



International
Labour
Organization

REPORT BRIEF

Assessment of 21st Century Skills Across Emerging Sectors

Software Design and Applications Industry

Volume 3

Key points

- Emerging technologies such as artificial intelligence and machine learning, cloud computing, blockchain technologies, and low-code and no-code development platforms, alongside advances in serverless and edge computing are reinforcing the demand for higher-level technical skills in the software design and applications sector. The findings of the study indicate a growing demand for STEM-related occupations, particularly in IT and Engineering, alongside persistent difficulties in filling these roles.
- Recruitment is constrained by skills shortages and experience gaps. A significant proportion of employers indicated challenges in filling vacancies, particularly in STEM-related roles, due to a limited pool of qualified applicants and insufficient work experience. Work readiness and behavioral attributes were also reported as barriers to successful recruitment.
- Skills mismatches are most acute in specialised technical roles and mid-level occupations. Employers reported significant gaps between the skills required and those possessed by both recent graduates and existing workers, particularly in cognitive and socio-emotional skills. These mismatches are especially evident in roles requiring problem-solving, analytical thinking and practical application of technical knowledge.
- Investing in focused upskilling and reskilling initiatives and expanding work-based learning are key to helping workers adjust to emerging technologies and changing work practices, boost efficiency, and strengthen enterprise competitiveness. These efforts should place emphasis on training aligned with industry needs, promote lifelong learning, and enable the ongoing development of both technical and foundational skills, ensuring the workforce remains agile and responsive to evolving sectoral demands.



HEADLINE STATISTICS



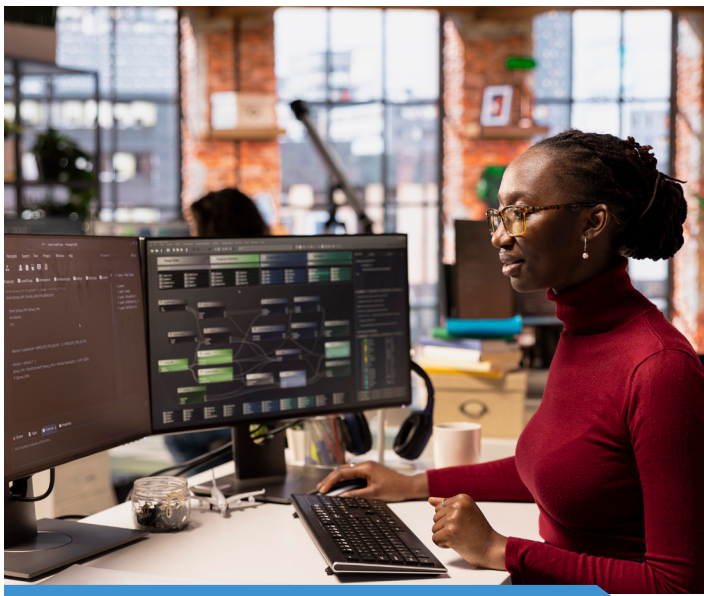
INTRODUCTION

Rapid technological change is transforming the software design and applications sector, requiring workers to continuously update and adapt their skills to remain competitive. The increasing adoption of technologies such as artificial intelligence (AI), machine learning (ML) and advanced digital systems is driving the demand for a workforce with strong technical skills alongside a broad set of core work skills. These developments highlight the growing importance of both specialised expertise and adaptable, future-ready skills to meet evolving industry requirements.

The Assessment of 21st Century Skills Across Emerging Sectors: Software Design and Applications Industry, conducted by NIHERST in collaboration with the ILO (2023–2025), gathered data from software design and application 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. 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. 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.

Overall, the findings indicate a sector dominated by micro and small enterprises with demand concentrated in IT and Engineering occupations. Despite relatively few vacancies, employers report persistent difficulties filling STEM roles due to limited work experience and gaps in work readiness, alongside notable shortages in cognitive and socio-emotional skills. Rapid technological change is increasing demand for advanced technical and future-ready skills, while limited engagement with TVET and concerns about training relevance point to the need for stronger alignment between education and industry and expanded work-based learning.



FIRM CHARACTERISTICS AND WORKFORCE COMPOSITION

Survey respondents are predominantly micro and small enterprises, with the majority (55%) employing fewer than 10 workers. This enterprise size structure shapes the organisation of work, with lean staffing structures and a concentration of functions across a limited number of employees. Employment is typically composed of a mix of occupational groups, including a core group of managers and professionals responsible for strategic and technical functions, supported by technicians and associate professionals who undertake operational and implementation

tasks. Lower-skilled roles are less prevalent. Overall, the workforce structure reflects the operational realities of small firms, where employees often perform multiple roles and where higher-level technical and management skills are critical for business performance and growth.

