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Development of Marine Science and Maritime Education and Training Programme at Busitema University: Basis, Need and Demand for Maritime Training in Uganda

RESEARCH AND EVALUATION

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ABSTRACT

This paper discusses the foundation, need, and demand for marine science and maritime education and training (MET) in Uganda. It's part of a scheme for curriculum development for university-level education at Busitema University. The scheme seeks to establish a local MET program in a way that cuts costs, is sustainable, and reduces turnaround time. Work was done using a qualitative-dominant mixed-methods approach that involved stakeholders' consultations and reviews of policy, regulatory, and technical MET standards at local, regional, and international levels, as well as examination of established BMPs for MET. Results show that Uganda has a limited but ambitious marine and maritime sector with relatively high economic potential; the country currently relies on individuals trained abroad and foreign workers to provide maritime skilled labor; and there is high demand for a skilled maritime workforce that exceeds the current supply, indicating a need for Uganda to develop its own capacity for local MET training to reduce training costs and meet the demand in a timely manner. This, together with established national requirements for university-level education, requires that any MET program and curricula developed be based on international standards to allow for both local and global employability of the graduates. The findings also established the need for a specialized institute focused on maritime education and training based on its peculiar, largely hands-on training modality. Existing policies and legal frameworks also require that the developed MET programs and curricula undergo accreditation by NCHE after scrutiny of process and review and consideration by specialized maritime organizations.

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1. INTRODUCTION

Uganda, with about 15% of its area covered by water bodies, is leveraging its resources to develop its blue economy (BE) potential, which includes fisheries, aquaculture, oil and gas, renewable energy, and tourism. A competent maritime transport system is crucial for maximizing this potential and positioning Uganda as an intermodal transport hub in Eastern and Central Africa, facilitating cost-effective access to regional and global markets. The National Development Plan IV (NDP IV 2026–2030) highlights improved water transport as a key driver of economic transformation, with an estimated annual BE potential of USD 25 billion (IGAD 2020), emphasizing the importance of maritime transport.

However, the country's limited capacity in marine science and maritime, hampers the effective utilization of BE resources. In response, the Ugandan government established the Busitema University Maritime Institute (BUMI) to serve as a national center for marine science, research, and Maritime Education and Training (MET). BUMI aims to enhance marine science and skills development, regulatory compliance, and sustainable growth in the maritime, operating under the guidance of the National Council for Higher Education (NCHE) and the Ministry of Works and Transport (MoWT).

A systematic review was conducted to assess the need and basis for MET at BUMI and recommend suitable MET programs designs and delivery models. This research documented the rationale for marine science and MET in Uganda, identifying curriculum approaches to develop the skilled workforce necessary to harness the country's BE potential. It also explored implementation options and delivery methods for marine science and MET programs, aligning with global shifts towards integrated and academically rigorous maritime education models that meet evolving industry needs (IMO 2010, 2017; UNCTAD 2023; Demirel 2020).

1.1 UGANDA'S WATERS AND TRANSPORT INFRASTRUCTURE DEVELOPMENT

Uganda, a landlocked East African country, has a population of around 46 million and covers 241,550.7 sq. km (UBOS 2024). It shares borders with Kenya, Tanzania, Rwanda, the Democratic Republic of Congo, and South Sudan. The country with surface area of 241,550.7 sq. km has about 15% as open waters with an extensive river network including the Nile River and 167 natural lakes. Notable among the lakes are the five large ones, that is, Victoria, Kyoga, Albert, Edward, and George. The remainder are relatively small and surround the larger lakes, and hence, they are commonly referred to as minor satellite lakes. Most of these waters, or significant sections of them, are navigable and serve as important inland waterways linking Uganda internally, and a number of them also link Uganda with neighboring countries.

The growing population has increased the demand for maritime transportation and infrastructure, prompting the Ugandan government to enhance its intermodal transport system, focusing on inland water transport and railways development. Key initiatives include rehabilitating regional roads and railways, establishing inland ports (e.g., Bukasa, Tororo, Ntoroko, Jinja, and Port Bell), developing navigational aids, and creating search and rescue facilities to improve maritime safety. Additionally, a maritime institute for marine science and education has been established to address the need for skilled workers in various maritime fields. This research aims to assess the necessity for developing local maritime manpower to support these initiatives effectively.

1.2 KEY STAKEHOLDERS OF BUMI

Busitema University, established in 2007, is a public institution focused on Science, Technology, Engineering, and Mathematics (STEM). It aims to enhance higher education, research, and community engagement in alignment with Uganda's national development goals, including Vision 2040 and the Sustainable Development Goals. The university has expanded access to quality education, especially in eastern Uganda. To address the demand for maritime skills, it recently established the Busitema University Maritime Institute (BUMI) as a center for Maritime Education and Training (MET) and marine science research. Key stakeholders include government agencies, maritime regulators, and industry operators, who are envisioned to support BUMI through curriculum development, training placements, and research collaborations. BUMI aspires to be a national center of excellence, fostering a skilled workforce and promoting Uganda's blue economy.

