NIHERST

International Labour Organization

Assessment of 21st Century Skills Across Emerging Sectors

Aviation Sector

Volume 5

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Acknowledgements

The successful completion of the "Assessment of 21st Century Skills Across Emerging Sectors: Aviation Sector" report was made possible through the contributions and support of numerous individuals and institutions.

NIHERST extends our deepest gratitude to our project partner and sponsor, the International Labour Organization (ILO), whose collaboration was instrumental to this project. Special recognition is given to Ms. Ilca Webster, Specialist on Skills and Lifelong Learning at the ILO, for her invaluable technical support and guidance to the survey team throughout the duration of the project.

The Institute also expresses its sincere appreciation to the 159 employers from the five emerging industries who participated in the survey, providing essential data and insights that underpin this report.

NIHERST gratefully acknowledges the support and oversight provided by the Ministry of Education and the Ministry of Tertiary Education and Skills Training. Additionally, we appreciate the contributions of various ministries, agencies, universities and associations, whose collaboration and input were crucial to the success of this assessment, notably the:

1. Ministry of Public Administration and Artificial Intelligence;
2. Ministry of Planning, Economic Affairs and Development;
3. Ministry of Labour;
4. Ministry of Sport and Youth Affairs;
5. Central Statistical Office (CSO);
6. The University of the West Indies (UWI);
7. University of Trinidad and Tobago (UTT);
8. College of Science, Technology and Applied Arts of Trinidad and Tobago (COSTAATT);
9. National Training Agency of Trinidad and Tobago (NTA);
10. Youth Training and Employment Partnership Programme (YTEPP);
11. Employers' Consultative Association of Trinidad and Tobago (ECA);
12. Public Services Association (PSA); and
13. Trinidad and Tobago Manufacturers' Association (TTMA).

Finally, we extend our heartfelt thanks to the dedicated staff at NIHERST, particularly those in the Science and Technology Statistics Department, for their tireless efforts and commitment in producing this report.

Foreword

The Aviation Industry in Trinidad and Tobago stands at a critical junction – poised for rapid technological advancement, increased global connectivity, and a renewed focus on sustainability. These changes demand a workforce that is steeped in STEM and future ready skills.

This report presents a timely and in-depth assessment of 21st century skills within the Aviation Industry, a sector that holds significant promise for economic diversification and sustainable growth in Trinidad and Tobago. By examining the alignment between workforce capabilities and industry needs, the study offers valuable insights to inform education, training and policy interventions.

As the Acting President of the National Institute of Higher Education, Research, Science and Technology (NIHERST), I am proud to present this landmark study, a testament to NIHERST's ongoing commitment to conducting research in high potential sectors that support the sustainable diversification of Trinidad and Tobago's economy. Our findings not only reveal the pressing need for alignment between education systems and industry requirements but also spotlight the resilience and readiness of our local establishments.

I extend my gratitude to our institutional partner, the International Labour Organization (ILO) for their unwavering support in enabling this series of research studies and in particular this fifth (5th) series which offers a comprehensive assessment of the local Aviation Industry's workforce landscape, its current and emerging needs and the opportunities that lie ahead for transformative growth through STEM.

This publication represents the collective efforts of dedicated researchers (inclusive of the staff of the S&T Statistics Department at NIHERST) and industry stakeholders and policy makers working together to illuminate the realities of aviation in this region. Thank you for your valuable insights and recommendations articulated in this report. I invite stakeholders across education, government and private enterprise to engage deeply with the information shared. Together we can chart a forward-looking path that ensures a vibrant, adaptive and skilled workforce equipped to lead the local aviation industry into the future.

Let us rise to meet the moment.

Ms. Julie David
President (Ag.)
NIHERST

Partner Message

The International Labour Organization (ILO) Decent Work Team and Office for the Caribbean is proud to be part of this publication to support Trinidad and Tobago's efforts to transition towards a more diversified workforce.

This report focuses on the Aviation Sector and is part of an impressive wider strategy by the National Institute of Higher Education, Research, Science and Technology (NIHERST) to identify needs and actions for effective skills development in emerging sectors. It offers a timely and insightful assessment of the 21st century skills and STEM competencies shaping the future of this industry.

It would be remiss of me not to highlight that the results presented in this report are based on a NIHERST survey launched with guidance from the ILO Global framework on core skills for life and work in the 21st century and technical advice from Ms. Ilca Webster, Lifelong Learning Specialist at the ILO Caribbean Office.

The ILO commends NIHERST for its targeted approach to enhancing skills anticipation and closing skills gaps for this sector. The aviation sector stands as a cornerstone of innovation and economic growth. Recruiting talent equipped not only with technical expertise but also with the soft and cognitive skills that are often underdeveloped in recent graduates is key to unlocking the full potential of this sector.

This report is more than a snapshot of current challenges; it is a call to action. By embracing its insights and recommendations, stakeholders across government, academia, and industry can work collaboratively to ensure that Trinidad and Tobago not only keeps pace with global trends but leads in shaping a digitally empowered future.

Dr. Joni Musabayana
Director
ILO Caribbean Decent Work Team and Office for the Caribbean

Executive Summary

The Aviation Industry in Trinidad and Tobago serves as a key driver of economic activity, facilitating both international and regional connectivity while supporting trade, tourism and employment. Driven by rapid technological advancements – from automation and digital navigation systems to data-driven maintenance and AI-powered operations – the aviation industry demands a workforce equipped with strong technical expertise and adaptable future ready skills that support continuous learning and change. International organisations such as the World Bank and the OECD have underscored the importance of STEM (Science, Technology, Engineering and Mathematics) education in preparing individuals to meet these evolving demands.

STEM education not only builds foundational knowledge in critical disciplines but also cultivates 21st Century Skills—such as problem-solving, critical thinking, collaboration, and digital literacy—that are essential for navigating today's innovation-driven economy. These competencies are particularly relevant in the aviation industry, where rapid technological advancements are reshaping operations, safety protocols, and service delivery, requiring a workforce that is both technically proficient and adaptable to continuous change.

To support this transition, countries like Trinidad and Tobago must invest in education and training programmes that align with the needs of emerging sectors. The *Assessment of 21st Century Skills across Emerging Sectors* study was designed to provide insights into the current and future skills demands in five (5) key industries: Maritime, Tourism, Software Design and Applications, Agro-processing and Aviation. This report - the fifth in this research series - focuses on the Aviation Industry, offering evidence-based findings to guide policy development and workforce planning aimed at strengthening national capacity and competitiveness in this vital industry.

In Trinidad and Tobago, the aviation industry is a network of organisations, stakeholders and regulatory bodies involved in the operation, regulation, and support of air transport and related services. The key players are Trinidad and Tobago Civil Aviation Authority, the Ministry of Works and Transport, the Airport Authority of Trinidad and Tobago, Caribbean Airlines Limited and other local/foreign airlines, aviation services and support, aviation training institutions and air traffic control and navigation services.

This report presents the key findings from data collected from 10 of the 24 establishments contacted to participate in this survey. This represents a response rate of 42%. These businesses were involved in air cargo services, aircraft maintenance and repairs, commercial air travel, and regulation of the industry. The report begins by examining key attributes of employers operating within the local aviation sector. This foundational data is vital for contextualizing the research

findings and deepening its understanding of business dynamics in the sector. Participating employers exhibited the following characteristics:

- The aviation industry is notably mature with 90% of businesses operating for over two decades – an indicator of long-term establishment compared to other emerging sectors.
- In terms of workforce size, 60% of the establishments employed between 10 to 49 individuals, while 40% had staff members exceeding 50
- Business activities varied across the sector:
    - 60% of the establishments were primarily engaged in air cargo services;
    - 20% specialised in aircraft maintenance and repairs; and
    - 10% in each case operated in commercial air travel and regulation.

Workforce Composition and STEM Relevance

Another critical component in this report was the composition of the workforce with emphasis on gender distribution, occupational role and STEM qualifications. These insights are essential in identifying current and future labour needs, and potential gaps in industry readiness. Occupations were classified according to the International Standard Classification of Occupations issued by the International Labour Organization (ILO) (see Appendix I). Notable findings include:

- Gender Distribution: 80% of establishments employed fewer than 100 male and female workers. The remaining 20% employed a larger proportion of males (150+), compared to females (100–149), indicating a gender imbalance at higher tiers.
- Occupational Profiles: All establishments (100%) employed Managers, while (70%) employed Professionals, Technicians and Associate Professionals and Clerical Support Workers. Males dominated in five (5) of the seven (7) occupational groups in the industry including:
    - Managers;
    - Professionals;
    - Technicians and associate professionals;
    - Plant and machine operators, and assemblers; and
    - Elementary occupations.
- STEM qualifications: A strong STEM presence was observed, with (70%) of businesses employing staff with STEM degrees. These qualifications were most prominent among Professionals, Managers, Technicians and associate professionals.

Additionally, there was a relatively larger proportion of male employees with STEM degrees compared to their female counterparts within the establishments surveyed.

- STEM Occupational Areas: All establishments reported employment in all STEM related groups of occupations used in this study, except in Food and Agriculture. The highest percentage of employees was in Computer Science/IT occupations (50%) followed by Engineering (30%) and Environmental Sciences (30%) occupations.

Job Vacancies and Recruitment Challenges in the Aviation Sector

A critical component of this assessment was the identification of job vacancies and recruitment challenges faced by employers in the aviation industry. Collecting such data provides valuable insight into current and projected labour market needs, particularly those related to STEM, and informs decisions around training, education, and workforce development. This information also sheds light on existing mismatches between graduate qualifications and employer expectations contributing meaningfully to policy development and investment in human capital for sustainable growth in aviation.

During the survey period, 60% of employers reported experiencing job vacancies, while 40% indicated no openings. Notably vacancies for non-STEM positions (40%) exceeded those for STEM roles (30%). All reported STEM vacancies fell within the fields of Computer Science/ IT and Engineering. Employers successfully filled 70% of total vacancies during the reference period, with a significantly higher fill rate for non-STEM (70%) compared to STEM positions (20%). The STEM roles that were successfully filled included Engineering, Computer Science/IT, and Mathematics and Statistics. More than half of the surveyed employers found suitable candidates for most STEM occupational categories except for Technicians and Associate Professionals which emerged as a persistent gap. Surprisingly, employers reported experiencing greater difficulty hiring non-STEM roles than STEM roles overall.

Regarding STEM vacancies, the highest level of difficulty experienced during recruitment was observed for Mathematics and Statistics (50%) occupations followed by Engineering (33%) and Computer Science/IT (20%) occupations. Specifically, Computer and Information Systems Managers were identified as the most difficult role to recruit for with 40% citing this as a challenge. The leading factor hindering recruitment was a low number of applicants possessing the requisite skill sets. To mitigate these recruitment barriers, employers recommended several actionable strategies:

- Developing policies that promote training and development programmes to enhance employees' knowledge and skills;
- Improve access to STEM talent, particularly for small and medium-sized enterprises (SMEs); and
- Expand outreach initiatives to promote aviation careers across educational institutions and the wider public.

Skills Gap Analysis and Workforce Development

The study also included an in-depth analysis of workforce skills, with a focus on identifying mismatches between the capabilities demanded by employers and those held by employees. Such discrepancies can restrict economic mobility, limit business productivity, and undermine industry competitiveness.[1]

The analysis centred on nineteen (19) core skills outlined by the International Labour Organization (ILO) as core skills that are important building blocks to lifelong learning and adapting to changes in the labour market (see Appendix III). Identifying the essential skills required to achieve business goals and matching them with the skills of employees can assist in understanding the size and nature of the skills gaps in the industry. The findings indicate that nearly all participating employers regarded the full suite of skills as important. Communication and collaboration/teamwork were rated as critical by 100% of respondents. In contrast, "green" competencies – such as waste reduction, waste management, and energy and water efficiency – were considered less essential, each receiving important ratings of 60%.

In terms of drivers of change impacting the demand for skills, the main internal driver of change was people (60%), followed by technology (40%) and profit margins (30%). To navigate these changes, employers viewed communication and adaptability (both cited by 20%) as the most valuable employee skill. The top external drivers of change were competition (71%) followed by climate change, digitisation and regulatory developments (all at 29%). In response, employers emphasized the importance of IT, communication, and creativity/innovation each named by 20% of respondents. Regarding employers' perception on the skill levels of recent university graduates employed in their establishments, most employers assessed their skills as high or medium across all core areas, with basic digital skills receiving the strongest ratings. Similarly, existing employees were rated as

[1] Productivity is defined as a ratio between the volume of output and the volume of inputs. It measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output (OECD 2024)

possessing medium to high proficiency in 18 of the 19 core skills. Top rated abilities included:

- Collaboration and teamwork;
- Information collection, organisation and analysis;
- Planning and organisation;
- Basic hardware and software use; and
- Operating safely in digital environments.

Despite generally strong ratings, the survey revealed considerable gaps between the skills employers required and the skills available. The largest discrepancies emerged in strategic thinking, emotional intelligence, conflict resolution and negotiation, problem-solving and decision-making; and self-reflection and learning to learn.

When evaluating recent job applications (2021-2023 graduates). Employers experienced minimal difficulty sourcing skills such as creativity, critical thinking, collaboration, communication, IT, decision-making. However notable challenges persisted in problem-solving and decision-making, as well as emotional intelligence. Graduates were more likely to possess basic digital skills and introductory competencies in green job skills which helped ease hiring in those areas. Graduate Preparedness and Impact of Skill Deficiencies

The majority of respondents (60%) indicated that recent university graduates were *somewhat prepared* for the workplace. Meanwhile, 20% felt that graduates were *well prepared* and the remaining 20% did not provide a response. In terms of operational impact, 80% of surveyed establishments reported that skill deficiencies among employees did not adversely affect their day-to-day operations.

Current and Future Demand for STEM Labour in Aviation

The study also examined the demand for STEM professionals in the aviation sector, recognising the industry's increasing reliance on technological innovation. As global aviation evolves, the demand for qualified STEM talent is expected to grow. Understanding both present and future workforce needs provides valuable insights for addressing talent shortages and informing education and training strategies. Key findings include:

Current Demand: During the survey period, the demand for STEM occupations was generally low across establishments. However, occupations in the field of Computer Science/IT showed the highest demand, while Food and Agriculture reported the least interest.

Most In Demand STEM Roles: Employers highlighted several priority areas, particularly within the fields of Computer Science/IT and Engineering identifying the following roles as most sought after:

- Electrical Engineers,
- Health, Safety and Environment (HSE) Officers,
- Web and Digital Interface Designers,
- Mechanical Engineers,
- IT Technicians,
- Civil Engineers,
- Environmental Scientists,
- Computer Programmers,
- Software Developers and
- Aeronautical Engineers.

Future Demand Outlook: Looking five years ahead, 43% of employers expect Web and Digital Interface Designers to be among the most critical roles for their organisation, followed by HSE Officers at 29% .

Technological Advancements in Aviation

This report includes an assessment of technological advancements in the global aviation industry, focusing on both challenges and opportunities. Technologies such as Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), Internet of Things (IoT) and Renewable Energy are enhancing efficiency, safety and sustainability. For local aviation establishments to remain competitive, it is essential that they adapt and integrate these technologies. The transformative impact of these advancements also presents an opportunity to boost demand for STEM careers and strengthen the industry's digital capacity.

Employers' Recommendation for Strengthening STEM Education and Workforce Development

Employers with the aviation industry contributed a range of strategic recommendations aimed at improving STEM education and labour force readiness. These suggestions emphasize the need for stronger alignment between educational institutions and industry requirements as well as, enhanced public-private collaborations.

Key recommendations include:

- Updating tertiary education programmes to reflect industry needs;
- Expanding access to training and apprenticeship initiatives;
- Integrating life skills into academic curricula;
- Increasing promotion of STEM education and careers at the school level;

- Providing more incentives for businesses operating in STEM-driven industries; and
- Enhancing STEM-specific training for educators.

In addition, the report outlines general recommendations derived from stakeholder consultations and employer feedback. These recommendations are focused on:

- Better alignment of education with industry demands;
- Broadening training opportunities across sectors;
- Embedding STEM more effectively in classrooms;
- Strengthening teacher training in STEM disciplines;
- Promoting STEM pathways throughout the education system; and
- Enhancing collaboration across government, academia and industry.

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Abbreviations and Acronyms

AI	Artificial Intelligence
AATT	Airports Authority of Trinidad and Tobago
AR	Augmented Reality
ATCEN	Aviation Training Centre
CAL	Caribbean Airlines
CATC	Civil Aviation Training Centre
CBTT	Central Bank of Trinidad and Tobago
CSO	Central Statistical Office
GORTT	Government of the Republic of Trinidad and Tobago
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICT	Information and Communication Technology
ILO	International Labour Organization
ISCO	International Standard Classification of Occupations
IT	Information Technology
MoE	Ministry of Education
MSEs	Micro and Small Enterprises
MSMEs	Micro, Small and Medium Enterprises
NIHERST	National Institute of Higher Education, Research, Science and Technology
SMEs	Small and Medium Sized Enterprises
STEM	Science, Technology, Engineering and Mathematics
S&T	Science and Technology
SDG	Sustainable Development Goal
T&T	Trinidad and Tobago
TTCAA	Trinidad and Tobago Civil Aviation Authority
TVET	Technical and Vocational Education and Training

UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UWI	The University of the West Indies
UTT	University of Trinidad and Tobago
VR	Virtual Reality
WEF	World Economic Forum
WTO	World Tourism Organization

Introduction

The Assessment of 21st Century Skills in Emerging Sectors project is both timely and strategically significant, aligning closely with government policy priorities. It serves as a critical mechanism for building a future-ready, STEM-empowered workforce, catalysing economic transformation, and advancing inclusive national development in accordance with the government's vision for a prosperous and modern Trinidad and Tobago. Grounded in the Government's Youth Development Policy which emphasises the empowerment of a future-fit generation through skills, purpose, and opportunity, this initiative reflects a firm commitment to equipping the nation's youth for the demands of the Fourth Industrial Revolution.

NIHERST, in collaboration with the International Labour Organization (ILO), undertook the Assessment of 21st Century Skills Across Emerging Sectors study from February 2023 to July 2025. The overarching objective of this study is to provide accurate data on STEM labour requirements in key industries to assist policymakers in developing effective education, training, and workforce strategies in response to rapid technological advancements. This report presents the research findings from the aviation sector.

Trinidad and Tobago has a well-established aviation services sector. The industry is a crucial part of the nation's economic structure, supporting tourism and trade as well as inter-island travel and international connectivity. Several sectors, including tourism, trade, and transportation, depend on aviation services to operate effectively. It is also essential for both regional and international connectivity. The industry comprises of two (2) airports, with the Piarco International Airport serving as a major hub for air travel in the region. Additionally, the national carrier, Caribbean Airlines (CAL), services numerous regional and international destinations. Training for the sector is delivered through three (3) main providers, including the Civil Aviation Training Centre (CATC) which is the training arm of the Trinidad and Tobago Civil Aviation Authority (TTCAA); The University of Trinidad and Tobago (UTT) Aviation Campus; and the Aviation Training Centre (ATCEN) which is a subsidiary of the Airports Authority of Trinidad and Tobago (AATT). The country serves as an aviation centre for the wider region with significant experience in airport administration, air traffic management, aircraft inspection, training and air navigation services (InvesTT).[2]

Recognising the vital role of aviation in supporting trade, travel and connectivity, and generating revenue and employment, it is essential to capitalise on the benefits of technological advancements. Investments in technological innovations can significantly transform various aspects of the industry while enhancing the services

[2] https://www.investt.co.tt/industries-and-opportunities/aviation-services/

provided, as well as improving safety, efficiency and sustainability. However, as the adoption of advanced technologies such as AI and machine learning (ML) becomes more widespread in the workplace, the demand for highly skilled workers will continue to grow. According to the World Economic Forum's (WEF) Future of Jobs Report 2025, employers predicted that 39% of workers' core skills will need to change by 2030. Additionally, based on the feedback from employers, technological skills were forecasted to grow in importance more rapidly than any other type of skills with AI and big data leading the way, followed by networks and cybersecurity, and technological literacy. Technological advancements are transforming workforce expectations across sectors and as the aviation industry continues to adopt more modern digital solutions, the demand for new and more advanced skills, especially those grounded in STEM disciplines, will become increasingly important.

Developing STEM competences within the workforce will be essential for employees to operate successfully in a technology-driven environment. STEM competences refer to an individual's ability to apply STEM knowledge, skills and attitude appropriately in his or her everyday life, workplace or educational context.[3] These competencies are essential for driving innovation, competitiveness and economic growth. STEM workers play a crucial role in innovation, creation and implementation of new technologies, leading to increased productivity, efficiency and sustainability across all sectors. They are needed to help develop solutions to address global issues such as climate change, healthcare and food security. Investing in the necessary skills and training for current and future employees will help them to reach their full potential and contribute more effectively to economic growth, prosperity and sustainability. Countries that invest in STEM education and careers are better able to capitalise on technological advancements and innovations and secure a better future for their citizens.

This research was conducted to gather data on the current and future demand for STEM skills and labour in the aviation industry of Trinidad and Tobago. The research explored key characteristics of both employers and employees of the aviation sector. Additionally, the study examined vacancies and recruitment issues such as the trends in employment and the level of difficulty employers encountered in filling STEM vacancies. This undertaking also included a comprehensive analysis of the skills characteristics of recent job applicants and existing employees and the skills demanded by employers. Furthermore, the skills mismatch in the industry was assessed based on the skills required by employers and the skills employees possessed. In addition, the enquiry focused on the current and future demand for STEM labour. It also investigated the types of innovations adopted in the global

[3] UNESCO International Bureau of Education, Exploring STEM Competences for the 21st Century, 2019

aviation market along with the associated careers and benefits. Drawing from the research findings, a series of evidence-based recommendations were developed.

This report is organised into the following sections:

Section 1 describes key aspects of the survey methodology employed for the study. The following aspects are discussed in this chapter: the objectives of the study, research methods, questionnaire design, sample design, data collection, limitations of the survey; and data processing and presentation.

Section 2 focuses on the characteristics of establishments that participated in this study, including length of time in operation and employment size by gender, occupational group and main economic activity performed by businesses.

Section 3 presents data on the characteristics of the workforce. This section provides data on employees by gender, occupational group, STEM qualifications and STEM occupations.

Section 4 introduces the recruitment issues reported by employers in the aviation sector. This section offers data on the number of establishments with current vacancies, difficulty employers experienced when filling vacancies, and the number of vacancies filled in the last 12 months of the survey period. In addition, the section features a comparison of vacancies and recruitment issues by STEM and non-STEM fields. It also provides recommendations from employers on how to overcome difficulties faced during recruitment.

Section 5 presents an assessment of the skills mismatches in the aviation sector. The chapter examines the skills employers identified as important for employees to possess in order to meet organisational goals and the skills set of job seekers, recent university graduates employed and existing employees is depicted in this section. Section 5 also provides data on the perception of employers on the preparedness of recent university graduates transitioning to work.

Section 6 examines the demand for STEM workers, including current and future demands. The top STEM occupations demanded by the industry based on their strategic plan are also identified in this section.

Section 7 offers recommendations provided by employers on how the tertiary education, government and business sectors can help improve STEM competencies.

Section 8 examines significant technological advancements in global aviation along with key STEM careers associated with these innovations. It also explores the ease and advantages of integrating these technologies into local operations. Furthermore, the section showcases the experience of Caribbean Airlines (CAL) in advancing technological innovations in the aviation industry of Trinidad and Tobago.

Section 9 offers general recommendations based on the research undertaken, stakeholder consultations and the results of the industry survey.

Section 10 concludes the report by summarising key insights and implications for future workforce development efforts.

1. Research Design

This section describes key aspects of the survey methodology employed for the Assessment of 21st Century Skills Across Emerging Sectors. The methodology for this study was guided by the European Training Foundation/European Centre for the Development of Vocational Training/ILO guide to developing and running an establishment skills survey. This section begins by identifying the objectives of the study. The next aspect discussed is the research method employed for the study. The section also includes a description of the design of the survey questionnaire, presenting several key documents that guided the development of the questionnaire. Additionally, the section summarises the sample design and response rate for the survey. The final aspects discussed under this section are data collection, limitations and data processing and presentation.

1.1 Objectives of the Study

The objectives of the study are to:

- Provide data on the demand of STEM graduates in emerging sectors
- Provide data on the skills mismatches in emerging sectors
- Provide information to improve the alignment between education and labour market demand
- Provide data to inform policymakers, education specialists, industry and all stakeholders in creating policies to develop the STEM workforce of the country
- Provide data on key areas where scholarships/incentives are needed to encourage students to pursue degrees in these fields
- Collaborate with the public universities to align their programmes to the key STEM areas and to introduce new programmes where necessary
- Provide information to introduce students to relevant STEM careers necessary for growth and development of critical sectors of the economy

1.2 Research Method

The survey employed a mixed methods approach. A questionnaire was designed to collect both quantitative and qualitative data.

