21ST Annual General Assembly

IAMU AGA21

26TH-28TH October 2021

The 21st Annual General Assembly

Arab Academy
for Science, Technology and Maritime Transport

The International Association of Maritime Universities (IAMU) Conference Book

Alexandria - Egypt

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Conference Book

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Program Editors

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Table of Contents

	Preface	4
	Theme	5
	Organization	5
	International Program Committee (IPC)	6
	Reviewers:	7
	Venue	8
	Program Overview	9
	Poster Presentations	12
	Technical Instruction	14
	Session Quick Index	15
	Abstracts Contents	16
1	Impact of Infectious Pandemic Disease is on The Future of The International Maritime Industry “What is After COVID 19”	19
2	GMP Applications and Human Capacity Building in Maritime Affairs	34
3	Smart Maritime Supply Chain and Logistics	42
4	Innovative MET Environment	47
5	New Trends in Maritime Transport and Job Opportunities	72
6	Efficiency of Shipping Port Management from Environmental Perspectives	87
7	Renewable Energy Resources Alternatives in Maritime Industry	89
8	Marine Pollution and Climate Change New Challenges	95

Preface

The 21st Annual General Assembly (AGA 21) is the annual meeting of the International Association of Maritime Universities (IAMU). The IAMU Conference (IAMUC), held annually as part of the AGA, brings together experts and official representatives of IAMU member universities from all over the world to discuss, exchange, and share recent progress and future trends in maritime education, training, research and other matters within the scope of IAMU.

The 21st AGA and IAMUC 21 are hosted by The Arab Academy for Science, Technology, and Maritime Transport (AASTMT), in the beautiful city of Alexandria, Egypt.

Due to travel restrictions imposed by the COVID-19 pandemic, and for the first time in 20 years, the IAMUC was canceled in 2020. In 2021, the International Executive Board (IEB) of the IAMU found it challenging to decide on how to proceed with the conference. Yet, after due consideration, it was decided to hold the conference in a hybrid mode, combining the regular "face to face" meeting with "online" participation, thus, enabling experts and scholars from around the globe to meet, disseminating the latest research advancements in the field of maritime education, training, research, and development.

The theme of the AGA21 IAMUC is "Innovation and Sustainability of Maritime Industry in the Scope of Blue Economy and Green Concept". The IMAUC program is organized within eight topics;Impact of Infectious Pandemic Disease is on The Future of The International Maritime Industry "What is After COVID 19" - GMP Applications and Human Capacity Building in Maritime Affairs - Smart Maritime Supply Chain and Logistics - Innovative MET Environment - New Trends in Maritime Transport and Job Opportunities - Efficiency of Shipping Port Management from Environmental Perspectives - Renewable Energy Resources Alternatives in Maritime Industry - Marine Pollution and Climate Change New Challenges.

IAMUC 21 is a stimulating and informative gathering with a wonderful array of keynote and invited speakers from all over the world. Delegates will have a wide range of scientific researches to choose from, as the program consists of topic dedicated sessions, technical workshops, and discussions with eminent speakers covering a wide range of topics and aspects of the Maritime Domain.

"The Conference Book contains information about organisation and program of the IAMUC 2021, and abstracts presented at the IAMUC in Alexandria, Egypt, on 27th and 28th of October 2021. Based on 127 high level abstract submissions from 29 different countries and 49 different IAMU universities, a strong program could be compiled with accepted 31 oral and 27 poster presentations. The selection was based on the double peer review process. The parallel oral presentations took place in two rooms and poster presentations were held during coffee/tea breaks, although all posters were displayed during the whole conference."

We hope your experience with AGA 21 and IAMUC 21 is a fruitful and long-lasting one. With your support and participation, the conference will continue its success for a long time.

Finally, we would like to thank the organizing committee, the members of the program committees, reviewers, and external reviewers. They have all collaborated to execute a world-class scientific conference appropriate to the respected work of the International Association of Maritime Universities and all member universities.

Prof. Yasser Gaber – Capt. Amr Moneer
IAMUC 21 Program Editors

Prof. Boris Svilicic
IAMUC Chief Program Editor

Theme:

Innovation and Sustainability of Maritime Industry in the Scope of Blue Economy and Green Concept

Organization Committees:

To make the AGA 21 and IAMUC 21 a success, the Arab Academy for Science, Technology and Maritime Transport (AASTMT), as the host, and the organized Executive Committees and International Program Committee with the cooperation of IEB members and members of the working groups supervised by Academic Affairs Committees.

Local Executive Committee (LEC):

Head	**Ismail Abdel Ghafar Ismail Farag** Arab Academy for Science, Technology and Maritime Transport, Egypt
Executive Director	**Gamal Ahmed Ghalwash** Arab Academy for Science, Technology and Maritime Transport, Egypt
International Affairs Committee	**Mahmoud Elsayed El-Bawab** Arab Academy for Science, Technology and Maritime Transport, Egypt **Mohamed Rowihil** Arab Academy for Science, Technology and Maritime Transport, Egypt
Local Organizing Committee	**Akram Soliman** Arab Academy for Science, Technology and Maritime Transport, Egypt **Alaa Morsy** Arab Academy for Science, Technology and Maritime Transport, Egypt
Program Editing Committee	**Yasser Gaber** Arab Academy for Science, Technology and Maritime Transport, Egypt **Amr Moneer Ibrahim** Arab Academy for Science, Technology and Maritime Transport, Egypt

International Program Committee (IPC):

Head	**Gamal Ahmed Ghalwash** Arab Academy for Science, Technology and Maritime Transport, Egypt
Program Editor	**Yasser Gaber** Arab Academy for Science, Technology and Maritime Transport, Egypt
Program Editor Assistant	**Amr Moneer Ibrahim** Arab Academy for Science, Technology and Maritime Transport, Egypt
Chief Program Editor	**Boris Svilicic** University of Rijeka, Faculty of Maritime Studies, Croatia

Session Chairs

Impact of COVID-19 Session

Chair: Vladimir Loginovsky
Admiral Makarov State University of Maritime and Inland Shipping, Russia
Co-Chair: Saeed Abd Al Kader
Arab Academy for Science, Technology and Maritime Transport, Egypt

Environmental Impact Session

Chair: Gamal Ahmed Ghalwash
Arab Academy for Science, Technology and Maritime Transport, Egypt
Co-Chair: Yasser Gaber
Arab Academy for Science, Technology and Maritime Transport, Egypt

Maritime Education & Training Session

Chair: Graham Benton
California State University Maritime Academy, USA
Co-Chair: Emad Khafagy
Arab Academy for Science, Technology and Maritime Transport, Egypt

Ports & Logistics Session

Chair: Paul Swizd
Massachusetts Maritime Academy, USA
Co-Chair: Mohey Al Sayeh
Arab Academy for Science, Technology and Maritime Transport, Egypt

Maritime Innovation Session

Chair: Shuhong Chai
Australian Maritime College, University of Tasmania, Australia
Co-Chair: Ahmed Al Kassar
Arab Academy for Science, Technology and Maritime Transport, Egy

GMP Session

Chair: Takeshi Nakazawa
International Association of Maritime Universities, Japan
Co-Chair: Mahmoud El Bawab
Arab Academy for Science, Technology and Maritime Transport, Egypt

Student Session

Amr Moneer Ibrahim
Arab Academy for Science, Technology and Maritime Transport, Egypt
Matthew Rooks
Kobe University, Graduate School of Maritime Sciences, Japan

Reviewers:

Abdel Monem Yassin, Ahmed Swidan, Akram Soliman Elselmy, Ali Shahata, Amr Moneer, Fawzy Dekinesh, Gamal Ghalwash, Ibrahim Seddiek, Kareem Tonbol, Kazem Agamy, Mahmoud Elbawab, Nahla Zakzouk, Rana Maher, Sameh Rashed, Seif Bayoumi, and Yasser Farag (AASTMT, Egypt), Apsara Abeysiriwardhane, Gamini Lokuketagoda, Hongjun Fan, Hong-Oanh Nguyen, Hung Nguyen, Kiril Tenekedjiev, Ming Yang, Natalia Nikolova, Poomintr Sooksripaisarnkit, Reza Emad, Samrat Ghosh, Shuhong Chai, Wei Zhang, Wenming Shi, and Yuquan Du (AMC, Australia), Vladimir Loginovsky (AMSU-MIS, Russia), Irina Makashina (AUMSU, Russia), Graham Benton, Joshua Shackman, and Tamara Burback (CSUM, USA), Anna Mujal-Colilles, Claudia Barahona, Inma Ortigosa, Manel Grifoll, and Marcella Castells-Sanabra (FNB-UPC, Spain), Jean Rom Rabe, and Michael Baldauf (HSW-UTBD, Germany), Matthew Rooks, and Takashi Miwa (KU-GSMS, Japan), Eddie Blanco-Davis, and Ian Jenkinson (LJMU, UK), Ashok Pandey, and Paul Szwed (MassMA, USA), Wayne Talley (ODU, USA), Ninna Roos (SAMK, Finland), Jens Brauchli Jensen (SIMAC, Denmark), Yoshiaki Kunieda (TUMSAT, Japan), Xiwen Bai (TU, China), Ana Peric Hadzic, Boris Svilicic, Damir Zec, David Brčić, Lovro Maglic, and Srđan Žuškin (UR-FMS, Croatia), Johan Bolmsten, Momoko Kitada, and Satya Sahoo (WMU, Sweden), Görkem Kökkülünk, and Ugur Bugra Celebi (YTU-NAMF, (Turkey

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Arab Academy for Science, Technology and Maritime Transport, Egypt

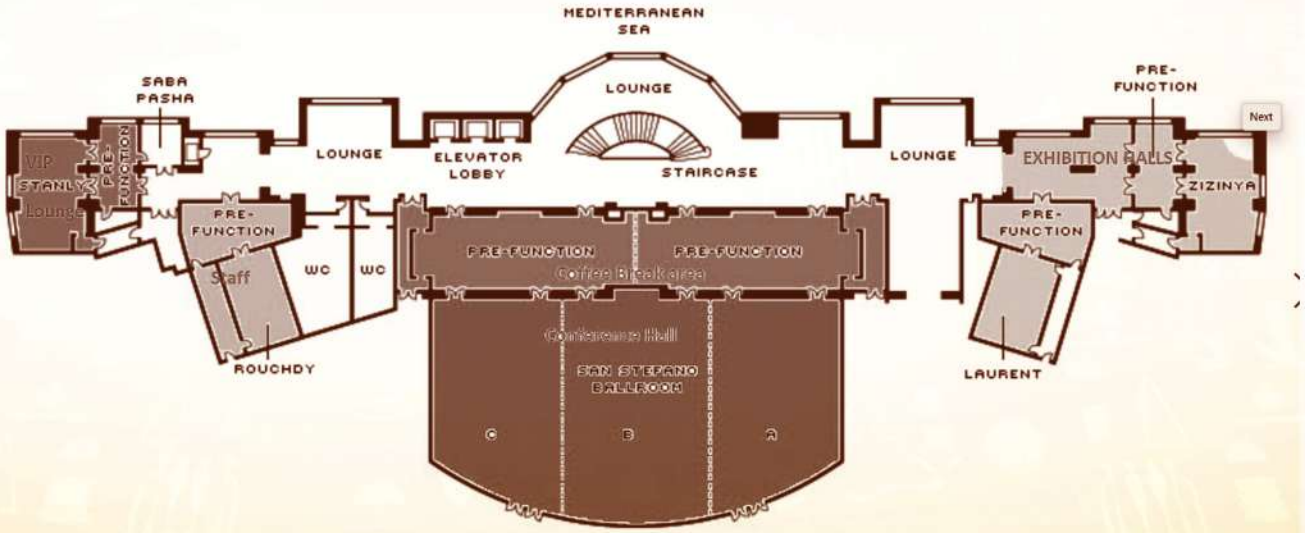
Venue

The IAMU Conference is held in the Four Seasons Grand Plaza Hotel

399 El-Gaish Rd, San Stefano, El Raml 1, Alexandria, Egypt.

Location:

Floor Plan



Program Overview:

IAMU Conference (IAMUC 21) Technical Sessions Wednesday, October 27th Location: Four Seasons Hotel		
Time	**Hall (A)**	**Hall (B)**
14:00 – 15:30	**Session 1 (A)**	**Session 1 (B)**
	Impacts of Infectious Pandemic Diseases on The Future of The International Maritime Industry ***Chair**: Dr. Vladimir Loginovsky (online)* ***Co-Chair**: Dr. Said Abd El Kader*	**Smart Maritime Supply Chain & Logistics** ***Chair**: Dr. Paul Szwid (online)* ***Co-Chair**: Dr. Sara El-Gazzar*
	1400: Qi Chen *"Fast Recovery or Stagnation? The Maritime Industry post COVID-19"* **1430: Emeliza Estimo (online)** *"Remote Instruction: Challenges, Initiatives, and Future Directions for Maritime Education Institutions in a Developing Country"* **1500: Rosanda Mulic** *"The COVID - 19 Pandemic and Its Impact on The Maritime Sector in Croatia and The World"*	**1400: Frane Tadić** *"The impact of the container throughput of the Adriatic Gate Container Terminal at the Port of Rijeka on air quality environmental parameters"* **1430: Esslam Hassan** *"Maritime Surveillance in the Gulf of Suez: Identifying Opportunities for Future Improvements"* **1500: Knud Benedict** *"Innovative Teaching Method for Ship handling – Element of Project "Euro Za" Between South Africa and Europe"*
15:30	Coffee Break + Poster Presentations	
16:00 – 17:00	**Session 2 (A)**	**Session 2 (B)**
	Impacts of Infectious Pandemic Diseases on The Future of The International Maritime Industry ***Chair**: Dr. Vladimir Loginovsky (online)* ***Co-Chair**: Dr. Said Abd El Kader*	**Smart Maritime Supply Chain & Logistics** ***Chair**: Dr. Paul Szwid (online)* ***Co-Chair**: Dr. Sara El-Gazzar*
	1600: George Gabedava *"Impact of COVID19 on Ports and Maritime Transport (Georgian Ports Response to COVID19)"* **1630: Karina Melikjanyan (online)** *"Life After COVID-19. Cruise Industry Rising from The Ashes"*	**1600: Toorban Mitra (online)** *"Is outsourcing the Panacea? A discourse on the sustainability of Indian Ports A case of Jawaharlal Nehru Port Trust"* **1630: Piotr Kopacz** ***"**Towards improving SAR search patterns by time-minimal paths"*
	Free Time	

Thursday, October 28th.	Location: Four Seasons Hotel	
Time	**Hall (A)**	**Hall (B)**
09:00 – 10:30	**Session 3 (A)**	**Session 3 (B)**
	Innovative MET Environment ***Chair**: Dr. Graham Benton* ***Co-Chair**: Capt. Emad Khafagy*	**New Trends in Maritime Transport & Job Opportunities** ***Chair**: Dr. Shuhong Chai (online)* ***Co-Chair**: Dr. Ahmed AL Kassar*
	0900: Paul Szwed (online) *"Developing Outcomes-Based Model Courses Using Identified Evidence-Based Practices"* **0930: Johan Bolmsten (online)** *"Sustainable development processes of education technologies - A case studies synthesis"* **1000: Sanjeev Vakil (online)** *"Application of Augmented Reality (AR) / Virtual Reality (VR) Technology for Remote Maintenance of Autonomous Ships"*	**0900: Joshua Shackman** *"The Interrelationship Between Coastal, Great Lakes, Inland, and Deep- Sea Freight Rates: A Longitudinal Approach"* **0930: Daniel Edwin (online)** *"Proposal for the introduction of "Shore to Ship Alert System"* **1000: Prasanna Kumar Rajakumaran (online)** *"Automation of FRAMO Cargo Pump purging with IoT"*
10:30	Coffee Break + Poster Presentations	
11:00 – 12:30	**Session 4 (A)**	**Session 4 (B)**
	Innovative MET Environment ***Chair**: Dr. Graham Benton* ***Co-Chair**: Capt. Emad Khafagy*	**Marine Pollution, Climate Change & Renewable Energy New Challenges** ***Chair**: Dr. Gamal Ghalwash* ***Co-Chair**: Dr. Yasser Gaber*
	1100: Adi Mas Nizar (online) *"Measuring Situation Awareness in Engine Control Operation"* **1130: Svitlana Barsuk (Online)** *"Active Learning Strategies in Maritime English Training"* **1200: Liza Nordfeldt and Johan Ljungklint** *"Marine student's information literacy skills- a case study of marine engineer's bachelor thesis at Chalmers University of Technology"*	**1100: Zhongmin Ma (online)** *"Analysis of marine diesel engine emission characteristics under bench test conditions in China"* **1130: Germán de Melo Rodríguez** *"Towards Zero Ship Emissions II – Project Greenship"* **1200: NikitasNikitakos** *"Using Artificial Intelligence (AI) methods to combat climate change at marine ports"*
12:30	Lunch	

