IAMU International Association of Maritime Universities

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AGA 20 — 20th Annual General Assembly IAMU

The 20th Commemorative Annual General Assembly

AGA20

International Association of Maritime Universities

30 October - 1 November 2019

Tokyo Japan

The International Association of Maritime Universities (IAMU) Conference Book

The International Association of Maritime Universities

Conference Book

Tokyo, Japan
1 November 2019

Editor-in-Chief
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Table of Contents

Preface

Dear Colleagues,

As a part of the Annual General Assembly (AGA), the International Association of Maritime Universities Conference (IAMUC) brings together academician and researchers of each member university from all over the world to discuss recent progress and future trends in maritime education, training, research and other matters within the scope of the IAMU. IAMUC 2019 is the 20th conference as a sequence of events that started in Istanbul in 2000, and were held more recently in Haiphong (2016), Varna (2017) and Barcelona (2018).

The theme of the AGA20 is Charting the Course for the Future of Maritime Universities: Environmental, Technological, Economical, Social, and Policy Impacts. The IMAUC program is organized within six sessions, five sessions dedicated to the main theme categories and the additional Student Session.

The Conference Book contains information about organization and program of the IAMUC 2019, and abstracts presented at the IAMUC in Tokyo, Japan, on 1st of November 2019. Thanks to 140 high level abstract submissions from 29 different countries and 50 different IAMU universities, a strong program could be compiled with accepted 30 oral and 39 poster presentations. The selection was based on the double peer review process. The parallel oral presentations took place in three rooms allowing switching between synchronized sessions. Poster presentations were held during coffee/tea and lunch breaks, although all posters were displayed during the whole IAMUC. Each of the sessions were concluded with the session discussion.

On behalf of the International Program Committee (IPC), I would like to thank all authors for their efforts and contributions in development of the IAMUC program. Specially, I would like to thank all IPC members and Session Chairs for their valuable time and expertise.

Prof. Boris Svilicic
IAMUC Program Editor

Theme

Charting the course for the future of maritime universities:
Environmental, Technological, Economical, Social, Policy impacts.

Organization

Committees

To make the AGA 20 a success, the IAMU Secretariat, as the host, organized Executive Committee and International Programme Committee with the cooperation of IEB members and members of the working groups supervised by Academic Affairs Committees.

Executive Committee (EC)

Head	**Neil Bose** *Fisheries and Marine Institute of Memorial University of Newfoundland*
Head of IPC	**Ismail Abdel Ghafar Ismail Farag** *Arab Academy for Science, Technology and Maritime Transport*
President Forum	**Thomas A Cropper** *California State University Maritime Academy*
Reimbursement Process	**Eduardo Ma R Santos** *Maritime Academy of Asia and the Pacific*
External Relations	**Cornel Panait** *Constanta Maritime University*
Host	**Takeshi Nakazawa** *IAMU Secretariat*

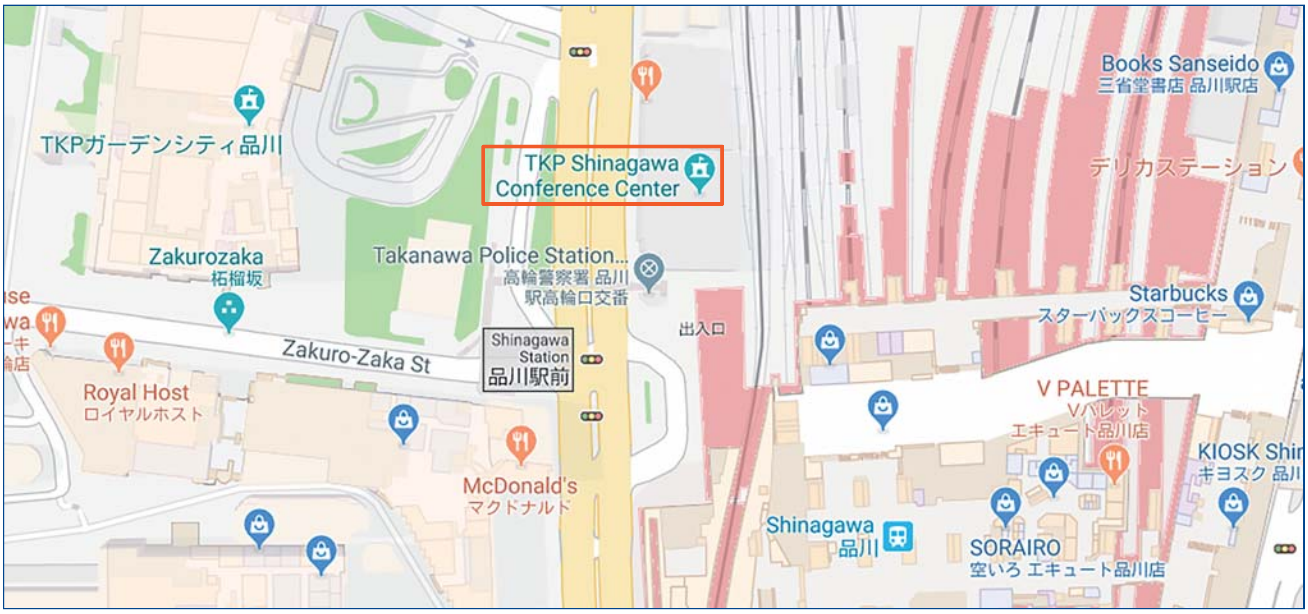
International Program Committee (IPC)

Head	**Ismail Abdel Ghafar Ismail Farag** *Arab Academy for Science, Technology and Maritime Transport*
Program Editor	**Boris Svilicic** *University of Rijeka, Faculty of Maritime Studies*
Members	**Graham Benton** *California State University Maritime Academy*
	Matthew Rooks *Kobe University, Graduate School of Maritime Sciences*
	Samrat Ghosh *Australian Maritime College, University of Tasmania*
	Gamal Ahmed Mohamed Ghalwash *Arab Academy for Science, Technology and Maritime Transport*
	Aykut Ölcer *World Maritime University*
Session Chairs	**Manel Grifoll** (Environmental Impact Session) *Barcelona School of Nautical Studies, Polytechnical University of Catalonia*
	Ian Jenkinson (Technological Impact Session) *Liverpool John Moores University*
	Nataliya Nikolova (Economical Impact Session) *Australian Maritime College, University of Tasmania*
	Salman Nazir (Social Impact Session) *University of Southeast Norway*
	Damir Zec (Policy Impact Session) *University of Rijeka, Faculty of Maritime Studies*
	Mahmoud Elsayed Elbawab (Student Session) *Arab Academy for Science, Technology and Maritime Transport*
Reviewers	**Nataliya Nikolova, Samrat Ghosh** *(AMC, Australia)*, **Gamal Ahmed Mohamed Ghalwash, Mahmoud Elsayed Elbawab** *(AAST-MT, Egypt)*, **Graham Benton** *(CSUM, USA)*, **Anna Mujal-Colilles, Manel Grifoll, Marcel·la Castells, Xavier Martínez de Osés** *(FNB-UPC, Spain)*, **Matthew Rooks** *(KU-GSMS, Japan)*, **Ian Jenkinson, Trung Thanh Nguyen** *(LJMU, UK)*, **Boris Svilicic** *(UR-FMS, Croatia)*, **Salman Nazir** *(USN, Norway)*

Venue

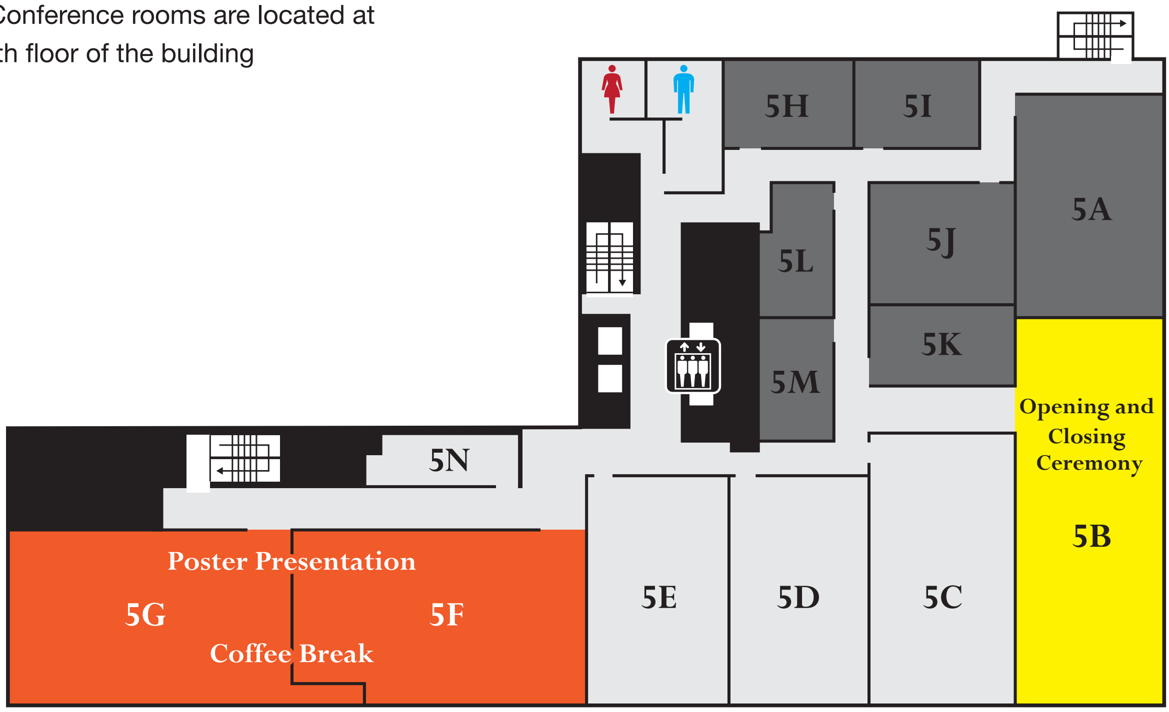
The IAMU Conference is held in the TKP Shinagawa Conference Center, located at Keikyu 10th Building, 3-26-33, Takanawa, Minato-ku, Tokyo 108-0074

TKP Shinagawa Conference Center



Floor Plan

The Conference rooms are located at the 5th floor of the building



Registration and Information

The registration and information desk is located in front of room 5E, and will be opened on the conference day from 08:00.

The preregistered participants can pick up name badge and publications at desk.

Program Overview

1 November

09:00 - 09:15	**Opening of the IAMUC** *Room: 5B* **Neil Bose (FMIMUN, Canada),** *Head of Executive Committee* **Boris Svilicic (UR-FMS, Croatia),** *IAMUC Program Editor*		
	Session: **Technological Impact** **Room: 5C** Chair: Ian Jenkinson *(LJMU, UK)*	Session: **Policy Impact** **Room: 5D** Chair: Damir Zec *(UR-FMS, Croatia)*	Session: **Student Session** **Room: 5E** Chair: Mahmoud Elbawab *(AAST-MT, Egypt)*
09:20 - 09:40	*Emergent Technologies and Maritime Transport: Challenges and Opportunities* T Fonseca, K Lagdami, JU Schröder-Hinrichs *(WMU, Sweden)*	*Climate Action and Maritime Business Education: Some Reflections* M Ghosh, J Roy *(MassMA, USA)*	*Use of Analytic Geometry for Task Solution on Maneuvering board* V Hai *(MSUN, Russia)*
09:40 - 10:00	*Training Model Based on The Anchoring Training* Y Kunieda, Y Ito, K Murai, H Kashima *(TUMSAT, Japan)*	*Towards a Responsive Maritime Education and Training Policy for Future Shipping: Boundary Object and Maritime Stakeholder Engagement* A Kataria, GR Emad *(AMC, Australia)*	*Cross-Cultural Communication for Seafarers* K Sato *(KU-GSMS, Japan)*
10:00 - 10:20	*E-Navigation Mixed Reality Interface* EV Khekert, AN Popov, AI Kondratiev, DE Studenikin *(AUMSU, Russia)*	*Marine Engineering Education Program Development due to CDIO Concept* JE Ljungklint, M Enelund *(SMT-CUT, Sweden)*	*Comparative Analysis of Different Current Turbine Designs Based on Conditions Relevant to main canals of the Nile River in Egypt* AM Hamouda, AS Abutaleb, SS Rofail, AS Shehata, AH Elbatran *(AAST-MT, Egypt)*
10:20 - 10:40	*Quantifying Fuel Consumption and Emission in Ship Handling Simulation - a New Approach for Sustainable and Safe Operation in Harbour Areas -* M Schaub, G Finger, C Krüger, G Tuschling, M Baldauf, K Benedict *(HSW-UTBD, Germany)*	*The Pathway to Autonomous Short Sea Shipping: Implications on Human Competence Across Maritime Industry* R Rajapakse, GR Emad *(AMC, Australia)*	*Computer Usage and Technology Integration among BS Mar-E Students of JBLFMU-Molo: Basis for Library Transformation* J Ampoyos, R Alimen, C Alde, M Abiera, K Diamante, M Gamarcha, M Giner, J Elechicon, C Lentija, J Magalit, J Sumbillo *(JBLFMU, Philippines)*
10:40 - 11:00	*Cyber Security of Shipboard Navigation Systems* B Svilicic, I Rudan, A Jugovic, D Zec *(UR-FMS, Croatia)*	*Process Approach for Determining Competences* A Gundić, L Maglić, M Šimić Hlača, L Maglić *(UR-FMS, Croatia)*	*The future competences of the maritime engineer* A Tynell Pauls, J Søgaard Hoff *(SIMAC, Denmark)*
11:00 - 11:30	*Poster Session* *Coffee/Tea Break* *Room: 5F, 5G*		
11:30 - 12:30	Session discussion: **Technological Impact** **Room: 5C** Chair: Ian Jenkinson *(LJMU, UK)*	Session discussion: **Policy Impact** **Room: 5D** Chair: Damir Zec *(UR-FMS, Croatia)*	Session discussion: **Student Session** **Room: 5E** Chair: Mahmoud Elbawab *(AAST-MT, Egypt)*
12:30 - 14:00	*Poster Session - Room 5F, 5G* *Lunch - Room: 5B*		

1 November

	Session: **Social Impact** **Room: 5C** Chair: Salman Nazir *(USN, Norway)*	Session: **Environmental Impact** **Room: 5D** Chair: Manel Grifoll *(FNB-UPC, Spain)*	Session: **Economical Impact** **Room: 5E** Chair: Nataliya Nikolova *(AMC, Australia)*
14:00 - 14:20	*Educating Future Generations Master Mariners: Using Technologies for Visualizing Prior Performance in Post-simulation Debriefings* C Sellberg, H Rystedt *(SMT-CUT, Sweden)*	*Optimising the Energy Efficiency of Small Ferries* JB Jensen, EDK Hansen, M Lützen *(SIMAC, Denmark)*	*Combined Qualitative Ship Valuation Estimation Model* O Cetin, M Koray *(PRU, Turkey)*
14:20 - 14:40	*The Use of Cooperative Learning in Enhancing the Competency in Maritime Communication with GMDSS* MCS Navallasca, JA Alingalan *(JBLFMU, Philippines)*	*Eco-Piloting Best Practices Will Reduce Emissions of Nitrogen Oxides from Passenger Ferry Operations* T Burback *(CSUM, USA)*	*Determination of Dry Port Location within the Hinterland of Kocaeli Ports by Applying AHP* O Cetin, M Saka *(PRU, Turkey)*
14:40 - 15:00	*The Effectiveness of Maritime Education System on Competency and Development of Seafarers. A Case Study from an International Maritime Education Institute* GR Emad, NSD Meduri *(AMC, Australia)*	*Complications of Robotic Delineation of Oil Spills at Sea* J Hwang, N Bose, S Fan, B Robinson, K Tenekedjiev *(AMC, Australia)*	*The Impact of Mergers and Alliances on Maritime Shipping* Q Chen *(MassMA, USA)*
15:00 - 15:20	*Opportunities and Challenges for Seafarers in Higher Education: A Comparative Study of the German and the Swedish System* N Nause, O Lindmark, P John, E Klimmek *(JUASWOE, Germany)*	*Impacts of Commitment and Goal Setting on Pro-Environmental Behaviors (PEBs) Toward Ocean Conservation: An Exploratory Study* PS Szwed, M Rooks, BY Gonzalez *(MassMA, USA)*	*Information Flows in the Global Shipping Industry: A Cointegration Approach* J Shackman, P Lambert, N Griffin, P Benitez, E Eragawie, D Henderson *(CSUM, USA)*
15:20 - 15:40	*Maritime digitisation and its impact on seafarers employment from a career model perspective* M Kitada, P Baum-Talmor *(WMU, Sweden)*	*The Motor Ways of the sea concept and its influence in the future development of European sustainable transport chains* FX Martinez de Oses *(FNB-UPC, Spain)*	*Toward Sustainable National Shipping: A Comparative Analysis* HO Nguyen, N Nikolova, K Tenekedjiev *(AMC, Australia)*
15:40 - 16:15	*Poster Session* *Coffee/Tea Break* *Room: 5F, 5G*		
16:15 - 17:15	Session discussion: **Social Impact** **Room: 5C** Chair: Salman Nazir *(USN, Norway)*	Session discussion: **Environmental Impact** **Room: 5D** Chair: Manel Grifoll *(FNB-UPC, Spain)*	Session discussion: **Economical Impact** **Room: 5E** Chair: Nataliya Nikolova *(AMC, Australia)*
17:15 - 17:30	**Closing of the IAMUC** *Room: 5B* **Neil Bose (FMIMUN, Canada),** *Head of Executive Committee* **Boris Svilicic (UR-FMS, Croatia),** *IAMUC Program Editor*		

Poster Presentations

Environmental Impact

iamu20190138

Study on the Environmental Risks of The Future Maritime Logistics with a Focus on Australian Context

Pedram KOOSHANDEHFAR, Gholam Reza EMAD *(AMC, Australia)*

Technological Impact

iamu20190008

Analysis of the none-uniformity of revolution of marine diesel engines

Ing. Karsten Wehner, Wolfgang Busse *(HSW-UTBD, Germany)*

iamu20190013

The Network-Centric approach to arrangement and management of the Maritime University as a component of transport space

Irina Makashina, Evgeniya Filatova, Andrey Naumenko *(AUMSU, Russia)*

iamu20190023

Risk assessment, as a competence of maritime professional

Vladimir A.Loginovsky *(AMSU-MIS, Russia)*

iamu20190051

Engine Room Simulator Training for Emergency Preparedness

Gamini Lokuketagoda *(AMC, Australia)*, Takashi Miwa *(KU-GSMS)*, Shantha G. Jayasinghe, Dev Ranmuthugal *(AMC, Australia)*

iamu20190056

Environmental improvement of seaborne transport by developing a new generation of fibreships

Xavier Martinez *(FNB-UPC, Spain)*, Alfonso Jurado *(Técnicas y Servicios de Ingeniería S.L., Spain)*, Julio García *(FNB-UPC, Spain)*

iamu20190075

Evaluating cybersecurity risks in the maritime industry: a literature review

Chia-Hsun Chang, Changki Park *(LJMU, UK)*, Wenming Shi, Wei Zhang *(AMC, Australia)*

iamu20190084

Preparing Maritime Professionals for Their Future Roles in a Digitalized Era: Bridging the Blockchain Skills Gap in Maritime Education and Training

Michelle May NASARUDDIN, Gholam Reza EMAD *(AMC, Australia)*

iamu20190085

S-Mode: Challenges and Opportunities for MET

Jiangang Fei, Peggy Shu-Ling Chen *(AMC, Australia)*, Shengping Hu *(SMU, China)*, Philip Bulman *(FMIMUN, Canada)*

iamu20190086

Weather Routing Software for academic purposes: A pilot study

Marcel·la Castells, Clara Borén, Manel Grifoll *(FNB-UPC, Spain)*

iamu20190100

Policy Recommendations for Autonomous Underwater Vehicle Operations Through Hybrid Fuzzy System Dynamics Risk Analysis (FuSDRA)

Tzu Yang Loh *(AMC, Australia)*, Mario P. Brito *(SSU, UK)*, Neil Bose *(FMIMUN, Canada)*, Jingjing Xu *(Faculty of Business, University of Plymouth, UK)*, Kiril Tenekedjiev *(AMC, Australia)*

iamu20190101

Using a web-based simulation software in education

F. Olindersson, R.Weber *(SMT-CUT, Sweden)*, F. Olsson *(SSPA, Sweden)*

iamu20190102

A Study on Work Load Evaluation Method and Quantitative Evaluation Method for Engine-room Resource Management training

Tatsuro Ishida, Takashi Miwa, Makoto Uchida *(KU-GSMS, Japan)*

iamu20190103

Intellectual technologies in the field of Maritime Professional Education and Training

Vitaly Bondarev, Olga Bondareva, Pavel Kovalishin *(BFFSA KSTU, Russia)*

iamu20190104

VR Training Videos: Using Immersive Technologies to support Experiential Learning Methods in Maritime Education

Tamera Gilmartin *(SUNYMC, USA)*

iamu20190109

Joint Production of Web-learning Material by IAMU Member Universities

S. Ahvenjärvi *(SAMK, Finland)*, I. Czarnowski *(GMU, Poland)*, J. Mogensen *(SIMAC, Denmark)*

iamu20190118

Autonomous shipping: How to reach competence requirements for the Shore Control Center (SCC) operators?

Rana Saha, Salman Nazir, Dmitrii Gonchariuk, Amit Sharma, Steven Mallam *(HSN, Norway)*

iamu20190123

About decision support system at risk of fleeting accident of a displacement vessel

Valyaev A., Lukina E., Fedosenko Y. *(VSUWT, Russia)*

iamu20190132

Clustering Algorithms for Maritime Data Analysis: The Case of AIS-SAT Data Analysis

Ireneusz Czarnowski *(GMU, Poland)*

iamu20190134

Safe Passing of the Vessels with Vessel's Momentum Consideration

Igor Burmaka, Dmytro Zhukov, Mykhaylo Miyusov, Maryna Chesnokov *(NU«OMA», Ukraine)*

Economical Impact

iamu20190112
Law, Economics and Law & Economics for Master Mariners in Master of Maritime Management studies
Peter Ivar Sandell *(SAMK, Finland)*

iamu20190140
Hydrographic education in Estonia and assessment of future prospects of the program
Inga Zaitseva-Pärnaste *(EMA, Estonia)*

Social Impact

iamu20190028
Mainstreaming Women in Maritime and their roles in the Maritime Industry: Charting the Course for the Future of Maritime Universities
Angelica M Baylon *(MAAP, Philippines)*

iamu20190039
Re-Engineering the Maritime University Organization - Serving and Preparing Gen Z for the Maritime World
Stephen J. Kreta *(CSUM, USA)*

iamu20190078
Maritime Innovation Management - A concept of an innovative course for young maritime professionals
Bolmsten Johan *(WMU, Sweden)*, Alop Anatoli, Heering Dan, Kasepold Kadi *(EMA, Estonia)*, Chesnokova Marina, Olena Sienko *(NU«OMA», Ukraine)*, Kaizer Adam *(GMU, Poland)*, Sköld Daniel, Ziemska Monika

iamu20190081
Current trends in the maritime profession and their implications for the maritime education
Mednikarov, B., Kalinov, K., Kanev, D., Madjarova, T., Lutzkanova, S. *(NVMA, Bulgaria)*

iamu20190091
Female leaders in maritime professions - Finnish educational aspect
Ninna Roos *(SAMK, Finland)*

iamu20190092
From Sailor to Scientist: Reaching Out to Researching Professionals on Doctorate Level
Goran Vukelic, Alen Jugovic, Ana Peric Hadzic, Tanja Poletan Jugovic *(UR-FMS, Croatia)*

iamu20190108
Creating Together: Problem Solving Techniques in Twinning Teaching
Monastyrska Olga, Chesnokova Maryna, Zhukov Dmytro *(NU«OMA», Ukraine)*

Policy Impact

iamu20190007

Best Practices in Water Safety and Survival Training

James Downey *(SUNYMC, USA)*

iamu20190029

Super Seven "S" Trends (SSSt) To Shape the Future of Global Ports: An Analysis on the Seaport Infrastructure Investments towards a Globally Competitive Philippine Maritime Industry

Angelica M Baylon, VAdm Eduardo Ma R Santos *(MAAP, Philippines)*

iamu20190093

Gender equality policies for the incorporation of the gender perspective in maritime studies: a case study

Clàudia Barahona-Fuentes, Marcel·la Castells i Sanabra, Santiago Ordás Jiménez, Jordi Torralbo Gavilán *(FNB-UPC, Spain)*

iamu20190094

Approved maritime education: harmonization of requirements

Mykhaylo Miyusov, Vadym Zakharchenko *(NU«OMA», Ukraine)*

iamu20190124

Use of fuzzy rule base to analyze the role of university maritime research in policy making in West Africa

Denis Atehnjia *(RMU, Ghana)*

iamu20190125

Team Resilience in Maritime Emergency Response: Analytical Framework and Implications from Accident Report Analysis

Hong-Oanh Nguyen, Siriwardhana H. Gamage, Anthony Beckett, Natalia Nikolova, Paul Turner, Mohammad Sadegh Taskhiri, Lidong Fan *(AMC, Australia)*

Student Session

iamu20190016

Alumni Tracer, Employability, and Their Level of Satisfaction

Daven C. Caldosa, Keith Benedict Eliseo B. Carmen III, Carl John C. Dago, Jessiemar C. Dellosde, M. Larence D.Farinas, Olsen A. Manalo, John RL G. Portugalete, Deither Khy T. Velez *(JBLFMU, Philippines)*

iamu20190034

A model for practising mooring/ unmooring operations at Maritime Universities

Vuong Hai *(MSUN, Russia)*

iamu20190126

Millennial Seafarers as Today and Tomorrow's generation of marine officers: Implications and future directions

Kyle M. Flores, Sirzyrus Vench P. Estrabo, Zayber Araya, Emeliza T. Estimo, Elisa V. Garcia *(JBLFMU, Philippines)*

iamu20190143

Seafarer Attrition in Japan

Akane Shiomi *(KU-GSMS, Japan)*

Technical Instruction

Oral Presentation Guidelines

- Oral presentation slots have 20 minutes (discussion will be held during the Session discussion). Session Chairs will strictly demand the time in order to allow time for members of the audience to switch the Sessions between presentations.
- All session rooms are equipped with projector, computer (MS Windows, MS PowerPoint and Adobe Acrobat), microphone, remote control and laser pointer. To avoid software compatibility problems, please embed all fonts in your PPTX file and bring a backup PDF file of your presentation. The projector is with VGA and HDMI connectors and have a resolution of 1280x800 pixels (16:10 aspect ratio).
- Please bring your presentation on a USB storage device and report to the Session Chair indicated in the IAMUC Program 15 minutes before start of the Session.

Poster Presentation Guidelines

- Posters will be presented during the Poster Sessions indicated in the IAMUC Program. Presenters should be standing next to the poster during the Poster Sessions in order to answer any question.
- Poster should be printed in size A0 (841 mm x 1189 mm). Please use large fonts (24 or above), avoid using dense text, tell the story in graphics, diagrams and pictures as much as possible. Poster main ideas should be clearly spelled out in the introduction and conclusions sections. The main point of the work should be crystal clear from spending only a few moments reading these sections.
- Material for mounting the posters will be at the registration desk. Poster boards will be organized by the Sessions
- Please mount your posters on Thursday (31 October) from 13:00 to 18:00 or on Friday (1 November) from 8:00 to 9:00.
- Posters should be dismounted at 17:30 of Friday (1 November).

