BAGONG PILIPINAS

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY

# SKILLS NEEDS ANTICIPATION

# WORKPLACE SKILLS AND SATISFACTION SURVEY (ROBOTICS SECTOR)

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| **4IR** | Fourth Industrial Revolution |
| **5IR** | Fifth Industrial Revolution |
| **AFMech** | Agricultural and Fisheries Mechanization |
| **AGV** | Automated Guided Vehicles |
| **AI** | Artificial Intelligence |
| **AMERIAL** | Advanced Mechatronics, Robotics, and Industrial Automation Laboratory |
| **AR** | Augmented Reality |
| **ASPBI** | Annual Survey of Philippine Business and Industry |
| **BOI** | Board of Investments |
| **CAGR** | Compound Annual Growth Rate |
| **CIG** | Competitiveness and Innovation Group |
| **CS** | Competency Standard |
| **DOST** | Department of Science and Technology |
| **DOST-ASTI** | DOST – Advanced Science and Technology Institute |
| **DOST-MIRDC** | DOST – Metals Industry Research and Development Center |
| **DTI** | Department of Trade and Industry |
| **EBT** | Enterprise-Based Training |
| **EIAPI** | Electronic Industries Association of the Philippines, Inc. |
| **HEI** | Higher Education Institution |
| **HEIs** | Higher Education Institutions |

| | |
|---|---|
| **IFR** | International Federation of Robotics |
| **ILO** | International Labour Organization |
| **IoT** | Internet of Things |
| **ISO** | International Organization for Standardization |
| **MCU** | Microcontroller Programming |
| **MNC** | Multinational Corporation |
| **MRSP** | Mechatronics and Robotics Society of the Philippines |
| **MSME** | Micro, Small, and Medium Enterprise |
| **NC** | National Certificate |
| **NEDA** | National Economic and Development Authority |
| **NTESDP** | National Technical Education and Skills Development Plan |
| **PDP** | Philippine Development Plan |
| **PHILFOODEX** | Philippine Food Processors and Exporters Organization, Inc. |
| **PLC** | Programmable Logic Controller |
| **PRC** | Professional Regulation Commission |
| **PSA** | Philippine Statistics Authority |
| **PSF** | Philippine Skills Framework |
| **PSOC** | Philippine Standard Occupational Classification |
| **R&D** | Research and Development |
| **ROAMER** | Robotics for Advanced and Mechanized Equipment for Research (Project) |
| **ROI** | Return of Investment |
| **ROPOs** | Regional Operations Processing Offices |

| | |
|---|---|
| **RPA** | Robotic Process Automation |
| **SCMAP** | Supply Chain Management Association of the Philippines |
| **SMD Line** | Surface Mount Device Line |
| **STEM** | Science, Technology, Engineering, and Mathematics |
| **TESDA** | Technical Education and Skills Development Authority |
| **TR** | Training Regulation |
| **TVET** | Technical and Vocational Education and Training |
| **UGV** | Unmanned Ground Vehicle |
| **UTPRAS** | Unified TVET Program Registration and Accreditation System |
| **VR** | Virtual Reality |
| **WSS** | Workplace Skills and Satisfaction Survey |

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# EXECUTIVE SUMMARY

The Skills Needs Anticipation – Workplace Skills and Satisfaction Survey (SNA–WSS) for the Robotics Sector is a pioneering initiative led by the Technical Education and Skills Development Authority (TESDA) to examine the readiness of the Philippine workforce in adapting to the growing presence of robotics and automation technologies. Conducted in alignment with the goals of the Philippine Development Plan (PDP) 2023–2028 and the PAGTANAW 2050 foresight agenda, the study aims to identify current skills gaps, anticipate future workforce demands, and assess employer satisfaction with the competencies of TVET graduates. The survey focuses on three priority robotics subsectors where adoption is either operational or emerging: Industrial Robotics – Electric/Electronics, Industrial Robotics – Food, and Service Robotics – Logistics.

Findings from the study reveal that the robotics workforce is largely composed of college graduates (approximately 60%), with a significant portion of professionals and technicians holding advanced degrees. The age distribution of employees is heavily concentrated in the 25–34 age range, indicating a youthful and evolving talent pool. However, the study highlights persistent mismatches between the skills currently taught in training institutions and those required by employers in robotics-intensive environments. Skills in robotics programming, automation systems, AI integration, and microcontroller unit (MCU) applications are cited as high-demand yet undersupplied across all subsectors.

Moreover, the study identifies several emerging skills that are expected to become essential over the next five to ten years. These include data analytics, systems integration, cybersecurity, and green robotics applications—signaling a shift towards interdisciplinary roles that blend engineering, environmental awareness, and digital competencies. Employers also noted that while TVET graduates are valuable, they remain underrepresented in the current robotics workforce. This reflects both a need to strengthen industry-academe linkages and to expand training offerings that are directly responsive to sectoral requirements.

In addition to technical gaps, the study uncovers structural challenges in workforce development, such as limited access to specialized training, insufficient exposure to real-world robotics applications, and a general lack of unified standards for robotics education. Despite these barriers, many facilities—especially multinational corporations—are investing in in-house learning and development programs, indicating a willingness to collaborate with public institutions like TESDA in crafting more targeted reskilling and upskilling pathways.

## Identified Gaps and Challenges

The SNA-WSS Survey shows a complex range of challenges hindering the growth of the robotics sector in the Philippines, particularly in the areas of workforce development, training system alignment, technology access, and industry readiness. Although robotics and automation present vast opportunities for productivity gains, the country's robotics ecosystem remains highly uneven—both geographically and sectorally—with adoption concentrated in export-oriented electronics firms in industrial zones such as Metro Manila and CALABARZON. Other sectors, such as food manufacturing and logistics, as well as regions outside key urban hubs, show minimal to no adoption, making it difficult to scale interventions and plan widespread workforce development strategies.

The concept of skills mismatch hinders the country's growth. While TVET institutions provide foundational technical training, the competencies required for robotics integration—such as programming, AI, machine vision, and microcontroller applications—are not yet widely embedded in existing curricula. This has led to a limited representation of TVET graduates in robotics roles, with most positions being filled by degree holders. Employers and validators of this survey cite a lack of targeted training regulations or national certificates (NCs) focused on robotics-specific tasks, which lowers their confidence in hiring TVET-qualified individuals. This constrains the potential contribution of TVET to the expansion of an inclusive workforce in robotics.

Compounding the issue is a multidisciplinary skills gap. As stated by a validator, robotics professionals must be adept in mechanical systems, electronics, programming, and control engineering. Current training offerings—whether from TESDA or higher education institutions—are often fragmented and fail to integrate these cross-functional skills into a cohesive learning pathway. This creates hiring difficulties for firms that require workers with broad technical knowledge, pushing some to invest in overseas training or hire multiple specialists to fill a single functional role—both costly and inefficient options.

In terms of cost and accessibility, training poses another major barrier, particularly for micro, small, and medium enterprises (MSMEs). As emphasized by the experience of one of the validators, robotics training programs are limited, expensive, and often centralized in urban areas. There are few standardized, nationally recognized robotics credentials. Although initiatives like the AMERIAL Project (DOST-MIRDC) and the Industry 4.0 Pilot Factory (DTI) aim to address these gaps, many smaller companies remain unable to access quality robotics training. This perpetuates the technological divide between large corporations with global linkages and MSMEs still reliant on manual labor and legacy systems.

Despite the global push toward sustainable automation, the robotics sector shows low readiness for integrating green practices and sustainability. Very few enterprises

incorporate green skills—such as energy-efficient system design, lifecycle assessment, and carbon tracking—into their workforce strategies. Although ESG (environmental, social, and governance) compliance is becoming increasingly relevant for global competitiveness and investment, it remains unfamiliar territory for the majority of robotics facilities. During validation meetings, stakeholders—especially in the electric/electronics subsector—stressed the urgent need for robotics companies to include sustainability measures in their workforce planning to keep up with new global supply chains and purchasing standards.

The sector also suffers from digital maturity and technological infrastructure gaps. Many small- to mid-sized firms operate outdated machinery and lack the foundational digital infrastructure required to implement even intermediate-level robotics solutions. This makes basic tasks such as sensor calibration, system diagnostics, or remote operation difficult to implement. These gaps not only delay robotics adoption but also create a cycle of technological stagnation and declining competitiveness. Validators noted that neighboring ASEAN countries are outpacing the Philippines in robotics deployment due to their more robust digital ecosystems and infrastructure.

Furthermore, robotics systems are highly dependent on large-scale capital investment, especially in the electronics sector. Full robotics deployment requires significant spending on programmable logic controllers (PLCs), integration software, industrial networks, and smart factory environments. These costs are often out of reach for MSMEs, which dominate the Philippine business landscape. This results in the clustering of robotics capabilities among large, multinational, and export-oriented enterprises, effectively excluding smaller firms from the productivity and innovation benefits of automation.

The study also revealed a weak pipeline for talent development and industry linkages. Validators emphasized that partnerships between training providers (TVET institutions and HEIs) and robotics companies are either limited or fragmented. This lack of coordination reduces opportunities for hands-on learning and hinders the integration of evolving industry practices into training curricula. Consequently, graduates enter the labor market with theoretical knowledge but without the practical competencies needed to operate real-world robotics systems—leading to job mismatches, retraining costs, and frustration among employers and employees alike.

## Recommendations and Policy Implications

The SNA-WSS Survey underscores the urgent need for a coordinated national effort to build a resilient and future-ready robotics workforce in the Philippines. At the core of this effort is the development of new robotics-related Technical and Vocational Education and Training (TVET) programs to address current and anticipated skills gaps. Priority job roles such as robotics technicians, MCU and PLC programmers, robotics operators, conveyor automation technicians, product test specialists, and robotics maintenance technicians currently lack corresponding training regulations or competency standards. In addition, emerging skills requirements driven by continuous innovation and research and development, particularly in subsectors such as logistics, demand new approaches through competency standards, microcredentials, and specialized training modules. These programs should be designed to strengthen reskilling and upskilling pathways for existing workers and professionals re-entering the industry, as employers often prefer training staff with prior field experience over hiring new workers in this fast-paced environment.

Promoting the recognition of TVET certification in the industry is equally critical to improve employment prospects for TVET-certified workers, even as many roles in robotics still require a bachelor's degree. This requires stronger job placement services, career guidance, employer engagement, and the institutionalization of Recognition of Prior Learning (RPL) to certify in-service workers and facilitate their transition into more advanced roles. TESDA must also work closely with the robotics sector to establish clear pathways from post-secondary education into robotics employment while promoting lifelong learning opportunities and continuous skills upgrading. Strengthening industry partnerships will be vital to these efforts. The expansion of Enterprise-Based Education and Training (EBET) across robotics subsectors—particularly food and electronics—will provide immersive, real-world exposure to learners, supported by General EBET, Apprenticeship, and Upskilling Programs adaptable to various workforce levels. Formalizing these partnerships through the establishment of Industry TVET Boards (ITBs) for robotics and its subsectors will ensure training remains relevant, industry-aligned, and scalable.

Sustainability must also be integrated into robotics workforce development. Green robotics standards should be embedded into curricula, with emphasis on energy efficiency, circular production, and environmentally responsible innovation. However, gaps remain in information dissemination regarding government-led green jobs initiatives. Stronger, more structured communication channels are needed, potentially through a centralized one-stop digital platform led by DICT to improve visibility and access to incentives, funding, and technical support. At the same time, inclusive growth requires urgent attention to the low participation of women in robotics-related STEM occupations. With less than 25 percent of the workforce in logistics and electronics facilities being women, stronger gender-sensitive recruitment, workplace equality practices, and awareness campaigns are necessary. TESDA, building on its advocacy for women in non-traditional sectors, must ensure gender considerations are mainstreamed into all robotics-related programs.

Building a strong training ecosystem also depends on capacitating trainers and assessors. TESDA should strengthen the pool of experts by developing regional lead trainers and facilitating training-of-trainers programs in robotics. This will help reduce

reliance on overseas training and ensure consistent, high-quality program delivery nationwide. Furthermore, robotics-related TVET must be implemented through the Area-Based and Demand-Driven approach, where TESDA Regional and Provincial Offices integrate robotics occupations into local priority skills programs based on sector-specific needs, especially in areas with concentrations of manufacturing and logistics facilities. Supporting these workforce initiatives requires access to modern equipment and technologies. To address the capital-intensive nature of robotics training and adoption, TESDA and industry must leverage existing government policies and incentives, including DTI-BOI's Strategic Investment Development Plan, DOST-MIRDC's Industry 4.0 initiatives, and the CREATE Law, to level the playing field for MSMEs and small-scale operators.

Collectively, these recommendations form the basis for a National Robotics Workforce Roadmap that aligns workforce development with industrial transformation, sustainability, inclusivity, and global competitiveness. The roadmap requires close collaboration between TESDA, DTI, DOST, DICT, and private sector partners to harmonize policy reforms, investment priorities, and workforce pathways.

Further, to ensure the sustainability of these efforts, refinements to the WSS survey methodology are also proposed, including improvements in survey design and sampling, stronger stakeholder engagement, better data interpretation, and the institutionalization of follow-up studies supported by a centralized data repository.