	Session 5 (A)	Session 5 (B)
13:30 – 15:00	**New Trends in Maritime Transport & Job Opportunities** ***Chair**: Dr. Shuhong Chai (online)* ***Co-Chair**: Dr. Ahmed AL Kassar*	**Marine Pollution, Climate Change & Renewable Energy New Challenges** ***Chair**: Dr. Gamal Ghalwash* ***Co-Chair**: Dr. Yasser Gaber*
	1330: Michael Baldauf (online) *"Navigational Alarms and Warnings to Support VTS Operation"* **1400: Natalia Nikolova and Kiril Tenekedjiev (online)** *"Novel Shipping Competitiveness Index Using Ordered Weighted Average Operator"* **1430: Ahmed Swidan** *"Towards Enhancing Maritime Asset Management Value Through Transforming Maritime Expert Knowledge into Machine Learning Models"*	**1330: Riina Palu (online)** *"Limitations and Opportunities for Wave Energy Utilization in the Baltic Sea: the case-study of Estonia"* **1400: Sheeja Janaradhanan (online)** *"Mathematical Modeling and Design of a Barrel Cam Based Transmission Mechanism for Uninterrupted Energy Harnessing from Vortices"* **1430: Loay Aboud** *"Zero Emissions Ferries Utilizing PV/ Shore Connection Hybrid Power System"*
15:00	Coffee Break + Poster Presentations	
15:30 – 17:00	**Session 6 (IAMUC + IAMUS)** **Main Hall**	
	GMP Applications & Human Capacity Building in Maritime Affairs ***Chair**: Prof. Takeshi Nakazawa* ***Co-Chair**: Capt. Mahmoud Al Bawab*	
	1530: Vladimir Loginovsky (online) *"Global Maritime Professional: University Course of Risk Assessment - Case Study of Cadets Academic Performance Based on Bloom's Taxonomy"* **1600: Graham Benton** *"The Application of The Global Maritime Professional Framework on An MET Program: A Case Study"* **1630: Mohamed Rowihil** *"Sustainable Development in Maritime Education and Training (SDIMET) Towards Global Maritime Professionals (GMP) Development"*	
17:00	Coffee Break + Posters Presentation	
17:30 – 18:00	**IAMUC Closing Ceremony** **Prof. Dr. Ismail Abdel Ghafar Ismail Farag** **Prof. Dr. Takeshi Nakazawa** **Prof. Dr. Glenn Blackwood**	
20:30 – 22:30	Gala Dinner	

Poster Presentations

1 Impact of Infectious Pandemic Disease is on the Future of the International Maritime Industry "What is after COVID 19"

- A Study on Impact of International Container Vessels during and post Pandemic
  M. Sekar
- Identification of Maritime Education and Training Institutions (METIS) Risk in Pandemic Restrictions
  Yasser B. A. Farag, Osman Turan, Rafet Emek Kurt, Amr M. Ibrahim, and Dhruva Kumar
- The Effect of Covid-19 on Coastal Shipping in Mediterranean and Black Sea
  Ismail Bilge Cetin, and Donald Maier
- What is after Covid-19? : Changing Economies of the Shipping Industries and Maritime Education Institutions
  G. Thiruvasagam, and R. Vettriselvan

2 GMP Applications and Human Capacity Building in Maritime Affairs

- Methodological Basis for Training Cadets/Professionals and Developing the Risks Management System in Maritime Shipping and Industrial Fishery
  Moiseenko Sergey, Meyler Leonid, and Gruntov Alexander
- Prediction of the Potential Human Errors Probability of Critical Safety Tasks
  Sameh K Rashed, and Hesham M. Helal

3 Smart Maritime Supply Chain and Logistics

4 Innovative MET Environment

- Behind the Scenes – Educating to Work as Done or Work as Imagined
  Signe Jensen
- Comparative analysis for State-of-the-Art Simulation Training Systems Those Influence onto the Future Engineers' Knowledge and Skills
  Yurii Bohdan, Iryna Bohomolova, Anatoliy Satulov, Serhii Voloshynov, and Volodymyr Savchuk
- ECDIS EHO: Handling the ECDIS Failure at Sea
  Miho Kristić, Srđan Žuškin, David Brčić, and Maro Car
- Intelligent Support of the User of the E-Navigation Marine Ergatic System
  Anatoliy Popov, Irina Makashina, and Alexey Kondratiev
- Interdisciplinary Development of Maritime Education and Training Orienting to Career Planning in the Era of Artificial Intelligence
  Ruolan Zhang, Weifeng Xu, and Lingfengli
- Prometheas Project - Mental Health Data Research Hub for Seafarers
  Reza Ziarati, Heikki Koivisto, Tomaž Gregorič, Germánde Melo Rodríguez, and Aris Chronopoulos
- Redefined Definition of the STCW Competences
  Ana Gundić, Srđan Vujičić, Livia Maglić, and Damir Zec
- The Evaluation of Professional Practice in Maritime Education: A Case Study at Faculty of Maritime Studies in the Republic of Croatia
  Valentina Šutalo, Livia Maglić, Perić Hadžić, and Lovro Maglić
- The Factors Affecting the MET Instructors' Efficiency
  Srđan Vujičić, Nermin Hasanspahić, Gundić, and Lovro Maglić
- The Use of Blended Learning Approach to Improve the Students' Academic Performance in Meteorology and Oceanography 1
  Mary Jean
- Towards Introducing Knowledge Management Concept to Maritime Education & Training
  Amr Moneer Ibrahim, Saleh Mesbah Elkaffas, and Hesham M. Helal

5 New Trends in Maritime Transport and Job Opportunities

- Big Data Management in the Shipping Industry: Examining Strengths VS Weaknesses and Highlighting Relevant Business Opportunities
  Dimitrios Dalaklis, Georgios Vaitsos, Nikitas Nikitakos, Dimitrios Papachristos, Angelos Dalaklis, and Esslam Hassan
- Cyber Security Analysis of Maritime Surveillance Systems
  Nedko Dimitrov, Chavdar Alexandrov, and Milen Todorov
- Leadership Capabilities for a Maritime University in the 21st Century
  Martin Crees-Morris, Natalia Nikolova, Marcus Bowles, and Kiril Tenekedjiev
- Ship board ECDIS : Cyber Security challenges
  Boris Svilicic, Sam Pecota, Jeric Bacasdoon, and Ahmed Khalil Barghash
- The Journey towards Autonomous Ships and the Role of Seafarers in the Future: A Bibliographical Perspective
  Ivan Nikolov, Ilknur Colmorn, Christoph Hluchy, Rodrigo Garcia-Bernal, and Ivan De Carvahod
- The New Trend of Maritime Transport, and Job Opportunities
  Dacosta Essel and Zhihong Jin

6 Efficiency of Shipping Port Management from Environmental Perspectives

- Applicability of International Law in Development of Sustainable Port Policy: An Analysis of Good Practices and Future Policy of Gwadar Port
  MJahanzeb Butt, Khadija Zulfiqar, and Yen Chiang Chang

7 Renewable Energy Resources Alternatives in Maritime Industry

- A Triboelectric-Electromagnetic Hybrid Generator for Wave Energy Harvesting
  Yawei Wang, Yan Wang, Hao Wang, and Minyi Xu

8 Marine Pollution and Climate Change New Challenges

- Design of Structure and Control System of an Underwater Vehicle for Marine Environment Perception
  Tingyu Wang, Jianhua Liu, Peng Xu, Jiaxi Zheng, and Minyi Xu
- Safe and Environment-Friendly Approach to Recycling of Tanker Ship
  Yogesh C. Shah

Technical Instructions

Oral Presentation Guidelines

- Oral presentation slots have 30 minutes (20 minutes presentation + 10 minutes discussion).
- Session Chairs will strictly demand time to allow members of the audience to switch sessions between presentations.
- All session rooms are equipped with LED Screens, a 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.
- Please bring your presentation on a USB storage device and report to the Session Chair indicated in IAMUC Program 15 minutes before the start of the Session.
- For Online Oral Presentations:
    - Please make sure to have a good stable connection during your live presentation.
    - ***Zoom Webinar*** is the application used for the conference sessions.
    - You will login as a panelist only via the link that has your session's name or number.
    - Please make sure to stay online even after your presentation to participate in the discussion at the end of your session.
    - Please make sure not to share the link (with your session name or number) received on your email as it is intended only for you as a panelist.

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 to answer any question.

• Posters should be designed to be presented vertically on X-Banners (1800 x 800 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 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.

• Posters will be printed and placed in their allocated place by the Conference organizers well in advance, using X-Banner ready-made rollups. Authors are free to take their posters after the conference closing ceremony at 18:30 on Wednesday (27 October), For any help regarding this matter please contact the registration desk.

Name Badge

All attendees must wear the name badge 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.

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Session Quick Index

1	Impact of Infectious Pandemic Disease on the Future of the International Maritime Industry "What is after COVID-19".	20
2	GMP Applications and Human Capacity Building in Maritime Affairs.	35
3	Smart Maritime Supply Chain and Logistics.	43
4	Innovative MET Environment.	48
5	New Trends in Maritime Transport and Job Opportunities.	73
6	Efficiency of Shipping Port Management from Environmental Perspectives.	87
7	Renewable Energy Resources Alternatives in Maritime Industry.	89
8	Marine Pollution and Climate Change New Challenges.	95

Abstract's Contents

1 Impact of Infectious Pandemic Disease is on the Future of the International Maritime Industry "What is after COVID 19" 20

- A Study on Impact of International Container Vessels during and post Pandemic **21**
  M. Sekar
- Fast Recovery or Stagnation? The Maritime Industry post Covid-19 **23**
  Qi Chen, Amanda Pang, and Daniel Pang
- Identification of Maritime Education and Training Institutions (METIS) Risk in Pandemic Restrictions **25**
  Yasser B. A. Farag, Osman Turan, Rafet Emek Kurt, Amr M. Ibrahim, and Dhruva Kumar
- Impact Of Covid19 on Ports and Maritime Transport (Georgian Ports Response to Covid19) **26**
  George Gabedava, and Parmen Khvedelidze
- Life after Covid-19: Cruise Industry Rising from the Ashes **28**
  Karina Melikjanyan
- Remote Instruction: Challenges, Initiatives, and Future Directions for Maritime Education Institutions in a Developing Country **29**
  Emeliza T. Estimo, Roberto Neal, and S. Sobrejuanite
- The Covid-19 Pandemic and its Impact on the Maritime Sector in Croatia and the World **30**
  Rosanda Mulić, and Andrea Russo
- The Effect of Covid-19 on Coastal Shipping in Mediterranean and Black Sea **32**
  Ismail Bilge Cetin, and Donald Maier
- What is after Covid-19? : Changing Economies of the Shipping Industries and Maritime Education Institutions **33**
  G. Thiruvasagam, and R. Vettriselvan

2 GMP Applications and Human Capacity Building in Maritime Affairs 35

- Global Maritime Professional: University Course of Risk Assessment - Case Study of Cadets Academic Performance Based on Bloom's Taxonomy **36**
  Vladimir A. Loginovsky
- Marine Student's Information Literacy Skills- A Case Study of Marine Engineer's Bachelor Thesis at Chalmers University of Technology **38**
  Liza Nordfeldt, and Johan Eliasson Ljungklint
- Methodological Basis for Training Cadets/Professionals and Developing the Risks Management System in Maritime Shipping and Industrial Fishery **39**
  Moiseenko Sergey, Meyler Leonid, and Gruntov Alexander
- Prediction of the Potential Human Errors Probability of Critical Safety Tasks **40**
  Sameh K Rashed, and Hesham M. Helal
- Sustainable Development in Maritime Education and Training (SDiMET) Towards Global Maritime Professionals (GMP) Development **41**
  Angelica Morales Baylon, and Mohamed Rowihil
- The Application of the Global Maritime Professional Framework on an MET Program: A Case Study **42**
  Graham Benton

3 Smart Maritime Supply Chain and Logistics 43

- Is Outsourcing the Panacea? A Discourse on the Sustainability of Indian Ports A Case of Jawaharlal Nehru Port Trust **44**
  Toorban Mitra, and Krushna Mohan Pattanaik
- Maritime Surveillance in the Gulf of Suez: Identifying Opportunities for Future Improvements **45**
  Esslam Hassan, and Dimitrios Dalaklis
- The Impact of the Container Throughput of the Adriatic Gate Container Terminal at the Port of Rijeka on Air Quality Environmental Parameters **46**
  Siniša Vilke, Frane Tadić, and Ines Ostović

4 Innovative MET Environment 48

- Active Learning Strategies in Maritime English Training 49
  Valentyna Kudryavtseva, Svitlana Barsuk, and Olena Frolova
- Application of Augmented Reality (AR) / Virtual Reality (VR) Technology for Remote Maintenance of Autonomous Ships 51
  Sanjeev S. Vakil
- Behind the Scenes – Educating to Work as Done or Work as Imagined 52
  Signe Jensen
- Comparative analysis for State-of-the-Art Simulation Training Systems Those Influence onto the Future Engineers' Knowledge and Skills 54
  Yurii Bohdan, Iryna Bohomolova, Anatoliy Satulov, Serhii Voloshynov, and Volodymyr Savchuk
- Developing Outcomes-Based Model Courses Using Identified Evidence-Based Practices 56
  Paul S. Szwed, Radu Hanzu-Pazara, and Michael E. Manuel
- ECDIS EHO: Handling the ECDIS Failure at Sea 57
  Miho Kristić, Srđan Žuškin, David Brčić, and Maro Car
- Innovative Teaching Method for Shiphandling – Element of Project "Euro Za" between South Africa and Europe – 58
  Knud Benedict, Michèle Schaub, Michael Baldauf, Michael Gluch, Matthias Kirchhoff, and Caspar Krüger
- Intelligent Support of the User of the E-Navigation Marine Ergatic System 59
  Anatoliy Popov, Irina Makashina, and Alexey Kondratiev
- Interdisciplinary Development of Maritime Education and Training Orienting to Career Planning in the Era of Artificial Intelligence 60
  Ruolan Zhang, Weifeng Xu, and Lingfeng Li
- Measuring Situation Awareness in Engine Control Operation 61
  Adi Mas Nizar, Takashi Miwa, and Makoto Uchida
- Prometheas Project - Mental Health Data Research Hub for Seafarers 62
  Reza Ziarati, Heikki Koivisto, Tomaž Gregorič, Germánde Melo Rodríguez, and Aris Chronopoulos
- Redefined Definition of the STCW Competences 63
  Ana Gundić, Srđan Vujičić, Livia Maglić, and Damir Zec
- Sustainable Development Processes of Education Technologies - A Multiple Case Study 64
  Bolmsten Johan, Kasepold Kadi, Kaizer Adam, Ziemska Monika, Heering Dan, Alop Anatoli, Chesnokova Marina, and Olena Sienko
- The Evaluation of Professional Practice in Maritime Education: A Case Study at Faculty of Maritime Studies in the Republic of Croatia 65
  Valentina Šutalo, Livia Maglić, Perić Hadžić, and Lovro Maglić
- The Factors Affecting the MET Instructors' Efficiency 66
  Srđan Vujičić, Nermin Hasanspahić, Ana Gundić, and Lovro Maglić
- The Use of Blended Learning Approach to Improve the Students' Academic Performance in Meteorology and Oceanography 1 68
  Mary Jean
- Towards Improving SAR Search Patterns by Time-Minimal Paths 70
  Piotr Kopacz
- Towards Introducing Knowledge Management Concept to Maritime Education & Training 71
  Amr Moneer Ibrahim, Saleh Mesbah Elkaffas, and Hesham M. Helal