Name Budge

All attendees must wear the name budge at all times to gain admission to IAMUC

Mobile Phone

As a courtesy to our presenters and other attendees, please turn off your mobile phones during the sessions.

Session Quick Index

Contents

Abstracts

Environmental Impact

The Motor Ways of the sea concept and its influence in the future development of European sustainable transport chains

F. Xavier Martínez de Osés
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Keywords: Short Sea Shipping, Motor ways of the Sea, Ports

According to EU white paper, 10% of the road networks in the European Union, are affected by daily traffic jams and to reduce this increasing production of the transport infrastructure both west and east Europe has to offer sufficient capacity and facilitate access to the market.

The Motorway of the Sea (MoS) concept was introduced in 2001 as part of the Transport White Paper. It was envisaged as a way of reviving SSS and thus alleviating some of the congestion and the pressure on bottlenecks in the European road and rail networks. This concept has evolved to include the introduction of maritime transport in the logistics chain and pursuit of wider benefits such as improving environmental performance, administrative procedures, training, safety and traffic management [1]. Also has provided a policy template for project ideas that are then funded under different programs. The largest source of funding has been the TEN-T program.

But the scenario has evolved over the period since 2001, meaning that MoS is seen as a broad definition and not a clear and focused proposition. Some of the comments repeatedly made by stakeholders has been a lack of clarity about the overall MoS goals and objectives, even being sufficiently dynamic to respond to the changing needs of the sector.

Within EU, Short Sea Shipping accounted for almost 1.9 billion tons of goods in 2016, meaning an increase of 2.6 % [2] from the previous year. Short sea shipping made up around 60 % of the total maritime transport of goods to and from the main EU ports in 2016, but varying considerably between the reporting countries. Despite this the total share of road transport measured in weight is still ahead of marine mode.

This article's goal is intended to show that the absence of a standard definition has been a subject of exchange in the scholastic world throughout the previous 20 years. The final conclusions are expected to provide an exhaustive list of requirements conducting to propose a clearer definition that really fit in the needs of the maritime sector. This proposal is going to be checked by different marine stakeholders involved in it, in order to cope their specific requirements and complying with the sustainability hits proposed by IMO and EC.

References:

[1] European Commission (2001), European Transport Policy for 2010: time to decide. White Paper on Transport com (2001) 370_final.
[2] https://ec.europa.eu/eurostat/statistics-explained/index.php/Maritime_transport_statistics_-_short_sea_shipping_of_goods (2019)

Optimising the Energy Efficiency of Small Ferries

Assistant Professor Jens Brauchli Jensen[a], Associate Professor Elin D. Kragesand Hansen[a], Docent Marie Lützen[ab]

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Keywords: ferries, harbour, energy efficiency, operations, practices.

Energy efficiency has been a major concern in the maritime industry in recent decades. This is partly due to the economic aspect, but regulations and concerns about the environment are playing an increasingly important role. Several studies have been conducted on energy efficiency in ships. These studies can be categorised into technical solutions and operational practices. This study falls into the second category, as it focuses on operational practices in smaller ferries, which are often neglected.

There is a large number of ferries worldwide, and ferries play an essential role when transporting people, cargo and vehicles across waters on fixed routes with regular schedules. The size of these vessels can range from smaller boats transporting passengers across a river to larger seagoing vessels carrying passengers, cars and trucks. Interferry [1], an organisation representing the ferry industry worldwide, estimates that there are thousands of smaller ferries globally.

Small ferries have unique operating patterns that do not correspond to the patterns of other vessel types. Small ferries usually have short sea passages and therefore spend a relatively large proportion of their time moored in harbour. This is in contrast to other vessels e.g. container, tanker and bulk carriers. While fuel consumption in harbour is relatively low, the secondary effects of a shorter harbour stay are worth pursuing. The most obvious effect is that a shorter harbour period leads to more time for the passage and manoeuvres. More time allows for a decrease in speed and thereby lower fuel consumption and emissions. A study performed by Eriksen et al. [2] shows that a significant amount of energy can be saved by prolonging passage time.

This paper maps the possibilities of optimising the harbour period. This is done by identifying what is done in harbour and then mapping the various processes to asses if this can be done more efficiently. It is discussed how some of these suggestions may be implemented. The fixed nature of ferry timetables is also discussed, as this may play a major role in realising the potential of a shorter harbour period. This study was conducted for ferries sailing in Danish national waters. However, it is assumed that the findings can be used as guidance for identifying similar possibilities in small ferries worldwide.

Special attention is paid to issues that could potentially be improved by training programmes and education. In order to perform harbour operations as efficiently as possible, officers must possess knowledge of the complete operation and have good communication skills. To understand the complete operation, it is advantageous to have nautical, technical and logistics expertise. Education and training can play a major role in acquiring this expertise.

References:

[1]Inter Ferry, www.interferry.com (accessed 8th August 2018).
[2] Eriksen, S., Lützen, M., Jensen, J. B., Sorensen, J. C., Improving the Energy Efficiency of Ferries by Optimising Operational Practices, *Proceedings of the Full Scale Ship Performance Conference. The Royal Institution of Naval Architects, London,* 2018, *p. 101-111*

Acknowledgements

This work was supported by the Danish Maritime Fund (2014- 089; SDU, Situation Awareness) and the Innovation Fund Denmark (File no. 155-2014-10). This study was conducted during a project carried out under Blue INNOship, a Danish societal partnership focusing on creating growth and employment in the Blue Denmark through the development of green and energy-efficient solutions.

Eco-Piloting Best Practices Will Reduce Emissions of Nitrogen Oxides from Passenger Ferry Operations

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Keywords: Air pollution, MARPOL Annex VI, Ferries

Air pollution negatively impacts climate change and human health. The World Health Organization describes air pollution as "the world's largest single environmental health risk," with an annual global financial impact of over 5.1 trillion USD, and an annual human health impact of over 3.2 million premature deaths (Roy & Braathen, 2017). Shipping contributes between two and six percent of global air pollution, depending on the pollutant, and the levels of pollution are disproportionately high in port cities (Caiazzo, Ashok, Waitz, Yim, & Barrett, 2013; Pettit, Wells, Haider, & Abouarghoub, 2018). MARPOL Annex VI regulations for the prevention of harmful emissions from ships dictate engine performance standards and fuel composition. On-land transportation in the US has a long history of regulation and has developed best practices to minimize harmful emissions. Best practices have not been developed for merchant vessels which present a missed opportunity for emission reduction, particularly for high profile inland operations such as passenger ferries. Content analysis of five eco-driving sources was conducted to identify comprehensive eco-driving best practices for adaptation to eco-piloting best practices. Quantitative analysis of engine specifications and vessel maneuvering characteristics was conducted to support the best practices and prove the emission reduction of oxides of nitrogen (NOx). Five eco-driving best practices were identified and adapted for eco-piloting. NOx emission reduction with the application of two of the best practices was between 0.7 and 4.6 percent reduction of operational NOx emissions, and the results suggest that additional emission reduction could be achieved through greater application. Eco-piloting best practices are a source of emission reduction that will complement existing engine and fuel requirements and allow ferries to better compete with other transportation sectors.

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Complications of robotic delineation of oil spills at sea

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Keywords: AUV, Marine robotics, Oil spills, Submersible fluorometers

Disasters at sea often run the risk of producing spillage of oil, either bunker oil, marine diesel oil or crude oil. The level of spill depends on the type of vessel, the severity of damage, the weather conditions, location and nature of the disaster [1]. Rapid response is crucial, yet an effective response depends on knowledge of the extent of the spill and its distribution through water column. Wave action and the depth of release add to the three-dimensional extent of this distribution. Small robotic autonomous underwater vehicles (AUVs) are attractive to delineate a spill due to their ability to sense in three-dimensional space and because they are capable of rapid deployment.

This paper describes the assessment of sensors for their effectiveness on AUVs for use as rapid response instruments for delineation of an oil spillage at sea. Fluorometers are the most commonly used instrument in oil spill investigation. In this work three sensors, *UV AquaTracka*, *Cyclops-7* and *LISST-200X* particle size sensor were tested for their effectiveness to sense marine diesel oil in regular wave and breaking wave conditions and uniform current in a sea water wave tank at the Bedford Institute of Oceanography (BIO), Dartmouth, NS, Canada. The wave tank configuration is shown in Figure 1. Marine diesel oil (MDO) was the focus of the tests because one aim of the work was to assess levels of risk in Antarctica where MDO is the primary fuel oil in use. The specification of the test conditions is shown in Table I.

Two main outcomes resulted from these tests:

1. Not all sensors were found to be effective in sensing marine diesel oil in sea water.

2. The distribution of oil in the water column was found to be "patchy" and "broken" as the wave action caused the oil to break up into various sized droplets at various depths below the surface.

The implications of these outcomes are that for an AUV to be effective for deployment to delineate an oil spill, firstly appropriate sensors, and secondly the robotic mission algorithms used to adaptively delineate an oil spill need to be able to account for oil in the water that forms patches [2], clouds of droplets of various sizes and distribution at varied depths.

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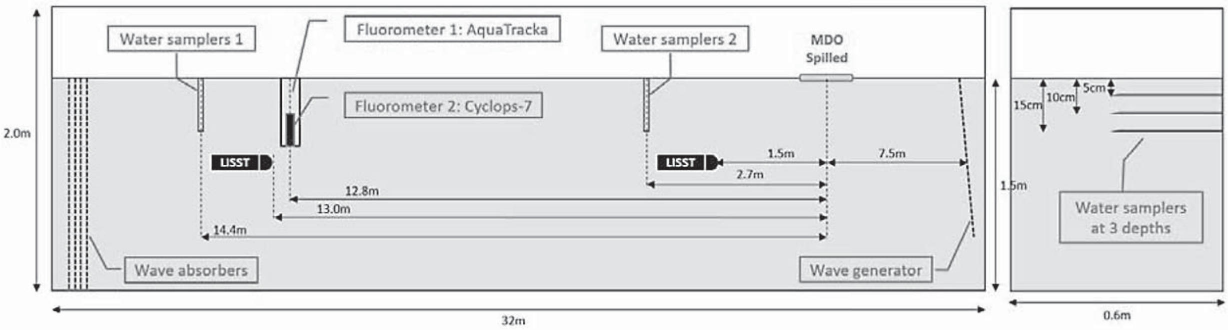

Figure 1. Schematic drawing of the wave tank (not to scale, all values are in meters) for surface oil release tests.

Table 1. The wave tank experiment specification.

Testing fuel	Refined fuel	Marine Diesel Oil
Duration		60 minutes
Spill condition		Surface release
In-situ oil sensors	Fluorometer	Cyclops-7
		UV AquaTracka
	Particle size analyzer	LISST-200X
Waves		Regular waves
		Breaking waves
Current	Uniform flow	$230Lm^{-1}$
Chemical-analysis	BTEX	Benzene, Toluene, Ethylbenzene and Xylene
	TPH	Total Petroleum Hydrocarbon
	GC-MS	Gas Chromatography-Mass Spectrometry

Acknowledgements
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Impacts of Commitment and Goal Setting on Pro-Environmental Behaviors (PEBs) Toward Ocean Conservation: An Exploratory Study

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Keywords: Ocean Conservation, Commitment, Pro-Environmental Behavior, MARPOL

Theme: Environmental Impact

We rely heavily on our oceans for food and natural resources, trade and commerce, recreation and tourism, biodiversity and clean water, as well as carbon storage and climate regulation, among many other critical life-sustaining and enriching functions. However, awareness efforts to get people to modify their behaviors toward ocean conservation are typically ineffective [1], often because people cannot see the direct connection between their actions and global conditions [2]. Commitment and goal setting are two techniques borrowed from consumer behavior research that have demonstrated an ability to enhance pro-environmental behaviors (PEBs) [3]. This study examined how goal setting and commitment influenced PEBs of mariners regarding their attitudes and behavioral intents toward MARPOL using a small scale experiment (n=284). Using an experimental design borrowed from safety culture research [4] and adapted to a shipboard environmental compliance setting, this survey measured ocean literacy [5] as a proxy for awareness about ocean issues and conservancy. Then a randomly-assigned treatment group was subjected to commitment condition using the Clean Seas pledge [6] and a goal setting exercise about ocean conservation. After a period of four to six weeks, a follow-up survey was administered to participants to determine the degree to which PEBs were sustained. Those that received the treatment and made commitments were 24% more likely to better sustain their PEBs well after the intervention. This research shows how a small, carefully planned intervention may have a desired impact on PEBs and potentially MARPOL compliance behaviors. Furthermore, this has implications on how the IMO model course on personal safety and social responsibilities [7] might be altered to shift from awareness and knowledge transfer to behavior change and even introduce desirable behavioral spill-over effects [8].

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Study on the Environmental Risks of The Future Maritime Logistics with a Focus on Australian Context

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Keywords: Environmental risks, Maritime logistics, Environmental impact, Australian ports

Maritime logistics and supply chain have been significantly developed over the last decades. Shipping as any other industrial operation involve risk. During the course of time, maritime industry has been able to develop different strategies for managing and mitigating the risks in its logistics and supply chain. Some of these risks have been identified to have impacts on the environment. Study shows that the risk management strategies so far have been alleviating reducing impact of the risks in the maritime industry [1]. However, the advancement in globalisation and technological innovations is furthering the progression of trade and shipping in ways which would be new to the industry [2].

This research is focused on investigating various environmental risks in the future of the maritime logistics with a focus on Australian context. The technical abilities of maritime logistics have been depended on the social and cultural values of each company [3]. There has been extensive requirement of risk assessment process in the maritime industry for negotiating environmental risks due to maritime logistics [4]. The investigation of several environmental risks in Australian logistics system have been resulted in evaluation of ongoing risk assessment processes [5]. There have been recommendations provided related to additional risk mitigation processes that might be employed for eradicating regulation of environmental risks in maritime logistics in Australia and other countries. The concept of maritime logistics has been maintained properly in the dependency of physical and economic integration of organizations.

Our mix qualitative/quantitative research has identified the environmental risks involved in the maritime logistics specifically in Australia. This paper, critically analyse the vulnerability of risks including workforce and identity adaptation measures, investigate challenges in implementing policy and practice and integrated decision support and recommends strategies for mitigating environmental risks in the maritime logistics.

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Abstracts

Technological Impact

Analysis of the none-uniformity of revolution of marine diesel engines

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Keywords: technical diagnosis; ship operation;

The analysis of the technical condition of marine diesel engines and the diagnostics of incipient disturbances is a major task of marine engineers.

Digital knowledge-based tools help us to detect early-stage disorders. Thus, severe engine damage can be avoided. Above all, this increases the safety during ship operation. Costly repairs and downtime can so be avoided.

The mission of maritime universities is to train tomorrow's engineers in the effective utilization these tools as well as to develop additional tools for safe engine operation. The decisive factor in education and training is to convey the physico-technical understanding of the processes to the students. The necessary knowledge in, for example, physics / thermodynamics, technical mechanics, higher mathematics, etc. is the basis and must be assumed.

In marine diesel engines, the combustion process is to be monitored. Disruptions of for example injection pumps and injectors affect the combustion process and the energy conversion. As a result, the piston, cylinder liner, exhaust valve, turbocharger or bearings can be damaged. In extreme cases it comes to piston seizure or piston stuck, which also endangers the ship, the crew as well as the cargo. For this reason, the engine is regularly supervised by an electronical cylinder pressure measurement in on-board operation. Although permanent cylinder pressure monitoring systems are available on the market, they are very costly and so rarely used aboard. Nevertheless, a permanent monitoring of the internal combustion process is useful to detect emerging changes early before the damage processes is started.

One possibility is the permanent monitoring of the none-uniformity of revolution of marine diesel engines. Based on the torque development in the single crank drive, the none-uniformity curve in the multi-cylinder engine can be derived physically. The basis for this is the internal pressure function in the combustion chamber. The interaction of all cylinders results in the torque function. This generates the none-uniformity of revolution. With help of a crank angle sensor this can be measured. The time for every degree is measured and displayed as a function.

Fig. 1: None-uniformity of revolution

By means of the Fourier analysis of this time course and the representation of the 1st order in the complex diagram with imaginary and real part, the end points of the vectors of each measurement can be represented. In this case, the amplitude and phase position of the first order are decisive for the analysis of the none-uniformity of revolution. The analysis of the first order is necessary because each cylinder fires once per cycle. If all cylinders of a machine produce the same power, then the amplitude of the 1st order must eliminated each other. If the combustion is disturbed on one cylinder, the power output of this cylinder is lower and the amplitude of the first order increases. The analysis of the associated phase angle indicates in correlation to the firing order, which cylinder is disturbed. For better analysis, the firing order of the engine can be included in the complex diagram.

Fig. 2: Complex diagram without/with disturbance on cylinder 4

A depth diagnosis can then be carried out with the help of the cylinder and injection pressure analysis. Thus, via the use of the crank angle signal, which should be available today at each diesel engine, there is the possibility to permanently monitor the load balance of the cylinders of a diesel engine and to detect impending disturbances us early as possible.

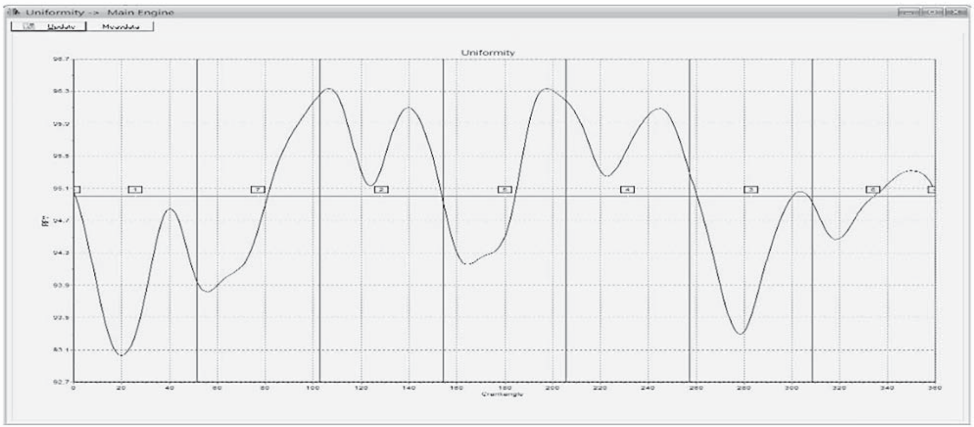

Fig. 1: None-uniformity of revolution

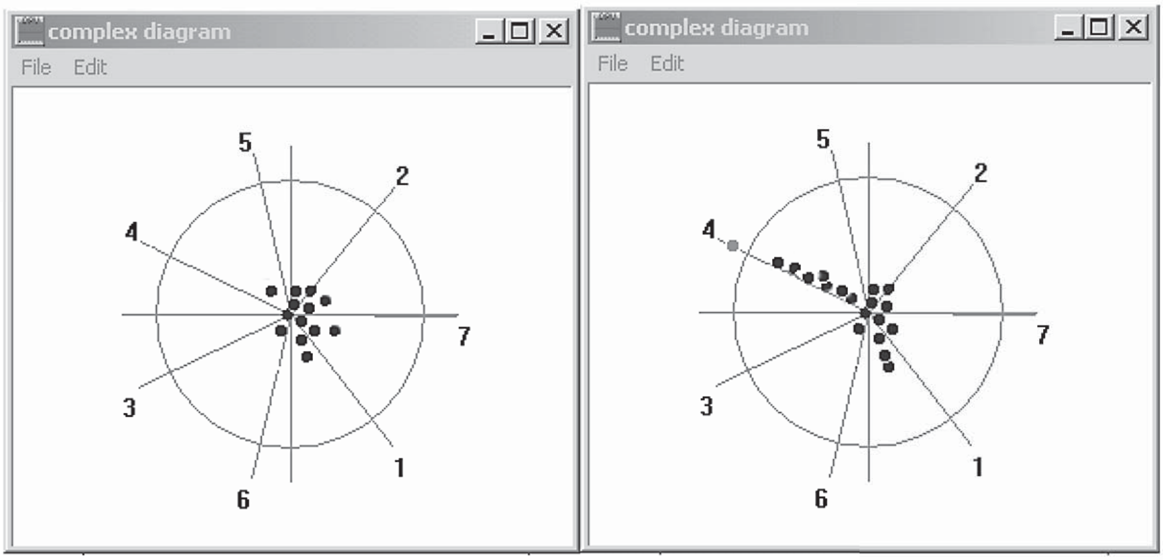

Fig. 2: Complex diagram without/with disturbance on cylinder 4

The Network-Centric approach to arrangement and management of the Maritime University as a component of transport space

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Keywords: Network-Centric system, transport space, maritime education, information

Abstract.
In the context of globalization processes, marine education is considered as one of the main components of the transport space with its own technologies and rules. Management of Maritime education at the present stage of development of the Maritime industry is implemented under targeted programs for the development of the transport complex and is particularly relevant for the economy of the country. It is proved that one of the main requirements for the development of this component is implementation the maximum possible information conductivity of all its elements and links, and, consequently, the maximum interest of its participants.

This paper presents an attempt to apply a network-centric approach to the management system in maritime education. The components of this system include: business (industry), processing centers and data transfer systems, competence and software.

The first component of the business represents the set of inputs for the formation of a task of training of specialists, capable of operating in the modern Maritime industry. Particular attention is paid to the formulation of tasks; used, implemented, developed technologies; to the STCW Convention requirements for the training of sea specialists. The data should be reliable and timely, which is the basis of the system.

The next component of the network-centric system is represented by the data processing and transmission center. It is a hardware and software complex designed for data accumulation, processing, storage, synchronization and presentation of solutions based on artificial intelligence. Adding or updating information in data centers or making decisions at different levels should take place in real time. Information exchange and transmission of control signals is carried out through a distributed software environment, so the quality of information transfer between the elements of the network and its reliability is particularly important. The third identified component is the competence of all participants using the system. The next component is the software, i.e. integrated compatible, modular software.

Functioning in a network-centric system largely depends on the efficiency of each component of the system, as well as on the quality of the relationships among them [1]. All components of the network-centric system of education management are information-dependent and operate in a "network-centric environment", involving various ways of interaction of human and technical resources, as well as technologies that ensure their effective interaction [2]. In addition to the above, this environment should ensure information security in the context of any destabilizing external influences [3].

The proposed arrangement of the network-centric management system in maritime education allows for the distribution and processing of information, namely: the collection of information from different sources of all structures included in the system of the marine industry, in whole, and in the system of Maritime education, in particular; fast and high-quality processing of information in real time with the display of the real situation with a high degree of reliability; ensuring the continuous accumulation and storage of information and a single information space for the information exchange of all elements of the network-centric management system.

The main purpose of the network-centric management system in Maritime education is to train a specialist whose level of competence must meet, first of all, the requirements of the modern Maritime industry. In addition to the proper scientific and methodological support and modern means of training, teachers of vocational schools should have constant access to the used and promising production technologies at the present stage, to understand the current requirements for the specialists of tomorrow, which ultimately will improve the quality of professional education of future sea specialists. Timely and systematic exchange of information between the objects (participants) of the system is the basis of network-centric management. The most important link in this system is the link between educational institution (university) and a customer (enterprise, business) in the relevant industry.

The node of the system, which includes the corresponding program module, will be one of the centers of this system, containing the requirements or instructions for the training of a specialist educated and suitable to concerned business representatives. No less important module, which is also one of the centers of the system is the module of legislative (national and conventional) requirements, which works as a guide while developing educational programs.

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Risk assessment, as a competence of maritime professional

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Keywords: change management, risk assessment, competence-based approach.

Shipping Industry is rapidly changing. It is strongly affected by revolutionary progress of information and communication technology (ICT) and the quick entering in force of new regulatory standards, which drastically transform the industry, overcoming the prevailing stereotypes in its development. In this connection, it is quite reasonable to emphasize some important facts, trends and new standards concerning these changes that must ultimately be human-controlled. The main of them are as follows: improving of energy efficiency, cutting Sulphur oxide emissions, uptake of alternative fuels, green technology for reducing GHG emissions from ships, ballast water management standards, big data and blockchain technology, implication of drones, internet of things (IoT), and at last e-navigation and Maritime Autonomous Surface Ships (MASS) concepts initiated by IMO - all of this is something the IAMU members cannot afford to ignore in their research and MET activity.

These changes are needed to make shipping industry more contemporary, efficient, safer, more affordable and environmentally friendly. However, these changes could also be a source of new and sometimes unpredictable hazards and challenges. That is why, risk-based Change Management, as a direct obligation of the shipping companies and also Risk Assessment activity conducted onboard ships, required by a lot of regulatory instruments, could be highlighted as an additional STCW'78 competence for seafarers and included in the process of MET. This increases the professionalism of a seafarer and also makes the implementation of STCW' 78 and ISM Code more effective, transforming both IMO instruments into a whole system.

Risk assessment onboard ship, which is based, first of all on the ability of seafarer to identify the hazards in a particular ship operation, is a powerful motivator and driver for the development of seafarer's professionalism [1]. To be able to assess risk in changing environment means to be a real professional.

The paper outlines the basics of "Risk assessment in seafaring" course, delivering in AMSU-MIS for students and seafarers, and analyses the implementation of fuzzy logic theory [2] for integration of heterogeneous information into risk assessment procedures.

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Quantifying Fuel Consumption and Emission in Ship Handling Simulation - A New Approach for Sustainable & Safe Ship Operation in Harbour Areas -

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Keywords: Ship Operation, Fast-time simulation, Voyage planning, Dynamic prediction Simulator & On-board training, Environmental Protection

New concepts to support sustainable and safe operation of ships in coastal and harbour areas have been developed at Maritime Simulation Centre Warnemünde MSCW/ISSIMS Institute in research projects (e.g. project MEmBran). A novel approach is the integration of advanced engine process models into Fast Time Ship's handling simulation:

- The focus is the transient engine behaviour to predict fuel consumption and emissions as e.g. NOX, soot particles and CO2 during non-steady operation during ships manoeuvres.
- This model will be interfaced into the Fast Time Manoeuvring Software to enable the user (e.g. a navigator or a harbour planning administration) to optimize ship manoeuvring actions e.g. with respect to effective control actions for safe distances, shortest time or most effective and least environmental effect.

Fast time solution methods provide instant visualization of the ship's track for the intended rudder, thruster or engine manoeuvres, including qualified estimations of energy/fuel consumption and emissions of pollutants. In contrast to conventional Fast Time Simulation concepts (FTS) with autopilot control [1] which are already known for simple manoeuvres, this new approach can be steered by a smart interface to allow for the involvement of the professionalism of a human operator for complex manoeuvres. Nowadays bridge management concepts demand a new type of manoeuvring design and optimisation of not only the next manoeuvring segment ahead, but also for the following segments – or even for series of manoeuvres for the full arrival / departure planning. One basic advantage beyond conventional ship-handling training and navigators' preparation of harbour approaches is the easy creation, visualization and comparability of different manoeuvring strategies with this new method.
The innovative FTS software system consists of various modules for (a) Manoeuvring Design & Planning, (b) Monitoring & Conning based on Multiple Dynamic Prediction, (c) Trial & Training and (d) Replay and Assessment. The Planning module in particular is the missing link in voyage planning because it allows to develop a comprehensive concept of the manoeuvres in the non-stationary motion segment after passing the breakwaters up to the final berthing manoeuvre – and even to check out alternatives and search for limits of environmental factors. For practical application in training and research the new FTS-features were interfaced to the new Full-Mission and Desktop ship handling simulator Systems, configured by benntec (MarineSoft) Systemtechnik GmbH, based on Rheinmetall Electronics GmbH bridge simulator software ANS 6000.
The new features in the FTS technology have already been proven great potential for teaching and learning in the maritime education [2], improving simulator training for advanced ship handling training at several MET institutions as well as for port risk assessments and in harbour & waterway design studies. Samples of application of this innovative technology will be shown in the paper (Figure 1&2). The big potential will be discussed to consider environmental and economic aspects during manoeuvring, when the ship's motion and requested power change permanently.