1.3 Questionnaire Design

The draft questionnaire was developed based on the objectives of the study and was designed to generate the key information necessary to achieve these objectives. The questionnaire design was guided by existing labour force studies and guides, mainly the ILO's Global Framework on Core Skills for Life and Work in the 21st Century and STEM in TVET Curriculum Guide.

1. The ILO's Global Framework on Core Skills for Life and Work in the 21st Century was utilised to capture data on the skills characteristics of the workforce. Recognising the importance of core skills for enabling workers to attain decent work and improving living standards, the ILO developed the Global Framework on Core Skills for Life and Work in the 21st Century. The framework was developed after a comprehensive literature review of international and national core skills frameworks and an analysis of the impact of the global drivers of transformative changes on the world of work was undertaken to extract the most important skills necessary to adapt to the future of work. Additionally, several consultations were undertaken to revise these skills into 19 core skills considered essential both for work and life. The Framework identified 19 core skills that were grouped into the four categories shown in Table 1. These skills are further defined in Appendix III.

Table 1: Core skills for life and work in the 21st century

Core skills for life and work in the 21st century			
Social and emotional skills: • Communication • Collaboration and teamwork • Conflict resolution and negotiation • Emotional intelligence	**Cognitive and metacognitive skills:** • Foundational literacies • Analytical and critical thinking • Creative and innovative thinking • Strategic thinking • Problem-solving and decision-making • Self-reflection and learning to learn • Collect, organise and analyse information • Planning and organising • Career management	**Basic digital skills**: • Use basic hardware • Use basic software • Operate safely in an online environment	**Basic skills for green jobs:** • Environmental awareness • Waste reduction and waste management • Energy and water efficiency

2. The survey utilised the STEM in TVET Curriculum Guide, ILO Women in STEM for Workforce Readiness and Development Programme to gather data on STEM skills in TVET workers. The STEM in TVET Curriculum Guide identified four major domains of STEM competencies that support TVET including STEM knowledge, thinking skills, multiliteracies, and socio-emotional intelligence. These skills are described further in Appendix IV.

1.4 Sample Design

The survey engaged a sample of 24 businesses within the aviation sector. The survey frame was developed using various data sources, including the CSO business register. The sector was divided into sub-sectors and a sample drawn from each category through systematic random sampling. Out of the 24 businesses contacted, 10 participated in the survey, resulting in a 42% response rate.

1.5 Data Collection

1.5.1 Interviewers

Field interviewers were recruited to conduct interviews with employers. These interviewers already had considerable training and experience in conducting labour surveys. They were further trained on the survey objectives and questionnaire. Data collection was undertaken during the period of October to November 2023.

1.5.2 Pilot Study

A pilot study was undertaken using a sample of twenty-four (24) businesses to pre-test the survey instrument to ensure that respondents understood the questions correctly and were able to provide accurate answers. The feedback from the pilot study was used to improve the questionnaire for greater accuracy in responses.

1.6 Limitations of the study

There were several challenges encountered whilst undertaking this study. These include:

i. Business listing was outdated - The CSO listing was outdated and had to be updated by the project team. An updated registry is essential for improving the efficiency and accuracy of future studies.
ii. Lack of disaggregated data for emerging sectors – There was no business listing available for some sectors categorised as emerging. Some emerging sectors, such as software design and applications, are part of a broader sector, as a result these companies had to be extracted from the overall list. In certain cases, alternative sources were used to compile a list of businesses within these specific sectors.
iii. Low response from industry – A substantial percentage of employers declined to complete the survey, citing several reasons, mainly time constraints. This underscores the need for greater awareness of the importance of STEM workforce data in supporting competitiveness and sustainability.

iv. Limited TVET Data - Although TVET labour needs were assessed in this study, the establishments in the aviation sector response rate for TVET-related question was very low and, as a result, TVET data is not included in this report. Overall, the response rate to the TVET section was low across all surveyed sectors.

1.7 Data processing analysis and presentation

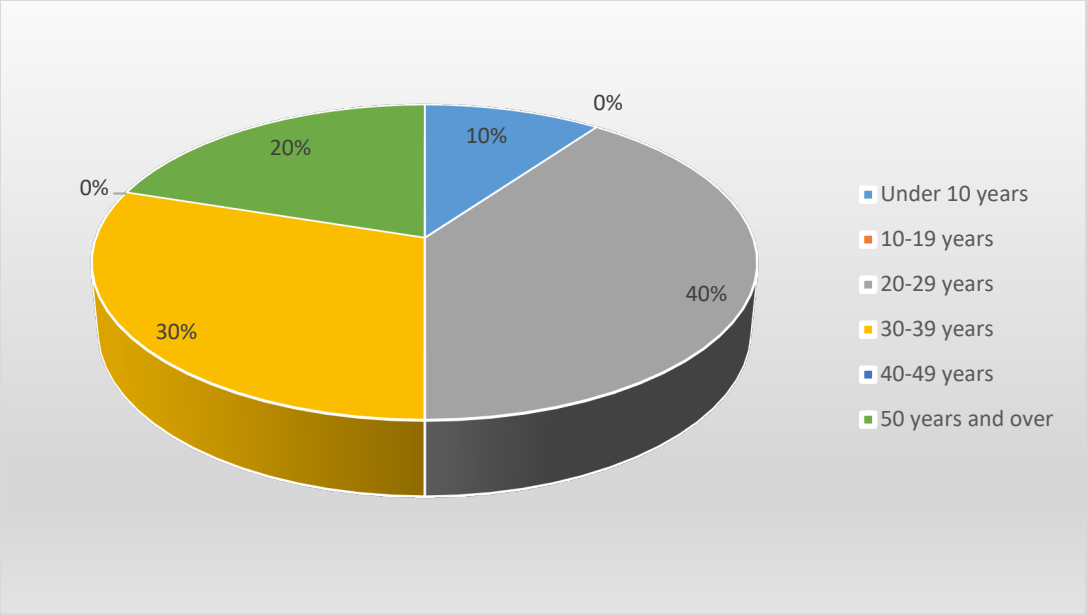
The quality of the data was checked for accuracy. Where there were discrepancies the field interviewer or office staff contacted the respondents for verification. Quantitative and qualitative data were coded and processed on SPSS and Excel. The results of the study are presented in the chapters that follow.

2. Characteristics of Employers

This section highlights essential characteristics of employers in Trinidad and Tobago's aviation sector. Gathering information on employers' characteristics is intended to provide context to the findings of the report and facilitate a better understanding of the survey population. The study examined factors such as the length of time in operation, size of the workforce, and main economic activities of establishments within the sector.

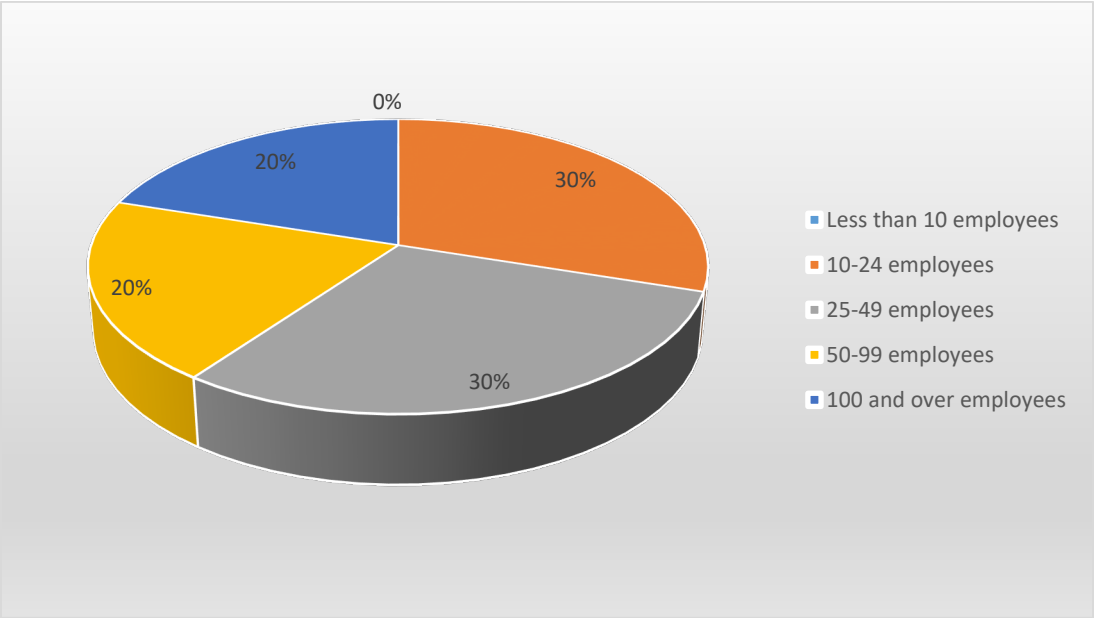
The first characteristic of employers presented in this section is the length of time in operation. Figure 1 presents the percentage of establishments from the aviation sector that participated in the survey by the length of time in operation. The data suggests that in terms of longevity, the aviation industry was more mature than most emerging industries that participated in this study. The highest percentage (40%) of establishments were in operation for 20 – 29 years followed by 30 -39 years (30%), 50 years and over (20%) and under 10 years (10%).

Figure 1: Percentage of establishments by length of time in operation



Regarding employment size, the results show that the majority (60%) of establishments from the sector was small and medium enterprises (SMEs) (Figure 2).[4] Two-fifths (40%) of the establishments that participated in the survey had 50 employees and over. At the national level, it is estimated that 95% of the businesses in Trinidad and Tobago were micro, small and medium-sized enterprises (MSMEs), with the vast majority being micro and small.[5] Therefore, the results indicate that the sector exceeded the national average in terms of employment size.

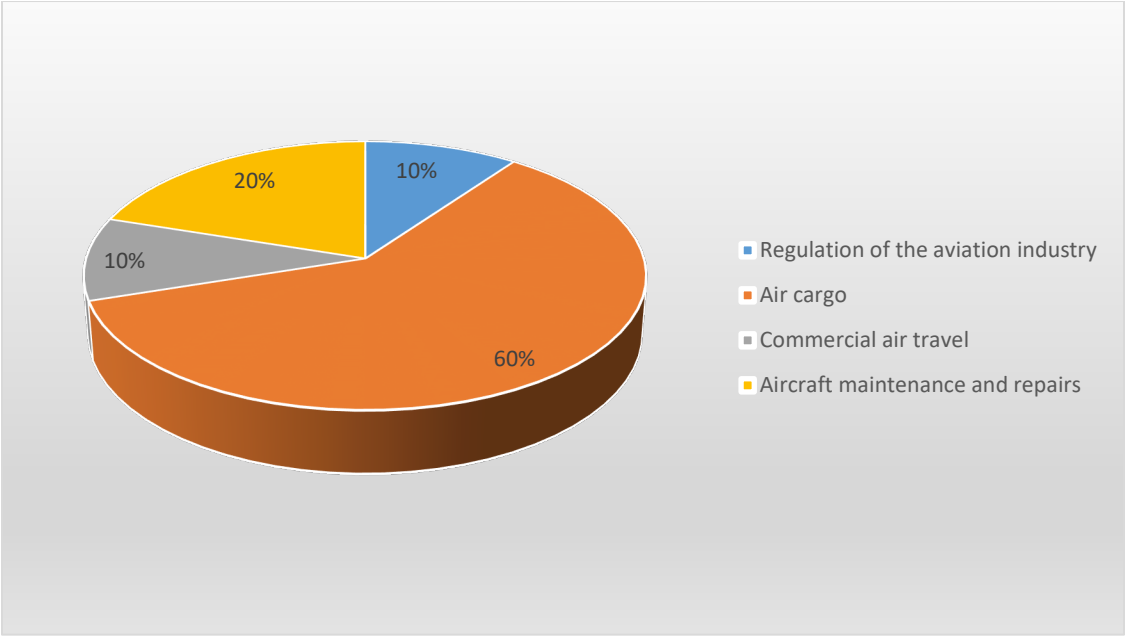
Figure 2: Percentage of establishments by employment size



Another aspect analysed in this section is the main economic activity performed by establishments. Figure 3 illustrates the main economic activities of the establishments surveyed. The data demonstrates that three-fifths (60%) of the establishments were primarily engaged in air cargo services while 20% were involved in aircraft maintenance and repairs and 10% in each case focused on commercial air travel and regulation of the industry.

[4] A micro enterprise has 1-5 employees; a small enterprise has between 6-25 employees; and a medium enterprise has between 26-50 employees (Ministry of Labour).
[5] Central Bank of Trinidad and Tobago, Research Papers Vol. 3 No. 2 September 2023

Figure 3: Percentage of establishments by main economic activity

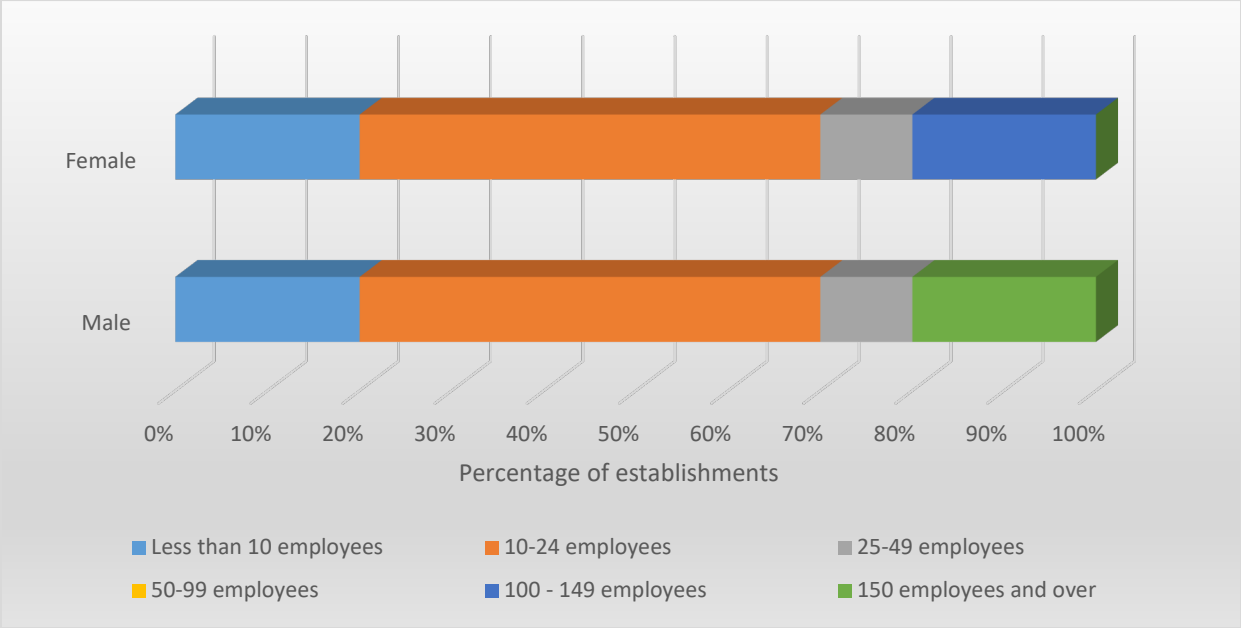


3. Characteristics of the Workforce

Understanding workforce characteristics is essential for analysing workforce composition, identifying skill gaps, and supporting strategic workforce planning. This section examines various attributes of the workforce, including gender, job categories, STEM qualifications and STEM occupations.

In terms of gender, all (100%) of the establishments employed both male and female employees (Figure 4). The data demonstrates a greater proportion of male employees compared to female employees within the establishments surveyed. The employment patterns of males and females were similar in the smaller employment categories. However, in regard to the larger establishments, 20% employed 100–149 females, while a similar percentage employed 150 males or more.

Figure 4: Employment size by gender



The study also explored the distribution of the labour force across occupational categories and examined how these roles were distributed between male and female. This breakdown is essential for understanding the composition of the workforce and identifying gender disparities within job categories. Occupational groups within the workforce were categorised according to the ILO's International Standard Classification of Occupations (ISCO). Figures 5 through 7 show the distribution of the workforce in the industry by occupational group and gender. The following is a summary of the key findings across different job categories:

- Managers:
    - All (100%) the establishments had managers; the majority (80%) reporting less than 10 managers.
    - A higher percentage (100%) of establishments employed male managers compared to females (90%).

- Professionals:
    - The majority (70%) of establishments employed Professionals; 50% employed less than 25 employees in this category while 20% employed 50 and over.
    - A higher percentage (70%) of establishments employed males in this category compared to females (60%). However, a larger proportion (20%) of employers reported 50 and over female employees in this occupation group compared to 10% in the case of the males.

- Technicians and associate professionals:
    - The majority (70%) of establishments employed workers in this occupational group.
    - By gender, the percentage of establishments that employed males (70%) in this job category was higher than females (60%).

- Clerical support workers:
    - The majority (70%) of establishments employed workers in this occupational group; 50% employed less than 25 employees in this category.
    - By gender, a similar percentage of establishments employed males (70%) and females (70%) in this category. However, a higher percentage (40%) of establishments recorded 10 or more female clerical support workers compared to only 20% that reported the same number of males in this category.

- Service and sales workers:
    - Overall, 40% of the establishments had workers in this category.
    - A similar pattern of employment was observed for both males (40%) and females (40%).

- Skilled agricultural, forestry and fishery workers:
    - There were no employees in this occupational group.

- Craft and related trades workers:
    - There were no employees in this occupational group.

- Plant and machine operators, and assemblers:
    - Thirty percent (30%) of the establishments employed workers in this category.
    - This job category recorded a higher percentage of male employees (30%) than female employees (10%).

- Elementary Occupations:
    - Two-fifths (40%) of the establishments employed workers in this job classification.
    - The percentage of male employees (40%) was higher than that of female employees (20%) in this occupational group.

Figure 5: Employment by occupational group and gender – Both genders

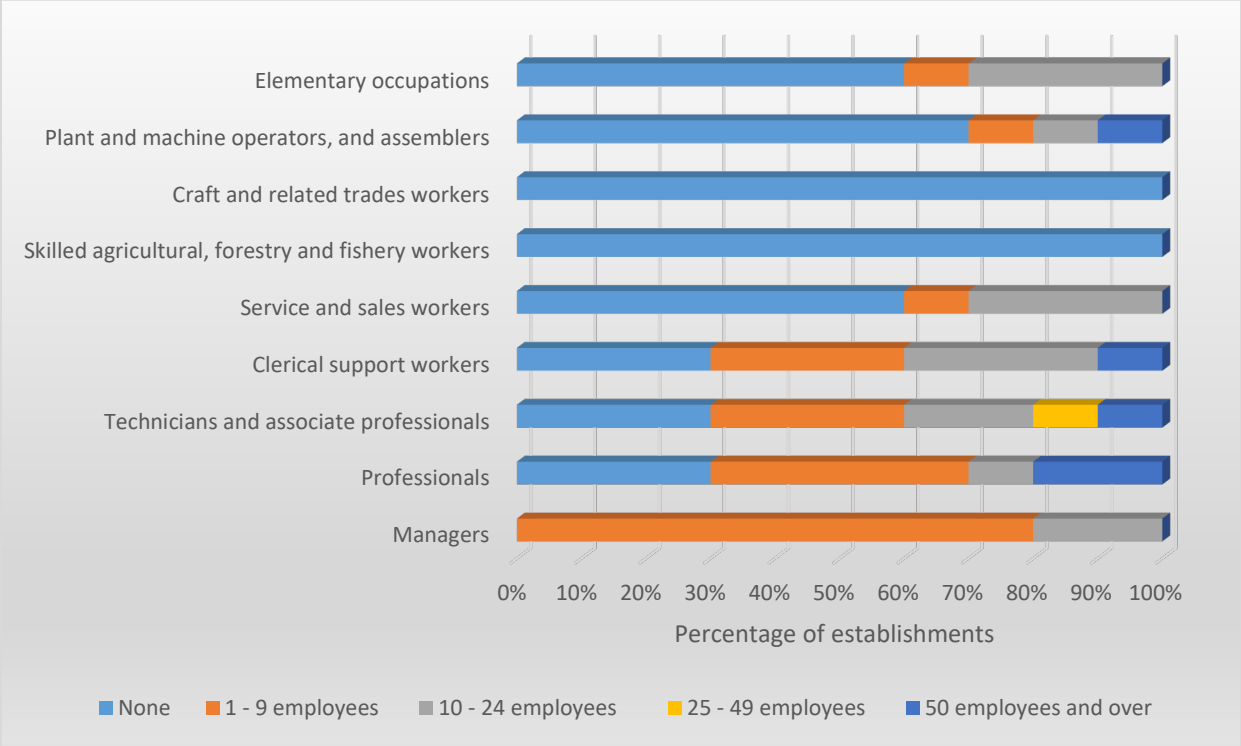


Figure 6: Employment by occupational group and gender – Males

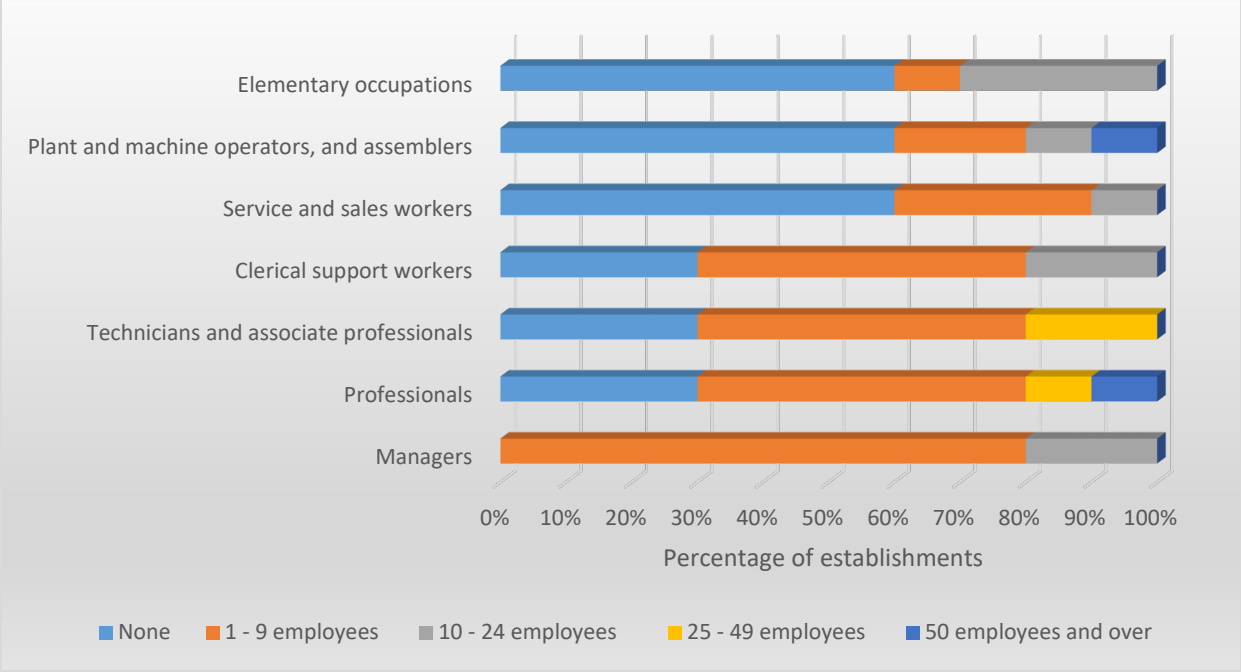
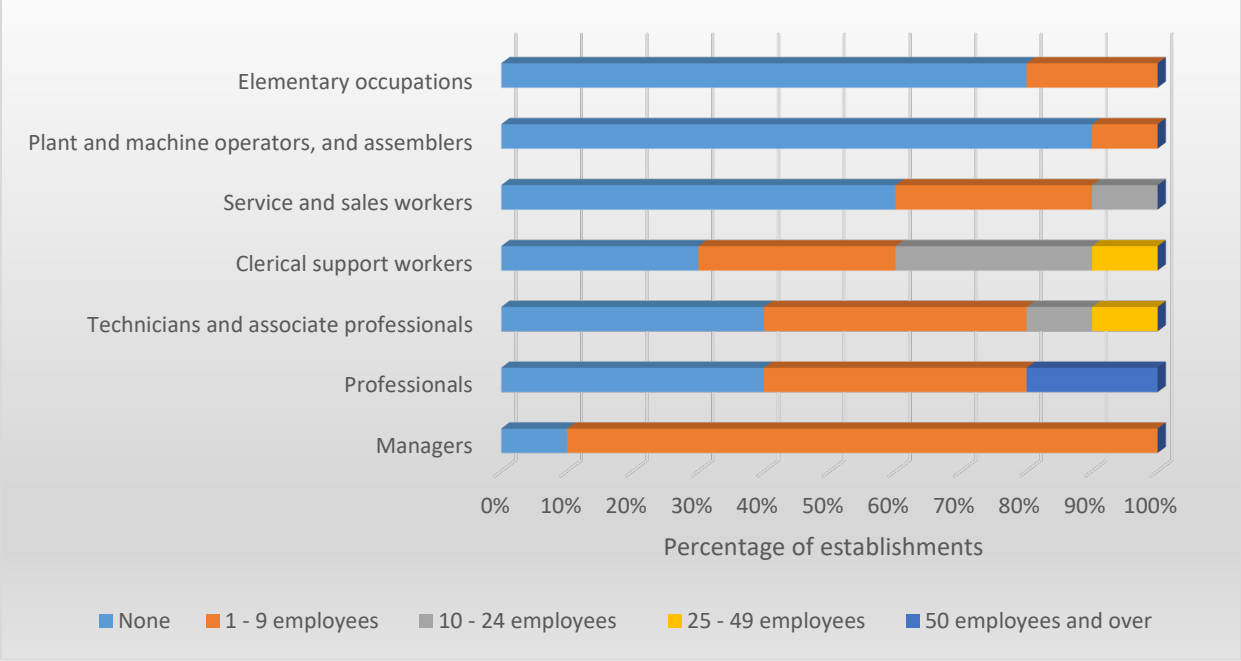


Figure 7: Employment by occupational group and gender – Females



To evaluate the STEM needs in the aviation industry, it is crucial to first understand the current size and characteristics of the STEM workforce within the sector. The survey gathered data on the percentage of establishments that employed workers with a bachelor's degree or higher in a STEM discipline, disaggregated by gender and job category. For the purpose of this study, STEM fields included Natural Sciences; Engineering; Computer Science/IT; Mathematics and Statistics; Food and Agriculture; Medical and Health; and Environmental Sciences.

