



## **DIGITALIZATION OF MARITIME EDUCATION AND TRAINING (MET) QUALITY STANDARD SYSTEM (QSS) IN MARITIME ACADEMY OF ASIA AND THE PACIFIC (MAAP)**

**Michael Amon<sup>\*</sup>, Susan Murillo, May Anne Conocido**

**Abstract.** In the era artificial intelligence and digitalization, quality standards as mandated in STCW '78, as amended, Regulation I/8 (IMO, 2018) as shouldn't be left behind as the green transition (Paris Agreement, 2015) charts its voyage. As MAAP top management leads its strides in full support of the digitalization and decarbonation (Fouquet, 2022) goals of the maritime industry, strong commitment and leadership in digitalizing the Academy's QSS a notch higher for better cybersecurity.

This paper shall discuss the transition from a google drive system into a web-based and databased system. It also shall discuss what are the MAAP's MET digitalization and decarbonation systems have implement ensuring quality its programs and courses offered. This paper would like to answer the questions "Does digitalization of MAAP QSS support decarbonization?"; "What are the advantages and disadvantages of web-based and databased QSS?" and "How can we further improve MET and QSS in the AI and digital era?"

Qualitative and quantity research method shall be used to further illustrate the development and implementation of such system that can assist the maritime lecturers and IMLA members how can they fully benefit of a digital QSS in their institution. The paper therefore concludes that digitalized decarbonation endeavors of MAAP definitely leads to Sustainable Development Goals (SDG) number 4. Quality Education and 13. Climate Action goals of the 2030 Agenda for Sustainable Development (UN, 2015) as the institution navigate towards 6th industrial revolution (Igugu, 2024).

**Keywords:** Maritime Education and Training; Quality Standard System; Digital Decarbonization; Sustainable Development Goals.

Maritime Academy of Asia and the Pacific, Quality Assurance Department, Mariveles, Bataan, Philippines

**\* Corresponding author:**  
[maamon@maap.edu.ph](mailto:maamon@maap.edu.ph)

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## 1. INTRODUCTION

According to the IMO Secretary-General Arsenio Dominguez during the last 49<sup>th</sup> Session of the Facilitation in London, "The IMO Maritime Digitalization Strategy is a game-changing effort to make smooth, seamless, smart shipping a reality. It will help integrate vessels and ports, improve logistics and optimize routes, while reducing greenhouse gas emissions. We must work together to ensure the strategy serves all." (IMO, 2025). It was a clear beacon in the maritime industry with the IMO leadership navigating the water of new technology to advance international shipping.

Digitalization and automation in the maritime industry is gaining fast waters with digital tech and solutions that are used increasing competitiveness and enhancing efficiency (DNV,2025). DNV added that maritime stakeholders need to re-think, just like IMO, strategies and adapt the element below:

- a) Management, resources, capabilities
- b) Integrated systems, tools, and connectivity
- c) Technology and efficient solutions
- d) Energy-efficient and enhanced performance.

In higher education institution (HEI), digitalization has fundamentally reshaped and revolutionized how students learn, faculty teach, and institution operate (Tandet, 2024). With the integration of digital technology and tools to enhance teaching, learning, research and administrative processes, the key aspects of digitalization HEIs includes the following:

- a) Online Learning
- b) Digital Resources
- c) Enhanced Communication
- d) Personalized Learning
- e) Data-Driven Decision Making
- f) Global Reach
- g) Administrative Efficiency
- h) Faculty Development
- i) Accessibility and Inclusivity.

According to United Nations Industrial Development Organization (UNIDO), digital transformation is affecting all spheres of life and quality and standards are no exception. The ongoing paradigm shift, driven by data, the convergence of technologies and their interconnectedness, will significantly impact quality infrastructure (QI) and related services (UNIDO, 2025).

Looking into this transition from all front that would definitely affect or influence MAAP operation such as

IMO, maritime industry, HEIs, and UNIDO and even local Maritime Administration (MARINA) have digitalized most of its operation has established a strong rationalization and justification to digital MAAP Educational Organization Management System (EOMS) which call Educational Quality Standard System (EQSS).

