that all of the modes(of transport vessels) except ocean shipping will quickly and permanently gains a significant cost advantage in adapting the autonomous mode over its non-autonomous counterpart .

Rolls-Royce estimates that unmanned ships would result in a 20% reduction in fuel costs, more cargo storage relative to the ship's size and a 40% reduction in operating costs (Mooney 2015). Although voyage crew costs will be reduced, the SCC requires manning by experienced mariners and in ports of call, the unmanned ship will need special communication, mooring and cargo handling infrastructure, which will increase the cost and limit areas of operation.

(Futurenautics Ltd. 2016) predicted that Unmanned ships could potentially offer 40%+ operational savings, whilst enabling more cargo to be carried, providing a major advantage for ship operators who invest in them. Crucially, it is also suggested that these ships will not just be as safe as those with experienced crew, but even safer[16]

(Trudi Hogg et al ,2016) reached the conclusion that Unmanned ships have the potential to improve maritime safety and environmental protection whilst balancing commercial interests and sustainable growth of the maritime industry.[9]

Based on the literature it has been suggested that autonomous vessels represent the future of maritime shipping, autonomous vessels will bring considerable opportunity for cost savings and potential increases in safety, but Technology could be mariner's best friend or worst enemy. Overreliance on these systems can create a false sense of security, especially while navigating or operating equipment on the high seas. The industry will be adversely affected in the near future with a growing cyber threat

4. Limitations of autonomous vessels.

4.1. Cyber Security.

Security has always been a concern with naval ships, and the military routinely exercise precautions to maintain the security of their ships and offshore assets. Commercial vessels routinely employ special security measures under certain circumstances to prevent theft, piracy, smuggling or stowaways. Those crimes are usually economically motivated, where destruction is not the goal. Acts of terror are usually politically motivated, and ships and offshore assets are prime targets because of their mobility and high potential for causing extensive damage to life, property, the environment, and the transportation and economic infrastructure, The topic of cyber security within the maritime industry is as dynamic as any other sector of business. The industry's global reach, large volume of capital transactions, extensive use of commercial services, and reliance on information technology create significant opportunities for exploitation through the cyber domain.

The growth of digitalization and the connectedness produce pressure on the industry to be more and more connected. shipping companies, vessels ,ports and terminals tend to install similar software to load ,unload and track cargo , the absolute dependency of systems and equipment regarding interconnectivity operations is creating more vulnerability and representing an increase in opportunities for cybercrimes ,so the vulnerability of a one single software installed could cause significant damages to other vessels, ports, terminals and shipping companies consequently.

IMO Facilitation Committee (FAL) and the Maritime Security Committee (MSC) defined IMO Guidelines on maritime cyber risk management in MSC-FAL.1/Circ.319. Both recognized the urgent need to raise awareness on cyber risk threats and vulnerabilities and to provide high-level recommendations on maritime cyber risk management from current and emerging cyber threats and vulnerabilities, including main areas that support effective cyber risk management (identify, protect, detect, respond and recover).

Cyber security is not just about preventing hackers gaining access to systems and information, potentially resulting in loss of confidentiality and/or control. It also addresses the maintenance of integrity and availability of information and systems, ensuring business continuity and the continuing utility of digital assets and systems. To achieve this, consideration needs to be given to not only protecting ship systems from physical attack, force majeure events, etc. but also ensuring the design of the systems and supporting processes is resilient and that appropriate reversionary modes are available in the event of a compromise.

In the previous year's Maritime has fallen victim to multiple cyber-attacks which caused huge financial and operational losses. In August 2011, the Islamic Republic of Iran Shipping Lines (IRISL), an Iranian state-owned shipping company, fell victim to a cyber-attack.33 Lars Jenson, founder of CyberKeel, reported, "The attacks damaged all the data related to rates, loading, cargo number, date and place ... resulting in severe financial losses

In 2012, the major Saudi Arabian state owned oil and gas company, Saudi Aramco, which provides 10% of the global oil suffered a cyber-attack during Ramadan month. An employee of the company opened a phishing mail with an infected link. According to Abdullah al-Saadan, vice president for corporate planning of Aramco, the primary intention behind this attack was to stop the flow of oil and gas to the international and national market (Reuter, 2012).