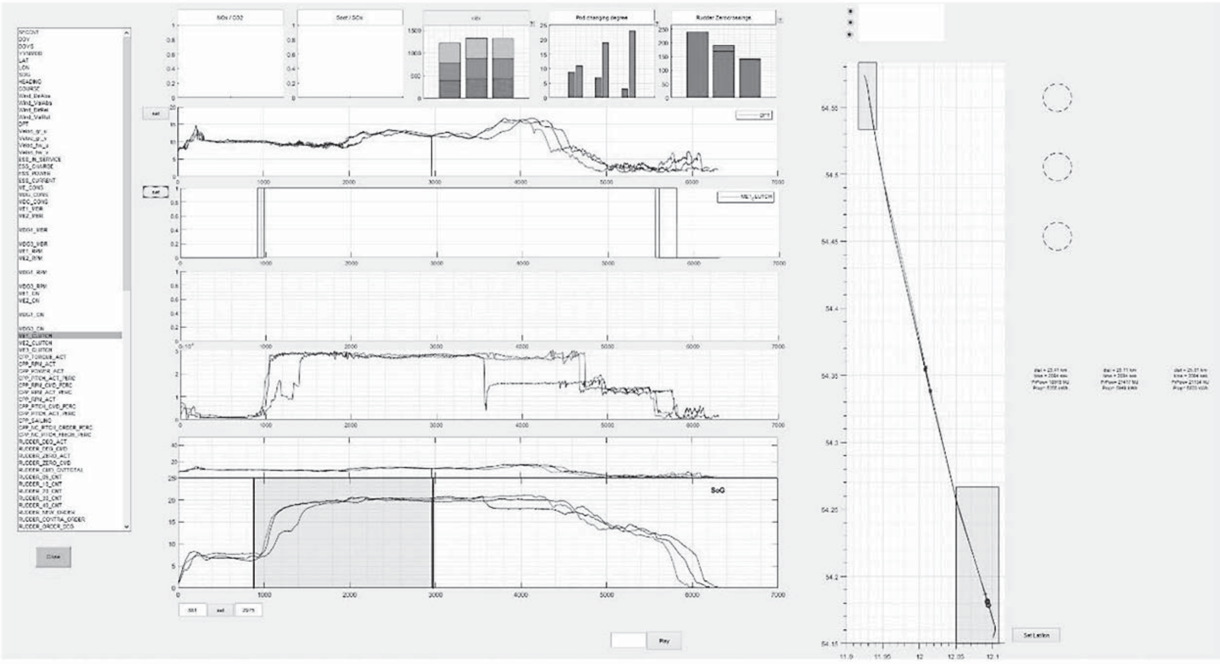

Figure 1 Ship's data analysis software allows for prediction of fuel consumption and emissions for a single manoeuvre, manoeuvre sequences or for a whole voyage "pier to pier" on the basis of available navigational and engine data. The post-processing algorithm enables to analyse the energy management and its efficiency.

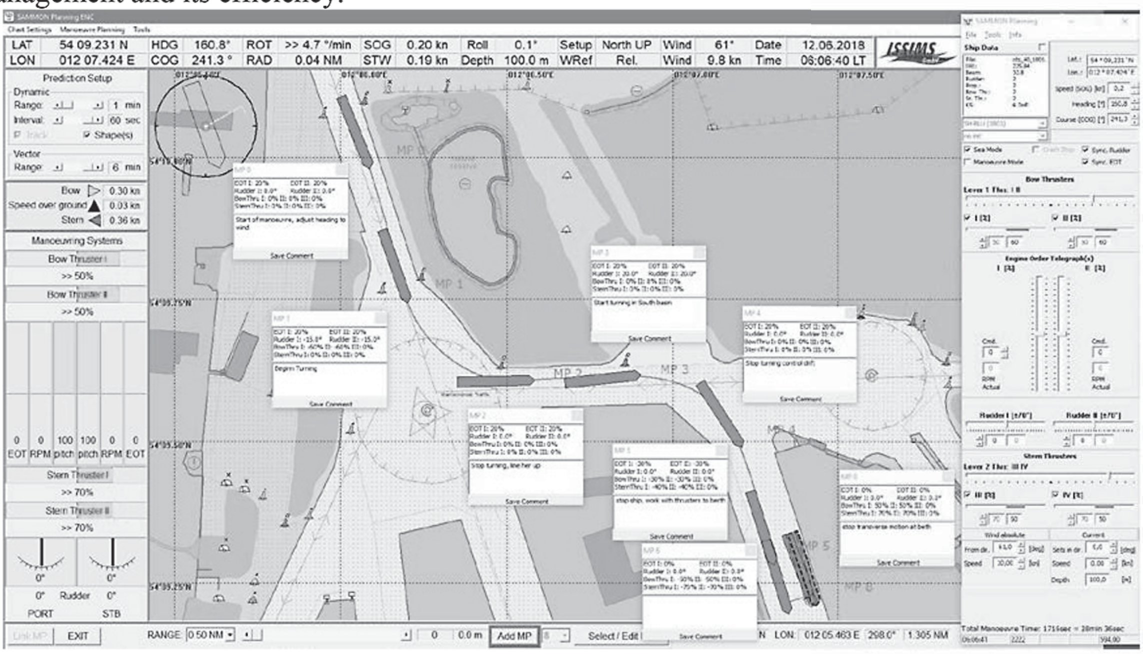

Figure 2 Sample for complete manoeuvring plan with final stopping manoeuvre and berthing by thrusters; additional manoeuvring point information text boxes show the control setting for the briefing session

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The professional version of the SAMMON software tools has been further developed by the start-up company Innovative Ship Simulation and Maritime Systems GmbH (ISSIMS GmbH) and made available to Hochschule Wismar.

E-Navigation mixed reality interface

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Keywords: mixed reality interface, artificial intelligence, e-Navigation, smart glasses, head-up display.

According to experts forecasts the set of traditional man-machine systems interfaces will have been transforming to the maximum users comfort by 2020. In compliance with e-Navigation (S4, S4.1.2) the strategic development plan, the standards interfaces for the data exchange to support the information transition from the communication equipment to the navigational systems were developed [1].

Nowadays, both the cognitive and timely opportunities of a navigator are used irrationally and the high emergency situation on the marine transport evidences it [2]. On the one hand this is caused by the absence of the detailed research in the subject matter, on the other hand the technological solutions in the sphere of the Artificial Intelligence (Al) and Augmented Reality (AR) have not been realized yet in the shipping industry. The Mixed Reality (MR) and particularly its development AR, provides a navigator with a new opportunity of perception and interaction with the environment which allows to receive the useful information to provide the safety of navigation with the minimum consumption of time and efforts [3].

The authors propose to realize the above mentioned idea by the marriage of applications of AI and AR, on the example of Smart Glasses use or special head up display (figure 1) [4].

In addition to Smart Glasses we can also consider the opportunity the visualization of virtual objects on head up display in such a manner that a navigator can see them in the correct location in the environment. The article offers the corresponding algorithm for the coordinate points calculations on the head up display.

The issue of new information devices is under discussion in the article. There is requirement in the measurement of the observer point of vision on the navigating bridge. It is necessary to investigate the abilities of the existing projective equipment for the AR formation on head up display and, probably, to develop the requirements for the most suitable devices for the navigational purposes.

The authors have developed the software to provide the information visualization on the head up display. The visualization algorithm of potentially dangerous target and its parameters is realized for several versions of the situation development and navigating bridge conditions. According to the opinion of developers the use of the present approach will make it possible to reduce time for the decision making as well as the cognitive load on a navigator and the main thing is to reduce the possibility of the wrong interpretation of the information submitted by the technical means of navigation .

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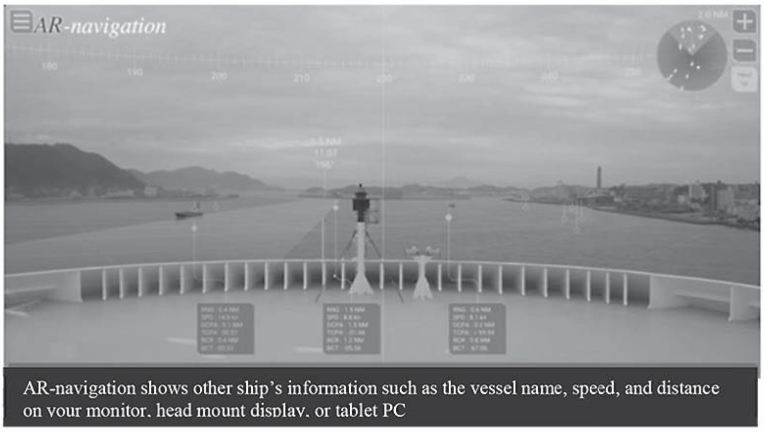

Figure 1. Prototype of mixed (augmented) reality interface

Engine Room Simulator Training for Emergency Preparedness

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Keywords: emergency preparedness, autonomous shipping, future maritime training

Autonomous shipping demands reliable propulsion and auxiliary machinery, zero down time, low environmental footprint, and intelligent operators who are able to make correct decisions and take appropriate actions in a timely fashion. While the first three relate to technological advancements and appropriate operational practices, the latter depends on the knowledge, skill, competence, and attitude of the operators. This requires adequate training to ensure that the operators will respond in an appropriate manner during normal operations and emergency situations. Thus, the training regimes for these operators must employ suitable learning strategies within an appropriate context to impart the required competencies.

Accident investigations show that human error contributes to around 80% of all marine accidents [1]. Thus the need to provide operators with the required competencies to deal with a range of emergency situations. These emergencies can be categorised as operational emergencies, breakdown emergencies, and accidents.

This paper investigates the potential of using the full mission engine simulators to train operators to handle emergency situations in order to reduce the risk of injury to personnel and damage to the vessel and the environment. Studies conducted by the authors show that full mission engine simulators provide an ideal tool and setting to demonstrate a range of emergency situations within the engine room and to train operators to handle such situations, while providing feedback on their actions and consequences. The paper also presents case studies and the lessons learnt during such simulation exercises and the approach to meet the stipulated STCW competencies [2].

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Environmental improvement of seaborne transport by developing a new generation of fibreships

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Keywords: Emission reduction, composite materials, ship structure

Seaborne trade is growing and it is expected to continue its growth at a pace of 3% in the upcoming years [1]. At the same time, environmental considerations have led the International Maritime Organization (IMO) to establish the target of reducing greenhouse gas emissions by a 50% by 2050, compared with 2008 [1]. Under this scenario, and because of the ambitious objective sought, it will be necessary to approach the problem with several strategies, from improvements in the propulsion system, to redefining and/or defining new maritime routes.

One of the approaches that can be followed to reduce the emissions in transportation is by minimizing the weight of the transport vehicle. This approach has been followed in the automobile sector by introducing aluminium and other alloys replacing steel, and in the aeronautical sector by incorporating composite materials in a high percentage of the structure in the latest designed aircrafts. The maritime industry has also embraced the use of composites in order to reduce the vessel weight, but it has only been applied to small crafts and ships. Large length ships, which are responsible of most of the seaborne transport, are not using composite materials extensively yet, losing an excellent opportunity to reduce greenhouse emissions

The European research project FIBRESHIP aims to develop the technologies and procedures required to facilitate the construction of large length ships made of composite materials. Eighteen different partners are involved in the project: research institutions, engineering companies, shipyards, ship-owners and classification societies, each one of them bringing their specific expertise to make feasible this new generation of fibreships. The most relevant results expected from the project are:

- Development of a composite material selection methodology, and a catalogue of materials and connection technologies to be applied in fibreships. The most promising materials are also characterized in terms of mechanical performance, fatigue strength and fire resistance.
- Development of numerical codes specially customized for designing fibreships. The project will design three different vessel types, a ROPAX, a container ship and a fishing research vessel, to understand the requirements of a fibreship design, and to test the numerical tools developed.
- Shipyard requirements, and modifications needed in actual shipyards based on steel construction, in order to build fibreships. This will be analysed with the construction of a large scale demonstrator.
- Cost-benefit analysis provided by this new generation of vessels, including a detailed study of their environmental impact.

Current work presents the main achievements obtained in the first two years of the project. These results prove that it is feasible to develop this new generation of fibreships and that the environmental impact of seaborne transport can be highly benefited by adopting this new technology.

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Evaluating cybersecurity risks in the maritime industry: a literature review

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Keywords: cybersecurity, maritime management, risk management

Around 80% of international trade is transported by sea [1]. At the same time, increased communication in international trade causes higher concerns on cyber-attacks as an emerging threat to maritime operations. For example, Maersk, the largest container shipping company in the world, suffered a cyber-attack in 2017, which led to a loss of $200-300 million [2]. The COSCO terminal in Port of Long Beach was cyberattacked in 2018 [3]. These cyber-attacks emphasize the importance of cybersecurity in the maritime industry. Cybersecurity is commonly defined as “the protection of cyberspace as well as individuals and organizations that function within cyberspace and their assets in that space” [4]. However, to the best of authors’ knowledge, there is no definition for maritime cybersecurity in the existing literature. Cyber-attack incidents have resulted in unquantifiable losses of monetary assets, intellectual property, and customer confidence [5]. In the aspect of maritime cyber risks, the International Maritime Organization (IMO) has defined it as a measure of the extent to which a technology asset is threatened by a potential circumstance or event, which may result in shipping-related operational, safety or security failures as a consequence of information or systems being corrupted, lost or compromised. Compared to the cybersecurity studies in other industries such as military, financing, airlines, cybersecurity in ports and on merchant vessels is sitting at the backseat (e.g. ten to twenty years behind other computer-based industries [6]). In light of the above evidence, the authors have found that the cybersecurity in the maritime industry needs to be addressed in urgency. This research aims to identify risk factors influencing cybersecurity in maritime operations and their control options through a state-of-the-art literature survey. For the further research agenda, a set of interviews will be undertaken to validate the identified maritime cyber risk factors from the literature review. A questionnaire will be distributed to measure the weights of the identified risk factors. A number of mitigation strategies will be proposed against the identified cyber risks.

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Preparing Maritime Professionals for Their Future Roles in a Digitalized Era: Bridging the Blockchain Skills Gap in Maritime Education and Training

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Keywords: Maritime Education and Training (MET), Blockchain Technology, Skills Gap, Supply Chain Management

Accelerated globalization backed by rapid advances in digital technologies has led to immense digital transformation across myriad industries. Digitalization is set to redefine industries, as vast amounts of data availability together with new advanced technologies presents opportunities for value creation; raising customer expectations at breakneck pace. Notwithstanding the conservatism [1], the global maritime industry faces imminent and digital disruption as industry players strive to embrace state-of-the-art technologies in light of heightening performance of their supply chains ("SCs") [2]. As digital momentum continues to push new frontiers in the 21st century, key emerging technologies underpinning the fourth industrial revolution ("*Industry 4.0*"), such as the Internet of Things, Artificial Intelligence, and Big Data, have driven current trends in information exchange and automation in economies. Correspondingly, traditional SCs are also gradually transitioning towards a more efficient, integrated, and smart SC ecosystem [4]. The leveraging of robotics and sensors for autonomous shipping, deployment of cyber risks mitigation strategies, intelligent systems for cargo tracking, implementation of sustainable shipping practices, among others have been deemed as global marine technology trends going forward [5]. Beyond the plethora of Industry 4.0 components is the advent of blockchains—a novel distributed ledger technology that is immutable and secured, where transactions are validated cryptographically in a decentralized fashion (in the absence of a centralized intermediary) [6]. Impelled by the cryptocurrency craze, blockchains have intrigued minds of maritime players given the proliferation of proof-of-concepts, start-ups and even initial coin offerings. Compelling blockchain use cases in the maritime industry include repository and verification of seafaring certification, tracking-and-tracing containerized shipments, digitizing of key cross-border trade documents, tokenization in ship financing, and the list goes on. Nonetheless, the leap in blockchain development in the industry reflects the increasing need for appropriate qualification and upskilling in a tech-savvy environment, consequently necessitating changes to teaching and learning methodologies in MET [7]. For instance, a blockchain consortium project funded by Lloyd's Register Foundation requires seafarers to manage digital certification repositories covering safety and training aspects in maritime shipping [8]. Despite the International Maritime Organization's Convention on *Standards of Training, Certification and Watchkeeping for Seafarers* stipulating standards for training mariners and professional education development in maritime business administration, graduates seem to lack multidisciplinary knowledge and technological literacy to meet future professional standards and requirements in the maritime sphere [9][10]. Touted as a disruptive technology, blockchains has the potential to fundamentally change business models leading to risks of job displacements due to obsolete skills and talent for blockchain adoption [11]. Moreover, most managers also lack knowledge about the concept of blockchains and how blockchain-based applications are set to transform their industries [12]. Changing educational paradigms in MET is therefore fundamental to meet requirements for graduates in the logistics and transportation field [13], which inevitably challenges the status quo and academic approaches to MET in the near future [14]. Inadequate transparency in future skills training and technological content in higher education is also adversely affecting the future skills gap [15]. Through in-depth literature review, the implications of digitalization on conventional MET is mostly preliminary and not thoroughly explored by academic research, especially with regard to blockchain development impacting MET methodologies. A recent study showed the propagation of blockchain and cryptocurrency courses offered by some universities in the United States [16]. The cultivating of life-long learning principles for continuous development is also essential for adaptation in a rapidly changing technological environment [17][18]. For this purpose, this paper aims to shed light on the implications of blockchain disruption in the maritime industry accelerating required changes in conventional MET approaches. In this essence, we further add to the topic of blockchain education and training in the MET sphere through analysis of existing academic research regarding blockchain adoption (and other advanced technologies) challenges in organizations. Additionally, we provide recommendations for blockchain talent development among maritime universities.

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S-Mode: Challenges and Opportunities for MET

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Keywords: S-Mode, human-machine interactions, standardisation, e-Navigation, safety

The prevailing differences in design, function, and interface among the same type of navigation devices and equipment on bridge pose significant challenges to seafarers and pilots alike since they have to familiarise themselves with all the devices and equipment within very limited time when they board on a different ship. In emergency situations, such differences may lead to wrong decisions or actions causing serious maritime incidents. Due to its significance to maritime safety, the International Maritime Organisation (IMO) has chosen the development of S-Mode as one of its top six priorities for e-Navigation and called the wide maritime industry to contribute to the development of guidelines for S-Mode. While the origins of S-Mode can be traced back to 2006 when the IMO adopted e-Navigation to address the challenge of uncoordinated complex navigation systems, no guidelines have been developed for S-Mode so far. Current discussions have involved seafarers on the one hand, as represented by maritime professional bodies such as The Nautical Institute, to address the 'user needs' of S-Mode. On the other hand, associations of manufacturers of navigation devices and equipment such as the Comite International Radio-Maritime (CIRM) have their own concept of S-Mode to express their views and concerns on 'standardisation'. However, maritime education and training (MET) institutions have had less direct involvement in the discussion of S-Mode. This paper reports part of the findings from the IAMU-funded project to address the challenges and opportunities of implementing S-Mode from MET institutions' perspective.

The core of S-Mode is to address the human errors that are caused by, or related to, human-machine interactions (HMI). The significance of human factors in the operational stability, performance, and safety of transportation systems, especially vehicle-operating or navigating tasks has attracted the attention of not only industries but also related regulatory bodies and educational and training institutions (Burmeister, Bruhn, Rødseth, & Porathe, 2014; Skalle, Aamodt, & Laumann, 2014). Research in HMI in transport is vast. The aviation industry has been in the forefront of research in HMI, for example, Hoc (2000), NLR (2013), Suijkerbuijk, Rouwhorst, Verhoeven, and Arents (2017), and Lim et al. (2018). Similarly, there have been large number of studies on HMI in road transport, for example, Pickering (2005), Weir (2010), Wu, Zhao, and Ou (2011), Muñoz, Reimer, Lee, Mehler, and Fridman (2016), and Vaezipour, Rakotonirainy, Haworth, and Delhomme (2019).

To a great extent, the six HMI problems on ship bridge identified by May (1999) 20 years ago are still relevant today. These are: (1) the irrelevance of displayed information; (2) inefficiency of interaction mechanism; (3) inadequacy in operational support; (4) fragmentation of implemented hardware; (5) inconsistency in information presentation; and (6) incoherence in its situational support. Ten years after May's publication, Jacobson and Lützhöft (2008) investigated the needs for standardisation from users' perspective to improve HMI on bridge. There has been continuous adoption of new technologies in ship design and construction with an aim to improve shipping efficiency and safety. However, research has shown that high system complexity, interdependency and automation may increase mental workload which could result in more human errors (Asyali, 2014; Hahn & Lüdtke, 2013; Man, Weber, Cimbritz, Lundh, & MacKinnon, 2018).

Regarding the design in HMI, different studies were conducted to investigate the trade-off relationship between the depth and breadth of the hierarchical menu structure. There has been an agreement that breadth is preferred over depth by automobile users (Burnett, Lawson, Donkor, & Kuriyagawa, 2013;

Jacko & Salvendy, 1996; Kiger, 1984). In aviation, Thomson (2015) suggests that four HMI design features are essential: (1) HMI should provide clear, unambiguous information; (2) Alarms should be designed to attract attentions, but not distractions; (3) Operators should be kept in the loop; (4) The possibility of making unintended irrational control input of the operator should be accounted for. Little research has been done in the maritime context despite the significant differences in design, display, and interfaces of on-bridge devices and equipment manufactured by different companies.

This paper, through focus group interviews, investigates challenges and opportunities faced by MET in relation to the effectiveness of education and training on on-bridge operations of device and equipment and to identify approaches that can improve learning outcomes under the proposed implementation of S-Mode. Nine focus group interviews with subject matter experts in China, Australia, Canada and the United States were conducted. The length of interviews ranges from 65 to 110 minutes. All interviews were recorded and then professionally transcribed. All transcripts were subject to careful check by subject matter experts before being analysed. Nvivo was used to analyse qualitative information obtained from the interviews. The analyses revealed some common concerns and themes of common interest including alarms on bridge, display/interface modes, and functions. These key themes covered many sub-themes and topics related to on-bridge human-machine interactions and the possible effects on human performance. While the results conform with the findings from previous studies, there have been some discoveries from the focus group interviews, especially in the areas of personalisation and integrated display.

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Weather Routing Software for academic purposes: A pilot study

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Keywords: Maritime Education and Training (MET); STCW competences; Weather Ship Routing; Marine Environmental impact, Technological Impact

Academic research has focused on ship routing optimization through pathfinding algorithms which take into account the meteo-oceanographic forecasts (i.e. wind, waves or currents predictions) [1, 2, 3 and 4]. Therefore, an academic software package (named SIMROUTE) for ship routing optimization oriented to students and cadets has been developed. The pedagogic purpose of this software package is to provide skills of ship routing optimization, to assess the impact of the meteo-oceanographic on ship navigation and to highlight the relevance of ship routing in terms of sailing time, fuel consumption and harmful emissions for the environment. SIMROUTE is a Weather Routing Software to be used as a learning platform for STCW learning. The expected outcomes are to develop best practices for a more efficient and sustainable maritime industry providing newly educated seafarers and to implement a very novel software in the framework of teaching innovation in Maritime Education and Training (MET) institutions.

This contribution will deal firstly with the design of the course structure and e-learning material. In parallel, comprehensive documentation material will be presented as a guide for teachers and instructors. In this sense, step-by-step test cases and video-tutorials, gradually increasing in difficulty covering the potentiality of the software, have been designed to ensure "on-line" learning available for the IAMU community. These materials are also available in the e-learning platform of the IAMU web site. The preliminary exercises are tested "on class" as a pilot case in a course of the "Master Degree in Nautical Engineering and Maritime Transport" at Barcelona School of Nautical Studies (FNB-UPC). Lecturers have been designed into two specific topics that are part of syllabus of MET institutions' programs and included in STCW 95/2010 Code: Ship Weather Routing application module (software familiarization, forecast weather and oceanographic conditions, software feasibility) and Marine environmental module (Methodology and calculation of Ship Emissions). With the aim of charting the course for the future of maritime universities from the point of view of technological and environmental impacts, this paper aims to provide preliminary results of the pilot case and some conclusions have been drawn. After the pilot study, strengths and weaknesses has been identified. For instance, the input date procedure still requires some improvements to make easy the learning curve. Therefore, further steps will be set into a more user-friendly graphical interface used in common weather routing software on the market today in order to be practically workable and to prepare the students for their coming work tasks in the best way.

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Emergent technologies and maritime transport: challenges and opportunities

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Keywords: autonomous ships, maritime industry, economic benefits, regulation, labour force, capacity building.

Over the last decades, the maritime sector has seen tremendous changes as a result of the introduction of automation and technology. More recently, the concept of autonomous shipping has raised the interest of the international shipping community leading to a scoping exercise on maritime autonomous surface ships (MASS) at the International Maritime Organization (IMO). While very often the technical feasibility is the main focus of many discussions at the moment, there are a number of other factors that need to be considered.

This paper describes the state-of-art when it comes to the technical feasibility of autonomous ships for commercial purposes. While arguing that technical feasibility is only one of the six main factors that affect its deployment, we further discuss how other factors play a significant role in it. The first factor is related to economic benefits. We develop on the argument that autonomous ships may not cope with the current business models, as autonomous ships are thought to be too costly in multiple ways under the current paradigm. The second factor comes from the regulatory side. The regulatory framework for the operation of autonomous ships is currently under discussion at the national and international levels. Only the regulatory scoping exercise undergoing at IMO shall last until 2023. Drafting regulations will take much longer. Apart from the legal framework, social acceptance is another factor that has historically determined the success or failure of technology. Furthermore, the relationship between technology and labour plays a large role in its successful deployment. On one hand, labour can determine the incentives for autonomous shipping to come to light. When labour is scarce and costly, companies are compelled to introduce automation to fulfil their role. Conversely, the abundance of qualified workers that are cost-effective demotivates companies to pursuit expensive technological solutions envisioned to replace labour. On the other hand, labour with specific competencies required to successfully operate the ships of the future, in particular, autonomous ships is not yet available in large numbers. What competencies will be required in the years to come are still subject to debate and by consequence far away from current educational systems.

As recent research has demonstrated, even more, automation onboard the demand for seafarers will continue to grow over the next decades.[1] This provides a great opportunity for educators and specialised trainers to think what the new requirements are for the future seafarers. A challenging task is given the high uncertainty on what are the precise right set of competencies demand in the future. This paper, therefore, attempts to shed some light on the issues related to factors other than technical feasibility impacting the introduction of autonomous ships and to provide a reflection on the future of educational programmes. It concludes with guidelines for the formulation of adequate capacity building policies that allow maritime professionals to tackle the challenges of the future and attract young and talented people to the industry.

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Cyber Security of Shipboard Navigation Systems

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Keywords: navigation safety, shipboard navigation systems, maritime cyber security, chart-radar

Shipboard navigation systems have been intensively developed for the last two decades by means of digitalization, network integration and software development, which resulted in complex and computer based technology systems. Therefore, safeguarding shipping from cyber threats is gaining increasing relevance in the development of shipboard navigation systems [1, 2]. Recently, the International Maritime Organization (IMO) issued the Guidelines on maritime cyber risk management, which offer recommendations for shipping protection from cyber vulnerabilities and threats. [3]. IMO has also placed to incorporate cyber risk assessment in the implementation of the International Safety Management Code on vessels by start of the year 2021 [4].