## Methodology

- A descriptive cross-sectional design was used to characterize the variables involved in the study. Following this, probability sampling was employed to capture various representatives of the population. Particularly, stratified random sampling was used to identify the sample size per renewable energy technology, and circular systematic sampling was used to select the actual respondents who will participate in the study.
- The SNA Manual developed by TESDA with the technical assistance of the International Labour Organization (ILO) served as a basis for the development of the survey questionnaire.
- The questionnaire is subdivided into 12 sections: (1) Profile of the company, (2) Basic organizational background, (3) Critical human resources, (4) Skills in your business, (5) Emerging skills associated with industry developments, (6) Green jobs and the transportation sector, (7) Learning and development, (8) Work and employment practice, (9) Business strategy, (10) Work processes and technology, (11) Organizational performance, and (12) Workforce matters.
- Respondents were sampled from 309 company facilities. The database is provided by partner government agencies, such as the Board of Investments (BOI), and industry associations, including MRSP National.
- The following subsectors were identified as the strata: Service Robotics - Logistics, Industrial Robotics - Electric/Electronics, and Industrial Robotics - Food
- A substitution replacement was used for some of the sampled facility where the enumerators had difficulty contacting or obtaining cooperation. However, there is no substitution applied for respondents who have expressed their non-commitment for reasons such as hectic schedules and prior commitments, among others.
- A subsectoral validation was also held with the participation of the respective stakeholders/industries in coordination with the Department of Trade and Industry - Bureau of Investments (DTI-BOI). This ensured the viability of the data provided by the respondents and the concerned stakeholders.
- The survey yields a sample size of 73 possible respondents with a 20.55% response rate.
- An enumerator conducted the survey using a self-administered online survey and phone interviews. In all modes of data collection, Jotform was utilized.
- For the proper implementation and standardization of the survey, the survey guide was developed and disseminated to the participating terminal facilities.
- A subsectoral validation was also held with the participation of the respective stakeholders/industries in coordination with the Department of Trade and Industry - Bureau of Investments (DTI-BOI).
- The survey was conducted from November to December 2024.
- The survey collected data on 8 participating companies across the four subsectors.

- The validated responses were used to generate tabulations.

## Highlights of the Results of Study

1. Profile of the Robotics Sector
   - Robotics functions are still in early stages of adoption.
   - In terms of workers working in a robotics facility, particularly in Food and Logistics - they employ hundreds of workers, but very few are engaged in the actual robotics-related functions.
   - Top occupational classifications of employees across all three robotics subsectors are Professionals (23.91%), Technicians and Associate Professionals (17.45%) and Plant and Machine Operators, and Assemblers (14.66%).
   - When broken down by subsectors, the results show that the Service Robotics - Logistics were dominated by Plant and Machine Operators, and Assemblers with 37.50%, Industrial Robotics - Food are dominated by Professionals with 40%, and lastly Industrial Robotics - Electric/Electronics were dominated by Craft and Related Trade Worker by 43.98%.
   - There are differences in the type of value chain in each subsector. Logistics relies on human dexterity and service orientation, Food manufacturing emphasizes supervisory and compliance functions, while Electronics focuses on machine based productivity driven by technical roles.
   - According to the total responses from robotics facilities, 100% are full-time employees. But also, it was highlighted that many in the Industrial Robotics - Electric/Electronic subsector are involved in investment promotion agencies.
   - In terms of the highest educational attainment, 37.44% of workers employed across the participating robotics facilities are College Level Graduate followed by Doctoral Degree/Level with 16.33%, and Master Degree/Level with 10.42%. However, it is important to note that during the validation process, it was confirmed that there are TechVoc graduates employed in the robotics facilities.
   - When broken down by subsector, the results show that Industrial Robotics - Food has the largest percentage of college graduates, at 75.00%. Service Robotics - Logistics accounts for 63.50%, while Industrial Robotics - Electric/Electronics comprises 41.25%.
   - In the Logistics subsector, while there are no reported TVET graduates, there is a small proportion less than 10% of TVET-certified employees among the total workforce. The Food subsector, on the other hand, shows a different pattern. There are reports of TVET graduates being present within the workforce, but no TVET-certified employees have been identified. In the Electronics subsector, the integration of TVET-certified and graduate employees is more pronounced. Some facilities report that 10% to 50% of their employees are either TVET graduates or certified, with certification often being a requirement prior to graduation.
   - In terms of age distribution, the majority of the workforce in robotics facilities falls within the 25 to 34 age bracket, comprising 62.00% of the total. This is followed by 18.13% aged 35 to 44, 12.50% aged 15 to 24, 4.83% aged 55 to 64, and 2.53% aged 45 and above. Among the subsectors, Industrial Robotics in the Food and Electrical/Electronics industries reported the highest

proportion of younger workers, with 12.50% and 25.00% of their workforce, respectively, belonging to the 15 to 24 age group.

- For all participating robotics facilities, the majority (52.00%) of employees earn a gross monthly salary of PhP27,000 to PhP33,999.

2. Recruitment in the Robotics Sector
    - In terms of vacancies in robotics facilities from 2023 to 2024, require highly educated candidates. A significant 87.00% of the job vacancies demand college graduates, followed by 6.67% requiring doctoral degrees and 4.17% requiring a master's degree. Meanwhile, only 3.33% of the vacancies require senior high school graduates, and a minimal 1.67% are open to Technical-Vocational (Tech-Voc) course graduates.
    - The majority of robotics facilities (80.56%) experienced an increase in employee size from 2023 to 2024, validators from different subsectors confirm this trend. In the food subsector, post-pandemic recovery is driving growth as enterprises rebound. In the electronics subsector, facilities report steady increases linked to expanded robotics and R&D activities, as well as the need for trainers due to ongoing workshops and projects. One validator noted a roughly 50% increase in employees aligned with facility expansions. The logistics subsector shows more mixed results, with some companies not yet fully adopting robotics and small SME growth reported.
    - Results show that promotions to managerial and supervisory positions are limited across all examined robotics subsectors.In the Service Robotics – Logistics sector, there is an even split, with 50% of organizations reporting no promotions and the remaining 50% indicating that less than 10% of their employees were promoted. Meanwhile, in both Industrial Robotics – Food and Industrial Robotics – Electric/Electronics, all organizations (100%) reported promoting less than 10% of their workforce.
3. Attrition in the Robotics Sector
    - 100% of respondents and validators said their employees left the robotics facilities due to resignation. Validators across subsectors highlight that resignations are largely driven by external factors such as better 1) overseas opportunities, 2) family reasons, an 3) higher local salaries.
    - In terms of the difficulty in replacing employees who resign within three months, the robotics subsectors show varying levels of workforce stability. In the Service Robotics – Logistics subsector, half of the facilities reported that less than 10% of resigning employees are hard to replace, while the other half indicated that more than 50% are difficult to replace—highlighting a split in workforce resilience. In contrast, the Industrial Robotics – Food subsector revealed that all resignations involve roles that are difficult to fill within three months, underscoring a heavy reliance on specialized workers. For the Industrial Robotics – Electric/Electronics subsector, 100% of resignations fall within the moderately difficult range (10–50% hard to replace), indicating some flexibility but also a continuing demand for skilled personnel.
    - Across all three subsectors the roles that are hard to replace are primarily technical, engineering, and IT-related. Validators agreed that the difficulty in replacing technical talent stems from a combination of skill mismatch, low supply of licensed professionals, high migration rates, and limited local training pipelines—especially for advanced roles in AI, robotics, and system integration.

- Reasons identified by the Industrial Robotics - Electric/Electronics subsector for fast turnover are: (1) Low wage offered compared to other companies, (2) Benefits offered are not competitive, (3) Long working hours, and (4) Poaching.

4. Performance of Employees
   - In terms of Employees by Performance Evaluation, it shows that 75% of employees are seen as ready for more demanding roles, indicating strong developmental capacity. Only 2.78% are viewed as underperforming, highlighting a generally capable workforce with opportunities for advancement.
   - There was no mention of employees who are unable to perform their job duties. Moreover, industries mentioned that there are also existing programs and support to improve employee performance.
5. Current and Future Skills Demand
   - There is a complete lack of both specialized technical skills and advanced robotics skills necessary for the subsector. These skills typically include robotics programming, system integration, troubleshooting, and operation of sophisticated equipment.
   - In terms of hard-to-fill requirements, the Service Robotics – Logistics subsector reported several roles that are particularly difficult to source. These include Supply Chain Automation Engineer, AI Specialist for Logistics Robotics, Robotics Logistics Consultant, and Conveyor Automation Technician. These positions require specialized knowledge in both robotics and logistics systems, making them more challenging to fill with readily available talent. In the Industrial Robotics – Food subsector, respondents identified Robotics Engineer, Robotics Technician, and Robotics Operator as hard-to-fill roles, highlighting the growing need for technical expertise in food processing automation. Meanwhile, in the Industrial Robotics – Electronics/Electrical subsector, the roles of Controls Engineer, Product Test Specialist, Computer Vision System Specialist, and Automation Technician were identified as difficult to fill. These positions often demand advanced technical skills and experience in high-precision, technology-driven environments, contributing to the talent gap in the sector.
6. Emerging Skills Associated with Industry Developments in the Robotics Sector
   - In terms of the Fourth Industrial Revolution, the emerging skills landscape in the next five years of the robotics sector will have a strong demand related to robotics, automation, and system integration. According to the data, Robotics Programming and Autonomous Systems top the list, with 87.5% of respondents expecting increased demand, followed closely by Artificial Intelligence in Robotics, Machine Vision, and Collaborative Robotics (Cobots) at 81.25%. However, these roles also present a significant hiring challenge, particularly Robotics Programming and Autonomous Systems, with 93.75% of respondents identifying them as hard-to-fill vacancies. This underscores a critical gap in specialized technical talent across industries.
   - Industry validators provided important contextual clarifications, suggesting revisions to skill classifications and terminology to better align with practical realities and training viability. For instance, “Robotics Programming” was recommended to be renamed “Robotics Integration Programming”, as programming a robot in isolation is typically brand-specific and often included in vendor training.

- In terms of why robotics facilities are not taking action on the emerging skills identified, the most significant barrier identified is the lack of physical infrastructure or facilities for conducting training and learning initiatives, reported by 75.00% of respondents. Additionally, 50.00% of facilities indicated budget constraints as a critical obstacle, limiting their ability to implement training programs. The same percentage also pointed to insufficient digital infrastructure as a hindrance to delivering effective learning and development activities.

7. Green Jobs in the Robotics Sector
   - In terms of Green Jobs, reveals that a majority of facilities (66.67%) have not yet taken action nor have plans to contribute to decarbonization, though 33.33% are planning to address this in the near future. In contrast, efforts toward protecting ecosystems and biodiversity, reducing consumption of energy, materials, and water, as well as minimizing waste and pollution, show more proactive engagement: 66.67% of facilities have already created or modified jobs to contribute in these areas, with the remaining 33.33% planning to act soon.
   - In the food subsector, although all surveyed facilities had received or sought government support, validators pointed out critical gaps in information dissemination. They emphasized that communication between government and private stakeholders is often informal or inconsistent.
   - To address this information gap, it was suggested that quarterly industry association meetings could be used as structured channels for agencies like DTI and DA to provide regular updates. Drawing from international examples, validators also recommended using official channels—such as chambers of commerce or a centralized “one-stop” government website—to improve access to programs, training, and incentives. The DICT was identified as a key player in supporting the development of such a digital platform.
8. Policies/Programs for the Employees in the Robotics Sector.
   - Employees supported by career and structured succession planning policies for current and future development in robotics practices show varying levels of support across different robotics subsectors.
   - In terms of structured programs for high-potential employees are fully implemented in the Industrial Robotics – Food and Electric/Electronics sectors (100%), with tailored development plans and further education support noted in Food. In Service Robotics – Logistics, only 50% of facilities offer such programs, with a focus on leadership training and performance improvement strategies.
9. Performance of TVET Graduates and/or TVET Certified Employees
   - The distribution of TVET graduates and certified employees across robotics subsectors varies significantly, reflecting different levels of technical-vocational skills integration in the workforce.
   - In terms of satisfaction with the work and performance of TVET graduates and certified workers, results show that satisfaction appears highest in logistics and electronics, where certification is either valued or required, while the food sector exhibits a more cautious or critical view of the current standards and readiness of certified workers.

# CHAPTER 1
# INTRODUCTION

Robotics has significant potential to improve the quality of life, especially in developing countries like the Philippines. In the Fourth Industrial Revolution, otherwise known as 4IR or Industry 4.0, rising global competition and increasing labor costs have driven Philippine industries to adopt automation through robotics and artificial intelligence (AI) to enhance productivity and reduce expenses. This shift is leading to significant transformative changes.

In the Philippine setting, the integration of robotics and AI into various sectors is steadily gaining momentum. Industries such as manufacturing, agriculture, healthcare, and logistics are beginning to harness these technologies to streamline operations and meet rising demands. Recognizing this shift, the Department of Trade and Industry (DTI) has identified robotics as one of the strategic technologies essential to advancing an inclusive, resilient, and technology-driven economy (DTI, 2020). National strategies such as the Philippine Development Plan (PDP) 2023–2028 underscores the importance of advancing research and development, technology, and innovation as key drivers of long-term economic growth and social progress. It highlights the need to develop and implement roadmaps for emerging technologies, including robotics, to enhance industrial competitiveness and foster innovation ecosystems. Additionally, the PAGTANAW 2050 foresight agenda also emphasizes the critical role of robotics in advancing the nation's development. It highlights the necessity for strategic planning and investment in these technologies to enhance productivity and competitiveness across various sectors. (National Economic and Development Authority, 2023; National Academy of Science and Technology, 2021).

However, despite the promising benefits and the growing integration of robotics, a recent scoping meeting with stakeholders in the Philippine robotics sector highlighted several key challenges hindering widespread and effective adoption. Among the barriers are significant skills gap concerning the specialized expertise needed for operators, technicians, and engineers; the high cost of training, particularly for MCU Programming and Integration; a general lack of fundamental technical and programming skills within the workforce; the complexity of forming multidisciplinary teams for robotics innovation, requiring diverse skill sets in mechanical, electronics, AI, and analytics; the substantial initial investment required for robotics implementation; and the observation that robotics is not yet highly promoted across industries in the Philippines.