Although the EQSS manual access and distribution is already have been digitalized using google drive as share folder, MAAP Quality Assurance Department (QAD) have further elevated the level of electronic documentation. This paper discusses the transition for a mere scan and post system into a web-based and databased EQSS that supports a more secured system advocating digitalization and decarbonization.

MAAP top management commitment and leadership emanates in this project with the approval of the Annual Quality Plan and IT department collaboration for the system development and address hurdles along the way.

## 2. REVIEW OF RELATED LITERATURE

On March 10-14, 2025 IMO's Facilitation Committee (FAL) laid down the roadmap for digital transformation as IMO's Strategy on Maritime Digitalization as approved work plan (IMO, 2025). This strategy shall be expectedly adopted by the end of 2027 by the IMO Assembly. The Key digital initiative are as follows:

- a) **IMO Compendium on Facilitation and Electronic Business** – This new version includes electronic bunker delivery note, electronic bill of lading, transportation of dangerous goods, container inspection regime, crew certificates, meteorological and oceanographic data collected by use of Voluntary Observing Ships, delivery bill for mail consignment, and Ship sanitation control certificate.
- b) **Enhance Maritime Single Window (MSW) Guidelines** – approved the Guidelines for Setting up a MSW (FAL.5/Circ.42/Rev.4) that enhanced verification functions in MSW system and reduced administrative burdens.
- c) **Cybersecurity for MSW** – introduced to develop cybersecurity measures to safeguard MSWs and protect digital maritime operators from attacks.
- d) **Electronic certificates Guidelines** – approved the joint FAL-LEG-MEPC-MSW Guidelines for the use of electronic certificates and forwarded authorized bodies for concurrent approval.

The main maritime body the governs and guides the MET and QSS is poised for this digital transformation to attain safer, greener and smarter maritime industry

in the future. Hence, the Maritime HEIs are would not be amiss if it dips in the stream of digital waters whether it be Information Technology (IT) or Operational Technology (OT).

According to DNV (2025) act smart in all aspect of shipping as a trusted advisor and partner for digital transformation that includes four (4) steps of towards data-smart shipping such as 1. Smart Strategy; 2. Smart Fleet Transformation; 3. Smart Ship Management Implementation; and 4. Smart Operation.

By integrating decarbonization, digitalization, and workforce transformation, we can establish structured initiatives like Green Digital Shipping Corridors (GDSCs), strategically scaling zero-emission, smart maritime routes (Khabir, 2025). Expanding maritime digital horizon into the green transition strongly support sustainability and environment care. Digitalization is not just using technology to advancement but a way of taking care of mother earth and easing workload of the workforce.

## 2.1. Digital MET

Digitalization of Maritime Education and Training (MET) Quality Standard System (QSS) in Maritime Academy of Asia and the Pacific (MAAP) mission is not only preparing the Seafarers for today but also for future requirements. It requires everyone to understand the impact of digitalization on the industry and adopt new programs, as well as the benefits of IT, to improve the teaching and learning methods of the academy. Digital transformation is reshaping industries worldwide, including the maritime sector, by integrating advanced technologies to improve efficiency, safety, and sustainability.

According to Ergun Demirel, one of the main aims of digitalization is to connect all respective parts of the systems. Not only the systems but also human beings should be connected. That means we should also work on not only the interface and interoperability among the systems, but also between the systems and human beings. When the technology takes grand steps to improve the existing shipping systems, it is also required to improve the quality of the crew through education and training. There is a strong need to make the crew eligible to work the state-of-the-art systems on board effectively (Demirel 2020).

Demirel discussed under the New Skills and Competencies that the future seafarers will experience their vessels becoming more digitalized and thus more reliant on computerized technology. This means that keeping the crew trained and ready to "Monitor the machine" will become no less important than it is today for a chief on the main engine. He added that shortly, there will be lots of remotely controlled and

autonomous ships at sea, which will require remote controllers on shore. The remote controllers are expected to be seafarers who are eligible to handle remote systems. One of the major challenges the industry faces will be enabling seafarers, shore staff, charterers, regulators, etc., to work together seamlessly to deliver safety, efficiency, and reliability. We are focused not just on how the way we work at sea will change, but how all of us in the industry can work differently to enable and support digital change and opportunity. MET institutes should take the necessary steps to embrace digitalization and adopt it in the maritime industry soon (Demirel 2020).