5 New Trends in Maritime Transport and Job Opportunities 73

- Automation of Framo Cargo Pump Purging withIoT 74
  R. Prasanna Kumar, and V Ajantha Devi
- Big Data Management in the Shipping Industry: Examining Strengths VS Weaknesses and Highlighting Relevant Business Opportunities 75
  Dimitrios Dalaklis, Georgios Vaitsos, Nikitas Nikitakos, Dimitrios Papachristos, Angelos Dalaklis, and Esslam Hassan
- Cyber Security Analysis of Maritime Surveillance Systems 76
  Nedko Dimitrov, Chavdar Alexandrov, and Milen Todorov

- Leadership Capabilities for a Maritime University in the 21st Century **77**
  Martin Crees-Morris, Natalia Nikolova, Marcus Bowles, and Kiril Tenekedjiev
- Navigational Alarms and Warnings to Support VTS Operation **78**
  Michael Baldauf, and Gianiti Claresta
- Novel Shipping Competitiveness Index Using Ordered Weighted Average Operator **79**
  Hong-Oanh Nguyen, Natalia Nikolova, Levashini Gunasegar, and Kiril Tenekedjiev
- Proposal for the Introduction of "Shore to Ship Alert System" **80**
  Daniel Isaac Edwin, Pengfei Zhang, Tushar L. Potey, and Shenhua Yang
- Shipboard ECDIS: Cyber Security Challenges **81**
  Boris Svilicic, Sam Pecota, Jeric Bacasdoon, and Ahmed khalil Barghash
- The Interrelationship Between Coastal, Great Lakes, Inland, and Deep- Sea Freight Rates: A Longitudinal Approach **83**
  Joshua Shackman, and Margaret Ward
- The Journey towards Autonomous Ships and the Role of Seafarers in the Future: A Bibliographical Perspective **84**
  Ivan Nikolov, Ilknur Colmorn, Christoph Hluchy, Rodrigo Garcia-Bernal, and Ivan De Carvahod
- The New Trend of Maritime Transport, and Job Opportunities **85**
  Dacosta Essel and Zhihong Jin
- Towards Enhancing Maritime Asset Management Value Through Transforming Maritime Expert Knowledge into Machine Learning Models **87**
  Mohammad S. Abbas, and Ahmed A. Swidan

6 Efficiency of Shipping Port Management from Environmental Perspectives 88

- Applicability of International Law in Development of Sustainable Port Policy: An Analysis of Good Practices and Future Policy of Gwadar Port **89**
  M Jahanzeb Butt, Khadija Zulfiqar, and Yen Chiang Chang

7 Renewable Energy Resources Alternatives in Maritime Industry 90

- A Triboelectric-Electromagnetic Hybrid Generator for Wave Energy Harvesting **91**
  Yawei Wang, Yan Wang, Hao Wang, and Minyi Xu
- Limitations and Opportunities for Wave Energy Utilization in the Baltic Sea: The Case-Study of Estonia **92**
  Nikon Vidjajev, Riina Palu, Jan Terentjev, and Tõnis Hunt
- Mathematical Modeling and Design of a Barrel Cam Based Transmission Mechanism for Uninterrupted Energy Harnessing from Vortices **94**
  Vidya Chandran, Sheeja Janardhanan, Gijo George Netticadan, Ajay S Kumar, Anand Rajeev, Ashwin T, and Dean vucinic
- Zero Emissions Ferries Utilizing PV/ Shore Connection Hybrid Power System **95**
  Loay Aboud, Omar M. Massoud, and Adel A. Tawfik

8 Marine Pollution and Climate Change New Challenges 96

- Analysis of Marine Diesel Engine Emission Characteristics Under Bench Test Conditions in China **97**
  Zhongmin Ma, Peiting Sun, Shulin Duan, Hui Xing, Hongfei Qu, and Kai Wang
- Design of Structure and Control System of an Underwater Vehicle for Marine Environment Perception **98**
  Tingyu Wang, Jianhua Liu, Peng Xu, Jiaxi Zheng, and Minyi Xu
- Safe and Environment-Friendly Approach to Recycling of Tanker Ship **99**
  Yogesh C. Shah
- Towards Zero Ship Emissions II – Project Greenship **101**
  German De Melo, Reza Ziarati, and Heikki Koivisto
- Using Artificial Intelligence (AI) Methods to Combat Climate Change at Marine Ports **103**
  Pavel Kovalishin, Nikitas Nikitakos, Boris Svilicic, Jinnan Zhang, Andrey Nikishin, and Maksim Kharitonov

Abstracts

Impact of Infectious Pandemic Disease is on The Future of The International Maritime Industry "What is After COVID 19"

A Study on Impact of International Container Vessels during and Post Pandemic

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Abstract

The international trade is totally relying on shipping, more than 90% of the international trade is dependent on shipping. The dependence of shipping in the international trade is due to its low-cost transportation. The container ships are more popular in the international trade, as the containers are easy to handle at ports, reducing the turnaround time for ship, reducing the dwell time of cargo, containerization provides better security for the cargo, also used in multimodal and intermodal transportation and also facilitating liner trade.

The outbreak of COVID virus has put the entire world shipping industry in mess, causing great havoc to all economies. This paper analysis the impact of COVID on the traffic of international container vessels and also, how the impact has affected the growth of world container port throughput. If the world container port throughput is affected, then the traffic of container vessels is also affected. The traffic of the world container port throughput is linked with number of container ships around the globe and with container ships in dead weight. The Study is analysed, with 10 years' data (2011-2020) taken from secondary sources. The data is analysed using DEA-Efficient Frontier. The efficient frontier signifies an efficiency mark in the entire set of decision-making units (DMU). Each year is considered as a decision-making unit, to find out the efficiency year-on-year, in the first model comparison was made keeping world container port throughput as output (O) and number of ships globally is assigned as input (I). In the second model efficiency was compared with world container port throughput as output (O) and container ships dead weight as input (I). The Relative efficiency is also calculated, that is, by dividing efficiency of DMU's by the best efficient DMU. Before applying DEA, it is ascertained that the world container port throughput is correlated with number of container ships around the globe and similarly world container port throughput is correlated with container ships in dead weight. To study the impact of growth of world container port throughput, compound annual growth rate (CAGR) is calculated on a year-on-year basis. The traffic of the world container port throughput has declined in 2020, the efficiency and the relative efficiency calculated also shows a downward trend. The compound annual growth rate also shows a negative growth in 2020. This reflects that the world container port throughput

has declined in 2020, which means the traffic of container vessels throughout the word has suffered enormously, essentially due to the impact of COVID virus.

Key Words: Container Vessels, Container Port Throughput, COVID, Data Envelopment Analysis

Fast Recovery or Stagnation? The Maritime Industry post COVID-19

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Abstract

Since the outbreak of COVID-19 in February 2020, the global maritime trade plunged by 9% in H1 2020, an unprecedented loss since the trade decrease triggered by the 2008 Financial Crisis. In addition to the disruptions of supply chains and decline of transportation sectors brought on by the pandemic, surging nationalism and protectionism, the retreat of globalization, and calls for more diversified global value chains and decoupling of economies have heightened the adverse impacts on survival and sustainable growth of the shipping industry. As a result, many people have adopted a more pessimistic view, and predicted that "the short-term outlook for maritime trade is grim, and that the industry's recovery is fraught with uncertainty," according to one UNCTAD report. Some even proclaimed to "wave goodbye to the greatest era of globalization," wrote The Economist in May of 2020.

This article argues that the maritime industry will have a strong and speedy recovery from the downturns despite transportation disruptions brought on by COVID-19, outcry for diversification of supply chains, and changes escalated and exacerbated by nationalist sentiments and protectionist conflicts. The adverse factors that the shipping industry faces would be marginal rather than fundamental in nature. Those marginally higher risks could be managed and ameliorated by multinational enterprises through alternate cross-border business strategies and harnessing of new technologies. Panic over the changes in supply chains (including nearshoring and reshoring) and diversifying production sites could be mitigated by emerging profitability earned from global specialization, rent-seeking strategies, and orchestrating a transformation in global value chains.

Most importantly, pandemic-driven fears that globalization could be “killed” will be minimized when actual data shows just the opposite - that globalization is expanding.

The paper also analyzes the elements that could strengthen the fast recovery and sustainable growth of the maritime industry. The vertical and horizontal integrations of maritime companies, especially the massive multinational enterprises, show their vast capacity in the cross-border movements of ideas, technology and portfolio capital, and consequently would help build up global production scale of economies and global amortization. Emerging technologies and their increasingly commonplace applications in digitalization, automation and robotics in maritime sectors, is crucial to sustaining both short-term productivity and long-term growth of the maritime industry.

The research provides evidence for why the maritime industry is poised for an expeditious post-pandemic recovery and seeks to answer many puzzling questions while our world still operates under globally disruptive and unprecedented pressures associated with the COVID-19 pandemic.

Keywords: Maritime industry, COVID-19, International trade, globalization

Identification of Maritime Education and Training Institutions (METIs) risk in pandemic restrictions

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The unprecedented COVID-19 crisis apparently has questioned our systems' survivability nationally or even in a global context. The pandemic has proven the indispensable role of international shipping in our societies' sustainability. Still, one of the main challenges for the shipping industry is to secure the supply of competent seafarers. Typically, Maritime Education and Training Institutions' (METIs') core mission revolves around keeping such demand supplied, however in restrictive situations, METIs' capability to achieve their mission is still questionable. During the pandemic restrictions, METIs are likely exposed to many uncertainties that directly threaten their role and may lead to hazardous consequences. In such scenarios, many questions arise to challenge whether the institution/organizational levels of control are sufficient or additional barriers to keep the risk as low as reasonably practicable are needed.

Consequently, this research investigates the possible threats exposed to METIs under such conditions, the potential consequences if they lose control of their operations, and the required barriers to prevent, detect, or protect the METIs from such a failure. To achieve this aim, a survey was designed to capture the expertise of a group of Maritime Education and Training (MET) experts. The survey responses have been quantified and statistically analysed to comprehensively identify these risk factors, their contribution, and their effectiveness.

Keywords: Risk Modelling, Risk Analysis, Crisis Management, Bowtie, Maritime Safety, Maritime Education and Training

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Impact of COVID19 on Ports and Maritime Transport (Georgian Ports Response to COVID19)

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Abstract

The importance of maritime transport and ports to international trade and the world economy is invaluable. It is maritime transport and seaports that ensure the integrity of the supply chain, which ensures the success of world trade and economic activities. The importance of maritime transport is confirmed by the fact that 80% of the transported goods come from maritime transport. Consequently, maintaining a sustainable supply chain is a guarantee of sustainable development in the world.

However, the new coronavirus (COVID19) changed the world and affected the civilized world, causing a crisis and having a very large impact on maritime transport and trade. The impact of the pandemic on maritime transport has challenged various industries whose operation and production depended on the production of raw materials, the processing of semi-finished products and more. Restrictions introduced to prevent the spread of the pandemic have led to the closure of ports, reduced working hours and manpower in ports, and freight-forwarding opportunities. Countries also avoided the spread of COVID-19, and therefore refrained from importing and exporting products and goods during the quarantine period, which led to a decrease in import-export, which in turn reduced demand for cargo. In some cases, due to the imposed restrictions, the transportation time was increased and it became impossible to transport goods with a specific nature. It was these restrictions that led to the slowdown in trade flows and supply chain operations. It was difficult to navigate and trade in different regions. Despite so many difficulties, restrictions, and the impact of the pandemic, maritime transport and seaports continued to operate to ensure the delivery of personalized goods to countries, such as: food, energy, raw materials, medicines and medical supplies.

We think that this topic is very important, it needs to be well researched and analyzed, because if we understand what impact the pandemic has had on maritime transport and ports, we will be able to quickly and easily lay out ways to respond to challenges and get the industry back to normal. The spread of the coronavirus has once again confirmed that the backbone of international trade is precisely maritime transport. Georgian ports are a good example of this.

This article discusses the impact of the new pandemic on maritime transport and ports, as well as the impacts identified and solutions found. The article analyzes for example the cargo turnover of Georgian ports during the pandemic. Based on the discussion and analysis of each of the above issues, conclusions are drawn.

Keywords: Ports; Maritime Transport; Pandemic; Impact; Results

LIFE AFTER COVID-19. CRUISE INDUSTRY RISING FROM THE ASHES

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Keywords: cruise industry, cruise tourism, pandemic, covid-19

After catastrophic waves of coronavirus disease that dramatically slammed world's economy, cruise industry appeared to be one of the most affected businesses [1] (Theodore Syriopoulos, 2020) Cruises had thrived for years: 55 ((CLIA), 2021) cruise lines, 400 executive partners, 53 000 travel agent members, 280 ships, $150 billion output business, 1,177,000 jobs and $50.24 billion in wages/salaries. [2] (CLIA, 2020) Though since 2020, the year that Adam Goldstein (Chairman of Cruise Lines International Association – CLIA) has called "a year unlike any other," almost all the cruise ships have dropped anchor. Relatively old ships were sold off or scrapped. Starting from the March 2020 three core cruise lines (Royal Caribbean, Carnival Corporation and Norwegian Cruise Lines) had experienced 60-80% drops in stock prices of their companies. (Team, 2020) [3] The cruise industry losses account for billions $.

However, every cloud has a silver lining. While much of the world had been stuck since the March 2020, the cruise industry was not wasting the time and has started adjusting to new requirements. According to CLIA report 2021 cruise lines are coming back equipped with "fleet of the future" (20 ships to debut in 2021), enhanced protocols, new onboard digital technologies, responsible tourism trend, cutting-edge maritime environmental technologies and record demand for 2023. The sector demonstrates incredible resilience and optimism supported by official numbers. ((CLIA), 2021) [4]

The paper reviews current situation of the global cruise industry and focuses on the steps already taken by cruise lines executives worldwide to overcome pandemic reality and those to be taken to optimize current situation and benefit from the post covid-19 rehabilitation processes.

The analysis is based on a desk research method, using official resources: reports, market analysis, expert opinions, press releases, previous studies and industry journals. The findings show specificities, future challenges and forecast of most possible ways for the sector development.

REMOTE INSTRUCTION: CHALLENGES, INITIATIVES, AND FUTURE DIRECTIONS FOR MARITIME EDUCATION INSTITUTIONS IN A DEVELOPING COUNTRY

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ABSTRACT

The COVID-19 pandemic has caused a shift in pedagogy that has affected the operations of maritime education and training institutions (METIs), the instructors, and the students. This study sheds light on the following topics: (1) Challenges faced by instructors, students, and METIs in implementing remote instruction, (2) METI initiatives to cope with and address these challenges, and (3) Future directions for METIs for effective delivery of remote instruction. Data were collected through a survey and structured interview with 105 instructors, 804 students, and five administrative officers of METIs. Frequency count and percentage were used to analyze the numerical data, while thematic analysis was employed in organizing data from open-ended questions. The results revealed that most of the challenges experienced during the transition from face-to-face to remote mode of instruction stemmed from the "far-from-advanced" technological resources and difficulty in coping with the sudden shift in the METIs' operations, and the instructors' and the students' new academic routines that have affected their physical, mental, and emotional state. Initiatives focused on the academic, financial, human, and technological resources were implemented to cope with the sudden change. Future directions in MET are set on Strengthening IT/Technological Infrastructure, Capitalizing on IT and Research and Development, Academic Calibration for a More Relevant and Responsive Maritime Education and Training, Advancing Instructors' Technical Capacities, Strengthening Parental Engagement, and Building Wider Alliances and External Partnerships.

