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STRENGTHENING MARITIME EDUCATION AND TRAINING IN KENYA: CHALLENGES AND OPPORTUNITIES

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Abstract. This study examines the challenges and opportunities within Kenya's maritime education and training (MET) sector using a mixed-method design. A survey of 18 maritime instructors revealed critical deficiencies in instructional resources, technological infrastructure, and professional development. Complementing these findings, a focus group with six instructors trained in Finland illuminated systemic barriers to aligning Kenyan MET with the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW). The STCW Code had major revisions in 1995 and 2010 and is currently being revised to accommodate emerging technologies, world-wide disruptions such as COVID-19 hence the need for updated training tools and methods. Against this background, key issues include limited access to modern training tools, inadequate pedagogical preparation, instructor training and experience, and regulatory awareness. This research proposes a strategic framework to enhance MET through technology integration, international collaboration, and capacity-building initiatives, offering a roadmap for elevating Kenya's maritime workforce to global benchmarks.

Keywords: Maritime Education; Professional Development; Simulation Technology; STCW; Pedagogical Training.

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1. INTRODUCTION

The maritime sector is a cornerstone of global trade and economic stability, demanding a skilled workforce proficient in safety, operational efficiency, and regulatory compliance. Maritime education and training (MET) is an enabler of growth in the maritime sector with institutions tasked with cultivating such expertise and human capital development., Yet developing nations such as Kenya, experience significant challenges in meeting and sustaining international training standards set by the International Maritime Organization (IMO) on the Standards of Training, Certification, and Watchkeeping (STCW). Kenya's strategic position along East African shipping routes registering over 41 million tons in 2024 (KPA, 2025) underscores the urgent need of a robust MET infrastructure to support shipping, national economic growth and maritime safety.

This study investigates the training needs, challenges, and prospective solutions for Kenyan maritime instructors, drawing on a survey conducted in May 2024 and qualitative insights from a focus group with instructors exposed to Finland's advanced MET practices. It aims to deliver evidence-based recommendations for aligning Kenya's MET with international benchmarks, addressing resource limitations, pedagogical deficiencies, and regulatory challenges. The research emerges from a Technical and Professional Development (TPD) initiative in maritime Technical and Vocational Education and Training (TVET) in Kenya, reflecting a commitment to workforce enhancement.

2. LITERATURE REVIEW

The human element is one of the key areas of focus in the shipping industry including its significance in safe and efficient navigation of ships. It is reported that 45% of marine safety recommendations on human factors in casualty investigation reports are rooted in training, competency and experience of seafarers (EMSA, 2022). Hence, the emphasis of quality maritime education and training cannot be over-emphasized as it reflects on safety and efficiency of maritime transport.

Similarly, technology and digitalization are seen to evolve the traditional seafarers' work onboard from labour intensive to more technical, calling for a shift or advancement in the training standards. This includes the introduction of alternative fuels and autonomous ships, use of digital navigation systems, remote monitoring among others. All these global developments have taken place since the last major revision of STCW Code with minimum amendments taking place over the years and therefore the need to update and develop clear minimum standards through a comprehensive review of the Convention to align with the industry needs, technology and practical implementation (IMO, 2025).

Moreover, extant literature generally underscores persistent challenges in MET systems across developing nations, least developed national and small island developing states. It is worth noting that seafarers' work is competency-based hence the requirement for mandatory onboard training to enable maritime students to gain practical skills and experience. This training, while it serves its general purpose, is limited to routine duties, hence simulator-based training provides an opportunity for MET students to develop skills for emergency preparedness.

Simulators are generally available in developed maritime nations, whereas developing nations continue to be characterized by limited access to not only simulators, but also updated training materials which forms a significant part of the maritime education and training (Nthia, 2014). Simulator training as a teaching method coupled with the onboard training provides a holistic environment for training for MET students. It is noteworthy that simulator training should be approved, having met the minimum requirements outlined in the STCW Code (Sellberg, 2017).

