

Education And Career Development -Skill Development For The Future: Addressing The Maritime Industry's Talent Gap

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Abstract

As technology promotes industry growth, a skill gap is expanding quickly. Onboard process automation requires a set of non-technical talents, or “soft skills” (which do not include software), that are beyond what robots can perform. The business has attempted to control that through skill, but crew performance is also crucial. Pressure on ship operators is increased by a more competitive market and information overload. Human mistake is the cause of more than 80% of marine accidents, which result in \$1.6 billion in insurance claims (Allianz Group, 2019). That figure could get worse if the skills gap is not given adequate attention. According to a Menon Economics report, taking use of the opportunities presented by the digital and other technologies will require both organizational and human skills.

Additionally, studies and researches have shown that the STCW's requirements for competence will not be adequate for seafarers of the future. Additionally, required will be soft skills for managing teams and remote workers, as well as leadership, language and communication abilities. This study also emphasizes that in order to combine people and digital technology, a new operational paradigm must be developed.

The use of virtual reality (VR) technology in skill development has the potential to revolutionize training and education in maritime engineering. Virtual Reality (VR) offers a secure, engaging and immersive setting for simulating complex marine operations, allowing students to gain useful skills without the dangers of real-world situations.

Some of the skills that are crucial for seafarers includes-

- Critical thinking
- Cognitive flexibility
- Emotional intelligence
- Problem solving
- Negotiative ability

Keywords: Soft Skills, Cognitive Flexibility, Maritime Industry, Human Error, Digital Technology, Virtual Reality, Seafarer Training, Leadership, Communication Skills, Problem Solving.

Introduction

More than 80% of world's good are transported via maritime sector which forms the foundation of international trade. This dynamic industry requires a highly competent and flexible workforce since it operates at nexus of tradition and innovation. A chronic skill gap, quickly developing technologies and changing regulatory framework are just a few of the major obstacles the business must overcome.

One of the most important ways to address these issues is through skill development, which keeps the maritime workforce efficient, competitive and in line with contemporary needs. The industry may improve operational performance, guarantee safety and promote sustainable growth by making investment in education, training and ongoing professional development.

VR Simulation: -

Virtual reality (VR) helps solve issues with skill development, safety and cost-effectiveness by producing realistic scenarios in a controlled virtual environment.

VR are also help in various sectors in the shipping industry such as-

- Crew Training And Development
- Navigation And Maneuvering
- Maintenance And Inspection
- Emergencies Responses
- Cargo Handling

Cross Culture Training: -

It diversifies knowledge regarding various culture across the Globe and help in enhancing our relation onboard while dealing with different nationalities. As well all know that shipping industries are being contributed by various nationalities across the globe which solve major problem regarding cultural differences.

Cross cultural training is crucial for international business since it informs newcomer about the culture and customs to different nationalities, enabling them to comprehend how many people behave and conduct themselves in other nations.

Effective communication between employees from various geographical location is insured by cross-cultural training, which also listens the possibilities of miscommunications resulting from a failure to comprehend colleague's behavior or form misinterpreting their words, gesture or body language.

Emotional Intelligence Training: -

It helps in understanding one's emotion and ability to act in various different situations. It acts as an important factor in improvising communication and builds a strong relationship between employees.

As most of seafarers are suffering with problem related to depression and anxiety EI aids in managing stress level onboard ship.

As some of the glimpses are also provided in STCW courses but more exposure shall be given to shed light on mental health of seafarers.

It helps a person onboard to be resilient in various emergency situations.

Adaptive neural networks: -

· In order to better suit the input during training, adaptive neural network can change their parameters and structure. This type of neural network is made to learn and adapt in dynamic situations.

· In Marine Engineering, adaptive neural network provide solutions for dynamic and unpredictable settings, allowing for reliable control and prediction in domains like as autonomous navigation, dynamic positioning and path following.

· Controllers for marine vessels that retain a precise location and heading even in the face of disturbances like wind, waves and currents can be created using adaptive neural networks.

· By creating automated berthing and docking systems, they can increase productivity and security. Despite environmental or ship dynamics uncertainty, these networks can assist ships in keeping to predetermined routes or destinations.