Keywords: Remote Instruction, Maritime Institutions, Maritime Education and Training, Institutional Initiatives, COVID-19

THE COVID-19 PANDEMIC AND ITS IMPACT ON THE MARITIME SECTOR IN CROATIA AND THE WORLD

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Abstract

The mere fact that more than 90% of global trade is performed by maritime shipping confirms the importance of the maritime industry in the world. During the current Covid-19 pandemic, seafarers still face the risk and mobility obstacles that pose a threat to their existence, and consequently to their physical and mental health. The well-functioning seaborne trade is extremely important for the internal and international markets as it enables delivery of goods worldwide.

However, many seafarers on board cargo vessels sailing across European waters are the third country nationals. Regardless of their citizenship, they should be able to easily travel to ports of embarkation/disembarkation and to return home because this, in addition to other effects, would contribute to mid-term and long-term efficiency of the maritime industry.

In Croatia, there are approximately 20,000 seafarers, 15,184 of whom take part in international and the rest in national navigation. According to the Croatian Ministry of Maritime Affairs, Transport and Infrastructure, the estimated number of seafarers (20,000) makes up merely 0.47% of the total population (4,290,612 according to the 2011 Census), which means that four or five out of a thousand people in Croatia are seafarers. Seafarers make up the same share (0.47%) of the general population in the Philippines, which is considered to be “the land of seafarers”.

The absolute number of Croatian seafarers is not large, but when compared to the population of the country it can be noted that Croatia is one of the countries with the highest incidence of seafaring profession worldwide.

In addition to seafaring, tourism also has an important share in Croatia's GDP, which includes cruise tourism, a branch closely related to the maritime sector.

Both branches of the economy have been heavily hit by the current Covid-19 pandemic. Repatriation and embarkation have become more difficult due to the pandemic. As a result, seafarers remain stuck on board for months following their contract expiry, awaiting possible return home, which is a serious threat to their mental and physical health.

A partial solution to these problems lies in awarding seafarers the key/priority worker status and in implementing priority seafarer vaccination against Covid-19 at the global level.

Key words: seafaring, Covid-19 pandemic, crisis, seaborne trade

THE EFFECT OF COVID-19 ON COASTAL SHIPPING IN MEDITERRANEAN AND BLACK SEA

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Abstract

The aim of this study is to analyze the effect of the COVID-19 pandemic on coastal shipping in the Mediterranean and Black Sea with emphasis on short sea bulk and general cargoes. Semi-structured interviews were with shipowners, and shipbrokers to enhance the qualitiative methodology and to gather more detailed responses. The result of the study shows that in the first quarter of 2020 shipowners and charterers signficantly reduced sailing with some ceasing operations altogether, due to the efect of COVID – 19. Trade stopped, factories shut down, ports slowed down and yet port congestion still occured. Shipyards and scrapyards also faced similar reduction in operations. Freight rates declined to new record lows (for a brief period of time) causing some shipowners to lay-up vessels. Crew change problems were faced and still continuing creatign more disruption in managing the human element of the maritime industry. By the third-quarter of 2020, as demand for raw materials and finished good inventories increased, so did the demand for charters. Fortunately for charterers, the increase in demand also caused an increase in freight rates.

Key words: COVID-19, Coastal shipping, Mediterranean, Black Sea

WHAT IS AFTER COVID-19? : CHANGING ECONOMIES OF THE SHIPPING INDUSTRIES AND MARITIME EDUCATION INSTITUTIONS

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Abstract

Most of the people in the world are struggling to ensure their presence and livelihood activities during this pandemic period. Achieving the third Sustainable Development Goal: "Ensure Healthy Lives and promote Well-being for all at all ages" since the end of 2019 is a big question mark to most of the economies. The first Case of Covid-19 was found in China during the mid of November 2019, still now there is no proper medicine and vaccine were found to cure fully. The vaccination availed after one year also not resulting 100% and the modern medicine there is no satisfactory effective therapy available to cure the Covid-19 infection due to the less genetic information regarding the mutation of this virus. World Health Organization suggested to implement Lock downs to handle this pandemic. Upto the end of first month of this decade more than 100 million people were infected and more than 2 million people were lost their lives. This pandemic severely affected most economic sectors of the world without any partiality. This attempt was made to analyze the impact of Covid-19 pandemic on the Maritime Education sector and Shipping Industry. For the study purpose detailed survey was conducted among the Maritime students, educators, sailors and practitioners in the different parts of the world. Collection of qualitative data for this study is quite difficult due to pandemic. So present study adopts descriptive cum analytical research design was adopted for the study. Totally 1094 respondents of the 16 countries were approached for the study purpose and received the responses from 857 respondents were responded to the survey and results were documented here to understand the future of the Maritime industry. The results of the study are interesting and highlighted the present mentality and economic status of mariners and future of the students. Mariners reported that they have less sailing opportunities compared to the past. Many of the respondents were worried that this economic slowdown due to pandemic had a huge impact on the industry is terms of less Liner schedules and reduced employment opportunities and poor practical

exposure. Maritime Students highlighted that they were unable to get the practical exposures to meet out the challenges and virtual education system gave less chances to learn the practical aspects. Maritime educators pointed that less interaction between the students resulted in terms of adverse results. Meanwhile few of them responded that this pandemic helps them in terms of increased business growth in absence of Air Cargos. This study suggests that both public and private sector should take initiatives to meet out the challenges of this changes in the Maritime sector. Maritime Education institutions have to revise their mandatory policies to meet out the changing trends in education sector. It concludes that both positive and negative aspects of this pandemic resulted the tremendous changes in the Maritime sector hugely in reduced possibilities in the economies of the maritime business ventures. Further, this study suggests future researchers to carry out the segment specific both qualitative and analytical studies to handle the pandemic situation to effectively meet out the needs of the sector for the sustainability.

Keywords: Covid-19, Maritime Education, Mariners, Shipping industry.

Abstracts

GMP Applications and Human Capacity Building in Maritime Affairs

GLOBAL MARITIME PROFESSIONAL: UNIVERSITY COURSE OF RISK ASSESSMENT - CASE STUDY OF CADETS ACADEMIC PERFORMANCE BASED ON BLOOM'S TAXONOMY

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Abstract

The International Association of Maritime Universities (IAMU) in 2019 submitted to IMO its publication under the title of «Global Maritime Professional: Body of Knowledge» [1], which proposes the implementation of structured approach to education and training of seafarers based on well-known Bloom's taxonomy. There is no doubt that the term Global Maritime Professional (GMP), which by its meaning is a powerful social, political and academic driver, gives the great cumulative significance and sense for developing the profession of seafarer.

Along with the rapid changing in industry, new trends and mainstreams, reflecting in development of new standards, new threats, hazards and risks appear that were not predictable before and to which seafarers must be professionally ready to respond adequately and sometimes immediately. All of this requires well timed management of changing in education and training process of seafarers based on research of up-to-date reality and trends to find the ways for development of new normal, keeping in line with such time-honored rule of seafarers as "safety first".

Risk Assessment is the core component of all STCW'78 standards intended to ensure safety at sea, against which prospective officers are to be trained and which should be implemented onboard as per ISM Code provisions. It is the basis for achieving the adequate level of situation awareness and decision making onboard ship in a lot of critical situations and the use of Bloom's taxonomy can be one of the keys to make the educational course of Risk Assessment more effective.

The paper presents some case study preliminary findings of cadet academic performance in perception and mastering the university course of “Risk Assessment in Seafaring” (RAS) delivered at the Faculty of Navigation and Communication of AMSU-MIS.

The study identifies difficulties cadets face in the process of learning the RAS course to follow each Bloom's level. It also outlines the relationship among Bloom’s levels in cognitive domain and steps of hazard analysis SWIFT, «Structured What If Technique» [2-3] used for risk assessment and gives recommendations for improvement the course.

Keywords: safety, risk assessment in seafaring, Bloom’s taxonomy.

Marine student's information literacy skills- a case study of marine engineer's bachelor thesis at Chalmers University of Technology

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Abstract

What do the marine engineer students remember from their library instruction sessions in information literacy (IL) when it is time for them to write their bachelor thesis? The need for IL in the education is important due to the students coming work life. The skills to be an engineer are so much more than just technical knowledge. To state this, we have worked with integrated learning sequences and development due to the Conceive Design Implement Operate (CDIO) concept. Within in this specific subject we will highlight the need of writing and IL. CDIO main goals can be closely connected to IL especially about how to lead the operation of processes and understand research impact and development of the society (Crawley et al., 2014).

During the autumn semester in 2017 we asked the marine engineers to fill in a one-minute paper to reflect over the library lecture. In the spring of 2021, the students wrote their bachelor thesis and we wanted to look at how much they remember from their previous lecture. With a short survey after they finished their theses we wanted to find out if they had used their information literacy skills during these years as students.

Keywords information literacy, active learning, marine engineers, CDIO

Methodological Basis for Training Cadets/Professionals and Developing the Risks Management System in Maritime Shipping and Industrial Fishery

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Abstract

Activity in the field of the industrial fishery is associated with risks determined by the state of the environment. In this regard the development of methodological approaches to the design of risk management systems in industrial fishery is relevant. The paper presents an approach to develop a concept of the risk management system for industrial fishery including catching biological resources of the World Ocean and transportation of raw materials. The suggested concept consists of four stages. The paper presents a structure of the adaptive processing model of risk management. This model reflects the processes and their relationships by means of which the risk management is carried out. The formation of the risk management system structure can be realized in three variants. The paper demonstrates an example of such an organizational structure (the state structure of the Russian Federation).

Keywords: Risk management, Industrial fishery, Shipping, Training, Methodology

Prediction of the Potential Human Errors Probability of Critical Safety Tasks

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Abstract

Safety operations onboard ships and onshore terminals in hazardous processes required the human element to be aware of the operational risks. Since the concept of human error has exposed ample arguments. An overview of the human element's failure is essential because the major provenance of accidents is human errors even there are many conventions and codes to reduce the petition errors. Human Reliability Assessment (HRA) techniques is a theoretical framework to assess human actions for predicting the potential human error probability (probability of failure) of a certain given task or operations' scenario. Accordingly, surveillance of the human performance through an operation "task steps and sub-steps" is vital. The Cognitive Reliability and Error Analysis Method (CREAM) tool is the second generation of HRA which offers a practical approach to both performance analysis and error prediction. CREAM essentially deals with the difficulties of human attention during an action control in the context of human organizational and technological issues under the impact of cognition (competence).

This paper reveals the importance of predicting human errors for keeping lives, by applying the HRA CREAM tool to critical safety tasks onboard ships (lifeboat drilling process). In addition to introducing a newly developed software based on CREAM tool "prospective phase" for monitoring the human performance during the task steps and sub-steps to enhance and expect the human failure points during the process by collecting the expert's opinions and utilizing the software then acquires the process quantitative and qualitative results.

Keywords: HRA – CREAM – CPCs – HEP.

Sustainable Development in Maritime Education and Training (SDiMET) Towards Global Maritime Professionals (GMP) Development

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ABSTRACT

Sustainable Development **(SD)** in Maritime Education and Training **(SDiMET**) can be seen as an innovative approach towards global maritime professionals (GMP) development. This IAMU funded study primarily reveals the perspectives of maritime representatives (i.e., presidents, administrative officers, leaders, and teachers) and maritime students on various areas of sustainability**.** The study looked into the conception and attitude towards **SD**, the awareness and commitment to **SD,** institutional measures to address **SD,** research and innovation of the Institution related to **SD,** and prioritization of **SD** in the maritime higher education institutions (MHEIs). A mixed-method approach to research was carried out with data obtained from the 73 institutional representatives and 405 students (from 31 IAMU members from 17 countries) involved in the study. Results suggest **SD** implementation in maritime higher educational institutions (MHEIs) are less than ideal and therefore needs improvement. Nevertheless, **SD** is of significant importance and has a place of high priority for MHEIs. However, barriers to the optimal implementation of **SD** principles in maritime higher educational institutions need to be strategically and committedly addressed**.** Using the **S-D-I-M-E-T** acronym for easy recall, MHEIS are encouraged to: **S**- Supervise campus by institutionalizing SD**; D**-Develop a team culture of Men and Women for sustainability roles; **I**- Incentivize or provide incentives to people's SD initiatives; **M**- Mix or integrate SD principles into disciplines, policies, procedures, curriculum, and practices ; **E**- Execute and **E**valuate sustainable initiatives & projects; and **T**-Train people for sustainability. The paper ends with conclusions and other recommended actions in navigating the future of MET for sustainability and GMP development.

Keywords: Global Maritime Professional (GMP), Maritime education and training (MET), Maritime higher education institutes (MHEI), Sustainable Development, Sustainable Development Goals (SDGs)

The Application of the Global Maritime Professional Framework on an MET Program: A Case Study

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Abstract

This paper delineates an attempt to apply the framework of the Global Maritime Professional (GMP) as it has been articulated in the *2019 Body of Knowledge* (BoK) to an existing program in order to asses that program, and also to test the navigability of the tables – to see what may be problematic, and to see how both the program and the BoK could be adapted to address the future needs of the maritime world. It was hypothesized that the Marine Transportation Program of CSUMA – embedded as it is within a very large American system of higher education with many externally-required provisions for general education and other knowledge acquisitions outside of maritime training – would align quite positively with the criteria and the levels of achievement stated in the BoK.

By describing the process of mapping an academic program onto the GMP framework it is hoped that such an endeavor will inform other institutions that are likewise engaged (or considering engagement) with this project. Furthermore, recommendations will be identified for improvement of the program under scrutiny, the mapping process, and, perhaps, the framework itself for continuous future improvement of the educational development of the maritime professional.

Keywords: Global Maritime Professional, Maritime Education and Training

Abstracts

Smart Maritime Supply Chain and Logistics

Is outsourcing the Panacea? A discourse on the sustainability of Indian Ports A case of Jawaharlal Nehru Port Trust

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Abstract: The discourse on sustainable transportation illuminates the fact that port competitiveness and efficiency gains are two major pillars of blue economy in a world which is much integrated than in the past. However, most literature on port efficiency measurement undermine the very eco system of a port. Port eco system is complex interconnected web of network which requires collaborative involvement of spate of stakeholders such as CFS, Agents, ICDs, Transportation companies, to mention a few. Understanding such network and their holistic potential impact on the efficiency of port performance is scarcely addressed in the context of larger dialogue on port efficiency. Such an analysis is paramount when deeper levels of economic integration and spatially competitive ports are considered to be co joint twins. Further, efficiency gains of ports have received much academic attention in view of total quality management which focuses on customer delight and thus customer retention. It is this regard; the present paper tries to make an infant endeavour in terms of measuring terminal efficiency with respect to the turnaround time which would include export cycle time and import cycle time of CFS (a potential outsourcing activity of a port). Such a step in efficiency measurement of ports is scanty in Indian scenario. A case of Jawaharlal Nehru Port Trust is referred as a case in point.

Maritime Surveillance in the Gulf of Suez: Identifying Opportunities for Future Improvements

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Abstract

The Gulf of Suez (GOS) is one of the most important waterways in the world. Furthermore, issues like maritime safety, avoidance of accidents and effective conduct of navigation, as well as protection of the marine environment in the GOS are always among the highest priorities of Egyptian legislators. As a result, maritime surveillance in the area under discussion is facilitated by a technologically advanced Vessel Traffic Management System (VTMS) that has been established by the competent authority as a cost-effective measure to reduce and mitigate risks in accordance with international standards and guidelines. The main aim of this paper is to discuss the status of the GOS VTMS and identify relevant opportunities for improvement.