These challenges underscore the context within which the rapid adoption of robotics also raises broader concerns, notably the potential displacement of workers, especially in industries where routine or manual tasks are susceptible to automation.

While robotics can increase labor productivity and create new high-skilled job opportunities, it also necessitates a workforce that is adaptable, resilient, and equipped with relevant skills. Fallert (2018) notes that large export-oriented industries such as electronics and machinery - comprising over 60% of the industry share - are highly susceptible to automation, which could significantly alter job structures and skills demand. However, the current education and training systems in the Philippines face difficulties in keeping pace with these changes.

The International Labour Organization (2021) highlights a persistent mismatch between technical skills and the requirements of emerging technologies, particularly in developing countries. In the Philippines, findings from the Department of Science and Technology's (DOST) Advanced Mechatronics, Robotics, and Industrial Automation Laboratory (AMERIAL) point to a shortage of skilled workers capable of operating and maintaining new automated systems due to gaps in training alignment, course accessibility, and follow-up support (DOST, 2022). These limitations, along with the absence of unified standards for robotics application, further constrain the effective adoption of these technologies.

These developments point out the urgent need for a proactive and data-driven approach to workforce development. Understanding the current landscape of robotics adoption, its implications for employment, and the specific skills required across various sectors is critical to crafting effective policies and interventions. Government agencies, educational institutions, and private sector stakeholders must work collaboratively to design and implement targeted upskilling and reskilling programs that prepare the Filipino workforce for the future of work.

This report will examine the impact of robotics on the Philippine labor market, focusing on emerging industry demands, skills mismatches, and policy responses. It examines the sectors where robotics is being applied, identifies barriers to widespread adoption, and analyzes the readiness of the current workforce to meet these challenges. Through this assessment, the report seeks to support informed decision-making and contribute to the development of a robust, future-ready skills ecosystem aligned with national development goals.

## 1.1 Objectives of the Study

The Technical Education and Skills Development Authority conducted the Skills Needs Anticipation-Workplace Skills and Satisfaction Survey (SNA-WSS) for the Robotics Sector.

Generally, this study intends to determine the employers' desired skills and competencies of its workers in the next five years, as well as to determine their level of satisfaction with the competencies and performance of TVET graduates in the Robotics Sector.

The survey analysis will offer insights to align TVET programs with the evolving demands of the labor market and anticipate requisite skills in the Robotics Sector. This data will serve as foundational evidence for discussions and policy reviews aimed at enhancing and refining the system to better address industry needs.

Specifically, it seeks to:

- Provide quantitative measures on skills, (e.g., skills gaps, skills shortages, skills utilization in the workplace); workforce need for reskilling and upskilling;
- Assess factors that are likely to impact skills utilization (i.e., outdated curricula, lack of training provided);
- Identify emerging future skills; and
- Determine the satisfaction of employers on the competencies and performance of TVET graduates in the workplace.

## 1.2 Scope and Limitations of the Study

### Scope

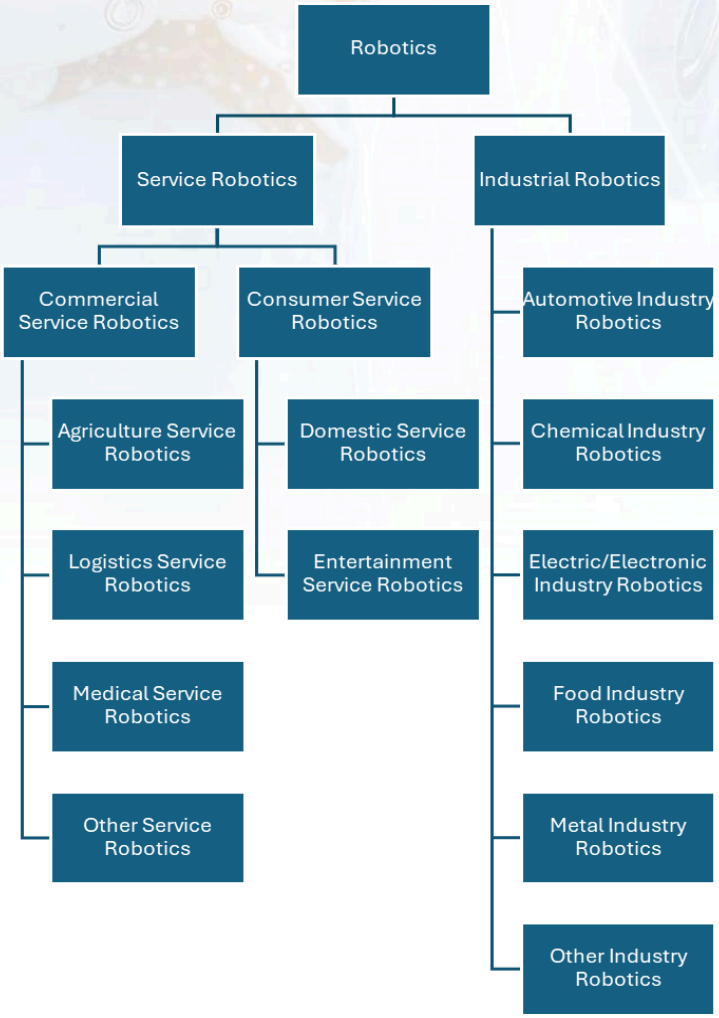
This study aligns with the goals of the NTESDP 2023–2028, which integrates robotics and other emerging technologies into curriculum development to prepare the Filipino workforce for the 5th Industrial Revolution. Specifically, the study seeks to address the skills needs of the robotics sector by examining the current state, practices, and workforce demands in industries where robotics is actively utilized.

To ensure the relevance and accuracy of findings, the survey population was drawn from databases maintained by national government agencies and industry associations directly related to robotics applications.

For the purpose of this study, the unit of analysis is the “facility”—defined as any location where robotics systems are in operation. A facility may include, but is not limited to, factories, warehouses, stores, harbors, airports, and other relevant environments where robotics is deployed.

According to ISO 8373:2012 and the International Federation of Robotics (IFR), robots are categorized by intended application into Industrial Robotics and Service Robotics. Industrial robots are automatically controlled, reprogrammable, and multipurpose machines, typically programmed in three or more axes. These robots can be stationary or mobile and are primarily used in industrial automation applications. In contrast, service robots are designed to perform useful tasks for humans or equipment, either fully or semi-autonomously, outside of industrial automation settings. Service robotics is further divided into Consumer Service Robotics, intended for use by the general public without requiring professional training, and Professional (or Commercial) Service Robotics, intended for use by trained operators in commercial or institutional environments.

**Figure 1**
*Robotics Framework*




*Source: Robotics - Worldwide | Statista Market Forecast.*

The study aimed to cover subsectors across both industrial and service (professional/commercial) domains of robotics following the selection criteria:

1. Industries that will be most affected by automation;
2. Industries that would benefit the most from the applications of robotics;
3. Priority industries/clusters of the other government agencies relative to robotics; and
4. Relevant policies/laws that are anticipated to contribute to the growth of the robotics industry in the Philippines.

Relative to this, four robotics subsectors were initially identified as part of the survey namely:

- Service Robotics - Agriculture Subsector
- Service Robotics - Logistics Subsector
- Industrial Robotics - Electric/Electronic Subsector
- Industrial Robotics - Food Subsector

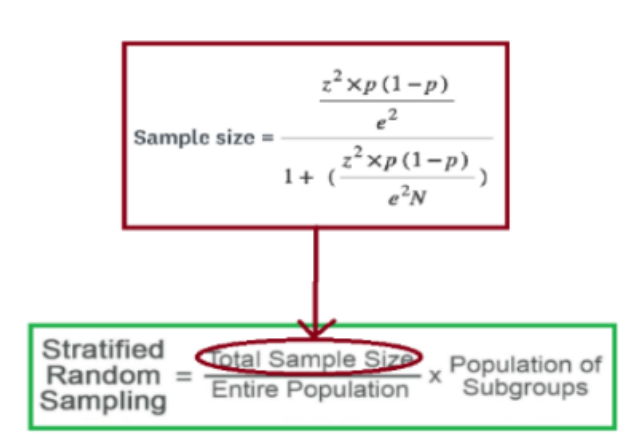
Within the industrial domain, the Industrial Robotics - Electric/Electronic Subsector was examined in terms of its value chain, which includes product and service development, manufacturing, maintenance, repair, and assembly. Similarly, the Industrial Robotics - Food Subsector focused on activities such as food processing, quality control, safety, and storage. On the service robotics side, the Service Robotics - Agriculture Subsector was examined in terms of its value chain, which includes Input Supply, Farming and Production, and Post Harvest. Lastly for the Service Robotics - Logistics Subsector covered operations involving storage and inventory management, as well as warehousing and distribution.

Although Service Robotics - Agriculture Subsector was originally included as part of the service robotics domain, it was later excluded from the final analysis. During the series of industry consultations, technical experts from other robotics applications noted that there is still a lack of operational robotics applications in the agricultural sector in the Philippines. At present, the mentioned subsector remains largely at the mechanization stage, with robotics-related efforts still limited to research and development. As a result, no facilities using robotics in agriculture were identified during the scoping and data-gathering phases.

## Limitations

In addition, the survey is generally limited to robotics facilities, with no available level of data disaggregation based on the facility size. The study recognizes that this limitation will have an implication on the granularity and interpretation of the survey results. Provided further, that the level of robotics application, maturity, and facilities' capacity will be directly influenced by its scope and facility size.

Furthermore, the response rate across all robotics subsectors was relatively low, remaining a persistent challenge in employer-focused surveys despite multiple follow-ups. Given the parameters of a 5% margin of error, a 95% confidence interval, and a z-score of 1.96 (based on the z-score table), the target sample size was 73 for a total population of 309 establishments. However, the actual number of responses received was only 15.




The table below provides a detailed breakdown of the sub-populations, sample size allocations, actual response counts, and actual response rates for the surveyed subsectors:

**Table 1.**
*Robotics Survey Statistics*

| Calculation | Service Robotics - Logistics | Industrial Robotics - Food | Industrial Robotics - Electric/Electronics | Total |
|---|---|---|---|---|
| Sub-Population | 13 | 240 | 56 | **309** |
| Sample Size Allocation | 3 | 57 | 13 | **73** |
| Actual Response Count | 5 | 4 | 6 | **15** |
| Actual Response Rate | 166.67% | 7.02% | 46.15% | **20.55%** |

Due to these extremely low and uneven response rates across the transportation subsectors, critical indices such as the Skills Content Index, People Focus Index, and Discretionary Effort Index could not be constructed in this study. Although the target sample size was 73 (based on a 5% margin of error and 95% confidence level), the actual response rate was only 20.55%, with particularly low participation from the Industrial Robotics-Food (7.02%) and Industrial Robotics - Electric/Electronics (46.15%) subsectors, While only the Service Robotics - Logistics subsector showed a notably higher response rate (166.67%), this figure was derived from a very small population base of only 5 establishments, significantly limiting its statistical value and representativeness. Consequently, these limitations restrict the study's ability to draw generalized conclusions about skills utilization and organizational practices within the transportation sector based solely on quantitative survey data.

Additionally, the survey was limited to identifying robotics facilities, without disaggregation of data based on facility size. This limitation will have implications for

the granularity and interpretation of the survey results, as the level of robotics application, maturity, and facility capacity are directly influenced by facility size and scope.

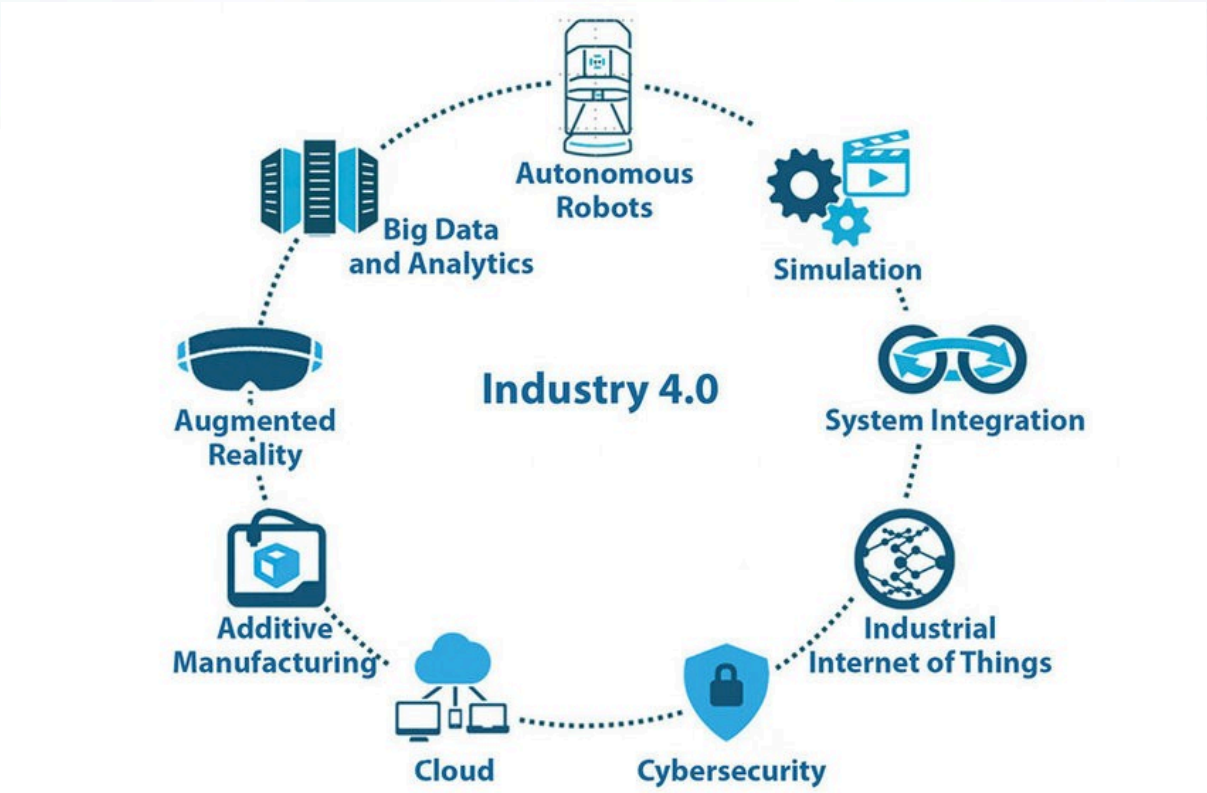
Nevertheless, the study greatly benefited from more in-depth insights garnered during validation workshops and stakeholder consultations. These rich qualitative inputs have been integrated into the final analysis, significantly enriching the overall findings.