2. LITERATURE REVIEW

As Uganda seeks to harness its marine and maritime potential, it faces challenges common to many landlocked countries. Poor maritime connectivity continues to limit access to regional and global markets, particularly for smaller and developing economies (UNCTAD 2023). However, experiences from other landlocked nations demonstrate that sustained investment in infrastructure, human capital, and institutional capacity can overcome these constraints (Evers and Menkoff, 2019). For Uganda, developing maritime competencies and supporting infrastructure is therefore essential to unlocking opportunities within the blue economy (BE).

Beyond technical training, maritime education should promote awareness of the opportunities, challenges, and sustainability considerations associated with blue economy resources. This broader understanding, often referred to as ocean literacy, is increasingly recognized as a prerequisite for sustainable development and responsible stewardship of aquatic ecosystems (Evans 2002; Kelly et al. 2022; Shellock et al. 2024). However, rapid population growth, unplanned urbanization around water bodies, and widening socioeconomic inequalities continue to undermine these efforts. Studies from Mtwara have shown that community engagement and training in marine and coastal resource management can enhance awareness, participation, and stewardship of marine resources (Howe 2001; Katikiro et al. 2015). Consequently, MET curricula should integrate community engagement and experiential learning approaches that strengthen interactions between students and local communities.

The Intergovernmental Authority on Development (IGAD) estimates Uganda's blue economy potential at up to US$25 billion annually (IGAD 2020). Despite this potential, much remains untapped due to limited technical capacity and traditional sector-based development approaches that are not fully aligned with blue economy principles. Building a skilled workforce is therefore critical for realizing these opportunities.

Maritime Education and Training (MET) must continually evolve to respond to emerging industry needs and technological advancements (Mkpandiok & Eni-Ukpai 2018). Demand for skilled maritime labor has increased globally, driven by expanding blue economy activities, technological innovation, and changing workforce requirements. Studies from Europe and Asia report persistent and growing demand for qualified seafarers and maritime professionals (Ćorović et al. 2021; Tang 2022). The emergence of new vessel technologies, increased exploitation of marine resources, and growing emphasis on climate resilience and environmental sustainability further necessitate curriculum reform and innovative teaching approaches (Mkpandiok & Eni-Ukpai 2018).

Continuous learning has consequently become a defining feature of modern maritime professions. Maritime personnel must regularly update their skills to remain responsive to evolving technologies, regulations, and operational practices. Lifelong learning enhances productivity, employability, and professional adaptability in an increasingly competitive global environment (Boulougouris et al. 2019).

Historically, MET focused largely on preparing seafarers for shipboard operations (IMO 2017). Contemporary MET, however, encompasses a much broader range of competencies required across both offshore and onshore maritime services (Demirel 2020). Modern programmes increasingly include maritime environmental management, occupational health and safety, logistics and port management, shipbuilding and maintenance, maritime security, marine engineering, digital technologies, and maritime business services (Mkpandiok & Eni-Ukpai 2018; UNCTAD 2023). The rapid growth of the blue economy, automation, digitalization, and increasingly stringent environmental regulations have further expanded the scope of maritime professions and training requirements (IMO 2017; Demirel 2020; UNCTAD 2023).

Training institutions are therefore expected to prepare graduates for diverse careers in maritime administration, port and logistics management, environmental management, maritime law, insurance, and maritime business operations. The increasing complexity of vessel operations has also created demand for competencies in information and communication technologies (ICT), digital navigation systems, cybersecurity, and automated vessel operations (Bacasdoon & Bolmsten 2022).

Technological innovations such as simulators, virtual reality systems, and e-learning platforms are increasingly used to support practical maritime training where access to vessels and

specialized equipment is limited (Maghoromi 2023; Kumar 2024). While these technologies reduce training costs and improve accessibility, they also require continuous curriculum adaptation to keep pace with evolving industry needs. In addition, English has become the global language of maritime communication, making language proficiency a critical competency for seafarers and maritime professionals (James et al. 2018). Evidence from Bangladesh demonstrates that proficiency in Maritime English significantly enhances employability in the international maritime industry (Ahmmed 2021).

Climate change, environmental protection, and occupational health and safety are also reshaping maritime training requirements. For example, implementation of the International Convention for the Control and Management of Ships' Ballast Water and Sediments require maritime personnel to understand and apply increasingly sophisticated environmental management standards and practices (Ghosh & Rubly 2017). These developments underscore the need for modern, competency-based MET programs capable of responding to evolving global maritime challenges.

3. METHODOLOGY

A qualitative-dominated mixed-methods approach was employed, combining a questionnaire-based survey of purposively selected stakeholders from Uganda's marine and maritime sector with a review of relevant policy, regulatory, and technical documents. Participants included academics, trainers, maritime regulators, industry practitioners, and technical personnel. Data were analyzed using descriptive statistics and thematic content analysis to assess the need, basis, and demand for MET, required competencies, and institutional requirements. Findings were validated through triangulation of stakeholder perspectives and documentary evidence.

3.1 METHODS AND STUDY TECHNIQUES

Data were collected through a questionnaire-based survey of stakeholders to assess the need, rationale, and competency requirements for MET programs at BUMI. This was complemented by a review of policy, regulatory, and institutional documents from Busitema University, NCHE, MoWT (Maritime Administration), MOESNA, and IMO to guide programme development and assess the institutional framework for establishing and operating BUMI.