The STCW Convention and Code provides minimum standards of training for seafarers. The Convention had major revisions in 1995 and 2010 and is currently under comprehensive review to regulate emerging technologies, world-wide disruptions in shipping as well as effects of global phenomena such as COVID-19 (IMO, 2025). Furthermore, Shipping is a dynamic industry which operates in a dynamic international business environment faced by economic, technological, environmental and social developments. This has been mitigated with minor amendments to the Conventions to accommodate changes such as the training for seafarers responsible for designated safety duties associated with case, use or in emergency response to the fuel onboard ships subject to the IGF Code. The IGF Code applies to ships using low-flashpoint fuels for which the building contract is placed on or after 1 January 2017, the keels of which are laid, or which are at a similar stage of construction on or after 1 July 2017 (IMO, 2015).

The IMO adopted the International Code for Ships Operating in Polar Waters or Polar Code in 2014 which came into force on 1st January 2017. The amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, were developed to

support the requirement for training in the International Code for Ships Operating in polar waters (Polar Code) through STCW Reg. V/4 which provides for basic and advanced training for seafarers. While the two amendments have been in force for a while, many member States have not put them into full and complete effect, hence the regulatory and implementation / training gap.

Noteworthy, the STCW Code is currently under comprehensive review to update the minimum standards of training, certification and watchkeeping for seafarers for uniform application amongst all member States (IMO, 2025). While the dynamics are taking place in the international sphere, implementation of the Convention and Code on the other hand faces inconsistent adherence nationally including slow domestication and implementation due to technicalities including domestication procedures and processes in different jurisdictions which may lead to effects such as delayed recognition of certificates (Kenya Law, 2018, Jones, 2022).

2.1. Technological Lag

The slow integration of digital tools such as virtual reality simulators and Learning Management Systems (LMS) limits experiential learning opportunities (Mallam et. al, 2019). Exploration of modern pedagogy has received attention in recent years with the emergence of web-based training, computer-based training, game and virtual reality and the use of artificial intelligence. These technologies can complement simulator training with respect to cost, flexibility and mobility noting that modern ships have internet connectivity hence facilitating training onboard ships (Tusher, Munim & Nazir, 2024). Adoption of training methods and tools may promote efficacy and availability of MET with the effect of promoting standards of training hence promoting graduate employability (Jones, 2022, Nyairo et. al, 2024).

Conversely, successful MET models in countries such as Finland highlight the efficacy of continuous professional development (CPD), international partnerships, and technology-driven training. For instance, Finland's emphasis on simulation-based instruction has been linked to higher competency rates among seafarers (Morariu et. al, 2025). This study bridges these global insights with Kenya-specific data to propose tailored interventions.

Estimo (2020) highlights that instructors with seafaring experience often lack formal teaching qualifications, reducing instructional efficacy. Learning is dependent on the ability to effectively transfer knowledge. While experienced seafarers may have a thorough knowledge and competence to work onboard ship, they require to be equipped with tools and methods to administer and disseminate the knowledge to younger seafarers and MET students. The STCW Convention following the Manila Amendment of 2010 made provisions for introduction of modern training methodology including distance and e-learning (IMO, 2011). Implementation of the STCW Code over the last decade indicates that e-learning tools may open opportunities for knowledge transfer convenient to seafarers who may not easily access physical learning due to their work schedules, however, its effectiveness has not been clearly evaluated. The paradigm toward e-learning requires careful assessment to measure the extent to which e-learning tools may be effectively applied, one of the areas this paper seeks to assess in the context of Kenya.

3. METHODOLOGY

3.1. Study Design

This study employed a convergent mixed-methods research design to examine the instructional capacities and systemic constraints faced by maritime education and training (MET) instructors in Kenya. The goal was to inform policy development and institutional reforms that align with the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and the evolving demands of a digitized, sustainability-oriented maritime industry. By integrating both quantitative and qualitative data streams, the study captured a multifaceted understanding of pedagogical challenges, professional development needs, and contextual limitations within Kenya's MET ecosystem.

3.2. Data Collection

A structured survey was administered to a purposive sample of MET instructors from various Kenyan institutions (n=18) and later contextualized with a focus group discussion (n=6) with question items spanning demographics, teaching qualifications, sea experience, assessment practices, technological proficiency, STCW course delivery, and perceived instructional barriers.