# CHAPTER 2
# REVIEW OF RELATED LITERATURE

## 2.1 Overview of Robotics Technology

Robotics is a key driver of the 4IR, a period characterized by the fusion of technologies that blur the lines between the physical, digital, and biological worlds (McGinnis, 2020). By enabling automation, increased efficiency, and improved production processes, robotics plays a central role in shaping global economic and societal transformations during 4IR.

**Figure 2**
*The Fourth Industrial Revolution*




*Source: Palka and Ciukaj (2019)*

As shown in the figure, robotics plays a pivotal role in the 4IR, not as a standalone technology, but as one deeply interconnected with other digital innovations.

### Classification of Robotics

To better understand how robotics shapes the Fourth Industrial Revolution, it is essential to first examine the key types of robotics technology and their respective functions.

According to ISO 8373:2012 robots are classified into **two classifications according to their intended application.** Industrial robots are used for industrial automation applications. It is automatically controlled, reprogrammable, and multipurpose manipulator that is programmable in three or more axes; can be either fixed in place or mobile for use in industrial automation applications. Meanwhile, a service robot performs useful tasks semi or fully autonomous to provide services beneficial for humans or equipment in various settings excluding industrial automation applications. Service robotics is then further classified into commercial and consumer services robotics.

As defined by International Federation of Robotics (IFR), a consumer service robot is a service robot built for use by everyone. Neither operation nor setup require a professionally trained operator. While a professional service robot is a service robot built for use by trained professional operators.

Meanwhile, **industrial Robotics** were among the earliest to adopt robotics technology, given the typically dull, dangerous, and dirty nature of the work. In this sector, robots collaborate with human workers to increase production speed while maintaining product quality.

## 2.2 Robotics Application in the Philippines

In the Philippine context, robotics technology is being applied across several key industries and sectors. These include:

- Industrial Automation, where robots are used to improve efficiency, precision, and productivity in manufacturing processes, such as with robotic arms on assembly lines, automated guided vehicles (AGVs) for logistics, and automated inspection systems;

- Agricultural Robotics, which help automate tasks like planting, harvesting, and crop monitoring, addressing both productivity challenges and labor shortages;

- Healthcare Robotics, utilized in surgeries, rehabilitation, and patient care—particularly through surgical robots for minimally invasive procedures and assistive technologies for elder care;

- Education and Research, where robotics is a growing field of study and innovation in universities and research institutions, driving the development of locally adapted technologies; and

- Emerging Applications, where robotics is being adopted in service industries (e.g., cleaning robots in hospitality), entertainment (e.g., robotic attractions),

and household use (e.g., domestic robots for chores).

This diverse and expanding application of robotics demonstrates the growing role of automation technologies in addressing both local industry demands and global innovation trends.

The adoption of robotics is still in its early stages but is gaining momentum as industries and government agencies respond to the demands of the Fourth Industrial Revolution (DOST-PCIEERD, 2021). Robotics applications are gradually expanding beyond manufacturing into sectors such as agriculture, healthcare, education, and logistics. Government-led initiatives, including the Department of Science and Technology's AMERIAL project, are actively promoting local research and capacity-building in robotics technology (Department of Science and Technology - Metals Industry Research and Development Center, 2022). Similarly, the Department of Trade and Industry - Competitiveness and Innovation Group (DTI-CIG) has conducted studies related to Industry 4.0, focusing on the impact of advanced technologies on Philippine industries. These studies aim to understand how companies can leverage Industry 4.0 technologies to improve competitiveness and boost economic growth. As part of their initiative DTI-CIG has launched its Industry 4.0 Pilot Factory to showcase emerging technologies, including robotics, to improve industrial competitiveness (DTI-CIG, 2020). These efforts reflect a growing recognition of robotics as a key driver of innovation and a critical component of national economic development.

Building on these national efforts, specific industries such as electronics manufacturing are already encountering increasing technical demands that robotics can address. The electronics manufacturing industry is experiencing growing complexity due to the continuous miniaturization of components and circuitry. Challenges such as high component density, tighter spacing, multilayered designs, and the need for accurate placement of delicate parts demand more advanced production solutions (Kingatua, n.d.). Industrial robotics offers a valuable response to these demands, as automation can be effectively integrated into nearly all stages of electronics production—from material and component handling to assembly, etching, quality inspections, and final testing.

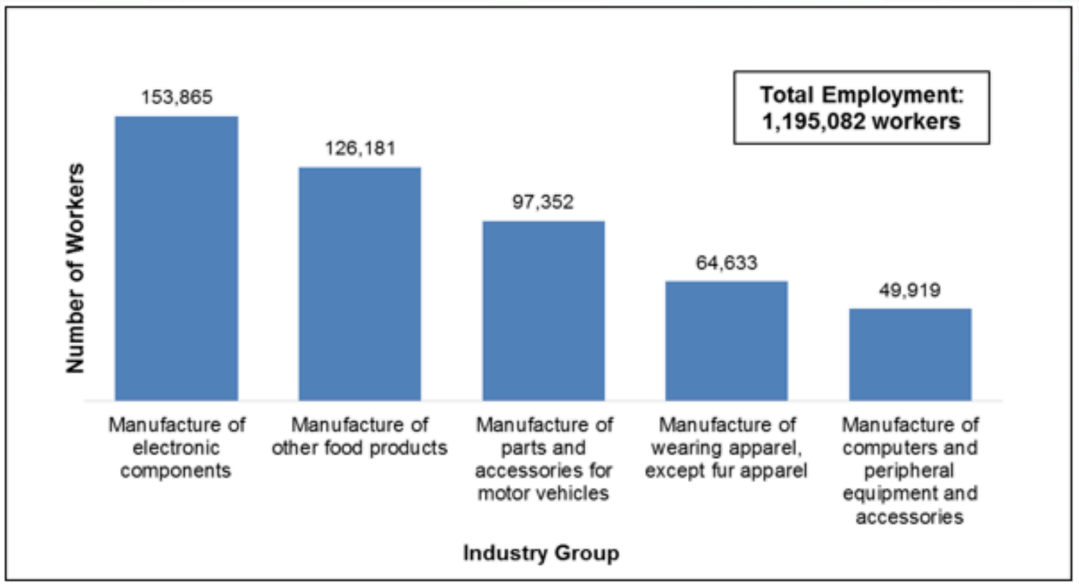
Besides electronics manufacturing, the food manufacturing and processing industries are also adopting cost-effective automation solutions to achieve higher production volumes compared to traditional methods. As manual labor is now seen as an outdated approach, there is a growing preference for robotic handling and manufacturing systems. These systems are commonly used in applications such as picking, placing, packaging, and palletizing (Iqbal, Jamshed & Khan, Zeashan & Khalid, Azfar. (2017)).

Automation is now essential for manufacturers to stay competitive. Robotic automation helps businesses cut costs, boost productivity, reduce errors and waste; thereby increase the revenue. Despite these benefits, many are hesitant to implement automation (Gotfredsen, 2018). Particularly as the reduction in labor costs due to automation is anticipated to cause a decrease in the number of employees.

In 2022, the manufacturing sector employed 1.20 million workers and among the industry groups, the manufacture of electronic components had the highest employment with 153,865 workers (12.9%). This was followed by the manufacture of other food products with 126,181 workers (10.6%) and the manufacture of parts and accessories for motor vehicles with 97,352 (8.1%).

**Figure 3**

*Distribution of Employment of the Top Five Industry Groups for Manufacturing Section: Philippines, 2022*




*Source: Philippine Statistics Authority, 2022 ASPBI (Preliminary Results)*

The study by Foodics (2023) emphasizes that, with the growing global population and increasing demand for food, suppliers are looking for ways to meet this demand while improving food quality. As a result, food business owners are increasingly turning to various automated technologies including in production, processing, preservation, packaging, distribution and other activities. The global food industry is undergoing a rapid transformation due to robotic technologies, which are projected to have a compound annual growth rate (CAGR) of 4.36% between 2024 and 2028 (Statista, 2024).

In terms of government-related initiatives, Industry 4.0 Pilot Factory facility of the Department of Trade and Industry will act as an interactive learning hub, showcasing advanced technologies such as digital twins, industrial software, and automation systems, supported by various technology partners. Additionally, the AMERIAL

Project by DOST impacts robotics in manufacturing by facilitating technology upgrades, promoting information exchange, and ensuring ongoing evaluation of manufacturers.

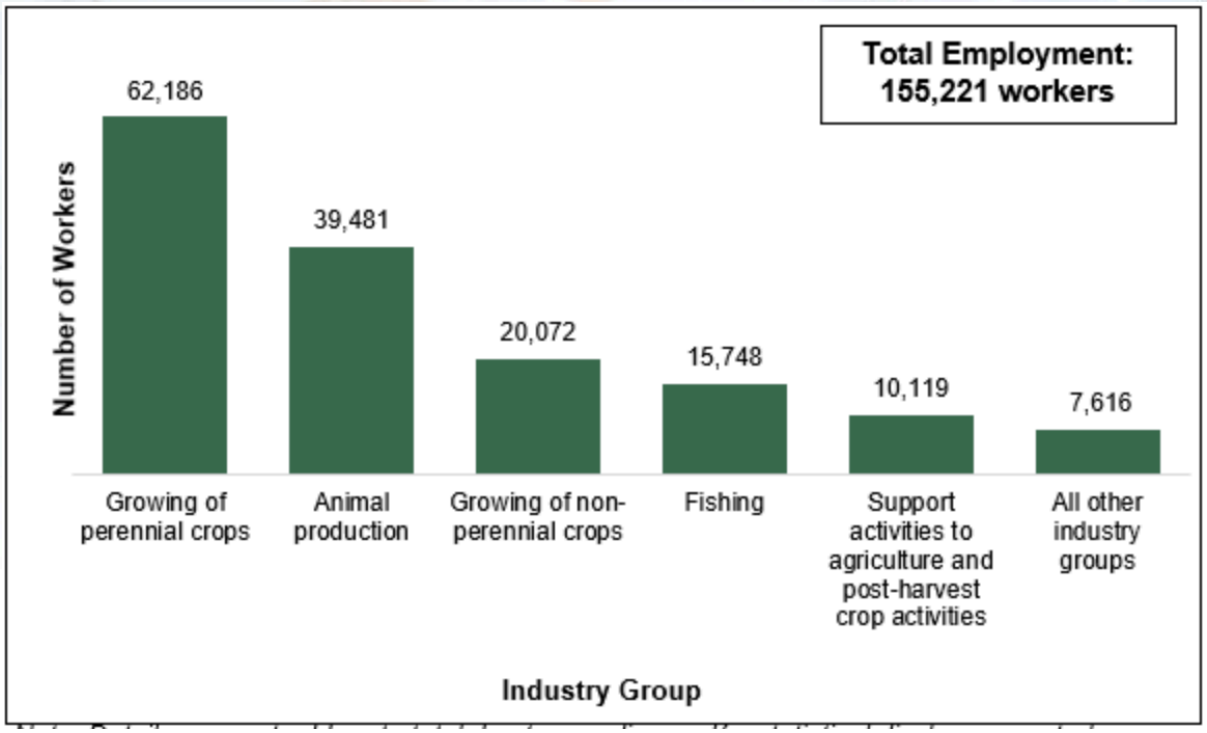
On the other hand, in the realm of **Service robotics**, particularly the **commercial service robotics**, agriculture service robotics is the largest contributor to this automation. Meanwhile, logistic service robotics has become essential for efficiently meeting customer demands and maintaining competitive pricing. Robotics are exploring their potential across the entire agricultural value chain. These robots must operate effectively in unpredictable environments while maintaining existing work standards. Agricultural robots vary widely in design, development, and assessment, with differences in objectives, structures, methods, techniques, and sensors (Bechar & Clement, 2016, as cited by Agustin, 2022).

Due to its terrain and tropical climate condition, farming and fisheries have been the largest agricultural sub-sectors in the Philippines. Crop production, particularly of sugarcane, palay or rice, coconut, and bananas were among the highest nationwide and were also among the top export products. In recent years, oils, fruits and nuts, along with animal or vegetable fats contributed the largest share of the total agricultural exports in the Philippines (Statista, 2024). Ironically, the country also heavily relies on rice imports in addition to its local produce, provided the high rice consumption of Filipinos.

The 2022 Annual Survey of Philippine Business and Industry provides employment figures for the agriculture, forestry, and fishing sector, totaling 155,221 individuals. The largest portion of this workforce (40.1%, or 62,186 workers) was engaged in the growing of perennial crops. Animal production was the second-largest employer with 25.4% (39,481 workers), while the cultivation of non-perennial crops accounted for 12.9% of the sector's employment, with 20,072 workers.

