NIHERST

International Labour Organization

REPORT BRIEF

Assessment of 21st Century Skills Across Emerging Sectors

Maritime Sector

Volume 1

Key points

- At the global level, rapid technological advancements, driven by artificial intelligence, automation, green energy transitions and the emergence of blockchain applications, are transforming the maritime sector. These shifts are expanding the demand for engineering, information technology, and data-related skills across the industry.
- Demand for STEM-related occupations is increasingly evident within Trinidad and Tobago's maritime sector, with engineering roles projected to experience particularly strong growth. However, employers report persistent difficulties in recruiting for key STEM occupations, including Marine Engineers and Information Technology professionals. These recruitment challenges are largely attributable to an insufficient supply of candidates possessing the required technical and sector-specific skills.
- Persistent skills mismatches are evident in the sector, especially in relation to social-emotional and cognitive skills, with employers highlighting gaps in emotional intelligence, basic literacies and critical thinking capacities required in evolving work contexts.
- Strengthening workforce development in the maritime sector necessitates coordinated action to better align education and training provision with industry requirements, expand opportunities for work-based and experiential learning, and address existing skills mismatches. At the same time, targeted interventions are required to support small and micro enterprises, foster inclusive participation in STEM fields, and reinforce technical and vocational education and training (TVET) systems to develop a responsive and future-ready workforce.

HEADLINE STATISTICS

74%
Of maritime establishments surveyed were Micro and Small Enterprises (MSEs)

52%
Of maritime establishments reported having no employees with STEM degrees

#1
Engineering occupations recorded the highest concentration of STEM workers

30%
Of employers reported current job vacancies within the maritime sector

#1
Barrier to STEM recruitment was a low number of applicants with required skills

50%+
Of employers reported gaps in social, emotional and cognitive skills among recent university graduates

INTRODUCTION

The ocean-based economy contributes to over 80% of Trinidad and Tobago's GDP, positioning the maritime sector as both a foundation of national economic development and a catalyst for future growth. Spanning offshore oil and gas exports, fisheries, ship repair services, maritime logistics, and emerging areas such as underwater heritage tourism, the sector intersects with multiple dimensions of the economy.

The Assessment of 21st Century Skills Across Emerging Sectors: Maritime Sector, conducted by NIHERST in collaboration with the ILO (2023–2025), gathered data from maritime establishments in Trinidad and Tobago using an establishment skills survey aligned with standards of the International Labour Office Geneva, the European Training Foundation, and the European Centre for the Development of Vocational Training. Data collection was conducted through structured, face-to-face interviews with employers and senior managers, examining firm characteristics, workforce composition, job vacancies, recruitment challenges, core skills needs, skills mismatches, and current and projected demand for Science, Technology, Engineering and Mathematics (STEM) occupations.

The survey frame was developed using business listings from the Central Statistics Office, the National Agricultural Marketing and Development Corporation, and the National Training Agency, with the sample selected through systematic random sampling. Respondents represent established enterprises within the maritime sector, and the findings are consistent with wider evidence on skills mismatches and the effects of technological change.

Global trends, including digitalization, climate change and increasing automation, are reshaping the maritime sector and intensifying the demand for STEM occupations and for a workforce equipped with strong core work skills. In a context of limited labour-market data, the findings of the skills assessment offer a valuable and credible baseline to inform policy development and guide the design of responsive education and training programmes.

FIRM CHARACTERISTICS AND WORKFORCE COMPOSITION

Survey respondents comprise firms at different stages of development, with a substantial share represented by long-established enterprises. This indicates a stable industry structure with firms that have accumulated experience and operational continuity over time. Most respondents are micro and small enterprises (MSEs), employing less than 25 workers. Their activities are concentrated in ship repair and dry docking (52%), and maritime services (44%), underscoring a strong operational focus on maintenance, support services, and logistics within the broader maritime economy.