Objective

To improve skill development in maritime sector through the integration of training in soft skills and modern technology.

Developing emotional intelligence to enhance leadership and teamwork, cultivating multicultural skills for successful international collaboration utilizing adaptive neural networks for individualized learning experiences and decision-making support and utilizing virtual reality simulation for immersive hands-on training are all example of this. The objective is to develop a maritime workforce that is highly qualified resilient and proficient in technology and able to handle the challenges of modern maritime environment.

Literature Review

Skill development in the maritime industry has been widely discussed in academical and industrial literature due to its critical role in ensuring safe and efficient operation resources highlight the importance of training programs that focuses on both technical and non-technical skills. Technical skills such as navigation machinery operation and cargo handling are fundamental for operational efficiency non-technical skills including communication teamwork and decision making essential for effective coordination and crisis management.

Studies emphasize the growing adoption of advanced technologies such as simulators and virtual reality for realistic and cost-effective training. VR simulation provides a safe environment for receipt errors to practice emergency responses and navigation techniques producing their risk of real-world errors additionally regulatory bodies like international maritime organizations stress compliances with standard such as STCW ensure uniform skill level globally. Recent research also highlights challenges like gaps caused by rapid technological changes and need form continuous learning industry exports advocate for the balance between traditional hands-on training and modern digital tools to address these gaps in summary scale development remains vital for maritime safety sustainability and global competitiveness.

Case study: CAL-TEK srl The Ship Bridge Simulator developed by CAL-TEK srl is designed to provide realistic and effective training that meets the Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) Convention. This simulator includes all the essential instruments found on a real ship's bridge, set up in a way that closely matches how they are arranged on an actual ship. This setup allows trainees to practice in a realistic environment, preparing them for the situations they will encounter at sea. The simulator can recreate complex, real-world scenarios, giving trainees the chance to assess situations, evaluate risks, and work together with others in a coordinated way. Using VR the simulator offers a highly engaging experience where trainees can respond to various emergencies, such as engine failures or fires, in a safe and controlled environment. Ship Bridge Simulator The Ship Bridge Simulator comes with a detailed database of geographic areas, including major international ports and inland waterways, ensuring that training scenarios are as close to reality as possible. The system is designed to be flexible and modular, allowing it to be customized to meet specific training needs, whether for different types of ships or propulsion systems.

Key features of the simulator include:

- **Advanced Visualization System:** this system provides a realistic view and sound to make the bridge environment feel real.
- **Complete Navigation Tools:** it includes several tools and, all meeting international standards to support comprehensive navigation training.
- **Scalability and Flexibility:** the simulator can be set up for basic desktop training or expanded to add more student stations—where trainees interact directly with simulated scenarios using tools to learn navigation and vessel operation, as well as more scenarios and software as needed.
- **Interoperability:** the system works well with other existing training solutions, thanks to IEEE 1516 HLA standards for interoperable simulation.
- **Instructor Workstation:** it serves as control centers where instructors manage, monitor, and customize these training scenarios. They adjust simulation conditions, track performance, and provide feedback, ensuring that the training is effective and meets educational goals.

Virtual reality (VR) has drawn a lot of interest as a changing technology in a number of industries, including entertainment, education, training and healthcare research shows that virtual reality (VR) may produce dynamic realistic environments that actual situations because it enables users to practice in a secure environment free from real world hazards

virtual reality (VR) is especially useful for training and skill development by offering practical experience virtual reality we are improved student engagements and comprehension in the classroom in the healthcare and marine sector VR is utilized to simulate difficult processes and situations researcher find the virtual reality enhanced decision making abilities, visual perception and learning retention.

Example:

Bridge Simulation: - By simulating a ship's bridge virtual reality system enables student to practice route planning navigation and avoiding collisions in a variety of weathers and see situations

Engine Room Simulation: - Engineers may learn how machinery works spot problems and do maintenance without the need for actual equipment by using virtual engine rooms."