Additionally, the shipping business becomes more technical, and it demands a highly skilled and specialized crew ready to embrace continuously evolving technology, (Demirel 2020).

Dr. Kamelia Narleva, Associate Professor, and Dr. Yan Gancheva, Assistant Professor of Nikola Vaptsarov Naval Academy (Bulgaria), mentioned in their research that in today's world, where work is done anytime and anywhere (and predominantly over digital channels), soft skills and neurodiversity are becoming increasingly relevant. Empathy, emotional intelligence, and the ability to connect with diverse colleagues across various parts of the world are just as important to success as technical skills. Organizations expect teams to collaborate and co-design to find complex solutions in a fast-changing world. Organizations, despite their size, would benefit from taking a broader view on upskilling and rounding out technical training with programs that focus on leadership, business management, and cross-functional competencies (Narleva, Gancheva, 2023).

Hybrid and remote workforces require/expect to meet them on their preferred channels. An agile approach that delivers training through a combination of synchronous and asynchronous channels will help drive deeper engagement, better collaboration, and real-time feedback.

They discussed that the relationship "modern education – digital transformation" includes a transition to a new way of presenting resources – skills, tools, support, tailored to the environment, and not a mechanical transfer of classical approaches to the new environment. The transition of universities to digital transformation is not a random process, but a continuous, systematic, planned, and entrepreneurial activity of improvement at the technological, administrative, and educational level (Narleva, Gancheva, 2023).

Dr (Capt.) Suresh Bhardwaj discussed in his writeups that Seafaring is a practical and demanding profession, requiring fast and accurate analysis of situations,

and swift, decisive action. Candidates for seafaring jobs are therefore expected to exhibit a balance of cognitive, affective, and psychomotor skills. In addition, in an increasingly complex workplace that ships are getting, seafarers require a high level of teamwork and interpersonal skills in order to function effectively. If the intention is to replace a well-designed training and exercise session supported by a good trainer with Computer-Based Training (CBT) material alone, it should be realized that it is possible to impart a lot of knowledge, but individuals may not be able to put it into practice due to the lack of tangible and physical environment, the lack of team support, and the lack of the necessary human interaction (Dr (Capt) Suresh Bhardwaj, 2019).

In safety-critical industries such as shipping, characterized by high-risk workplaces, any changes to training and assessment methodologies must be aimed at enhancing critical skills as opposed to commercial expedience or just fad (Dr (Capt) Suresh Bhardwaj, 2019).

## 2.2. Digital QSS

The Quality Standard System (QSS) serves as a structured approach to maintaining and improving organizational quality, often guided by international benchmarks such as ISO 9001, Total Quality Management (TQM), or Six Sigma. Traditionally, these frameworks were implemented through paper-based documentation and manual auditing processes (Garvin, 1988). However, the digital age has brought about significant transformations in how quality is managed and monitored.

Digital QSS refers to the integration of technology in the administration of quality standards, enabling automation, real-time monitoring, and data-driven decision-making. According to Lopez and Fernandez (2020), digital QSS platforms enhance operational efficiency by reducing documentation time, ensuring compliance tracking, and promoting continuous improvement. These systems often include modules for document control, audit management, corrective actions, and performance analytics.

In the educational sector, for instance, the use of digital quality assurance portals has been shown to improve the consistency of evaluations and feedback processes (Santos & Cruz, 2019). Meanwhile, in industrial contexts, companies are increasingly adopting cloud-based quality management systems (QMS) to comply with ISO standards while ensuring faster response to quality issues (Lee et al., 2021).