Employment within the sector is predominantly concentrated in managerial and clerical occupations, with comparatively fewer workers employed in professional and technical roles. This occupational structure indicates that many firms continue to rely heavily on administrative and supervisory functions rather than specialised technical expertise, which may limit operational efficiency, slow innovation and hinder the adoption of more advanced practices. The workforce is male dominated across most occupational groups, with particularly low female participation in management, professional and technical roles. This imbalance reflects structural barriers that may limit women's entry into and progression within higher-skilled and decision-making positions. At the same time, it highlights the untapped potential of a more diverse workforce in strengthening the sector's human capital base.

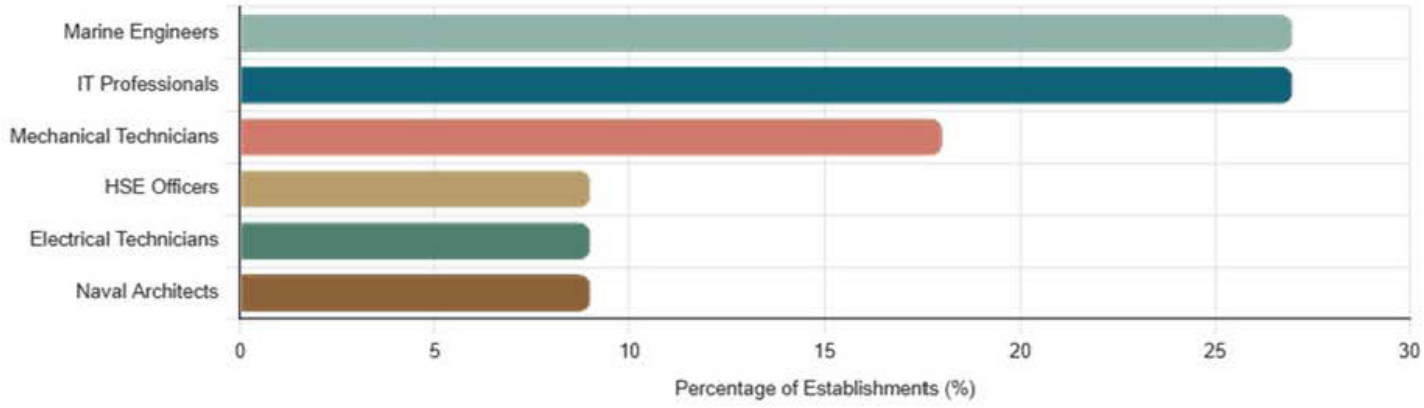
JOB VACANCIES AND RECRUITMENT CHALLENGES

VACANCY PROFILE

Overall vacancy levels in the maritime sector at the time of the survey were low, indicating limited short-term labour demand and relatively stable staffing structures among firms. A greater share of vacancies was observed in non-STEM occupations, suggesting that immediate recruitment needs are concentrated primarily in administrative and operational roles rather than in specialized technical positions. However, employers highlighted that STEM vacancies, primarily in engineering and IT, are more difficult to fill, indicating that while the demand for these roles may be lower in absolute terms, they require specialised skills that are less readily available in the labour market.

Job vacancies for marine engineers and IT technicians, reflecting core operational requirements in vessel maintenance, as well as vacancies in systems management, and digital support functions, were identified as the most difficult to fill.

MOST DIFFICULT STEM OCCUPATIONS TO FILL



Looking ahead, the demand is expected to expand for electrical engineers, marine surveyors, and related technical occupations, as firms adapt to more complex equipment, stricter regulatory requirements, and increasingly technology-driven operations. This shift reflects a widening of technical occupational requirements beyond routine maintenance, extending into functions related to inspection, regulatory compliance, systems integration and infrastructure development.

MAIN RECRUITMENT BARRIERS

The main constraint to recruitment is the limited availability of applicants possessing the requisite skills, underscoring a persistent mismatch between the competencies demanded by employers and those present within the labour force. Employers reported low levels of interest in maritime careers, suggesting that the sector may not be sufficiently visible or attractive to potential entrants. Recruitment challenges are most pronounced for occupations in the group of Technical and Associate Professionals that require both practical experience and advanced technical skills and for specialized STEM roles, especially in engineering.

Employers also indicated that compensation packages are often perceived as insufficiently competitive, particularly for specialised and high-demand roles. This limits the ability of firms to attract qualified candidates and may contribute to the outflow of talent to other sectors or international labour markets where remuneration and career prospects are more attractive. As a result, even when vacancies exist, employers may experience prolonged recruitment periods and difficulty securing candidates with the appropriate qualifications and experience.