Cross cultural training is a means of preparing and educating individuals in an organization for the organization's international business operation cross culture training enhance intercultural communication awareness and understanding enhancing business operations.

Interaction Management:

Enables employees to interact with people from foreign cultures talking into account the culture values and customs.

Dealing with Conflict Resolution: - Learn through role play as situational exercises this is the most common focus of cross culture training programs offered by companies that work internationally.

We apply the Hecklau et al. categories for the classification of competencies. The study's authors categorized the competencies into four groups: methodological, social, technical, and personal. The competences identified in the research of Bartman, Hecklau et al., Prifti et al., IAMU, WEF, Grzybowska and Łupicka, Kusmin and Normak, and Prifti are thoroughly examined in order to determine the competencies. As a result, 33 competencies are identified for a seafarer's future talents within 4 categories. . With the maritime industry becoming more digitally integrated, information and data processing and programming skills will become critical technological skills.

Seafarers will be more equipped to handle the social problems of future if they possess emotional intelligence, negotiation skills, cultural sensitivity, and knowledge transfer abilities. Important fundamental qualities for the professionalism of a seafaring include intellectual ability, IT and technology affinity, and learning and research competencies.

Seafarers will be more likely to adopt the newest technical advancements in the future, if they have a sustainable mentality, adaptability, and learning drive. The 33 competencies include Operations Monitoring and Analyzing, Equipment Operation and Control, Equipment Maintenance and Repair, Troubleshooting, Information and Data Processing, Programming, Emotional intelligence, Negotiation, Language ability, Communication with people, Teamwork, Collaborating with others, Adapting to cultural differences, Ability to be compromising and cooperative, Ability to transfer knowledge, Leading and supervising, Creating and Innovating Cognitive, Ability Problem solving, Conflict solving, Reasoning and Decision making, Learning and Researching Managing complexity, Efficiency orientation IT and Technology Affinity.

A specific subclass of artificial neural networks called Adaptive Neural Networks are made to dynamically modify their weights learning parameter or structure in response to fresh input or shifting conditions the literature highlights how they can increase learning effectiveness and flexibility which makes them appropriate for challenging non-stationary tasks.

Application of ANN in domain such as autonomous system robotics and predictive modeling and are highlighted by research to handle dynamic process in real time for example, they are employed in adaptive control system (ANN) are used in financial forecasting to improve forecast by adjacent to changing market circumstances.

Research indicates that when compared to starting neural network adaptive processes like self-organizing structures and online learning improve the performance nonetheless issues including overfitting risks and computational complexity are mentioned.

The capacity to identify comprehend and controls one's own emotion as well as those of other is known as emotional intelligence. Self-awareness, empathy, emotional control, social skills, and motivation are some of the essential elements emotional intelligence according to researchers is essential for developing leadership skills collaboration and interpersonal and professional connections. The most intelligence has been recognized as the important talent in marine business where teamwork and efficient communication are essential. Research indicates that emotional intelligence improved decision-making stress management and conflict resolution especially in high stress situation like ship operation or crisis.

Emotional Intelligence on port workers' performance in the Port of Algeciras Bay, Spain: -

When compared to other public sector organizations, only a very small fraction of employees had higher

levels of stress, according to several 2007 research conducted by outside companies, indicating that conflicts have a relatively residual character in the ABPA. There are six unions inside this organization, which employs about 350 individuals, and their huge dispersion, each with a distinct stance, hinders the port's proper operation. The primary reasons of clashes are this reality combined with group disputes, like a strike, or disagreements amongst employees. This results in higher costs, both financially and in terms of maintaining an engaged and driven workstation. In some cases, conflicts arise due to the lack of the EI skills that are necessary for the job. It is for this reason, that the "level" of EI of each individual can be an excellent indicator of future conflicts within the company. In order to know if a employee has higher EI levels in a selection process, the port authorities evaluate people using different methods, such as group dynamics, personal interviews and personality testing, among others. These alternatives must be weighed together, since that will be the only way to make a reliable selection process.