The radar equipment is considered as a critical navigation system for safe navigation and collision avoidance. With additional integration of electronic navigational charts (ENC) with the full radar functionality (the chart-radar system), the improved efficiency and safety at sea is provided. The radar is, however, essentially a software application running on a standard computer with installed a general operating system. While IMO regulations standardize radar operational software performance [5], the supporting hardware and software is arranged by ship-owners and implemented by radar equipment manufacturers.

Recently, we presented an experimental cyber risk assessment of a ship and application of vulnerability scanning for identification of cyber threats [6]. In this work, in order to study the source of cyber vulnerabilities of shipboard navigation systems, we had examined cyber security of a chart-radar system implemented on a ro-ro passenger ferry sailing on an international route across Adriatic Sea, between Croatia and Italy (Figure 1). The Wärtsilä SAM Electronics RADARPILOT Platinum system (which is IMO compliant) was examined by performing vulnerability scanning using an industry-leading tool, the Nessus Professional vulnerability scanner (Figure 2). Details on the shipboard chart-radar system and experiment setup will be presented. The identified cyber vulnerabilities together with possible solutions will be discussed.

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Figure 1. The international route vessel of the shipping company Jadrolinija.

Figure 2. Computational cyber vulnerability scanning of the ship's chart-radar system.

Acknowledgements
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Training Model Based on The Anchoring Training

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Keywords: Anchoring training, Group work, Peer learning, Briefing

It is thought that the anchoring training in a training ship has an effect in acquisition of ship handling skills (1). Moreover, trainees think actively themselves and are considered to be effective also in the ability development which solves a problem (2). Authors investigated the feature of the effect of training to trainees from the result of the training in the anchoring training. We analyzed about the anchoring training that was carried out with the training ship of Tokyo University of Marine Science and Technology in 2017 and 2018. Two teachers who have experience of captain evaluated this anchoring training using the evaluation list of rubric form. Evaluation has the following nine items, and include four steps of evaluation criteria.

(1) Procedure for heaving up anchor,
(2) Lookout,
(3) Course setting,
(4) Give-way or stand-on ship handling,
(5) Position fixing and anchoring position,
(6) Anchoring procedure
(7) Gradual speed decrease,
(8) Bridge resource management (BRM) / bridge team management (BTM),
(9) The whole of the training.

As a result, the skills of the contents which memorize the procedure for heaving up anchor and the anchoring procedure, etc. were high evaluation. On the other hand, contents corresponding according to the situation at those times, such as the give-way or stand-on ship handling and the route voyage, were low evaluation. Then, the more effective training methods of the contents which were low as for evaluation were examined from the comment of the instructors and the trainees. The contents about the improvement in the training effect of comment were classified, and the theorized main point was summarized as follows.

(1) In ship handling planning, trainees do the sufficient dialog, and exchange of opinions, etc. within a group. An understanding progresses by peer learning, and then the performance as a team improves.
(2) Implementation of considering the correspondence to various assumption beforehand, a role play, and a simulation is effective for skill acquisition.
(3) In a briefing, carrying out the presentation of the ship handling plan has an effect in arrangement and fixing of knowledge and skill.

As effective training based on the result of the anchoring training, we propose the training model which combined “group work”, “actual ship training”, and “debriefing.”

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Policy Recommendations for Autonomous Underwater Vehicle Operations Through Hybrid Fuzzy System Dynamics Risk Analysis (FuSDRA)

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Keywords: Risk Analysis, System Dynamics, Fuzzy Logic, Autonomous Technology, Policy Setting

The advancement of science and technology has resulted in an emerging trend in the use of autonomous equipment in many Maritime Universities. One such example is the use of autonomous underwater vehicle (AUV) for underwater data acquisition. However, one of main challenge lies in preventing loss of the AUV at sea. More than just tangible financial impact such as increase in insurance premium, any mishap to an AUV during deployment can also cause indefinite delay to research projects, loss of valuable research data, damage to reputation of the AUV community and a possibility of contaminating the marine environment (1). To prevent the loss of an AUV, there have been significant developments in risk analyses methods aimed at developing effective policy recommendations. However, most existing methods adopts a chain-of-events perspective which promotes a reductionist mentality. This often results in a simple linear narrative that displaces more complex, and potentially fruitful accounts of multiple and interacting contributions. In addition, the lack of systematic and regular data for AUV deployment posed another challenge to risk analysis. As a result, most existing approaches depended on the elicitation of expert's opinions for subjective probability quantification. However, experts may face difficulties to provide precise numerical figures due to the vagueness and ambiguity nature of risk (2)(3)(4). To overcome these limitations, a new form of hybrid fuzzy system dynamics risk analysis (FuSDRA) framework (Fig. 1) is proposed.

System dynamics is an objective-oriented deterministic approach, facilitating a comprehensive risk analysis by accounting for the dynamic nature of risk and interrelationships between risk factors within the system. Fuzzy logic is integrated with system dynamics to account for uncertainties due to imprecise or lack of empirical data. The result is a robust approach which utilises the strengths while overcoming limitations of both methodologies. The usefulness of the FuSDRA methodological framework was demonstrated in a case study based on the University of Tasmania's (UTAS) nupiri muka AUV program. FuSDRA models were developed for scenario analysis to understand the risk behavior under reducing government support and increasing alternatives to the AUV. The combination of reducing support and increasing alternatives was found having a synergistic effect on the risk of AUV loss, resulting in a greater increase in the risk of loss than the sum of their individual effects. As a result, the risk of AUV loss noticeably deviates after the second year of the AUV program. After 7 years into the program, the risk of loss exhibited a sharp increase and diverges significantly from the base scenario (Fig. 2). A series of risk control policies were recommended based on the results. The case study demonstrated how the FuSDRA approach can be applied to improve risk management policies, with potentially broader application to other autonomous systems which are increasingly being adopted by Maritime Universities.

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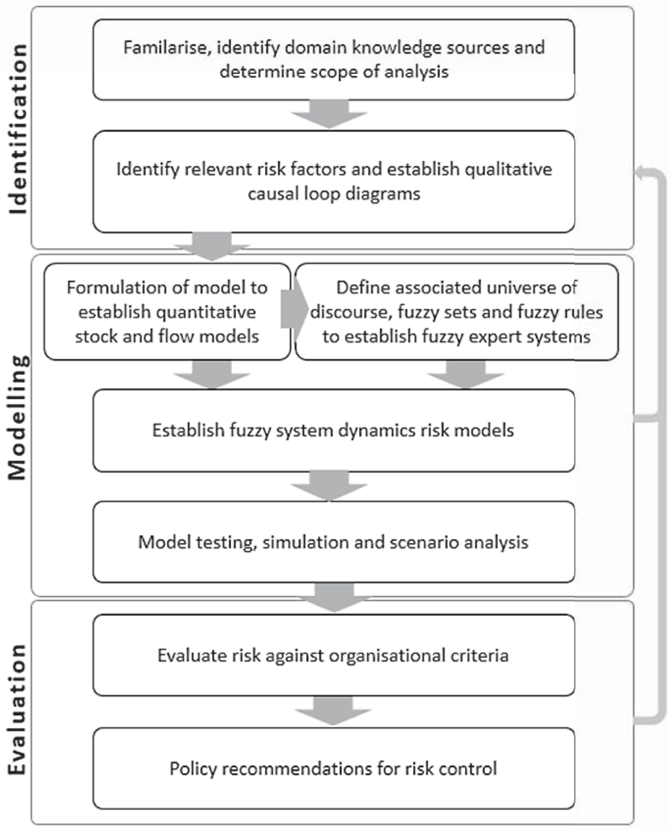

Figure 1: An overview of the FuSDRA framework.

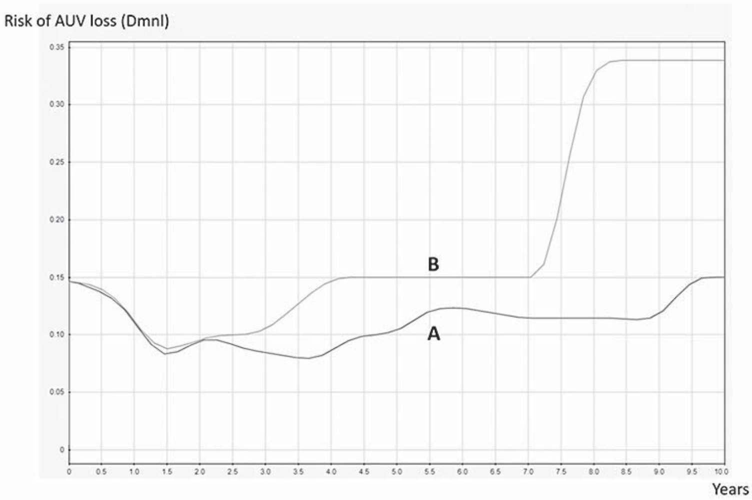

Figure 2: Combined impact on ‘risk of AUV loss’ with a 10% annual increment in alternatives to the *nupiri muka* AUV and 10% annual reduction in government support, as compared to the base scenario. **A:** Base scenario. **B:** Combined effect.

Using a web-based simulation software in education

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Keywords: Simulator, maneuvering, teaching

In the third year of their Master Mariner education, students at Chalmers University of Technology attend the course "Ship handling and navigation in confined waters" which mainly focuses on the following topics:

- Applied hydrodynamics (IMO manoeuvre tests, shallow water effects, interaction, etc.).
- Maneuvering characteristics of different ships including the controllable, semi-controllable and uncontrollable forces involved in ship handling.
- Planning, executing and monitoring passages in confined waters such as archipelagos (blind pilotage techniques on radar, controlled turns, etc.)
- Maneuvering large ships with and without the use of tugs.

The teaching methods consists of lectures, exercises in the bridge simulator and some limited practical maneuvering training on a small ship. To further support the student's learning, Chalmers and SSPA have developed a web-based simulator "Seaman Online". This web application builds on SSPA's simulation software Seaman and uses high-quality mathematical models originating from SSPA's comprehensive data bank from model tests conducted during the last 60 years.

Using Seaman Online, the instructor can build and publish specific exercises which the students can access by logging in to their account from any computer connected to the internet at any time. No software needs to be downloaded as Seaman Online runs directly on a web page. When an exercise is finalized it may be flagged by the student telling the lecturer that it is ready for assessment through the integrated evaluation tool. The student and lecturer may also give comments through Seaman Online.

In the course "Ship handling and navigation in confined waters" the goal and purpose of the exercises focus on the students understanding of various hydrodynamic effects due to e.g. hull form, UKC, interaction with banks and other ships and to give them training in maneuvering/berthing of large ships with and without the use of tugs. After having completed an exercise, students can replay the simulation on an evaluation page where all important maneuvering data such as forces, moments, rudder angles, etc. from the run are presented in a graphical and numerical format facilitating the analysis of the run (see figure 1 and 2). By saving and flagging a completed exercise by the student, the instructor gains access to the evaluation page of the run to assess the performance.

Presently (March 2019), Chalmers is evaluating the software and its use in education but believes that by using Seaman Online, students will not only increase their knowledge and understanding of the complexity of ship behavior in various conditions but also provide students the possibility to practice and learn at any time they wish.

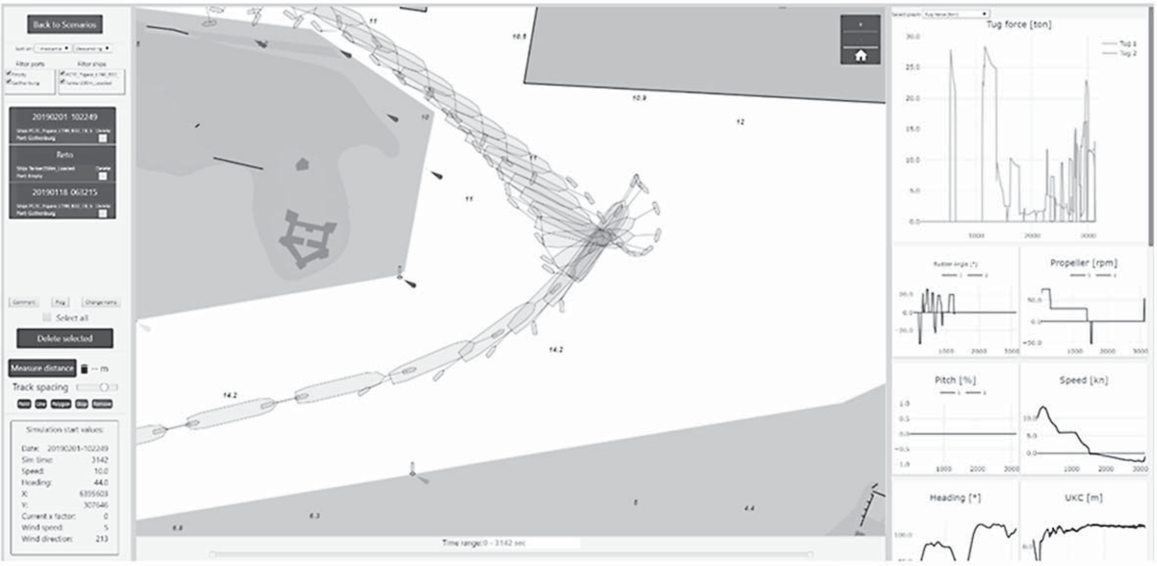

Figure 1. Evaluation of simulator run.

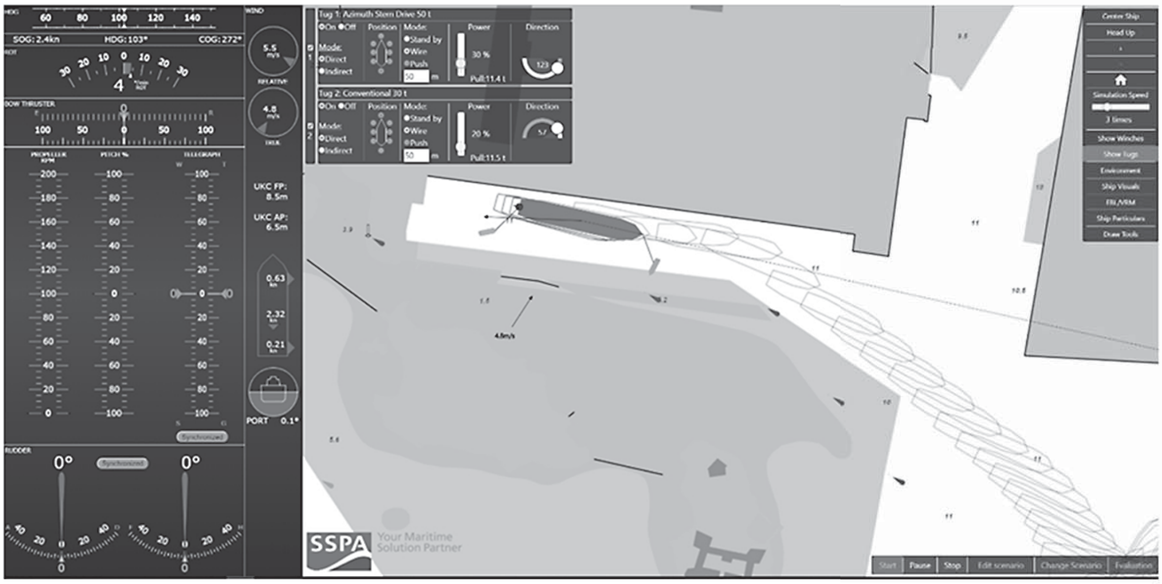

Figure 2. Running the simulator.

A Study on Work Load Evaluation Method and Quantitative Evaluation Method for Engine-room Resource Management training

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Keywords: Engine-room Resource Management (ERM), Work Load Evaluation Method, Quantitative Evaluation, Non-technical skills

In 2010 Manila amendments of STCW convention, the requirement concerning Engine-room Resource Management (ERM) have been introduced into mandatory requirement for engineer and full implementation is required on 1st January 2017. Amended requirement increased needs of simulator training to evaluate engineer's non-technical skills. To carry out ERM training and evaluate non-technical skills, IMO model course 2.07 Engine-Room Simulator 2017 Edition program was introduced to provide guidance with a view to supporting training providers. In Model course 2.07 program there are several sample exercises and ERM practice task is included for marine engineering at the operational level (STCW code A-III/1). Also Sample evaluation form: Behavior markers for non-technical skills is provided to evaluate ERM training. Even though model course program is designed to provide flexibility so as to allow training providers to adjust the course program to the needs of trainees. According to these background, maritime education institute and universities are developing suitable ERM training program and effective evaluation method of the training exercise.

This study aims to propose work load evaluation method and quantitative evaluation method of trainee regarding to ERM training. Training exercise is developed based on IMO Model course 2.07 sample exercise ERM training, Recovery of blackout situation. Trainee take up the position assigned (Control room: C/E,1/E. Engine room:2/E,3/E)

The necessity of work load evaluation during simulator training exercise is considered to evaluate trainee's performance. The effect of the trainee's work load during training exercise is evaluated by objective evaluation using VACP (Visual, Auditory, Cognitive, Psychomotor) method and heart rate data comparing subjective evaluation NASA-TLX (Task Load Index). We studied the difference of trainee's work load and biological reaction during training exercise. VACP work load scale is modified for ERM training exercise. For quantitative evaluation, we used evaluation form: behavior markers for non-technical skills. Evaluation criteria is based on sample evaluation form and evaluation markers are modified. Both work load evaluation using VACP scale and quantitative evaluations using evaluation form are carried out by recorded video and audio data of training exercise.

The result of VACP evaluation, heart rate data and NASA-TLX shows that trainee assigned to control room had higher work load compare to trainee assigned to engine room case. The result of quantitative evaluation indicate that trainee assigned to control room had higher behavior markers for non-technical skills compare to trainee assigned to engine room case.

These results explains that developed training exercise had more complex tasks in control room and these task responses were evaluated as higher behavior markers for non-technical skills. Also higher work load of control room case explained higher performance were required to these task responses.

Results of evaluation experiments suggest that the proposed work load evaluation method and quantitative evaluation method are applicable for the assessment of ERM training.

INTELLECTUAL TECHNOLOGIES IN THE FIELD OF MARITIME PROFESSIONAL EDUCATION AND TRAINING

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Keywords: maritime education and training, intellectual technologies, artificial intelligence

The modern global system of maritime education, having a very significant inertia, similar to all other educational systems, is currently focused to face the developing and expected needs of the maritime industry.

The requirements the of e-Navigation concept, application of the principles of artificial intelligence in all maritime transport infrastructures are already quite relevant. It has become clear that the improvement of the requirements of the STCW and maritime educational standards of many countries of the world provides only a minimal need to meet the demands the of seafarers' professional competence field that is developing more rapidly than the process of maritime education.

In the context of understanding what is happening many maritime universities are persistently proposing to update the established process of maritime education and training of maritime professionals justifying their proposals on the basis of B. Bloom's educational taxonomy and the principles of artificial intelligence.

Based on the assumptions of the Global Maritime Professional (GMP) concept formulated by the IAMU Executive Directorate it is proposed to assess the early (weak) evidence of the emerging trends in the modern maritime industry and in the training of the marine specialists, the analysis of which will make it possible to formulate important changes in customer needs, as well as economic, environmental and regulatory trends to meet the perceived needs of the maritime industry and the rapid development of the educational process.

Attention to the "weak" signals generates new perspectives and non-linear thinking that will help educational systems to present and plan various possible future options and create an adaptive culture that analyzes the constant changes in the whole diversity of the educational process, thus, strengthening the sustainability of educational systems and leading to an increase in their effectiveness.

The modern stage of application and development of artificial intelligence in maritime research and technology is characterized by the integration of various approaches, concepts and trends, using mostly the achievements of fuzzy logic and neuroinformatics based on an artificial neural network.

The development of the GMP model is difficult to formalize, since the processes of maritime education are non-linear and have extremely complex dependencies. Neural networks are non-linear in nature and represent an exceptionally powerful modeling method that allows you to reproduce extremely complex dependencies for which they cope with the task best of all.

In modern conditions, the creation of adaptive, self-organizing, structurally complicated systems for managing objects of marine infrastructure and training — systems with a high level of artificial intelligence — is important and relevant.

The issue of restructuring the fundamental education of navigators in the conditions of intensive development of modern computer mathematics, intelligent technologies and high-performance computing is considered. The main attention is paid to the formation of the information-educational environment that provides intellectual support for the student. Examples of the use of intelligent technologies that contribute to the organization of the learning process as a creative process of knowledge formation are presented.

VR Training Videos: Using Immersive Technologies to support Experiential Learning Methods in Maritime Education

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Keywords: virtual reality; 360 degree videos; experiential learning; immersive technologies

The use of David Kolb's experiential learning theory is strongly ingrained in maritime education. This process of gaining an experience, reflecting upon the experience, forming ideas from this reflection, and eventually applying these ideas, is interwoven throughout maritime training schemes worldwide. Unfortunately, experiential learning can be difficult to implement. The two primary platforms which are currently used to engage this learning process in maritime education include simulation and real-world platforms. Although these two platforms are successful and effective at implementing this learning method, the high costs related to these platforms make them difficult to implement throughout the student's progress from introductory levels of instruction to advanced levels of application.

With the recent advancements in immersive technologies, new opportunities to engage students in the experiential learning process are becoming available. The combination of instructional 360 degree videos and virtual reality, or VR Training Videos, creates a highly immersive experience which engages the visual, audio, and tactile senses, causing the viewer to be fully engaged in the event which is being displayed. These VR Training Videos can be used in a standard classroom environment to create a variety of experiences focused on specific learning outcomes. SUNY Maritime College has begun to create and implement the use of VR Training Videos within their maritime transportation courses as a part of this experiential learning process.

This paper will discuss the pedagogy and research-based foundation behind a course design using these VR Training Videos and experiential learning. It will also discuss the process which SUNY Maritime College has undergone to implement this technology and course design into the classroom along with some of the initial findings of this project.

Joint Production of Web-learning Material by IAMU Member Universities

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Keywords: e-learning, web-learning, IAMU

Abstract

In all areas of higher education the use of the internet and web-based learning have gained much attention. There are several reasons. Firstly, the internet is a source of useful material for educational purposes. Secondly, affordable and versatile software tools are available for development and running web-based courses. Thirdly, conducting lectures online for a larger number of students is very cost-effective. Fourthly, web-based courses can be followed online by students anywhere in the world.

The convention on Standards of Training, Certification and Watchkeeping (STCW) by IMO is an ideal basis for international collaboration between maritime education providers. Since the contents of training of seafarers is standardised, the essential contents of training material should be equal all over the world. Naturally, this does not fully apply in reality due to linguistic and cultural differences, variation in the educational system between countries and different pedagogical policies applied. However, there is unexploited potential in producing training material for seafarers in collaboration between MET institutions.

Shared production of web-learning material was examined by three IAMU member universities: Gdynia Maritime University (GMU), Satakunta University of Applied Sciences (SAMK) and Svendborg International Maritime Academy (SIMAC). The three universities carried out an IAMU research project on Addressing Cyber Security in Maritime Training and Education (CYMET), coordinated by SAMK. One of the targets of the project was to produce web-learning material for IAMU member universities on Maritime Cyber Security Management in collaboration by the three universities. The IAMU e-learning platform was chosen for producing and publishing the training material. It uses the open source code software Moodle, which is the most popular web-learning platform globally.

Even though there may be challenges in combining material from different sources, the parties can benefit from this kind of collaboration. Collaboration between IAMU member universities in production of web-learning material should be developed actively. This could be an effective way to enhance the quality of education and training of seafarers globally, as stated in the basic agreement of IAMU: *The members shall cooperate with each other in a range of scientific and academic studies, developments, and practical applications associated with Maritime Education and Training and endeavor to achieve measurable and worthwhile outcomes for Maritime Education and Training through IAMU activities.*

Acknowledgements

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Autonomous shipping: How to reach competence requirements for the Shore Control Center (SCC) operators?

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Keywords: Maritime automation; Competence; human element; Autonomous Operator.

Abstract: Currently, the shipping industry has its fair share of ‘automation’ which is in a transition towards ‘autonomy’ with increasing efforts. To accelerate the progress on the regulatory process on Autonomous shipping, the Maritime Safety Committee of IMO further defined 4 degrees of Autonomy. Which are: *1. Ship with automated processes and decision support; 2. Remotely controlled ship with seafarers onboard; 3. Remotely controlled ship without seafarers onboard; 4. Fully autonomous ship.* However, in each degree of autonomy, the role of human is changing. Therefore, attention must be given to the human element of future vessel operations [1]. The human element is a complex multi- dimensional issue that comprises the entire spectrum of human activities performed by all relevant parties from both ship and shore who need to collaborate to address human element issues efficiently [2].

Primarily, this research will investigate the transition from the 2nd to the 3rd degree i.e. switching into remote/unmanned operation from the manned operation where the vessel will be operated and controlled from the Shore Control Centers (SCC). Hence, this study will outline the competencies for future Autonomous Operators (AO) for SCC’s. The potential informants to define the AO’s competence are:

a. technology developers: who are currently designing and manufacturing the technology, they shall know the competency requirements for the future operators of their product.

b. regulatory authorities: who issue the Competency certificates under STCW to ensure safety at sea.

c. academic institutions: who developed the learning methods and will be training the future operators.

Other stakeholders such as the seafarers-who are at the core of shipping and the investors (ship owners, insurance company etc.) might have a common agenda of ensuring the safety and business at the same time, which should also be a collective agenda for the selected informants for this study. All these stakeholders will be covered in the next step-a survey. Subsequently, informants from diverse platforms will adjust and validate the findings of the primary data analysis. Figure 1 illustrates the research design further.

The role of the human element on future maritime autonomous ships will be different than the current seafarers. The remote and autonomous operation of ships will not eliminate the necessity of human element in shipping, rather it will transfer the education and skill requirements on a higher level to facilitate the operation centres on land [3]. This research will detail those competencies for the future AO’s. Besides, defining competence requirements, it will facilitate the process of designing the training method for the human element who will be playing a vital role in future maritime autonomy.

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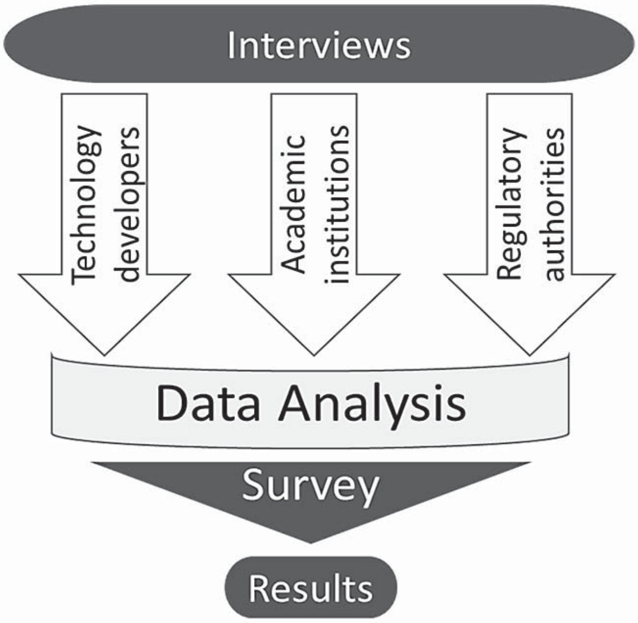

Figure 1: research design for this study

About decision support system at risk of fleeting accident of a displacement vessel

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Keywords: displacement vessel, swimming safety, proactive monitoring, fleeting accident, support system for the acceptance

Ensuring the safety of navigation on inland waterways is becoming increasingly important considering development of tourism and optimization of cargo costs. Water transport accidents cause damage to the vessels, loss of cargo, shipwrecks and casualties.