This effort utilizes qualitative primary and secondary data. Primary data was collected by employing in-depth, semi-structured interviews; secondary data was sourced from relevant national legislations, IMO, IALA and UK hydrographic office publications. Thus, the distinctive features of the GOS VTMS along with its degree of compliance with international standards and guidelines have been closely examined for a comprehensive assessment. A conclusion standing out is that GOS' VTMS is a very powerful tool for a more efficient conduct of navigation, with a positive contribution on maritime safety and the protection of the marine environment; however, certain gaps that must be addressed in the near future were identified. A portfolio of the necessary recommendations on how to improve the system's overall performance are also provided.

KEYWORDS: Safety of navigation, Marine environment, Data integration, Vessel Traffic Services, IMO, IALA.

THE IMPACT OF THE CONTAINER THROUGHPUT OF THE ADRIATIC GATE CONTAINER TERMINAL AT THE PORT OF RIJEKA ON AIR QUALITY ENVIRONMENTAL PARAMETERS[1]

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Abstract

In this paper, the authors emphasize the increase in air pollution in the eastern part of the city of Rijeka caused by the increase of the container throughput of the container terminal at the Port of Rijeka (Adriatic Gate Container Terminal), i.e., the increase in the number of vessel arrivals, the increase in the number of trucks in arrivals/departures related to road deliver/dispatch of containers.

Since the Adriatic Sea is the deepest part recessed in the European mainland, it is logical that the northern Adriatic Sea provides the Central European countries the closest access to world seas through the Gulf of Trieste and the Gulf of Rijeka. The natural advantage of the Port of Rijeka is the fact that the Dinaric Mountain barrier is the lowest and narrowest on the transport route through the northern Adriatic Sea. The North Adriatic traffic flow is the shortest natural thus the most economical way Europe relates to the Mediterranean and, by sailing through the Suez Canal, with most of the countries in Asia, Africa and Australia.

Important transportation links from landlocked Central European countries to seaports on the Adriatic coast, i.e., the Port of Rijeka, intersect on the territory of Croatia, Slovenia and Italy with other important traffic flows which move from Western and Central Europe to South-eastern Europe and the Middle East. Considering Northern and Western European ports, sea distance from Far East ports and Northern Adriatic ports, i.e., the Port of Rijeka, is approximately 2 000 nautical miles shorter, resulting in a shorter voyage time up to ten days. As for land cargo traffic directions, main Central European industrial and commercial centres are closer to the North Adriatic region by 400-600 km.

[1] The paper is the result of research activities of the scientific project Connected Traffic implemented within CECOM for smart cities (CECOM – Center of Competence for smart cities, the city of Rijeka), funded by the EU ESIF fund, started in March 2020. and ends in March 2023.

This paper presents the geographical and traffic characteristics of the Port of Rijeka, analyzes the total container throughput and land transport to/from the Adriatic Gate Container Terminal at the Port of Rijeka. The air quality at the measuring station Rijeka 2 was also analyzed, where the parameters in five years were analyzed; nitrogen dioxide, sulfur dioxide, particulate matter (<10µm), carbon monoxide, particulate matter (<2.5µm) and ozone.

This paper aims to interpret the possible dependence between the increase in container throughput of the Port of Rijeka and air quality concerning the increased traffic of trucks, but also the port activities themselves. The expected results of this paper are manifested through an increase in container throughput in the past five years, increased flow of ships in the Port of Rijeka, a high share of shipping/delivery of containers by road transport and an increase in certain environmental parameters.

Keywords: air quality parameters, container terminal, environmental parameters, port of Rijeka.

Abstracts

Innovative MET Environment

ACTIVE LEARNING STRATEGIES IN MARITIME ENGLISH TRAINING

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Abstract

The aim of higher education has always been to equip graduates with a set of professional skills for a particular professional area. This is provided by a number of technical subjects which guide students in acquiring necessary knowledge and practicing essential skills. From such perspective, Maritime English occupies a special place in MET, as it combines knowledge of language itself, professional terminology and communication skills with knowledge of the profession itself. The process of Maritime English training is complex enough as it requires answers to the questions what should be trained, how to organize the process and evaluate the progress. It is a real challenge to integrate language learning activities with a profession-focused content into meaningful tasks, find and implement interdisciplinary content to trigger genuine communication. Students should be engaged into a real-life maritime scenario simulation, provided with an opportunity to apply a broader set of professional knowledge, understand, adapt, and create a new scenario in response to the investigated complex problem. The students are trained to think critically and transfer knowledge to the other situation, as well as develop career skills, such as ability to plan, prioritize and communicate in a decision-making process, demonstrate their leadership and teamwork.

To provide sustainable development and face challenges of the current pandemic situation, the educational system shall apply innovative approaches and technologies into the learning process. As the language teachers, our task is to organize a collaborative classroom environment and establish a process for asking questions and developing knowledge through students' cooperation and effective communication. Active learning as a key approach to teaching Maritime English aimed at customizing the educational process to the individuals' needs, encouraging students to reflect on and share responsibility for their progress and train

life-long learning strategies. It is implemented into everyday practice through embedding inquiry into the learning process, when students collaborate to create hypotheses, select information and investigate a driving question. The learning process has moved beyond the class and transformed into flipped classroom environment, where students drive their own learning, and teachers coach them to facilitate and personalize learning through developing individual playlists. It requires from teachers to adjust learning materials and training tasks to respond to students' needs and develop new generation course books as well as digital courses (e-learning) to provide a wide access to applicable resources and make learning feasible.

The article describes the ways how to apply active learning strategies in Maritime English training. The authors of the article share their experience of implementing active learning strategies to provide students with "good command of English in written and oral form" necessary to perform profession-oriented tasks and meet occupational requirements listed in the STCW Convention.

Keywords: communicative competence, active learning strategy, Maritime English course.

Application of Augmented Reality (AR) / Virtual Reality (VR) Technology for Remote Maintenance of Autonomous Ships

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Abstract

Autonomous ships are going to be the ships of the future. The operation and maintenance of Autonomous ships will be vastly different, requiring proper knowledge and understanding of many interrelated human and machine components. Today's skills would become obsolete for running Autonomous and remotely operated ships. Modern technology tools will need to be incorporated, so that the seafarers could be trained to use such tools and enhance their knowledge to help them operate ships from remote locations, and also improve the safety of the vessel as also the safety of lives of those few human beings who would be required to work onboard such vessels. Thus, the entire training will need to be revamped and various skills including Augmented Reality (AR) / Virtual Reality (VR) technology will need to be included in the curriculum and syllabus of Maritime Education and Training programs. Since there will be limited crew on board, it will be necessary to carry out trouble shooting and diagnosis of failure of machinery from remote locations and also plan the survey and repair of the machinery using AR technology. The future education experience can also be enhanced by using Augmented Reality (AR) / Virtual reality (VR) and such technologies like the HoloLens technology, which will make learning more effective through annotations and interaction by simulating various conditions that could be experienced on board a vessel. It would also help to simulate conditions which might not be safe and practically possible to be carried out on board a vessel. Such training could be carried out in shore- based establishments where various types of vessels operating under different environmental conditions could be replicated through simulation, thus, making training as effective, if not more effective, in comparison with the current training methods. In this paper an attempt is made to outline appropriate trouble-shooting procedures, machinery survey procedure from remote locations as also suitable training methods for training crew for autonomous ships of the future.

Key Words

Augmented Technology, Virtual Reality Technology, HoloLens Technology, Training, Curriculum.

Behind the scenes – Educating to work as done or work as imagined.

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Keywords: ISM-Code, Goffman's front stage/back stage behaviour, regulation, human factor, Work as Imagined vs Work as Done.

Abstract

The ISM-Code became mandatory in 1998 and with the adoption of the Code, meta-regulation was introduced into maritime regulation. The Code added a "triple loop" regulatory system, which means that shipping companies became forced to evaluate and report on their self-regulation strategies and document the effectiveness of these. The effectiveness of the ISM Code has been studied by several researchers. The point of departure for this paper is a research project that studies how the ISM Code influences practice on board and whether it is in accordance with the regulator's initial intentions. This study was conducted in the period from 2017 to 2020 and is based on case studies conducted in two Danish shipping companies. It showed that, despite intensified evaluation, reporting and auditing, there was a divergence between what was done in practice and what was documented. Observations disclosed *front stage/back stage* behaviour among the seafarers. This behaviour is regarded as a consequence of the discrepancy between requirements and resources. A newly published report from the World Maritime University describes this discrepancy as "*a culture of adjustment"*. Their study emphasises that it is common among seafarers to adjust records of work/rest hours to ensure compliance with regulations. This behaviour is also acknowledged by the companies involved in the current study. Comparing the seafarers' workload based on a planned maintenance system (PMS) and their watch schedules with the resources available, a gap was identified. Even though this problem is well-known, the companies often leave it to the master to bridge the gap between procedure (work as imagined) and reality (work as done). This research project concludes that this system, to a large extent, is supported by the existing system of governance and by the industry, which ignores reality and depends on paper trails. The question is whether we, as teachers in an educational institution, support this gap by our way of teaching. The students are taught to act the "right" way and follow the rules and procedures. The issue of the matter is that, on board a vessel, they will not always be able to follow the rules and procedures;

hence, they will be forced to adapt to each situation, a conflict that may result in *front stage/back stage* behaviour.

This paper will focus on whether *front stage/back stage* behaviour is supported by the training the master mariners are given based on narratives from a case study onboard a medium-sized tanker.

COMPARATIVE ANALYSIS FOR STATE-OF-THE-ART SIMULATION TRAINING SYSTEMS THOSE INFLUENCE ONTO THE FUTURE ENGINEERS' KNOWLEDGE AND SKILLS

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Abstract

Within the rapid changes of technologies and shipping digitalization, the requirements for specialists' proficiency have been constantly increasing which, in turn, demands for changes in the maritime education and training (MET). Having been discussed in great detail, this issue was examined in the context of utilizing virtual reality, augmented reality, mixed reality and e-learning applications specifically for MET [1-3]. However, this paper answers the question of possibility of Kherson State Maritime Academy (KSMA) marine engineer cadets' knowledge and skills formation being influenced by non-immersive 3D virtual reality (VR), immersive virtual reality (IVR) using a head-mounted display (HMD) simulation training system.

The role of VR simulation technologies from the point of competency-based learning and the voluntary experiments results of different methods of using simulation technologies for marine engineers' training are defined in this paper. Based on the example of "Virtual-real vessel" simulation complex at KSMA, the profit of implementing VR technologies has been shown i.e. a connection between educational process and practice, educational process changes according to the specific professional tasks, and an establishment of more proficient degree of practical skills within no life and health threating.

The paper compares the results of several cadets' subgroups studying under the "Ship Technical Systems and Complexes Operation" bachelors' program. The machinery operation task of preparing to start and starting an emergency generator has been carried out utilizing the Wartsila Engine Room Simulator "ERS 5000 TechSim", HTC head-mounted display and a real diesel generator in the different combinations of simulation equipment and cadets'

experience. The results of the experiment are certainly to be evaluated as an empirical evidence of the simulators training system usage effectiveness and conclusively to have been validated on real diesel generator.

Keywords marine education, simulator training, virtual reality

DEVELOPING OUTCOMES-BASED MODEL COURSES USING IDENTIFIED EVIDENCE-BASED PRACTICES

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Abstract

The current state of the practice is for maritime education and training (MET) to use outcomes-based educational methods. Additionally, stakeholders increasingly require outcomes assessment as a means of accountability oversight. Recently, through the work of the Sub-Committee on Human Element, Training, and Watchkeeping (HTW), the International Maritime Organization has taken another step in developing its outcomes-based training policies. In this regard, a correspondence group was tasked with creating a taxonomy of action verbs to support model course development. This paper summarizes that work, provides a review of several of the many educational taxonomies across the five main domains of learning (cognitive, affective, psychomotor, interpersonal, and meta-cognitive), and examines a method for evaluating learning domain coverage for the Organization's model courses. The evaluation method presented provides a sound tool that could be used in revising existing model courses, validating current model courses, and designing future model courses. The IMO's foundational model course in firefighting is used to test/illustrate this method. While this particular model course appears to be practical and requires trainees to learn how to fight fires through practice, the mapping of domain coverage using the model indicates only 18.2% of the time allotted in the course is devoted to the acquisition of psychomotor competencies and interpersonal knowledge and skills. This study also analyzed the frequency of action verb usage in the performance criteria for the competencies in the model course and found 84.2% of the performance criteria use only four action verbs (i.e., list, state, describe, explain) which are usually devoted to knowledge (cognitive) acquisition. These findings indicate that the model course in firefighting is not-balanced in its learning domain coverage and has misplaced emphases. Using a taxonomy or taxonomies for the learning domain(s) of interest, action verbs can be chosen from the taxonomy to ensure that future revisions of this and other model courses or designs of new model courses, will have the appropriate balance between the content (and time allocated) on one hand, and the desired learning domain(s) and outcomes on the other. Additionally, this paper explores the matter of constructive alignment – how teaching methods and learning assessment can be adopted to match the outcomes they are intended to support.

Key Words

Pedagogy
MET (Maritime Education and Training)
STCW
Model Course
Outcomes Assessment

ECDIS EHO: Handling the ECDIS failure at sea

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Keywords: maritime navigation, electronic chart display and information system, ECDIS EHO

Abstract: The meaning of navigational safety is changing together with everlasting evolution of technology on ships at high seas. The Electronic Chart Display and Information System (ECDIS) as a most recent breakthrough in shipping, changed drastically not only layout of the navigational bridges but also navigational methods and routines. The safety reasons dictate compulsory redundancy of ECDIS system, recognising its central role in modern day navigation. If a ship's ECDIS back-up arrangement is realized by installation of second independent system, it is known as paperless ship. Duplication increases the reliability of the system, but even a duplication doesn't guarantee full reliability of the system at all times. In emergency situation as ECDIS total failure, navigator should rely on company procedures and guidelines.

The aim of research is to determine navigators' response in case of ECDIS total failure, and to identify if their reaction is supported or guided by company procedures. The research is based on international survey in form of questionnaire conducted among wide spectra of ECDIS stakeholders. This paper analyses part of the questionnaire which refers to the behaviour of navigators in ECDIS failure emergency and seek for procedure clarification by respondents. Answers are presented and discussed, revealing certain drawbacks in failure response and procedures. Along with presented results, survey of practice among shipping companies was carried out, supporting the results of questionnaire. The findings are emphasized in concluding chapter followed by proposal for further research and activities.

INNOVATIVE TEACHING METHOD FOR SHIPHANDLING

– ELEMENT OF PROJECT "EURO ZA" BETWEEN SOUTH AFRICA AND EUROPE -

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Abstract

Some years ago, the SAMMON software tool box was introduced for "Simulation Augmented Manoeuvring Design, Monitoring & Conning". It is based on the innovative "Rapid Advanced Prediction & Interface Technology" (RAPIT) to simulate the ships motion by Fast Time Simulation (FTS) with complex dynamic math models and to display the ship's track immediately in an Electronic Sea Chart for any rudder, thruster or engine manoeuvre planned by the navigator. Specifically, the SAMMON Planning Tool will be shown in its opportunities for achieving new knowledge for teaching of ship's dynamic and training of ship handling elements. That system represents the full information from ship's manoeuvring documentation and from additional trial results squeezed in a ship dynamic model, capable of simulating environmental effects by using the RAPIT technology. The paper introduces the variety of opportunities of the training tools by presenting use case studies, e.g. for drifting under wind. Additionally, two complex manoeuvring strategies for a port arrival scenario will be compared for a ship with azimuth propeller to find out potential alternatives with less fuel consumptions and emissions.