3.1.1 Documents review and examination

This research also involved examination of information from internal (within the university) external (outside the university) sources regarding public policy, regulatory and socioeconomic aspects of maritime and maritime education and training at university level in Uganda and elsewhere. This review examined, among many more others, the following key documents, reports and websites:

- **a)** MoWT policy statements and annual reports over the last five years.
- **b)** MoWT website (https://www.works.go.ug/) and documents/reports thereon.
- **c)** IMO website (https://www.imo.org/) regarding Uganda's membership and issues regarding standards for education and training in maritime.
- **d)** Website (https://centralcorridor-ttfa.org/) containing information about the East African-based 'Central Corridor Transit and Transport Facility Agency' as to the regional policy on intermodal transport and required technical capacity.
- **e)** Act pertaining to Ugandan higher education, the 'University and Other Tertiary Institutions Act, 2001 (Amended, 2006).
- **f)** NCHE for Uganda, website (https://unche.or.ug/).
- **g)** Busitema University Development Strategy (2021–2025) and stipulations for Marine Science and MET.
- **h)** BUMI Academic Strategy (2021–2025) as to the requirements and targets set forth.
- **i)** BUMI Steering Committee Meeting reports and minutes as to the plan and activities for development of Marine Science and MET programs and teaching and research infrastructure.

3.2 DATA COLLECTION AND ANALYSIS

Information from the reviewed documents was captured based on the relevance and/or concern as to the research questions. This was considered and interpreted based on the context of the maritime sector and the need for and basis of having a maritime education programme in Uganda. The stakeholders' views were captured from the returned questionnaires, collated and similar responses counted in the form of frequency. These were used to derive the proportional representation of the different views and perceptions for comparison purposes.

4. RESULTS

4.1 CHARACTERISTICS OF RESPONDENTS

Table 1 shows that the majority of respondents were male; this conclusion is despite the fact that the questionnaire was sent out to 35 females and 35 males working in the marine and maritime sector. Thirty-four (34) participants, comprising ten females and twenty-four males from Uganda's marine and maritime sectors, provided their views and opinions through a questionnaire-aided survey on the need, basis, demand, and potential content for Maritime Education and Training (MET). This sample was skewed toward male respondents and older age groups, potentially limiting its representativeness.

Table 1 Gender Characteristics of Respondents.

SEX	NUMBER	PERCENT
Male	24	70.6
Females	10	29.4
Total	**34**	**100**

Table 2 shows that the majority of those who responded were above 50 years of age, with marked differences, followed by those between 40 and 50, 31 and 40, and 19 and 25 years of age, in that order.

Table 2 Age Group of the Respondents.

AGE	NUMBER	PERCENT
Up to 25	0	0.0
to 30	4	11.8
to 40	6	17.6
to 50	10	29.4
>50	14	41.2
Total	**34**	**100**

Approximately 80% of respondents possessed a university education, with around 60% holding postgraduate degrees (Table 3).

Table 3 Basic Education attained by Respondents.

LEVEL OF BASIC EDUCATION	NUMBER	PERCENT
Secondary	8	23.5
University	6	17.6
Postgraduate	20	58.9
Total	**34**	**100**

A majority had some level of maritime training experience, including sea time and STCW professional courses, while others indicated that they had participated in some type of maritime apprenticeships or short vocational courses related to maritime training (Table 4).

LEVEL OF TRAINING	NUMBER	PERCENT
Only sea time without training	4	11.8
Apprenticeship without documented transferable skills (certificate)	6	17.6
Apprenticeship with documented transferable skills (certificate)	0	0.0
Short vocational training courses with certification	6	17.6
Professional STWC training with 'certificates of competency'	8	23.6
Academic (university level)	6	17.6
None	4	11.8
Total	**34**	**100**

Table 4 Level of Respondents' Professional or Vocational Training in Maritime.

Table 5 shows that nearly all the respondents were engaged or working with the maritime industry or sector in Uganda. Table 6 shows that whereas up to 20 participants had technical university training in related fields, only 50% of respondents indicated having had actual maritime education and training, while the other 50% received training in fields such as fisheries, oceanography, limnology, and water engineering. Of those who had maritime training at university, 60% obtained the training from outside Uganda and Africa, and 40% got the training from Africa but outside Uganda (Table 7).

ENGAGED/EMPLOYED IN MARITIME INDUSTRY IN UGANDA	NUMBER	PERCENT
YES	33	97.1
NO	1	2.9
Total	**34**	**100**

Table 5 Currently employed or engaged with Maritime Industry and Sector of Uganda.

LEVEL OF TRAINING IN MARITIME INDUSTRY	NUMBER	PERCENT
Maritime Postgraduate degree	10	50.0
Maritime, Graduate – degree course	0	0.0
Maritime, Graduate – diploma	0	0.0
Maritime, Graduate – vocational training	0	0.0
Related courses	10	50.0
Total	**20**	**100.0**

Table 6 University level training in Marine Science and Maritime.

LOCATION	NUMBER	PERCENT
Uganda	0	0.0
Outside Uganda but in Africa	4	40.0
Outside Africa	6	60.0
Total	**10**	**100**

Table 7 Place of Training for Maritime Course.