The data demonstrates that the majority (70%) of the establishments had STEM qualified employees (Figure 8). The highest percentage of employees with STEM degrees was observed among professionals, followed by managers, and technicians and associate professionals (Figure 9).

A further examination of STEM qualified employees by gender reveals that, overall, a larger proportion of establishments reported males with STEM degrees compared to females (Figures 10 – 11). Males with STEM qualifications outnumbered their female counterparts in managerial and professional roles while the reverse was observed for technicians and associate professionals. The clerical support workers' category recorded a similar distribution of STEM qualified males and females.

Figure 8: Percentage of establishments with employees with STEM degrees

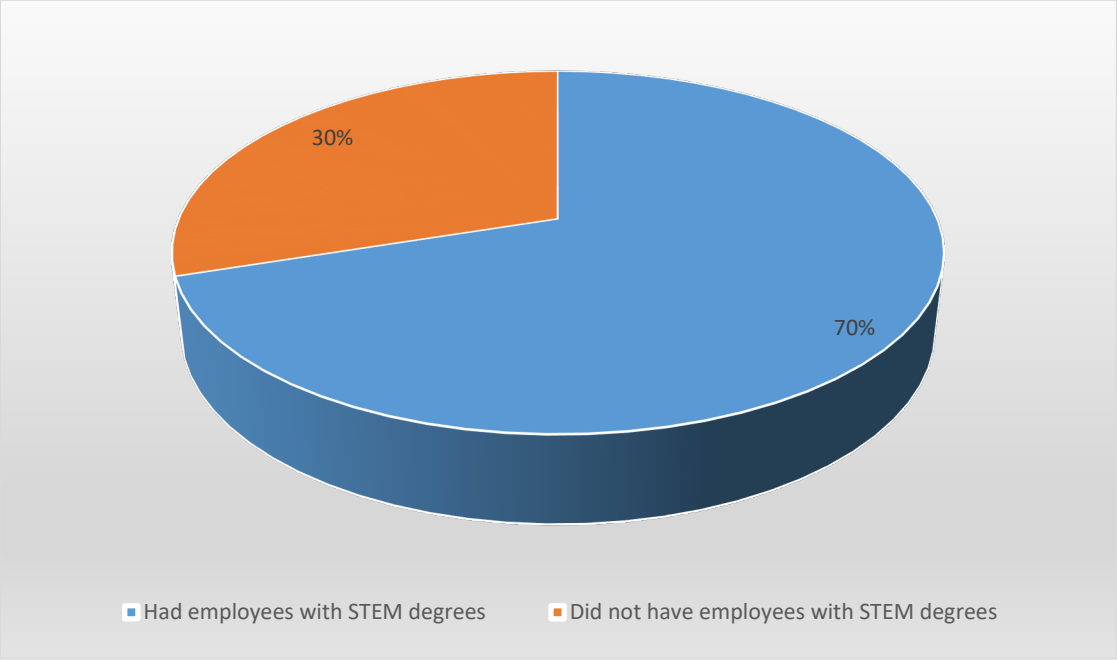


Figure 9: Percentage of establishments with employees with STEM degrees by gender and occupational group – Both genders

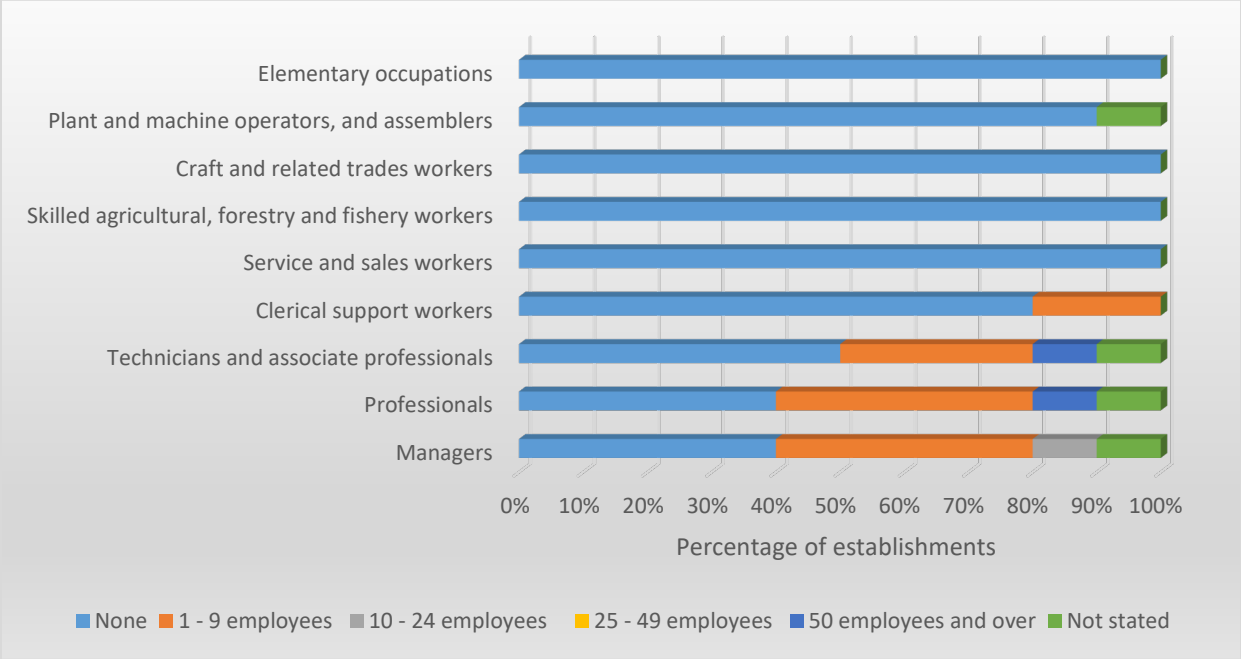


Figure 10: Percentage of establishments with employees with STEM degrees by gender and occupational group – Males

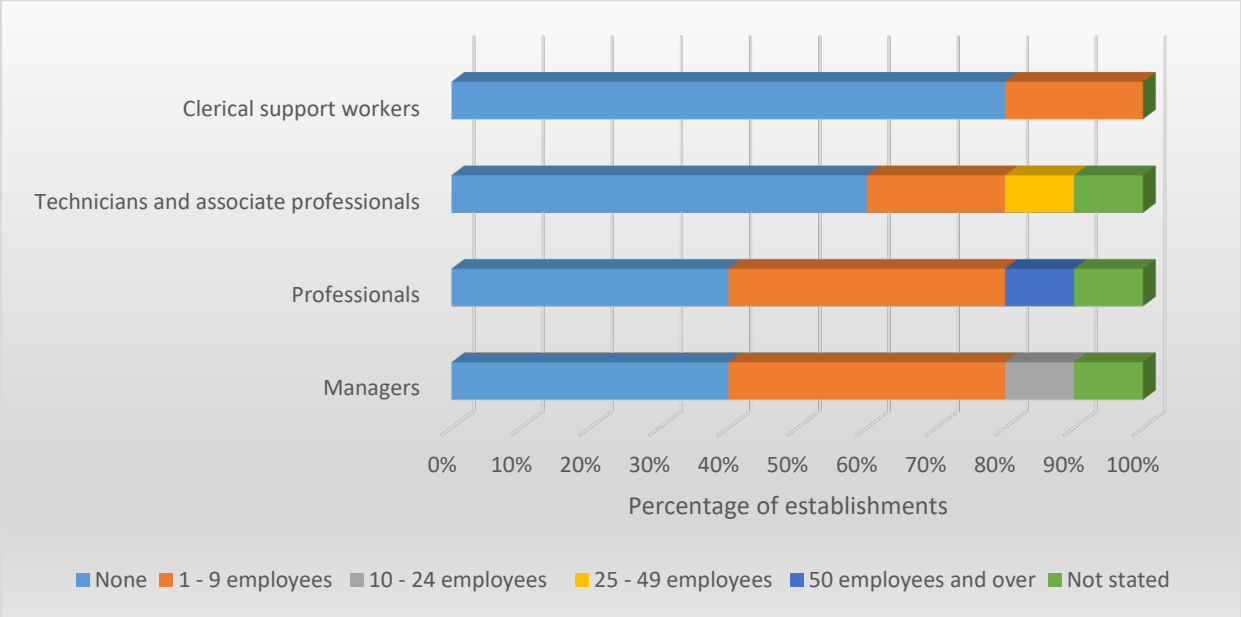
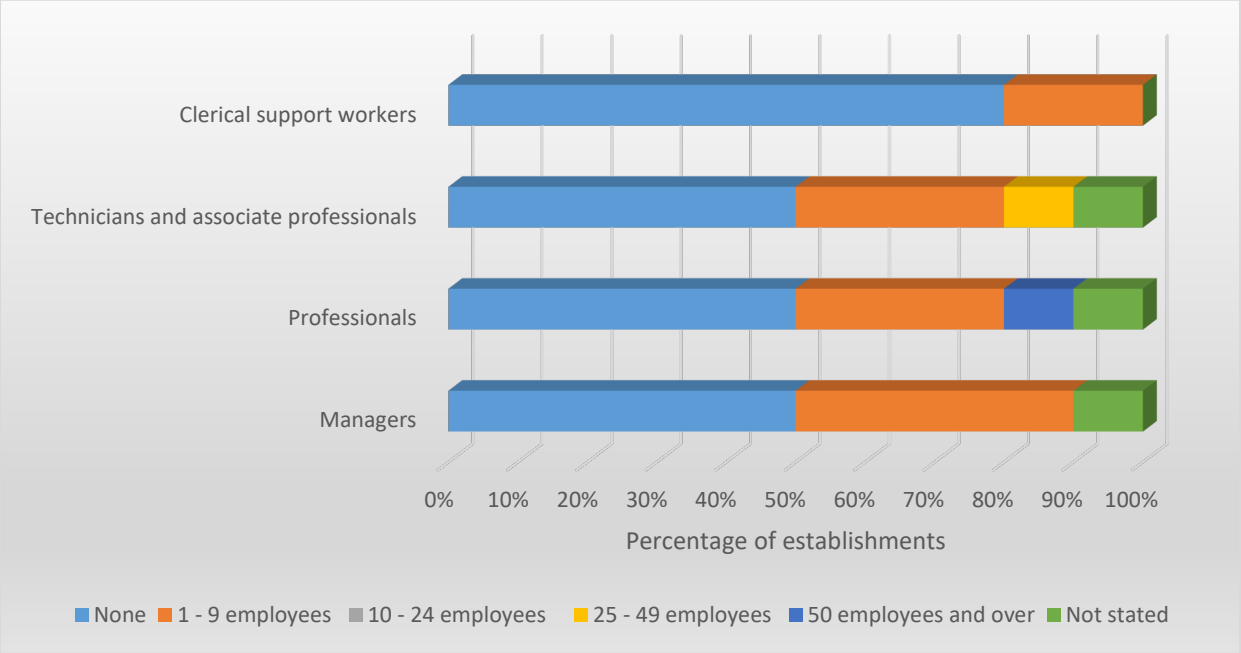


Figure 11: Percentage of establishments with employees with STEM degrees by gender and occupational group – Females



In addition to STEM qualification, the report also explored the labour force participation in STEM occupations. For the purpose of this study, STEM occupations consisted of Natural Sciences; Engineering; Computer Science/IT; Mathematics and Statistics; Food and Agriculture; Medical and Health; and Environmental Sciences occupations. In addition, a list of STEM occupations is included in Appendix II. Although educational requirements vary, the survey focused on STEM occupations that required a bachelor's degree or higher.

Figure 12 presents the number of workers employed in STEM occupation groups within the establishments surveyed. The data demonstrates that all of the establishments reported employment in STEM occupations except in the field of Food and Agriculture. The highest percentage of employment was recorded for Computer Science/ IT occupations (50%) followed by Engineering (30%) and Environmental Sciences (30%) occupations.

A review of the number of employees in STEM occupations by gender demonstrates that a higher percentage of establishments had male employees in Engineering and Natural Sciences occupations compared to females (Figures 13 and 14). Females outnumbered males in Computer Science/ IT and Medical and Health jobs. A similar pattern of male and female employment was observed for Mathematics and Statistics and Environmental Sciences occupations.

Figure 12: Employees in STEM occupation groups by gender – Both genders

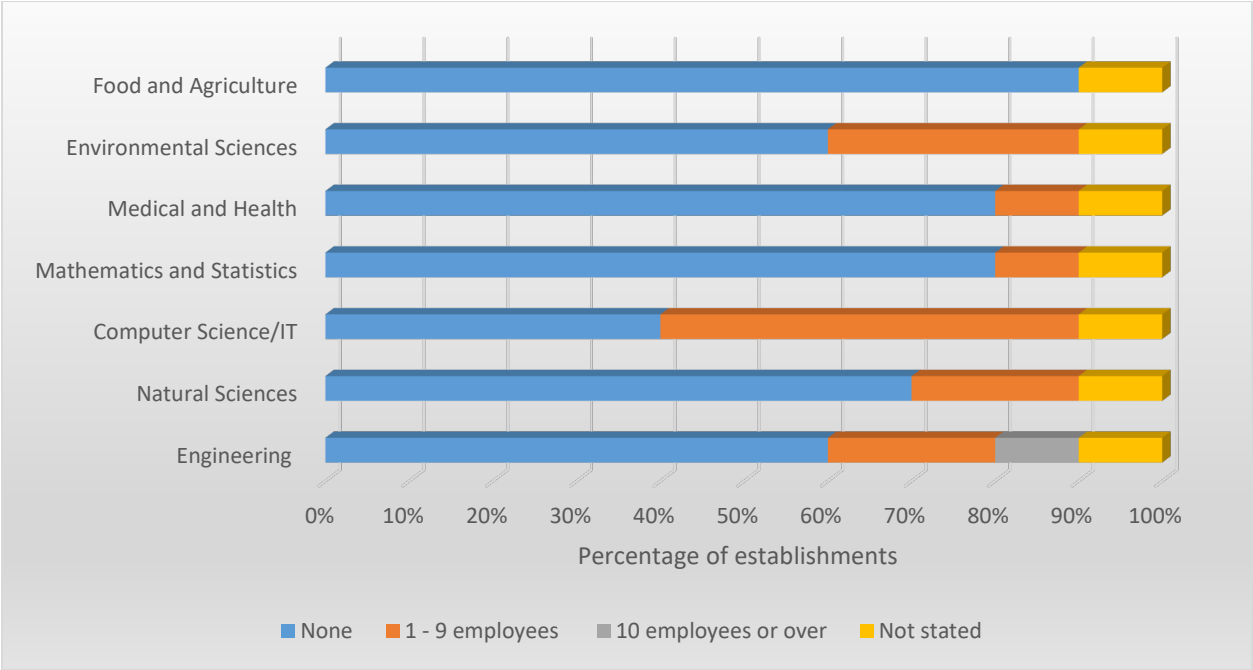


Figure 13: Employees in STEM occupation groups by gender – Males

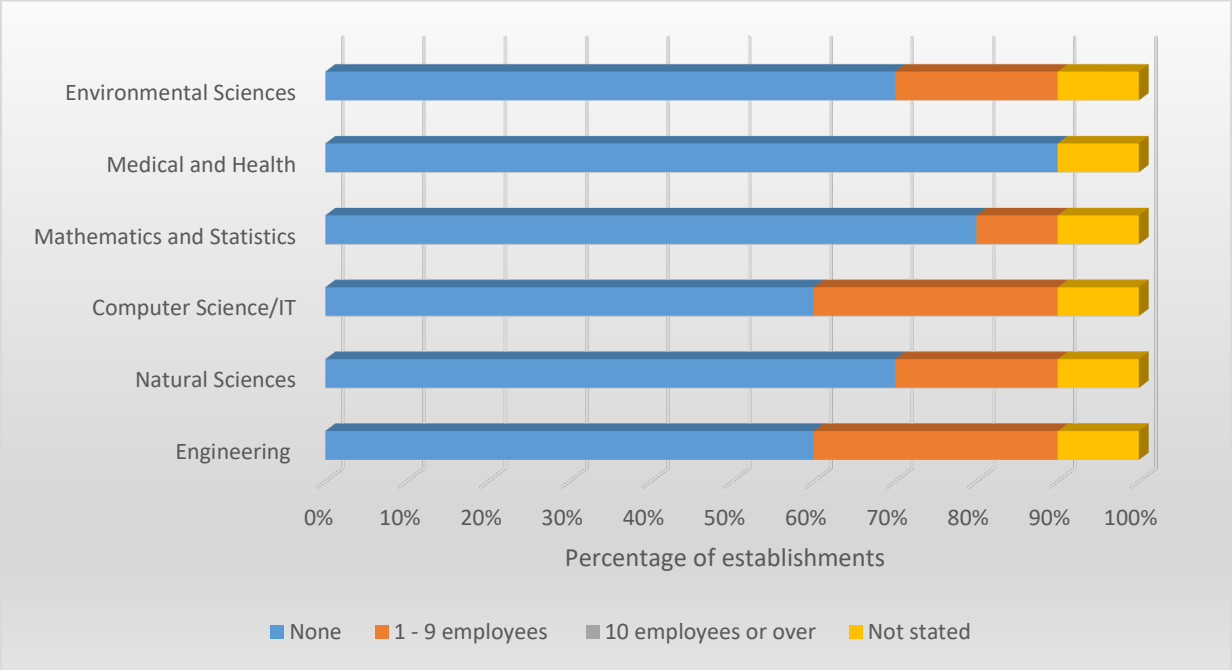
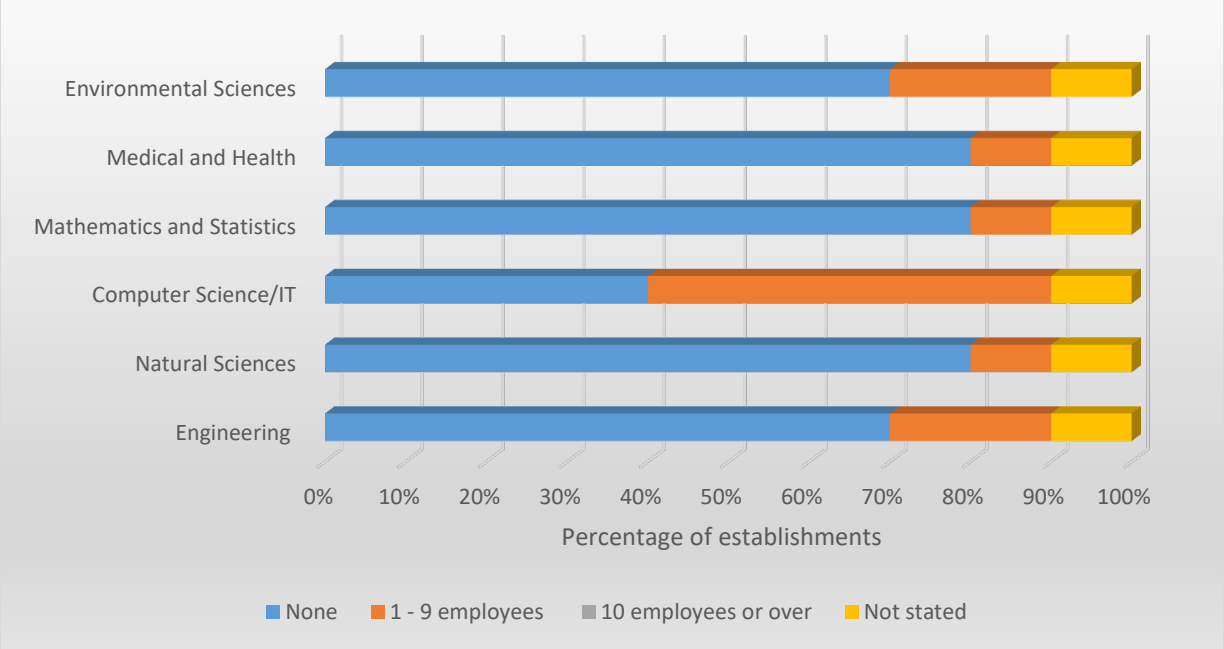


Figure 14: Employees in STEM occupation groups by gender – Females



4. Recruitment and Vacancies

Data on vacancies and recruitment provides valuable insights into employment trends within the aviation industry and identifies the fields that have the most opportunities. This data is particularly important for policy-makers, workforce planners, educational institutions, job seekers and students. This section begins by identifying the proportion of employers with job openings, with a particular focus on STEM vacancies, during the survey period. The study considered vacancies across various STEM fields, including Natural Sciences; Engineering; Computer Science/IT; Mathematics and Statistics; Food and Agriculture; Medical and Health; and Environmental Sciences. Additionally, the section compares job availability in STEM versus non-STEM areas within the industry. It also provides insights into positions filled by employers over the past year and the difficulties faced during recruitment. Lastly, the section offers recommendations from employers on how to overcome these recruitment challenges.

In terms of vacancies, a higher percentage (60%) of employers reported vacancies during the survey period, while the remaining 40% reported no vacancies (Figure 15). A review of the data by field of study demonstrates that the percentage of establishments with non-STEM vacancies (40%) was higher than those with STEM (30%). A further examination of the data by STEM fields reveals that all STEM vacancies were in the fields of Computer Science/ IT and Engineering (Figure 16).