**Figure 4**

*Distribution of Employment for Agriculture, Forestry, and Fishing Section by Industry Group: Philippines, 2022*




*Source: Philippine Statistics Authority, 2022 ASPBI (Preliminary Results)*

As such, with the high rice consumption locally, high export demand, the magnitude of employment in agriculture accounting to around 24% share and characterized by low productivity, the agricultural farming would likely be affected by the introduction and development of robotics. The government together with the private sector could work together to support and prioritize agricultural farming in terms of skills retooling/skills upgrading of the existing workforce; training of would be new entrants in agricultural farming and in post-harvest crop activities.

Other government agencies also recognize the potential of automation and robotics application to the agriculture sector. Several existing initiatives include the ROAMER Project developed by the Department of Science and Technology - Advanced Science and Technology Institute (DOST-ASTI), which created a prototype autonomous unmanned ground vehicle (UGV) designed to track, survey, and map banana farms. Additionally, the AMERIAL Project, led by DOST-MIRDC, aims to enhance the agricultural sector's preparedness for the Fourth Industrial Revolution (4IR) by incorporating robotics. Furthermore, TESDA conducted a study on Smart Farming to help Filipino farmers adapt to and stay informed about advancing agricultural technologies.

On the other hand, logistic service robotics has become essential in the industry, particularly due to the rapid growth of e-commerce. According to DHL Trend

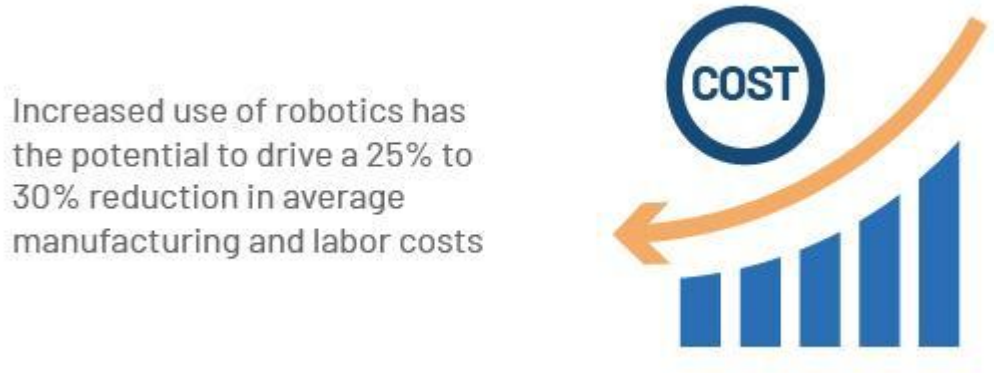
Research in 2016, the logistics sector has experienced a significant increase in robotics usage, driven by the need for efficiency in tasks such as picking, packaging, and sorting. These tasks, when performed manually, are often time-consuming and prone to errors. Robots and automated systems, however, can handle these jobs with unmatched speed and precision, reducing order fulfillment delays and minimizing mistakes.

Automated warehouses and robotic handling systems are key examples of how robotics is helping companies scale operations, reduce turnaround times, and improve accuracy. This allows workers to focus on more skilled tasks, enhancing overall productivity. The International Labour Organization reports that the Philippine eServices sector, including e-commerce and business process management, grew by 13.8% during 2020-2021, largely driven by the digital shift during the health crisis.

Report Ocean, a research firm focusing on labor market reseraches, emphasized the importance of efficiency in the rapidly evolving logistics and warehousing industry. Robotics is revolutionizing storage and distribution processes by optimizing space utilization and streamlining workflows, which further drives down overall costs.

**Figure 5**

*Warehouse Automation Statistics*




*Source: Zhenhub | Data from Important Warehouse Automation Statistics of Meteor Space*

Statistics from Zhenhub on Important Warehouse Automation Statistics of Meteor Space indicated that the increased use of robotics has the potential to drive a 25% to 30% reduction in average manufacturing and labor costs.

From service to industrial robotics, the following are existing laws that may facilitate in the adoption of robotics:

- Republic Act 10601 Agricultural and Fisheries Mechanization Law of 2013 (AFMech Law)
- Republic Act 11293 Philippine Innovation Act - Innovation fund for MSMEs (2019)

- Republic Act 11337 Innovative Startup Act- promotion of innovations, startup venture fund, support R&D (2019)
- Republic Act 10055 Philippine Technology Transfer Act ( 2009)
- Republic Act 11927 Enhance the Philippine Digital Workforce Competitiveness (2022)
- Senate Bill 1255 Integrating Robotics Application in the Teaching of Secondary Science Education (2012)

To summarize, two main sub-sectors were identified within the realms of commercial service robotics and industrial robotics. In commercial service robotics, the focus is on agricultural service robotics and logistics service robotics. On the industrial robotics front, the primary sectors expected to benefit are electronic manufacturing and the food industry, with robotics offering substantial potential for enhancing productivity and efficiency.

The adoption of robotics in sectors like agriculture and logistics is increasingly supported by government initiatives and legislation, recognizing the critical role of automation in enhancing productivity and maintaining competitiveness. In agriculture, for example, robots are being utilized to improve efficiency and output, which is particularly vital given the high local demand for staple crops like rice in the Philippines. In logistics, the use of robots is essential for meeting the demands of the e-commerce boom, where precision and speed in tasks like picking, packing, and shipping are paramount. However, the application of robotics technology in the agriculture subsector, specifically in the case of human resource development and skills needs anticipation will be an area to explore once the industry moves past research and development to its actual operationalization in the Philippines.

On the other hand, manufacturing, particularly electronics and food manufacturing, has the highest proportion of automatable tasks. Electronic Industry Robotics can streamline production processes, reduce labor costs, and enhance product quality. Also, Electronics manufacturing is a major contributor to the Philippines' manufacturing output and exports, representing a significant opportunity for robotics integration. While the Food Industry Robotics can produce large quantities of products in a short period of time and they ensure product quality and safety. The operations are more effective and efficient.

# CHAPTER 3
# METHODOLOGY

## 3.1 Research Methodology

The main objective of the study is to determine the current skills supply and demand in the workplace, emerging skills requirements and competencies, and the existing job-skills mismatches, which can help in the projection of future skills needs in the Robotics sector.

Additionally, the study will help complement the strategies indicated in the PDP 2023-2028, particularly under Chapter 4: Increase Income-Earning Ability and Chapter 6: Revitalize Industry. The study is also in support of the DTI's industrialization priority cluster industries.

Thus, to better assess the situation of the robotics workforce vis-a-vis the industry demand and in light of the challenges and opportunities in automation, artificial intelligence, and sectoral landscape, a descriptive cross-sectional design was used.

## 3.2 Questionnaire

The research instrument, developed with the assistance of the International Labour Organization (ILO) and including minor enhancements from the previous year's survey round, will serve as the basis for the 2024 survey questionnaire. However, modifications were made based on the nature and characteristics of the Robotics Sector and the conducted industry scoping to better contextualize the industry's environment.

Based on the results of the scoping meetings conducted for the sector, the developed questionnaire was validated by the industry associations/organizations through a validation meeting conducted last September 2024. Particularly, the following organizations/industry associations were involved in the development and validation of the research questionnaire:

**Service Robotics**

- Philippine Multimodal Transport and Logistics Association, Inc.
- Mechatronics and Robotics Society of the Philippines (MRSP) - NCR
- Department of Trade and Industry - Bureau of Investment (DTI-BOI)

**Industrial Robotics**

- Department of Trade and Industry - Bureau of Investment - BOI
- Hytec Power Inc.
- Hexatronics Marketing

- IONICS
- EMS Group of Companies - CREOTEC
- Advanced Manufacturing Workforce Development Alliance

The questionnaire was divided into 12 sections, as listed below, to achieve the survey objectives as follows:

1. Profile of the Company - this gathers information such as the position of the respondent, the name of the company, location, areas of operation, and the primary type of robotics technology it is involved in.

2. Basic Organizational Background – This section asks for information on the company's organizational structure, highlighting the human resource and the concerned unit/division in the Robotics sector (human resource and labor unit). Further, information will be gathered regarding the affiliation to other organizations/institutions.

3. Critical Human Resources – this section asks for information on the number of workers/members and distribution of the company's workers from 2023 to 2024 by the following categories:
    - Gender
    - Age group
    - Robotics Technology
    - Occupational type
    - Employment status (i.e., full-time and contractual workers)
    - Educational attainment from highest to lowest
    - Gross monthly salary (PHP)

    This will also include the expected change in employee size for the succeeding years, unfilled positions in the last six (6) months, and the occupational types that are difficult to fill and retain. Likewise, it inquires about the approximate percentage of employees who would be difficult to replace within three (3) months, as well as the jobs that would be difficult to replace, the percentage of decrease in employment in robotics, and factors affecting the employment i.e., retirement, decreasing workforce participation, as well as resignation and contract termination, etc.

4. Skills in the Business - for this section, respondents are asked on the percentage of members according to their performance (able to perform the job, unable to perform the job, and have the potential to perform with more demanding duties), reasons behind poor performance and corresponding actions applied, whether actions were done for those with more potential and whenever applicable, the reason why no action was done.

The positions that require a college degree, two (2) to three (3) weeks of induction training, continuous learning or developmental activities, at least three (3) years of industry-relevant experience, and a technical vocational certificate or National Certificate. The number of additional employees needed for the succeeding years, identify the jobs and skills requirements that either may have a shortage, no change, surplus or will be hard to fill in the next five (5) years, and occupations/skills needs/requirements may be addressed by a TVET Program.

5. Emerging Skills Associated with Industry Developments - this section contains questions on the emerging skills as well as the list of futuristic skills that may be applicable in the industry in the next 5-10 years. Further, STEM related occupations will be given priority in this section, particularly in line with the lack of skilled workers relating to technology and engineering that can be addressed through the TVET System. Identify how these policies will impact skills demand in the next 1-5 years. Self-evaluation of the companies in their readiness for implementing actions and preparations for the human resource relative to the emerging skills. For capable companies, elaborate on the actions undertaken.

6. Green Jobs and the Robotics Sector - questions under this section include the extent of implementation of robotics companies on various aspects of green jobs and provisions for any aspects of green jobs. The identified list of emerging skills relative to green jobs and the relevance of the green industry developments to the current and near-future business needs in terms of knowledge, skills, and attitude.

7. Learning and Development - this section seeks information such as the percentage of payroll expenditure/funds allotted for training. Identify the company's list of capacity-building services, i.e., training and business planning. It also supports the service company's rating of various training-related statements using a 5-point scale where 5 means "strongly agree" and 1 means "strongly disagree."

8. Work and Employment Practice - for this section, questions are about the company's policies covering various documents (i.e., business, training, staff development plans, budget, and development for high potential staff). Company's information sharing with their employees concerning the percentage entitled to various rewards or opportunities.

9. Business Strategy -under this section, companies are asked to rate various statements regarding the approach to business and the extent of implementation of actions for different areas of business development.

10. Work Processes and Technology - this section primarily focuses on gathering information on how up-to-date are company's core equipment that is being used in the production of goods and services compared to the best commonly available technology in the country and overseas.

11. Organizational Performance - this particular section asks about the status of outcomes such as profitability, total sales or revenue, and market share for 2023-2024. Moreover, it seeks information on the percentage of members exhibiting various behaviors at work.

12. Workforce Matters - the last section of the questionnaire gathers information on the percentage of members/employees that are TVET graduates. Likewise, respondents are asked to evaluate the work and performance of TVET graduates and certified employees.

The questionnaire was converted online using JotForm, an online and code-free application used to create custom online forms. However, a PDF version of the questionnaire was also provided as requested to aid those who are not well-versed in online platforms. The questionnaires answered through other methods were also converted and encoded in the form of a JotForm submission.

## 3.3 Sampling and Sampling Techniques

A total of 309 respondents were provided by partner government agencies, such as the **Board of Investments (BOI)**, and industry associations, including **MRSP National**. These respondents were grouped into each of the 3 subsectors (Service Robotics - Logistics, Industrial Robotics - Electric/Electronics, and Industrial Robotics - Food)

**Table 2.**
*Distribution of the Robotics Facilities by Robotics Subsector*

| Robotics Subsectors | Number of Robotics Facilities |
|---|---|
| Service Robotics - Logistics | 13 |
| Industrial Robotics - Electric/Electronics | 56 |
| Industrial Robotics - Food | 240 |
| TOTAL | ***309*** |

To ensure representativeness, stratified random sampling was used to determine the sample size per subsector and systematic circular sampling was used to select the definite respondents who would participate in the study. The unit of analysis in this study is the ***robotics facility***.

The sample size per subsector was estimated based on a 10% margin of error and 95% confidence interval. The computation yielded a final sample size of 3 (4.11%) in Service Robotics - Logistics, 13 (17.81%) in Industrial Robotics - Electric/Electronics, and 57 (78.08%) in Industrial Robotics - Food, as seen in Table 3.

**Table 3.**
*Distribution of the Final Sample Size by Robotics Subsector*

| Robotics Subsectors | Number of Robotics Facilities Sample Size | Sample Size Percent Share |
|---|---|---|
| Service Robotics - Logistics | 3 | 4.11% |
| Industrial Robotics - Electric/Electronics | 13 | 17.81% |
| Industrial Robotics - Food | 57 | 78.08% |
| **TOTAL** | ***73*** | ***100.00%*** |

## 3.4 Preparation for the Survey

To ensure the survey's proper implementation and standardization, an interviewer manual was developed, building upon the framework of the past SNA-WSS Survey. This manual was carefully adapted and modified to align specifically with the robotics questionnaire and the data-gathering procedure for this study.