In April 2012, the Danish Maritime Authority was subjected to a cyber-attack. However, it was not until 2014 that the Administration discovered the attack. The attack was simply introduced by a Pdf document infected with a virus, and the virus was propagated from the Danish Maritime Authority to other government institutions before it was discovered in 2014 (Linton, 2016). Sensitive information from Danish shipping companies and merchant navy fell into the hands of hackers

The growing use of big data, smart ships and the "internet of things" will increase the amount of information available to cyber attackers and the potential attack surface to cyber criminals. This makes the need for robust approaches to cyber risk management important both now and in the future.[3]

GPS technology, coupled with geographic information system (GIS) software, is key to the efficient management and operation of automated container placement in the world's largest port facilities. GPS facilitates the automation of the pick-up, transfer, and placement process of containers by tracking them from port entry to exit. With millions of container shipments being placed in port terminals annually, GPS has greatly reduced the number of lost or misdirected containers and lowered associated operation costs, the most likely GPS maritime threat scenarios could be Jamming of a port or other congested waterway by an individual or small group of non- state actors using small, portable jammers[22]

The maritime vessels have become especially reliant on GNSS technology , The vast majority of vessels now rely on (GNSS) which could be spoofed or blocked causing disrupt of navigation, , GNSS signals could be vulnerable to the following threats ;Jamming and Interference by broadcasting a stronger signal that intentionally or unintentionally blocks or impacts a GNSS satellite signal. Spoofing by broadcasting a false GNSS signal, but at a slightly greater power which could deceives the GNSS receiver into locking onto the spoofed signal, Meaconing by causing intentional delay and rebroadcast of a GNSS signal intended to introduce error to receivers.

A cyber-attack could also modify ship information details, such as course, name, cargo, position, and speed, or send false warnings, alarms and distress signals. One more system used for vessel navigation is the Electronic Chart Display and Information System, used to supplement the old- style navigation charts. It is interconnected with other vessel systems and sensors, such as Navigational Telex (Navtex), AIS, echo-sounder, radar, and anemometer.

[3]BIMCO, CLIA, ICS, INTERCARGO, INTERMANAGER, INTERTANKO, IUMI, OCIMF and WORLD SHIPPING COUNCIL "The guidelines on cyber security onboard ships, Version 3.0".

Autonomous vessels will rely heavily on navigation, communications, and monitoring capabilities so will need to ensure that cyber security incidents do not arise. All these
systems will need to be robust and resilient to any attacks by criminals or pirates wishing to hijack the vessel or its cargo

The maritime industry must be cognizant of the probable devastating effects that cyber-attacks can have on shipping companies, vessels, ports and maritime administrations, with catastrophic environmental impacts and consequences that can result in business interruption, financial loss and reputational effects. To minimize the possible negative outcomes in terms of environmental damage, it is essential to develop and implement robust cyber security measures and actions[12]

The Baltic and International Maritime Councils (BIMCO) in 2017 relied on publications of NIST and IMO. The BIMCO's attitude is published as 'Guidelines on Cyber Security Onboard Ships". BIMCO approaches to cyber risk problems through the following items: 1-identification of threats and vulnerabilities, 2-assesment of risk exposure, 3-development of protection and detection measures, 4-establishment of contingency plans to respond and recover upon a cyber- security incident.

It has now been suggested that various actions needed to improve the cyber security of critical infrastructure. These include developing a cyber-security framework; increasing the volume, timeliness, and quality of Cyber threat information shared with the maritime industry ; considering Prioritized actions to identify critical infrastructure for which a cyber-incident could have a Catastrophic impact, The concept of cyber security is novel to many maritime stakeholders and it is timely to raise awareness about the existing countermeasures. It is essential to create a common understanding that includes the shared responsibility amongst maritime stakeholders.

(Victor Bolbot et al., 2019) implemented a risk assessment for the navigation and propulsion systems of an inland autonomous vessel ,The study implemented the Cyber Preliminary Hazard Analysis (CPHA) method to an autonomous vessel , The CPHA better described the relevant hazardous scenarios by incorporating the potential attack type and the relevant hazardous Consequences, The CPHA also seems to be more realistic than the STRIDE and MaCRA methods cause it is not limited to certain types of attacks. [13]

The research findings had several interesting features; the most critical scenarios are related to the access to the ship control station and shore control station, whilst other top critical ones were related either to the GPS signal related attacks or a malware installation on the collision avoidance system and the situation awareness system. In this analysis, single attacks scenarios have been considered. However, more complicated attacks can be implemented, if several single attack scenarios are combined. The research suggests that the following cyber security recommendations;

- Increasing redundancy in communication between different network zones (Zone 1,Zone 2, Zone 3 and Zone 4.
- Installation of firewalls between each zone (on the conduits).