Table 8 presents the categories of stakeholders who participated in the survey, demonstrating broad representation from regulatory agencies, maritime operators, academia, and industry. Respondents were purposively selected based on their direct involvement in Uganda's marine and inland water transport sectors.

STAKEHOLDER CATEGORY	NUMBER OF RESPONDENTS	PERCENTAGE (%)
Government regulators	9	26.5
Maritime operators and practitioners	11	32.4
Academic and training institutions	8	23.5
Industry and private sector	6	17.6
Total	**34**	**100**

Table 8 Stakeholder Categories and Survey Participation.

4.3 NEED AND BASIS OF MARINE SCIENCE AND MARITIME EDUCATION AND TRAINING IN UGANDA

The majority of the respondents (94.1%) agreed that there is urgent need for locally developed and implemented marine science and MET programs, as well as the establishment of a local MET institution (Table 9). This they indicated was largely due to high shortage of skilled maritime workers, frequent accidents on inland waterways, high dependence on foreign-trained and costly maritime personnel, and high costs of overseas maritime education and training. However, about 6% of participants indicated that there was need for a local marine science education and MET institute, and instead suggested that the government should prioritize practical skills for existing workers through opportunities for sea time in Uganda or neighboring countries including Kenya and Tanzania, which are coastal states.

A number of reasons were given by stakeholders for the need for a MET school in Uganda, and they are stated below:

1) Need for skilled manpower to effectively manage marine and maritime affairs in Uganda.
2) Uganda has several water bodies supporting fishing, tourism, transport, etc.
3) High or increased maritime activity on waterways without requisite technical capacity to effectively manage services and ensure safety and survival on the water.
4) Low technical capacity/manpower to operate the recently established maritime search and rescue system.
5) Low vocational/technical training and/or academic capacity for marine science and maritime affairs in Uganda.
6) Vast opportunities presented by the growing local and international maritime labor market.
7) Lack of awareness about the inland transport and the blue economy.

IS THERE NEED FOR MET SCHOOL IN UGANDA	NUMBER	PERCENT
YES	32	94.1
NO	2	5.9
Total	**30**	**100**

Table 9 Need for Marine Science and MET School/ Institute in Uganda.

Predominance of unskilled low-cadre workers currently engaged in marine and maritime activities is seen as one of the key factors in having a local MET school with apprenticeship training seen as important especially for vocational training. Table 10 shows the level as which respondents thought the marine science education and MET should be focused with majority (38.2%) recommending vocational training at certificate level through formal academic education. They favored vocational training, followed by academic programs for basic degrees in Marine Science and MET.

4.4 CHALLENGES OF UGANDA'S MARINE AND MARITIME SECTOR RELATED TO SKILLED MANPOWER

Table 11 indicates that the primary challenge identified by the majority of respondents is the lack of skilled workers, particularly skilled seafarers in Uganda, which was cited by 52.9% of the respondents. The other challenges cited included lack of skilled workers (44.1%), increased accidents on water (41.2%), poor state of vessels and lack of navigators (38.2%), increased traffic on water (35.3%), and environmental management risks with increased pollution and increasing use of over water transport for oil and gas products (29.4%).

DESIRED TRAINING LEVEL	NUMBER	PERCENT
University level training – diploma academic programs	2	5.9
University level training – basic degree programs	10	29.4
Vocational training – certificate academic programs	13	38.2
Professional training – certificate of competency programs	4	11.8
Apprenticeship training – across all categories of maritime workers	5	14.7
Total	**34**	**100**

Table 10 Level at which Marine Science and MET school should operate.

CHALLENGE	NUMBER	PERCENT
Lack of skilled workers especially seafarers	18	52.9
Lack of skilled workers in water transport management and logistics	15	44.1
Increased cases of maritime accidents, and safety and security incidents	14	41.2
Increased risks of pollution and environmental impacts due to use of inland waters for oil and fuel transport	10	29.4
Poor state of vessels and lack of adequate manpower to monitor navigation	13	38.2
Increased use of waterways for goods and passengers	12	35.3

Table 11 Challenges in the maritime and marine industry and sector in Uganda.

The most commonly cited solution to the above challenges is establishing local maritime education and training capacity, according to 47.1% of respondents. The second solution commonly cited is that of conducting maritime education and training within Uganda by foreign experts (Table 12). A third solution, which is very similar to the first two, is establishing an industry-based training system that would allow people to become certified as maritime trainers within the maritime industry locally and also globally.

SOLUTIONS	NUMBER	PERCENT
Provide training locally to close the knowledge and skills gaps – build capacity	16	47.1
Sea time, locally and or abroad	2	5.9
Deploy specialized personnel or specialized experts	2	5.9
Policy interventions and management actions	6	17.6
Enforcement of the laws	4	11.8
Putting in place standards in the Legal regime and regularly inspect	4	11.8
Establish a local MET institute provides a more cost-effective alternative to overseas training and reduces the financial burden on students, industry, and government	10	29.4
Financial investment to develop facilities	2	5.9
Early warning system in place	2	5.9
Register all those working in maritime sector	2	5.9
Establish training structures to enable BUMI graduates to be certified	8	23.5
Support to skills development especially to youth and women	4	11.8

Table 12 Suggested Solutions to the Challenges cited in Tables 4–11 above.