4. RESULTS

The survey data provided a detailed snapshot of the professional backgrounds, instructional responsibilities, and challenges experienced by MET instructors in Kenya. Respondents represented a spectrum of teaching experience: approximately 39% had fewer than five years of teaching experience, 28% had five

to ten years, and 33% had over a decade of service. The age distribution was similarly diverse, with the majority (56%) aged between 30–40 years, suggesting a cohort in their early to mid-career stages, balanced by both younger and senior professionals. A significant proportion of instructors (44%) reported over 36 months of sea service. This seafaring experience affirms their credibility as maritime practitioners, although it does not consistently translate into formal pedagogical preparation.

The study showed that assessment practices varied across institutions. While some instructors employed a mix of practical, written, and simulator-based evaluations, there was inconsistency in assessment training and alignment with STCW Table A-I/6 standards. Technological capacity also emerged as uneven. While seven instructors reported confidence in operating simulators, significantly fewer had experience with Learning Management Systems (LMS), virtual reality, cloud-based simulation platforms, or digital assessment tools. Technological tools in current use included desktop simulators (n=7), full mission bridges (n=5), virtual reality (n=2), and cloud-based systems (n=2).

Regarding regulatory awareness, only ten instructors rated their STCW knowledge as "Excellent" or "Good," with the remainder indicating only fair familiarity. The application of standards to lesson planning and classroom instruction remained an area of concern, particularly with the integration of practical competencies. While 90% of instructors regularly used lectures and collaborative learning strategies, fewer expressed confidence in using gamification, adaptive learning, or briefing/debriefing practices essential for simulator-based education. The study reported a number of institutional and systemic challenges, including limited access to updated training materials and simulator infrastructure, lack of continuing professional development (CPD), and unclear regulatory guidance. Additionally, instructors highlighted limited institutional support, lack of sea time opportunities for trainers, and student disengagement due to weak academic readiness and career motivation.

4.1. Insights into Instructional Adaptation and Reform

The qualitative data from the focus group discussion (FGD) enriched the survey findings by offering granular, experience-based reflections on teaching practice and policy alignment in Kenya's MET landscape.

Participants unanimously acknowledged the pedagogical value of the Finnish training, especially the structured approach to simulator-based learning, briefing and debriefing protocols, and scenario-based assessment strategies. The training enhanced their confidence and introduced them to global best practices in instructional delivery, student engagement, and competence-based evaluation.

Despite their enthusiasm, instructors voiced concerns about contextual challenges impeding the implementation of these methodologies in Kenya. These included unreliable electricity supply, limited access to modern simulators, budgetary constraints, and insufficient institutional autonomy. The disconnect between exposure to global pedagogies and the capacity to apply them locally underscores the need for systemic investments in infrastructure and autonomy in curriculum development.

The discussion also highlighted structural challenges at the institutional level. Curriculum misalignment, management roles filled by non-maritime professionals, and low instructor remuneration were cited as barriers to reform. These governance-related constraints were seen as undermining the effectiveness of instructor training and the overall legitimacy of MET programs.

Instructors advocated for structured national CPD programs tailored to maritime educators and aligned with STCW requirements. There was a strong preference for international benchmarking, peer learning exchanges, and participation in global ToT initiatives. Suggestions included the establishment of national resource repositories, harmonization of instructor qualifications, and expanded use of digital tools for collaborative curriculum design.

5. DISCUSSION

The findings from this study underscore the dual nature of Kenya's MET challenges: structural deficits (equipment, resources, policies) and instructional capacity (pedagogical methods, technological familiarity, professional development). The quantitative data highlights the scale of gaps in simulation tools, pedagogical training, and regulatory clarity. Qualitative data adds texture and nuance, illustrating the practical realities instructors face such as unreliable infrastructure, limited student motivation, and poor institutional governance. As a whole, the study reveals strong instructor willingness to adapt and grow professionally, suggesting that with targeted support, systemic improvements are feasible.

5.1. Policy Implications

The findings suggest a need for multi-level reforms including institutional, regulatory, technology, and pedagogy. At the institutional level, MET providers

must prioritize continuous professional development, invest in low-cost simulator technologies, and adopt modular training aligned with STCW scenarios. On the regulatory front, Kenyan maritime authorities continue to provide clear, updated guidelines for instructor qualification, CPD compliance, and STCW-aligned curriculum delivery. It is worth noting that the Sector Skills Advisory Committee is in its final stages of developing national occupational standards for MET training in accordance with the STCW Convention, 1978 as amended. To complement this effort, a professional development framework should be instituted whereby annual workshops are implemented to blend pedagogical renewal, digital technology, and updates on STCW amendments. These initiatives should aim for 80% instructor participation within five years, ensuring widespread impact across Kenyan MET institutions.