- Addition of a safety system verifying the safety of the automatic navigation control system actions.
- Checking and filtering application for the GPS signals measurements, addition of anti-interference antennas, Encryption for the VHF signals,Use of kernels on the critical controllers, implementing Two or three factors authentication for software updates and patching. Installing an intrusion detection system in each zone, Selecting critical health sensor measurements and sending them to the shore control centre at specific intervals, Implementing a safe system shutdown, in case of a critical systems loss, Interconnecting the main engine with the generator using power take-in/take off systems. Planning of route verification by the shore control center.

4.2. Human Resource.

One subject gaining interest among maritime students is going to be of course how the training for land based operators is going to be made. After all as a seafarer the introduction of unmanned vessels can still be seen as a possibility for new kinds of job openings and safer industry, instead of just reducing number of jobs and creating new worst-case scenarios[24]

The human element is present on the unmanned ship, because it has been designed and constructed by a human being. The human factor has been shifted from the actual moment of operation to an earlier phase of the life time of the ship, when the whole technical system was designed, built and tested.

Leveson (1995) expresses this by stating that "removing dependence on an operator by installing an automatic device to take over the operator's function only shifts that dependence onto the humans who design, install, test, and maintain the automatic equipment – who also make mistakes.[15]

The incident categories collision and foundering are responsible for almost 50% of all total losses in the 2005 to iod. Thus it clearly represents the category with the highest incident probability. Furthermore, human errors are a crucial part of the root cause of most maritime accidents. Based on an analysis of collision and foundering scenarios for a Maritime Unmanned Navigation through Intelligence in Networks MUNIN concept vessel and given a proper operational and robustness testing, a decrease of collision and foundering risk of around ten times compared to manned shipping was found to be possible, mainly due to the elimination of fatigue issues[7]

It is proclaimed that the incidence of human error will be significantly decreased on the unmanned merchant ship; however, the onboard technology requires calibration and maintenance by humans and the vessel requires constant monitoring from a shore control room where operators will be interpreting, absorbing and acting on information sent from the ship. Human error risks are not eliminated and the unmanned vessel will face new challenges for safe operation and monitoring, as shore operators seek to obtain awareness of the vessel and its surrounds.[9]

The absence of personnel costs onboard reduces operational costs at sea, therefore the viability of slow steaming ships increases, enabling less fuel consumption and lower gas emissions from exhaust. With no need for crew accommodation unmanned ships would weigh less and have more room to carry cargo.

As ship design becomes more sophisticated and big data-centered, a new generation of naval architects, technicians and engineers will evolve and new roles in cyber security and management of operations will be created in the industry. This will effect educational institutions, regulation requirements, port operations and commercial expectations. Countries unable to afford to move with the times will be limited in their capacity to build new designs. High-skilled jobs will require tertiary educated employees who demand higher wages. Lower-skilled positions previously available to mariners with certificates of ability acquired through sea-time and physical performance may become obsolete due to technological evolution of the industry

4.3. Further Challenges.

Legislative.

To date, there are no public international law instruments to regulate autonomous shipping – whether the construction or operation of vessels or relevant training and certification requirements of onboard crew or shore-based operators. There has however already been an international crossing by an Unscrewed Surface Vessel from West Mersey to Oostende (Maritime Training Insights Database [MarTID], 2019). [18]

Shipping industry is currently regulated by both international and national regulations which may present some challenges to the introduction of autonomous maritime operations. This includes conventions from the International Maritime Organization (IMO), The most important conventions that might require excessive amendments to include a fully autonomous maritime operations are: International Convention for the Safety of Life at Sea (SOLAS), 1974, International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997 (MARPOL) International Convention on Standards of Training, Certification and Watch-keeping for Seafarers (STCW) as amended, including the 1995 and 2010 Manila Amendments, and Convention on the International Regulations for Preventing Collisions at Sea (COLREG), 1972.

International Convention for the Safety of Life at Sea (SOLAS),The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960. The 1974 version includes the tacit acceptance procedure - which provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties.