An interviewee survey guide was also created to assist respondents in completing the questionnaire. This guide was particularly important, as respondents could answer on their own, either through the online survey tool or using the traditional pen-and-paper approach. The guide provides instructions and clarifications for specific questionnaire sections, including explanations of key terminologies, to enhance the convenience and accuracy of responses. Instructions on using the online survey tool were integrated directly into the JotForm link.

To streamline the process of sending customized invitation letters and accompanying materials, the researchers utilized mail merge. A database was also established to support this mail merge function and to serve as a monitoring and status sheet for tracking the responses and participation of the targeted companies.

## 3.5 Data Collection Strategies and Processes

The assistance of the DOST - Metals Industry Research and Development Center, DTI - BOI, DOST - Advanced Science and Technology Institute and all industry associations that participated in the study was critical in the data collection. Specifically, the database provided by the Board of Investments (BOI), and industry associations, including MRSP National contained comprehensive information on all potential additional respondents and validators across all three (3) robotics

subsectors (Service Robotics - Logistics, Industrial Robotics - Electric/Electronics, and Industrial Robotics - Food).

For the survey operation, the following data collection strategies were administered, based on respondent preference:

- Self-administered using the online survey tool
- Self-administered using the traditional pen-and-paper/PDF method

Regardless of the data collection method used, JotForm was utilized for data encoding and validation.

Although respondents were offered a choice of data collection methods, JotForm was consistently used by the researchers for data processing. The data collection was conducted from November 2024 to January 2025, following the outline below:

1. The survey team informed the relevant industry associations that their member facilities would be contacted.
2. An email invitation was sent to the sampled respondents. This invitation included guidelines for participation, specifying the available data collection modes, the online survey link and access code, and key instructions from the survey guide. The initial email also contained the following attachments for respondent reference:
    - Invitation letter signed by the TESDA Deputy Director General for Policies and Planning
    - Survey guide
    - Consent form
3. The survey team conducted follow-up emails and calls, the frequency of which depended on the responses to the initial email invitation. A replacement strategy was developed and implemented to mitigate the risk of low response rates resulting from persistent unresponsiveness among sampled respondents.
4. Once a sampled respondent agreed to participate, a subsequent email was sent. This email included essential reminders before and after completing the survey, along with the JotForm guide. The scheduling of the validation interview was also arranged at this stage.
5. If a respondent declined the invitation, the reasons for their non-participation were recorded to inform future recommendations.

Further, to mitigate the limited responses received and gather further information, the researchers also strategized to conduct a series of industry validation meetings. These meetings served as an additional avenue for collecting data and for industry representatives to provide insights and feedback on the survey. Below are the participating government agencies, industry associations, and companies who were involved in the validation meetings:

A. Service Robotics
   - Department of Science and Technology - Metals Industry Research and Development Center
   - DTI - Board of Investments
   - Supply Chain Management Association of the Philippines (SCMAP)
   - Hand Plus Robotics
   - Gothong Southern Shipping Lines
   - Yello X Supply Chain Solutions

B. Industrial Robotics
   - Department of Science and Technology - Advanced Science and Technology Institute
   - DTI - Board of Investments
   - Mechatronics and Robotics Society of the Philippines (MRSP) NCR
   - Philippine Food Processors and Exporters Organization, Inc. (PHILFOODEX)
   - Electronics Industries Association of the Philippines (EIAPI)
   - Hand Plus Robotics
   - KLT Fruits, Inc.
   - Hytec Power, Inc.
   - Creotec Philippines, Inc. / EMS Group of Companies

## 3.6 Editing , Encoding, and Analysis

Following data collection from participating robotics facilities, the gathered responses and submissions underwent a thorough review process. Using a developed clarification guide, the data was checked for completeness, potential errors, and inconsistencies. Any necessary clarifications and verifications were obtained from the respondents, and the database was subsequently cleaned.

The resulting tables, key findings, interpretations, and analyses are presented in the subsequent sections/chapters of this report.

# CHAPTER 4
# RESULTS AND DISCUSSION

This chapter contains the study's findings in the form of summary statistics and tabulations based on the survey responses and inputs during the validation of survey results. The chapter is organized by section, following the format of the questionnaire.

The data collection phase encountered several challenges that significantly impacted the overall response rate. In some instances, the research team did not receive member databases from relevant industry associations, making it difficult to identify and reach target respondents. Additionally, acquiring active and accurate contact information was a major hurdle, especially for facilities not affiliated with associations or those with outdated records.

Another key challenge was the responsiveness of target companies. Despite follow-up efforts via email, only 64 (or 20.71%) of the respondents were successfully reached at least once, based on the research team's monitoring.

Only 15 robotics facilities, out of the total computed sample size of 73, participated in the survey, yielding an overall response rate of 20.55%. Among the 15 responses, 11 of these facilities were part of the industry validations that helped strengthen qualitative insights from the survey.

As previously stated in the study's limitations, although four robotics subsectors were initially covered in the study, no responses have been received from the service robotics - agriculture subsector. Therefore, all succeeding tables from table 4 will not include the Service Robotics - Agriculture subsector

As shown in Table 4, the Service Robotics - Logistics subsector yielded the highest response relative to its originally allocated sample size. To clarify, the calculated response rate of 166.67% for this subsector indicates that the actual number of responses received was 5, which exceeded the target sample size of 3. This was allowed in the context of voluntary participation beyond the target, and such cases were retained in the analysis to further enrich the study findings.

**Table 4.**
*Distribution of Participating Facilities and the Response Rate by Robotics Subsectors*

| Robotics Subsectors | Sample Size | Actual Response | Response Rate % |
|---|---|---|---|
| Service Robotics - Logistics | 3 | 5 | 166.67% |
| Industrial Robotics - Food | 57 | 4 | 7.02% |
| Industrial Robotics - Electric/Electronics | 13 | 6 | 10.53% |
| **Total** | ***73*** | ***15*** | ***20.55%*** |

## 4.1 Basic Organizational Background

Table 5 presents an overview of the estimated number of workers across robotics facilities by robotics subsector. However, the numeric range alone does not capture the full complexity of workforce distribution, particularly in terms of how many employees are actually involved in robotics-related functions.

In the Service Robotics – Logistics subsector, validators confirmed that while some companies have hundreds of employees, **none or very few workers are engaged in robotics-related functions.** Several validators shared that even with workforce sizes nearing 500 employees, the companies have no designated robotics personnel, as automation has not yet been adopted in their operations. Others estimated that approximately 50 personnel are typically involved in logistics or supply chain roles, although these positions are primarily manual or client-facing. A validator with experience in automation solutions noted that, based on past engagements, only around 5% of the total workforce in logistics companies tends to be involved in automation. This is due to the operational characteristics of the sector—where direct human involvement in routing, storage, and fulfillment remains dominant—and where applying a “1 robot : 1 engineer” staffing model is not feasible.

For the Industrial Robotics–Food subsector, the range of workers per facility typically falls between 250 and 500, but the proportion of workers engaged in robotics remains very minimal to none, according to validators. One validator noted that even in facilities with 600 to 800 workers, the number of robotics-related personnel is “almost zero,” as automation is only in the exploratory phase. Other validators emphasized that micro and small food enterprises lack automation capacity altogether and have little to no exposure to robotics technologies. Past assessments showed that most of these firms have not yet reached Industry 3.0 and would require

foundational digital and process automation support before moving toward robotics. While large and multinational food companies may employ hundreds of people, validators indicated that only a small percentage are currently assigned to robotics-related functions—though growth in this area is anticipated over the next 5 to 10 years.

Validators in the Industrial Robotics – Electric/Electronics subsector reported a wider range of workforce sizes and significantly higher involvement in robotics-related functions. Depending on the production scale, some facilities employ thousands nationwide, while local plants range from 15 to 2,000 employees. Validators estimated that these facilities may engage 1,000 to 2,000 workers in robotics-related tasks, specifically in printed circuit board assembly (PCBA) and precision manufacturing. However, it was also noted that many companies with robotics activity in this sector are registered under other investment promotion agencies, making comprehensive workforce data harder to consolidate. Some validators from industry associations mentioned that their member companies collectively employ thousands of workers; however, the number of staff directly involved in robotics varies significantly based on the size of the company and its level of automation maturity. **In support of industry upgrading, research institutions and government technology agencies were also noted to have dedicated teams of engineers and researchers working on robotics applications and partnerships with MSMEs**—many of whom are still at the early stages of technology adoption.

The numbers in Table 5 come from estimates made during validation meetings and show the total number of workers in the companies surveyed, along with insights from validators about how many of those workers are actually involved in robotics-related jobs. It's important to note that these estimates might be different from the workforce breakdowns in Tables 6 and 7, which categorize employees by job type (like technicians, plant operators, and professionals) but don't specifically identify roles related to robotics. In sectors such as Food and Logistics, validators emphasized that while technical roles exist, they are not necessarily linked to robotics or automation functions at this stage.

Similarly, while later sections of the report (e.g., Tables 32-43) highlight skills gaps and emerging occupations relevant to robotics, these reflect anticipated future workforce needs rather than current deployment levels. The relatively low representation of robotics functions reported in Table 5—particularly in Food and Logistics subsectors—therefore does not contradict the broader skills findings but rather underscores the ongoing transition toward automation across industries.

**Table 5.**
*Distribution of Workers working in the Facilities by Robotics Subsector*

| Robotics Subsectors | Range of Workers |
|---|---|
| Service Robotics - Logistics | 1 - 50 |
| Industrial Robotics - Food | 250 - 500 |
| Industrial Robotics - Electric/Electronics | 15 - 2000 |

The survey's design and implementation strictly follow the nine major groups identified by the 2012 Philippine Standard Occupational Classification (PSOC). This methodological choice guarantees a strong level of internal consistency in the gathered data and allows for significant comparisons with statistics generated by the Philippine Statistics Authority (PSA) and other governmental organizations. Utilizing this standardized classification system improves the relevance and compatibility of the survey's results within the wider context of national labor and employment data.

Table 6 presents the distribution of employees by occupational classification across all surveyed Robotics subsectors. This also reflects the weighted averages of occupational distribution across the three subsectors, heavily influenced by the Industrial Robotics - Electric/Electronics subsector, which accounts for over 75% of the sample size. Professionals represent the highest distribution at approximately 24%, followed by Technicians and Associate Professionals at 17.45%. No employment was reported under the categories of Elementary Occupations or Skilled Agricultural, Forestry, and Fishery Workers. The detailed breakdown by subsectors of the following occupational classifications can be found in Table 7.

**Table 6.**
*Distribution of Employees by Occupational Type*

| Occupational Type | Distribution (%) |
|---|---|
| Managers | 14.53% |
| Professionals | 23.91% |
| Technicians and Associate Professionals | 17.45% |
| Clerical Support Workers | 6.39% |
| Service and Sales Workers | 10.56% |
| Skilled agricultural, forestry, and fishery workers | 0.00% |
| Plant and Machine Operators, and Assemblers | 14.66% |
| Craft and Related Trade Worker | 12.50% |
| Elementary Occupation | 0.00% |
| **Total** | **100.00%** |

Table 7 shows the distribution of employees by occupational type by robotics subsectors. It shows distinct workforce compositions shaped by the nature of each industry and reveals the type of value creation in each subsector, which was further strengthened during the validation meeting. Logistics relies on human dexterity and service orientation, Food manufacturing emphasizes supervisory and compliance functions, while Electronics focuses on machine-based productivity driven by technical roles.

In the Service Robotics – Logistics subsector, the workforce is dominated by craft and related trade workers, who make up 37.5% of employees. This is followed by service and sales workers at 25% and an even distribution of managers, professionals, and clerical support workers, each comprising 12.5% of the workforce. Notably, there are no technicians, plant operators, or elementary workers reported in this subsector, highlighting a hands-on, client-facing operational model supported by skilled trades.

In contrast, the Industrial Robotics– Food subsector leans more heavily on professionals, who account for 40% of the workforce, and technicians and associate professionals at 20%. Managers represent 26.67%. Service and clerical roles are minimal, at just under 7% each, and there is no representation from trades, plant operators, or elementary occupations.

While the Industrial Robotics – Electric/Electronics subsector shows the most pronounced technical specialization. Plant and machine operators and assemblers constitute the largest portion of the workforce at 43.98%, followed by technicians and associate professionals at 32.35% and professionals at 19.24%. Managers are present but make up only 4.43% of the workforce, while there is no representation from clerical, service, or trade roles. This composition reflects the highly technical and production-intensive nature of the electronics industry, where automated processes and skilled technical oversight are central to operations.

The following results, where Professionals constitute 40% in food but only 12.5% in Logistics and 19.24% in Electronics, shows more than 3x concentration in Industrial Robotics - Food subsector. Furthermore, Technicians are entirely absent in Logistics but make up 32.35% in Electronics which is an important indicator of specialization needs. For instance, these numbers reflect the operational demands and strategic priorities unique to each robotics application area, which are then mentioned in the analysis on Table 6.

**Table 7.**

*Distribution of Employees by Occupational Type by Robotics Subsector*

| Robotics Subsector | Occupational Type (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Managers | Professionals | Technicians and Associate Professionals | Clerical Support Workers | Service and Sales Workers | Skilled agricultural, forestry and fishery workers | Craft and Related Trade Worker | Plant and Machine Operators, and Assemblers | Elementary Occupation | Total |
| **Service Robotics - Logistics** | 12.50 | 12.50 | 0.00 | 12.50 | 25.00 | 0.00 | 0.00 | 37.50 | 0.00 | 100.00 |
| **Industrial Robotics - Food** | 26.67 | 40.00 | 20.00 | 6.66 | 6.67 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| **Industrial Robotics - Electric/Electronics** | 4.43 | 19.24 | 32.35 | 0.00 | 0.00 | 0.00 | 43.98 | 0.00 | 0.00 | 100.00 |

Table 8 provides a comprehensive overview of the age distribution across the entire robotics industry, revealing a labor force overwhelmingly concentrated in younger age groups. The 25–34 age range dominates at 62%, forming the operational core of the sector and spanning roles from technical operators to middle management. This cohort is particularly crucial in fast-evolving subsectors like electronics and logistics, where adaptability and continuous skill development are essential. The data also show a notable presence of employees aged 15–24 (12.5%), largely involved in entry-level and technical roles, often supported through academic-industry collaborations such as internships. Workforce representation drops significantly after age 44, with minimal participation from those aged 45–54 (2.53%) and 55–64 (4.83%), and no employees reported over the age of 65. The overall picture painted by Table 8 is one of a youth-driven industry shaped by high technical demands, early career mobility, and a growing need for internal upskilling to address talent gaps caused by attrition and international labor migration.