The captain has the right to determine the time of abandonment of a vessel. He orders the evacuation of passengers and crew in accordance with the actual developing situation. He chooses the way of its implementation. People can leave the vessel only at the risk of immediate death. International and domestic rules of safe navigation in case of emergency accident or wreck regulate these cases. However, as it is shown by the materials of investigations of accidents and shipwrecks, panic, arising on the vessel in such extreme situations, hinders the captain to take timely and optimal solutions for the evacuation of passengers and crew.

In order to reduce the time of captain's decision-making in case of emergency incident, to reduce the influence of the subjective factor, to improve implementation of rescue task, authors of the report examine development of the architecture of decision support system (DSS) at risk of fleeting accident of a displacement vessel. The hardware and software implementation of the DSS will provide proactive monitoring of the state of the river displacement vessel as an object, operating under the conditions of a potential flooding risk. The system will collect and analyze information of the vessel's systems and services in on-line mode and control the key parameters. Thus, the use of the system will timely allow to detect regularities and provide the captain a complete picture of the status of the vessel, to identify trends in its unwanted changes and reflect the content of information messages on the monitor.

The structural scheme of the DSS includes the following three levels: the level of sensors, from which the values of parameters characterizing the current state of the vessel are taken [1]; server level, in which incoming information is processed and its results are stored; user level, allowing you to see a generalized picture of the current state of the vessel.

The authors are developing an algorithm for proactive monitoring of the potential loss of river displacement vessels under the threat of a transient accident and identifying a method for predicting the value of the angle of heel of a river displacement vessel. The lead interval should be no less than the time taken to don a lifejacket and the time of people on deck.

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Clustering Algorithms for Maritime Data Analysis: The Case of AIS-SAT Data Analysis

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Keywords: machine learning, clustering, AIS-SAT, data analysis, maritime data analytics

Abstract text.

Modern and intelligent vessels, including autonomous ships, can contain thousands of different sensors. These sensors can generate huge data every day, so consequently thousands of data can be collected. Use of these data requires looking for and implementing new technologies and techniques, including new approaches to data processing. Data analytic is opening up to new opportunity to create values from data. Data analytics is the process of discovery and drawing conclusions from information - from technical point of view, from data collected in different repositories. Data analytics supplies different tools for data processing, based on machine learning algorithms, and becomes increasingly important also for ship control. This importance should be merged with different critical decisions and ships' automation. Data analytics are also becoming crucial for shipping, where greater volumes of data are today more natural than ever before. In this case data analytics is needed to improve performance monitoring and optimization of operations, condition monitoring maintenance of equipment and assets, as well as safety improvements.

Data analytics applications involve more than just analyzing data. They include integrating and preparing data, then developing, testing and revising analytical models to ensure that they produce accurate results [1]. Data analytics and its tools are exchanged among six key technologies that will impact vessel operations. It is these tools that are perceived as those that will transform marine technology and shipping operations [2]. In [2] there are also pointed out four primary technology enablers for the collection and use of data analysis tools in shipping, i.e.:

- the availability of affordable, reliable and accurate sensors for data collection,
- the high data transfer speeds between ship and shore,
- the continuously increasing computational power and development of IT platform solutions,
- the development of analytical methods and algorithms for creating value from collected data.

An example where machine learning tools can be successfully implemented is the AIS data analysis. As described, AIS (Automatic Identification System) is an automatic tracking system based on transponders located on ships and used by vessel traffic services (VTS) (see, for example [4]). In the present case, machine learning tools can relatively accurately predict future vessel movements, several port steps ahead, based on AIS statistics and vessel data [2]. Due to the increasing ship traffic in ports, the maritime traffic safety needs more attention, and analysis of data collected from AIS can help to control and prediction of ship behaviors. Based on deep and wide analysis of data from the AIS system, a big set of different parameters and factors [3] can be monitored.

Machine learning tools can also be very helpful in data processing for the needs of different systems, including marine systems, in case when the data is incomplete. Data processing in the AIS satellite transponder [5] is an example. The AIS satellite transponder collects data from AIS transmitters located

on ships and sends it to the ground component. However, data collected by the satellite component of AIS-SAT are incomplete and contain noise, and it is difficult to determine the AIS data packages in their basis. It means that, incomplete package sets are transmitted from the satellite transponder to the ground component.

In this paper the selected clustering algorithms, i.e. unsupervised machine learning tools, for analyzing of AIS data and for determining packages are considered. In general, the aim of the research was to answer the question whether the clustering algorithms can be helpful in a recovery of data when they are lost as is the case with the AIS-SAT system.

The algorithms have been validated experimentally using the raw AIS data available from real system and recorded from the area of the Baltic Sea. Advantages and main features of the AIS data analysis approach based on clustering are discussed considering results of the computational experiment.

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Safe Passing of the Vessels with Vessels' Momentum Consideration

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Keywords: maritime safety, passing of the vessels, vessels' momentum

International shipping transports more than 80 per cent of global trade to peoples and communities all over the world. Shipping is the most efficient and cost-effective method of international transportation for most goods; it provides a dependable, low-cost means of transporting goods globally, facilitating commerce and helping to create prosperity among nations and peoples. Shipping is an essential component of any programme for future sustainable economic growth.

Maritime safety is concerned with the protection of life and property through regulation, management and technology development of all forms of waterborne transportation.

However, collisions and groundings are still severe problems today, especially with increasing traffic density and speed as well as growing ship sizes. The main reason for collision related disasters is still the human factor, which is periodically confirmed every few years by several studies.

The paper deals with the actual problem of reducing the number of accidents resulting from collisions of vessels by the correct consideration of their dynamic characteristics while determining the collision avoidance maneuver. The paper gives the general formulas, considering the **vessel' momentum** for calculating the rate of the turn of the maneuvering vessel at all the stages of the collision avoidance maneuver. Three dynamic models of the vessel's turning moment, describing her momentum are considered in the paper. Analytic formulas are obtained for each of the models. They allow to calculate the parameters of the collision avoidance maneuver taking into account the dynamics of the vessel.

The natural observation of the ship's turning ability for different maneuvers and sailing conditions were made in the real condition of the ship's operation. They were studied by the method of selected points and minimum squares. The vessels' mathematical model is described in the paper. It is designed for checking the correctness of the obtained method of safe **passing of the vessels** with consideration of the momentum of the maneuvering vessels. The results of the experiment and mathematical modelling in the paper showed the necessity to take into account the ship's dynamic characteristics during collision avoidance maneuver.

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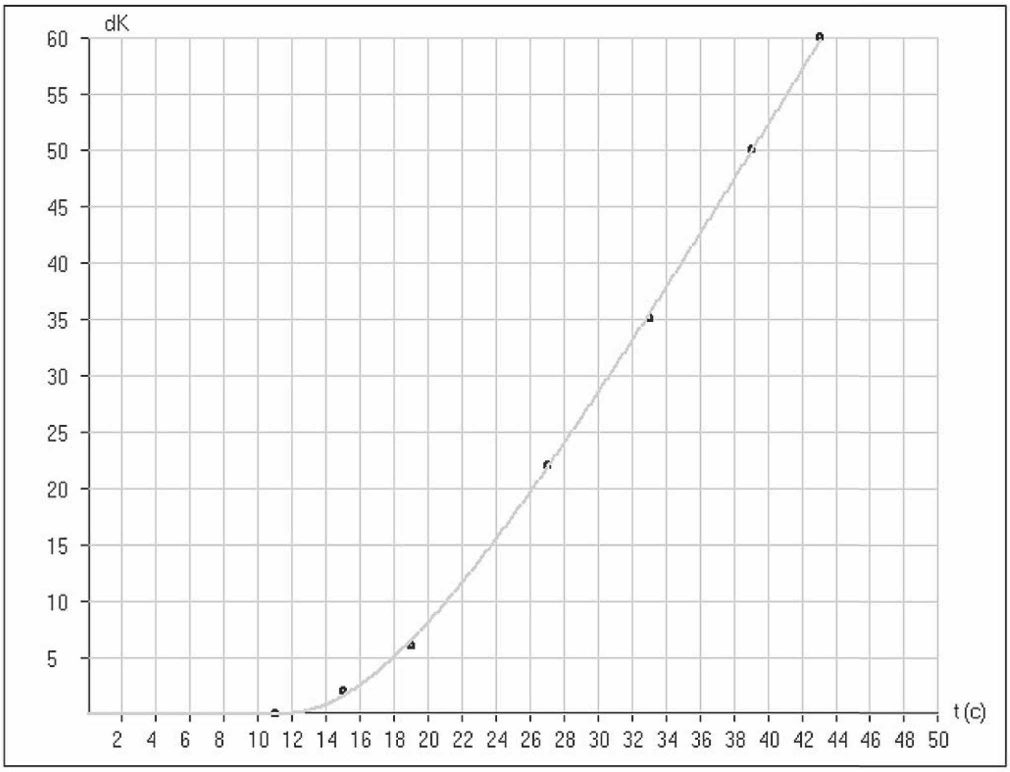
The third order vessels' mathematics model results

Number of maneuver	Rudder angle	Vessels' speed	t_Z (c)	a_ω (°/c)	T_1 (c)	T_2 (c)
1	5	24	0	0,88	9,61	1,69
2	-5	24	0	0,88	9,61	1,69
3	10	21	0	1,28	8,89	1,54
4	- 10	21	0	1,28	8,89	1,54
5	15	27	14	2,65	9,62	1,23
6	- 15	27	11	2,50	7,45	0,80

Fig 1. Calculation the dependence of the □K by t for Maneuver # 6

(third order vessels' mathematics model results)



Abstracts

Economical Impact

Combined Qualitative Ship Valuation Estimation Model

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Keywords: Ship Valuation, Future Estimation, Maritime Management, International Management.

The determination of the direction in which the supply-demand balance will occur due to the instability in the periods of economic crisis and the volatility of the market necessitates the use of combined mathematical methods.

Brokers experience difficulty in determining a ship's real value because of the lack of instant and unbiased data that can be accessed at any time or anywhere in the world. Mostly, brokers use a marketing approach to determine a ship's value. However, a marketing approach doesn't give an accurate solution under all conditions.

Ships, especially those from the age range 6-25 which are more than five years old, need to be evaluated with a combined method which differs from marketing approaches. There is no systematic and standard mechanism to determine a ship's value worldwide.

The aim of this study is to develop a reliable ship valuation mechanism using the "Combined Qualitative Ship Valuation Estimation Model" to validate the ship's actual price. Within this model the ship's value can be calculated more accurately. This model will be useful to determine the adjusted ship value and to provide decision making support for willing buyers and willing sellers.

Determination of Dry Port Location within the Hinterland of Kocaeli Ports by Applying AHP

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Keywords: Dry port, Maritime Management, Transportation Strategy, Analytic Hierarchy Process, Container Terminal.

The rapid increase in container traffic has required new investments in the port sector. It is evident that the increase of containerized traffic leads to the development of dry ports within the hinterlands of seaports in all over the world [1]. It is anticipated that the container terminals suffering from the limited stacking capacity, such as the ones located alongside the Gulf of Kocaeli in Turkey, might benefit from the realization of a dry port.

Determining the most appropriate location for a dry port is a delicate process that requires careful consideration of many criteria [2]. The studies in the literature show that dry port application will provide advantages for many actors, especially in port, transportation and industry, and it will also provide benefits in terms of reducing traffic congestion of port cities and providing a healthier environment.

The transaction volume of the container terminals in the Kocaeli region is higher than that of the world average in recent years. In this paper, a study on a dry port model that can be connected with four terminals in Kocaeli city and which can enable a more quick and effective transportation through both production and consumption centers within the hinterland of Kocaeli ports (see Figure-1) has been conducted. The criteria that would affect the selection of dry port location were determined by taking the expert opinions from the relevant sectors. The possible dry port locations have been determined related to some certain qualities and evaluated in terms of the feasibility of the railway connection by way of working group meetings in two different public institutions. The feasible alternative locations were assessed within an Analytic Hierarchy Process (AHP) related to the process plan as seen in Figure-2. The criteria applied in this process were graded by a survey method which includes the opinions of 83 experts from 12 sectors. The "Convenience for transportation within the hinterland" among these criteria, as seen in Table-1, has been determined as the highest priority criterion. As the result of the AHP, Kosekoy location, which has a distance of 20-50 km between the four container ports stationed in the Kocaeli Gulf, has been determined as the most suitable dry port location. It is assessed that the criteria of the method applied in this study can be taken as a sample for studies with similar purpose in different countries.

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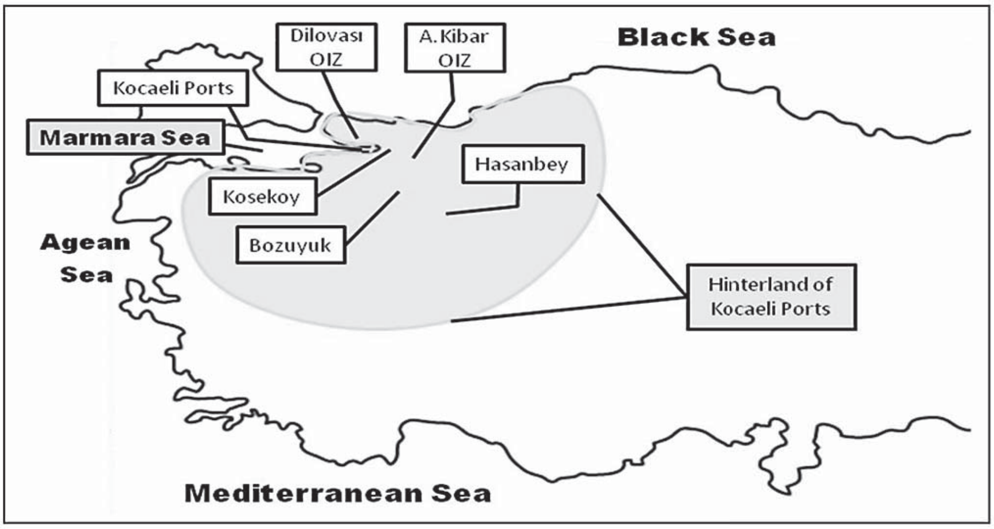

Figure 1. Hinterland of Kocaeli ports and the alternative locations for a dry port.

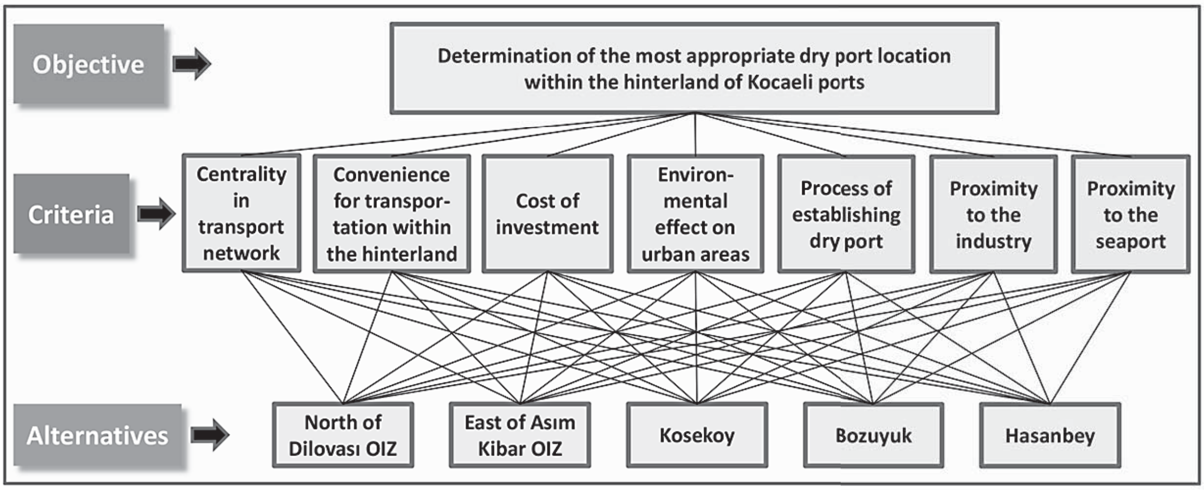

Figure 2. AHP plan to determine the most appropriate dry port location.

Table 1. Result of the survey for grading the criteria related to their priority.

Rank	Criteria	Rating %
1	Convenience for transportation within the hinterland	16,62
2	Proximity to the port	14,81
3	Proximity to the industry	14,49
4	Cost of investment	14,07
5	Centrality in transport network	13,95
6	Environmental effect on urban areas	13,90
7	Process of establishing dry port	12,16

The Impact of Mergers and Alliances on Maritime Shipping

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Keywords: shipping consolidation, mergers & integrations of maritime companies, market power

In recent years, many shipping companies have been actively engaged in vertical & horizontal integrations, mergers and alliances in response to shortages in demand and excess supplies in shipping capacity dominated by mega container ships. As a result, the merged companies hold greater market shares, gain control over logistic chains and become more cost effective and ascertain of rents. By the first half of 2018, the top 15 shipping companies accounted for 70.3% of all capacity, and top 10 shipping companies controlled almost 70% of the fleet capacity. However, there is a general concern that a more concentrated maritime industry will mitigate the competition levels, increase the potential for market power abuses by the consolidated companies, and possibly generate a decrease in supply and service quality and lead to higher prices from demanders. As we speak, some of these adverse consequences may already be a reality. For example, in 2017–2018, the number of operators decreased in several small developing island states and structurally weak developing countries.

The paper examines how the increasing concentration in shipping industry could reinforce market power, and mitigate the competition levels. The paper also looks into the consequences of the more consolidated maritime industry affecting cost efficiency, market shares, profitability, reorganization and changes in the scale of industry structures and the potentially strengthened bargaining power vis-à-vis the downstream seaports and other terminal operations.

The findings indicate that with mergers, acquisitions, vertical & horizontal integrations of shipping and port companies, the maritime industry tends to be more concentrated, more cost effective and profits assurance. However, the excess supply, derived from decreased demand for vessel shipping and overcapacity in TEU throughout, continues to hinder the growth of maritime companies and their motivations for seeking higher profit margins. Most importantly, a more consolidated maritime industry with a few mega companies holding large market shares would mitigate the competition levels, causing concerns over the potential for market power abuse by gigantic companies and their related impact on smaller players.

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Information Flows in the Global Shipping Industry: A Cointegration Approach

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Keywords: Maritime stocks, transparency, cointegration, gradual information diffusion

In this study we examine how global maritime stock prices impact the stock prices of large transportation companies in the U.S. and other large markets. Maritime stocks are chosen because they are central in global trade and may be good indicator of future global stock market and economic trends. Maritime companies are often owned by families or governments, and are traded in stock markets with lower standards of accountability. We use cointegration and vector error-correction analysis to analyze the short-term and long-term relationship among our chosen stocks. We find evidence of a gradual diffusion of information from maritime stock prices to large U.S.-based transportation companies.

Few industries are more central to international trade than the maritime sector, with 80% of world trade by volume and 70% by value being carried by ships. The maritime industry is also unique in that in spite of its large size, leadership in this sector often comes from smaller countries such as Greece, Singapore, Norway, and South Korea with shipping the U.S. and U.K. playing a surprisingly modest role. In addition, ownership of even the largest companies tends to be concentrated in the hands of a single family. But in spite of the central importance of the maritime industry and its unique global ownership structure, very little research has been done on maritime stocks.

Giannakopoulou, et al. (2016) point out that in spite of the large size of the maritime sector, family ownership is common in many countries that have large shipping industries. For example, Denmark's AP Moller-Maersk in spite of being the world's largest shipping company has over 50% of its voting shares controlled by a holding company owned solely by the founding family. The Mediterranean Shipping Company and CMA CGM Group are the second and third largest shipping companies in the world respectively, but both are majority owned and operated by the founding families. None of the top twenty shipping companies are traded on U.S. stock exchanges, perhaps because foreign stock exchanges can be more conducive to family-controlled companies.

The fact that many of the leading maritime shipping companies are family-owned and headquartered in dispersed countries has several implications for how their stock prices may behave. First of all, family-ownership and control may lead to information being closely held and not widely released to the public. This may slow information available to stock traders and slow information flows. Secondly, the maritime shipping companies compete for the same customers around the world in a global market. Thus their fates are tightly intertwined. However, their shares are traded on different exchanges around the world (many of which don't have higher standards for transparency) so stock price adjustments may be slow.

In this study, we will be looking at the long-term relationship between global shipping company stock prices and the stock prices of some large truck and rail transport companies. We expect maritime stock prices to reflect information relevant for other transportation companies involved in the same supply chain. But due to corporate governance and transparency issues in the maritime industry, we expect that stock price adjustments in other portions of the transportation sector may be slow. We will use unit root and cointegration to test for short-term and long-term relationships between maritime, trucking, and rail stocks.

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Toward Sustainable National Shipping: A Comparative Analysis

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Keywords: national shipping; shipping competitiveness; shipping policy; cross-section data analysis; maritime nation

The paper will present results from a study on analysis of national shipping of key maritime nations in the world. We focus especially on how national fleets may be affected by various country-specific factors. The analysis is based on data of 84 countries. We demonstrate that the country's external trade, registered fleet, shipbuilding, energy export, maritime history, shipping financial sector and policy have strong effects on truly-owned national fleet. On the other hand, we are also demonstrating through the results that the effects of income per capita and coastline length are insignificant. The results of our analysis suggest that, in light of increasing competition in the global shipping market, countries need to target more on their strategic needs as well as the factors that they have competitive advantage of.

Law, Economics and Law & Economics for Master Mariners in Master of Maritime Management studies

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Keywords: Maritime Law, Maritime Economics, Law & Economics, Master degree, MET

Master Mariner education is based on the STCW convention which also determines the minimum requirement for the Bachelor level studies on legal and economical subjects that need to taught to future Master Mariners. STCW requirement on these subjects are rather modest, but the Bachelor education gives the graduates a basic understanding of what maritime law and maritime economics consist of. However, understanding their interrelation seems to be insufficiently explained so that the graduates need further studies when they enter in shipping management after they start working in shipping company´s land based organization.

The central aim of tort law and liability regimes is not the absolute minimization of losses from individual accidents because the total accident cost of any economically fruitful activity/industry includes both the expected cost of the accidents that happen to occur and the actual costs expended in avoiding the accidents. In maritime industry it is important to be able to assess the risks and analyze the risk management strategies from the point of view of the shipping company. Risk management is a strategy chosen and carefully planned for the company and it can be essential for the company that the risk can be predicted and evaluated both from economical aspects and legal aspects. Best experts in shipping companies have experience from sea as well as understanding of law and liabilities as well as economic understanding of the meaning of maritime business, its interruption and managing especially the interruption risks of the business.

Master of Maritime Management students, who have STCW education and seafaring experience of some years, need both legal and economic skills in their studies. Studies during/after maritime career needs to be well tailored for shipowners and managements needs. Therefore, both of these – As parts of risk management – should be taught combining both law and economics to practical problems of maritime management. As used by lawyers and legal scholars, the phrase "law and economics" refers to the application of microeconomic analysis to legal problems. This application has not been analysed from the point of view of maritime management education.

Analysis how this approach could benefit the MET is the topic of this article. The areas which are considered traditionally to form parts of both maritime economics and maritime law, are the marine insurance and the charter parties and their interrelation with maritime accidents as well as their effects on maritime business. The writer is a lawyer who is finalizing Phd. (in School of Economics) on Marine Salvage and has over 25 years experience in teaching both law and economics for bachelor and master of maritime students as well as lawyers. It will be analyzed is the theory of Law and Economics is practicable in educating future leaders in Maritime Industry with seagoing backround.

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Hydrographic education in Estonia and assessment of future prospects of the program

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Keywords: hydrography, IHO, waterway safety management, study program.

Maritime transport safety is essential factor as over 90% of the world's trade transported by sea. One of the main maritime safety components is reliable nautical charting. Nautical charts and publications are crucial information sources to mariners for providing safety navigation. One of basic inputs for nautical publications is hydrographic information in the form of seafloor imagery. Consequently strategic development plans and investments should account hydrography as a fundamental component for building capacity that directly benefits communities. The collection, processing and analysis of hydrographic data are highly technical processes requiring specialize training and education so highly qualified hydrographers with the appropriate educational background needed not only to operate equipment and software; but also to evaluate the information being received and recorded [1]. Estonian Maritime Academy of Tallinn University of Technology (TalTech) is the only educational institution in Baltics States that offers higher education in hydrography, marine cartography, waterway engineering and maritime safety for more than 25 years.

This paper presents an overview of hydrographic education in Estonia: history and development of the waterway safety management (WSM) study program, structure of the curriculum, entry requirements and statistics, organization of the practical training in cooperation with the public-private sector. New approach for the development of skill-based interdisciplinary education discussed. The contribution concludes with depiction of future prospects and delimitation of activities planned toward further development of the program and discusses potential economic benefits that derive from developing of hydrographic education in Estonia.

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Abstracts

Social Impact

Educating future generations master mariners: Using technologies for visualizing prior performance in post-simulation debriefings

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Keywords: Maritime Education and Training (MET); simulations; debriefings

A general problem in educating for work in safety critical domains is to prepare for skilled performance in real work settings. Simulations have been developed to meet these demands in education of master mariners, but have also been most prominent for decades in healthcare and aviation. An almost unison conclusion in research on simulation is that post-simulation debriefing, allowing for feedback and reflection, is a necessary component for participants to learn from their experiences. The rationale is that retrospective analyses of what just happened can form the basis for prospective strategies on how to manage future situations [1]. In order to facilitate feedback and reflection on prior performance, different technologies have been developed to visualize and replay the scenarios during debriefings [2;3]. On this background, this study investigates a series of simulations intended to train the application of the rules of the sea in ways that constitutes good seamanship. The analysis was carried out by scrutinizing video-data from six post-simulation debriefings in a navigation course for master mariners during their second year [4]. The aim of the study is to present and discuss the practical use of devices for visualization, in this case, a playback of scenarios that reconstruct the events from a birds-eye-view, in order to demonstrate navigational problems and how these should be dealt with to be in line with good seamanship. The analytical focus is put on instructions, i.e. the facilitators' use of the play-back and interplay with the students to both re-create critical events during the scenarios and to show how these should be managed.

The results support findings from previous studies on the practical use of visualization technologies as providing the means for re-actualizing prior performance, enabling assessments of the participants' conduct and opening up for discussions on what constitutes good work practices [2;3]. Moreover, the results display a number of instructional methods for bridging between the application of navigation rules in line with good seamanship and the students' specific actions during the recently performed scenario. The use of the playback of the prior scenario was at the core of re-creating its temporal and spatial nature. This, in turn, formed the basis for demonstrating alternative solutions by contrasting what was done and what should be done and by comparing the performed courses of action versus hypothetical ones. A range of different instructional resources were combined in this process. The dynamic play-back of the scenarios functioned as backgrounds to which instructions was directed and as a means to create a shared perceptual field. In doing this, navigational problems were elaborated to demonstrate how to coordinate with other ships in confined waters. In this way, the application of the rules of the sea were addressed in terms of practical and timely actions in relation to the ever-changing and contingent character of navigation practice.

In summary, the meanings of the rules of the sea are hard to teach in abstraction since every decision relay on an infinite number of contingencies that have to be accounted for. The use of visual means in post-simulation debriefing offer opportunities to portray rules in a context in which their meanings could be tied both to situations as they were actually carried out and to demonstrate more preferable alternatives.