The rise of Industry 4.0 has further accelerated the use of smart QSS tools such as IoT sensors, machine learning algorithms, and real-time dashboards that

proactively detect quality deviations (Zhou et al., 2018). However, challenges persist, including cybersecurity risks, the complexity of system integration, and the need for employee training on digital tools (Martinez & Ghosh, 2022).

Despite these barriers, there is a growing consensus that digital QSS is essential for achieving scalable, efficient, and transparent quality compliance. Still, literature highlights the need for further research on localized and customizable digital QSS frameworks, especially for small organizations or schools where resources may be limited (Del Rosario, 2023).

The evolution from manual to digital QSS reflects broader trends in organizational modernization. While benefits are well-documented, more work is needed to standardize and streamline digital quality systems across sectors.

## 3. DISCUSSIONS AND RESULTS

Digitalization MET is the comprehensive integration of digital technologies and innovative pedagogical approaches into the curriculum and delivery of education and training for maritime learners. Its modality is a paradigm shift from traditional, often solely classroom-based or manual practical training, to a more dynamic, accessible, and technologically advanced learning environment. With the ultimate goal is to prepare a "future-ready" maritime workforce equipped with the necessary digital competencies and adaptive skills to efficiently handle modern, technologically sophisticated ships and maritime operations (Virtual Maritime Academy, 2024; Nautical Institute, n.d.).

Digital QSS set the smart governance on this digital MET towards quality, artificial intelligence, automation, simulation, supervision, monitoring and data-driven decision making. Looking into the basic foundation of Maritime QSS they are STCW Convention, Reregulation I/8 (for maritime administration and training institutions), ISM Code (for shipping companies), and ISO 9001 (for many maritime organizations). What then is applicable for MAAP? It will be then STCW Convention and ISO 9001 where in digital transformation can be leveraged.

With publication of ISO 21001:2018 as the standard for Educational Organizations Management System (EOMS), MAAP changed gears from ISO 9001:2015 last 2019 and be certified to the new standard. Spearheading in the Philippines and MHEIs we also presented a paper at IMLA 2021 Joint Conference with the title "MAAP Transition from ISO 9001:2015 to ISO 21001:2018 the New Quality Standard in Education Organization" (Santos and Amon, 2021). This

standard is a stand-alone management system standard, aligned with ISO 9001 (ISO, 2018). According to STCW Code as amended, Part B, Chapter 1 Section B-I/8. 5.1 stated that "in establishing quality standards for education, training and assessment programmes, the organizations responsible for implementing these programmes should take account ... where provisions exist for established national accreditation, or **education quality standard**, such provision should be utilized for courses incorporating the knowledge and understanding requirements of the Convention."

Educational Quality Standard System (EQSS) was coined to present the fusion STCW's QSS and ISO's EOMS as MAAP standard. This paper shall describe transition from a simple scan and post in a shared portal into a web-based system with database that align to data analytics that can be used in monitoring and decision making.

### 3.1. Digitalizing MET EQSS at MAAP Timelines

With the MAAP Voyage Plan 2020-2025 QAD have targeted to support the Digitalization of its manuals and processes. In 2020 the paper base distribution for Policy and Procedure Manual was retrieved was replaced by a shared posting using google drive. This simple digitalization has reduced significantly use of paper whenever there is revision since we print only the master copy and distribution is now fully digital.

The plaque of the Corona disease (COVID-19) pandemic swept the world and quarantined everyone last March 11, 2020. How did the Academy survive the predicament? Answer: Digital Maritime and Training. As we maintained our bubble for safety, we were using Learning Management System for the theory and used cloud simulation for practical. During these trying times hasten the use the development and use digital content and systems in the Academy.

In terms of National Accreditation, PACUCOA has Implemented Remote Virtual Accreditation (RVA) the uses Electronic Self Survey Instrument (ESSI) that **digitized** the exhibits for accreditation. MAAP attaining level III accreditation for both BSMT and BSMarE programs using digital documents last January 22, 2022.

Last April 7, 2022, the International Maritime Organization (IMO) thru independent evaluators Prof. Malek Pourzanjani and Prof. Milhar Fuazudeen and together with representatives from MARINA and CHED conducted an audit at MAAP, West Campus. During the audit besides the master copy of EQSS the **digital EQSS** was used and accepted during the audit.