One of the most important issues which may challenge the very essence of the Autonomous ship is Chapter V Regulation 14 of SOLAS, regarding the manning of ships. The other one is Regulation 33 (Distress Situations: Obligations and Procedures) of the same chapter, which will be analyzed under paragraph 3.5 Search And Rescue. The Autonomous ship is not excluded from Chapter I, thus the phrases “shall be sufficiently and efficiently manned” and “shall be provided with an appropriate minimum safe manning document or equivalent”, means that somehow these requirements must be fulfilled, otherwise the rule must be adapted to reflect the new reality of a ship without crew on board.[19]

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes,The MARPOL Convention was adopted on 2 November 1973 at IMO. The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977. A in 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument entered into force on 2 October 1983. In 1997, a Protocol was adopted to amend the Convention and a new Annex VI was added which entered into force on 19 May 2005. MARPOL has been updated by amendments through the years.

The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes. Special Areas with strict controls on operational discharges are included in most Annexes.

It is our recommendation to amend the order on reporting under the act on protection of the marine environment in order to clarify that reports could be made by a remote operator in relation to autonomous ships, with reference to the future definitions of a ”remote operator” and ”autonomous ships” in the merchant shipping act, cf. section 4.5.9.[20]

International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978 (STCW). The Manila amendments to the STCW Convention and Code were adopted on 25 June 2010, marking a major revision of the STCW Convention and Code. The 2010 amendments are set to enter into force on 1 January 2012 under the tacit acceptance procedure and are aimed at bringing the Convention and Code up to date with developments since they were initially adopted and to enable them to address issues that are anticipated to emerge in the foreseeable future.

STCW (2010) states clear requirements for watch-keeping, assuming that the ship is manned. The convention requires that a ship shall be navigated and maneuvered by the master or a responsible watch officer on the bridge. This leaves little opportunity to have these functions carried out fully autonomously. Similarly, there is a requirement to have ships manned with certified engineers. [17]

Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs). The 1972 Convention was designed to update and replace the Collision Regulations of 1960 which were adopted at the same time as the 1960 SOLAS Convention. One of the most important innovations in the 1972 COLREGs was the recognition given to traffic separation schemes - Rule 10 gives guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes, Only under special circumstances are deviations from the rules may take place but the vessel shall always follow “the ordinary practice of seamen”. It is however very hard to define “ordinary practice of seamen” to an autonomous system – there is no such practice yet.

The International Maritime Dangerous Good (IMDG) Code (IMO 2014) in the case of an emergency, immediate crew intervention onboard is essential to contain and manage any potential dangers that arise. The liability of transporting hazardous cargo by MAS is most unlikely to be covered by any insurance company.

Insurance.

The marine insurance is determined based on the risks of the business. The new role of shore based controller definitely generates new risks. Even though the shore based controller is going to be regarded as “crew” in the context of law, the insurer is very likely to have opposing views due to the new change

The liability of AV is definitely far more complex than the ROV. The autonomous ship is something that is unparalleled to anything previously. Although it has been discussed previously that the ship- owner will be strictly liable for the damage, it does not prevent the injured parties to seek compensation from other relevant parties directly based on other rules. The main reason is that there is no limitation amount for those claims as they are not considered as maritime claims.[21]

As the primary party capable of including the risk connected with the operation of ships in its business and obtaining insurance coverage, ship-owners have historically been the liability nexus for the operation of ships. In general, it is assumed that ship-owners will retain this position also in relation to MASS. However, the introduction of MASS brings about considerations in relation to (a) liability standards, (b) the right to limitation of liability and (c) right of recourse towards manufacturers.[22]

In the absence of clarification and explicit solutions to clarify the issue of liability, there is a real concern that the application of the current fault-based liability could be replaced with a strict liability standard for ship-owners. This development would not be welcomed.

The autonomous vessels contribution to the green logistics.