CORE SKILLS NEEDS AND MISMATCHES

KEY SKILLS

Communication, collaboration and teamwork, emotional intelligence and foundational literacies were identified by survey respondents as the most essential skills in the maritime sector. These findings underscore the growing importance of strong interpersonal abilities, effective teamwork and the capacity to understand and apply basic knowledge within the workplace. Analytical and critical thinking, problem-solving, and planning and organising skills were also highly valued, as they support decision-making, operational efficiency, and the ability to respond to complex and evolving work demands.
Drivers of change such as competition, technological advancement, and profitability place increasing

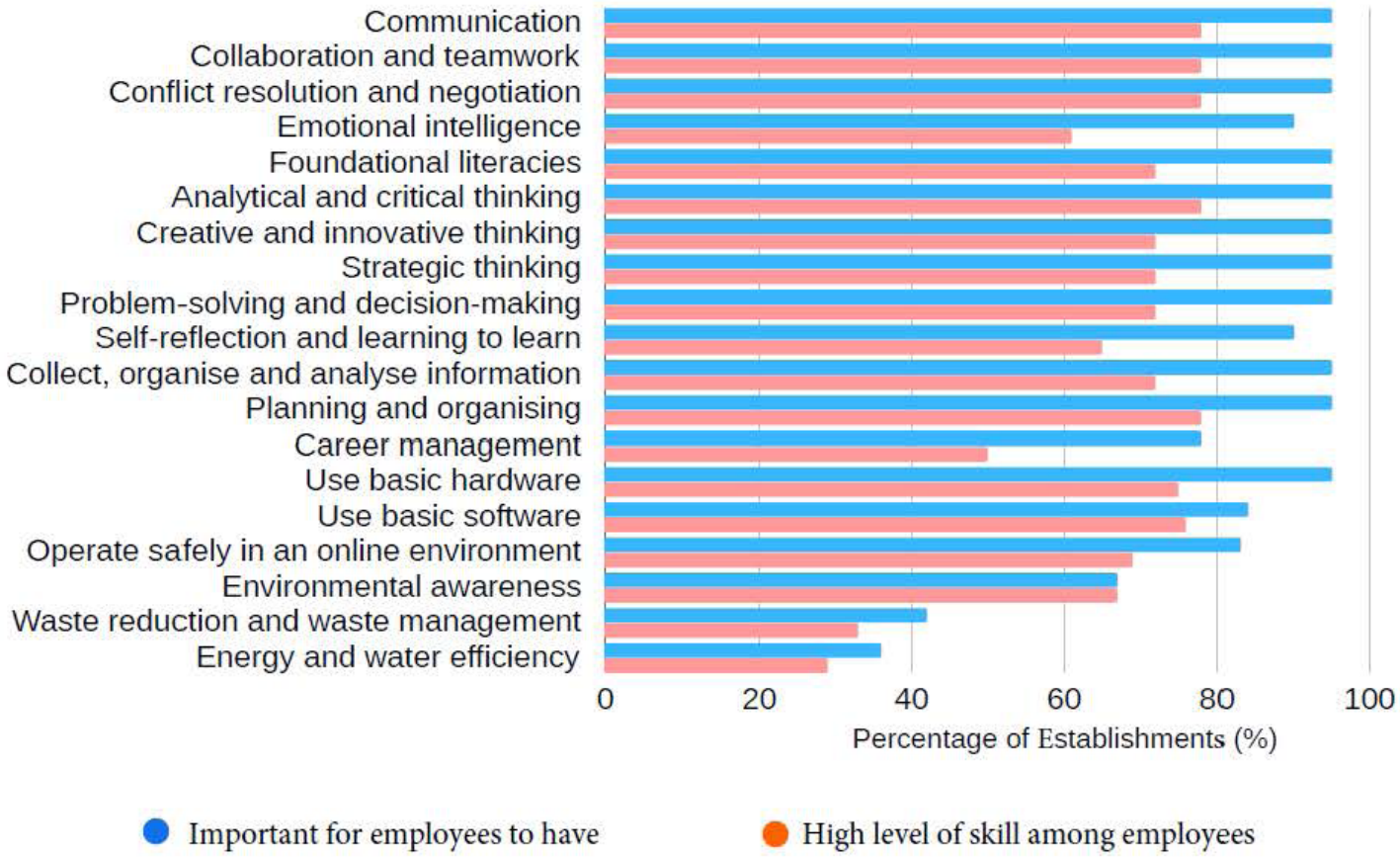
pressure on firms to adapt and remain competitive. In this context, employers identified adaptability, marketing, IT, leadership, and problem-solving as essential skills for navigating changing business environments, responding to market dynamics, and integrating recent technologies into operations.