Series of Maritime Authority (MARINA) and Commission on Higher Education (CHED) have accredited and audited MAAP with digital EQSS Implemented.

Most of the audit results were found positive and were done remotely meaning via digital platforms. These digital (remote) audits and accreditations practices are indicators that we can digitize our documentation and even systems that can be used even during normal or challenging situation.

Highlighting the increase of digitalization in the Academy, Cybersecurity for MET is indispensable for the protection of networks, devices and data from unauthorized or unintended access or illegal use (Santos et. Al, 2023). As utilized recommendation in our paper "Maritime Education and Training (MET) Cybersecurity and ISO/IEC 27001:2022 from Maritime Academy of Asia and the Pacific (MAAP) Perspectives and Traditions", of training IT personnel and use of ISO/IEC 27001:2022 standard, MAAP's Vice-President, IT Director and QMR have added DNV's Training last February 19-20, 2024. As result stronger policies, process and systems were in place as part of EQSS and MET in the Academy's after a series of orientation, documentations, and drills. On top regular curriculum that MAAP entered into MOU (2023) and MOA (2024) forming Green Skills Academy (GSA) driving innovation in maritime and energy transition education using Aprendio as a digital LMS platform. A joint collaboration between MAAP (Maritime Academy of Asia and the Pacific) in the Philippines and SIMAC Training and Aprendio, Denmark. Green Skills Academy (GSA) is a global initiative dedicated to accelerating the green transition through future-ready skills, digital innovation, and inclusive education. In the Academy we enroll 1000 learner per year and this year 2025 is the 2<sup>nd</sup> batch that cover ten (10) online self-paced courses (Renewable Energy, IGF, Technologies, Cybersecurity).

### 3.2. Development of Databased and Web-based EQSS Pilot-test Results

Navigating back to the QAD Voyage Plan of the developing with the IT department a databased and web-based EQSS development as not always smooth sailing along the course. As hurdled with the pandemic and constraints of prioritizing other system, the web-based EQSS was given attention on 2024 and finished in 2025 for beta/pilot test.

During the development, there were several issues about the user-friendliness and presentation of data during creation and review process of system. Our Vice-President also have given several advise and valuable insights during development and our President advised that the master copy should bear the original signature and digital can posting will just have label original signed. Below are the major issues that were resolved during the development and first of part of the beta test:

- Flexible and simplified review process by the Vice-president
- Direct comments per subsection for the policy and procedure
- Simplified mail notification if there are policy and procedure for review/approval
- Allow printing for the master copy of policy and procedures
- Relevant external documents can have link for easy access

In Figure 1, it shows the difference between a google drive based digital EQSS and the Web-based EQSS in terms user-interface and presentation. Aesthetically perspective we can see a big difference in

presentation because the google drive EQSS is like a listing just like windows explorer while the web-based EQSS exudes a professional presentation. Below are the comparative capability and features of the Google drive based EQSS and Web-based EQSS for us to analyze the benefits of having a data-base driven system.

Basic documented information controls focus on creation, review, and approval that can be seen Table 1 making this digital EQSS version compliant with ISO 21001:2018 Clause 7.5 (ISO, 2018). Furthermore, since the medium is digital this version of EQSS strongly support SGD 13 Climate Action to Take urgent action to combat climate change and its impacts by lessening carbon footprint with less paper use.