**Table 8.**
*Distribution of Employees by Age Group*

| Age Group | Distribution (%) |
|---|---|
| 15-24 | 12.50% |
| 25-34 | 62.00% |
| 35-44 | 18.13% |
| 45-54 | 2.53% |
| 55-64 | 4.83% |
| 65 and above | 0.00% |
| **TOTAL** | **100.00%** |

Table 9 presents the age distribution of the robotics workforce across three subsectors: Service Robotics – Logistics, Industrial Robotics – Food, and Industrial Robotics – Electric/Electronics. Although the 25–34 age group dominates in all three, their share differs—reaching as high as 70% in the Electronics subsector and dropping to 50% in Food. Younger workers aged 15–24 are most visible in Electronics, where they make up 25% of the workforce. However, this age group is entirely absent in the Logistics subsector, which may point to stricter entry requirements or limited opportunities for entry-level roles. Those aged 35–44 are more prevalent in the Logistics and Food subsectors (about 25%) compared to just 3% in Electronics, possibly due to a greater reliance on experience or leadership roles. When it comes to older workers (ages 45 and above), their presence is uneven. The Food sector, in particular, has a notable share of workers aged 55–64 (12.5%), which may indicate longer career retention in roles that are less physically demanding or more professional in nature. Feedback from industry validators across all sectors emphasized that while age distribution often reflects career progression, physically intensive or highly technical roles tend to limit the participation of older workers due to safety and performance considerations.

**Table 9.**
*Distribution of Employees by Age Group by Robotics Subsector*

| Robotics Subsector | Age Group | | | | | | |
|---|---|---|---|---|---|---|---|
| | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65 and above | Total |
| **Service Robotics - Logistics** | 0.00 | 66.00 | 26.40 | 6.60 | 1.00 | 0.00 | 100.00 |
| **Industrial Robotics - Food** | 12.50 | 50.00 | 25.00 | 0.00 | 12.50 | 0.00 | 100.00 |
| **Industrial Robotics - Electric/Electronics** | 25.00 | 70.00 | 3.00 | 1.00 | 1.00 | 0.00 | 100.00 |

***Distribution of Multinational Facilities by Robotics Subsector***

The distribution of multinational facilities across robotics subsectors highlights distinct trends in adoption and investment patterns. In the Service Robotics – Logistics subsector, multinational organizations dominate entirely, indicating a strong alignment between global logistics strategies and automation technologies. This high concentration reflects the sector's prioritization of operational efficiency and the need for scalable, high-performance solutions—areas where multinational companies have the resources and motivation to lead in robotics integration. Insights from a validator also emphasize that a significant proportion of companies within logistics and manufacturing networks (e.g., approximately 40% of SCMAP members) are part of multinational organizations. Despite having local headquarters, some multinational organizations leverage automation more effectively due to their regional or global footprints.

Conversely, in the Industrial Robotics – Food subsector, the absence of multinational facilities suggests a slower pace of automation adoption or a preference for smaller, localized operations. However, validators note that multinational corporations often serve as the primary customers for robotics solutions in food processing, highlighting their influential role in driving demand even if not directly operating the facilities. This points to a multilayered relationship where multinational corporations (MNCs) have an indirect effect on automation by buying things and setting standards and expectations that trickle down to local providers. In Industrial Robotics – Electronics, the data suggests complete multinational involvement, although validators caution that the picture may not be statistically comprehensive. Nonetheless, it underscores a broader trend: automation in electronics is heavily dependent on large-scale investment and advanced technological infrastructure, which remains largely out of reach for MSMEs. Therefore, only multinationals currently possess the capacity and global scale necessary for robotics adoption, as demonstrated by the electronics subsector.

As shown in Table 10, the overall salary distribution across the robotics workforce in the Philippines is concentrated in the mid-to-upper income brackets, with 52% of employees earning between ₱27,000 and ₱33,999, and an additional 30.5% earning ₱34,000 and above. This means that over 80% of the surveyed workforce receives at least ₱27,000 monthly, reflecting compensation levels well above the minimum wage. Only a small proportion, 10.42%, earn between ₱13,000 and ₱19,999, and 7.08% fall within the ₱20,000 to ₱26,999 range. Notably, no respondents reported earning only the minimum wage, suggesting that roles within robotics-related occupations generally command specialized skill premiums, whether in technical, engineering, or production functions.

These findings generally align with the feedback from industry validators, particularly in the Electronics and Food subsectors. In the Service Robotics – Logistics

subsector, as shown in Table 11, the majority of employees (47.50%) earn between ₱27,000 and ₱33,999, followed by 31.25% earning ₱13,000 to ₱19,999. A smaller share, 11.25%, receive salaries between ₱20,000 and ₱26,999, and only 10.00% earn ₱34,000 and above. This indicates that while most workers fall within the mid-income range, a sizable portion are still clustered in lower wage brackets.

In contrast, the Industrial Robotics – Food subsector shows a more favorable salary structure. About 63.50% of employees earn ₱27,000 to ₱33,999, while 36.50% receive ₱34,000 or more. Notably, no respondents reported salaries below ₱27,000, indicating a more advanced workforce profile and the presence of higher-skilled roles, likely due to automation maturity and technical requirements.

Meanwhile, the Industrial Robotics – Electric/Electronics subsector has an even distribution between the mid-income and high-income ranges, with 45.00% of employees earning ₱27,000 to ₱33,999 and another 45.00% earning ₱34,000 and above. Only 10.00% fall in the ₱20,000 to ₱26,999 range.

**Table 10.**
*Distribution of Employees by Gross Monthly Salary*

| Gross Monthly Salary (Php) | % |
|---|---|
| Minimum wage Php 13,000 | 0.00% |
| Php 13,000 to Php 19,999 | 10.42% |
| Php 20,000 to Php 26,999 | 7.08% |
| Php 27,000 to Php 33,999 | 52.00% |
| Php 34,000 and over | 30.50% |
| **Total** | **100.00%** |

**Table 11.**
*Distribution of Employees by Gross Monthly Salary by Robotics Subsector*

| Robotics Subsector | Minimum wage Php 13,000 | Php 13,000 to Php 19,999 | Php 20,000 to Php 26,999 | Php 27,000 to Php 33,999 | Php 34,000 and over | Total |
|---|---|---|---|---|---|---|
| **Service Robotics - Logistics** | 0.00 | 31.25% | 11.25% | 47.50% | 10.00% | 100.00% |
| **Industrial Robotics - Food** | 0.00 | 0.00 | 0.00 | 63.50% | 36.50% | 100.0%0 |
| **Industrial Robotics - Electric/Electronics** | 0.00 | 0.00 | 10.00% | 45.00% | 45.00% | 100.00% |

## 4.2 Critical Human Resources

Tables 12 to 13 show the distribution of the highest educational attainment of the robotics facilities that participated. Table 12 presents the distribution of current employees in robotics facilities based on the highest educational attainment required. The data highlights that highly educated individuals predominantly make up the workforce in this sector. A significant majority of the current employees (59.92%) had a college degree, followed by 16.33% with a doctoral degree and 10.42% with a master's degree. Additionally, 9.17% of the current employees are college undergraduates. Only a small portion of the employees are senior high school (3.33%) or junior high school graduates (0.83%). Notably, there are no recorded current employees specifically requiring junior high school education or TVET graduates.

However, it is important to note that during the validation process, it was confirmed that there are TechVoc graduates employed in the robotics facilities, although their exact numbers were not available for inclusion in the table. This discrepancy is acknowledged in Section 4.11, Workforce Matters, which states that there are indeed TVET graduates and certified individuals among the workforce. In some cases, their technical-vocational education is integrated into higher studies, meaning that while pursuing their bachelor's degree, students are also required to undergo specialized technical training and obtain industry-recognized certifications. These additional components are often embedded within the curriculum to strengthen practical competencies and ensure that graduates are equipped with both theoretical knowledge and hands-on skills relevant to the robotics field. These considerations may explain why they are categorized under college or postgraduate levels. Therefore, while the table does not reflect their presence numerically, TechVoc graduates do contribute to the workforce and are integrated into the broader educational profiles of employees.

**Table 12.**
*Distribution of current employees in the Robotics Facilities by Highest Educational Attainment*

| Highest Educational Attainment | % |
|---|---|
| No Grade Completed | 0.00% |
| Elementary Undergraduate | 0.00% |
| Elementary Graduate | 0.00% |
| Junior Highschool Undergraduate | 0.00% |
| Junior Highschool Graduate | 0.83% |
| Senior Highschool Undergraduate | 0.00% |
| Senior Highschool Graduate | 3.33% |
| TechVoc Course Undergraduate | 0.00% |
| TechVoc Course Graduate | 0.00% |
| College Level Undergraduate | 9.17% |
| College Level Graduate | 59.92% |
| Master Degree/Level | 10.42% |
| Doctoral Degree/Level | 16.33% |
| **Total** | 100.00% |

When broken down into their subsectors, Table 13 shows the distribution of current employees in robotics facilities by highest educational attainment across three subsectors: Service Robotics – Logistics, Industrial Robotics – Food, and Industrial Robotics – Electronics.

In the Service Robotics – Logistics subsector, a significant portion of the workforce (63.5%) holds a college degree, while 29% possess doctoral degrees. Validators then pointed out the unusually high share of employees with doctoral degrees may seem disproportionate given the limited number of PhD holders in the country. However, the presence of research and development (R&D) activities within logistics-focused robotics facilities, where PhD-level expertise is essential, accounts for this increase. Validators emphasized that where R&D is integrated into logistics operations, the employment of doctoral degree holders is justified.

In the Industrial Robotics–Food subsector, 75% of the employees are college graduates, and 25% are college undergraduates. There are no reported holders of master's or doctoral degrees. This aligns with validator feedback indicating that most roles in this subsector are operational or technical in nature, requiring a minimum of a college degree. Validators noted that although the sector generally demands college-level qualifications, TVET training and National Certifications (NCs) still play

a role in upskilling workers, especially those transitioning from other fields or industries.

Further, in the Industrial Robotics–Electronics subsector, the educational distribution is more diverse. While 41.25% of employees are college graduates, there is a notable representation of advanced degree holders, with 23.75% holding a master's degree and 20% holding doctoral degrees. Additionally, 10% of employees are senior high school graduates, and 2.5% are college undergraduates or junior high school graduates. This diversity reflects the subsector's broader range of job roles, from technical and operational positions to research-intensive functions. Validators also highlighted a trend wherein some workers may have initially left engineering for other industries (e.g., finance) and later returned, requiring reskilling through specialized TVET training. Targeting professionals aged 35 to 55, these training programs aim to bridge knowledge gaps and facilitate reintegration into the robotics field.

**Table 13.**
*Distribution of current employees in the Facilities by Highest Educational Attainment by Robotics Subsector*

| Robotics Subsector | No Grade Completed | Elementary Undergraduate | Elementary Graduate | JHS Undergraduate | JHS Graduate | SHS Undergraduate | SHS Graduate | TVET Undergraduate | TVET Graduate | College Level Undergraduate | College Level Graduate | Master Degree/ Level | Doctoral Degree/Level | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Service Robotics - Logistics** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 63.50 | 7.50 | 29.00 | 100.00 |
| **Industrial Robotics - Food** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 25.00 | 75.00 | 0.00 | 0.00 | 100.00 |
| **Industrial Robotics - Electric/Electronics** | 0.00 | 0.00 | 0.00 | 0.00 | 2.50 | 0.00 | 10.00 | 0.00 | 0.00 | 2.50 | 41.25 | 23.75 | 20.00 | 100.00 |

The survey additionally inquired about job vacancies requiring educational attainment at the participating robotics facilities for the period from 2023 to 2024, with the results displayed in Table 14. Particularly, it indicates that the majority of current vacancies in robotics facilities require college graduates (87.50%), with smaller proportions for master's (4.17%) and doctoral degree holders (6.67%). Positions requiring only senior high school or TechVoc qualifications are minimal. This information reflects a general preference for higher education levels across the robotics sector.

While TechVoc graduates and senior high school finishers make up only a small fraction of current vacancies, during the validation meeting, validator insights from Table 13 highlight that TVET pathways remain relevant for certain operational or support roles. These roles may not be prominently reflected in formal job postings but continue to support workforce entry or career transitions, especially in subsectors like Industrial Robotics – Food and Electronics where upskilling and reskilling efforts are ongoing.

**Table 14.**
*Distribution of the Vacancies in the Robotics Facilities by Highest Educational Attainment*

| Highest Educational Attainment | % |
|---|---|
| No Grade Completed | 0.00% |
| Elementary Undergraduate | 0.00% |
| Elementary Graduate | 0.00% |
| Junior Highschool Undergraduate | 0.00% |
| Junior Highschool Graduate | 0.83% |
| Senior Highschool Undergraduate | 0.00% |
| Senior Highschool Graduate | 3.33% |
| TechVoc Course Undergraduate | 0.00% |
| TechVoc Course Graduate | 1.67% |
| College Level Undergraduate | 0.00% |
| College Level Graduate | 87.50% |
| Master Degree/Level | 4.17% |
| Doctoral Degree/Level | 6.67% |
| **Total** | 100.00% |

Table 15 breaks down the distribution of vacancies by highest educational attainment across the three robotics subsectors: Service Robotics – Logistics, Industrial Robotics – Food, and Industrial Robotics – Electric/Electronics.