Research Methodology

Skill Development required for individuals in order to perform proficiently in multinational company in future. The foremost skills required in the aspects of technical, social, methodological and personal were showcased in the survey. These aspects are interrelated to the sub topic like VR simulation which can help in improving the operation monitoring and analysing part. Social aspects cover emotional intelligence, adapting to cultural differences. The research is done on the basis of view point of different people who are active in these fields as well as people who had retired. This study employs a descriptive and exploratory research design to analyze skill development in the maritime industry, focusing on current competency levels, training needs, and the influence of emerging technologies. A survey-based approach is used, incorporating quantitative (survey-based) data. The research follows a cross-sectional approach, collecting data at a single point in time to capture the current state of skill development.

Primary data is collected through online surveys using Google Forms, distributed to maritime professionals, students, employee and trainers. The survey includes self-assessments of maritime skills, preferred training methods, and perceptions of industry readiness for digitalization and automation.

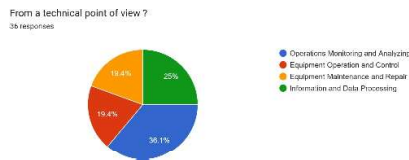
Additionally, semi- structured interviews with maritime experts and trainers provide deeper insights into skill development challenges and best practices. Secondary data is gathered from reports by organizations like the maritime training institutes, as well as academic journals and industry whitepapers.

Analysis And Interpretation:-

The Maritime Industry is a dynamic and critical sector that requires a diverse range of skills to ensure efficient and safe operations. Analysing the current trends and challenges in skill development reveals several key insights.

From A Technical Point Of View:-

- **Operation Monitoring And Analysis:-** Observing and accessing system performance to ensure efficient and safe operations.
- **Equipment Operation And Control:-** Managing and regulating machinery and system to perform task effectively.
- **Equipment Maintenance And Repair:-** Conducting routine maintenance and fixing issues to ensure reliability and longevity of equipment.
- **Information And Data Processing:-** Collecting organising and analysing data to support decision making and operational efficiency.

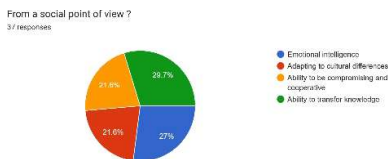


From A Social Point Of View:- Emotional intelligence: - Understanding and managing one's emotion and empathizing with others.

Adapting To The Culture Differences: - Being flexible and respectful in diverse culture settings.

Compromising and Cooperative:- Working collaboratively and finding mutual solution.

Knowledge Transfer:- Effectively sharing skill and expertise with others.



Methodological Point Of View:-

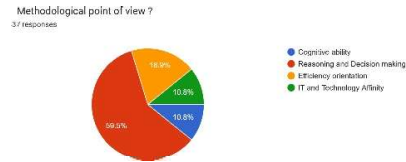
Cognitive ability: - Capacity to learn, understand and solve problems.

Reasoning and decision-making: - Analyzing situation

and making sound judgments.

Effective orientation: - Focusing on achieving goals effectively.

IT and technology affinity: - Comfort and proficiency in using digital tools and technology.



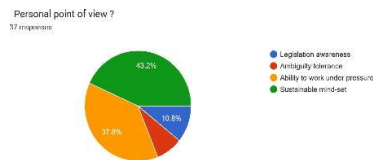
From A Personal Point Of View:-

· **Legislation Awareness:-** Understanding and compiling with laws regulation and policies.

· **Ambiguity Tolerance:-** Comfort with earned certainty and unclear situation.

· **Ability To Work Under Pressure:-** Maintaining performance and composure in challenging conditions.

· **Sustainable Mindset:-** Commitment to environmentally and social responsible practises.



Findings & Conclusion:-

The technological developments will radically change the employment pattern in maritime industry and also trigger the necessities of highly qualified human resources. For this reason, to figure out future skill sets of human resources in maritime industry provides a new perspective specially for maritime education and training institutes to reform their training and education activities to educate highly qualified seafarers. At this insight, this study focuses on identification of futureproof skill sets in maritime industry. As a conclusion, although our analysis was mainly based on literature review, this study can serve as a foundation for further research and studies on the analysis of futureproof skill sets in maritime industry.

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