Figure 15: Percentage of establishments with current vacancies by field of study

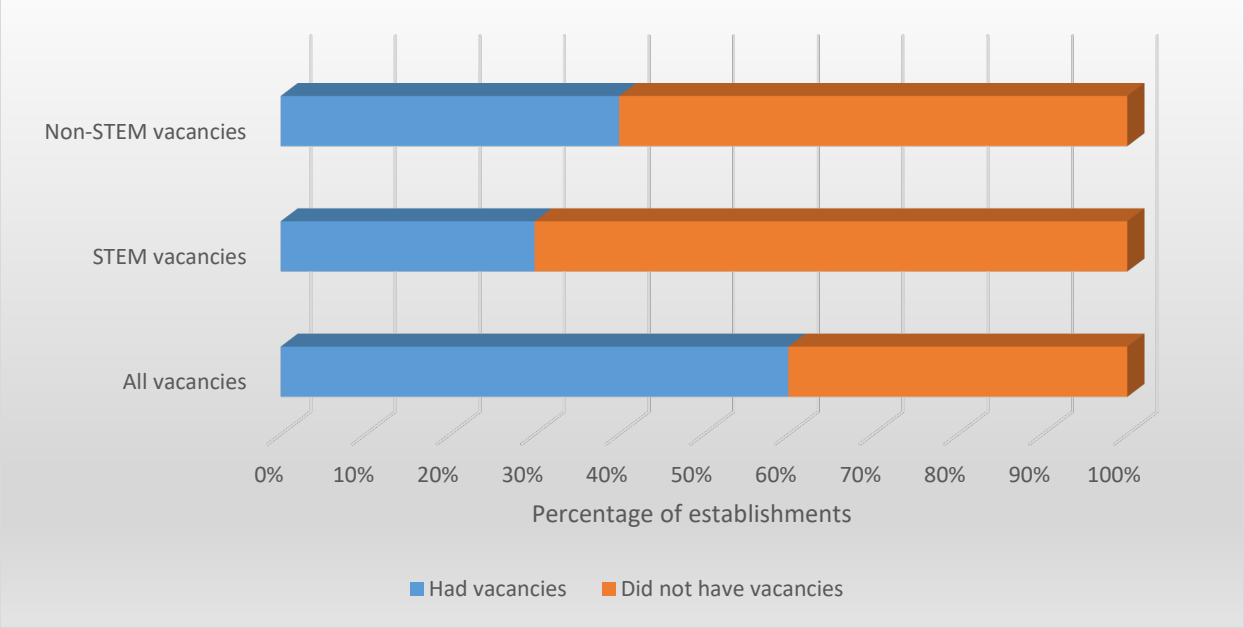
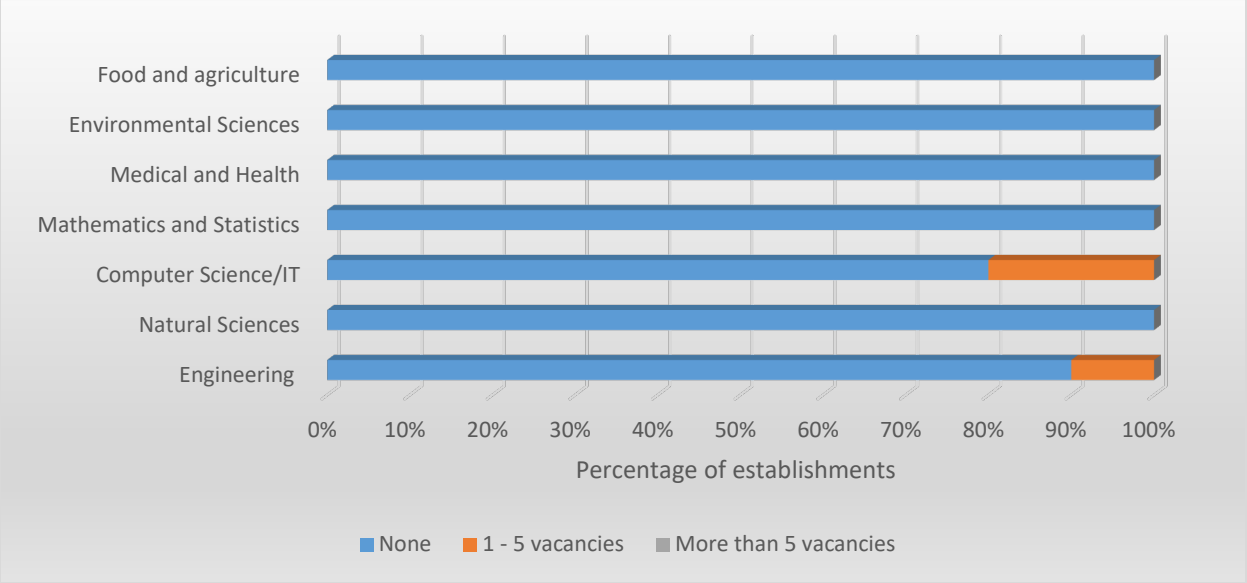
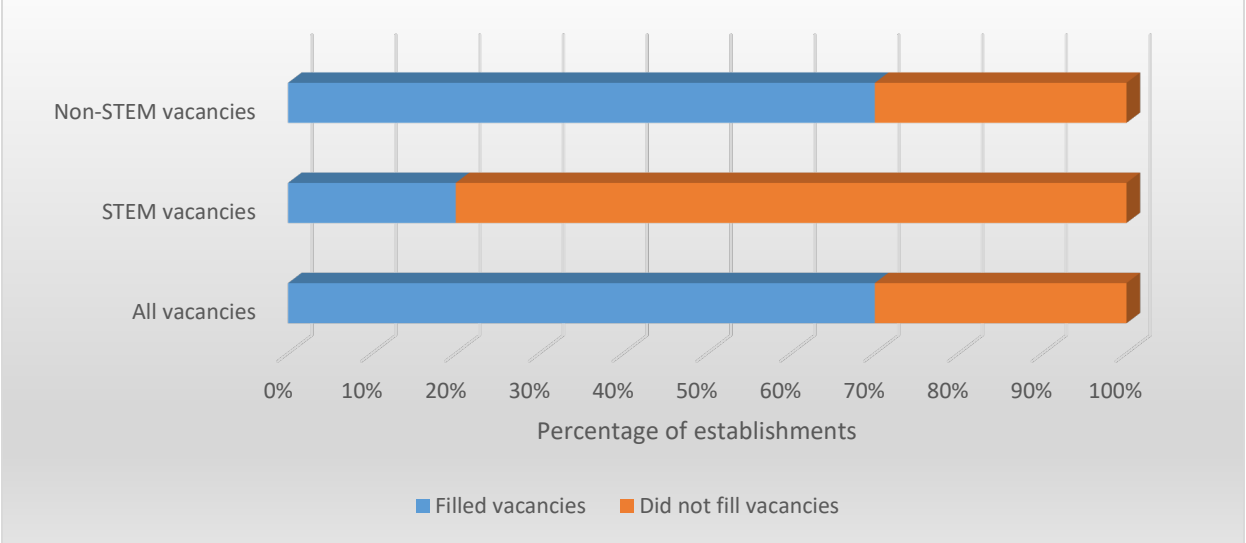


Figure 16: Percentage of establishments by STEM vacancies



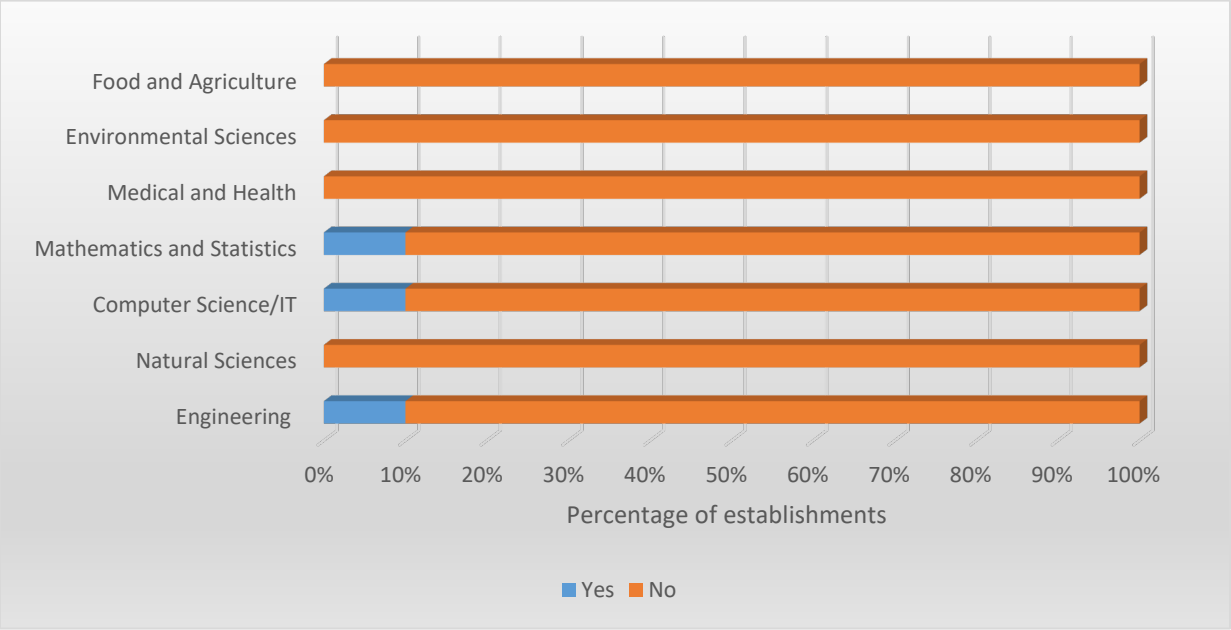
In assessing recruitment within emerging industries, the survey gathered data on the percentage of establishments that successfully filled vacancies during the survey period. Figure 17 demonstrates that 70% of the employers filled vacancies over the reference period while 30% did not. A further disaggregation of vacancies filled by STEM and non-STEM categories reveals that a significantly higher proportion of establishments filled non-STEM vacancies (70%) compared to STEM vacancies (20%).

Figure 17: Percentage of establishments that filled vacancies over the last 12 months



A review of the STEM vacancies by STEM fields reveals that a similar percentage of employers filled job openings in Engineering (10%), Computer Science/IT (10%) and Mathematics and Statistics (10%).

Figure 18: STEM vacancies filled over the last 12 months by field of study



The research also provides insights into the challenges employers faced when filling vacancies. Employers were asked if they experienced any difficulty when filling vacancies over the last twelve (12) months of the survey period. Table 2 outlines the level of difficulty employers encountered during recruitment across the various job categories.

Overall, over a half of the employers did not experience any difficulty finding suitable candidates in each occupational group except technicians and associate professionals. A relatively higher proportion of employers experienced more difficulty filling non-STEM occupations compared to STEM occupations among the three applicable job categories. The highest level of difficulty was recorded for technicians and associate professionals occupations which 63% and 50% of the employers reported difficulty for non-STEM and STEM vacancies, respectively.

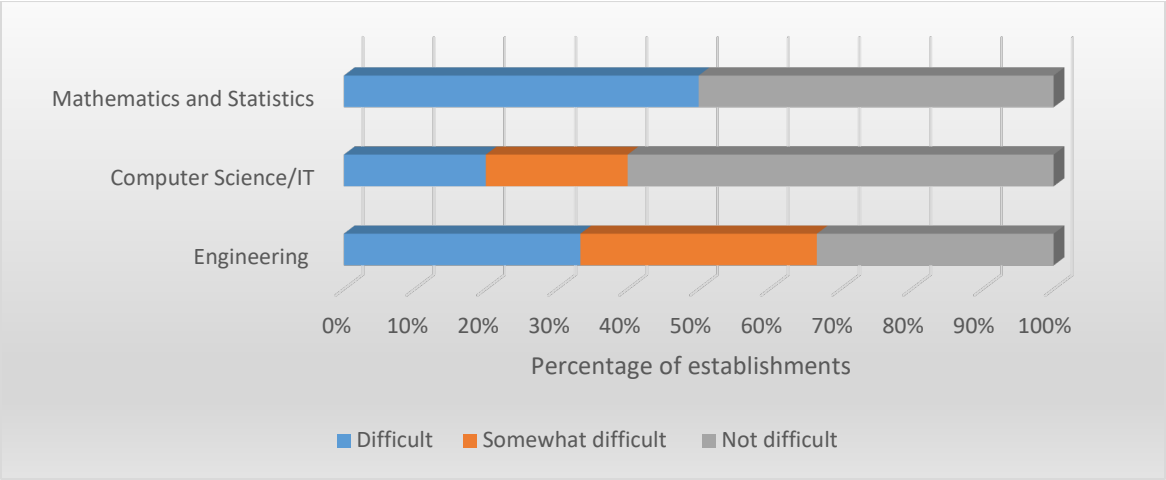
Table 2: Comparison of difficulty experienced when filling STEM and Non-STEM vacancies by occupational groups

Occupational groups	STEM vacancies			Non-STEM vacancies		
	Difficult to fill	Not difficult to fill	Total	Difficult to fill	Not difficult to fill	Total
1. Managers	40	60	100	43	57	100
2. Professionals	40	60	100	43	57	100
3. Technicians and associate professionals	50	50	100	63	38	100
4. Clerical support workers	na	na	na	0	100	100
5. Service and sales workers	na	na	na	17	83	100
6. Skilled agricultural, forestry and fishery workers	na	na	na	0	100	100
7. Craft and related trades workers	na	na	na	0	100	100
8. Plant and machine operators, and assemblers	na	na	na	0	100	100
9. Elementary occupations	na	na	na	0	100	100

na – not applicable

Figure 19 demonstrates the level of difficulty employers faced during recruitment for STEM professions over the survey period. The highest level of difficulty was observed for Mathematics and Statistics (50%) occupations, followed by Engineering (33%) and Computer Science/IT (20%) occupations.

Figure 19: Level of difficulty experienced when filling STEM vacancies



The study also examined the major factors that contributed to the difficulty employers' experienced during recruitment for STEM roles. Figure 20 demonstrates the significance of these factors on a scale from 1 to 5, where 1 represents low significance and 5 denotes high significance.

The most significant factors contributing to the difficulty employers experienced while filling STEM vacancies were a low number of applicants in general and a low number of applicants with the required skills, which were both rated 5 by 50% of the respondents. Employers also assigned high ratings (4+5) to poor terms and conditions (e.g. salary) offered for the post (75%) and candidates' educational level did not meet the company's demands (75%). The least significant factor was too much competition from other employers, followed by a low number of applicants with the required attitude, motivation or personality which received a rating of 1 by 75% and 50% of the employers, respectively.

Figure 20: Significant factors why STEM occupations are difficult to fill

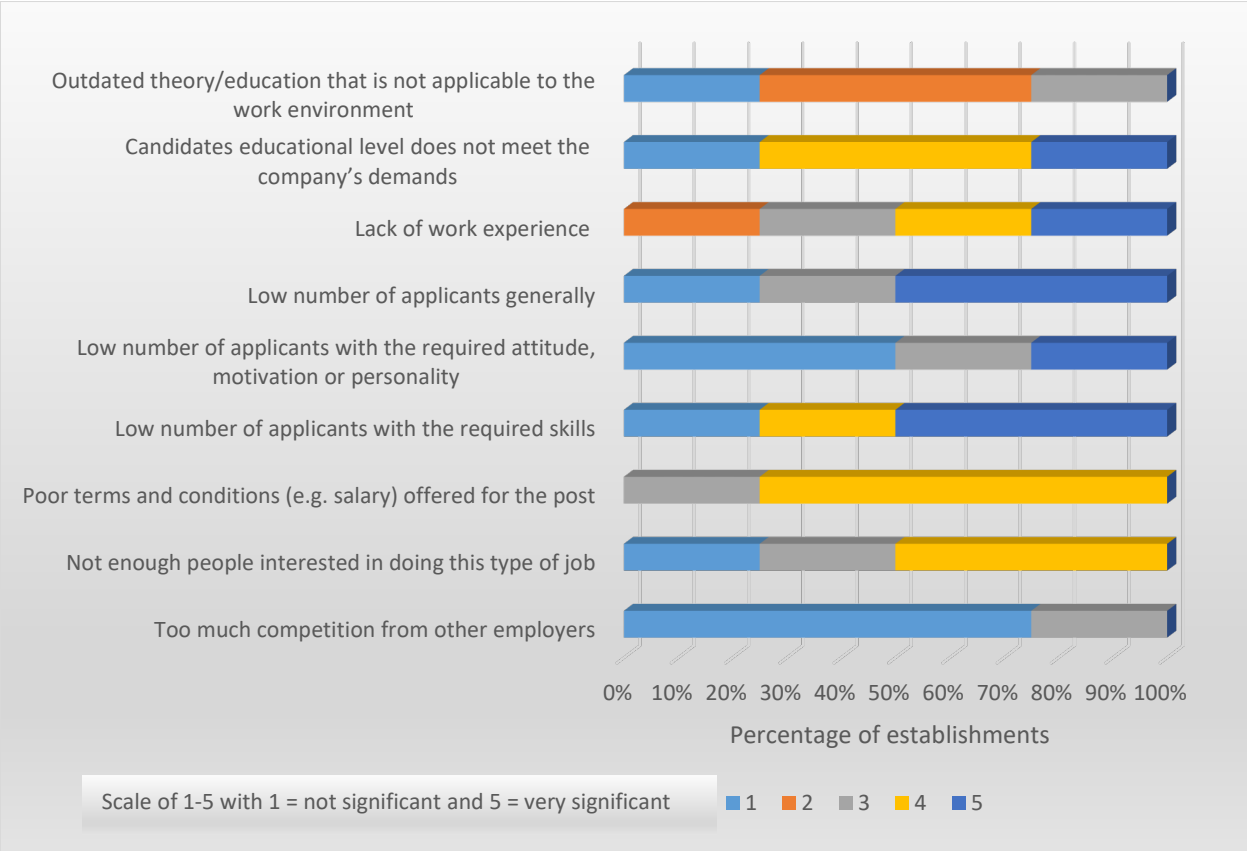


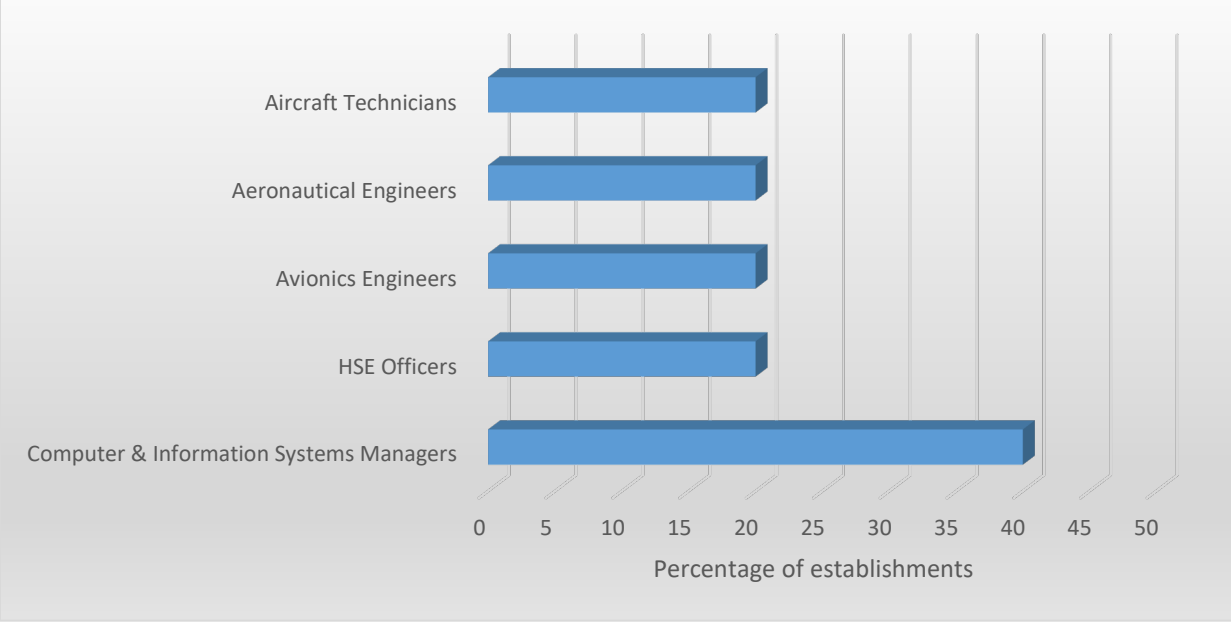
Table 3 summarises the recommendations employers suggested to overcome problems experienced while filling STEM vacancies. The main actions employers recommended include: creating policies that promote training and development programmes aimed at increasing employees' knowledge and skills; making STEM labour more accessible to SMEs; and expanding efforts to promote careers in the aviation industry.

Table 3: Recommendations to overcome problems experienced when filling STEM vacancies

Recommendations
• Create policies that promote training and development programmes aimed at increasing employees' knowledge and skills
• Make STEM labour more accessible to SMEs
• Expand efforts to promote careers in the aviation industry

Figure 21 demonstrates the STEM occupations that employers in the Aviation sector identified as the most difficult to fill. The most difficult occupations to fill were Computer and Information Systems Managers (40%). One-fifth (20%) of the employers, in each case, identified Health, Safety and Environment (HSE) Officers, Avionics Engineers, Aeronautical Engineers and Aircraft Technicians as the most difficult STEM jobs to fill.

Figure 21: Most difficult STEM occupations to fill



5. Skills of the Workforce

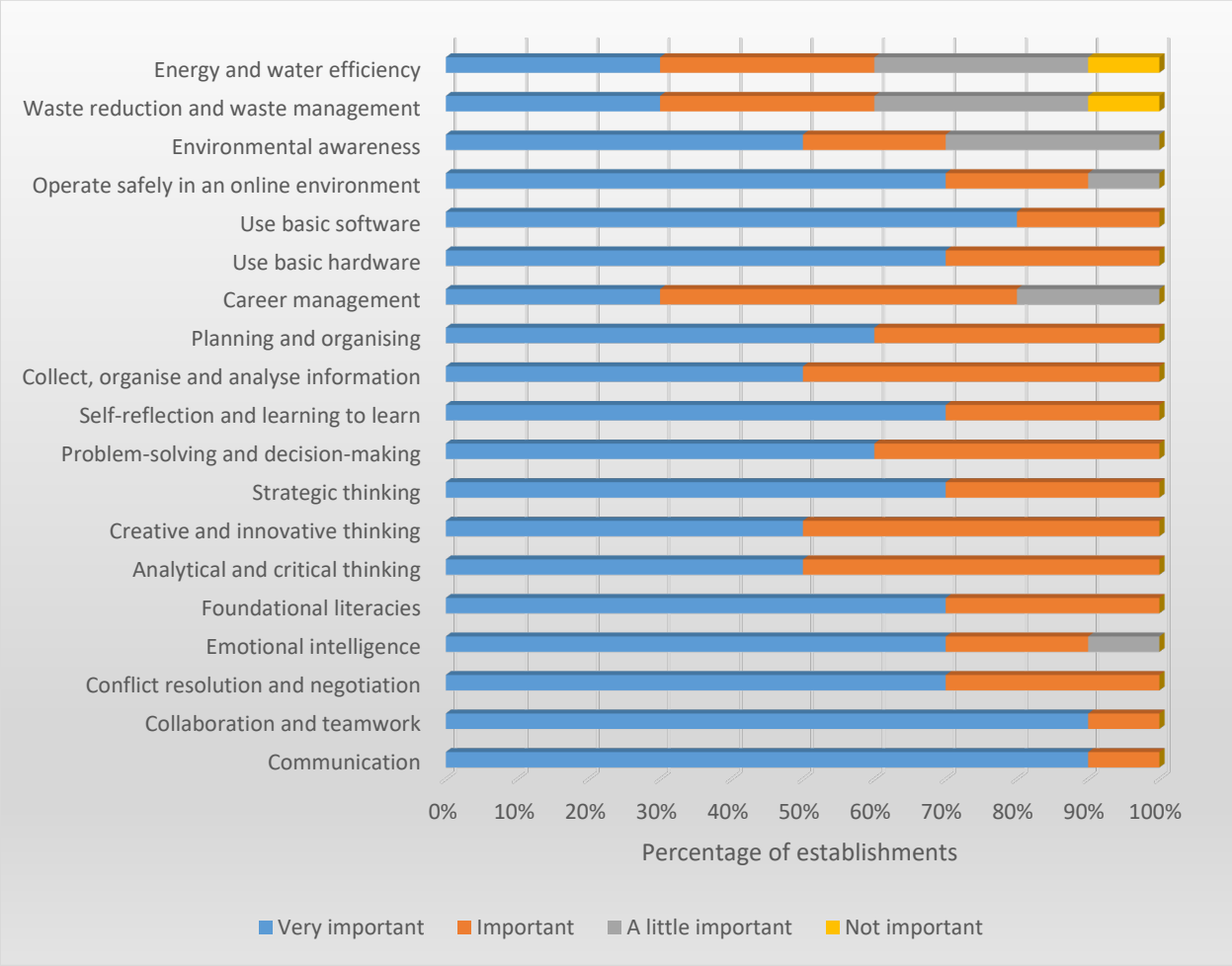
Skill development can be beneficial for both employers and employees. For businesses, improved skills can lead to higher productivity and greater competitiveness. With regard to employees, foundational skills are essential for accessing better job opportunities and improving their quality of life. This study assessed core skills based on the ILO Global Framework on Core Skills for Life and Work in the 21st Century, as detailed in Table 1 and Appendix III.

The aim of this section is to assess the existing skills mismatches in the aviation sector. This section provides data on the skills that employers consider essential for employees to achieve organisational goals and objectives. It also summarises information on the internal and external factors driving change and the necessary skills required to respond to these factors. Following the identification of core skills required by employers for achieving business goals and objectives, the skills of recent job applicants, university graduates and existing employees were examined mainly to determine the skill mismatches in the workforce. The section concludes with an evaluation of how well university graduates were prepared for the workplace.