At the national and donor engagement level, collaboration with partners such as GIZ, IMO, and international MET centers can catalyze strategic interventions, including shared simulator hubs, regional ToT academies, and policy advisory bodies. Pedagogical renewal should emphasize scenario-based learning, learner engagement strategies, use of learning analytics, and digital platforms to optimize delivery in resource-limited contexts. Furthermore, the establishment of regional and international RDI consortia can facilitate cross-border pilot projects, co-development of simulation scenarios, and harmonization of training standards. Such initiatives would foster long-term research, innovation, and shared knowledge production in support of Kenya's maritime education transformation.

5.2. Lessons from International MET Context

The infrastructural deficits and human capacity gaps highlighted in the study align with global MET literature (e.g., Jones, 2022) yet Kenya's context, marked by economic constraints and a nascent maritime sector demands localized solutions. The simulator training offered abroad underscores simulation technology's transformative potential, though scalability remains a hurdle without additional external funding or partnerships. Regulatory clarity, a persistent issue, requires government-industry synergy to enhance seafarer training standards and ensure long-term compliance. Examples from the Philippines, Nigeria, and Finland illustrate how donor-supported CPD programs, localized standards, and simulation-based instruction can uplift national MET systems. Finland's model, with strong public-private cooperation and policy coherence, remains an aspirational benchmark.

5.3. Recommendations

To address identified gaps, this study proposes a number of recommendations:

Resource Enhancement

Simulator resources are highly capital intensive. MET institutions should secure donor or government funding to procure high quality simulator resources and establish maintenance protocols, targeting a 50% increase in equipped institutions by 2027. It would be advisable that MET institutions develop a framework of sharing resources among MET institutions, such as simulators, through scheduling of simulator training and marine engineering workshops which may mitigate the resource gap and provide optimal resource mobilization and utilization.

International Partnerships

We recommend networking and partnering with maritime leaders in Europe and Asia in the form of instructor exchanges, joint training programs, and collaborative applied research initiatives. These international linkages should be embedded within a broader regional and global RDI consortium, enabling maritime academies, TVET institutions, and research centers to co-develop simulation scenarios, harmonize training standards, and contribute to evidence-based maritime education policy.

Regulatory Awareness

Kenya has undertaken independent evaluation in accordance with Reg. I/8 of the STCW Convention and found by the Committee of Experts to have put the Convention into full and complete effect, hence maintaining its position in the IMO "whitelist" (IMO, 2025a). Kenyan maritime authorities continue to provide clear, updated guidelines for instructor qualification, CPD compliance, and STCW-aligned curriculum delivery. It is worth noting that the Sector Skills Advisory Committee has concluded development of national occupational standards for MET training in accordance with the STCW Convention, 1978 as amended. To complement this effort, a professional development framework should be instituted whereby annual workshops are implemented to blend pedagogical renewal, digital technology, and updates on STCW amendments. These initiatives should aim for 80% instructor participation within five years, ensuring widespread impact across Kenyan MET institutions.

6. CONCLUSION

This mixed-methods study espouses existing challenges in Kenya's MET sector including resource shortages, pedagogical weaknesses, and regulatory

awareness while spotlighting pathways to improvement through technology, collaboration, and capacity building. Insights from Finland-trained instructors underscore the value of simulation-based training and structured CPD, offering a blueprint for reform. By enacting the proposed framework, Kenya can elevate its maritime education beyond the minimum requirements of IMO STCW standards, bolstering seafarer competence and national economic prospects.

Future research should investigate the long-term impact of professional development programs on instructor effectiveness and student outcomes in MET. Studies should also assess the feasibility and cost-effectiveness of shared simulation infrastructure across institutions. As AI technologies become increasingly relevant, further inquiry is needed into the integration of AI-driven learning analytics and simulation-based assessments. This includes examining not only their pedagogical value but also the ethical implications—such as data privacy and algorithmic fairness. Equally important is exploring the AI-related competencies required of MET instructors to effectively adopt these tools within their teaching practice.

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