The research participants were also asked about the legal requirements, the ability of potential or target students to afford MET given its high cost, its primarily practical delivery mode, and possible solutions to various challenges that may arise during the developing and implementing of MET curricula and programs at Busitema University.

The stakeholders' response and information from the review of the national policy and regulatory framework (MoWT 2021) and country obligations under the international maritime conventions, reveal that maritime workers required certified maritime competencies that cannot be sustainably achieved without establishing local Maritime Education and Training (MET) capacity.

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Table 13 provides suggested solutions from stakeholders as to how the legal requirements imposed by newly enacted laws and regulations for maritime in Uganda can be satisfactorily addressed. Nearly 40% of the respondents supported the majority's view that local staff should receive local training to meet the legal requirements. This recommendation was followed by those calling for the sensitization of stakeholders and the establishment of a local MET school to provide the service (20% of the respondents).

Table 13 Solutions to addressing the new regulatory requirements.

SOLUTION	NUMBER	PERCENT
Skilling of staff locally so that they meet required level	13	38.2
Training school	6	17.6
Eliminate the need to seek certification abroad as it is costly and a barrier	1	2.9
Hands-on training to build competency in specific areas	2	5.9
Enforcement	1	2.9
Sensitize workers on the compliance to new regulatory requirements	7	20.7
Require training before issuing permits	4	11.8
Total	**34**	**100**

4.5 BASIS FOR MARITIME INSTITUTION AND MET PROGRAM

Table 14 presents the research participants' views as to the basis for establishing a MET institution and developing MET programs in Uganda. This includes the need to retool over 80% of existing maritime workers, a shortage of schools for competency training, and a demand for professional upgrade training of the few existing technical maritime workers. Additionally, the research participants point to the need to generate employment for the high number of youths, especially school dropouts, and the need to address the inadequate managerial capacity in Uganda's maritime sector.

Table 14 Basis for MET Curriculum development.

BASIS FOR MET CURRICULUM	NUMBER	PERCENT
Retooling of the existing maritime workers	28	82.4
A programme to address high rates of school dropout	22	64.7
Inadequate managerial level manpower	20	58.8
Need for professional and upgradation training	24	70.6
Lack of school to offer 'certificate of competency' as legally required	26	76.5

Table 15 indicates that the stakeholders view the need for the marine science and MET programme in Uganda as the most appropriate solution in the medium term, with high and very high rankings being over 97%.

Table 15 Perceptions of the Need for Marine Science and MET in Uganda over the Medium Term.

RANKING	NUMBER	PERCENT
Very high	25	73.5
High	8	23.6
Moderate	1	2.9
Low	0	0.0
Negligible	0	0.0
Total	**34**	**100**

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4.6 CHALLENGES TO AND SOLUTIONS FOR SUSTAINING MET PROGRAM AND BUMI

Table 16 indicates the most pressing challenge against establishing a Marine Science and MET Institute and Programs in Uganda is the high investment cost, especially for setting up and/or acquiring the requisite training infrastructure for Marine Science and MET. This is followed by the issue of a lack of trained mariners and the skills gaps among them.

Table 16 Challenges in Establishing a Local Marine science MET Institute.

MOST PRESSING CHALLENGE	NUMBER	PERCENT
Lack of trained mariners/ Skills gaps/Lack of skills	7	20.6
High cost of training mariners outside Uganda	2	5.9
Lack of training opportunities for maritime in Uganda	4	11.8
Need for investment for MET infrastructure	13	38.2
Lack of practical skills for existing workforce	2	5.9
Poor safety of seafarers	2	5.9
Lack of boat building standards	2	5.9
Lack of inspection of marine vehicles to IMO standards	1	2.9
High unemployment among youth and women may constrain enrolment and hinder the effective establishment of the MET institute	1	2.9
Total	**34**	**100**

Another challenge highlighted by research participants is that of lack of capacity for Uganda to absorb the future MET graduates, despite growth potential of the maritime sector (Table 17). This is attributed to the limited onshore maritime activities given that the maritime sector in Uganda is nascent and based on foreign shipping that is controlled and managed largely from outside the country.

Table 17 Capacity of Uganda's Marine and Maritime Sector to absorb the MET Graduates.

SUSTAIN/ABSORB GRADUATES OF MET	NUMBER	PERCENT
YES	12	35.3
NO	22	64.7
Total	**34**	**100**

Table 18 outlines research participants' suggestions for absorbing the future MET graduates, including deliberate effort to produce maritime professionals that are globally employable, increasing public investment in the marine sector, enhancing coastal infrastructure, and promoting inland waterways to boost the maritime industry and local skilled workforce demand.

Table 18 Sustaining the Established Marine Science and MET Programme in Uganda.

SUGGESTED SOLUTIONS	NUMBER	PERCENT
Limit the university training to crew and deckhand staff/diploma level	3	8.8
Train and certify graduates of the programme can work globally	14	41.2
Focus on vocational maritime and marine training level with ability to manufacture and fabricate	4	11.8
Train the number needed at a time	3	8.8
Government investment in marine and maritime sectors	7	20.6
Establish a dynamic training programme that caters for different categories of workers	1	5.9
Provide practical skills development instead of a formal school	2	11.8
Total	**34**	**100**

4.7 FOCUS, CONTENT AND MANAGEMENT OF MARINE SCIENCE AND MET PROGRAMS IN UGANDA

Table 19 shows the stakeholders' perceptions of which level of MET the BUMI should prioritize. Over 50% of the respondents indicated that BUMI should focus on the training of seafarers. Nearly half of the respondents suggested that BUMI should concentrate on management courses for water transport and logistics and on the development and management of marine engineering and coastal infrastructure.