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The Use of Cooperative Learning in Enhancing the Competency in Maritime Communication with GMDSS

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Keywords: cooperative learning, maritime communication, GMDSS

This descriptive-quasi-experimental study aimed to determine the effectiveness of cooperative learning in enhancing the competency of second year BSMT students in maritime communication with GMDSS (Global Maritime Distress and Safety System) during the second semester of school-year 2015-2016. The groupings were selected having collective similarity that comprise of 30 respondents per group. The design is known as quasi-experimental design. Statistics used were means, percentages, and standard deviations. Alpha level was set at .05. In the pretest, although the experimental group had a higher mean rating than the control group, the two groups were comparable and did not differ significantly. The data revealed that the performance of the experimental group before the treatment is relatively higher than the performance of the control group before the treatment was given. When, however, the treatment was introduced, the findings showed a significant difference in performance between the experimental and the control groups, indicating the experimental group's better performance which could be attributed to the intervention of making the students actively involved in the learning process.

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Mainstreaming Women in Maritime and their roles in the Maritime Industry: Charting the Course for the Future of Maritime Universities

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Keywords: (3-5 words)

The paper provides a general overview of the Roles of Women in Maritime Industries based on the five topics presented during the 2018 IAMU under the Session entitled " **Roles of Women in the Maritime Industries"** and the five topics presented at the 2018 EAS Congress under Session 6.1 entitled " **Empowering Women, balancing Gender, Adapting for Climate Change and Strengthening Marine Environmental Protection in the Port and Maritime Sector**" From the various presentations both at IAMU 2018 and EAS 2018 concerning Women In Maritime, it can be surmised that there are **7 essential components** that would help support young women seafarers to be developed into women leaders in maritime. They are not costly but proven to be very useful as all women leaders in maritime have shared the similar pattern on how they rose from the ranks. The seven essential components can be summarized as GECAMET wherein: G stands for **G- Global Dispositions, Mind-set, Perspectives, and Attitudes;** E stands for **E-Empirical Basic Knowledge and Skills;** C stands for **C- Character Role Models;** A stands for **A-Aspiration to be Successful and not to be second best**, M stands for **M-Mentoring**; E stands for **E- Experiences in International or worldwide**; and T stands for **T- Timely acquisition for Higher-Order Cognitive, Metacognitive, and Interpersonal Skills.** Each of this component is explained in detail and were taken, processed and analyzed based on the five various presentations, thus providing new knowledge thru an easy to remember perspectives. The paper ends with concluding remarks and recommendations on how to mainstream women in maritime

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The Effectiveness of the Maritime Education System on Competency and Development of Seafarers. A case study from an International maritime education institute.

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Keywords: Seafarer's, International shipping industry, Maritime education and training, Competency developments, International maritime training institute.

The success of the world's shipping industry ultimately depends on one special group of people: seafarers. These men and women have led humankind in the discovery of the world and changed the global economy. Today, the role of seafarers on board ships has greater importance than ever before and will continue to be key in the coming years. Without motivated, qualified and trained seafarers, the international shipping industry will not thrive. Maritime education and training (MET) is therefore crucial for all parts of the world's maritime community, and particularly for the seafarers of today and tomorrow, as it is the basis of a secure, safe shipping industry. Effective MET for seafarers at various levels provides them with proof of their competence in the particular skills and duties they need to perform on board. However, the effectiveness of MET varies widely, such that having a certificate does not guarantee a seafarer's competency – as demonstrated by the many maritime accidents that continue to occur as a result of human error. Competency must therefore include knowledge and skills, and more importantly, their application in the workplace. This study explores the effectiveness of current MET in developing competency among seafarers. This is achieved by examining and comparing data gathered from interviews with participants with seagoing experience on a competency development course at an international maritime training institute in Australia. The findings of this research show that the participants need more practical studies in their STCW competence development course and different approaches in teaching them. The study concludes by providing a summary of changes to MET on competence developments suggested by the participant interviewees. The findings highlight the importance of teaching practical skills and applying relevant teaching methods to allow seafarers to become competent in the skills they will require in real-life situations. Furthermore, they may serve as an incentive for MET institutions to improve their course content and delivery, as well as for researchers to continue studying this subject further.

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Re-Engineering the Maritime University Organization

Serving and Preparing Gen Z for the Maritime World

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Keywords: Generation Z, Millennials, Maritime University, Leadership Development

Generation Z students – those born around or after the turn of this century – learn, socialize, and interact with authority figures in a significantly different manner than students of previous generations including those students of the most recent Millennial Generation. Gen Z students, as they are called, have unique expectations of programming and academic choices, and may seem somewhat impatient or irreverent to those groomed in a more traditional maritime manner with strong sense of responsibility and chain of command structures. Life at sea and in other maritime venues has also changed, and continues to do so. Technology and communications processes also provide a life-style quite different from just a few years ago.

While it is critical to maintain strong academic and practical content as well as leadership development as the core of maritime education and training, looking at the pedagogy and environment of the maritime university may be useful in helping young men and women entering our campuses to be more effective at understanding, believing and engaging in those critical lessons. Working on previous IAMU research involving teaching leadership to Millennials and Gen Z students at maritime universities, the author will provide options of a university structure that will encourage student success as well as promoting the positive personal and ethical attributes needed by maritime professionals in today's work force.

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Opportunities and challenges for seafarers in higher education: A comparative study of the German and the Swedish system.

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Keywords: maritime education and training, lifelong learning, higher education, retention of seafarers

The global maritime industry is one of the world's largest economies and employs, directly or indirectly more than 200 million people on a worldwide scale [1]. Supplying this industry with a competent and well-educated work force is a challenge for the international society [2; 3; 4].

Maritime companies face an area of tension between a (forecasted) global shortage of seafarers and the higher importance of well-being at sea in terms of an increased work-life-balance [5]. This conflict is reinforced as the shipping profession is getting increasingly complex in terms of social, economic and ecological factors. Therefore, lifelong learning and continuous education pose modern challenges for future trends in maritime education, training and research [2; 3; 4].

Existing studies build the starting point of this paper to provide an overview of the current situation [5; 6; 7]: career paths of nautical officers, the nautical environment and living conditions aboard, reasons for going to sea, reasons for staying at sea and leaving the sea behind, retention times of officers on board ships, etc. Wide-ranging reasons exist for pursuing further education with the aim of changing the job to a shore-based position. All these different factors may change over time and moreover, may result in a shortage of active seafarers. Professionals' interest in further education/lifelong learning seems to grow while job demands increase simultaneously (smaller crews, rising degree of digitalisation, higher demands in terms of regulations, etc.).

Following up on this, two case studies of German and Swedish IAMU members will be presented. These case studies include the status quo of maritime education as well as further education in two higher-education institutions. On that basis, a comparative analysis will be conducted with the aim of highlighting differences and similarities. The article will give answers to the following questions, amongst others: What are the pros and cons of on-campus and distance education when taking the requirements of the unique group of seafarers into consideration? What is the motivation to participate in post-graduate studies? How do employers in the maritime industry influence careers of their employees? How many years do seafarers spend aboard before they change their jobs to land-based positions and why? In how far has this changed over the last few decades in terms of time and why? Which impact do cultural differences have on the transferability of the given system/situation to others? The comparison will identify synergy effects not only for the two member universities. Additionally, this article bears great potential in terms of transferability to other IAMU member universities as it could serve as a 'good practice example' for future concepts of maritime education and training in general.

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Maritime digitisation and its impact on seafarers' employment from a career model perspective

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Keywords: maritime digitisation, seafarers' employment, career models, Industry 4.0 Category of the theme for contribution: **Social Impact**.

Abstract

This paper discusses how maritime digitisation may impact on current employment practices for seafarers in the global labour market from a career model perspective. Maritime digitisation has been driven mainly by the industry that highlights a paradigm shift in ship management and operations [2]. While the Fourth Industrial Revolution (Industry 4.0) implies the modernisation of work in general, it is anticipated that Industry 4.0 will have an impact on seafarers' employment on board contemporary ships [3]. Such impact analyses on seafarers' work are based on future scenarios of maritime industries, however previous analyses seem to overlook seafarers' and their career trajectories as an important human resource to support the future maritime industries.

The paper begins with the discussion on careers, addressing current changes to the nature of careers. Changes to the classic model of careers started in the 1980s, when worldwide economic factors led to uncertainty and increased competition for international companies [4]. These changes occurred due to different factors, e.g. mass layoffs and the flattening of traditional hierarchies [5, 6, 7, p. 685] which put pressure on organisations worldwide to '*push for greater profits and be more flexible in contracting their employees*' [8]. These changes facilitated a greater flexibility in employment [8] and contributed to the rise of a new career model, often referred to as a '*flexible career*' [5, 7], '*boundaryless career*' [9-12] or '*portfolio career*' [13]. In a flexible career, an individual's career identity is independent of the employer [10], and generally develops beyond the borders of a single organisation. Nowadays, in many industries, individuals do not merely spend their whole working lives in one organisation, but possibly change workplaces, even across different sectors and industries. In this context, seafarers are often employed on short-term contracts in various workplaces (i.e. different ships) and in different companies and are often seen as following a 'flexible' career model [4].

In this context, based on an extensive literature review on Industry 4.0 and its impact on jobs, the paper discusses how current career models among seafarers may be affected and what alternatives for employment they might have after graduating from maritime education and training (MET) institutions. The paper presents preliminary remarks on career opportunities for seafarers and possible socio-economic implications on future maritime careers in the context of Industry 4.0. It concludes with a set of agendas for seafarers and MET institutions to ensure the attractiveness of maritime careers to support individuals and the industry in this transition.

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Maritime Innovation Management – A concept of an innovative course for young maritime professionals

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Keywords: innovation management, education management at maritime university, innovative course, distance learning

Purpose - In response to the growing interest in innovative management and lifelong learning in the maritime area, the idea was born to create a new blended-learning concept to empower young maritime professionals to be active change agents throughout their careers.
The maritime industry is a rapidly developing, heavily technologized, and globalized industry. Maritime professionals entering the employment market today will need to participate in ongoing development of both the maritime industry and profession throughout their career. New technical developments such as autonomous ships and port operations, and new environmental and safety considerations are just a few examples that will impact both the individual maritime professional, who the maritime industry actors are, and how they relate. The question is how maritime professionals can be equipped and supported for this journey?

Approach - This paper reports on the results of a one year project funded by the Swedish Institute with the aim of exploring maritime innovation and growth processes, starting with competence development and life-learning processes from students and young maritime professionals point of view. The project focuses on the capabilities of MET institutes to serve as a central actor in the maritime cluster to support these processes, based on the premise of the European Union ERASMUS programme framework of Strategic Partnerships in the field of Education, Training, and Youth. Four partners have been part of the project: World Maritime University in Sweden, Gdynia Maritime University in Poland, National University "Odessa Maritime Academy" in Ukraine, and Estonian Maritime Academy in Tallinn. To localize the understanding of issues and potential solutions, workshops at each of the partner universities have been organized. To gain a students perspective, students from each of the partner universities have given their input through a participatory design workshop. Furthermore, one survey of the maritime universities and one survey of the local maritime clusters have been carried out.

Findings - The results of the project indicates how young maritime professional can be supported in acquiring and developing basic skills and key competences to foster employability, socio-educational and personal development. Specific competences include the opportunities and challenges of Industry 4.0 and how to cope with the special employment and professional conditions in the maritime industry. The course is designed to foster entrepreneurial skills, critical thinking and creativity. Another important finding was the importance of international collaboration and enabling students to build networks between national and professional borders. The results of the project also indicate how a

blended-learning course targeting these dimensions can be developed, combining crossborder distance-learning with a face-to-face workshop format at the local MET institutes.

Originality - The result of the project and the design of the course respond to the slow changes in the study programmes in areas of maritime innovation and lifelong learning at MET universities. The course contributes with a spaces for innovation and growth to support science based economic and social development that does not exist in the maritime industry today. The blended learning platform and deliver approach of the course is furthermore designed to sustain also after the project ends and to scale to innovate additional students and MET universities into the collaboration.

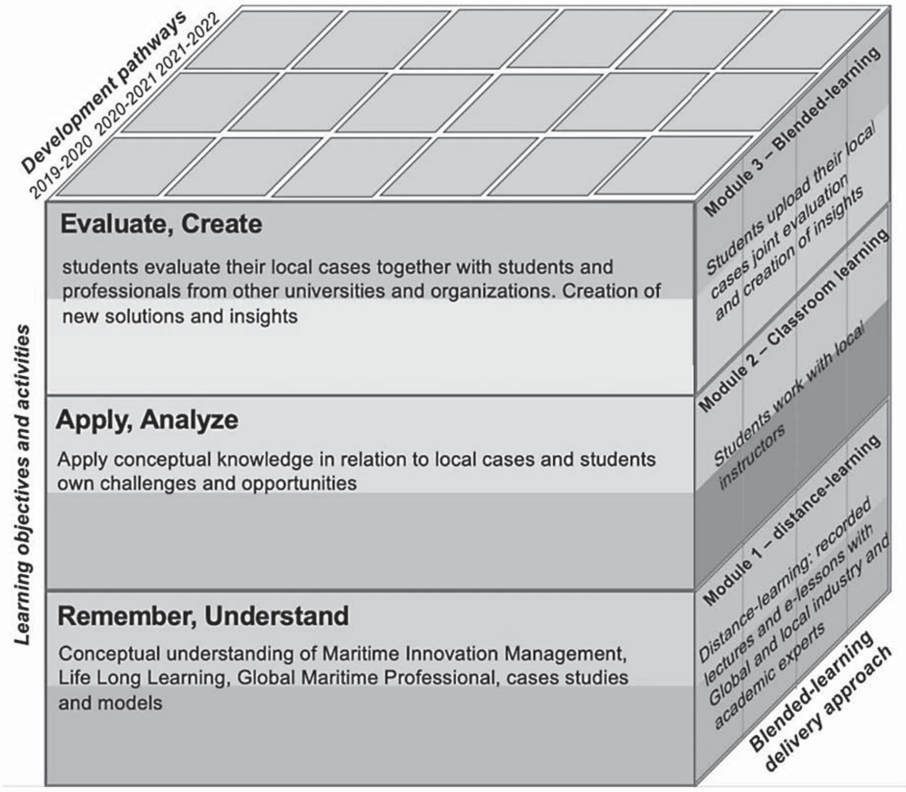

Figure 1. Proposed learning objectives and activities, blended-learning delivery approach, and development pathway.

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Current trends in the maritime profession and their implications for the maritime education

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Keywords: maritime education, trend survey, transformation processes, optimization

The paper presents the current trends in the seafaring profession and their educational dimensions. The initial thesis is that different maritime spheres in the maritime domain perceive and interprete trends in different perspectives. The study consists of two parts. The first identifies the trends in the maritime profession based on analysis of experiences from conference' and seminar' debates and research studies. These trends are presented in three groups: global trends, those directly related to the maritime profession and educational trends. The global tendencies we assume as overall valid. Among them very important are the processes of networking of the contemporary organizational structures on lower operational level, the connected processes of moving the intellectual potential of the organization to the periphery and increasing the authonomy and the responsibility of the lower operational level. Other processes are connected with the „splitting" of the professions and of the formation of two parallel professional groups - that of the high-tech operators of automated equipment and the group of those who know the principles of the equipment's work and the ways of its innovative use, their upgrading and integration into sophisticated technical systems.

Relatively new is the global trend of rapid career growth of the management and operational staff. This process provokes some gaps in the professional competence and the need to update and acquire additional training skills. These developments include also features such as the increase in automatization, the high role of the human factor, environmental care and other modern trends. In parallel there are also pure maritime specifics such as the trend for „standardization" of the profession. The IAMU initiatives to develop and implement common lists of competencies and regulations should be consider as sustainable process. On the other hand, in addition to and as a result of standardization, the "internationalization" of the profession and the access of women are particularly important. Long time ignored aspects of cultural diversity and gender equality in the seafaring profession emerged.

At the same time, the maritime profession is strongly integrated into the overall logistics processes. There is a need for more economic know-how of seafarers, as well as more knowledge of the sea for onshore staff. The list of maritime specialists greatly increased. Global trends found their new forms in the seafaring profession and further contributed to its specifics. Other aspect are the trends in the educational sphere like high informational awareness and emphasis on „soft skills". On this basis, the study presents an overview of trends in the maritime professional sphere in order to classify them regarding their origin and possible consequences. The research includes a survey on the already formulated trends, causes and consequences. Respondents are divided into four groups: stakeholders, academic staff, seafarers and students. Based on the empirical research the results are analized in order to define which trends and areas are characterized my more consensus and which trends and processes are characterized by differencies in the opinions of the evaluated target groups. The study provides recommendations for adapting the maritime education to the current trends. The obtained results are the basis for a second survey among the same target groups, analyzed and presented as specific recommendations to the maritime educational system.

Female leaders in maritime professions – Finnish educational aspect

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Keywords: female leadership, training & education, MET

It has been generally stated that investing in women is the utmost effective way to lift societies, businesses, and even nations. The more there is gender equality- the more the economic is growing. In the companies which have more female leaders acting, are the achievements better. [2]

Nowadays, there are globally approximately 1,2 million seafarers sailing at sea, but only 2 per cent of them are women. Most of the female seafarers, up to 94 per cent, are working in the cruise industry. Many international organization, governmental agencies and private organizations have been promoted the progress of women in maritime industry for several decades. [1]. International Maritime Organization (IMO) started in 1988 a gender programme called "*Women in maritime*". A strategic approach of IMO programme is towards enhancing the contribution of women as key maritime stakeholders. The theme for annual World Maritime Day for year 2019 has selected to be "*Empowering Women in the Maritime Community*" [2]

The purpose of this paper is to examine the current status of women leadership in maritime sector. What kind of preconditions the leadership education accordingly STCW requirements and education in master level in maritime institutions (MET), gives for female seafarers in Finland? What kind of managerial skills and knowledge should female mariners gain to success in male dominated industry?

In this paper, there are interviewed Finnish women, who are currently working in managerial level positions in maritime sector. The subjects of the interview were connected to the leadership and managerial skills.

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From Sailor to Scientist – Reaching Out to Researching Professionals on Doctorate Level

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Keywords: researching professionals, doctoral education, professional doctorate, online doctorate

Abstract. Doctoral programs are usually offered in full-time and part-time form. Part-time doctoral programs are mainly chosen by working professionals – those who opt for pursuing doctoral degree along with their regular full-time job. These part-time doctoral students often carry substantial practical experience in industry and business, experience that can significantly contribute in detecting actual challenges that need to be confronted by new scientific methods. However, practical-solving approach of these working professionals often collides with somewhat rigid academic mindset so, quite often, their full potential is not recognized and universities miss on prospering from this unique academic and professional blend [1]. The problem is even more specific in maritime sector where professionals working at seas are separated from universities for prolonged periods. Obviously, in order to keep them at doctoral programs, universities must reach out to them and help them overcome the obstacles in their path to postgraduate diploma. This paper discusses two possible approaches in handling this problem, which can quite easily be incorporated together. One possible solution, rarely used in maritime sector, is offering a professional doctorate (Doctor of Engineering, EngD) over classical research doctorate (Doctor of Philosophy, PhD). In brief, PhD is intended to develop "professional researchers" and EngD is designed to develop "researching professionals" [2]. EngD combines foundational and theoretical knowledge of a discipline (or, sometimes, more than one discipline) with knowledge of research in its context. EngD should be considered as it could suit the needs of working professionals more adequately than PhD. Another possible solution would be addressing the needs of working professionals in maritime sector by composing adequate online curriculum of postgraduate program. Principles that need to be considered in order to successfully produce online doctorate are: setting the dissertation in practice, identifying a problem related to the discipline, establishing appropriate question-literature-method link, adhering to academic rigor, rethinking implications of dissertation for improving professional practice [3].

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Creating Together: Problem Solving Techniques in Twinning Teaching

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Keywords: STCW Code, leadership and team-working skills, decision-making techniques, a twinning lesson, situational awareness, perspective officers

In accordance with the STCW Code Table A-II/1 one of the main competences for Officers in charge of Navigational Watch on ships of 500 GT or more, is the **application of leadership and team-working skills**. The same Code highlights the urgent need for officers for applying **decision-making techniques** such as situation and risk assessment; identifying and considering generated options; selecting course of action and evaluation of outcome effectiveness. [1]

Most vessels have a multi-lingual crew on board which eliminates communication skills for insuring proper and safe operation of the ship. Besides safety issues pose a number of new challenges involving ability of all crew members (without exclusion) to communicate effectively in a stressful situation being aware of professional, social and linguistic hazards.

The training of the cadets at the Operational level to this competence is conducted according to the IMO model course 1.22 "Ship simulator and Bridge Team Management". Under operational level the cadets will gain experience in handling ship under various conditions and will make a more effective contribution to the bridge team during ship maneuvering in normal and emergency situations. [2]

Discussing "Ship simulator and Bridge Team Management" matters the cadets use knowledge of Shiphandling, Ship's Operations, Navigation and Maritime English in an integrated way.

To avoid confusion, misunderstanding and error chains of crew members in emergency situations we need to increase their **situational awareness and onboard safety culture** by **inter-disciplinary immersion system**. The amalgamation of experienced navigators and mentors and Maritime English lecturers will create successful perspective officers who is ready to bear the burden of responsibility on cargo, ship, crew and environment on their shoulders. [3]

A greater awareness and understanding of a good interactive communication style and benefit of building up **a common shared mental model of the planned passage**.

Interdisciplinary exercises are aimed at improving professional language skills as well as the increase of the situational awareness by means of professional English competence.

To sum it up the most efficient and fruitful approach is Twinning Teaching in maritime educational institutions in non-English countries. Professional disciplines are taught in native and English languages and it serves two purposes – more effective training and mutual competence enrichment of English and professional lecturers. [4]

This paper will illustrate the above-said proposals with the sample(s) of **a twinning lesson** methodology for the 4th year navigation cadets.

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Abstracts

Policy Impact

Best Practices in Water Safety and Survival Training

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Keywords: Policy Impacts

The study reviles the current supplemental water survival training best practices of American and the Japanese maritime universities. This research reviews ongoing institutional training above the required STCW practical assessments, Table A-VI/1 and NVIC 08-14. The purpose of this paper is to highlight and share the best practices of participating schools. This vital supplemental training showcased in this study is meant to promote this accessory training throughout all maritime universities. Additionally, the study encourages further discussion on how much supplemental training is needed for today's mariners.

This research will give administrators and instructors valuable insight into their counterparts training methods. The analysis reveals each participating school's rational involving the supplemental training. Moreover, the level of importance given to this training in their curriculum and academic schedules. The study reviews, training methods, equipment and whether there is an emphasis on swim instruction. The paper intends to be a water survival reference guide, impacting training policies and procedures where ever possible.

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Table 1. Shows the variation of STCW water survival training and supplemental activities at participating maritime universities

Maritime Universities	Indoctrination STCW Water Survial	STCW Water Survival practical assessments, Presentation	Swim Instruction Presentation	Supplement al Training individual	Supplemental Training team activates	STCW ocean training environment
MET Institutions of Japan		Course format (one semester)	Course format physical fitness & swimming			Continues ocean swimming three hours plus
California State University Maritime Academy		Course format (one semester)	Swim instruction is included			
Massachusetts Maritime Academy	One day Introduction	Course format (one semester)	Swim instruction is included		Two person unconscious victim relay race	
Maine Maritime College	One day Introduction	Course format (one semester)				Mandatory "ship jump"
SUNY Maritime College	One day Introduction	Course format (one semester)	Swim instruction is included	Boiler Suit Challenge & 500 Yard swim	Cross chest carry rescue with and without PFDs	
Texas A&M University at Galveston	One day Introduction	Course format (O week training or 2- three hour lab	Swim instruction is included			

Super Seven "S" Trends (SSSt) To Shape the Future of Global Ports: An Analysis on the Seaport Infrastructure Investments towards a Globally Competitive Philippine Maritime Industry

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Keywords: sustainability, safety, security, competitiveness, technology

The paper presents the port investments and initiatives being spearheaded by the Philippine Port Authority and its financial performance and operational highlights. The information and data generated from various readings of the Philippine Port Authority (PPA) reports, internet search, documentary analysis, observations from news et. al and interviews conducted, were analyzed and categorized to Seven Super "S" trends or SSS-T for easy recall. The SSS-T that would shape the future of global ports is summarized into Seven Super "S" Trends or 7S-T namely: STEMS, SIZE or SCALE, SPEED, SMARTNESS, SUSTAINABILITY, SAFETY & SECURITY and SCARCITY & SUPPLY. Each of this "S" Trend shall be explained based on the current (2017-2018) initiatives, trends, best practices and port investments that are currently being initiated and implemented amidst constraints and challenges in the Philippines. The paper ends with concluding remarks. The views and analysis set out in this paper are those of the author(s) and do not necessarily reflect the official opinion of the Philippine Port Authority (PPA) unless otherwise the statement(s) of the person(s) have been quoted "in toto". The analyses provided in this paper are ideas and interpretations of the author(s) as maritime educators and researchers and solely intended for academic discourse. Trends in ports are global issues and therefore the seven super trends or SST may also be the same trends observed by port experts although it may come in different terminologies.

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Towards a Responsive Maritime Education and Training Policy for Future Shipping: Boundary Object and Maritime Stakeholder Engagement

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Keywords: Boundary Object(s), Maritime Vocational Education and Training, Maritime Policy Design and Implementation, Maritime Autonomous Surface Ships

Autonomous unmanned ocean-going ships are predicted to ply the seas by 2035 and at the outset are likely to commence operations in local/regional waters [1]. In the coming years individual nation states and/or littoral states will play a pivotal role with respect to autonomous craft operations. The technological changes currently underway and on the horizon would alter the nature of work on board ships. Maritime education and training are required to keep pace with the dynamically evolving technological developments.

Tremendous complexity is engendered by novel technological advancements and increasing automation in shipping. Consequently, maritime vocational education and training needs to address the challenges posed by these developments. There is a need to clarify the gaps between current operations and envisaged technological changes, including with respect to the technologically saturated Maritime Autonomous Surface Ships (MASS). Training, upskilling and reskilling would be required to bridge the training gaps [2]. This unfolding scenario necessitates in-depth stakeholder engagement to prevent gaps between maritime educational policy design and its implementation. Equipping the workforce and developing it to meet current and tomorrow's challenges requires extensive engagement of all stakeholders to unpack the technological evolution. With respect to autonomous craft operation, the key stakeholders at the national level are the national maritime administration, ship operators, port (terminal) operators and maritime training providers and seafarers' representatives.

This paper builds upon literature on boundary objects – artefacts that reside at the intersection of diverse social worlds [3]. Boundary objects serve varied worlds by facilitating articulation of their respective needs and coordination of their efforts [4]. They can be utilized to meet the diverse informational requirements of the disparate social groups and yield insights on how to best service them [5]. We argue that the concept of boundary object would facilitate maritime stakeholder engagement and dialogue to promote an in-depth understanding of the evolutionary scenarios playing out and support informed policy making. Furthermore, at the local/regional level, stakeholder engagement supported by boundary object(s) would facilitate the robust identification of their training requirements and in turn training design, delivery and assessment leading to support in policy implementation at the grass root level. This paper recommends the utilization of boundary object(s) in the design of the national maritime vocational education and training policy for MASS for the creation of empathetic responsive policy [6].