In order to investigate the contribution of the autonomous vessels to the green logistics the research will adhere to a matrix to evaluate the expected contribution of the adoption of the autonomous vessels to the green logistics, As mentioned by (David Staš et al., 2015) designed a conceptual framework for creating the Green Transport Balanced Scorecard models from the viewpoint of industrial companies and supply chains using an appropriate multi-criteria decision making method. The research suggested that the green transport GT strategy matrix is based on the following criteria:

(1) Expected green effect after the GT strategy implementation - low or high. (2) Estimated cost of the GT strategy implementation - low or high. (3) Responsibility to decide on the GT strategy implementation in the given company: (I) In the responsibility of the implementers or (II) Limited responsibility of the implementers (e.g., within the responsibility of another company department or corporation). The results are four main

GT strategies: (1) Ideal - high green effect can be achieved at low costs or even cost savings. (2) Economic - only a limited green effect can be achieved at low costs or even cost savings. (3) Ecological—incurring high costs will achieve a high green effect. (4) Ineffective - incurring high costs bring only a limited green effect. [23]

The research had used the balanced scored card as a tool to evaluate the company's performance to green logistics strategic goals. We refined the method Balanced Scorecard metric explained by (David Staš et al,2015) to match the nature of our studies , For the sake of simplicity some of the key performance indicators (KPIs) were eliminated to provide an overall evaluation for the subject without going through details that doesn't match our research nature. Balance score card metric was selected in order to evaluate the promotion of the autonomous vessels to the maritime industry cause it analyze and monitor the performance of financial and non-financial data items[4].

Figure 1

Perspectives	Objectives
Financial	Transport cost saving
Internal Business Processes	High return on investments in green projects Decreasing the CO2 emissions
Learning and Growth	Increasing the Green Knowledge Increasing the green innovativeness of the staff
Customers	Increasing the green image of transport Reducing the local environmental impact

Source: Authors.

Figure 1 shows the four main pillars of the balance score card (financial, internal business, learning and growth, customers). The current study will focus in each of the four perspectives objectives to review the efficiency of the autonomous vessels in matching these objectives, else ways a typical balanced scorecard will include accurate KPI in measuring the performance of the four perspectives.

[4]Balanced scorecard is a strategy performance management tool – a semi-standard structured report, that can be used by managers to keep track of the execution of activities by the staff within their control and to monitor the consequences arising from these actions

4.4. Financial Perspective.

Transport cost saving.

The promotion of the autonomous vessel will mainly provide the same services provided by the non- autonomous vessels ,the reduce of the non -autonomous associated costs as crew salaries ,energy usage will provide competitive advantage for the autonomous vessels however (C L Benson, Sumanth,et al,2018) argues that the current costs for autonomous transport modes have to account for the higher capital costs incurred due to automation. With the new modes of transport (i.e. autonomous modes) there is by definition significantly less publicly available data. Thus, the current operational costs are calculated using increase factors derived by comparing individual data points for a transport mode and their autonomous counterpart.

4.5. Internal Business Processes.

High Return on investment in green projects, reduce CO_2 emissions.

Despite the research which took place during the previous decade on autonomous vessels, the concept remained out of Ship owner's interest mainly due to high investment and maintenance costs involved as fully autonomous vessels monitored from land will require high-quality and reliable communication systems between the unmanned ship and shore. The communication systems are critical for safety and security and will come at a high cost[9], As others have highlighted "autonomy [is] best suited to smaller vessel types, where the return on investment is relatively short", concurs with ours, at least in the short and medium term.

Nearly one third of the world's fleet could switch to unmanned operations but that there was a particularly good case for the switch being made for cargo vessels moving non-hazardous cargoes, ferries, tugs and other smaller units in the confines of the port, as well as on inland waterways.[5]

The current costs for autonomous transport modes have to account for the higher capital costs incurred due to automation. With the new modes of transport (i.e. autonomous modes) there is by definition significantly less publicly available data. Thus, the current operational costs are calculated using increase factors derived by comparing individual data points for a transport mode and their autonomous counterpart.[8]

Yara Birkeland will be the world's first fully electric and autonomous container ship with zero emissions ,Yara will reduce diesel-powered truck haulage by 40,000 journeys a year, The new vessel is expecting to move transport from road to sea and thereby reduce noise, dust, improve the safety of local roads, and reduce NO_x and CO_2 emissions ,The new autonomous vessel is scheduled to start operation in 2020 by shipping products from Yara's Porsgrunn production plant to Brevik and Larvik in Norway.

[5]https://www.hfw.com/Autonomous-ships-MASS-The-Pearl-of-an-Opportunity-July-2019.

4.6. Learning and growth.

Increasing the green knowledge / Increasing the green innovativeness of the stuff.