5.1 Demand for Skills by Employers

Figure 22 presents employers rating on the level of importance for employees to have the 19 core skills to achieve the goals and objectives of the business. Most employers in the aviation sector, who participated in the study, indicated that it was important for employees to possess all 19 skills. Furthermore, 13 of the 19 skills were rated as important by all employers (100%). Communication, and collaboration and teamwork, were the two most highly rated skills, with 90% of employers deeming them very important. Green skills such as waste reduction and management (60%) and energy and water efficiency (60%) received the lowest importance ratings. The lower degree of importance placed on green skills should be monitored given the commitment of airlines to achieve net zero carbon by 2050 (IATA, 2021). The importance of green skills should be promoted among employers and employees in support of this goal.

Figure 22: Employers' rating of skills employees should have to meet business goals



5.2 Drivers of Change and Skills Required

To determine the skills necessary for future success in the aviation sector, both internal and external drivers of change were examined. These drivers influence the demand for specific skills and help identify the competencies required for employees to adapt and thrive. This section outlines the main skills required to address each driver.

The internal drivers of change reported by employers are depicted in Figure 23. The main internal driver of change was people (60%), followed by technology (40%) and profit (30%). Overall, communication (20%) and adaptability (20%) were viewed as the most important skills to address internal drivers of change followed by IT (13%), leadership (13%) and collaboration and teamwork (13%) (Figure 27). The following were the main skills identified to address each internal driver:

1. People – Leadership (33%) and Collaboration and teamwork (33%)
2. Profit – Communication (40%)
3. Technology – Adaptability (50%)

Figure 23: Top internal drivers of change in establishments

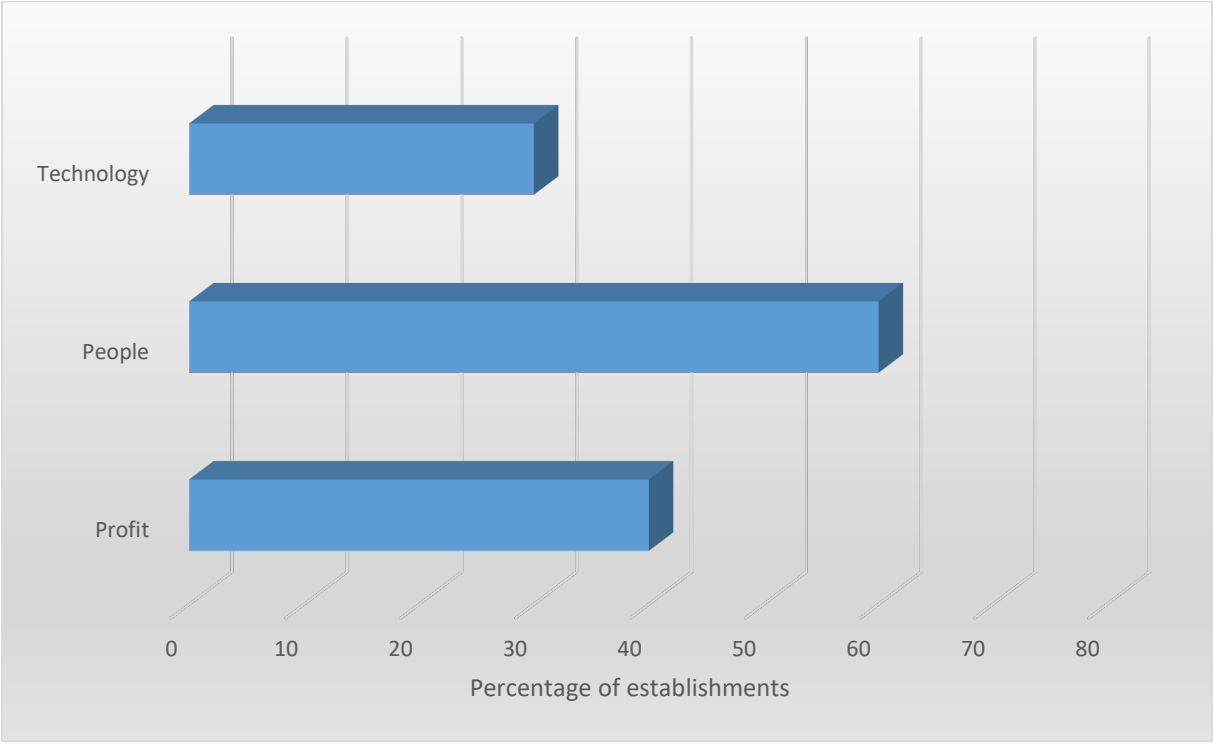
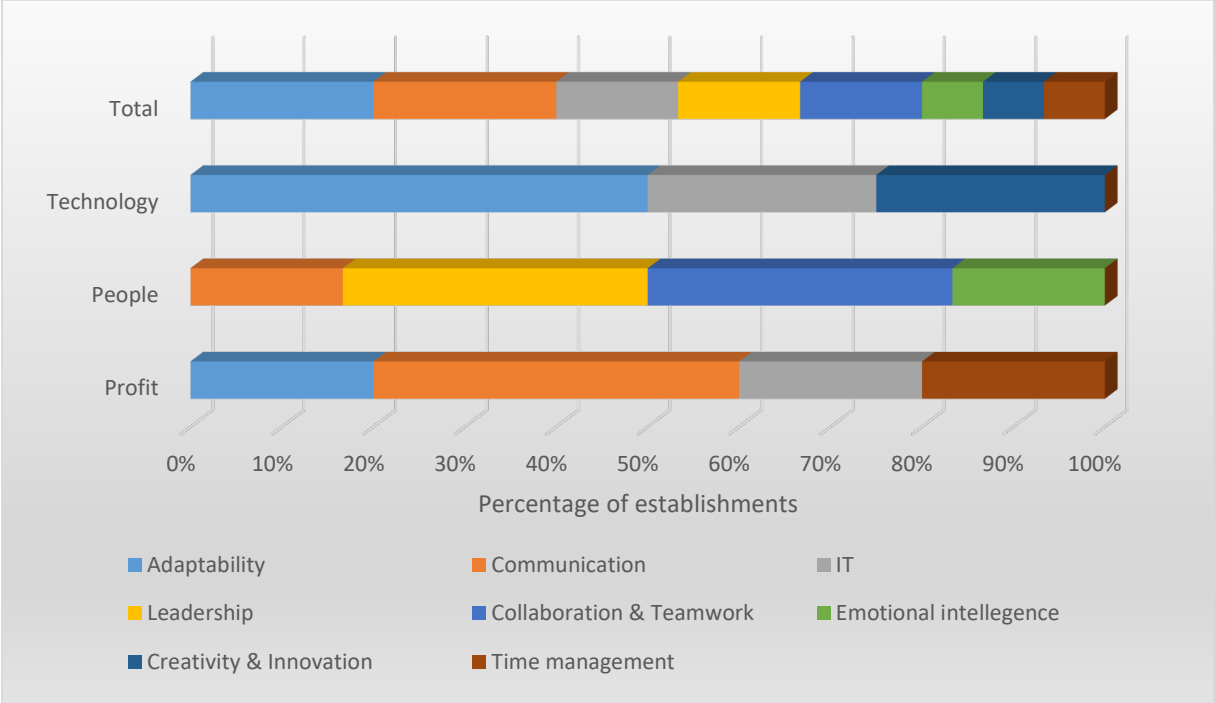


Figure 24: Main skills required to address internal drivers of change



In terms of external drivers of change in the aviation industry, employers were asked to list the top drivers of change and the skills required to address these drivers. The survey results revealed that the top external driver of change was competitors (71%) followed by climate change (29%), digitisation (29%) and regulations (29%) (Figure 25). Figure 26 depicts the skills employers identified as necessary to address external drivers of change. Overall, the top three (3) skills recorded were IT (20%), communication (20%) and creativity and innovation (20%). The following were the main skills identified to address each internal driver:

1. Competition – Communication (60%)
2. Climate change – Creativity and innovation (50%)
3. Digitisation – IT (100%)
4. Regulations – Creativity and innovation (25%), Problem solving (25%), Critical and analytical thinking (25%) and Time management (25%)

Figure 25: Top external drivers of change in establishments

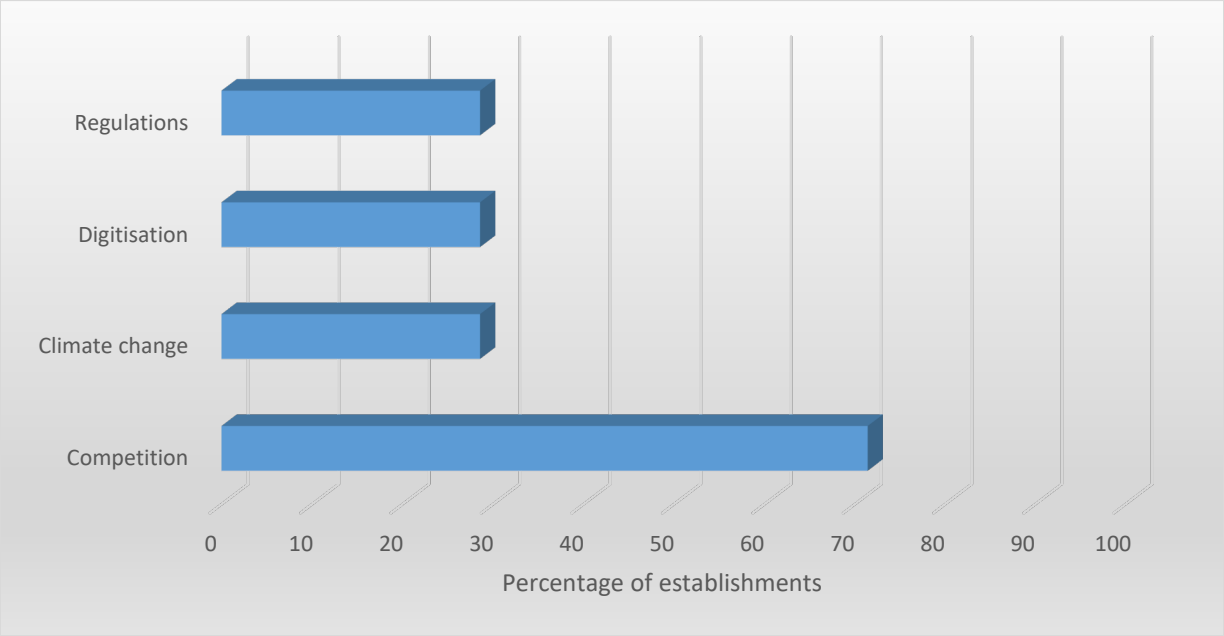
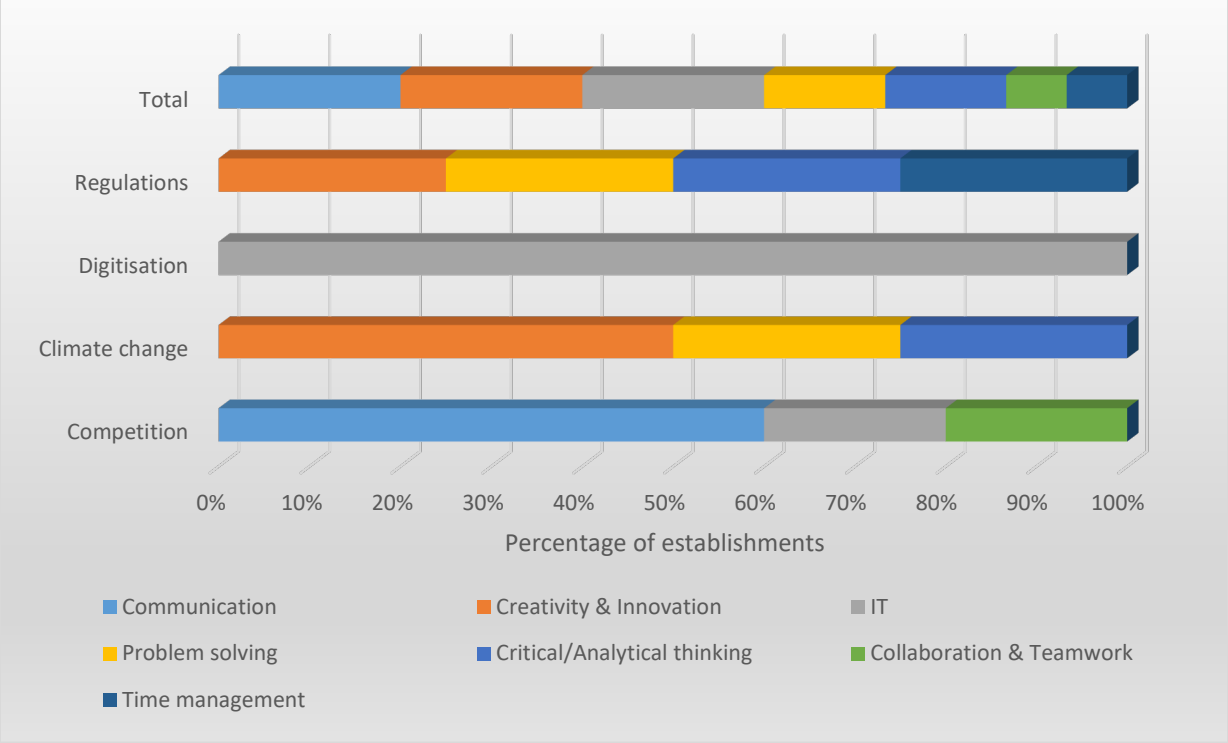


Figure 26: Main skills required to address external drivers of change

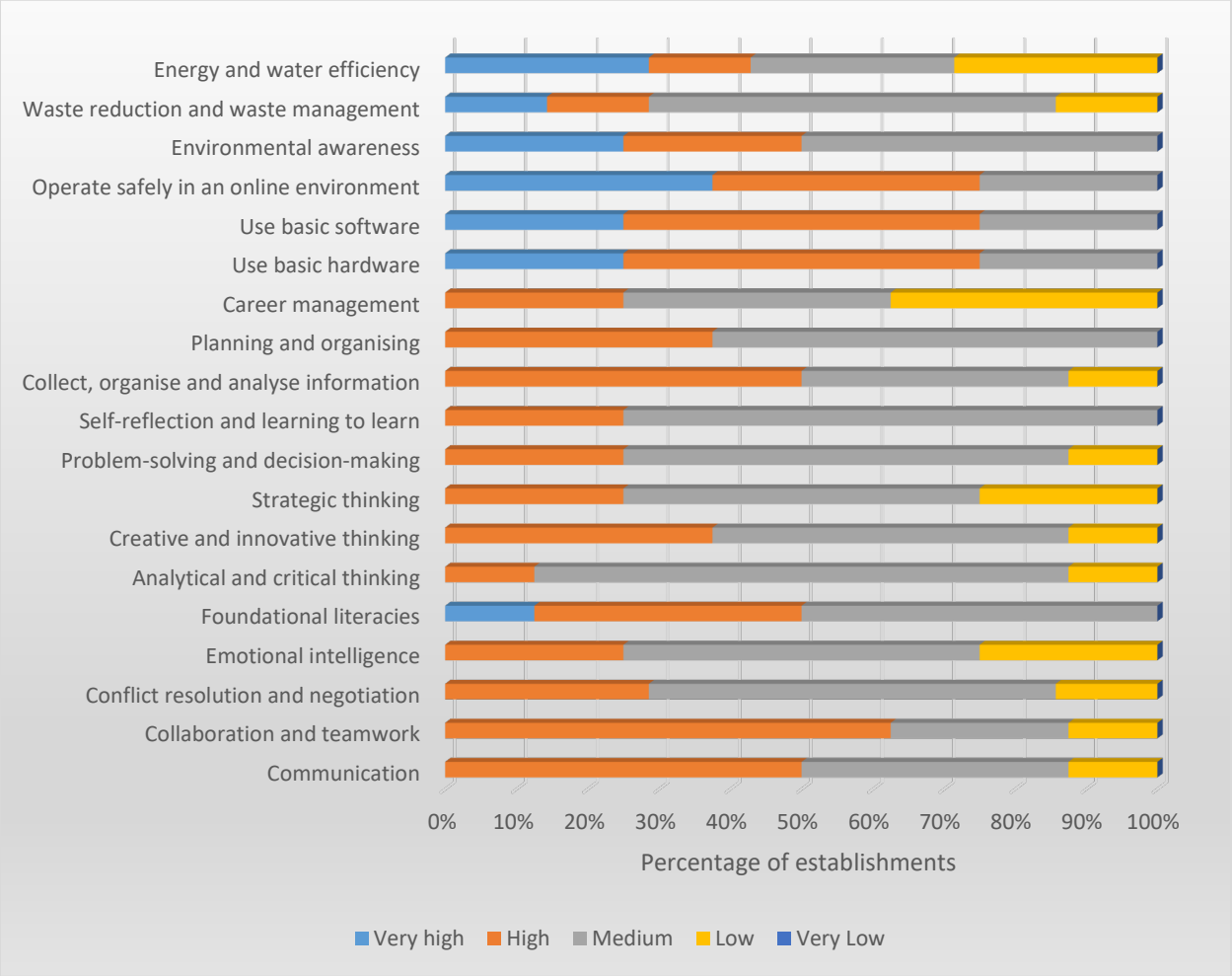


5.3 Employers' Perception on the Skill Levels of Employees

To gain a comprehensive understanding of the level of skills among employees in emerging sectors, employers were asked to assess their employees' proficiency across the 19 core skills identified as crucial building blocks to lifelong learning and adapting to changes in the labour market. This included new entrants into the workforce and existing employees. The new entrants assessed were employees who graduated from university between the years 2021 and 2023.

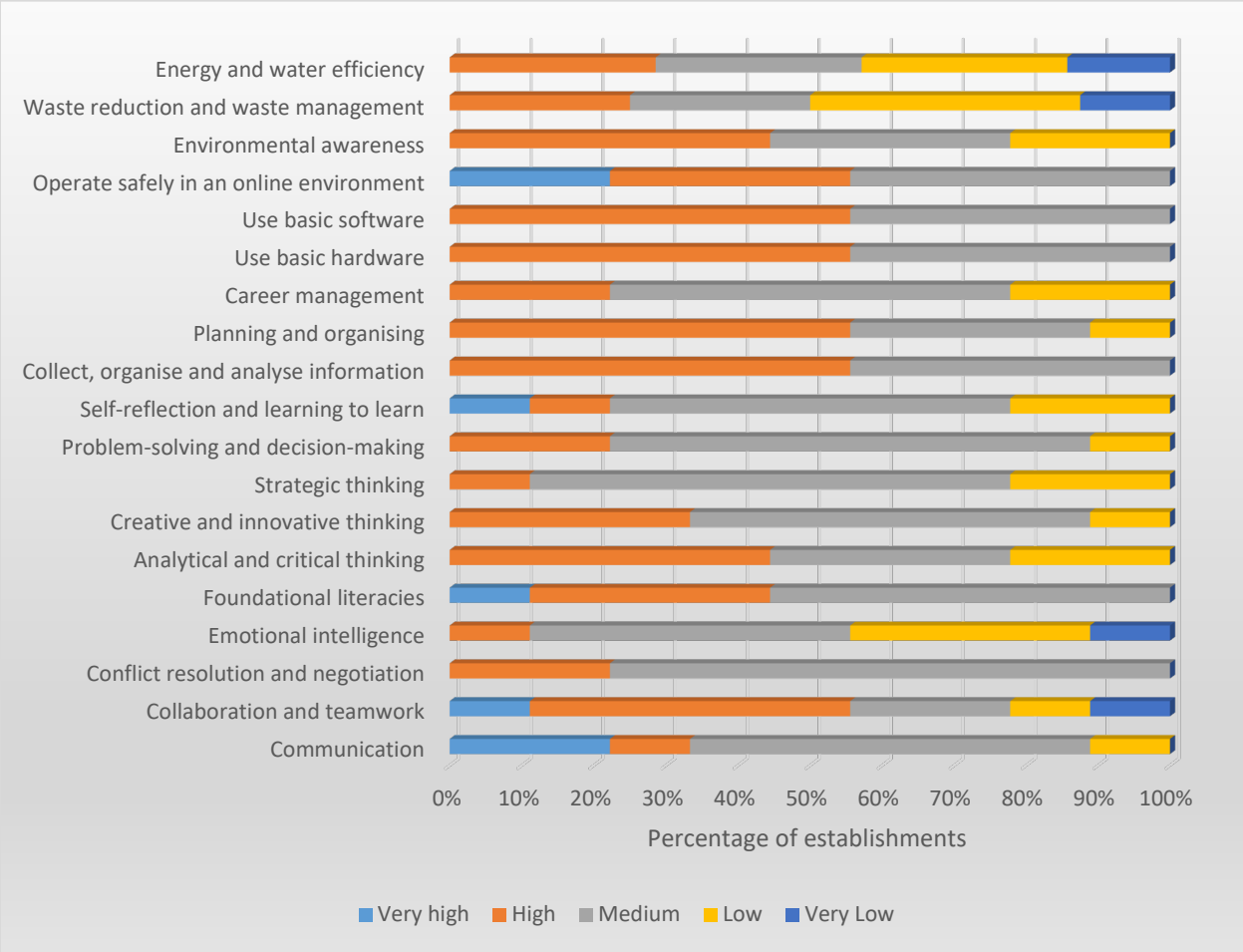
Figure 27 presents employers' perception on the skill levels among recent university graduates, focusing on the 19 core skills. These skills were evaluated on a 5-level scale, ranging from very low to very high. The data demonstrates that the majority of employers rated their employees' level of skill as high (very high + high) or medium in all 19 core skills. Recent graduates received the highest ratings for their basic digital skills, with three-quarters (75%) of employers assigning high ratings for their employees' abilities in using basic hardware, operating basic software, and navigating safely in an online environment. This suggests that the future workforce is more proficient using technology, which is essential as businesses continue to rely more heavily on technology. The lowest rating (very low + low) was assigned to Career management (38%).

Figure 27: Employers' rating of level of the skills among recent university graduates



A review of the skill sets of existing employees was also undertaken in order to fully understand how their skills aligned with business goals. Figure 28 illustrates that the majority of employers assigned medium to high (high + very high) ratings to their employees' skill levels across 18 of the 19 core skills. The highest rating (very high + high) was assigned to six (6) skills; collaboration and teamwork (56%); collect, organise and analyse information (56%); planning and organising (56%); use basic hardware (56%); use basic software (56%); and operate safely in an online environment (56%). The lowest (low + very low) ratings were waste reduction and waste management (50%), emotional intelligence (44%) and energy and water efficiency (43%).

Figure 28: Employers' rating of level of the skills of existing employees



Figures 27 and 28 indicate that, overall, employers reported a relatively higher level of skills among recent graduates compared to existing employees for most core skills. This suggests that new entrants into the workforce are better prepared for

the jobs of the future as they are equipped with more relevant competencies for the jobs of tomorrow, such as basic digital skills.