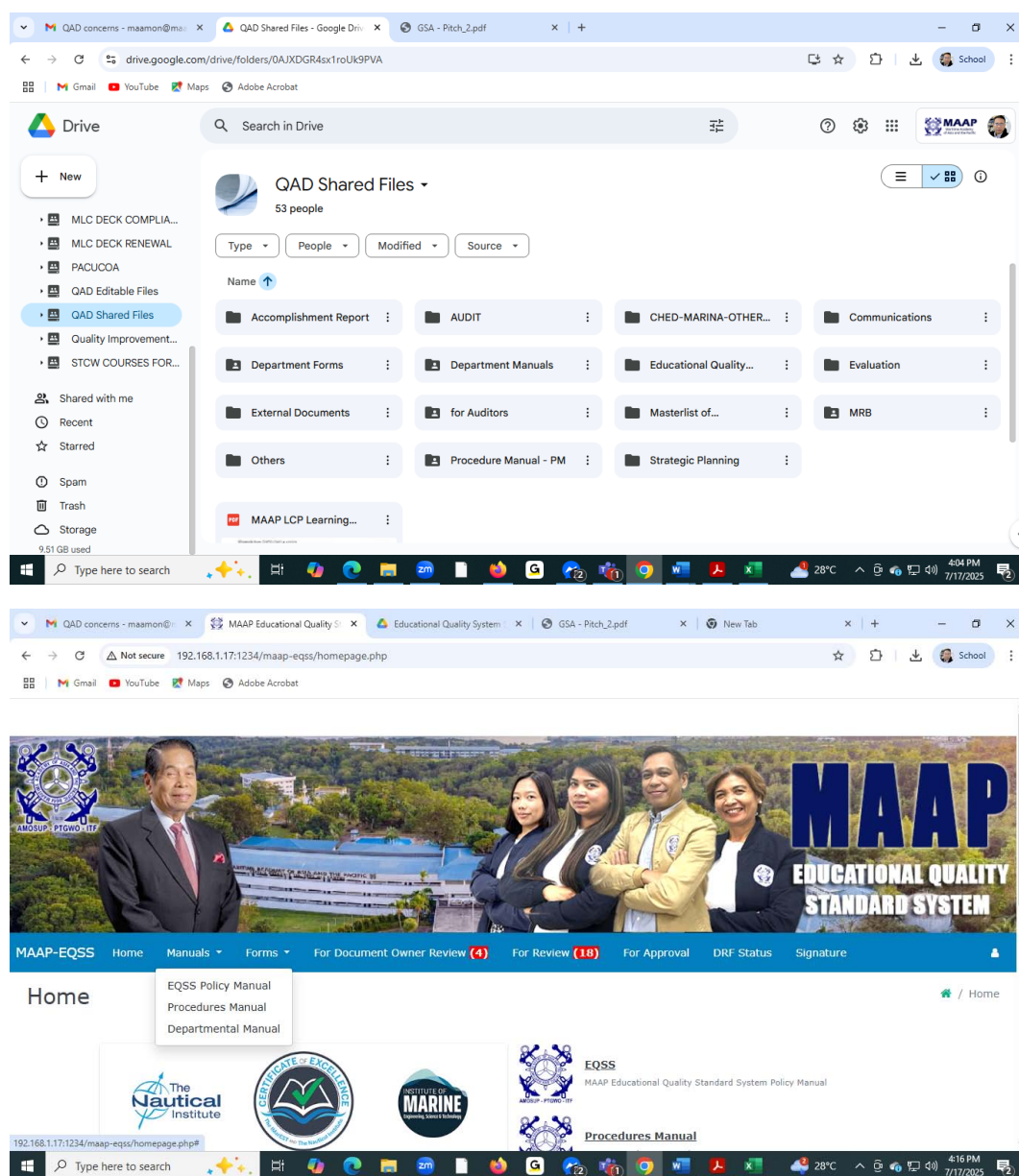


Figure 1. Google drive based EQSS vis-à-vis Web-based EQSS

**Table 1.** Google drive based EQSS and Web-based EQSS Capabilities

| Capability and Features      | Google drive based EQSS | Web-based EQSS |
|------------------------------|-------------------------|----------------|
| 1. Digital Posting           | Capable                 | Capable        |
| 2. Digital Creation/Revision | Not Capable             | Capable        |
| 3. Digital Review            | Not Capable             | Capable        |
| 4. Digital Approval          | Not Capable             | Capable        |
| 5. Digital Security          | Capable                 | Capable        |
| 6. Digital Notification      | Not Capable             | Capable        |