Keywords

Fast time manoeuvring simulation, voyage planning, dynamic prediction, simulator training

INTELLIGENT SUPPORT OF THE USER OF THE E-NAVIGATION MARINE ERGATIC SYSTEM

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Abstract. The article proves that the issue of effective operation of the ergatic control systems in the period of digitalization of the maritime transport industry continues to be relevant. Despite the mandatory use of various navigation systems, navigation errors as a result of the human factor are one of the main causes of marine accidents. In this regard, the intelligent support of the user of the marine ergatic system E-Navigation based on the information approach requires more attention from both developers of navigation systems and educational organizations, which are to ensure the proper level of training of specialists serving this industry. Technological advancements in the field of creating visualization means and software for designing various objects and environments currently allow us to create artificial environments with any content that are indistinguishable in their impact on the human senses from physical reality, which largely contributes to the adoption of the right decision in any production process. Taking into account the increased interest in computer interfaces, the authors attempted to explain and illustrate the need to develop an intelligent interface in a mixed reality environment, which in the future will allow the user to obtain aggregated information to make the right decision intuitively. The authors consider the navigator as one of the main participants of the marine ergatic system, grounding on the fact that the human factor is decisive both in the process of creating risks for the crew, the ship, its cargo and the environment, and in making decisions to avoid or reduce these risks. The paper provides analysis of virtual educational technologies such as: computer training systems, advanced software programs, simulation tools, and associated hardware, which enable education institutions to package and deliver a range of different programs and learning options, including those traditionally considered as obligatory within regulated Certificate of Competency (CoC) courses, thus providing the flexibility that compliments the life style of modern seafarers, as well as promoting self-directed learning. The advantages and disadvantages of virtualization of the education process are disclosed. The paper shows that in spite of understanding of effectiveness of simulators for skill acquisition, considerably less attention is devoted to evaluation of the education/training methods engaged in simulation training, which indicated the needs to investigate the current methodologies with attempt to improve and enhance the effectiveness of simulator-based training. The authors prove that the quality of the simulation modeling on training equipment is largely determined by the introduction of "through" digital technologies of virtual and augmented reality. The paper stipulates the reasons why simulation in combination with real world cadet shipping experience is the most affective mean for training. The results show that the revised training method provides trainees with improved operative performance, which can be further developed and implemented as a means for ensuring proficiency.
Keywords: maritime education, virtualization, Augmented Reality, human element, interface, etc.

Interdisciplinary Development of Maritime Education and Training Orienting to Career Planning in the era of Artificial Intelligence

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Abstract

Artificial intelligence (AI) potential impact on the future of maritime transportation has been extensively discussed in recent years, increased autonomy of the shipping industry is inevitable. This study investigated maritime students' and educators' perception of the impact of AI influence, and explore how to optimize the maritime education and training (MET) curriculum to increase their lifelong career ability. Traditional MET focuses on the specific equipment operation and convention-required certificate examination, the result of market demand-oriented is the training institutions only pay attention to the seafarer's ship operating ability and seamanship experience, which brings challenges to the seafarer's lifelong career planning. The investigation results show that the AI-influenced MET curriculum requires multi-disciplinary integration, keeping the overall difficulty and curriculum intension significant to keep student study willing. The training schools, academic institutions, policy-making institutions, and international regulations-making institutions need to achieve unified coordination to deal with these challenges.

Keywords

Maritime education and training (MET); Interdisciplinary collaboration; Seafarers career; Intelligent ship navigation; Demand-oriented.

Measuring Situation Awareness in Engine Control Operation

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Abstract

Situation awareness (SA) as a framework to understand operator's behavior in doing work has been implemented well as theoretical and application in various work environments, including maritime operation. However, most SA studies in maritime operation only covered the work on the bridge and focused on the theoretical construction rather than the empirical studies. To fill the gap in the literature, this study aims to measure SA, especially in engine control operation. Two scenarios were built using the high-fidelity engine plant simulator: ocean-going scenario and entering port scenario. Students (N = 16) recruited as the participants were divided into two groups by their sea training experience. Two measurement types were used to examine the SA during each scenario: subjective measurement using the questionnaire and objective measurement using the freeze-probe technique. Also, the workload was examined using well-known workload subjective measurement. The result showed two scenarios successfully made different perceived workload; the entering port scenario was perceived with a higher workload than the ocean-going scenario. In contrast with the workload, SA was perceived higher in the ocean-going scenario than in the entering port scenario. Moreover, with the freeze-probe technique as the objective measurement, although all participants achieved the same degree in achieving the SA level 1 (perception), the participants with more extended sea training experience have higher sensitivity in achieving SA level 2 (comprehension). In summary, while the subjective measurement can only discriminate between different workloads, the objective measurement can also discriminate the level of the participant's experience. These measurement methods are beneficial for examining the non-technical skill in maritime education and training to support the cadet in recent and future work environments.

Keywords: engine control, situation awareness, workload

PROMETHEAS Project - Mental Health Data Research Hub for Seafarers

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Abstract

Some 90% of the world visible trade is transported by sea. It is therefore of prime importance that the mental wellbeing of all seafarers onboard ocean-going vessels is seriously taken into consideration. Mental health is a state of wellbeing in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community. Research as C4FF has shown that many seafarers endure a range of stressful situation, and this is often not seriously studied.

This paper report on the outcome of an investigation carried by C4FF and its European partners into the mental health problems of seafarers focusing on identification of the problems which create or lead to mental health issues with a view to find feasible solutions hence making life on board more pleasant. There have been several studies by C4FF reviewing seafarers' difficult life on-board ocean-going vessels and looking at factors such as sleeping patterns which is known to impact on fatigue and stress in seafarers. Fatigue alone has led to many accidents and serious incidents at sea. Bullying is also a subject of interest in PROMETHEAS project but the work on bullying is planned for another paper which will explore as why it is important to study the causes and effects of bullying? The paper offers a number of practical solutions to achieve a high level of mental hygiene and have some understanding the affects of the medicinal remedies.

The main purpose of this paper is to gather sufficient data and establish a data hub for mental well-being of seafarers so that sufficient information is to gather for legislators helping to bring about new rules and regulations to improve mental health as sea. The intention also is to use the findings to develop an e-course in Mental Health and Wellbeing for seafarers with a special section for captains and shipping companies.

Keywords: mental health of seafarers; bulling; wellbeing of seafarers.

REDEFINED DEFINITION OF THE STCW COMPETENCES

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In this paper, the authors propose a new approach to defining competences according to which a competence is a defined set of three elements: executors of the actions, on board processes and objects needed to execute a task or a decision within one process. Each of the elements has to be defined separately. Correlation between the competences' elements should be defined as well. Generic competences are of the extreme importance for the successful on board processes. Therefore, a correlation between the generic competences' elements should be defined as well. These definitions' application has been shown on the examples of professional and generic competences. As has already been mentioned, objects have become a part of the new, redefined and improved definition of competences. Objects can be divided into the ones referring to generic competences and the ones referring to professional competences. They are devices, machines, tools, persons, groups of people and concepts. They change significantly under the influence of technological development and automation, which, consequently influences the whole process as well as task executors.

Key words: professional competences, generic competences, group competences, on board team's competences, on board processes

Sustainable development processes of education technologies - A multiple case study

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Keywords: Sustainable development, Capacity-building, E-learning, Education technologies

Abstract

The purpose of this study is to identify sustainable development processes of education technologies. The theme of the IAMU AGA21 targets innovation and sustainability, including innovative MET environment and GMP applications. It is, however, a known issue that the outcomes of research and education technology development projects do not sustain beyond the lifetime of the projects. This research study is a multiple case study of education technology development at three different Maritime Education Training institutions. The cases are analyzed using a framework of sustainable participatory processes of education technology development. The individual cases show the need for and dynamics of integrated e-learning infrastructure; empowering teachers with new e-learning activities and resources; and enabling students to contribute to educational capacity-building as part of their studies. The study highlights key considerations to sustain the results of research and development projects. The results are valuable to maritime education and training institutes to enhance their study programs with online, blended, and distance delivery modes.

THE EVALUATION OF PROFESSIONAL PRACTICE IN MARITIME EDUCATION: A CASE STUDY AT FACULTY OF MARITIME STUDIES IN THE REPUBLIC OF CROATIA

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Abstract: Professional practice in higher education has a threefold function: it enables students to gain practical knowledge and skills needed to enter the job market, it provides employers with access to human resources, and universities offer better study programs. Professional practice at the Faculty of Maritime Studies in Rijeka (Croatia) is conducted as part of five undergraduate and five graduate study programs and is organized through activities that enable the acquisition of practical knowledge, such as laboratory exercises, simulators, polygons, practicums, practice grounds, study visits, training ship and in maritime shipping companies. The paper presents the results of research conducted within the Pandora project, funded by the European Social Fund, Operational Programme Efficient Human Resources 2014-2020. The Pandora project aimed to explore existing forms of professional practice at the Faculty of Maritime Studies Rijeka-Croatia, evaluate and make recommendations for improving existing forms of professional practice. Interview and survey methods were used for data collection. The research was conducted on 100 respondents, of which 50 respondents were students, 17 respondents were professors, and 33 respondents were maritime companies. Constructive recommendations are provided to contribute to the higher quality of different forms of professional practice. The results show that the organization of professional practice has no logistical-administrative support and is often individualized, mechanisms for the evaluation of professional practice are not established, an insufficient connection of the tripartite student-teacher-employer relationship leads to an underdeveloped mentoring system, and there is a lack of bachelor's and master's theses written in collaboration with the maritime shipping industry.

Keywords: higher education, professional practice, maritime education, experiential learning

THE FACTORS AFFECTING THE MET INSTRUCTORS' EFFICIENCY

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The instructors who teach professional courses at maritime education and training institutions play an important role in the process of acquiring new and/or upgrading existing competences of seafarers. Both the instructors' and the seafarers' standards of competence must meet the requirements of the STCW Convention. The implementation of the education system that complies with these requirements is responsibility of each Party of the STCW Convention. If there are discrepancies, the maritime education and training system will not deliver intended learning outcomes, with highly probable negative impact on the motivation of learners and teachers participating in the process. The IMO has identified the problem and supported development of the different IMO Model Courses to help the instructors at MET institutions to deliver the curriculum in accordance with expectations.

The main goal of the research presented in this paper was to identify the current situation and the key factors that influence the learning outcomes in different countries. The research lasted one year, from January 2019 through January 2020. It included 113 MET instructors from 26 countries. All the data were collected by means of a questionnaire.

For the purpose of this paper, the key factors affecting the intended learning outcomes have been divided into two main categories: the factors referring to the MET instructors and those referring to the trainees. The organisational segment (duration, costs of education process, etc), although indirectly influencing the intended learning outcomes, has not been analysed in this paper.

The key factors identified as relevant for instructors' competences are sea service time, and additional training (both professional and educational). The factors referring to the trainees' competencies are their personality and cognitive abilities of a person or a group, motivation and communication skills. The last part of the research deals with opinions of the MET

instructors regarding the usability of the IMO Model Courses as a practical tool in MET processes.
The paper presents the findings of the research but also indicates the most important conclusions and recommendations supported by the findings.

Keywords: STCW, IMO Model Courses, Competences, MET instructors

THE USE OF BLENDED LEARNING APPROACH TO IMPROVE THE STUDENTS' ACADEMIC PERFORMANCE IN METEOROLOGY AND OCEANOGRAPHY 1

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Keywords: quasi-experimental, blended learning, meteorology and oceanography

Abstract

This quasi-experimental study aimed to determine the effectiveness of blended learning approach to the academic performance of the first year Bachelor of Science in Marine Transportation (BSMT) students in Meteorology and Oceanography 1 at JBLFMU-Arevalo during the second semester of school year 2018-2019. The participants of this research were the two sections comparable with each other who were enrolled in the course Meteorology and Oceanography 1. There were 30 students composed of 15 in the experimental group and 15 in the control group. Validated and reliability-tested researcher-made questionnaire was utilized to gather the data needed for the study. The independent variables were the blended learning approach and the lecture-class discussion method while the dependent variable was the academic performance as scores in Meteorology and Oceanography 1. The statistical tools used were mean, standard deviation, Mann-Whitney test, and Wilcoxon-Signed ranks test set at .05 level of significance. The effect size was computed to determine the effectiveness of the intervention which is the blended learning approach to students' academic performance in Meteorology and Oceanography 1. Results showed that in the pretest, though the experimental group had a higher mean score than the control group, the Mann-Whitney test showed no significant difference in the mean scores of the two groups. When blended learning approach was introduced, findings showed that there were significant differences in the mean scores of pretest and posttest of experimental and control groups as well as in the posttests of both groups. Furthermore, a significant difference was observed between the mean gains of both groups. Lastly, the Cohen's d effect size revealed a 2.22 (>1.0) which has a very large effect size indicating that 98% of the control group (lecture-class discussion method) who are below

the average person in experimental group (blended-learning approach). This simply means that blended-learning approach is an effective way to improve students' performance in the course Meteorology and Oceanography 1. It is recommended that this approach may be utilized to complement other method of teaching and learning as well as for individual learning.

Towards improving SAR search patterns by time-minimal paths

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Abstract

In this paper, we consider improving the standard search patterns under the effect of drift with application to the maritime and aeronautical search and rescue operations, basing on time-minimal paths being the solutions to the aircraft navigation problem.

Keywords: maritime Search and Rescue (SAR), search patterns, IAMSAR Manual, time-minimal trajectory, aircraft navigation problem.

Towards Introducing Knowledge Management Concept to Maritime Education & Training

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Abstract

Knowledge Management (KM) concept had been introduced to the world through the industrial domain, where it generated following a necessity to maintain knowledge and information within a certain border, driven from strong and fierce competition. The concept itself had evolved in a way that allowed the technology to affect the process of maintaining the knowledge to transform it to more sophisticated processes of information analysis, thus producing much more useful data, which lead to further usage of KM concept, such as categorization, gap analysis, and areas of which companies need to invest more in.

However, the KM concept in the educational domain was not properly used until the early 90s, not until the problem was raised by certain fields of education, where they found that their knowledge was not less vital than that in the industrial domain. But the technological solutions faced the problem of the type of knowledge used in the educational domain, which consists partly of an implicit nature, which raised the need to develop certain administrative and Technological solutions to tackle this challenge.

In the maritime education domain, the KM Concept had had an even later start and far weaker approach than other types of education, mainly because of its vocational nature, and several other reasons that will be discussed thoroughly in this paper.

This paper is a part of ongoing research by the authors on the history of KM and how it should properly be introduced to the maritime education domain. The research includes a case study and customization of a prototype KM software to fit the nature of Knowledge normally found in the maritime domain. The paper also displays the importance of KM to the Maritime

education and training entities, and how it affects its performance and helps with its sustainable development in general.

Keywords

Maritime Education and Training – Knowledge Management – Educational policies – Communities of Practice – Maritime Knowledge

Abstracts

New Trends in Maritime Transport and Job Opportunities

Automation of FRAMO Cargo Pump purging with IoT

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Abstract. Liquid cargo tankers of variable size can preferably choose FRAMO system for their cargo transfer requirements. FRAMO [1] system has been proved as a reliable technology with maker recommended human supervision. The reliability of the pump is mainly depending upon the seals fitted on both cargo and hydraulic oil sides. The major damage of these seals makes the pump completely in- operatable or minor damage leads to the maintenance requirement to bring the pump back to normal. To determine the condition of seals, FRAMO recommends to perform purging operations of cargo pumps whenever the tanker is loaded with cargo on daily basis. This procedure will help us to decide the choice of the particular pump for cargo discharging operations. On today's onboard practices the complete purging procedure is performed manually. The pressurized air supply through the cofferdam forcefully removes the content in that space and it helps the crew member to identify any failure of seals and the extent to which the failure is. This paper discusses about automating the purging process under unmanned environment and communicating the test results to the control center for the decision making on the use of the particular pump. In this paper details of electronic control circuit to automate the purging procedure is described. Added with the above, the detailed testing methods to determine the cofferdam space content and the data transmission of collected test results to control center also explained.