The workforce composition by gender indicates that women are equally represented in overall employment; however, men remain disproportionately concentrated in managerial, professional and technical occupations. This suggests that, despite parity in aggregate participation, gender-based occupational segregation persists within the sector. Men are more likely to occupy higher-skilled and decision-making roles, while women are less represented in these positions. This distribution highlights potential differences in access to advanced roles and career progression opportunities, with implications for equity, talent utilisation and the overall inclusiveness of the sector's workforce development trajectory.

JOB VACANCIES AND RECRUITMENT CHALLENGES

VACANCY PROFILES

Vacancies within the software design and applications industry were relatively limited, with only a small proportion (27%) of establishments reporting open positions during the survey period. Where vacancies existed, they concentrated entirely on STEM-related occupations, particularly in IT roles such as programmers, software developers, web designers and IT managers. While non-STEM roles are more readily filled, employers report persistent challenges in recruiting for mid and high-skilled positions, particularly in specialised technical roles.

KEY RECRUITMENT BARRIERS

Employers reported that the main barriers to recruitment stem from a low number of applicants with the

required technical and non-technical skills, particularly appropriate attitudes, motivation, and interpersonal qualities. Many enterprises noted that the pool of suitably qualified applicants is limited in terms of both technical competencies and overall work readiness.

Insufficient work experience among applicants was also frequently cited as a significant constraint in filling vacancies. In addition, a considerable share of employers reported a low number of candidates in general, which further intensifies recruitment challenges.

CORE SKILLS NEEDS AND MISMATCHES

KEY SKILLS

A broad range of core skills was identified as essential for effective job performance and overall organisational effectiveness. These include technical and job-specific skills, as well as digital literacy and ICT capabilities, which have become increasingly critical in technology-intensive work environments. Employers also underscored the importance of higher-order cognitive skills, particularly problem-solving and critical thinking, as fundamental requirements across occupational roles. In addition, social and behavioral skills such as teamwork, communication, adaptability, and the capacity for self-reflection and continuous learning were highlighted as key determinants of worker effectiveness. These findings reflect the dynamic and rapidly evolving nature of the sector, in which employees must continually adapt to technological advancements and organisational change.

LARGEST SKILLS GAPS (IMPORTANCE X PROFICIENCY)