LARGEST SKILLS GAPS (IMPORTANCE X PROFICIENCY)

Survey respondents assessed the extent to which recent graduates (2021–2023) applying to vacancies in their enterprises possessed a range of core skills. While basic digital competencies were generally reported as readily available, employers noted substantial difficulties in identifying applicants with strong cognitive and socio-emotional skills. In particular, critical thinking, foundational literacies and communication skills were frequently reported as difficult to source among recent graduates.

Survey respondents were also asked to share their perceptions of core skill levels among their workforces. The largest gaps were observed in core socio-emotional skills, where the differences between employer expectations and the perceived workforce proficiency are more pronounced.

ESTIMATED SKILLS GAPS (IMPORTANCE OF SKILLS TO MEET BUSINESS GOALS X PROFICIENCY LEVEL AMONG EMPLOYEES)



TECHNOLOGICAL ADVANCEMENTS IN THE SECTOR

The maritime industry is undergoing significant transformation driven by emerging technologies, including autonomous vessels, artificial intelligence (AI), blockchain technologies for supply chain transparency, green energy solutions for decarbonisation, and the use of drones, robotics, and big data analytics.

These technologies are improving efficiency, safety, and sustainability while simultaneously increasing demand for STEM-related occupations such as engineers, data analysts, cybersecurity specialists, and AI professionals.

The transformation of the Port of Port of Spain highlights the significant role of technology in reshaping maritime operations. By implementing advanced systems such as NAVIS Sparcs N4, digital monitoring and real-time tracking technologies, energy-efficient equipment, and the Port Community System (PCS), the Port Authority of Trinidad and Tobago (PATT) has achieved substantial improvements in operational efficiency, cargo management, customer service, and environmental sustainability. This demonstrates how digital transformation can strengthen competitiveness, improve logistics performance, reduce operational costs, and support sustainability within the maritime industry.

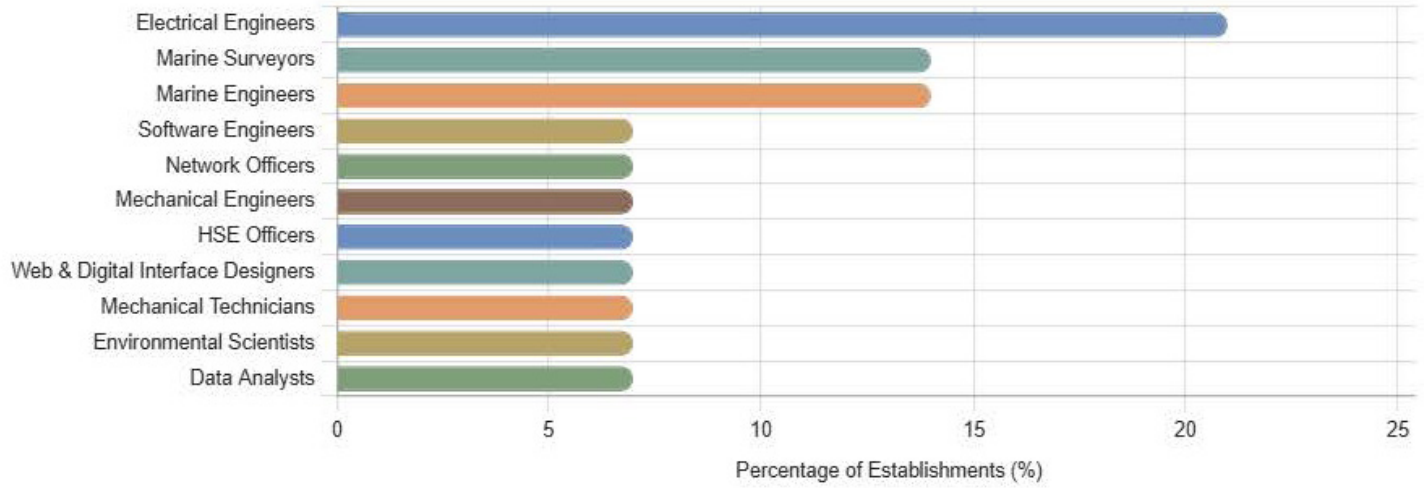
As global maritime operations continue to modernize, there is an increasing need for a workforce equipped with digital, technical, analytical, and problem-solving skills. The growing adoption of smart technologies, automation, and green innovations underscores the importance of strengthening STEM education, workforce upskilling, cybersecurity capacity, and technical and vocational training to ensure Trinidad and Tobago remains competitive within the global maritime economy. Emerging technologies also create opportunities for innovation, entrepreneurship, and the development of high-value maritime services, positioning the sector as a key driver of economic diversification and sustainable development.