Keywords: FRAMO, Autonomous Ship, IoT, Automation

Big Data Management in the Shipping Industry: Examining Strengths Vs Weaknesses and Highlighting Relevant Business Opportunities

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Abstract

History testifies that there is a dialectic relationship between humans and technology. Especially during the last couple of decades, the shipping industry has benefitted from a very extended number of advanced technology innovations. Today, all systems supporting the conduct of navigation and the various information technology (IT) applications related to ship management activities are heavily reliant upon (almost) real-time information to safely/effectively fulfil their allocated tasks. As a result, truly vast quantities of data -which are often described as "Big Data" in the wider literature- are created and the issue of how to effectively manage all the associated information is clearly standing out. Furthermore, topics such as optimising the conduct of all relevant activities on-board the vessel at sea, identifying the right opportunities in order to further promote business and boost profits, or even contributing to the numerous elements of sustainability by achieving reductions in energy consumption and/or a better environmental footprint for shipping, should all be researched further.

Considering the quite limited capacity of the human brain to process really enormous quantities of data in comparison to modern computers, the trend to use advanced software tools for extracting and processing the "right" information that is often hidden in the vast pool of Big Data, as well as relying on advanced techniques and algorithms to perform the relevant statistical analysis becomes quite obvious. The purpose of this paper, which follows a qualitative approach working in unison with a "Strengths, Weaknesses, Opportunities, and Threats" (SWOT) analysis, is to identify and briefly discuss the most relevant tools and techniques that are associated with Big Data Management. It will also clearly highlight the various benefits that are opening up and will try to explain the notion behind this transition to a new era, characterized by the term "smart shipping". A very important conclusion is that the exploitation of Big Data and the role of certain software applications in accessing and managing this large volume of information are key factors for improving/optimising the conduct of ship operations and management; establishment of a "Data Driven Culture" within a shipping company can clearly improve the current business model and at the same time promote sustainability.

Keywords: *Big Data Analytics, SWOT Analysis, Data Driven Culture, Optimisation, Shipping Industry.*

CYBER SECURITY ANALYSIS OF MARITIME SURVEILLANCE SYSTEMS

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Abstract

The authors present in the paper the main technical features of the AIS system as most popular marine traffic surveillance system. In the framework of the made cyber vulnerability analysis they shape the main cyber vulnerabilities of the system. The explanation of the vulnerabilities is connected with the possible way of their exploitation, together with the motivation of the actors. The research is conducted by applying the technical assumptions and simulations in the operational environment. The methodology allows to replay various scenarios and to outline the most typical, the most usual, the most unusual, etc. The four most typical scenarios are described and assessed based on the two factors risk assessment methodology. Groups of technicians and AIS system operators were involved in the assessment filling in a questionnaire. After the answers processing the authors define the level of cyber risk for the AIS systems for each scenario. The experts indicated controls to deal with the risk.

The last part of the paper is dedicated to the ways to cover the cyber vulnerabilities of the AIS system during the real work of the system in favor of the effective and safety marine traffic control. The operators are given the awareness of how real is the situation they monitor and how to recognize possible inadequacy of the actions. The results of AIS cyber vulnerabilities analyses help the operators to have clear understanding how much the generated operational picture on the screens represents the reality. The most important outcomes are included in the cadets' educational program.

Keywords: **AIS, cyber threats, cyber vulnerabilities, risk assessment, marine surveillance, traffic control**

LEADERSHIP CAPABILITIES FOR A MARITIME UNIVERSITY IN THE 21ST CENTURY

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Abstract

Faced with a rapid evolution in technology, maritime universities are under increasing pressure to recognize, anticipate and respond to the complex needs of the maritime industry. This depends on organizational leadership and the capabilities of its leaders. Our study proposes a set of 16 capabilities for the leadership in maritime universities, allocated to four groups: Self-Mastery; Interpersonal Mastery; Process Mastery; Systems Mastery. We present results from an online survey to explore these leadership capabilities, seeking to test the relevance of the proposed leadership capabilities using Bootstrap statistical analysis. It also defines and confirms the gap between the required level, at which a capability should operate, and the actual level experienced and practiced within the organization. Our study also examines the findings for both academic and professional staff to discern any statistically significant variances in the responses of the two groups, which could be seen as being culturally distinct. These results are compared to a control sample from a non-maritime university to identify if there were capabilities unique to a maritime university. As future research, we can validate these leadership capabilities across all maritime universities and then, on a more critical basis, compare these capabilities to those considered most important by the maritime industry.

Keywords: leadership mastery, demographical features, Bootstrapping, skills and attributes, online survey, statistical analysis

Navigational Alarms and Warnings to Support VTS Operation

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Abstract

In this paper, the authors discuss the current development of IMO and IALA regulatory framework and future technological developments to look at the present state of VTS operation. Taking into account the importance of situational awareness and any dangerous situations that could potentially be overseen, collision avoidance warnings to support the operation onboard and ashore are highlighted. Research is ongoing by participating observations, online surveys and interviews of VTS operators around the world. The selected results emphasized that although technology is rapidly developing, heading to digitalization and autonomous operation, the basis of alarms and warnings functions are still the same. In the future different mixed traffic situations, reliable technology and adaptive training would be very much suggested to achieve the harmonization of VTS operation by competent VTS operators.

Keywords: Vessel Traffic Services, IALA, Alarms and Warnings, Harmonization of Maritime Safety, Competent VTS Operators

NOVEL SHIPPING COMPETITIVENESS INDEX USING ORDERED WEIGHTED AVERAGE OPERATOR

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Abstract

There is limited research on the sustainable development of maritime economies, and on the role of maritime transport in those economies. At most, we can find some isolated case studies that fail to explore the dependencies across factors. In some of our previous works, we introduced indices assessing the national and the beneficial fleet competitiveness and their connection with several factors that influence the role of shipping for a given country. Here, we extend this research and create models only with significant variables, as well as propose a new index to rank countries based on shipping competitiveness that utilizes the ordered-weighted average operator. We demonstrate in detail our methodology. We also test our new index and compare its efficiency with previously developed indices using a data set for 84 maritime countries. We clearly demonstrate the advantages of the new ordinary weighted average operator index.

Keywords (3-5 words): linear regression; national fleet; beneficial fleet; influential factors

Proposal for the introduction of "Shore to Ship Alert System"

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Abstract

Maritime accidents continue to occur despite advanced technology onboard and ashore assisting ships. Human error being the catalyst of most of the scenarios is evident. There are more than a few incidents which occurred in coastal waters, even with warnings and frequent attempts to call on Very High Frequency (VHF) by the Vessel Traffic Service (VTS). To identify the issue, an overview of the assistance of VTS and its contribution to the safety of navigation on board is going to be showcased with relevant past incidents. The present trend of VHF communication on board, its effective use, and instances when the VTS calls went unanswered on VHF will be emphasised and evaluated through case studies, qualitative and quantitative methods. To identify the gap in communications between the VTS and ships, the reasons for being unresponsive will be depicted through the methods of data collection.

This study intends to evaluate how the effective usage of VTS can mitigate maritime accidents and near misses, especially in the coastal waters within the range of VTS. In the meantime, it aims to propose a theory of a new system to be introduced to the maritime industry which could be a breakthrough to minimise navigational accidents particularly in the proximity of the coastal states.

The purpose of the theoretical solution is to improve the communication gap between shore to ship, especially in imminent danger by introducing a "Shore To Ship Alert System" (STSAS). This system could eradicate human error of being non-responsive to VTS advice or warnings. A complete framework of the functions will be described, and the advantages and disadvantages will be discussed for the reader's judgment.

Keywords: Marine accidents, human error, communication, unresponsive, shore to ship alert system.

Shipboard ECDIS: Cyber Security Challenges

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Keywords: navigation safety, ECDIS, maritime cyber security, cyber-physical system

The Electronic Chart Display and Information System (ECDIS) has strongly influenced how ships are navigated. The ECDIS meets the International Maritime Organization (IMO) requirement for the nautical charts carriage and the IMO mandatory ECDIS carriage requirement is currently in force for all SOLAS vessels [1]. The paper charts workload reduction and real-time navigational information provided by the ECDIS have allowed the ship's command to focus on the actual traffic situation, and thus the safety of ship navigation is improved [2]. The ECDIS has been improved for nearly three decades, primarily on the basis of integration and networking, which resulted in development of a complex cyber-physical system.

The IMO has recognised security risks rising from the usage of cyber technologies and published the Guidelines on maritime cyber risk management, which offers general guidelines for safeguarding the ship navigation from cyber threats and risks [3]. In addition, IMO has imposed that cyber security risks are to be adequately implemented in the International Safety Management (ISM) code and the periodical audit of ships for ISM code by 1st January 2021 [4].

In this work, we present an analysis of cyber security challenges in ECDIS system implemented on board of a ship. The analysis is based on experimental cyber security testing of a shipboard ECDIS with a vulnerability scanning software tool [5-7]. The tested ECDIS is implemented on the training ship *Kraljica mora* of the Faculty of Maritime Studies Rijeka, University of Rijeka, Croatia (Figure 1). Technical specification of the ECDIS and details of the experiment will be presented. On the basis of the cyber security testing (Figure 2), cyber security challenges are identified and analyzed regarding the ECIDS working conditions. The cyber security challenges together with possible solving solutions will be presented.

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Figure 1. The training ship *Kraljica mora*.

Figure 2. Cyber security testing of the shipboard ECDIS.

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The Interrelationship Between Coastal, Great Lakes, Inland, and Deep-Sea Freight Rates: A Longitudinal Approach

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Keywords: water freight rates, forecasting, inland shipping

This study examines freight rates in four key areas of the U.S. water freight transportation industry – coastal, Great Lakes/St. Lawrence River, inland waterways, and deep-sea shipping. The data involved in this study includes more than 20 years of longitudinal data on freight rates on all four of these sectors. The interrelationship between the freight rates is tested through forecasting methods to see if an increase or decrease in a freight rate in a given month leads to increases or decreases in other freight rates in the next month. This method assesses whether or not you can forecast one freight rate using data from another freight rate.

We find that inland freight rates are predictive of all three other freight rates, as an increase in inland freight rates is shown to lead to increases in all three other freight rates in the following month. Coastal and Great Lakes freight rates do not have any predictive power on other freight rates. However, deep sea freight rates do predict inland freight rate but at a much slower rate. An increase deep sea freight rate leads to an increase in inland freight rates after two months instead of one.

Explanations for this result may be that inland shipping is highly fragmented and competitive with more than 500 operators (Schlubach, 2019). Inland shipping also has lower barriers to entry with far less expensive vessels than ocean-going ships. By comparison coastal shipping has far higher barriers to entry than inland shipping due to much more costly ocean-going vessels and thus has fewer market participants (Rodrigue, 2020). As a result, inland shipping faces more competition than coastal shipping and thus may be quicker to adjust freight rates to meet market conditions. Other sectors such as coastal shipping have less flexibility and thus may be slower to adjust their rates to market conditions. Hence the most competitive sector, inland shipping, is the most predictive of the three less competitive sectors.

Deep sea shipping, like coastal shipping, has high barrier to entry but unlike coastal shipping this sector is involved in foreign trade and faces competition from foreign carriers. Hence deep-sea shipping freight rates may be predictive of future trends in international trade and thus may predict future trends in domestic transportation markets such as inland shipping. Implications of this study may be that maritime industry executives as well as customers of water freight transportation freight services can use inland freight rates to better predict trends in revenues and costs. Likewise, investors may be able to use inland freight rates to predict maritime stock prices. Both inland freight rates and deep sea freight rates may have potential to predict domestic and global economic trends and may improve economic forecasting accuracy.

The journey towards autonomous ships and the role of seafarers in the future: a bibliographical perspective

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Abstract

Autonomous ships have become a buzzword in recent years, encouraging technological development on board systems. Many different approaches have been undertaken over the years to figure out how future vessels will look like and whether artificial intelligence (AI) will take over ship operations. There is a need to capture the progress made by the global research community in recent years and highlight trends and developments. This should be done based on an unbiased and in-depth analysis and quantitative evidence. The emphasis of this work is to provide an objective scientometric analysis based on publisher peer-reviewed articles and to contextualise the results against the competencies required for deck officers in the Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Convention. The results show that the digitisation of on-board operations is focused on path planning and tracking, taking collision avoidance rules into account. However, the new concepts and possible systems are not covered by STCW requirements, and future seafarers may be overwhelmed by the new technologies.

Keywords: Autonomous vessel, scientometrics analysis, maritime research trends, STCW Convention

The new trend of maritime transport and job opportunities

Abstract:

Maritime transport for over decades now has demonstrated to be the world's largest mode of transport, transporting about 90% of global trade volume and providing the cheapest freight option to shippers. The maritime industry has long been acknowledged as one of the greatest pillars of the world's economy that contribute significantly towards economic growth and social development by linking businesses and market centers globally. Maritime transport over the years has been undergoing series of transitional changes and stages which are believed to be driven by the objective of International Maritime Organization and port users. Technological advancement in the maritime industry has caused tremendous improvement in maritime transport helping to improve issues of environmental, social and economic concern that has been a bottom neck to the industry and authorities. The current trend of maritime transport has caused a significant change in port operational settings with a resultant effect on port logistics and supply chain system. These changes are said to be accompanied by new business and job opportunities. Recent literature suggest that very few studies have been conducted focusing on the new trend of maritime transport and it associated job opportunities. The research gap makes it needful for this study to be conducted to examine the new trend of maritime transport and the available job opportunities for maritime professionals. This study adopt the use Partial Least Square Structural Equation Modeling (PLS-SEM) in examining the model and to establish a positive relationship between new trend of maritime transport and job opportunities. The exogenous variables (including green maritime transport, new capacity, formation of alliance, and green port practices) and the exo-endogenous variable (thus, emergence of technology) were used to examine their predictive relevance on job opportunities (endogenous variable). The rationale behind the use of the PLS-SEM model is it great ability to handle relatively small data. It is also said to be suitable for theory development. Again, the software is robust in nature and has high predictive relevance. The model of the study was assessed by examining the measurement and the structural model. Consequently, the findings of the study highlight on the current trend of maritime transport and it associated job opportunities. It also provide a hint to maritime authorities and investors on the new direction of maritime transport and key areas that can be invested in for business and profitable gains. Again, it serves as a guideline for maritime professionals on how to organize themselves to embrace these new developments for a brighter opportunity and career development.

Key word: Green maritime transport, new capacity, formation of shipping alliances, green port operations, emergence of technology, and job opportunities.

Towards Enhancing Maritime Asset Management Value Through Transforming Maritime Expert Knowledge into Machine Learning Models

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Abstract

Over the past decade, Machine Learning (ML) techniques have been utilised as an efficient decision making tool when big data is provided from systems' operators and/ or business developers. To generalise the diagnostic and prognostic analysis respectively for rolling element bearings, two ML models, namely; Weighted KNN classification and Linear regression were developed and are discussed in this paper. These models showed discrepancies in their performance when compared with domain expert's defined and models' defined training and testing datasets. However, considering the limited amount of training data used to train Weighted KNN model and the classification accuracy so obtained, it has been established that there is a strong potential of fostering expert knowledge into ML models. The presented approach can be employed effectively not only for a data-driven decision making to balance cost, risk and performance in a maritime asset management system but also for a better human training.

Keywords

Machine Learning; Maritime Asset Management; Condition Monitoring; Condition Indicators; Domain Expert.