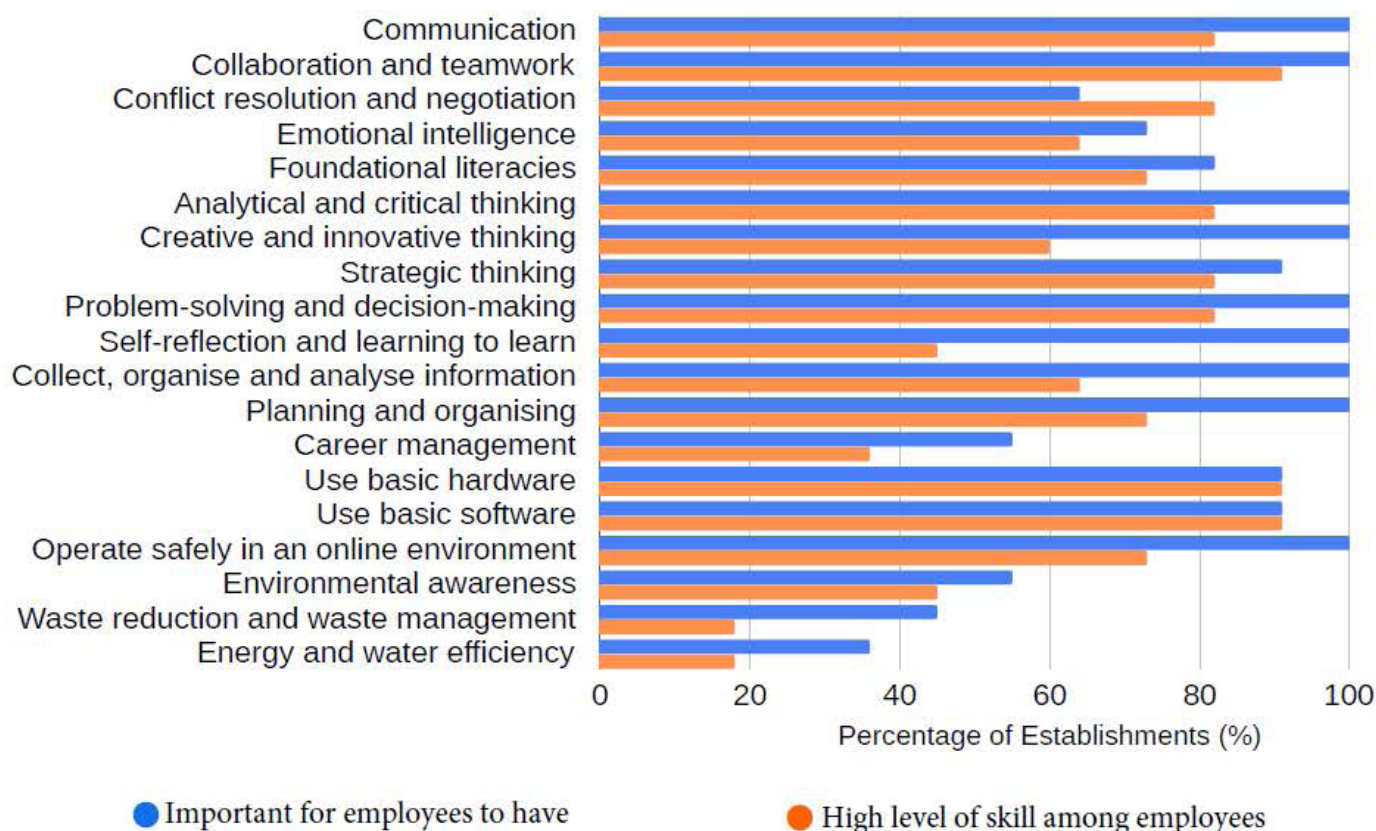
Employers were asked to assess the extent to which a set of core skills were present among recent graduates (2021–2023) applying to jobs in their companies. The findings indicate that employers experi-

enced considerable difficulty in sourcing creative and innovative thinking, conflict resolution and negotiation, strategic thinking, problem solving and decision making and analytical and critical thinking among recent graduates. By contrast, employers reported relatively low levels of difficulty in basic digital skills, including the use of basic hardware and software and operating safely in an online environment. Overall, these results suggest that while foundational digital skills are generally present among graduates, significant gaps persist in cognitive and socio-emotional skills required for effective performance in the sector.

Employers were also asked to provide their assessments of the core skill levels of their workforces. The study findings point to gaps in self-reflection and learning to learn, followed by creative and innovative thinking, and the ability to collect, organise and analyse information. These skills were rated as highly important, yet employers assessed their workforce's proficiency in them as relatively low. These findings underscore the importance of prioritizing learning to learn as a core competence within education and training programmes. As a lifelong competency, learning to learn is essential for employability and for enabling workers to continuously adapt to changing work environments, particularly in the software design and applications industry sector, which is among the most significantly impacted by evolving technologies.



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



TECHNOLOGIES RESHAPING THE SECTOR

The software design and applications sector is undergoing rapid transformation, driven by the adoption of advanced digital technologies and evolving global innovation trends. Key technological developments identified in the study include artificial intelligence and machine learning, cloud computing, blockchain technologies, and low-code and no-code development platforms, alongside advances in serverless and edge computing, and new approaches to software development such as DevOps (software development united with IT operations) and DevSecOps (Development, Security, and Operations). These technologies are reshaping software development processes by increasing productivity, improving effi-

ciency, and enabling greater scalability and innovation. At the same time, their adoption is increasing the demand for highly skilled workers, particularly in areas such as software development, cybersecurity, data analytics and cloud computing, thereby intensifying the need for a workforce equipped with advanced technical and future-ready skills.