Table 19 Focus of BUMI in developing the MET curriculum.

LEVEL OF TRAINING	NUMBER	PERCENT
Seafarers for different grades and categories	18	52.9
Senior level management on boat and ships	4	11.8
Water transport management and logistics	8	23.6
Marine Engineering and coastal infrastructure development and management	8	23.6
All the above categories	12	35.3

Table 20 indicates that the majority of respondents perceive that the target or potential students may not be able to meet or pay the required tuition and other dues for the established MET program. While, a significant proportion (nearly 40%), believes that the target students should be able to pay for the program.

Table 20 Capacity for Target/ Potential Students to Pay Tuition for MET.

ABILITY TO PAY FOR MET	NUMBER	PERCENT
YES	12	35.3
NO	22	64.7
Total	34	100

Table 21 shows that most respondents favor the government sponsoring the target students for MET training. This view is supported by those who believe that the industry should cover the costs to increase enrolment, and that those students not catered for by industry should have access to education loans and grants to facilitate their training.

Table 21 Recommendations in designing of an appropriate MET program.

SOLUTIONS	NUMBER	PERCENT
Government should sponsor students	18	52.9
Industry should sponsor students	6	17.6
Offer students loans and grants	6	17.6
Create incentives for the students to take on the course	1	2.9
Provide soft loans	1	2.9
Prioritize sea time and practical training to build essential onboard and onshore operational skills	2	5.9
Total	**34**	**100**

The leading solution is that of the programme from onset aiming to create globally employable graduates (Table 22). The second leading one is for Government to increase investment in marine and maritime sectors so as to absorb the graduates locally.

Table 23 presents the maritime content that should be addressed in MET programs, the key skills gaps identified by stakeholders, and their implications for MET curriculum design. The findings demonstrate a clear mismatch between sectoral needs and existing educational and training provisions, underscoring the urgency of establishing a nationally coordinated MET program.

SUGGESTED SOLUTIONS	NUMBER	PERCENT
Limit the university training to crew and deckhand staff/diploma level	3	8.8
Train and certify graduates that can work both locally and abroad	14	41.2
Focus on vocational training with ability to manufacture and fabricate	4	11.8
Adopt phased training based on anticipated workforce demand	3	8.8
Government investment in marine and maritime sectors	7	20.6
Dynamic MET programs that cater to diverse needs of different worker categories	1	5.9
Provide practical skills development instead of a formal school	2	11.8
Total	**34**	**100**

Table 22 Options for the sustaining of the established maritime education and training programme.

IDENTIFIED SKILLS GAP	EVIDENCE FROM STAKEHOLDERS	CURRICULUM DESIGN IMPLICATIONS
Shortage of certified maritime professionals	Reliance on foreign training and personnel	Development of local, STCW-aligned MET programs.
Inland-water safety deficits	Frequent accidents and weak compliance	Strong emphasis on safety management and regulation
Limited technical and engineering capacity	Dependence on external consultants	Inclusion of naval architecture and marine engineering modules
High cost of overseas training	Financial burden on government and operators	Cost-effective national MET provision

Table 23 Content: Skills Gaps and Implications for MET Curriculum Design.

5. DISCUSSION

5.1 INSTITUTIONAL, POLICY AND REGULATORY FRAMEWORK FOR MARINE SCIENCE AND MET

The establishment of the Busitema University Maritime Institute (BUMI) is firmly anchored in the Universities and Other Tertiary Institutions Act (2001) and the Inland Water Transport Act (2021), which provide the legal basis for higher education, professional training, maritime safety, technical capacity development, and compliance with international maritime standards. Uganda's Vision 2040 and the National Development Plan IV (NDP IV) further identify the blue economy as a strategic driver of socioeconomic transformation and underscore the need for a skilled maritime workforce. In response, the Government of Uganda through Busitema University has invested in maritime training and research infrastructure, human resources, and strategic industry partnerships to develop marine science and maritime education and training.

As a member of the IMO and the MOESNA, Uganda is committed to developing a competent maritime workforce and a robust regulatory framework for MET that is aligned with international standards. Stakeholders view BUMI as a necessary and critical institution for building local maritime expertise, strengthening technical capacity, supporting the growth of the maritime sector, while reducing dependence on costly foreign training and expatriate labor. Stakeholders also viewed the NCHE as having the mandate to accredit, regulate, and assure the quality of university level academic programs, while the MoWT, through its department of maritime administration, and the MoES, were viewed as institutions that ensure compliance with national, regional, and international maritime training standards, including the STCW Convention.