5.4 Skills Mismatch

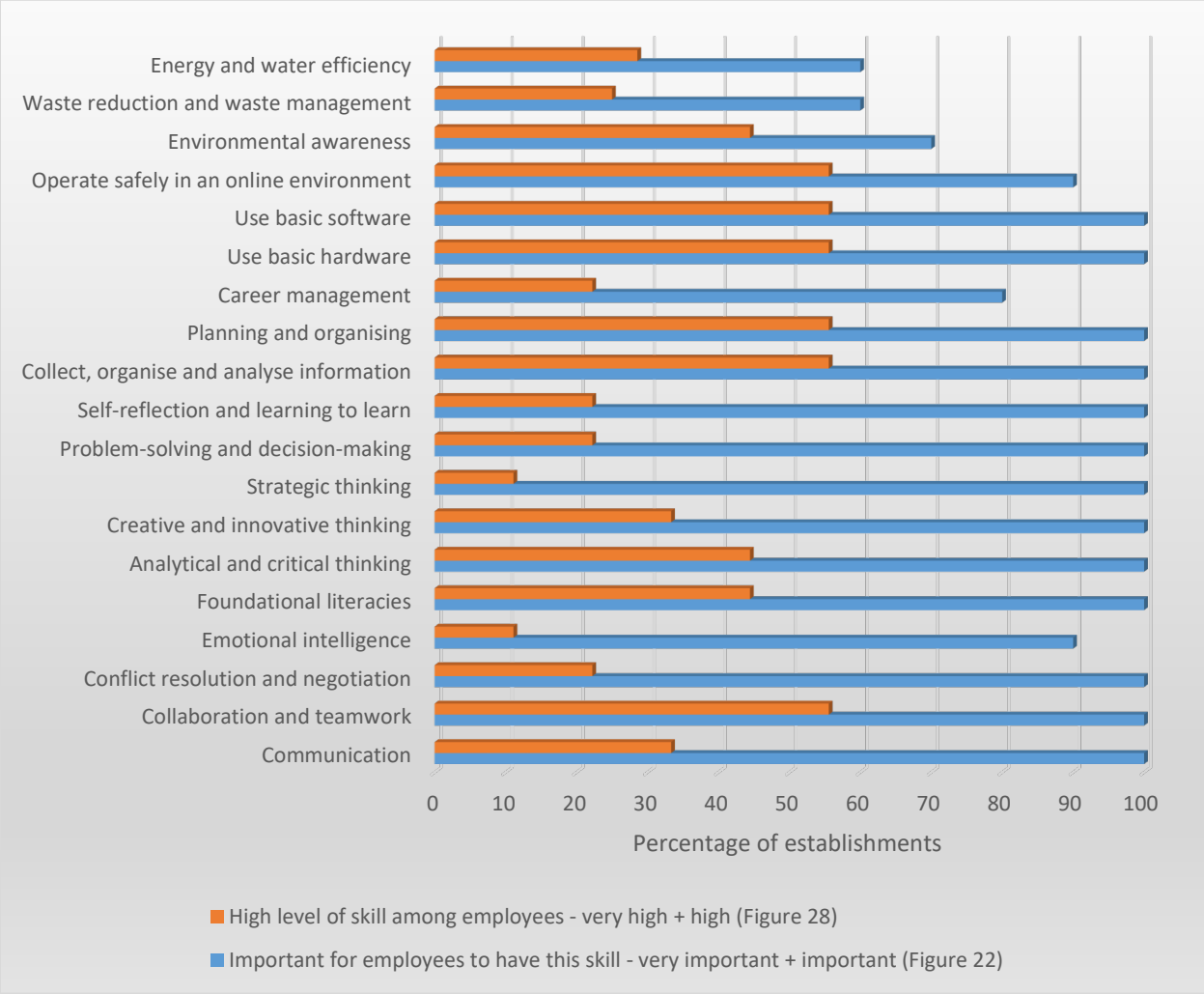
An analysis of the skill mismatches was undertaken by comparing the data provided by employers on the skills that were important for employees to possess with the skill levels of existing employees. This comparison revealed the areas where there was a gap between the required skills and the current skill levels of employees.

Figure 29 presents a comparison between the percentage of employers who reported skills that were important (very important + important) (Figure 22) for employees to have and the percentage of the workforce possessing a high (very high + high) (Figure 28) level of these skills. This comparison highlights a significant gap in the level of skills employers required from employees and the level of skills they reported among their employees. The percentage of employers who indicated that the skill was important for the success of the business was greater than the percentage of employees with a high level of skill in all 19 core skills. The largest gaps were recorded for:

- strategic thinking (89%);
- emotional intelligence (79%);
- conflict resolution and negotiation (78%);
- problem-solving and decision-making (78%); and
- self-reflection and learning to learn (78%).

The lowest disparity was observed for basic skills for green jobs. The extensive gap between the skills deemed important by employers and what they perceived as the actual proficiency levels within their workforce is a significant issue. This mismatch can lead to several problems, including lower productivity, innovation, and economic growth.

Figure 29: Comparison of employers' rating of skills required to meet business goals and current level of the skills of employees



5.5 Level of Difficulty Employers Experienced in Finding Core Skills among Recent Job Applicants

The study also captured data on the challenges employers face in acquiring core skills from new entrants into the workplace. This data is crucial in identifying specific skills that are lacking in new employees. Understanding these difficulties is essential for addressing the root causes of the skills mismatch and implementing effective solutions that can better align the skills of the workforce with the needs of employers.

Figure 30 depicts the percentage of employers who found it difficult to find seven (7) key skills – Creativity, Critical thinking, Collaboration, Communication, IT, Decision-making and Problem solving - among recent job applicants within each occupational group. The data demonstrates that, overall, and within each occupational group, the majority of employers did not experience any difficulty finding these seven skills from recent applicants, except communication skills among clerical support workers (71%) and technicians and associate professionals (57%). Overall, communication skills recorded the highest level of difficulty followed by problem solving and collaboration. By occupational group, the highest level of difficulty was observed among technicians and associate professionals and clerical support workers. The skills employers found the most difficult to find within the various occupational groups are outlined below:

- Managers – Collaboration (43%)
- Professionals – Critical thinking (43%) and Creativity (43%)
- Technicians and associate professionals – Communication (57%)
- Clerical support workers - Communication (71%)
- Service and sales workers – Creativity (29%), Communication (29%) and Problem solving (29%)
- Plant and machine operators, and assemblers - Critical thinking 14%), Communication (14%) and Problem solving (14%)
- Elementary occupations – Collaboration (29%), Communication (29%) and Problem solving (29%)

Figure 30: Employers' rating on the difficulty experienced to obtain skills from recent applicants by occupational groups

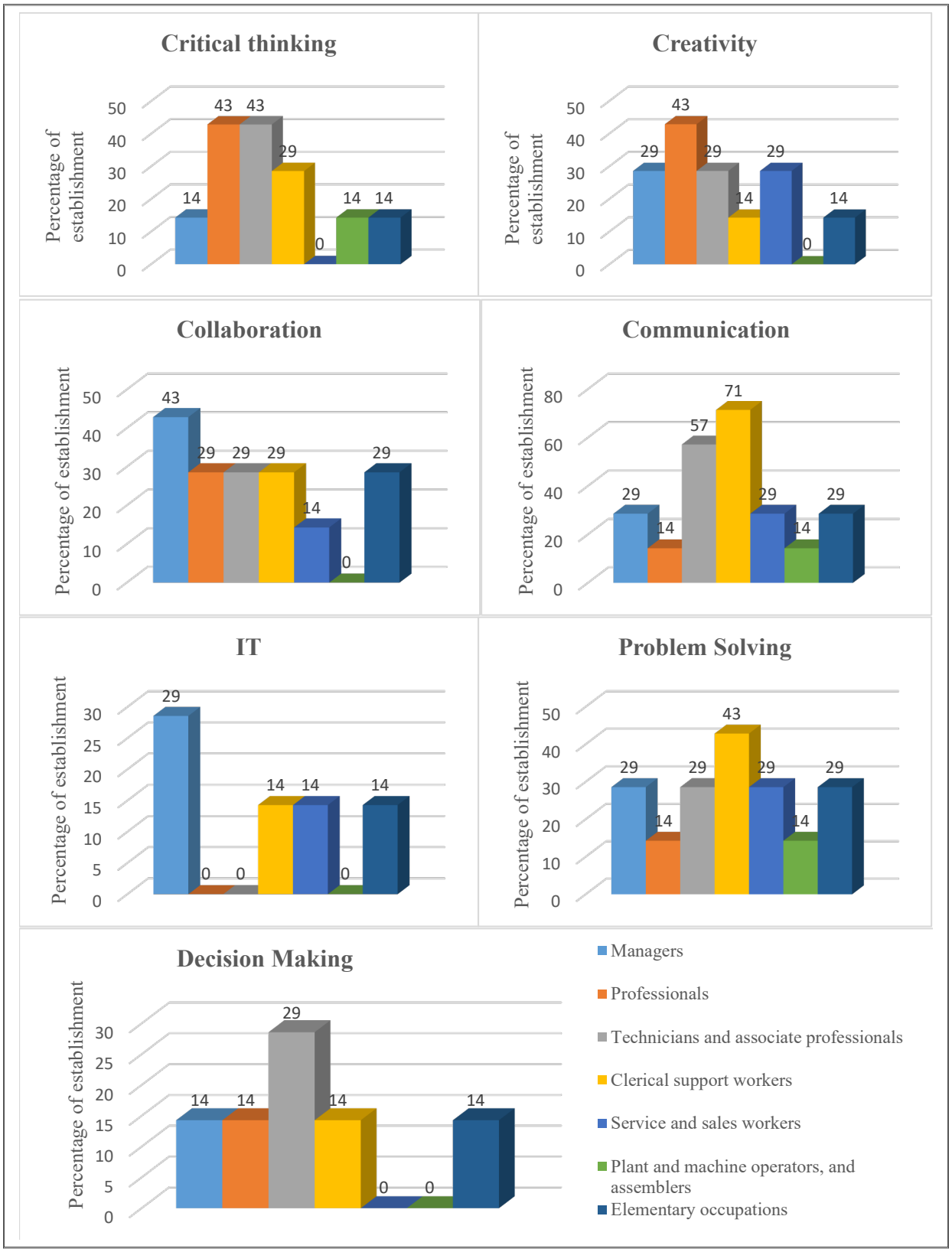
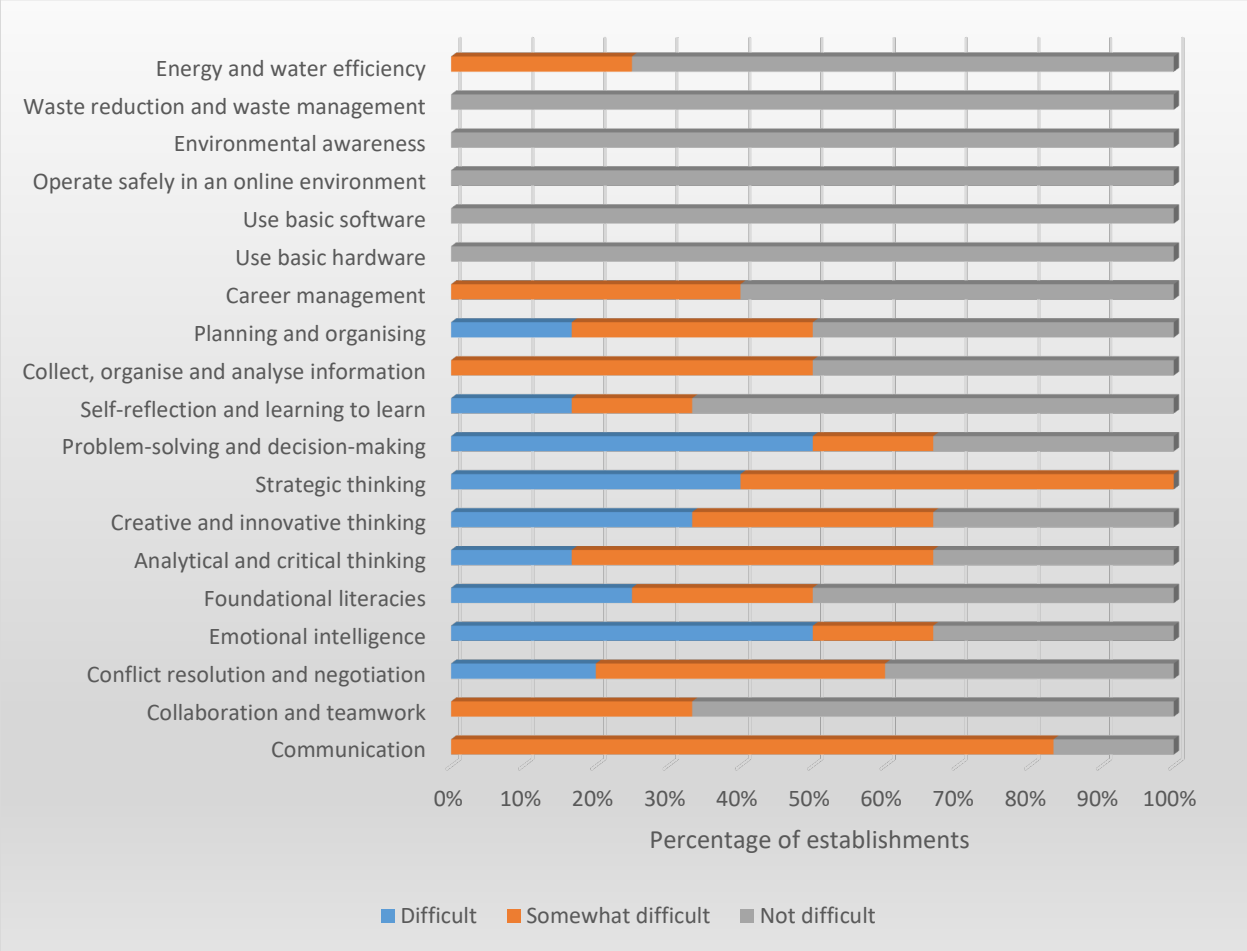


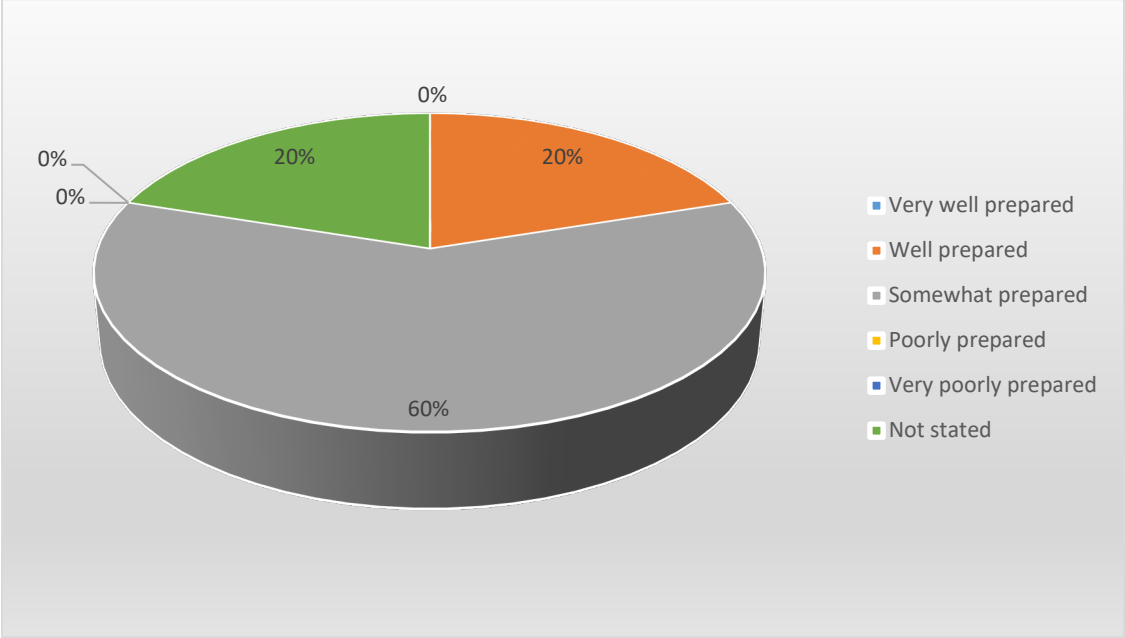
Figure 31 demonstrates that, in general, employers encountered less difficulty in finding most skills among university graduates who graduated between the years 2021 to 2023. A half (50%) or more of the employers experienced some level of difficulty in obtaining the majority of the social, emotional and cognitive, and metacognitive skills from recent university graduates except for collaboration and teamwork, career management and self-reflection and learning to learn. The highest percentage of difficulty was observed for both problem-solving and decision-making (50%) and emotional intelligence (50%). Employers experienced less difficulty obtaining basic digital skills and basic skills for green jobs from recent university graduates.

Figure 31: Level of difficulty employers experienced in obtaining core skills from recent university graduates



Further to the assessment of the skills of recent university graduates, the survey also gathered information on employers' views on the level of preparedness for work among university graduates employed over the last two (2) years of the survey period. The majority (60%) of respondents reported that recent university graduates were somewhat prepared for work while 20% indicated that they were well prepared and a similar percentage did not respond (Figure 32). None of the employers reported that recent graduates were poorly prepared for work.

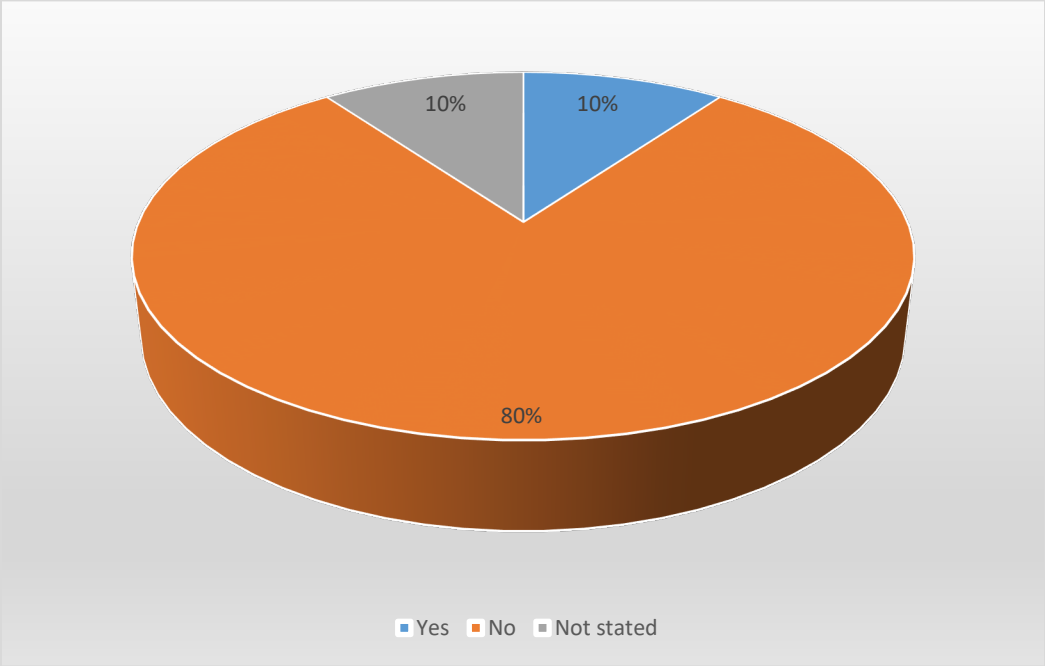
Figure 32: Level of preparedness for work among university graduates employed over the last two (2) years



5.6 Impact of skills-shortages on establishments

The absence of essential skills in the workforce can impact business operations. However, the majority (80%) of establishments surveyed reported that skill deficiencies did not affect their operations while 10% disagreed with this assessment and 10% did not respond (Figure 33).

Figure 33: Lack of skills among workers affected business operation



6. Demand for STEM Labour

A key aspect of the assessment of 21st Century Skills in the aviation sector involved identifying and understanding current and future demand for STEM workers. This activity should help policymakers and employers develop data-driven policies and strategies that address existing labour gaps and strengthen the workforce. In terms of future demand, forecasting the jobs of the future will help businesses adapt to global changes that are transforming economies, businesses, workforce structures and society as a whole.

Figure 34 demonstrates the current demand for STEM occupations reported by aviation establishments. During the survey period, the demand for STEM occupations was generally low. Computer Science/IT occupations were demanded the most with a higher percentage of employers reporting moderate demand for jobs in this field (40%). The lowest demand was observed in the field of Food and Agriculture for which the majority (90%) of employers reported no demand.

In terms of STEM jobs, the top jobs currently demanded were mainly in the fields of Computer Science/IT and Engineering (Figure 35). A similar percentage (10%) of employers identified the following STEM jobs as the most in-demand: Electrical Engineers, HSE Officers, Web & Digital Interface Designers, Mechanical Engineers, IT Technicians, Civil Engineers, Environmental Scientists, Computer Programmers, Software Developers and Aeronautical Engineers.

Figure 34: Current demand for STEM occupations

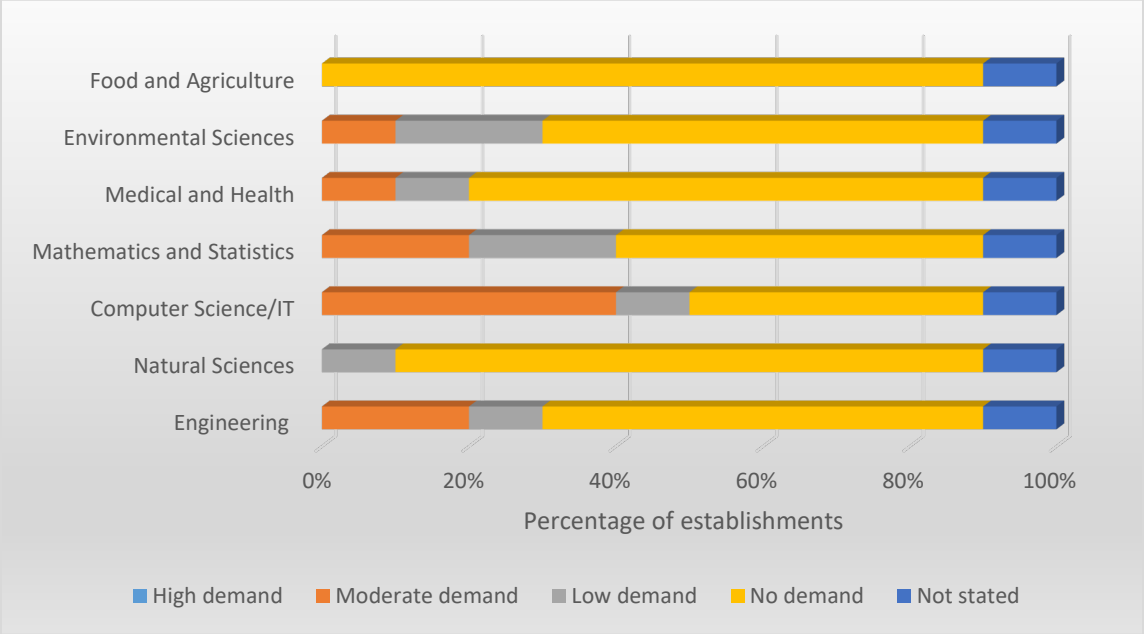
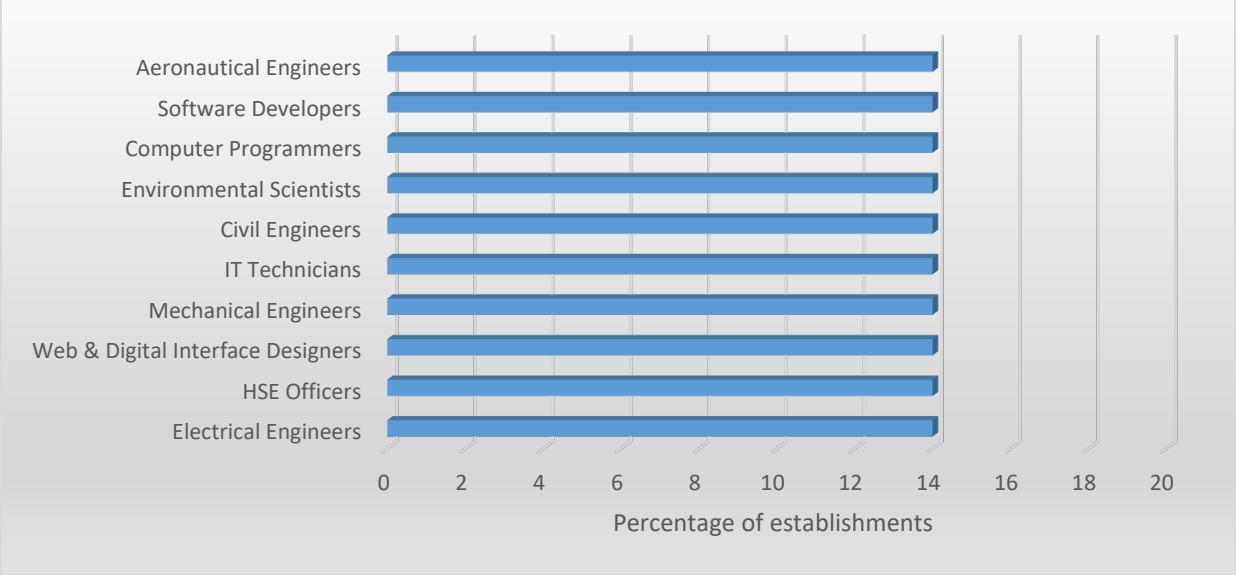
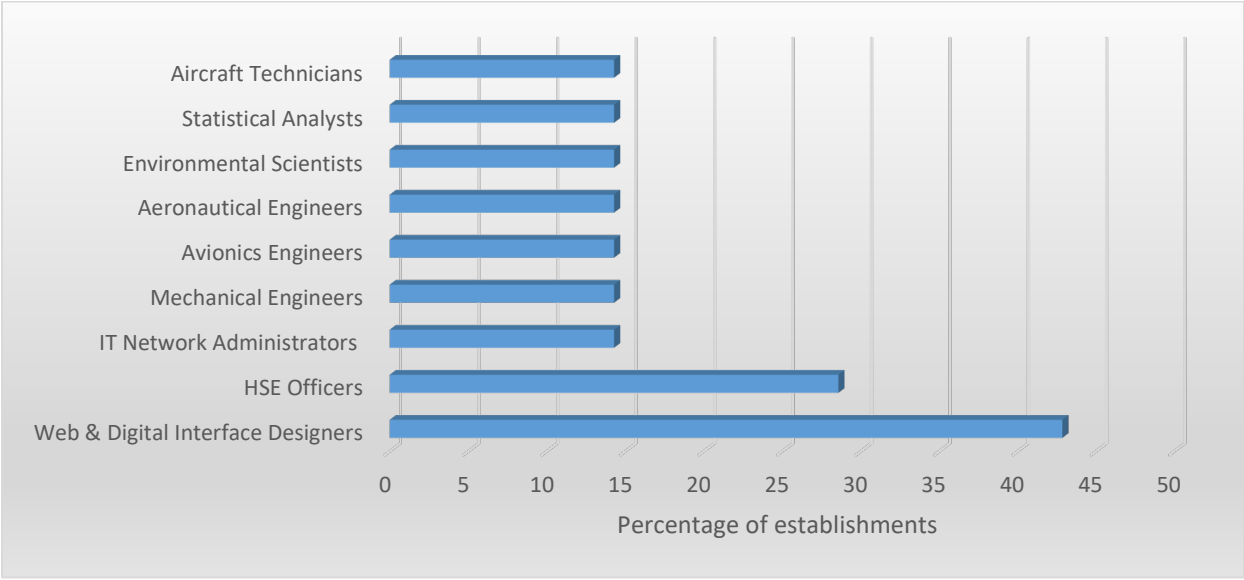


Figure 35: Top STEM occupations currently demanded by establishments



Employers were asked to list the top three (3) STEM occupations for their organisation in the next five (5) years based on the strategic direction of their company. The most important STEM occupation was Web and Digital Interface Designers (43%), followed by HSE Officers (29%) (Figure 36).