DEMAND FOR STEM LABOUR

The findings indicate that demand for STEM labour is concentrated in IT occupations, followed by Engineering. Employers identified database developers and IT technicians among the most in-demand roles. Employers also reported persistent difficulties in filling STEM vacancies, particularly in IT and

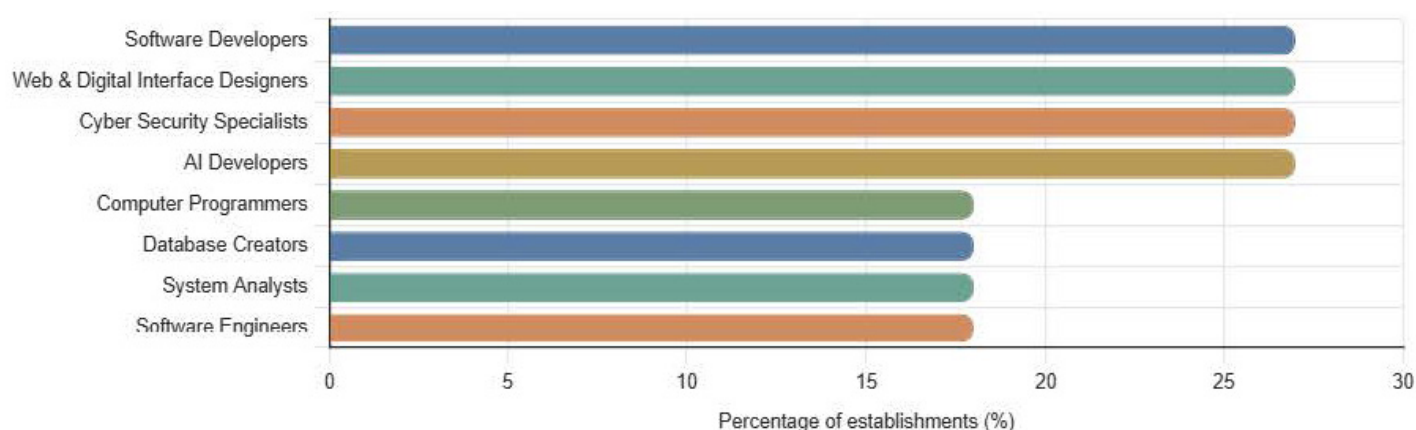
Engineering. The most difficult roles to fill included web designers, software developers, programmers, computer and information systems managers and IT technicians.

Employers were further asked to identify the most important STEM occupations for their organisations over the next five (5) years based on the strategic direction of their businesses. The top future STEM occupations identified were Cyber Security Special-

ists, Web and Digital Interface Designers, Software Developers and AI Engineers.

Overall, these findings point to a growing gap between the increasing demand for STEM occupations and the availability of suitably qualified candidates with the technical and future-ready skills required by the industry.

MOST IMPORTANT STEM OCCUPATIONS FOR ESTABLISHMENTS IN THE NEXT FIVE YEARS



TVET FINDINGS

Technical and Vocational Education and Training (TVET) systems play a critical role in workforce preparation in the software design and applications sector; however, the study highlights several gaps that limit its effectiveness. Notably, responses to the TVET component of the survey were very limited, suggesting weak engagement between firms and TVET providers. Among participating employers, there is a consistent perception that training programmes are not sufficiently aligned with industry needs, particularly in terms of practical application of skills. Employers emphasised the need for stronger integration of work-based learning, including internships and apprenticeship programmes, to improve graduates' readiness for the workplace. In addition,

deficiencies in hands-on experience and exposure to real-world work environments were frequently cited, indicating that graduates often enter the labour market without the practical skills required for immediate productivity. These findings underscore the importance of strengthening linkages between TVET institutions and industry to improve curriculum relevance, expanding work-based learning opportunities, and better aligning skills development with evolving sector demands.

RECOMMENDATIONS

Coordinated and evidence-based policy efforts, drawing on both the empirical findings of the study and the recommendations put forward by employ-

ers, are essential to building a skilled, adaptable and future-ready workforce capable of supporting the growth and competitiveness of the software design and applications sector. The evidence highlights persistent skills mismatches, recruitment challenges in STEM occupations, and gaps in work readiness, alongside the accelerating impact of technological change on skills demand. Employers emphasised the need for stronger alignment between education and industry, expanded work-based learning opportunities, and targeted skills development initiatives. Addressing these priorities through integrated policy responses that strengthen linkages between government, industry and training institutions will be critical to improving labour market outcomes and ensuring that the workforce is equipped to meet current and emerging sector needs.



PROMOTE THE DEVELOPMENT OF SOCIO-EMOTIONAL AND COGNITIVE SKILLS ALONGSIDE TECHNICAL TRAINING

The findings indicate that employers face significant challenges in sourcing key skills among recent graduates, particularly in areas such as communication, teamwork, problem-solving, analytical and critical thinking, and creative and innovative thinking. While basic digital skills are generally present, gaps in cognitive and socio-emotional skills limit effective job performance and workplace integration. These findings highlight the need to strengthen the integration

of core skills within education and training systems. Improving these skills is key to improving employability, supporting school-to-work transitions, and ensuring better alignment between the skills profile of graduates and the requirements of the software design and applications industry.