### 3.3. Digital MAAP MET EQSS now and the future

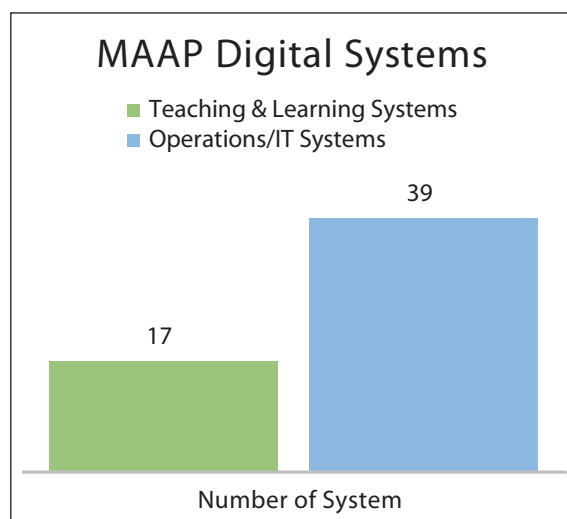
Looking to MAAP Portal, there are fifty-six (56) MAAP Digital System used and installed in the Academy. These digital systems comprises the digitalized MAAP MET EQSS in practice. Categorized into Teaching and Learning Systems (TLS) (LMS, CBTs, Digital Video Library, Guidance, Assessment systems) and other departments' Operations/IT Systems (OIS) (Support Information Systems) Chart 1 shows the number and percentages of MET system and supports. With several TLS in place, it is indeed, there is a concrete evidence of the SDG 4 of Quality Education as exemplified by elevating the mode of delivery and paced by the learners.

Just recently, July 7-8, 2025 NI have accredited MAAP as NI Dynamic Positioning Satellite Training Center in partnership with MOLMAT and Magsaysay Training Center. The quality system the academy adopted from Japan as the main training center is also digital using MS Teams Platform. This system will be fully integrated to MAAP EQSS as well. As to date an Asset Management and People Management System is development with United Training Service (UTS) as donors for the said web-based system with mobile app.

Furthermore, looking into the horizon ahead after full installation of digital twins. MASS ROC, IMEC building digital classroom and other will be operational as digitalization and decarbonization take its course across the institution.

## 4. CONCLUSIONS

Digitalization is here to stay and rapidly influence the way we teach, learn, decide and operate specially in maritime higher education and training. IMO had laid the digitalization strategy road map it means the maritime industry as it trickle down to schools, training centers, colleges and university will definitely follow suit. There is no escaping the inevitable technology advancement like AI and ESG (Environmental, Social, and Governance) initiative. MAAP development of a web-based EQSS is a vivid mirror of ESG

**Chart 1.** MAAP MET and OT/IT Systems

targets while taking care of the environment, having good relationship management of the organizational stakeholder, and promotes company's leadership, internal controls, and audits, ensuring ethical and transparent decision-making. MAAP's digital MET QSS have a lot upgrades and modules created to address the requirement of the future tech and standards.

## 5. RECOMMENDATIONS

Though the web-based EQSS is still infancy stage more module can be develop to have a more robust digital MET QSS in place for the next evolution and revisions. Thus, IMLA members' can have further collaboration and studies in term of digitization of ME QSS with MAAP. The following recommendation are based from the experience in the digitalization study.

- MAAP to include in the upcoming Voyage Plan 2026-2030 the development of digital EQSS module on internal audit, risk management and institutional planning to have a more data analytics for better decision making.
- IMLA members and MAAP to come up with study and creation of LMS for Maritime Lectures to have

a self-paced learning system exclusive to Members to increase value-adding service to IMLA members with certificate.

- c. Full implementation of MAAP web-based EQSS to fully reap the benefit of digitalization and decarbonization and show strong support to IMO 2050 climate ambition in the shipping industry
- d. IMLA member to benchmark to MAAP if the find the MAAP EQSS and MET systems beneficial to the faculty and institution and vice-versa to benefit both schools and lecturers
- e. IMLA to provide regular digitalization short courses or webinars that will benefit the maritime lecturers as part of the members benefits in term of upskilling and reskilling

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