Figure 36: Most important STEM occupations for companies in the next five (5) years

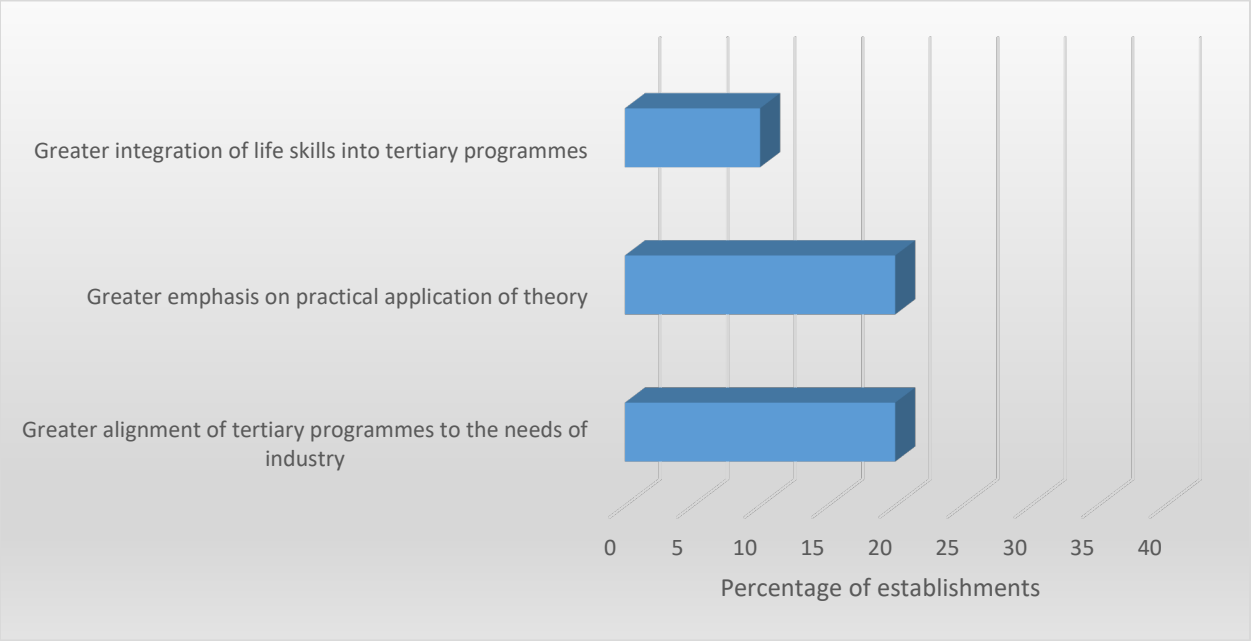


7. Employers' Recommendations

Employers in the aviation sector provided recommendations for strengthening STEM education and STEM labour. This section proposes specific actions that government, industry, and tertiary institutions should take to address these needs based on the feedback from employers.

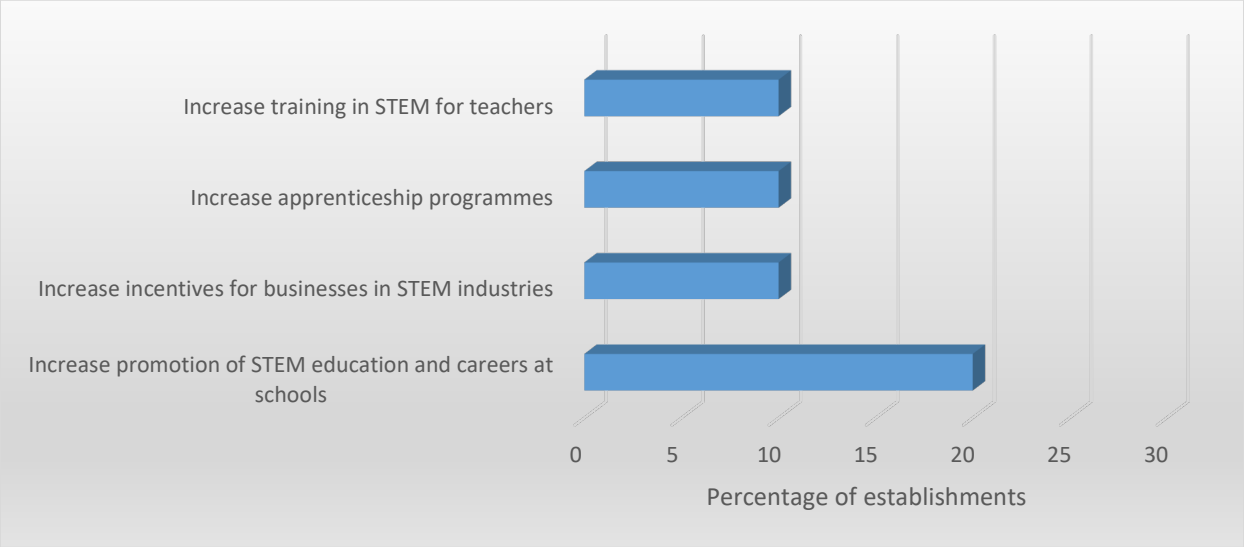
Employers were asked to provide recommendations on how tertiary education programmes can be improved to meet their needs. The main recommendations provided by employers were: greater alignment of tertiary programmes to the needs of industry (20%), greater emphasis on practical application of theory (20%) and greater integration of life skills into tertiary programmes (10%) (Figure 37).

Figure 37: Employers' recommendations to improve tertiary education programmes to meet the needs of the industry



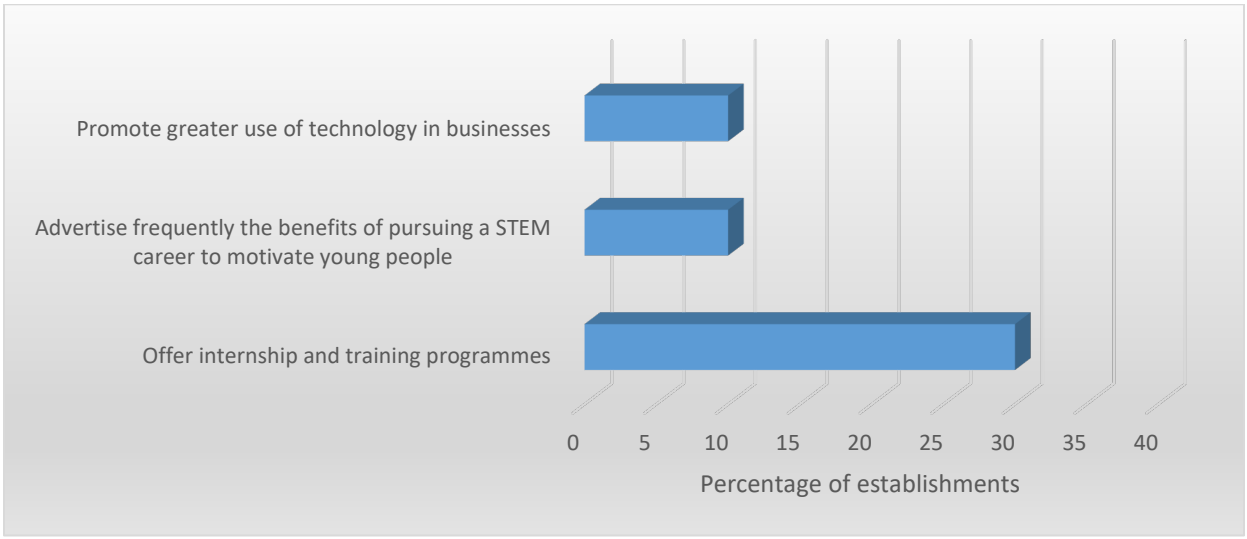
Employers also recommended actions Government could take to support the development of the STEM labour force. The main suggestion from employers was to increase promotion of STEM education and careers at schools (20%), followed by increase incentives for businesses in STEM industries (10%, increase apprenticeship programmes (10%) and increase training in STEM for teachers (10%) (Figure 38).

Figure 38: Employers' recommendations on how government can help develop STEM labour



Additionally, employers provided recommendations on different strategies the private sector could introduce to help develop the STEM workforce. Figure 39 demonstrates that 30% of the employers recommended offering more internship and training programmes while 10%, in each case, suggested advertising more frequently the benefits of pursuing a STEM career to motivate young people and to promote greater use of technology in business operations.

Figure 39: Employers' recommendations on how private sector can help develop STEM labour



8. Technological Advancements in the Aviation Industry

8.1 Overview

The aviation industry is undergoing a rapid transformation, driven by emerging technologies that improve efficiency, safety, and sustainability. Technologies such as AI, biometric security systems, green aviation fuels, autonomous airport operations, and big data analytics are reshaping global aviation. As airlines and airports adopt these advancements, they improve passenger experience, reduce operational costs, and support environmental initiatives (ICAO, 2022). This section explores how leading aviation nations integrate these technologies and assesses their potential impact on Trinidad and Tobago's aviation sector. It also examines STEM career opportunities arising from these innovations and presents a case study on Caribbean Airlines, detailing its adoption of modern aviation technologies.

8.2 Key technologies reshaping the aviation industry

Some of the main technological innovations that are transforming aviation services include:

- **Artificial Intelligence (AI) and Machine Learning (ML)** is transforming aircraft maintenance by enabling predictive diagnostics. By analysing real-time data from on-board sensors, AI can detect irregularities and potential failures before they escalate into costly repairs or safety hazards, reducing downtime and ensuring aircraft remain in service longer. AI-driven predictive maintenance can improve operational efficiency and flight safety by preventing unexpected mechanical issues. Beyond maintenance, AI is also streamlining passenger interactions through automated booking systems, virtual assistants, and chatbots, enhancing customer service and simplifying travel processes.

- The adoption of **biometric security systems** such as facial recognition, iris scanning, and fingerprint authentication, is modernising airport security and passenger processing. Airports like Singapore Changi and Dubai International have adopted biometric-enabled check-in and boarding systems, improving security while reducing wait times. These technologies improve passenger flow and eliminate the need for manual document verification, leading to a more seamless and efficient travel experience (ICAO, 2022). Biometric security is also increasing airport safety by minimising human error and ensuring accurate passenger identification.

- **Green aviation fuels and Sustainable flight operations**, derived from renewable sources like algae and waste oils, can reduce emissions by up to 80% compared to conventional jet fuels (ICAO, 2022). With aviation accounting for 2-3% of global carbon emissions, these fuels are vital for mitigating the environmental impact of the sector. Additionally, airlines are investing in more fuel-efficient aircraft and advanced route optimisation software to further minimise their carbon footprint.

- **Autonomous Systems and Airport Automation** is revolutionising ground operations at airports, improving both efficiency and accuracy. Technologies such as self-driving baggage carts, robotic aircraft marshalling systems, and drone-based runway inspections are being deployed to optimise operational processes. These autonomous systems reduce reliance on human labour, allowing airports to operate with greater speed while minimising delays (Airports Council International, 2023). AI-powered air traffic control systems are also being explored to optimise aircraft landing and take-off sequences, improving fuel efficiency and reducing congestion.

- **Big Data Analytics and the Internet of Things (IoT).** The aviation industry generates vast amounts of data daily, from aircraft performance metrics to passenger movement patterns. Airlines and airports are leveraging big data analytics to improve efficiency and reduce costs. IoT sensors embedded in aircraft monitor engine health, fuel consumption, and structural integrity in real time, enabling airlines to make data-driven decisions that improve safety and performance. According to the IATA, airports also use IoT technology to optimise baggage tracking, monitor passenger flow, and adjust flight scheduling dynamically, leading to improved punctuality and a better overall passenger experience.

8.3 Growing STEM jobs in the Aviation Industry

The increasing integration of advanced technologies such as AI, automation, green aviation fuels, and data analytics is driving a surge in demand for skilled professionals in the aviation sector. The table below outlines some of the key STEM careers linked to these technological advancements.

Table 4: Key STEM careers associated with technological advancements in the Aviation Sector

Technological advancements	Examples of stem careers
▪ AI and ML	Data Scientists, AI Specialists, Aerospace Engineers, Avionics Engineers
▪ Biometric Systems & Smart Airports	Cybersecurity Specialists, IT Engineers, Systems Architects
▪ Green Aviation Fuels	Environmental Engineers, Renewable Energy Scientists, Chemists
▪ Autonomous Systems & Airport Automation	Robotics Engineers, Software Developers, AI Technicians, Software Engineers
▪ IoT and Big Data Analytics	Data Analysts, IoT Specialists, Aviation Network Engineers

8.4 Examples of leading countries in aviation and technological advancements

This section highlights countries that have set benchmarks in the aviation industry through the integration of ground-breaking technologies. It also explores the emerging STEM career opportunities resulting from these advancements in the aviation sector.

Table 5: Examples of global technological advancements in Aviation and associated STEM professions

Country	Technological advancements	STEM careers associated with technological advancements
United States	The U.S. is a global leader in AI-driven predictive maintenance, advanced avionics, and the development of smart airports. These innovations have improved the efficiency and safety of flight operations.	Aerospace Engineers, Data Analysts, AI Specialists, Avionics Engineers
Singapore	Singapore has implemented biometric-based security systems and automated baggage handling, making its airports some of the most efficient in the world. Smart air traffic management systems further improve its air travel infrastructure.	IT Engineers, Systems Architects, Robotics Engineers, Cybersecurity Specialists
United Arab Emirates	The UAE has pioneered the use of green aviation fuels, autonomous airport ground vehicles, and biometric screening technology, creating a more sustainable and seamless airport experience.	Environmental Scientists, Aviation Cybersecurity Experts, Renewable Energy Engineers

8.5 Benefits of adopting emerging technologies in the Aviation Industry

The integration of emerging technologies provides significant advantages for the aviation sector:

- Increased Efficiency – AI and IoT optimise flight routes, minimise delays, and streamline ground operations (IATA, 2023).
- Cost Reduction – Predictive maintenance lowers aircraft repair costs, while green aviation fuels reduce fuel expenses.
- Enhanced Safety – Automated monitoring and biometric security systems improve risk detection and response.
- Environmental Sustainability – Green aviation fuels and fuel-efficient aircraft contribute to lower carbon emissions (ICAO, 2022).
- Improved Passenger Experience – Biometric systems and self-service kiosks expedite airport procedures, enhancing convenience.

Ease of adoption by local businesses

- Trinidad and Tobago's aviation sector stands to benefit from adopting emerging technologies such as AI, biometric security, and green aviation fuels. However, the path to integration requires addressing several key challenges, including high initial investment costs, limited local expertise, and aging infrastructure and processes. Strategic investments in technology, workforce development, and airport modernisation are essential for overcoming these hurdles.

- To facilitate a smooth transition, partnerships with global aviation companies can promote technology transfer and knowledge sharing. Additionally, educational programs and training initiatives at institutions such as the University of Trinidad and Tobago (UTT) can cultivate a skilled workforce capable of supporting these advancements in aviation.

- Government incentives and funding can also help offset the significant upfront costs involved in upgrading infrastructure and implementing green technologies. By focusing on long-term gains, such as environmental sustainability and operational efficiency, Trinidad and Tobago's aviation sector can successfully navigate the challenges of technological adoption.

8.6 Case Study: Transformation of Caribbean Airlines

This case study explores the technological and operational transformation of Caribbean Airlines (CAL), a major airline in the Caribbean region. By leveraging advanced digital solutions, modernising its fleet, and focusing on sustainability,

CAL aimed to improve its operational efficiency, customer experience, and market competitiveness.

Background

Caribbean Airlines was established on September 27, 2006, and commenced operations on January 1, 2007. It serves as the national carrier of Trinidad and Tobago and plays a crucial role in connecting the Caribbean with North and South America. As a vital hub for regional tourism, trade, and cultural exchange, CAL has faced significant challenges in terms of rising operational costs, inefficiencies in key processes, and growing customer expectations for digital and sustainable solutions.

Historically, CAL's operational framework was marked by a mix of outdated legacy systems, high fuel consumption, manual processes, and a fleet in need of modernisation. Recognising the need to evolve, the airline embarked on a comprehensive transformation strategy, adopting cutting-edge technologies, enhancing fleet efficiency, and integrating sustainable practices to address both operational inefficiencies and environmental concerns (Oxford Business Group, 2022).

Challenges

Before its transformation, Caribbean Airlines encountered several operational challenges that impacted its efficiency and profitability:

- High Operational Costs - The aviation industry is highly fuel-dependent, and rising fuel prices put significant financial pressure on CAL. Additionally, maintenance costs for aging aircraft were increasing, reducing the airline's profitability (Caribbean Development Bank, 2021).
- Environmental Concerns - With growing global attention on reducing carbon emissions, airlines worldwide, including CAL, were required to implement greener technologies and fuel-efficient aircraft to meet sustainability targets (International Civil Aviation Organization, 2021).
- Customer Expectations - The airline industry was shifting toward digital services, with passengers expecting faster check-in, self-service options, and enhanced real-time flight tracking. CAL needed to modernise its digital infrastructure to remain competitive.
- Operational Inefficiencies - Outdated systems for passenger management, cargo handling, and maintenance led to longer turnaround times and flight delays, negatively affecting CAL's on-time performance and customer satisfaction (International Air Transport Association, 2022).

Solutions Implemented

To address these challenges, Caribbean Airlines launched a multifaceted modernisation initiative, which included fleet upgrades, the adoption of digital solutions, AI-driven maintenance, and sustainability programs. These solutions were aimed at enhancing operational efficiency, improving the customer experience, and reducing the airline's environmental impact.

1. **Fleet Modernisation**
   To combat rising fuel costs and improve overall operational efficiency, CAL replaced several of its older aircraft with the Boeing 737 MAX series. These aircraft offer a 20% improvement in fuel efficiency over previous models, significantly lowering operating costs. The 737 MAX's advanced aerodynamics and new engines provide not only cost savings but also greater passenger comfort and increased cargo capacity (Caribbean Development Bank, 2021).

   The airline also invested in Airbus A320neo aircraft, which are known for their fuel efficiency and low environmental impact. By modernising its fleet, CAL was able to reduce both fuel consumption and maintenance costs, while enhancing overall flight performance.

2. **Digital Transformation of the Passenger Experience**

   CAL prioritised improving the digital passenger experience, implementing a range of solutions to enhance convenience, reduce wait times, and improve customer service:

   - Self-Service Kiosks - CAL introduced self-service kiosks at major airports to streamline the check-in process, reducing wait times and improving operational efficiency. This initiative was particularly impactful during peak travel seasons, helping passengers avoid long queues and enabling staff to focus on other operational tasks.
   - Mobile App Integration - CAL enhanced its online booking system, integrating it with a mobile app that allows passengers to book, check-in, and manage their travel plans more seamlessly. The app provides passengers with real-time flight updates, gate information, and baggage tracking, improving overall service quality.
   - Automated Baggage Tracking Systems - CAL deployed radio frequency identification-enabled baggage tracking systems to minimise the incidence of lost luggage and provide passengers with real-time updates on their baggage status. This solution significantly improved customer satisfaction by providing greater visibility and reducing the anxiety associated with lost luggage.

3. Predictive Maintenance & AI Integration

To enhance fleet reliability and minimise unscheduled downtime, CAL implemented AI-driven predictive maintenance using real-time sensors installed on aircraft. These sensors continuously monitor engine performance, structural integrity, and other critical systems to predict potential mechanical issues before they escalate into more serious problems. By leveraging predictive maintenance, CAL was able to optimise repair schedules, reduce maintenance-related delays, and extend the lifespan of its aircraft (International Air Transport Association, 2022). The airline also integrated advanced data analytics platforms to support maintenance decisions, providing engineers with actionable insights that enabled more efficient use of resources and quicker turnaround times.

4. Cargo and Logistics Optimisation

In response to increasing demands for more efficient cargo handling, CAL modernised its logistics infrastructure. The airline implemented a series of automated and digital systems aimed at improving the movement of goods and freight:

- Automated Cargo Tracking - The introduction of radio frequency identification -based tracking solutions enabled CAL to monitor the status of shipments in real-time, improving transparency and reducing the risk of lost or delayed cargo.
- Integrated Logistics Platforms: CAL adopted digital platforms that integrated with customs systems, allowing for quicker and more efficient customs clearance and reducing delays in the movement of freight across borders.

5. Sustainability Initiatives

Caribbean Airlines has made significant strides in adopting more sustainable practices. To address environmental concerns and meet international aviation sustainability standards, CAL introduced several initiatives:

- Sustainable Aviation Fuels - CAL began using SAFs, which have a significantly lower carbon footprint compared to conventional jet fuel. This initiative was part of the airline's broader commitment to reducing emissions and meeting global sustainability goals (International Civil Aviation Organization, 2021).
- AI-Powered Route Optimisation - CAL implemented AI-driven route optimisation software to reduce unnecessary fuel consumption during

flight planning. The software uses real-time data to identify the most efficient routes, considering factors such as weather conditions, air traffic, and fuel consumption.

- Fuel-Efficient Operations - The airline also adopted fuel-efficient procedures such as single-engine taxiing and optimised flight routes, all aimed at reducing its carbon footprint.

Results

CAL's transformation has delivered significant improvements across several areas:

- Operational Efficiency - The adoption of modern aircraft, predictive maintenance technologies, and automated systems has led to a significant reduction in fuel consumption, operational delays, and maintenance costs.
- Customer Satisfaction - The digital transformation of passenger services, including self-service kiosks, mobile app integration, and real-time baggage tracking, has improved the overall customer experience, leading to higher satisfaction ratings.
- Environmental Impact - CAL's sustainability initiatives, including the use of SAFs, AI-driven fuel efficiency programs, and fuel-efficient operational procedures, have resulted in a reduction of its carbon footprint and alignment with international sustainability standards.
- Market Competitiveness - The modernisation strategy has positioned CAL as a more competitive regional airline, attracting both leisure and business travelers. The airline's increased operational efficiency and improved customer service offerings have helped it to operate in a highly competitive market.

Conclusion of the case study

Caribbean Airlines ongoing transformation demonstrates the power of technology in reshaping aviation operations. The industry faces high costs and lower profit margins and is held to extremely high regulatory safety and environmental policies. By integrating advanced technologies in fleet management, predictive maintenance, digital passenger services, and sustainability initiatives, CAL can continue to improve its operational performance, customer satisfaction, and environmental footprint. This case study underscores the importance for airlines to continue updating digitally and sustainably to remain competitive and meet the evolving demands of modern travelers.

9. General Recommendations

The recommendations below are guided by the research undertaken during this study, stakeholder consultations and the results of the industry survey. The recommendations are intended to guide policy makers, educators, employers, and development partners in strengthening STEM talent pipelines and reducing skills mismatches.

STEM Education:

1. Increase the practical/training component in tertiary education programmes. This is widely recognised as essential for preparing graduates better for the workplace. By integrating more hands-on experiences, students can put theory into practice in real-world situations, helping them gain the necessary skills and experience to transition smoothly into the workplace.