ENCOURAGE GENDER INCLUSION AND DIVERSITY IN STEM-RELATED OCCUPATIONS

The findings indicate that, although women and men are similarly represented in overall employment in the software design and applications industry, women are underrepresented in managerial, professional and technical occupations. Men are more prevalent in higher-skilled and decision-making roles, particularly in IT and engineering-related fields, pointing to persistent gender-based occupational segregation. This distribution suggests potential inequalities in access to advancement opportunities within the sector. The evidence underscores the need to strengthen pathways into STEM education and careers for women, address barriers to entry and progression, and promote inclusive workplace practices. Increasing gender diversity in STEM occupations can contribute to more equitable outcomes while broadening the talent pool available to support the sector's development.

INCREASE PRACTICAL TRAINING AND INTERNSHIP OPPORTUNITIES IN TERTIARY PROGRAMMES

The study indicates that employers consistently report gaps in work readiness among recent graduates and place strong emphasis on the practical application of skills. A significant share of employers identified lack of work experience and insufficient exposure to real-world work environments as key barriers to recruitment. Employers recommended expanding training opportunities aligned with industry needs

and increasing internship and apprenticeship programmes to bridge this gap. Strengthening the practical components of tertiary education through structured internships, industry placements and work-based learning can support the development of job-relevant skills and improve school-to-work transitions.

INVEST IN UPSKILLING AND RESKILLING PROGRAMMES

The findings of the study highlight the need for continuous skills development to address emerging and persistent skills gaps within the software design and applications industry. Employers reported deficiencies not only in advanced technical and digital skills but also in cognitive and socio-emotional skills among both recent graduates and existing employees. In addition, technological advancements, including the adoption of artificial intelligence, cloud computing and other digital tools, are reshaping job requirements and increasing demand for higher-level skills. Investing in targeted upskilling and reskilling programmes is therefore essential to enable workers to adapt to evolving technologies and work processes, increase productivity, and support business competitiveness. Such initiatives should prioritise industry-relevant training, support life-long learning, and facilitate the continuous development of both technical and core skills to ensure that the workforce remains responsive to the changing needs of the sector.

INCREASE INCENTIVES FOR STUDENTS TO PURSUE STUDIES AND CAREERS IN STEM FIELDS

The findings of the study indicate a growing demand for STEM-related occupations, particularly in IT and Engineering, alongside persistent difficulties in filling these roles. Employers identified key occupations such as software developers, AI developers, web and digital interface designers, and cyber security specialists as priorities for future growth, while also reporting challenges in sourcing suitably quali-

fied candidates. This suggests a need to strengthen the pipeline of students entering STEM fields aligned with industry demand. Increasing incentives for students to pursue STEM studies and careers through scholarships, targeted programmes, and career guidance, can support greater participation in these fields. Such measures can contribute to expanding the supply of qualified talent, improving alignment between education and labour market needs, and supporting the long-term development and competitiveness of the software design and applications industry.

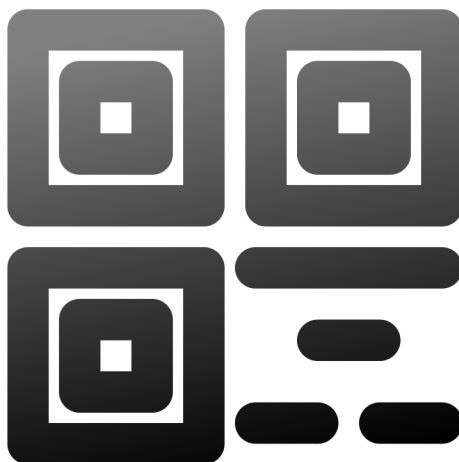
ENCOURAGE MORE LABOUR FORCE STUDIES ON STEM SKILLS AND STEM JOBS

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 software design and applications industry. Improved labour market intelligence will enable policy-makers, education and training institutions, and industry stakeholders to develop targeted policies and programmes to address identified gaps, strengthen workforce planning, and facilitate greater alignment between education and training systems and industry needs. Continuous labour market research can also support evidence-based decision-making related to scholarships, curriculum reform, workforce development initiatives and future STEM workforce requirements.



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