(M. Baldauf et al ,2018) conducted a simulation study for traffic scenarios including conventional manned and future unmanned ships , The results of the 24 participants involved in the study shows the seafarers very much tend to use VHF to get in contact with VTS and other targets respectively. The use of the view out of the bridge window was seen as essential part to fulfil the task however the research suggested further analysis to be laid on the need for specific training issues that might be needed to remote control an unmanned vessel.

The shore crew required to operate unmanned ships will involve a new level of aptitude to manage and analyze data, an attractive opportunity for some, whilst raising concerns about training and certification for others. An experienced Master remains a requirement to helm the vessel from ashore, and whilst shore-based employment has family and social benefits likely to attract new recruits to the profession, as specialized shore crew age how will these experienced mariners be replaced if there are less crew gaining first-hand experience of actually working at sea, for example the shore control center SCC[6] workers could be exposed to too much information in a manner such they would no longer have the capability in understanding the situation at the sea. Two reasons for this can be identified. Firstly, the workers could be overwhelmed quite simply because they have to take care of several ships instead of just one; human errors might take place especially when focus is steered from one ship to another Secondly, since there would be limited "natural" feel of the ship, this information could be replaced with visual representation on the three dimensional orientation of the ship (based on gyroscope-derived data); this, however, could be overwhelming in view of the capabilities of the operators In other words, replacing the bodily feel of the ship with visual indications could come with the tradeoff of information overload.[9]

4.7. Customers.

Increasing the green image of transport / Reducing the local environmental impact.

According to the Nielsen report, "Brands that are able to strategically connect (sustainability) to actual behavior are in a good place to capitalize on increased consumer expectation and demand.[7] The autonomous vessels reveals the possibility of providing the current maritime services in a more sustainable manner which provide a competitive advantage against other non-autonomous vessels .

[6]Rolls-Royce unveiled its vision of the land-based control center?s that will remotely monitor and control the unmanned ships of the future, the center will be composed of a small crew of 7 to 14 people monitor and control the operation of a fleet of vessels across the world. The crew uses interactive smart screens, voice recognition systems, holograms and surveillance drones to monitor what is happening both on board and around the ship.

[7]https://www.entrepreneur.com/article/324001.

Conclusions.

The deployment of the autonomous vessels can contribute to the aim of more sustainable economies as it bears the potential to reduce operational expenses with a less environmental impact.

There is evidence to suggest that autonomous vessels represent the future of maritime shipping, autonomous vessels will bring considerable opportunity for cost savings and potential increases in safety, but Technology could be mariner's best friend or worst enemy. Overreliance on these systems can create a false sense of security, especially while navigating or operating equipment on the high seas. The industry will be adversely affected in the near future with a growing cyber threat

In our opinion various actions needed to improve the cyber security of critical infrastructure. These include developing a cyber-security framework; increasing the volume, timeliness, and quality of Cyber threat information shared within the maritime industry; considering Prioritized actions to identify critical infrastructure for which a cyber-incident could have a Catastrophic impact, The concept of cyber security is novel to many maritime stakeholders and it is timely to raise awareness about the existing countermeasures. It is essential to create a common understanding that includes the shared responsibility amongst maritime stakeholders.

As ship design becomes more sophisticated and big data-centered, a new generation of naval architects, technicians and engineers will evolve and new roles in cyber security and management of operations will be created in the industry. This will effect educational institutions, regulation requirements, port operations and commercial expectations. Countries unable to afford to move with the times will be limited in their capacity to build new designs. High-skilled jobs will require tertiary educated employees who demand higher wages. Lower-skilled positions previously available to mariners with certificates of ability acquired through sea-time and physical performance may become obsolete due to technological evolution of the industry

To date, there are no public international law instruments to regulate autonomous shipping - whether the construction or operation of vessels or relevant training and certification requirements of onboard crew or shore-based operators.

In the absence of clarification and explicit solutions to clarify the issue of liability, there is a real concern that the application of the current fault-based liability could be replaced with a strict liability standard for ship-owners. This development would not be welcomed.

Yara Birkeland will be the world's first fully electric and autonomous container ship with zero emissions ,Yara will reduce diesel-powered truck haulage by 40,000 journeys a year. The new vessel is expecting to move transport from road to sea and thereby reduce noise ,dust, improve the safety of local roads, and reduce NO_x and CO_2 emissions ,The new autonomous vessel is scheduled to start operation in 2020 by shipping products from Yara's Porsgrunn production plant to Brevik and Larvik in Norway.

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