Abstracts

Efficiency of Shipping Port Management from Environmental Perspectives

Title: Applicability of International Law in Development of Sustainable Port Policy: An Analysis of Good Practices and Future Policy of Gwadar Port

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Abstract: With the emergence of Sustainable Development Goals (SDGs), the port governance models attempt to incorporate more sustainable practices in their operational policies. As nodes of international trade, ports play a significant role in global financial growth, and their operations are subject to environmental protection. However, the literature on port governance models is limited with the perspectives of either national economic growth or environmental hazards or ports interface with the hinterland. There is much margin in examining the role of the port in SDGs, which seems effective to accommodate the role of sustainable ports in achieving economic growth, environmental protection and social development simultaneously. The intricacy is due to the undeveloped connection between 'sustainable port' and 'SDGs.' On the other hand, good national port policies are effective and practical in harmonising port governance models and SDGs. The futuristic policy for a developing port will be further constructed to assist the international community in establishing policy for 'sustainable ports' and their influential role in global sustainability.

Keywords: Sustainable Ports, International Maritime Organization, Sustainable Development Goals, Port Governance, Sustainability.

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Abstracts

Renewable Energy Resources Alternatives in Maritime Industry

A triboelectric-electromagnetic hybrid generator for wave energy harvesting

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1 Abstract

Wave energy is one of the most promising renewable energy sources in the ocean, which comes with high energy density, water depth independence and 24-hour availability, collecting low-frequency wave energy by triboelectric nanogenerators (TENGs) is still a considerable challenge. In this study, a hybrid wave energy harvester (H-WEH) is proposed. Herein, the H-WEH composes coupled TENG and electromagnetic generator (EMG). This design exhibits better output performance in harvesting wave energy compared with individual components. Moreover, the electricity generation unit makes no direct contact with the water surface, which enhances the durability of the generator. Additionally, the output characteristics of TENG can be complementary to the performance of EMG to achieve satisfactory power production. The device can work in the frequency range of 0.1-1Hz, which provides a simple, reliable, and durable alternative for large-scale and low-frequency wave energy harvesting.

Keywords: Hybrid Wave Energy Harvester, Triboelectric Nanogenerator, Electromagnetic Generator

Limitations and Opportunities for Wave Energy Utilization in the Baltic Sea: the case-study of Estonia

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Abstract

The EU plans to achieve climate neutrality by 2050, which requires it to be prepared to reduce emissions on its territory by 80% compared to 1990 levels. In Estonia renewable energy potential is primarily reflected in bioenergy-based cogeneration, wind energy, and in the production of green gas/biomethane, while solar energy only became widely promoted throughout the region in recent years. The target percentage of renewable energy use in Estonia for 2020 was 17.6%, with the current average in Estonia at 24%, with 30% planned by 2030. The intent of the Authors is to show limitations and opportunities of the application of wave energy in the Baltic Sea Region alongside with such widely adopted renewable energy sources as wind generation and photovoltaics as an alternative to fossil fuels.

This is a case-study on limitations and opportunities for wave energy potential in the Baltic Sea on the example of the Estonian territorial waters. A survey is conducted with industry experts in Estonia in order to understand possible and desired usage of wave energy in offshore and coastal applications including seafaring, ports, maritime traffic services, maritime rescue, sea tourism and marine planning. Other relevant studies on the subject in the region and in other areas are analyzed in order to take account the aspects that did not arise in the survey conducted. Mapping of limitations, including natural barriers, such as NATURA2000 reserves, salinity, depth, and their impact on wave energy prospects as well as political and legislative burdens is carried out and then tested against the expectations of the industry experts and other possible usage of wave energy in the region.

The quantitative value of the study lies primarily in mapping the marine environment. Locations where sea wave energy could be an appropriate means of providing electricity will be discussed. Areas where wave energy production is limited will be discussed in order to determine the reasons for the limitations and provide proposals for mitigating the obstacles, if possible. For instance, in practice this can translate to the installation of wave energy converters in nature reserves, provided that it does not disturb protected wildlife, e.g., if the unit is installed underwater or in a secluded location, and necessary environmental impact assessments are carried out.

Expected Results: 1) By taking limitations and potential into account and proposing an optimal theoretical model of wave energy converter (WEC) based on that, the paper contributes to the rising awareness and real application of wave energy conversion in environments with low wave intensity such as the Baltic Sea; 2) the article can also be used by the Estonian and similarly placed public administrations as a background research for energy-policy related decision making processes; 3) the case-study of how limitations and opportunities in applying wave energy in the Baltic Sea region can be used as a showcase for other regions that face similar issues.

Keywords: Wave energy, Renewable electricity supply, Marine resources, Wave energy converters, Baltic Sea

MATHEMATICAL MODELING AND DESIGN OF A BARREL CAM BASED TRANSMISSION MECHANISM FOR UNINTERRUPTED ENERGY HARNESSING FROM VORTICES

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Keywords: Transmission Mechanism, Barrel cam, Renewable energy

Mathematical modeling and design of a unique transmission system for converting linear oscillatory motion of variable frequency and amplitude to uniform rotation is discussed in this paper. The transmission system discussed here derives its constructional and working principle from a candle holder which is further modified to suit a barrel cam mechanism. Any longitudinal motion with in the helical grooves produces rotation of the entire body about its vertical axis. This principle was adopted to convert the variable linear oscillations of the bluff body due to vortex shedding to bi-directional rotations of the barrel cam. A ratchet integrated gear mechanism is incorporated to convert the bi-directional rotations to uni-directional. The system forms an integral part of a renewable energy generator named Hydro Vortex Power Generator, which is capable of generating electricity from slow moving currents. The vertical oscillatory motion is transmitted to the slider and the same is transmitted to the barrel cam through the cam follower. A complete mathematical model of the transmission system is presented in this paper, through which the transmission efficiency is estimated to be 78.7 %. A computer aided design model with design specifications of each component of the transmission device is also presented. Based on the CAD model, transmission system is fabricated and is tested for its efficiency on a standalone HVPG module. The overall efficiency of the power generator with the novel transmission system was observed to be 60.2 % for an output power of 19. 8 W

Zero Emissions Ferries Utilizing PV/ Shore Connection Hybrid Power System

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Keywords: RES, GHG, PV, hybrid power system, Suez Canal ferry.

Abstract

The use of non-clean energy sources such as fossil fuels is a major threat to the environment and the general climate change. The quick economic development has increased the energy demand and conventional fuel consumption, thus increasing the pollution and environmental impacts. The societies and most countries are now turning to renewable sources like: solar, wind, hydroelectric, biomass, and geothermal energy to produce clean energy and to reduce emissions. The need to search for renewable sources of energy in Egypt is important in terms of economic and environmental impacts, due to Egypt's geographical location and the vital role of the Suez Canal. The present study aims to present renewable energy sources for ship propulsion. Renewable solar energy and electric storage systems are the beneficial solution to achieve the major target of the present research. A conversion of 35 Suez Canal car/passenger ferries to use photovoltaic (PV) solar panels combined with a battery bank instead of conventional propulsion system. The ferries are operating between Port Fouad and Port Said. The proposed propulsion system of the case study cars/ passengers ferry consists of electric output power from PV solar panels in conjunction with an appropriate battery bank system combined with charge shore connection. The results of the study indicate that the ship power generation using PV system is appropriate for long term investments. In addition, solar energy utilization reduced the output emissions by 38.76 tons of NOx, 1421.15 tons of CO_2 and 2.92 tons of particular matter (PM) annually. The financial calculations show that the conversion costs per ferry will be recovered after three years, and the annual operation costs saves more than 262,000 $ each year when compared to traditional operation. Finally, it is noted that the installation of photovoltaic solar panels on the board ferry does not affect its stability.

Abstracts

Marine Pollution and Climate Change New Challenges

ANALYSIS OF MARINE DIESEL ENGINE EMISSION CHARACTERISTICS UNDER BENCH TEST CONDITIONS IN CHINA

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Abstract

In order to accurately evaluate air pollution caused by ships, two main methods are usually used for calculation, such as, the method based on ship fuel consumption (top-down approach) and the method based on ship activities (bottom-up approach). Both of the methods require accurate diesel engine emission factors. If the underlying data is not accurate, the assess results will significantly depart from actual conditions and mislead policy decisions. In this paper, the emission characteristics of NOx, CO, CO_2 and THC from 198 domestic marine diesel engines were investigated under bench test conditions by standard emission measurement system which conformed to the requirements of the International Maritime Organization (IMO). The emission factors of marine diesel main engine (ME) and auxiliary engine (AE) were analyzed statistically. The ME's and AE's fuel-based emission factors and energy-based emission factors are given in detail and compared with the reference data given by IMO. The energy-based emission factors for different types of diesel engines are closely related to the diesel engine load, and the relationship between them can be expressed by quadratic polynomial or power function. In addition, the emission factors for marine high-speed engines are illustrated in detail. The results of this paper can provide valuable data for the estimation of waterway transportation exhaust emissions, emission regulation revise and comprehensive understanding of the emission characteristics of marine diesel engines.

Keywords: Fuel-based emission factor; Energy-based emission factor; Ship emissions; Specific emission.

Design of structure and control system of an underwater vehicle for marine environment perception

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Abstract

With the increasingly severity of marine pollution and climate change, the protection of marine ecosystem is particularly important. In order to realize ship inspection, ocean cleanup and marine pollution detection, this work introduces an underwater vehicle for marine environment protection. An underwater vehicle for marine environment perception is comprised of land-based console, a zero buoyancy cable and an underwater vehicle motion platform. In particular, the video and sensor data collected by underwater vehicle system are displayed in real time through zero buoyancy cable back to the land-based console. This paper proposes a multi-stage PID cascade controller, aiming at the shortcomings of traditional proportional integral derivative (PID) algorithm. Underwater vehicle designed in this paper was tested in real environments such as ports and polluted sea areas, which were successfully completed.

Keywords: posture control, underwater vehicle system, marine environment perception

Safe and Environment-friendly approach to recycling of Tanker ship

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ABSTRACT

Every drop counts because it is the little drops of water that make the mighty ocean. Every drop of oil that is prevented from polluting the Ocean will make the Blue Economy a truly Green Economy and every life saved from being lost in accidents, in the recycling yards will truly make every Ship-Recycling yard a safer workplace.

Alang (Gujarat-India), one of the world's biggest ship-breaking yards, recycles about 300 of the 1000 ships that are demolished per annum globally and with India ratifying the Hong Kong convention this number is bound to go up manifold soon.

The two most important aspects of the Hong Kong convention namely, environmentally friendly and labour safety, are directly related to making a scrap ship completely gas-free before being permitted to enter the recycling yard. Although recycling yards are claiming compliance with this convention, it appears that its implementation is not taking place as desired, thereby defeating the very purpose of this convention.

When a product tanker goes for a grade change, the amount of cleaning carried out and efforts made to ensure that cargo tanks are free from the residues of previous cargo, including all kinds of un-broachable oil that may remain in the pumps, pipe-lines or tank bottoms, is humongous. Depending on the size of the tanker, it may take up to a week to completely remove all the traces of residues. Since the commercial interest of the shipowner/charterer is involved, best efforts are made to do the job most professionally, but in the case of a ship that is being scrapped, since the deal has already been done, it is most unlikely that the shipowner would show similar enthusiasm or concern in making the ship gas-free and make it safe for carrying out hot work. Are the people inspecting the ship before permitting its entry into the recycling yard determined to ensure that the ship is absolutely Gas free, before issuing it a Gas Free certificate? Only the number of accidents and the marine pollution incidents will tell the tale. The data was collected through a survey of shipping companies operating tankers and through appropriate authorities at Alang Ship-recycling

yard. The extensive experience of the Author and his colleagues in Tanker operations (Over 20 Years) was utilized in the analysis of data.

Only the involvement of third-party experts from the field in Tank cleaning and gas freeing operations can pave the way to safe & environmental friendly Tanker recycling.

Keywords: - Tankers; Gas Free, Pollution; Safety, Hong Kong Convention, Ship-recycling

TOWARDS ZERO SHIP EMISSIONS II – PROJECT GREENSHIP

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Keywords: ship emissions, ship energy efficiency management, pollution, climate change, Energy Manager Training Program.

Abstract

IMO's own International Shipping Facts and Figures report 2012 stated the number of vessels across the globe of 100 Gross Tonnage and over was 104,304, with cargo carrying vessels being 55,138 and expressed concern about the exponential increase of CO_2, NO_2, CH_4 and so forth in recent year. The EU responded by setting targets. The EU 2050 objectives set some intermediate targets for Eco-Efficient Vessel Emission Reduction for key pollutants: CO_2: >80% (-30% by 2020), NOx: 100% (-80% by 2020), SOx: 100% (-80% by 2020) and Noise Reduction: -3dB. A review of current research (Ziarati et al, 2018) clearly shows that the targets set for 2020 by both IMO and EU were not achieved and the 2050 goals are also unlikely to be achieved. The Industry is taking steps to reduce its air pollution and carbon footprint due to recent and upcoming IMO and EU regulations; IMO GHG study, Buhang et al (2009) reports that IMO has introduced some limits but has been unable to monitor ship emissions.

EMSA has tried the use of satellites and drones to monitor ships, which pollute the sea but has been unable to monitor ship emissions and waste discharge at sea effectively due to technical difficulties and also vastness of the oceans.

As the regulations and technologies governing energy efficiency on board ships becomes more complex it is realised by both the IMO and the shipping industry that seafarers need specific training to a much higher level in these fields. There needs to be a position specifically for managing, checking and controlling a ship's emissions for gases that are harmful to human health and the environment, an "Emissions Manager". As this is a brand new position, there are

neither defined competences for this role nor any specific knowledge, understanding or proficiency for it.

The paper gives full account of IMO efforts in recent years in setting legislation for key pollutants and reports on a new job specification for the Emissions Manager and proposes that an e-course being developed by several EU member states for the training of key ship officers and crew on how to minimise and monitor harmful emissions. The corresponding programme concerned with the current practice of managing emissions as well as the principle of making ships energy efficient. The new training programme targets both current cadets and existing seafarers in order to complement their skills.

USING ARTIFICIAL INTELLIGENCE (AI) METHODS TO COMBAT CLIMATE CHANGE at MARINE PORTS

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Abstract

Marine ports operations are often associated with a variety of externalities including air pollution, noise, accidents, vibration, land take and visual intrusion. Climate change is considered to be a crucial challenge that mankind has to confront nowadays Special attention has to be paid to the emissions of greenhouse gasses from freight transport. When berthing at a port a vessel needs considerably large amount of electric power to support its operations such as loading, unloading, lighting, cooling, etc. The power is usually supplied by auxiliary machinery and the fuel used causes several gasses emission that results in air pollution. Furthermore, this kind of engines produce noise pollution to a neighbourhood. The negative factors have an impact on the working environment and the quality of life of the citizens living in an area adjacent to a port.

A universal method of shore-to-ship electrification, also known as Cold Ironing, has been recently applied for connection between all the types of ships or on-land electrical systems with different frequencies – 50 and 60 Hz. Although the cold ironing is a way to reduce ships' emission and air pollution of a port and its neighboring areas consequently, the fact that the

ship is connected with a grid is a disadvantage. The disadvantage lies in its holistic approach to combat climate change. The electrical grid is powered by fossil fuels so the total contribution to air emission is limited. The zero emissions' port approach using a smart grid technology approach connected to renewable energy sources. The electrical grid is used only as a backup source in a situation where there is a deficit in power balance. The offered energy sources, found in nature, are wind, solar, geothermal, tidal and wave energy while there is also energy in biomass and earthquakes. Although there are so many of them, the challenge is the conversion to electricity and the efficiency of the converting systems. The use of such sources for commercial electrical supply is only possible with the new "Smart Grid" concept. The optimal control of such systems soon will require up-to-date algorithms with the use of artificial intelligence(AI).

In the paper, an overview of AI methods for smart grid energy management optimization are presented for ports discussing the potential application of each algorithm to zero-emission port concepts.

Keywords: artificial intelligence, climate change, cold ironing, smart grid, green port, zero-emission port

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