DEMAND FOR STEM LABOUR

The current demand for STEM labour in the maritime sector remains low and concentrated in engineering and IT roles. Marine engineers and IT technicians are the most sought-after positions at present.

Looking ahead, the demand for STEM professionals is expected to increase for electrical engineers, marine surveyors, and marine engineers, reflecting the sector's strategic direction toward technological adoption and modernization. This indicates a growing need to strengthen the STEM talent pipeline.

PROJECTED DEMAND FOR STEM OCCUPATIONS (NEXT 5 YEARS)



TVET FINDINGS

The survey utilised the STEM in TVET Curriculum Guide developed by the ILO Women in STEM for Workforce Readiness and Development Programme to gather information from respondents on the work-readiness of their current workforce and of recent Technical and Vocational Education and Training (TVET) graduates (2021–2023) applying for positions within their enterprises.

Available evidence suggests that TVET graduates are well prepared for work, particularly in relation to job-readiness and the application of practical skills in workplace settings. This indicates that TVET pathways are contributing positively to school-to-work transitions. Despite this, employers highlighted the need for stronger alignment between TVET programmes and industry requirements, suggesting that current curricula may not fully reflect evolving operational practices and technological changes within the sector.

Key gaps include insufficient training opportunities, limited availability of industry-specific programmes, and a need for more practical, hands-on learning that reflects real workplace conditions. Employers also point to gaps in exposure to sector-specific equipment, processes, and standards. In addition, there is a perceived need for closer coordination between training providers and employers to ensure that course content, delivery methods, and certification pathways are responsive to industry demand and changing skill requirements.

RECOMMENDATIONS

Preparing the maritime sector workforce for current and future demands requires coordinated and sustained action across key areas. Greater collaboration between stakeholders is needed to ensure that the education and training provision reflects current and anticipated industry needs and firms can access and develop the skills required to remain competitive in a rapidly changing environment.

Employers in the maritime sector articulated recommendations for actions by government, industry stakeholders, and education and training institutions to strengthen workforce development. Complemented by broader recommendations derived from the findings of the study, the priority recommendations in this section are proposed for consideration by policymakers, education and training institutions, industry stakeholders, and social partners.

ADDRESS SKILLS MISMATCHES

Education and training programmes that are responsive to industry sector needs contribute to reducing skills mismatches. Continuous collaboration between training institutions and employers to review curricula, integrate emerging industry requirements, and expand maritime-related programmes in line with evolving demand can ensure that graduates possess relevant and up-to-date skills. The findings of this study point to strengthening both technical and core competencies. Embedding skills such as communication, critical thinking, and emotional intelligence within education and training systems can better prepare individuals for employment. At the same time, continuous upskilling and reskilling of the existing workforce is necessary to ensure adaptability to evolving job requirements.