2. Greater alignment of tertiary programmes to the needs of industry. Achieving greater alignment of tertiary education programmes with industry needs is crucial for ensuring that graduates are equipped with the skills and knowledge demanded by industry. This alignment can lead to increase employment, productivity and growth.

3. Increase incentives and promotion for students to pursue studies and careers in STEM fields demanded by industry. Increasing incentives and promoting STEM studies and careers that are demanded by industry is essential for addressing labour gaps. This can also result in higher employment rates for graduates and greater success for businesses.

4. Increase research on STEM careers emerging from technologically advanced aviation sectors and promote these careers locally. This is crucial for preparing the workforce for the technological transformation needed to ensure business continuity. Furthermore, these findings should be available to educators, employers, students and all key stakeholders.

5. Introduce more STEM programmes based on current and future needs of industry. This would lead to increase productivity and profitability for businesses and employability of graduates.

6. Make STEM fun so that children can enjoy and as a result pique their interest in STEM. Increasing students' interest in STEM is essential to increasing their participation in STEM education and their pursuit of STEM careers.

7. Fully integrate STEM skills into the curriculum at an early age. Students will have a greater understanding, appreciation and interest in STEM from a

young age. Furthermore, integrating STEM skills into the curriculum at an early age would help develop STEM skills that are essential in an increasingly technology-driven world. Additionally, increase training for teachers in STEM-related topics and skills to enable them to effectively transfer knowledge to students and boost students' interest and proficiency.

8. Create/introduce more resources that help parents and teachers make STEM more relatable and fun for children. This would help students develop an appreciation and enthusiasm for STEM, which can lead greater interest and participation in the field.

9. Fostering partnerships between government, businesses, universities and all stakeholders to continue promoting and enabling skills development. These collaborative efforts help bridge the gap between education and industry needs and increase the STEM capacity of the workforce.

STEM Labour Force Development:

1. Provide more training and apprenticeship programmes based on the needs of the industry. This will ensure that graduates are able to transition smoothly into the workplace and reduce the mismatch of skills.

2. Provide more career guidance for young people through mentorship, structured programmes or career paths. This would help increase the participation of young people in STEM careers and satisfy anticipated future demand for STEM jobs.

3. Retrain employees to meet the current and future demand of the workplace. This is essential for addressing labour shortages and remaining competitive, in a rapidly evolving industry. Increase awareness among employers and employees on core skills required to successfully operate in a digital environment. This would not only help employers recognise the importance of investing in upskilling their workforce but also drive employee to upgrade their skills.

4. Provide more support and incentives to promote STEM. Providing incentives to pursue STEM careers is crucial for driving innovation and competitiveness in businesses.

5. 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 and gaps. This data will enable policymakers to develop policies and programmes to address these

gaps and facilitate greater alignment of education and training with industry needs.

6. Increase awareness and access to emerging technologies that are transforming the industry and the benefits of adopting these technologies. This could stimulate demand for STEM jobs that are needed to keep up with emerging technologies and ensure the industry's long-term sustainability.

7. Promote STEM jobs aviation employers identified as key for future growth. This will increase employability of students and increase the STEM talent in the workforce.

8. Increase investment in Research, Development, and Innovation to drive the development of the aviation sector. Technological advancements are key to transforming the sector into an automated, resource-efficient and competitive industry. This investment would also stimulate the demand for STEM talent associated with emerging technologies

9. Provide more incentives for companies to invest in STEM education and workforce development, such as tax breaks and easy access to technological and human resources.

10. Given the lack of response for the TVET section, undertake studies that focus solely on TVET.

11. Establish and regularly update a comprehensive business registry for this sector to enable accurate and more seamless measurement of growth, both at the sectoral level and within individual businesses.

10. Conclusion

In conclusion, this study offers a comprehensive assessment of the current and future STEM labour needs within the aviation sector of Trinidad and Tobago. Several recent studies have reported that technological change would lead to significant declines in certain job categories in the coming years as automation in the workforce continues to evolve. The most competitive businesses will be those that are able to develop core skills among their employees. The WEF reported that analytical thinking, creativity and flexibility were among the top skills needed in 2025. The results of this survey highlight key insights into the skill set of the current workforce and the growing demand for STEM competencies as the industry evolves. The findings of this study underscore the crucial role that technological advancements, such as AI, robotics and renewable energy, will play in reshaping the workforce. Moreover, the study emphasises that the most competitive businesses in the sector will be those that invest in developing core skills among their employees, enabling them to effectively adapt to the evolving demands of the work environment.

While the findings reveal that the current STEM workforce within the aviation industry in Trinidad and Tobago is still relatively small and demand was low at the time of the survey, the outlook for integrating STEM talent into the sector is promising particularly as the country continues to embrace digitalisation and innovation. Globally, there is a strong push to upgrade aviation systems for improved efficiency, safety and sustainability. Particularly, as the Aviation industry operates under strict international standards that are designed to uphold mandatory safety, operational efficiency and regulatory compliance. These requirements often force upgrades to greater automation and advanced technology in aviation services. This technological shift presents a strong case for not only expanding STEM roles in aviation but also upgrading traditional roles to satisfy new technological demands.

Moreover, the number of STEM professionals is expected to grow in the coming years, with employers anticipating increased demand for occupations such as Web and Digital Interface Designers, HSE Officers, Network Administrators, Mechanical Engineers, Avionics Engineers, Aeronautical Engineers, Environmental Scientists and Statistical Analysts, over the next five years. Additionally, some of these jobs were identified as the most difficult STEM roles to fill and employers highlighted the low number of applicants for these positions and a low number of applicants with the required skills as key contributing factors. This indicates a clear need for targeted workforce development and training strategies in these STEM fields to meet the evolving needs of the industry. In addition, career guidance programmes should focus on these priority areas, with targeted incentives to encourage students to pursue higher education in these essential fields.

Furthermore, the study highlights a substantial gap between the skills demanded by employers and the level of skills among the current workforce. While most employers believed that it was important for employees to possess all 19 core skills to achieve business objectives, the majority rated the core competencies of existing employees as medium to high. This meant that the overall skill levels still fell considerably short of what was required to meet organisational goals. There were noticeable gaps, especially among existing employees, in critical areas such as strategic thinking, emotional intelligence, conflict resolution and negotiation, problem-solving and decision-making, and self-reflection and learning to learn. Furthermore, the majority of employers indicated that universities only prepared graduates for the world of work to some extent, this suggests that there is a disconnect between education and industry. The ability to address these gaps will be crucial for employers seeking to maintain their competitiveness and their ability to adapt to future challenges. While the majority of employers indicated that the mismatch of skills has not yet severely affected operations, there is a potential risk that these gaps could impact their future growth and sustainability if left unaddressed, especially as aviation becomes more modernised and the demand for more high-tech skills increases.

While the research findings reveal a gap in the skills of the current workforce and industry needs, there is encouraging news about the future workforce in terms of education, technological skills and environmental sustainability. Overall, employers reported a relatively higher level of skills among recent graduates compared to existing employees. Additionally, they rated basic skills for green jobs and basic digital skills higher among recent university graduates compared to existing employees. Furthermore, they encountered less difficulty in finding most skills among recent job applicants. This is a positive indication that the younger workforce is better equipped with the core skills needed for work in the 21st century. Moreover, this trend suggests that the emerging workforce is becoming more tech-savvy and climate-conscious, better prepared to operate in a digital and environmentally sustainable work environment. Therefore, to build on this progress, it is vital that education and training systems continue to develop these core skills among students, ensuring they are fully prepared for the future of work.

21st Century Skills within the aviation sector is critical not only for the sector's development but also for ensuring the broader economic growth and sustainability of the nation. The implications of these findings are significant. First, there is an urgent need for a strategic approach to workforce planning and development that aligns education and training programmes with the demands of the aviation industry. This includes improving the STEM curriculum at various levels to ensure a STEM talent pipeline that can effectively meet the industry's evolving needs. Collaboration between industry stakeholders; education and training institutions; and government will be key to developing relevant training and apprenticeships programmes. Through collaboration, there will be greater alignment between

education and training programmes and industry requirements, thereby, ensuring that the future workforce is equipped with the skills demanded by the industry and helping to reduce the skills gap.

Moreover, addressing the skill shortages in key STEM areas will require a multi-faceted approach, which would involve increased promotion of STEM education and careers to increase the talent pool in the aviation industry. To remain competitive in a rapidly evolving aviation sector, employers must prioritise upskilling and reskilling their existing workforce to adapt to technological advancements and changing work processes. These advancements require a workforce capable of managing and innovating within tech-enhanced environments. Reskilling initiatives not only equip employees to thrive in increasingly digital workplaces but also mitigate job displacement by aligning human capabilities with the demands of automation and smart aviation systems.

Ultimately, the findings from this study will inform policy decisions and guide the development of programmes aimed at addressing the skills disparities in the aviation sector. Data-driven policies and strategies will ensure that both the current and future workforce are well equipped to meet the challenges posed by technological advancements and global sustainability goals. By addressing these labour needs proactively, Trinidad and Tobago can increase the productivity, innovation and competitiveness of its aviation sector, driving growth, development and sustainability in this critical sector.

Appendix I: Occupational Groups

1. **Managers -** Includes occupations whose main tasks consist of planning, directing, coordinating and evaluating the overall activities of government, enterprises and other organisations, or of organisational units within them, and formulating and reviewing their policies, laws, rules and regulations. Formal preparation for these occupations may be supplemented or replaced partly or wholly by on-the-job training and/or experience. Examples**:** Managing Directors, Senior Officials, Hotel Managers and ICT Managers.

2. **Professionals -** Includes occupations whose main tasks require a high level of professional knowledge and experience. The main tasks consist of increasing the existing stock of knowledge, applying scientific and artistic concepts and theories, teaching about the foregoing in a systematic manner or engaging in any combination of these activities. Competent performance in most occupations in this occupational group requires skills which have been acquired from tertiary-level education leading to a university or post-graduate university degree. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Farming, forestry and fisheries professionals, Mechanical Engineers, Software Developers and Visual Artists.

3. **Technicians and Associate Professionals -** Includes occupations involving the performance of mostly technical and related tasks connected with research and the application of scientific or artistic concepts, operational methods, and government or business regulations. Most occupations in this occupational group require skills which have been acquired from post-secondary education leading to an award not equivalent to a first university degree. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Civil engineering technicians, Agricultural technicians, Ships' deck officers and pilots and Web technicians.

4. **Clerical Support Workers -** Includes occupations which involve the recording, organising, storing, computing and retrieving of information and performing a number of clerical duties in connection with money-handling operations, travel arrangements, requests for information and appointments. Most occupations in this occupational group require skills which have been acquired from secondary-level education lasting about five years. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Secretaries, Office Clerks, Hotel receptionists and Transport clerks.

5. **Service and Sales Workers -** Includes occupations involving personal and protective services related to travel, housekeeping, catering, personal care, or protection against fire and unlawful acts, or demonstrating and selling goods in wholesale or retail shops and similar establishments, as well as at stalls and in markets. Most occupations in this occupational group require skills which have been acquired from secondary-level education lasting about five years. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Travel Attendants, Conductors, Guides, Cooks, Waiters and Bartenders.

6. **Skilled Agricultural, Forestry and Fishery Workers -** Workers in this group grow and harvest field or tree and shrub crops, gather wild fruits and plants, breed, tend or hunt animals, produce a variety of animal husbandry products, cultivate, conserve and exploit forests, breed or catch fish and cultivate or gather other forms of aquatic life in order to provide food, shelter and income for themselves and their households. Most occupations in this occupational group require skills which have been acquired from secondary-level education lasting about five years. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Market gardeners, Crop growers, Poultry producers and Deep-sea fishery workers.

7. **Craft and Related Trades Workers -** Workers in this group apply specific knowledge and skills to construct and maintain buildings, form metal, erect metal structures or set machine tools. They make, fit, maintain and repair machinery, equipment or tools, carry out printing work, and produce or process foodstuffs, textiles, or wooden, metal and other articles, including handicraft goods. Most occupations in this occupational group require skills which have been acquired from secondary-level education lasting about five years. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Riggers, Cable splicers, Aircraft engine mechanics and repairers and Musical instrument makers and tuners.

8. **Plant and Machine Operators and Assemblers -** Workers in this group operate and monitor industrial and agricultural machinery and equipment on the spot or by remote control, drive and operate trains, motor vehicles and mobile machinery and equipment, or assemble products from component parts according to strict specifications and procedures. Most occupations in this occupational group require skills which have been acquired from secondary-level education lasting about five years. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Cocoa, coffee and chocolate processing machine operators, Assemblers, Mobile farm and forestry plant operators and bus drivers.

9. **Elementary Occupations -** Covers occupations which involve the performance of simple and routine tasks which may require the use of hand-held tools and considerable physical effort. Most occupations in this occupational group require skills which have been acquired from primary education. On-the-job training and/or experience may supplement formal preparation or replace it partly or wholly. Examples**:** Cleaners and helpers in offices, hotels and other establishments, Crop farm labourers, Kitchen helpers, Messengers, package deliverers and luggage porters.

Source: International Labour Organization. 2012. *International Standard Classification of Occupations*

Appendix II: STEM Occupations

STEM occupations include computer and mathematical, architecture and engineering, and life and physical science occupations, as well as managerial and postsecondary teaching occupations related to these functional areas and sales occupations requiring scientific or technical knowledge at the postsecondary level.

Science	Computer Science/ IT	Engineering	Mathematics
• Natural Sciences Managers • Animal Scientists • Food Scientists and Technologists • Soil and Plant Scientists • Biochemists and Biophysicists • Microbiologists • Zoologists and Wildlife Biologists • Biological Scientists, All Other • Conservation Scientists • Foresters • Epidemiologists • Medical Scientists, Except Epidemiologists • Life Scientists, All Other • Astronomers • Physicists • Atmospheric and Space Scientists • Chemists • Materials Scientists • Environmental Scientists and Specialists, Including Health • Geoscientists, Except Hydrologists and Geographers • Hydrologists • Physical Scientists, All Other	• Computer and Information Systems Managers • Computer Systems Analysts • Information Security Analysts • Computer and Information Research Scientists • Computer Network Support Specialists • Computer User Support Specialists • Computer Network Architects • Database Administrators • Database Architects • Network and Computer Systems Administrators • Computer Programmers • Software Developers	• Architectural and Engineering Managers • Architects, Except Landscape and Naval • Landscape Architects • Cartographers and Photogrammetrists • Surveyors • Aerospace Engineers • Agricultural Engineers • Bioengineers and Biomedical Engineers • Chemical Engineers • Civil Engineers • Computer Hardware Engineers • Electrical Engineers • Electronics Engineers, Except Computer • Environmental Engineers • Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	• Actuaries • Mathematicians • Operations Research Analysts • Statisticians • Data Scientists • Mathematical Science Occupations, All Other

Science	Computer Science/ IT	Engineering	Mathematics
• Agricultural Technicians • Food Science Technicians • Biological Technicians • Chemical Technicians • Environmental Science and Protection Technicians, Including Health • Geological Technicians, Except Hydrologic Technicians • Hydrologic Technicians • Nuclear Technicians • Forest and Conservation Technicians • Forensic Science Technicians • Life, Physical, and Social Science Technicians, All Other • Computer Science Teachers, Postsecondary • Mathematical Science Teachers, Postsecondary • Architecture Teachers, Postsecondary • Engineering Teachers, Postsecondary • Agricultural Sciences Teachers, Postsecondary • Biological Science Teachers, Postsecondary • Forestry and Conservation Science Teachers, Postsecondary • Atmospheric, Earth, Marine, and Space	• Software Quality Assurance Analysts and Testers • Web Developers • Web and Digital Interface Designers • Computer Occupations, All Other	• Industrial Engineers • Marine Engineers and Naval Architects • Materials Engineers • Mechanical Engineers • Mining and Geological Engineers, Including Mining Safety Engineers • Nuclear Engineers • Petroleum Engineers • Engineers, All Other • Architectural and Civil Drafters • Electrical and Electronics Drafters • Mechanical Drafters • Drafters, All Other • Aerospace Engineering and Operations Technologists and Technicians • Civil Engineering Technologists and Technicians • Electrical and Electronic Engineering Technologists and Technicians • Electro-Mechanical and Mechatronics Technologists and Technicians	

Science	Computer Science/ IT	Engineering	Mathematics
Sciences Teachers, Postsecondary • Chemistry Teachers, Postsecondary • Environmental Science Teachers, Postsecondary • Physics Teachers, Postsecondary • Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products • Sales Engineers		• Environmental Engineering Technologists and Technicians • Industrial Engineering Technologists and Technicians • Mechanical Engineering Technologists and Technicians • Calibration Technologists and Technicians • Engineering Technologists and Technicians, Except Drafters, All Other • Surveying and Mapping Technicians	

Source: Bureau of Labour Statistics, Department of Labour, US. 2021. *'Occupational Employment and Wage Statistics Survey'*

Appendix III: 19 Core Skills

1. **Analytical and critical thinking** - The ability to assess issues appropriately and adequately, and analyse relevant information to form an opinion or take an individual or a collective decision. The ability to think clearly, logically and rationally; to evaluate and interpret information; and to objectively analyse and evaluate an issue to make a judgement.

2. **Career management** - The ability to establish, plan and work towards the achievement of short- and long-term goals having both tangible and intangible success criteria. The ability to exchange information and ideas with individuals and groups that share a common interest, developing relationships for mutual benefit. The ability to use labour market information and intelligence to help identify work opportunities, understand work contexts and work conditions and apply job-search skills.

3. **Collaboration and teamwork** - The ability to work in diverse teams effectively and respectfully, assuming shared responsibility for outputs and demonstrating willingness and flexibility. The ability to identify and acknowledge the feelings, experiences and viewpoints of others, showing care, affection and kindness.

4. **Collect, organise and analyse information** - The ability to search, select, evaluate and organise information in order to effectively and efficiently mobilise relevant information. The ability to re-structure and model sourced information to produce personal interpretations of data.

5. **Communication** - The ability to listen effectively in order to decipher meaning; articulate thoughts and ideas effectively; exchange information; and express opinions, desires, needs and fears using oral, written and non-verbal skills in diverse environments for a range of purposes.

6. **Conflict resolution and negotiation** - The ability to reach a consensus between divergent interests by utilising logical argument and influencing others to cooperate, thereby resolving disagreement or dispute.

7. **Creative and innovative thinking** - The ability to utilise a wide range of idea creation techniques, so as to generate, articulate and apply inventive and original ideas and perspectives, thereby solving complex tasks and life issues through original ideas.

8. **Emotional intelligence** - The ability to identify, understand and manage one's own emotions, as well as helping others to do the same. It can comprise of four domains: self-awareness, self-management, social awareness, and

relationship management, which together have 12 competencies, including empathy, adaptability, achievement orientation and positive outlook.

9. **Energy and water efficiency** - The ability to use energy and water efficiently in ways that sustain the natural and physical environment.

10. **Environmental awareness** - The ability to understand and demonstrate an awareness of the physical environment and the need for it to be protected.

11. **Foundational literacies** - Literacy, numeracy, health, financial, scientific, cultural, and civic
    - Literacy: the ability to understand, identify, interpret, create and communicate effectively utilising inscribed, printed, or electronic signs or symbols for representing language.
    - Numeracy: the ability to understand and have the confidence and skill to work with numbers and mathematical approaches in all aspects of life.
    - Health literacy: the ability to gain access to, understand and utilise information in ways which promote and maintain good health.
    - Financial literacy: the ability to understand and apply financial management skills appropriately and to be able to make a financial plan, manage debt, calculate interest, understand the time value of money in order to make informed and effective decisions about personal financial resources.
    - Scientific literacy: the ability to understand those scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.
    - Cultural literacy: the ability to understand the perspectives of people from diverse backgrounds instead of considering one's cultural beliefs and practices as the correct ones.
    - Civic literacy: the ability to participate effectively in civic life through knowing the rights and obligations of residents at local, state and national levels.

12. **Operate safely in an online environment** - The ability to safely use basic online functions, applications, digital learning and communication platforms and media to explore, analyse and share information safely and ethically.

13. **Planning and organising** - The ability to plan and organise tasks in order to fulfil the job responsibilities satisfactorily within a given time and appropriately for a complex environment and situation.

14. **Problem-solving and decision-making** - The ability to identify and assess issues and problems, utilise available resources to generate and "brainstorm" potential solutions, evaluate the pros and cons of solutions and decide on a solution

15. **Self-reflection and learning to learn** - Self-reflection is the ability to apply reason to thought and behaviour, reflecting upon personal characteristics, assessing progress and identifying areas of for self-improvement. Learning to learn is the ability to apply the cognitive process of personal learning (what and how we learn) and to make use of guidance to continuously pursue learning new knowledge and skills and strive for improvement.

16. **Strategic thinking** - The ability to think conceptually, imaginatively, systematically and opportunistically, leading to a clearly defined set of goals, plans, and the new ideas required to survive and thrive in competitive and changing environments.

17. **Use basic hardware** - The ability to operate a personal computer, tablet, mobile phone or other digital device using the hardware functionalities, such as a keyboard, mouse, navigation buttons and touchscreen technology, where appropriate.

18. **Use basic software** - The ability to use and troubleshoot basic programs and applications, and able to word process, manage files, and access and adjust privacy settings.

19. **Waste reduction and waste management** - The ability to use, manage and dispose of resources in ways that sustain the natural and physical environment.

Source: International Labour Organization. 2021. *Global framework on core skills for life and work in the 21st century*

Appendix IV: STEM Competencies that Support TVET

1. **Creative/Inventive** - Thinking combine or connect ideas and information in unique and novel ways to generate new ideas, applications, products, processes, or services

2. **Critical Thinking** - Apply logic and reasoning to make sense of data or information by posing questions, putting forward arguments, exploring counterexamples, searching evidence, identifying relationships, recognising patterns and trends, evaluating pros and cons, and synthesising information

3. **Systems Thinking** - Understand the bigger context of a system, its emergent properties, and behaviour over time by knowing the connections, interrelationships, and dynamics of its constituent parts

4. **Problem Solving** - Identify feasible and efficient solutions to solve problems and to create new opportunities

5. **Transdisciplinary Thinking** - Put together relevant concepts and processes from multiple disciplines to generate solutions and new applications

6. **Decision-making** - Make a logical choice of action by looking at evidence, exploring alternatives, considering likely impact, evaluating options and providing justifications

7. **Computational Thinking** - Develop or apply computational models, tools and techniques to interpret and understand data, solve problems, and guide decision-making

8. **Ethical Thinking** - Use value system as guide for making choices that adhere to acceptable standards and protocols.

9. **Numeracy** - Apply mathematical ideas in personal, occupational, societal, and scientific contexts by reasoning, creating representations, or using measuring instruments or calculating tools

10. **Digital Literacy** - Search, evaluate, create, and share digital information using ICT device, equipment, tools, platforms, and applications for communication, collaboration, or problem solving

11. **Civic Literacy** - Contribute to the broader goals of the community by participating proactively in community affairs and observing social responsibility

12. **Cultural Literacy** - Be sensitive and respectful of the culture where an individual is immersed in

13. **Occupational Health Literacy** - Understand and apply occupational safety standards and protocols as well as take care of one's health and well-being to maintain productivity

14. **Entrepreneurial Literacy** - Detect an opportunity and make it grow in a sustainable way applying relevant knowledge, skills, and attitudes

15. **Organisational Literacy** - Negotiate way within an organisation by understanding its structure, dynamics of its members, communication channels, and appropriate procedures

16. **Communication** - Convey and exchange thoughts, ideas and information effectively through various mediums and approaches

17. **Collaboration** - Work effectively in a team to achieve shared goals either through face-to-face or virtual interaction

18. **Empathy** - Sense, share and respond positively to the feelings of another

19. **Agency** - Manage own behaviour and emotions to act professionally and independently, make choices freely, and pursue goals persistently

20. **Lifelong/Lifewide Learning** - Find opportunities to enhance one's knowledge and skills for continual learning; Maintain curiosity, passion, and growth mindset; Connect learning to a purpose and real-world context

21. **Resilience** - Thrive or prosper despite difficult circumstances; Be adaptable and flexible

22. **Leadership** - Lead others to attain shared goals by managing relationships, respecting diversity, recognising talent, and empowering people

23. **Service Orientation** - Support a culture of service excellence within the organisation by producing products or providing services that exceed the expectations of the customers

24. **Project Management** - Use resources (human, material, and time) wisely to deliver work-related tasks or projects

25. **Glocal** - Mindset be adaptive to global standards but remain responsive to local needs

Source: International Labour Organization. 2021. *STEM in TVET Curriculum Guide*

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