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Climate Action and Maritime Business Education: some reflections

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Keywords: Climate change regulations, sustainability, experiential learning, maritime education

Abstract

Mitigation actions compatible with global climate stabilisation goals and sustainable development goals have both synergies and tradeoffs. For long term sustainable development, there is need for enhancing synergies and minimising tradeoffs. Transportation is a critical sector in this context. The international shipping industry is responsible for the carriage of around 90% of world trade .This paper explores the impact of environmental policy and climate change regulations on maritime trade. There has been ongoing interdisciplinary research on the overall challenges of ocean sustainability that include living and non living resource extraction (such as aquaculture, fisheries, underwater mining) as well as non extractive industries such as shipping and tourism [1,2,3,4,5,6,7,8]. Without ocean shipping, intercontinental trade, the bulk transport of raw materials, and the import/export of affordable food and manufactured goods would be impossible. This benefits consumers by creating choice, boosting economies and creating employment. Ocean shipping is the most economical and environment friendly compared to all other modes of transportation of bulk cargo. Several new climate change related regulations have been enacted such as the IMO Marpol Annex VI regulation on limiting sulphur content of bunker fuel to a maximum of 0.5% that will enter into force in 2020 [9]. This paper attempts a comprehensive mapping of such recent environmental policies, identifies the target sectors in the maritime space and summarises their impact on those sectors including maritime education. At Massachusetts Maritime Academy, we pursue an international experiential learning program that takes our students to major maritime hubs where students engage with industry practitioners to understand the impact of the latest environmental policies and also improve cross-cultural awareness. In a recent trip to Singapore in January 2019, students were exposed to this ongoing discussion. They were later surveyed to assess their understanding of these environmental policies and regulations. The paper uses this experiential learning program and the survey results as a case study to assess student understanding of sustainability practices in the maritime sector as well as their Cultural Quotient (CQ) [10].

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Marine Engineering Education Program development due to CDIO concept

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Keywords: Education development, CDIO, Integrated learning, General skills, Quality Assurance

Abstract text.

The paper describes and analyses the education development process of the BSc Marine Engineering Program at Chalmers University of Technology. The goal has been to advance to both fulfil the STCW Manila Amendments [1] as well as to implement the CDIO approach for engineering education [2]. The initial aim was to develop a program with emphasis on fundamentals in the context of marine engineering with integrated learning of general engineering skills that support the students' knowledge, skills and understanding for their future careers.

We argue that program development is a long-term process and that the success lies in the ability to sustain an enduring long-term process as well as using a continuous improvement philosophy with the ability to set new goals. The development process of the Marine Engineering program started already in 2010 with a renewed program plan that was evaluated and updated in 2014 after the graduation of the first cohort. The program has since then been continuously updated and refined with the focus on the professional role while using the CDIO approach and toolbox to form an integrated up-to-date Marine engineering education. In this process special attention has been put on satisfying the IMO regulations [3] and the Swedish Degree Ordinance as well as the Local Qualifications Framework for Chalmers University of Technology. The program's aim, idea and learning outcomes together with a design matrix connecting learning outcomes to the courses are stated in the program description. The development of the program description is found to be the most important tool for the unification of the program as well as for the design of courses and teaching activities. It generates a common terminology and helps to shift the emphasis on program development discussion from specific courses towards high-level issues such as program outcomes, idea and the teaching/learning of general skills. Moreover, the program quality assurance system comprised a set of planning and evaluation tools including the agreement between the program and the departments on course delivery. Finally, input from various evaluations as self-evaluation, benchmarking as well as student and faculty are taken into account in a systematic manner. To conclude, the paper aims to

- Provide a detailed description of the long-term development process of the Marine Engineering program at Chalmers with focus on aims, goals, quality assurance, success factors, failures, delays etc.
- Evaluate the results, in what way is the different and better compared to ten years ago? How are achievements measured? How do the different stakeholders view the results?
- Identify critical success factors for a long-term education development process.

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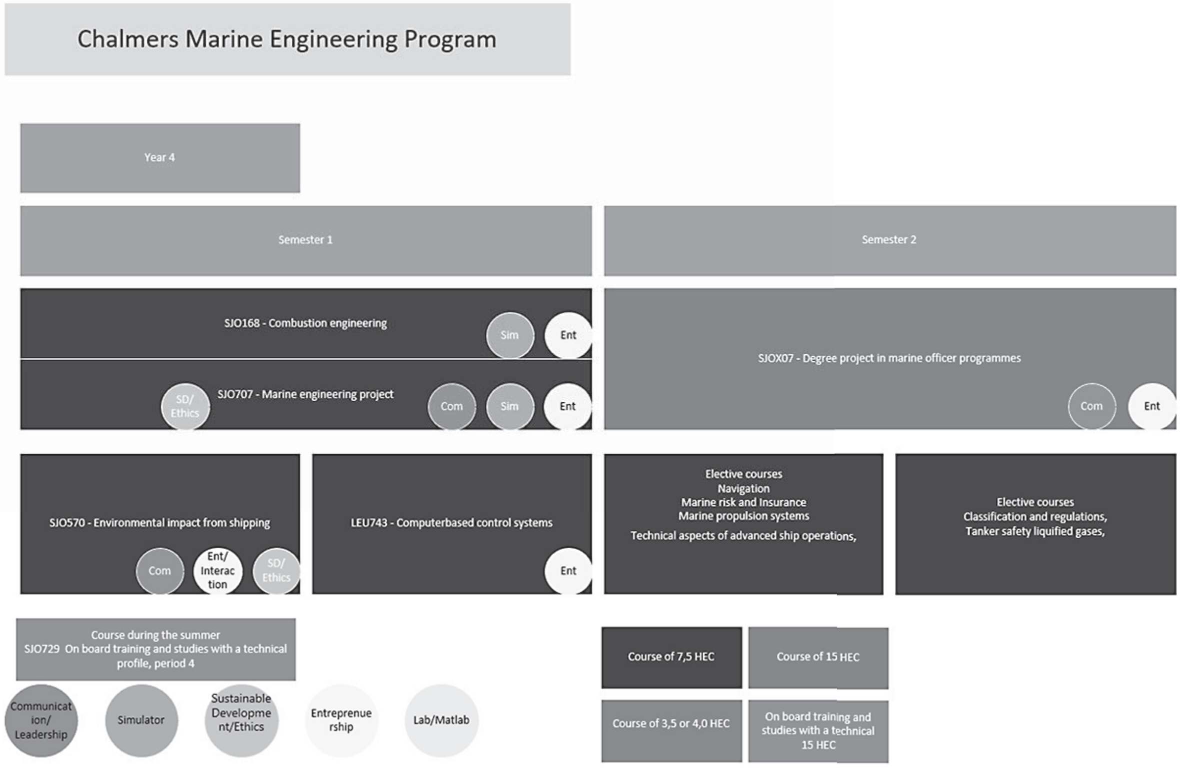

Figure 1 Overview of integrated topics in courses

Area	Basic courses	Continuation courses	Advanced course/specialist course
Mechanical engineering	SJO555 Marine engineering	SJO700 Fluid mechanics and thermodynamics	SJO167 Internal combustion engine technology
	SJO560 Marine engine systems	SJO707 Project on machine and drive technology	SJO061 Steam and cooling plants
Electrics, regulation and control technology	SSY032 Basic electrical engineering	LNB726 Advanced electrical engineering	LEU743 Control and regulation systems
	SSY036 Control technology	LEU751 Regulator technology	

Figure 2 Example of learning sequences

The pathway to Autonomous Short Sea Shipping: Implications on human competence across maritime industry

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Keywords: Maritime Autonomous Surface Ship, International Maritime Organization, Seafarer, Shipping, Competency

Shipping is fast moving towards digitalisation and minimising human intervention in its processes. Rapid technology advancement and notion of autonomous ships being safer and more efficient compare to manned conventional ships has found new rigour in Maritime Autonomous Surface Ship (MASS) domain [1][2]. Research on MASS is recently enhanced by the International Maritime Organization (IMO) approval of a scoping exercise to develop regulations for standardising MASS operation [3]. Present literature on prototype MASS projects such as MUNIN- Maritime Unmanned Navigation through Intelligence in Networks (a collaborative research project co-funded by the European Commission), YARA BIRKELAND (a collaborative research project by Kongsberg Maritime with assistance from the Norwegian government transport division) and AAWA- Advanced Autonomous Waterborne Applications Initiative (a collaborative research project funded by Finnish government and lead by Rolls Royce Marine) demonstrate that there are consensus on design and operation of future MASS [4] [5][6]. Further, all projects propose a taxonomy hierarchy where eventually seafarers would be based in a Shore Control Centre (SCC) remotely operating and monitoring the MASS [7]. In that scenario, in the future, as the automation level elevates, there would not be any seafarer on-board MASS. It is important to comprehend that even though a MASS would be embedded with the latest technology, it has inherent risks to casualty such as fire and pollution just as a conventional ship does [8]. This will affect the entire maritime industry as for instance salvage of a conventional ship with seafarers' on-board would be very different with salvage of a MASS. Thus the effects of automation are not only confined to a MASS but also to other stakeholders associated with safe MASS operation. This suggests that with shipping embracing higher level of autonomy the entire maritime transportation system will require significant changes in how the systems operate [9]. Thus, as the MASS automation elevates towards full autonomy, this article intends to explore the implications of such changes in human element competencies across maritime industry other than ships such as ports, Vessel Traffic Services (VTS) and Search and Rescue (SAR).

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Gender equality policies for the incorporation of the gender perspective in maritime studies: a case study

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Keywords: gender equality policies, gender perspective, MET

Although the number of female students enrolled in Maritime Education and Training (MET) institutions has shown an increase since their incorporation into maritime studies, female figures are still far from the desirable gender equality expectations. A recent study (Barahona-Fuentes, Castells, Ordás & Torralbo 2018) shows that between 2009 and 2018, there is no significant raising tendency concerning female figures in any of the European MET universities analysed. This gender imbalance seems to be a widespread problem and becomes worse in developing countries where women have even more difficulties for enrolling in maritime programs. In addition, the same study concludes that gender equality promotion policies are still scarce or inexistent in the MET institutions studied and have had a limited effect on female enrolment figures. Hence, in spite of a raising awareness of the need to foster policies and programmes for the incorporation of female students in maritime education, there is still a lot of work to be done to guarantee the success of gender equity in MET. In line with this, considerations of gender discourse or pedagogy in maritime studies may also constitute an important asset to reduce the present gender imbalance in this male-dominated maritime educational sector and to incorporate a new and necessary gender perspective.

This paper aims to provide an overview of current gender equality policies, regulations and programmes in the educational maritime sector to subsequently determine their actual applicability. To this end, the specific policies and programmes that are applied at the Universitat Politècnica de Catalunya·BarcelonaTech (UPC) have been considered. More specifically, for the purpose of the current research, a pilot project implemented at the UPC, which tries to incorporate the gender perspective in engineering university degrees, has been studied. The outcomes of such a plan on maritime studies have been analysed in order to determine the impact of its implementation. One hundred students from Marine Engineering and Nautical bachelor's degrees participate in the present project and some preliminary results show that the gender distribution among the participating students (20% of female students and 80% of male students) corresponds to the present figures of student enrolment in Barcelona School of Nautical Studies. After analysing their replies to some questions in a preliminary test in this pilot study, a 32% of students identify some male reference in the maritime sector in front of the 14% that identify a female reference. Also, a 15% consider that there is a differential treatment among girls and boys on the part of teaching staff and a 16% believe that girls encounter more difficulties throughout their studies due to gender issues. Only a 16% believe that there is visibility of female professionals in the maritime sector and a 90% consider the existence of gender projects like this really necessary. These preliminary results confirm the gender gap in the maritime educational and professional sector and the need to foster more inclusive gender policies in MET institutions. Finally, some conclusions have been drawn up to intend to provide some recommendations based on the evidence gathered with the final aim of assisting institutions and companies in making informed decisions on future gender equality actions.

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Approved maritime education: harmonization of requirements

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Key words: approved education, complexity, responsibility, qualifications framework

Abstract

Human element is one of the most influential in ensuring safety of shipping and efficiency of maritime sector. Technology progress leads to increase of a percentage of officers' positions in total working places supplied by the world maritime fleet for seafarers [1], as well as to increase of requirements to officers' proficiency and responsibility. On the other hand, maritime higher education has to ensure qualifications of graduates in compliance with the established standards and modern requirements [2] as well as ensure necessary competencies for their further personal development after completion of a seafarer's career. In this context quality of maritime higher education and its relevance to established standards, economical and wider social needs have to be in special focus of maritime higher education institutions.

Content and quality of Maritime Education and Training (MET) programmes are the basis for sufficient education and training of seafarers, and for conformity of their qualifications with the established STCW standards. Under the STCW Convention requirements, all candidates for certification as officers shall have "completed approved education and training". At the same time STCW Convention and STCW Code do not contain clear provisions or criteria concerning approved education. In such situation the parties of the STCW Convention can establish own criteria for approval of MET programmes. As a result, MET programmes leading to the same certificates of competency in different countries can have different levels of complexity [3]. However, insufficient programmes can result in the inadequate performance of prescribed seafarers' duties. In this regard the provisions related to approved education have to be clarified and harmonized with standards of competence, and appropriate amendments to the STCW Convention and STCW Code have to be introduced. Such amendments have to promote the policy of ensuring the sufficient level of education of seafarers. Defining the requirements to approved education and their promotion in International Maritime Organization shall be among the most important action lines in the maritime higher education institutions policy.

Authors have analyzed the levels of approved MET programmes in some countries and proposed to harmonize the requirements to approved maritime education on a base of International Standard Classification of Education taking into account the complexity of STCW standards of competence and seafarers' responsibility. The requirements to approved maritime education can be harmonized with the use of qualifications frameworks as a tool for identifying actual levels of complexity of the STCW standards of competence and for defining proper levels of MET programmes. The proposed approach can be used for developing appropriate amendments to the STCW Convention and STCW Code.

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Process approach for determining competences

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Keywords: STCW, higher MET institutions, competences, process approach

A rapid development of technologies used on board ships changes the way the ships are controlled and operated. Anticipated developing trends include further increase of decision power in various control units (AI), extensive redundancy of critical systems on board, remote-controlled vessels, and finally gradual introduction of autonomous vessels. Consequently, the concurrent operations of autonomous vessels, remotely controlled vessels and manually controlled vessels is highly probable.

During the process development, the role of the human operators will change extensively. It is beyond any doubt that humans, taking part in the shipboard processes, will have to acquire additional competencies. The competencies, as defined in the STCW Convention, are in most part based on traditional shipboard organization, related strictly to common shipboard departments and traditional levels of responsibilities (i.e. management, operational and support levels). Their descriptions mostly refer to the certain task, and are not interconnected with other jobs and tasks. In the new environment, the strict division between departments and tasks is expected to disappear, or at least to significantly diminish.

In the paper the results of the two-year research activity will be presented. The main goal of the research efforts was to interrelate the on-board processes with competencies required to effectively accomplish those processes. Project methodology required process approach to be applied, and that implies identification and analysis of critical processes, associated sub processes, activities, decisions, tasks, and their executors, in addition to quantitative and qualitative analyses of required competencies. In that respect, the work processes of the Masters and Chief Officers on board LNG carriers and passenger cruise ships have been thoroughly analysed, and compared with competencies as stipulated in STCW Code A and B, respective Model Courses, study programs of the Croatian higher MET institutions, and continuous professional development programs offered (or required by ship-owners and managers) to Masters and Chief Officers on board LNG carriers and passenger ships.

Research results indicate that mode presently used to describe required competences is not adequate for complex competencies, as expected to be required in new working environment. According to the results, it is necessary to interrelate competencies with associated processes more strictly. In addition to personal competencies, it will be necessary to define more precisely the collective competencies (in the present STCW Convention the collective competencies, i.e. competencies required and executed by the group of people, are already recognized as teamwork competencies, although not precisely described).

In particular, research outcomes emphasize generic competencies as a highly important segment of the required set of competencies for management level. At the same time these competencies are not clearly recognized in the curricula, and in particular in the STCW Convention and related documents (although several generic competencies are mentioned). In order to ensure the uniform education, at least in part dealing with critical processes, these competencies have to be more precisely described, including the methods of delivering and assessment.

Finally, research results clearly indicate a need for thorough revision of the STCW Convention and related documents. Considering the complexity of the task, it is not reasonable to expect that it can be done only by the IMO and maritime administrations. The process needs extensive participation of all involved parties, in particular those providing maritime education and training. In that respect, IAMU, as the most important association of prominent MET institutions is expected to participate in the process.

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Use of fuzzy rule base to analyze the role of university maritime research in policy making in West Africa

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Keywords: Fuzzy rule base, policy making, researcher

Environmental changes at home and abroad as well as rapid advancement in ocean technology are calling for a great shift in the perception of the maritime industry and for new policy measures. This situation demands that researchers provide policy-makers with accessible and reliable information regarding the maritime industry. This study employs fuzzy rule base analysis to examine the role of researchers in maritime universities in policy making and implementation with specific application to West Africa. The idea of using evidence to formulate maritime policy is not new. There is a need for a combination of scientific knowledge, pragmatic knowledge and value-led knowledge for inform decisions in policy making [1, 2]. This approach will help directors in maritime institution make well-informed decisions about policies programs locked within anachronistic institutional framework by putting the best available evidence from research at the heart of the maritime policy development [3]. This is of great importance in developing nations in reducing poverty and improving economic performance. In general, evidence transforms lives, whilst lack of evidence-based response has cause widespread failure in managerial procedures, misery and death. Policy making in the maritime sector and how issues of flexibility, movement, and how change can be accommodated in the new maritime governance framework is of great significance for maritime institution in West Africa [4]. Evidence-based interventions associated with evidence based policy approach have been most carefully pursued in areas such as education [5], social welfare [6,7], criminology [8] and healthcare [9,10] but interventions associated with the maritime industry in West Africa are limited. A novel Fuzzy rule base algorithm applied in this research shows that *governmental capacity* and *poor policy comprehension* are ranked by researchers as the most impacting factor leading to lack of university driven maritime research for impacting policy making in the sub-region, hence the need for inter-regional governmental capacity building and networking between maritime researchers and senior governmental maritime executives.

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Table 1. Maritime University Researcher dilemma in West Africa

Ineffective communication by researcher	Lack of libraries	B1
	Cost of assessing online journals	B2
	Lack of funding	B3
Governmental capacity	Recognize	B4
	Absorb Resourceful	B5
Domain research relevance	Social impact	B6
	Economic influence Cultural influence	B7
Ignorance of policies	Lack of cultivated relationship between researcher and bureaucrats	B8
	Lack of informal interactions	B9
	Policy relevant ideas	B10
Poor policy comprehension of researcher	Policy process Methodology Relevance of research	B11
Societal disconnection	Encouraging public participation	B12
	Street level understanding	B13
	Local participatory content	B14

R	Table 2: Rule base development example							
	F^L	C^S	F^{CP}	P	F	A	G	VG
1	Very low	Negligible	Highly U					1
2	Very low	Negligible	Unlikely				0.25	0.75
3	Very low	Negligible	Likely			0.25		0.75
4	Very low	Negligible	Highly L		0.25			0.75

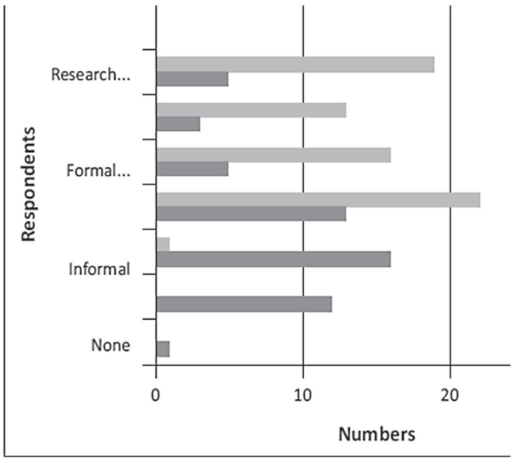

Figure 1 shows the main sources of evidence that respondents working in maritime governance as directors and chief directors identified. Some officials identified 'my networks'; 'my academic circle of friends'; 'I contact the experts' – a network of people we know') for making decision on maritime policy making

E/B	B 10
E1	F^L_{HF} C^S_{CR} F^{CP}_{HL}
E2	F^L_{A} C^S_{MO} F^{CP}_{HU}
E3	F^L_{L} C^S_{MO} F^{CP}_{HU}
E4	F^L_{L} C^S_{MO} F^{CP}_{U}
E5	F^L_{L} C^S_{CR} F^{CP}_{HU}
S O	S_{19}

HF	CR	HL
A	MO	HU
L	MO	HU
L	MO	U
L	CR	U

=

3/5 HF	1/5 CR	1/5 HL
1/5AV	3/5 MO	1/5 U
1/5L		3/5 HU

Figure 2. Five university researchers from Cameroon, Ghana, Liberia, Gambia, and Sierra- Leone (E1-E5) gave linguistic judgments on base event 10, leading to 18 rules firing

Team Resilience in Maritime Emergency Response: Analytical Framework and Implications from Accident Report Analysis

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Keywords: shipping, resilience, analytical framework, crew team communication

Objective: The current trend in shipping accidents poses a quest for a new approach to ship safety management with a focus on crew team training. At the same time, reviews by Hollnagel (2008) and Lundberg et al. (2009) suggest that accident investigations are often constrained by the principle of "What-You-Look-For-Is-What-you-Find and What-You-Find-Is-What-You-Fix" approach. This study seeks to identify the influential factors in team resilience and analyse their effect on team performance in maritime emergency and crisis.
Design/methodology/approach: A new analytical framework for team resilience in emergency response and crisis is proposed based on a review of the current literature. The framework is then applied to evaluate team performance in emergency situations involving five well-documented recent ship accidents.
Findings: The analysis found crew team communication and coordination being among the key issues in maritime emergency response. This is traced back to bridge resources management (BRM) training and its effectiveness in improving onboard team performance and leadership. The effect of team-related factors such as unity and culture, on team resilience is also highlighted.

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Abstracts

Student Session

Alumni Tracer, Employability, and Their Level of Satisfaction

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Keywords: alumni, tracer study, employability, satisfaction

This study aimed to determine the profile of John B. Lacson Foundation Maritime University (Arevalo), Inc. alumni, in terms of their employability and their satisfaction on the contribution of JBLFMU- Arevalo for school year 2018-2019. The respondents of this study were 663 alumni of JBLFMU-Arevalo chosen through snowball sampling. A questionnaire made by the JBLMU System Research Council was used to gather the data. The statistical tools used were mean, frequency, and percentage. Results showed that there were 343 or 52% alumni respondents came from the year 2011 to 2019 and most age of the alumni range between 18 to 25 years old or 57% with a total of 375 respondents which comprises of Deck Cadets who lived within the Province of Iloilo. Most shipping companies of the alumni came from Pacific Basin with a total of 31 respondents. In addition, the level of employment of the alumni was "Very High" and most of them were employed with a total of 491 respondents or 74%. Furthermore, data analysis revealed that the alumni level of satisfaction was "High" with a grand mean of 7. 97 which means that the alumni are highly satisfied on the contribution of JBLFMU-Arevalo. The comments of the alumni respondents were classified to the following themes: First, enhance the learning equipment, trainings, navigational facilities, school facilities and programs of the institution to strengthen the competency of the students. Second, provide more hands-on and practical activities to its students especially on major subjects. Third, improve the competency of the school and instructors. Fourth, promote the core values to its students and alumni to equip themselves in their future endeavors. There were also comments and suggestions to improve the alumni services that were classified according to the following themes: First, strengthen the education and training to the alumni and or students. Second, strengthen the link between the school and its graduates. Third, accessible website for updates of the school and shipping companies.

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USE OF ANALYTIC GEOMETRY FOR TASK SOLUTION ON MANEUVERING BOARD

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Keywords: maritime education, navigation, maneuvering board, analytic geometry, ARPA.

Nowadays, maneuvering board is still taught in maritime institutions. This aid to navigation provides a graphical solution for determining relative-motion factors of vessels.

The project of the author is focused on the method of navigation task solution **at schools**. Beside using graphical solution as an initial step of training, analytic geometry can be used as a secondary or control method.

In navigation, a navigational polar coordinate system is used to determine an object position with a bearing (in degree) and a range (in nautical mile). A position can be converted into a point in a Cartesian coordinate system, i.e. with two axes x and y.

Analytic geometry is used to make up some formulas to determine those relative-motion factors of other objects or vessels, e.g. CPA (in nautical mile or cable), TCPA (in minute), heading/course (in degree), speed (in knot), etc.

$$\boldsymbol{CPA = OD = |\vec{O}\vec{D}| = \sqrt{x_D{}^2 + y_D{}^2}}$$

$$\boldsymbol{TCPA = \frac{A_2D}{A_1A_2} \cdot \Delta t}$$

$$\boldsymbol{H_A = (\widehat{Oy; \vec{OA_2}'}) = arctan\frac{x_2{}'}{y_2{}'} = arcsin\frac{x_2{}'}{V_A/10} = arccos\frac{y_2{}'}{V_A/10}}$$

$$\boldsymbol{V_A = 10 \cdot \sqrt{x_2{}'^2 + y_2{}'^2}}$$

The project is still in its progress for further navigation tasks' solutions, e.g. determining new course and speed for preventing collision. Furthermore, this method's solution is compared with calculation data from ARPA (Automatic radar plotting aid) on the vessel, where the author has been on during his shipboard training [1].

There are some interesting questions, which are, "What if this method was made up before ARPA was?" and "Will this method improve the way ARPA works, if the latter's calculation formulas are different from the former's?".

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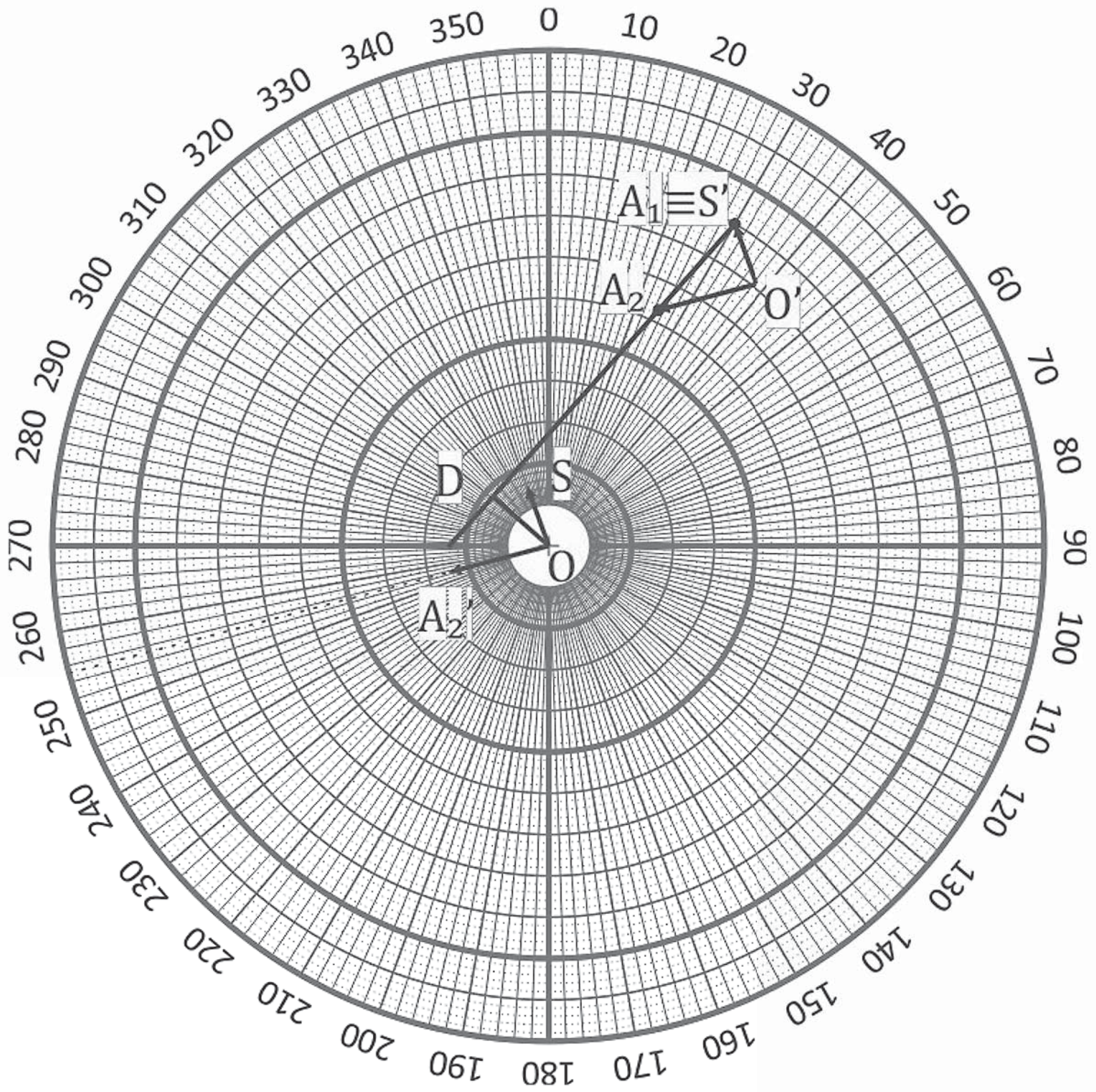

Figure 1. An example for a graphical solution on a maneuvering board.