EXPAND WORK-BASED LEARNING OPPORTUNITIES TO MICRO AND SMALL ENTERPRISES

Work-based learning includes all forms of learning that take place in real work environments, most commonly through apprenticeships and internships. By combining classroom learning with on-the-job experience, it helps learners to build practical skills and transition more easily into the labour market. Micro and small enterprises play a central role in Trinidad and Tobago's maritime sector and, as in many countries, can be key providers of work-based learning opportunities. Expanding work-based learning within micro and small businesses requires regulatory and institutional frameworks to enable their effective participation, along with sustained investment in infrastructure to create a stable training environment. Education and training institutions must also adjust programmes to better meet their needs, including through broader job profiles that span multiple tasks. Because micro and small enterprises often lack the full set of resources needed for hands-on training, rotational placements across several firms may offer an effective solution.

EXPAND AND DIVERSIFY THE STEM TALENT POOL

STEM labour demand in the maritime sector is currently modest but expected to grow, particularly in engineering roles, yet employers already face hard-to-fill vacancies and low female representation in technical occupations. Building a stronger and more inclusive talent pool is essential to meet evolving workforce needs, supported by measures such as financial incentives, scholarships, career-awareness programmes, and mentorship initiatives. Recruitment practices that actively encourage women's participation, along with supportive networks, can help narrow gender gaps. However, STEM education reflects broader systemic dynamics, with participation influenced by performance in mathematics and science at the secondary level and by degree completion at the postsecondary level. Persistent inequalities in access and delivery highlight the need for innovative teaching approaches, including integrating science and technology content into non-STEM disciplines to broaden participation.

Support small firms in accessing skilled labour

Given the predominance of micro and small enter-

prises in the sector, ensuring their access to skilled labour is essential. Survey results show that these firms typically operate with small teams, limited in-house training capacity, and strong competition from larger companies and international labour markets, leading to persistent challenges in filling technical and specialised roles. Structural constraints such as higher relative recruitment costs, limited visibility, and less competitive compensation further hinder their ability to attract qualified workers. Strengthening coordinated approaches to skills development, including shared training arrangements and partnerships with education and training providers, can help address these barriers. Improving the access of small and micro enterprises to skilled labour is critical for maintaining productivity, supporting technology adoption, and enhancing overall sector competitiveness.

PROMOTE THE ADOPTION OF EMERGING TECHNOLOGIES

Technological change is reshaping the sector, with firms increasingly exposed to automation, artificial intelligence, and digital systems; however, many lack the capacity to adopt and operationalise these innovations. Employers report rising pressures linked to competitiveness and digital transformation, underscoring the need for sustained investment in digital infrastructure, innovation, and organizational readiness. Targeted training in areas such as AI, data analytics, robotics, and green technologies is essential to the adoption and use of emerging technologies, increase productivity and safety, and contribute to a more efficient and environmentally sustainable sector.

STRENGTHEN TVET-INDUSTRY COLLABORATION

Strengthening TVET is key to ensuring responsiveness to the evolving skills needs of the maritime sector. While employers generally view TVET graduates as job-ready, survey findings point to gaps between existing programmes and current operational practices, particularly in relation to technological change. This highlights the need to expand training aligned with maritime occupations, update curricula to reflect industry standards, and invest in modern training infrastructure that mirrors workplace conditions. Stronger collaboration between training providers and employers can help ensure that course content, delivery methods, and certification pathways remain relevant and demand-driven, while supporting better integration of theoretical learning with practical exposure to sector-specific equipment and processes. A more responsive TVET system will improve the quality and relevance of training outcomes and contribute to a more adaptable and capable workforce.
Encourage more labour force studies on STEM skills and STEM jobs

Undertaking more labour force studies on STEM skills and STEM jobs is crucial for understanding labour market trends, workforce gaps, and emerging occupational demands within the maritime sector. Strengthening data collection and labour market intelligence will enable policymakers, education and training institutions, and industry stakeholders to develop evidence-based policies and programmes that address skills shortages and facilitate greater alignment between education and training systems and industry needs. Improved labour market data can also support workforce planning, scholarship targeting, curriculum development, and investment decisions aimed at strengthening the competitiveness and sustainability of the maritime sector.

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