Stakeholders emphasized that the development and sustainability of MET in Uganda will depend on strong collaboration and partnerships between BUMI, the maritime industry, and government institutions responsible for fisheries, water resources, trade, tourism, energy, education, transport, and security. These institutions, including MAAIF, MWE, MTIC, MTWA, MEMD, MoES, the Uganda Railways Corporation, and maritime security agencies, are expected to support BUMI through the MET programs curricula development and review, maritime research, MET practical training, maritime workforce seat-time and certification, maritime policy harmonization, and infrastructure development essential for effective delivery of MET programs.

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As Busitema University advances its vision of becoming a Centre of Excellence for Blue Growth in Africa and a regional hub for marine science, maritime education and training, research, and innovation, BUMI will be expected to deliver globally competitive graduates. To achieve this, the Institute must align its programs with IMO model courses and international best practices, while adhering to established maritime education and training standards and guidelines.

5.2 IDENTIFIED REQUIRED MARITIME SKILLS AND COMPETENCES

For a landlocked yet maritime-dependent country such as Uganda, stakeholders identified several competencies that should complement the STCW requirements, including maritime digital systems, cybersecurity, sustainable maritime practices, and maritime logistics management. Nearly all respondents emphasized the need for BUMI to equip students with competencies in maritime environmental management, data analytics, maritime administration, multicultural communication, and emerging autonomous vessel technologies.

Stakeholders further highlighted the importance of competencies in navigation and vessel operations, cargo handling, marine engineering, maritime safety and security, communication, and onboard information systems. Graduates should also be proficient in green shipping, logistics, supply chain and port management, intermodal transport, vessel maintenance, digital technologies, and STEM-based innovation.

In addition, respondents identified cross-cutting competencies such as strategic partnership building, critical thinking, teamwork, problem-solving, adaptability, and resilience as essential for effective performance in the modern maritime industry.

5.3 NEED AND BASIS FOR MARINE SCIENCE AND MET IN UGANDA

Stakeholders strongly supported the development of local marine science and MET programs as a strategic response to Uganda's shortage of skilled maritime personnel. They noted that reliance on overseas training is costly and insufficient to meet the country's growing maritime and blue economy workforce needs. Consistent with Mkpandiok and Eni-Ukpai (2018), stakeholders viewed the establishment of BUMI as a sustainable and cost-effective approach to building national maritime capacity.

However, concerns were raised about the ability of Uganda's still-emerging maritime sector to absorb large numbers of graduates. Stakeholders therefore recommended that BUMI focus on producing globally competitive graduates capable of securing employment both within Uganda and internationally, while aligning enrolment with projected national and global workforce demand. They further emphasized the need for government and industry sponsorships, soft loans, and apprenticeship opportunities to enhance access to MET training.

In regards to gender balance, the findings show that women constituted only 29.4% of respondents, highlighting the gender imbalance within Uganda's maritime and inland water transport sector despite identifying women and youth as priority groups for skills development and employment in the emerging maritime industry and blue economy. These findings underscore the need for BUMI to integrate gender-responsive and socially inclusive approaches into MET programs design to reduce barriers to participation for women, youth, and other underrepresented groups.

The study also identified the high cost of MET as a major barrier to access, with stakeholders recommending government sponsorships, industry support, grants, and soft loans to broaden participation. These financial constraints were seen to disproportionately affect women, youth, and economically disadvantaged groups. Consequently, stakeholders recommended that BUMI promote equitable access through inclusive admissions, targeted scholarships, flexible learning pathways, mentorship, gender-responsive facilities, and structured industry placements. Such measures would strengthen participation and retention while advancing Uganda's goals for equity, skills development, youth empowerment, and inclusive socioeconomic transformation.

Contemporary maritime education offers an opportunity to reposition the maritime sector as a more inclusive profession beyond its traditional focus on male-dominated seafaring roles. Modern MET increasingly encompasses maritime environmental management, logistics, digital technologies, maritime administration, safety management, maritime business, and blue

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economy governance, creating pathways for greater participation by women and learners from diverse backgrounds. Accordingly, MET curricula should mainstream gender and social inclusion across course content, practical training, community engagement, leadership development, occupational health and safety, and workplace ethics. Such an approach would not only address maritime skills gaps but also foster a more diverse, equitable, and socially responsive workforce capable of advancing Uganda's sustainable blue economy.

5.4 MARINE SCIENCE AND MET PROGRAMS AND INSTITUTION

According to the BUMI Academic Strategy (2021–2025), the development of MET program is intended to strengthen Uganda's capacity to harness its blue economy resources and related sectors. Stakeholders emphasized that these programs should integrate emerging technologies while addressing critical sector challenges through development of a skilled and competent maritime workforce. A major concern identified was the high incidence of accidents and safety-related incidents on Uganda's inland waterways. Although the Government of Uganda has established maritime safety and rescue coordination facilities across major water bodies, stakeholders noted that the availability of adequately trained personnel to operate and manage these systems remains limited.

Consequently, BUMI is expected to develop competency-based MET curricula that address workforce needs across multiple maritime disciplines while promoting sustainability, safety, health, and gender inclusion. Stakeholders considered BUMI particularly well positioned to host Uganda's first comprehensive marine science and MET programs because of its location on the shores of the Victoria Nile and its accessibility through both road and inland water transport networks.