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The shipping company Wagenborg Shipping B.V. provides the project's author with a shipboard training period on board a vessel, as well as with advisors.

A MODEL FOR PRACTISING MOORING/ UNMOORING OPERATIONS AT MARITIME UNIVERSITIES

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Keywords: maritime education, mooring, unmooring, model, installation.

At maritime university, mooring and unmooring operations are taught only by books, slides and videos. Students can only practise those operations during their shipboard training. Proper teaching, training and practising mooring operation in advance at school can partly decrease accidents [1].

Installation of mooring/ unmooring operations

The installation is **placed at the school yard** and **movable**. It is **not required any pool of water**.
The installation consists of 2 parts: the ship model and the shore bollards.
The ship (1) is fitted with 360-degree wheels (2), which can help the ship to move easily as in water. On the ship, there are the bridge (3), the aft mooring station/ winch (4) and the fore mooring station/ winch (5). The mooring ropes (6) connect the winches and shore bollards (7).
The special feature of the bollards is that, their height can be changed. This feature imitates the influence of tide.
The real movements of the ship are imitated by the **360-degree wheels** (horizontally) and the **flexible bollards** (vertically).

Training

Each group of cadets is divided into 4 teams: the first team – the bridge, the second team – the aft station, the third team – the fore station and the fourth team – the shore team.
Those teams on the ship communicate to each other by using VHF radios. Between the ship's teams and the shore team, communication is by voice or by hand signal.
Besides, cadets can study about the influence of tide, forces affecting mooring ropes, snap-back areas and their actions during their watches.

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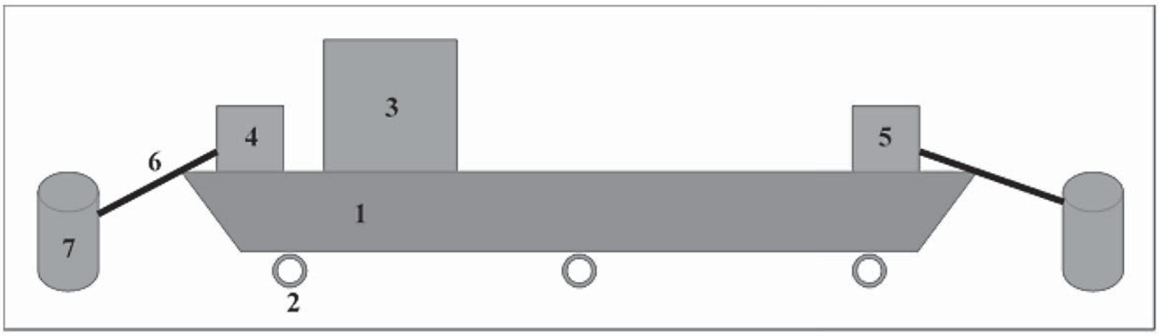

Figure 1. Installation of mooring/ unmooring operations – Side view.

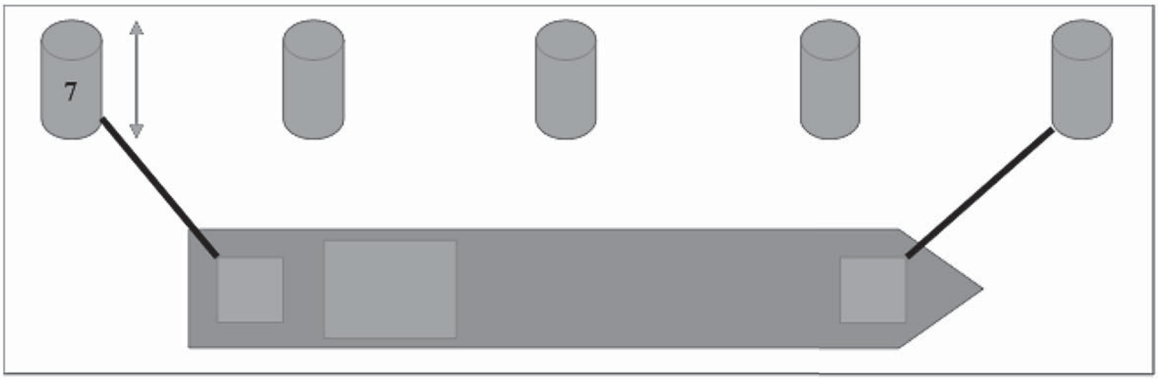

Figure 2. Installation of mooring/ unmooring operations – Top view.

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Computer Usage and Technology Integration among BS Mar-E Students of JBLFMU-Molo: Basis for Library Transformation

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Keywords: Computer usage, computer education, technology integration, and access to social media.

Abstract. Schools rely on computers to make learning more effective by using audio visual aids for learners to proactively participate in learning. The introduction of computer education online on the potential readiness of technologies such as multimedia application and computer networks. These innovations have major impacts on the nature of computer. It is therefore the purpose of this study to determine the level of computer usage and technology integration of marine students of JBLFMU-Molo when classified according to residence, high school last attended and family income. Provided information as the basis for library transformation. The respondents of this study were 100 marine students of JBLFMU-Molo for School Year 2016-2017. A single random sampling was conducted from the total population of this university. Research Design; A descriptive research design was utilized to provide facts for scientific judgment through a data gathering instruments. A validated questionnaire was used in this study. Statistical Data Analysis; Descriptive statistics such as frequency, percentage, mean, and rank were employed to determine the level of computer usage and technology integration of respondents. Inferential statistics such as t-test and ANOVA were likewise employed to establish whether there is significant difference among variables identified. Results: Data revealed that respondents coming from rural areas tent to access social media online, listening to music, chatting with friends, calling with family and friends. And the integrated technology is through smart phones while those coming from urban areas tend to do research for assignment and other school works using desktop computer.

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The future competences of the maritime engineer

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Keywords: Maritime engineer, Competences, Future,

The maritime industry is undergoing a transformation and it seems that there are different perspectives within the field on what the future holds. Therefore, it is likely that the competences of the marine engineer will undergo a transformation as well. Through 15 interviews, this study investigates which competences a marine engineer in the field should possess in 10 years' time. Furthermore, it seeks to assess whether the educational system can supply the necessary competences of tomorrow. In order to generalize the findings and ensure accurate representation from the industry, the industry participants have been sorted into the following three categories: The shipping companies, the equipment manufacturers, and the frame organizations.[1] The different competence demands have been analyzed using a taxonomy to determine the level of understanding that is required in the industry.

The study finds that, in the future, the marine engineer is a logical applicator and a practical problem-solver with competences in leadership, innovation, and operational and procedural understanding.
A key point of the study is the focus on personal competences such as curiosity, autonomy and resilience, which has been emphasized by several key figures in the industry.
Furthermore, it shows how competence demands change based on the different positions within the industry.

Based on the study, three suggestions have been made:

1. *There should be an increasing focus on the areas of digitalization and innovation.*

2/3 of those interviewed, mention innovation, and ½ mention digitalization. There is an inconsistency in how the respondents define the two areas of competences, hence it is suggested that there be an increased focus and that the meaning be clarified.

2. *The study indicates a need for a better use of continuous education to enhance the competences of the marine engineer*

The entire educational system is headed towards *lifelong learning* and if the maritime industry is to do the same, it must be focus on ensuring continuous education throughout the maritime engineer's carrier.

3. *Finally, the need to keep and expand the flexibility of the educational system to support the changing demands.*

The challenges of tomorrow are very different within the member countries of IAMU and regardless of the nation, the company or the seafarers it is important that the education institutions, legislative institutions and the maritime companies work together in order to produce the best seafarers, with the right competences, to solve the problems of tomorrow. The study could be used as a pilot for further quantitative studies or as a starting-point for further discussion for charting the course for the future maritime engineer.

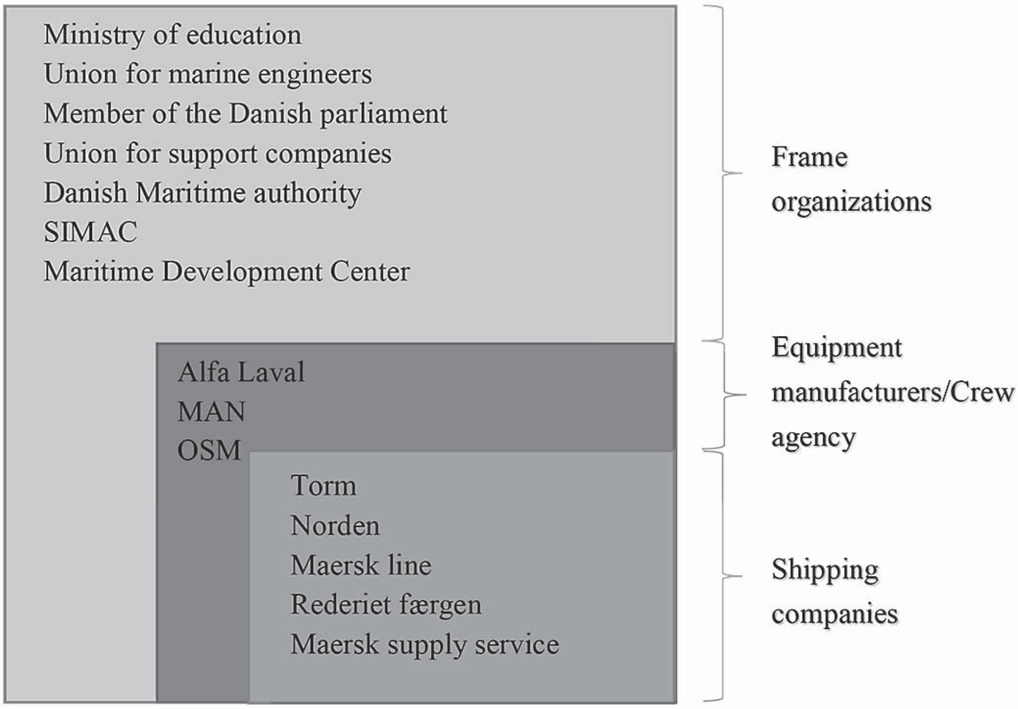

Table 1: Participants and industry arranged by category.

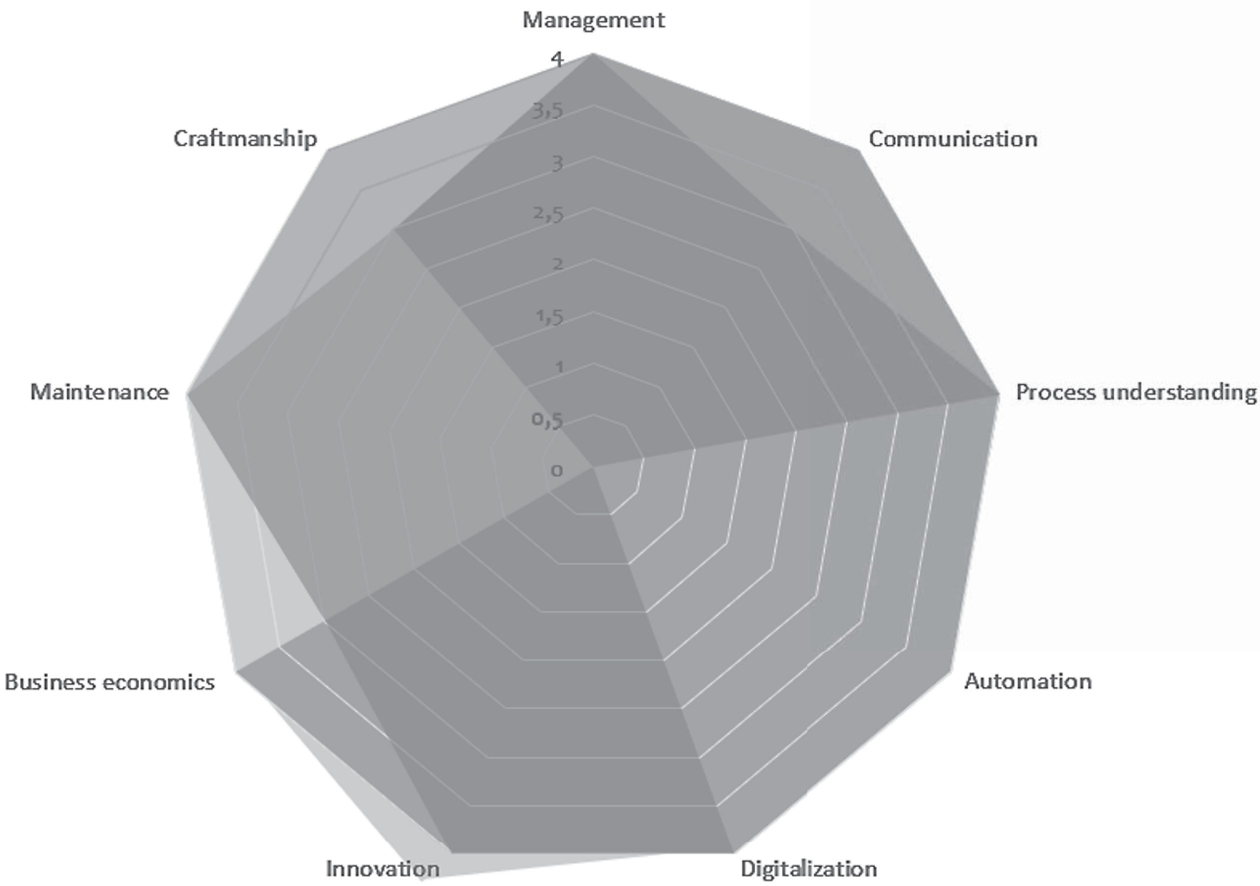

Figure 1: Radar chart of the competences requested by informants

Comparative Analysis of Different Current Turbine Designs Based on Conditions Relevant to main canals of the Nile River in Egypt

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Keywords: Current Energy; Nile River; Savonius Turbine; Darrieus Turbine; CFD simulation.

The global energy demand continues to increase with the majority of this demand coming from developing countries. Such ongoing increase is mainly met by consumption of fossil fuels -which are already accounting for majority of global energy consumption- resulting in environmental degradation due to the accompanied emissions [1]. Also being finite energy sources promotes renewable energy sources to be the major energy supplier worldwide in the near future due to being environmentally friendly and guaranteeing sustainability. As a result, all sectors has been urged to adopt renewable energy sources and cut down emissions with the maritime sector being no exception. The maritime sector answer to this was adopting new approaches to cut down emissions and exploitation opportunities for offshore wind, water tides and water currents.

Since Egypt is regarded as a developing country [2], so developing reliable, efficient energy production techniques for potential renewable sources shall cut down the country fossil fuels dependence by a considerable margin in the years to come. One of the most promising renewable sources within the country is the water current in the vast network of 40,000 km of channels branching from the Nile River through hierarchically classified canals: principal (water directly from the Nile) main branches and distributary canals [3]. In addition, there are also mesqas, private ditches distributing water to the field. The preceding implies that Current energy from flowing water in open channels has the potential to support local electricity needs with lower regulatory or capital investment than impounding water with more conventional means.

The theory of current stream power is similar to wind power but advantageous in being more predictable in velocities and direction of the fluid and hence more predictable power generation, adds to this water density is more than 800 times that of air, hence smaller scale hydrokinetic turbines are needed to extract the same power at even lower velocities if compared to wind turbines.

This study aims at investigating and comparing the performance of different types of hydrokinetic turbines such as Savonius turbine and Darrius turbine based on real-time data from the site based on a detailed two-dimensional numerical model analysis using ANSYS computational fluid dynamics module, fluent. **The results were discussed** in the light of current turbine performance objectives thus **recommending** the most suitably performing turbine in the light of the local real-time site conditions.

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Millennial Seafarers as Today and Tomorrow's Generation of Marine Officers: Implications and Future Directions

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Keywords: millennial, seafarers, characteristic, traits

As the new generation of seafarers in the maritime industry comes into the picture, there are so many questions and opinions now about who the millennial seafarers are---the way they socialize, communicate, react or respond to the current situation, and the way they behave as they grow and gain more experience while on board. Research analysts conclude that although young people today are different in some ways, it is difficult to determine how different they are from past generations and to predict their behaviors in the future [1]. The millennial generation workers value and require different traits, both positive and negative, in their work than the earlier generation. Leadership and motivation come into play for millennial professionals on the job [2]. Their motivation drivers for organizational commitment consists of more specific feedback, personalized attention, empowerment, need for freedom and flexibility, balance between work and personal life, good pay and benefits, opportunities for advancement, meaningful work experiences, and nurturing work environment [3] [4]. The researchers hope to understand who the millennial seafarers generally are and how they would fare as future officers in the maritime industry. Given the different dominant traits and perspectives on every generation towards work, the young generations need to be understood by the older generations for them to cope up with being a seafarer. With the help of other peers, they can motivate the millennial seafarers to go further and reach what the senior seafarers have achieved, and set a goal to achieve their goals and reap success in seafaring.

This study aimed to identify the dominant characteristics of millennial seafarers as perceived by themselves, their senior officers, their crewmates, and by the shipping companies, and to rationalize how these dominant characteristics can be positively maximized to help them succeed as effective and efficient marine officers. This study also identified some of the interventions that may be proposed to help the millennial in preparing themselves for the growing industry.

The concept of this study is anchored on the Five-Factor Model of Personality [5] which represents five core traits that interact to form human personality: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (OCEAN). *Openness* means the tendency to be informed, creative, insightful, curious, and have a variety of experience. *Conscientiousness* is the tendency to portray self-discipline, act accordingly and dutifully, and yearn for achievement. High conscientiousness drives a person to be stubborn and focused, while low conscientiousness is synonymous to flexibility and spontaneity, but may also take the form of being sloppy and unreliable. *Extraversion* means to have energy, positive emotions, and the tendency to be sociable, talkative, assertive, and energetic. High extraversion causes a person to seek attention and dominate others, while low extraversion manifests a reserved, reflective personality, which may be taken to mean as aloof or self-absorbed. *Agreeableness* means the tendency to be compassionate, trusting and cooperative rather than suspicious and antagonistic towards others. High agreeableness displays a naive or submissive person, while low agreeableness portrays a competitive or challenging personality, which may be observed as argumentative or untrustworthy. *Neuroticism* means a tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, or vulnerability. It is the tendency to give in to psychological stress. High stability exemplifies a stable and calm personality but maybe uninspiring and unconcerned, while low stability shows the reactive and excitable side of a person but can impress others as unstable or insecure [6].

Research design using the mixed method [7] was employed in this study. Data gathered for this study were derived from a modified survey questionnaire conducted to 50 millennial seafarers who had been on board for at least six months, 50 senior officers who have directly supervised seafarers who belong to the said generation, 50 crewmates who have worked with millennial seafarers, and representatives of 5 shipping companies. This study used a mixed method which employed both quantitative and qualitative research. The survey was administered personally by the researchers, while for the respondents who were on board when the study was conducted, the survey questionnaires were sent and retrieved via electronic mail. To determine the dominant characteristics of the millennial seafarers based on the different dimensions, *Mean* was used. To analyze the qualitative data, thematic analysis was employed.

The results of this study revealed that the millennial seafarers generally perceive themselves to be agreeable (4.00-Agree), conscientious (3.87-Agree), and open (3.85-Agree), respectively. This means that they tend to be compassionate, trusting, cooperative and submissive rather than suspicious and antagonistic towards others. As conscientious individuals, they value discipline and act accordingly and dutifully to set norms. They yearn for achievement. They are open to new ideas and they tend to be informed, creative, insightful, curious, and to have a variety of experience. However, the millennial seafarers slightly agree that they tend to experience unpleasant emotions easily, such as anger, anxiety, depression, or vulnerability, and that they have the tendency to give in to psychological stress. Moreover, a closer look at the specific descriptors of the five core traits revealed that they slightly agree to strongly agree that they possess the following characteristics: ingenious, a deep thinker (4.62-Strongly Agree), has a forgiving nature (4.58-Strongly Agree), does things efficiently (4.40-Strongly Agree), makes plans and follows through with them (4.40-Strongly), is full of energy (4.26-Strongly Agree), can be moody (4.00-Agree), is easily distracted (2.90-Slightly Agree), can be cold and aloof (2.80-Slightly Agree). On the contrary, they disagree to the following traits: remains calm in tense situations, is relaxed, handles stress well, is emotionally stable, not easily upset, prefers routine work, has few artistic interests, is reserved. This implies that when put in an undesirable situation, they have the tendency to lose control of their emotions and could easily get upset, provoked or angered.

The perception of senior officers who have handled or directly supervised them, their shipping companies, and their crewmates who had worked with them supported the self-perception of the millennial seafarers in that they found them to be generally agreeable and conscientious and open. In particular, these people who have supervised or worked with them strongly agree that the millennial seafarers like to cooperate with others (4.39), do a thorough job (4.38), have new ideas (4.36) and active imagination (4.35), are generally trusting (4.34), persevere until the task is finished (4.32), considerate and kind (4.31), value artistic and aesthetic experiences (4.30), do things efficiently (4.28), helpful and unselfish with others (4.27), are reliable workers (4.27), and have a forgiving nature (4.27). However, they find the millennial seafarers to be easily distracted, tend to worry a lot, can be moody/easily upset, and have difficulty in handling stressful and tense situations. They also tend to be rude and pick up a fight when provoked and find fault with others. Like everyone else, they also possess some negative characteristics that may be detrimental to establishing a harmonious working relationship with people they work with on board.

This paper concludes by looking at how the findings of this study can be beneficial in understanding the characteristics of seafarers that dominate our sea workforce nowadays. The industry is filled with people who belong to the generation of the millennials. They supply the constant demand for a stable workforce who can keep up with the expanding needs and expectations of the industry. Since human resource is as crucial as the modern equipment and technology that keep the vessels running, it is also imperative that equal importance must be given to initiatives that are designed to develop the full potential of our present and future generations of seafarers by way of tapping the inherent characteristics that they are good at, and looking for ways and avenues by which these characteristics can be maximized and utilized in the workplace. The industry is presently teeming with techy people who have the ability to think fast, generate new ideas, and actively engage in challenging tasks that stir their imaginations. On one end, if others in the workplace can provide them with a nurturing environment that encourages optimum use of these capacities instead of an environment that blocks them, imagine the positive impact that it could build for the maritime industry. On the other end, since these are the generation of seafarers that serve as present and future marine officers, internal measures may also be put in place to strengthen their weaknesses, particularly on the affective/emotional dimension. Coping strategies need to be developed and strengthened particularly in handling stressful situations, defusing tensions, and dealing with matters that may distract them from performing their jobs efficiently and effectively.

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Cross-Cultural Communication for Seafarers

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Keywords: cross culture communication, intercultural awareness, MET

Seafarers from various cultural backgrounds work together in close quarters on vessels. The rigorous demands of the job combined with cultural and linguistic differences can sometimes cause misunderstandings and troubles. In order to reduce such problems, it is important to understand their causes, and provide training and education to produce effective Global Maritime Professionals. In order to achieve comprehensive training for current and future seafarers, it is important for them to be tolerant of different cultures and aware of any potential misunderstandings that can arise while onboard. In the case of Japanese MET, strong technical proficiency and basic language training are considered to be sufficient, but direct communication skills and cultural awareness training needs to be improved. Due to this situation, many Japanese seafarers can be hesitant to speak English and create professional bonds with fellow seafarers from different cultural backgrounds.

The research outlined in this presentation will focus on identifying strong and weak points of MET in Japan via surveys administered to maritime students, with a particular focus on language and culture awareness training. A second focal point of this research will be language training for Japanese seafarers. By identifying the effective and also underdeveloped aspects of Maritime English training in Japan, potential solutions and improvements to MET may be discovered. This research will also investigate similar aspects of MET with current Japanese seafarers who are active in the industry. Based on these investigation points, this research hopes to highlight points for improvement so that future Global Maritime Professionals coming out of Japan can effectively contribute to the international maritime industry.

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Seafarer Attrition in Japan

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Keywords: seafarer attrition, seafarer retention, MET

The number of seafarers in Japan is decreasing every year. Seafaring in Japan reached it's peak in terms of human resources in 1974, when there were 278,000 active Japanese seafarers. Since the 1970's, however, the Japanese seafaring population has gone through a drastic decline. Japan is an island country surrounded by sea that relies on shipping as a vital source of trade and resources, and thus a steady, stable supply of seafarers is essential.

In Japan, marine navigator and engineer jobs are not as popular as they once were, and there are few young people who want to be seafarers. For this reason, Japan has started focusing on ways to create opportunities for small children to experience nature and the sea, and to visit and experience ships firsthand. In addition, in March 2017, the curriculum guidelines for Japanese elementary and junior high schools were revised, and specific content related to shipping, which had not been described in detail before, was incorporated into the national curriculum. Will these measures be enough to increase the number of future seafarers? In order to solve this question, I will clarify the cause of seafarer attrition in Japan by investigating various aspects of modern Japanese society, education, and the shipping industry.

There are two ways to become a seafarer in Japan. One is a method to graduate from national college of maritime technology or maritime university and subsequently find a job at a shipping company. The other is to graduate from a university that has nothing to do with ships, and then work for a shipping company's "in- house training course," from which you can receive support from the company and go to school or get on board.

Looking at the recent new graduate recruiting status of the three major shipping companies, the numbers remain dauntingly small. There are also examples of shipping companies and other industry entities not disclosing their recruitment statistics. Unexpectedly, there were some companies that employed the former and the latter seafaring employment tracks by almost equal numbers. It can be seen that the major shipping companies not only need to retain Japanese seafarers for long careers in the industry, but also seek excellent new human resources who can contribute to companies by utilizing their experience on the sea. In addition to seafaring skills, knowledge, and tolerance, we, as university students who aim to be seafarers, are also required to have the ability to effectively perform for these companies in the future. The goal of the research outlined in this presentation is to identify causes of seafarer attrition in Japan and suggest possible MET-level solutions for the problem.

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