Supported by the Government of Uganda, BUMI will initially focus on marine engineering, naval architecture, maritime studies, maritime environmental management, and maritime bridging programs for mechanical engineers and other technical professionals. Since 2020, the Institute has developed three academic programs, a Bachelor of Science in Marine Engineering and diploma programs in Marine Engineering and Nautical Science. Additional achievements include preparation of a Namasagali Campus master plan, construction of teaching and research facilities, and admission of the first cohort of students in August 2025.

6. CONCLUSIONS AND RECOMMENDATIONS

The research concludes that the need for marine science and MET programs in Uganda is driven by the country's rapidly expanding inland water transport system, growing blue economy potential, increasing maritime trade and passenger transport, rising safety and environmental concerns on inland waters, and the persistent shortage of skilled maritime manpower. Uganda's extensive network of lakes and rivers, strategic regional position within East Africa, ongoing investments in ports, navigational aids, and search and rescue systems, as well as growing regional intermodal transport linkages, collectively require a competent workforce capable of supporting safe, efficient, and sustainable maritime development. The current dependence on costly foreign training institutions and externally sourced maritime professionals further reinforces the urgency of establishing locally accessible and internationally compliant MET programs.

The study further established that Uganda possesses a strong legal, institutional, policy, and socioeconomic foundation for the establishment of university-level marine science and MET programs. The Universities and Other Tertiary Institutions Act, 2001 mandates public universities to provide higher education, professional training, research, innovation, and community engagement, while the Inland Water Transport Act, 2021 requires development of certified maritime competencies, enhancement of maritime safety systems, and compliance with international maritime conventions and standards. In addition, Uganda's Vision 2040, National Development Plans, blue economy agenda, and regional transport integration initiatives all strongly support development of local maritime capacity and specialized manpower. Together, these frameworks provide the legal and policy justification for establishment and operation of the Busitema University Maritime Institute as a national center for marine science and MET.

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The research also confirms that Uganda currently faces substantial shortages in maritime technical and professional competencies, including seafarers, marine engineers, maritime administrators, safety personnel, logistics and transport managers, environmental management specialists, and maritime educators. Stakeholders identified increasing water transport accidents, inadequate vessel inspection and navigation systems, weak safety enforcement, low technical capacity for operation of maritime rescue systems, and limited awareness of blue economy opportunities as major sector challenges linked to inadequate training capacity. The predominance of low-skilled and uncertified workers within Uganda's marine and maritime sector further demonstrates the urgent need for structured, competency-based, and internationally recognized MET programs.

The study additionally established overwhelming stakeholder support for local MET development and the establishment of BUMI. Respondents emphasized that reliance on overseas maritime training is financially unsustainable and insufficient to meet Uganda's growing manpower needs. Establishment of a local MET institution was therefore viewed as a more cost-effective, accessible, and sustainable solution for developing national and regional maritime capacity. Stakeholders particularly emphasized the need for programs that combine practical training, sea time, competency certification, and academic rigor, while aligning with international standards such as STCW, SOLAS, IMO, and MOESNA requirements. The findings further indicate that Uganda's MET system should move beyond the traditional narrow vocational approach toward a more integrated, multidisciplinary, competency-based, and work-integrated university model that reflects modern developments in marine science, digital technologies, automation, maritime safety, environmental management, and blue economy governance.

The research further concludes that establishment of BUMI presents an important opportunity for employment creation, workforce upgrading, and youth empowerment. Stakeholders identified maritime training as a potential pathway for addressing unemployment among youth and women, while also supporting professional upgrading of the existing maritime workforce. However, concerns were raised regarding the current capacity of Uganda's relatively narrow maritime sector to absorb large numbers of graduates in the short term. Consequently, participants recommended that BUMI should prioritize development of globally competitive and internationally employable graduates capable of working both within Uganda and abroad, while adopting phased training approaches aligned with anticipated workforce demand and regional labor market opportunities.

The study also demonstrates that gender, equity, and inclusion should be treated as central considerations in the development and implementation of Maritime Education and Training (MET) programs in Uganda. The observed underrepresentation of women within the maritime sector, combined with affordability and access barriers affecting youth and disadvantaged groups, highlights the need for deliberate inclusive strategies within curriculum design, student support systems, and institutional policies. By integrating gender-responsive training approaches, equitable access mechanisms, inclusive learning environments, and broader maritime career pathways beyond traditional seafaring roles, Busitema University Maritime Institute can contribute to development of a more diverse, socially responsive, and globally competitive maritime workforce that supports Uganda's sustainable blue economy aspirations.

Finally, the study concludes that the long-term sustainability and success of BUMI and Uganda's MET programs will depend on strong collaboration among government, industry, regulatory bodies, development partners, and regional and international maritime institutions. Successful implementation of the planned MET programs will require substantial investment in training infrastructure, laboratories, simulators, vessels, sea-time opportunities, staffing, and research facilities, alongside student sponsorships, soft loan schemes, and apprenticeship programs to improve accessibility. The study therefore recommends that BUMI adopts internationally aligned competency-based curricula by partnering with industry and maritime regulators to facilitate integrating of practical and experiential learning approaches in the academic programs, and through the industry partnership put in a place a mechanism for continuously aligning the marine science and MET programs with emerging national, regional, and global maritime workforce demands in order to position Uganda as a competitive participant in the evolving blue economy.

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COMPETING INTERESTS

The author has no competing interests to declare.

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