In the Service Robotics – Logistics subsector, vacancies require mostly college graduates (62.5%), with a notable share for doctoral (20%) and master's degree holders (12.5%), as well as a small portion (5%) for TechVoc graduates.

Both the Industrial Robotics – Food and Electric/Electronics subsectors show a clear preference for college graduates, with 100% of vacancies requiring this level of education. The Electric/Electronics subsector also reports some vacancies for junior high school (2.5%) and senior high school graduates (10%), indicating limited

opportunities for lower educational attainment levels in operational roles. The junior high school-level vacancies are typically associated with line production roles, where tasks are more routine and require less specialized training.

Validators noted that TechVoc training plays an important role when there is a need for reskilling workers, particularly professionals transitioning back into the industry or adapting to new technologies. This aligns with the presence of TechVoc vacancies mainly in the logistics subsector, where continuous innovation and R&D demand both advanced academic qualifications and practical upskilling. Overall, while college degrees dominate vacancy requirements across subsectors, TechVoc remains vital for targeted upskilling, reskilling, and supporting workforce adaptability in robotics.

**Table 15.**
*Distribution of the Vacancies in the Facilities by Highest Educational Attainment by Robotics Subsector*

| Robotics Subsector | No Grade Completed | Elementary Undergraduate | Elementary Graduate | Junior Highschool Undergraduate | Junior Highschool Graduate | Senior Highschool Undergraduate | Senior Highschool Graduate | TechVoc Course Undergraduate | TechVoc Course Graduate | College Level Undergraduate | College Level Graduate | Master Degree /Level | Doctoral Degree /Level | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Service Robotics - Logistics** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 0.00 | 62.50 | 12.50 | 20.00 | 100.00 |
| **Industrial Robotics - Food** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |
| **Industrial Robotics - Electric/Electronics** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |

Table 16 shows that the majority of robotics facilities (80.56%) experienced an increase in employee size from 2023 to 2024; validators from different subsectors confirm this trend. In the food subsector, post-pandemic recovery is driving growth as enterprises rebound. In the electronics subsector, facilities report steady increases linked to expanded robotics and R&D activities, as well as the need for trainers due to ongoing workshops and projects. One validator noted a roughly 50% increase in employees aligned with facility expansions. The logistics subsector shows more mixed results, with some companies not yet fully adopting robotics and small SME growth reported.

**Table 16.**
*Distribution of the Robotics Facilities by Status of Employee Size, 2023 to 2024*

| Status of Employee Size | % |
|---|---|
| Decrease | 8.33% |
| No Change | 11.11% |
| Increase | 80.56% |
| **Total** | 100.00% |

Table 17 presents the breakdown of employee size status by robotics subsector from 2023 to 2024. The majority of facilities in the Industrial Robotics–Food subsector reported an increase in employee size, with 100% experiencing growth. The Industrial Robotics – Electric/Electronics subsector also saw substantial growth, with 75% of facilities increasing their workforce. In contrast, the Service Robotics – Logistics subsector showed more variability, with only 66.67% of facilities increasing employee size, 33.33% reporting no change, and a notable 25% experiencing a decrease.

This distribution highlights strong workforce expansion, particularly in food and electronics robotics, driven by growing demand and investment in these areas. The logistics subsector appears less uniform, reflecting its varied pace of robotics adoption and integration. This supports Table 16's data showing that employee size increased across robotics subsectors between 2023 and 2024.

**Table 17.**
*Distribution of the Facilities by Status of Employee Size, 2023 to 2024 by Robotics Subsector*

| Status of Employee Size | Decrease | No Change | Increase | Total |
|---|---|---|---|---|
| Service Robotics - Logistics | 0.00 | 33.33 | 66.67 | 100.00 |
| Industrial Robotics - Food | | | 100.00 | 100.00 |
| Industrial Robotics - Electric/Electronics | 25.00 | | 75.00 | 100.00 |

Table 18 shows that all separations from robotics facilities were recorded as resignations, with no official terminations or retirements. Government agencies such

as DOST-MIRDC and DOST-ASTI reported some end-of-contract separations, but these often involve rehiring, so they may not fully reflect permanent employee loss.

External factors such as better overseas opportunities, family reasons, or higher local salaries largely drive resignations, according to validators across subsectors. Additionally, validators noted that the trend in the Industrial Robotics-Food subsector is similar to trends observed throughout Southeast Asia, where high demand rarely results in unemployment for skilled workers.

In the Industrial Robotics - Electric/Electronics subsector, employment depends on production volume; during downturns, some facilities operated by validators have implemented forced leaves or retrenchments but typically recall high-performing employees. Efforts are made to reskill or redeploy affected employees, and layoffs are minimal among highly technical staff due to skill shortages, and some workers are outsourced to partner companies.

Validators also raised concerns about skill gaps in robotics and mechatronics within the Philippines. The country lacks sufficient expertise to fully design and commission robotics systems, relying heavily on imported machinery and overseas engineers. Poaching skilled workers is an issue, with some companies facing legal disputes. There is a recognized need to strengthen educational programs, starting from bachelor's degrees, to build foundational knowledge and gradually develop advanced industry capabilities. Programs like MIRDC's Cuatro aim to provide more hands-on robotics training, addressing the gap between theoretical and practical skills.

The workforce turnover in robotics is mostly due to normal labor market factors rather than direct impacts of automation. However, the industry faces challenges related to skill shortages, education system gaps, and the need for sustained reskilling to support the sector's growth.

**Table 18.**
*Distribution of Separated Employees from the Robotics Facilities by Reason for Leaving*

| Reason for Leaving | % |
|---|---|
| Resignation | 100.00% |
| End of Contract | 0.00% |
| Termination of Contract | 0.00% |
| Retirement | 0.00% |
| **Total** | **100.00%** |

Table 19 illustrates the difficulty of replacing employees who resign within three months across different robotics subsectors. In Service Robotics – Logistics, half of the facilities report that less than 10% of employees are hard to replace quickly, while the other half indicate more than 50% are difficult to replace within this timeframe, showing a split in workforce resilience. The Industrial Robotics – Food subsector finds that all resignations involve employees who are difficult to replace within three months, highlighting a critical dependency on specialized staff. Conversely, the Industrial Robotics – Electric/Electronics subsector reports that 100% of resignations are for positions where replacement is moderately challenging (10–50%).

**Table 19.**
*Distribution of Current Employees who would be Difficult to Replace Within Three Months from Resignation*

| Robotics Sector | % | | | |
|---|---|---|---|---|
| | None | Less than 10% | 10-50% | More than 50% |
| **Service Robotics - Logistics** | 0.00% | 50.00% | 0.00% | 50.00% |
| **Industrial Robotics - Food** | 0.00% | 0.00% | 0.00% | 100.00% |
| **Industrial Robotics - Electric/Electronics** | 0.00% | 0.00% | 100.00% | 0.00% |

Table 20 categorizes specific jobs in robotics facilities by subsector that are considered difficult to replace in case of resignation. Across all three subsectors—Service Robotics – Logistics, Industrial Robotics – Food, and Industrial Robotics – Electric/Electronics—the roles that are hard to replace are primarily technical, engineering, and IT-related.

In the Logistics subsector, roles like software developers, software engineers, technicians, mechatronics, and mechanical engineers are most challenging to replace. Validators noted that software roles (developers and engineers) often overlap in skill sets and are critical for system operations. Mechanical engineers are also in demand, but many have narrow, drafting-focused skill sets—roles that might otherwise be filled by well-trained TVET graduates if properly upskilled.

In the Food subsector, while the table lists roles such as operations and production assistants, validators emphasized that it's the technical and professional roles—like robotics maintenance specialists, cyberthreat, and blockchain specialists—that are truly hard to replace. Given the increasing importance of digital security and system maintenance in robotics, these specialized roles are in particularly short supply.

For Electric/Electronics, jobs such as product and process engineers, IC designers, equipment technicians, and electrical engineers are cited as difficult to replace. Validators highlighted a growing scarcity of licensed electrical engineers and IC design experts due to low engineering enrollment and migration of skilled professionals. There's a widening gap, as many engineers pursue other fields like IT or move abroad for better opportunities. Government institutions like DOST also experience longer hiring delays due to public sector constraints, For instance, in government offices, hiring cannot proceed unless positions are officially vacant. In contrast, the private sector has more flexibility and can hire in anticipation of needs (i.e., foreshadowing). This constraint results in making the loss of specialized AI or robotics staff even more impactful.

Validators agreed that the difficulty in replacing technical talent stems from a combination of skill mismatch, low supply of licensed professionals, high migration rates, and limited local training pipelines—especially for advanced roles in AI, robotics, and system integration. They stressed the urgent need for both reskilling initiatives and education system reforms to build a sustainable talent pipeline in the country.

**Table 20.**
*Identified Jobs that will be Difficult to Replace in Case of Resignation by Robotics Subsector*

| Robotics Sector | Jobs that are difficult to replace |
|---|---|
| **Service Robotics - Logistics** | 1. Software Developer<br>2. Technician<br>3. Software Engineers<br>4. Mechatronics Engineers<br>5. Mechanical Engineers |
| **Industrial Robotics - Food** | 1. Operations Assistant<br>2. Production Assistant<br>3. Admin<br>4. Cyberthreat Specialist<br>5. Blockchain Specialist<br>6. Robotics Maintenance Specialist |
| **Industrial Robotics - Electric/Electronics** | 1. Product Engineer<br>2. Process Engineer<br>3. Equipment Technician<br>4. IC Designers<br>5. Electrical Engineers |

***Robotics Facilities with Fast Turnover per subsectors***

According to the responses, turnover occurs among professionals/engineers, managers and supervisors, and technicians/associate professionals. This response demonstrates that retention issues exist in the Food subsector even for mid- to high-level roles.

In the Industrial Robotics – Electric/Electronics subsector, the only occupational group reported to have fast turnover was plant and machine operators and assemblers, highlighting workforce instability in lower-skilled, production-based roles.

There were no responses from the Logistics subsector regarding turnover by occupational type. However, validator insights suggest that location and demand from other regions influence managerial mobility, while high turnover in lower-level roles often leads companies to outsource these positions rather than hire in-house.

Table 21 highlights the key reasons identified by the robotics facility under Service Robotics - Logistics subsector for fast turnover and difficulty in retaining employees. Respondents cited low wages, non-competitive benefits, the geographical location of the firm, long working hours, and poaching as the primary reasons for employee exits or fast turnover at the facility.

Interestingly, in Table 21 in the Industrial Robotics—Food, it can be seen that despite frequent movement of skilled workers, "shift to other employment locally or abroad" was mentioned by validators, particularly in the food subsector, alongside location-related challenges.

These findings emphasize that compensation-related issues and external competition for talent (e.g., poaching and migration) are the primary pressures driving workforce turnover in the robotics sector, rather than internal organizational factors such as job conditions or training opportunities. Validators also reinforced the notion that regional disparities in job availability and facility location play a significant role in employee retention, especially in more remote or less urbanized areas.

**Table 21.**

*Reasons of Facilities with Fast Turnover per Reason for the Difficulty in Retaining Employees*

| Subsector | Reason |
|---|---|
| **Service Robotics - Logistics** | • Low wages, non-competitive benefits<br>• The geographical location of the firm<br>• Long working hours<br>• Poaching |
| **Industrial Robotics - Food** | • Unattractive working conditions<br>• Lack of career prospects,<br>• Unsocial hours, and Limited training access<br><br>Others:<br>• Geographical Location of the firm<br>• Shift to other employment opportunities locally or abroad |
| **Industrial Robotics - Electric/Electronics** | • Low wage offered compared to other companies<br>• Benefits offered are not competitive<br>• Geographical location of the firm<br>• Long working hours<br>• Poaching |

Table 22 shows that promotions to managerial and supervisory positions are limited across all examined robotics subsectors. In the Service Robotics – Logistics sector, there is an even split, with 50% of organizations reporting no promotions and the remaining 50% indicating that less than 10% of their employees were promoted. Meanwhile, in both Industrial Robotics – Food and Industrial Robotics – Electric/Electronics, all organizations (100%) reported promoting less than 10% of their workforce. Notably, no subsector reported promotions in the 10–50% or more than 50% ranges. Furthermore, during the industry validation meeting, one validator mentioned a program called "**Star Promotion.**" This promotion does not represent a typical job advancement; instead, it serves as a form of recognition in which an employee's rank increases with the number of stars they earn. Of course, their advancement is based on their performance, and there is a corresponding salary increase for each level. However, this system also indicates that moving up in these fields is somewhat limited, likely because of small company structures, an emphasis on technical skills rather than management, or a lack of higher-level job openings, as noted in other sections of the report.

**Table 22.**

*Distribution of Employees Promoted to Managerial and Supervisory Positions by Robotics Subsector*

| Robotics Sector | % | | | | |
|---|---|---|---|---|---|
| | None | Less than 10% | 10-50% | More than 50% | Total |
| **Service Robotics - Logistics** | 50.00% | 50.00% | 0.00% | 0.00% | 100.00% |
| **Industrial Robotics - Food** | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |
| **Industrial Robotics - Electric/Electronics** | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |

Table 23 shows varying levels of employee support through career or structured succession planning across robotics subsectors. In Service Robotics – Logistics, validators reported strong initiatives, with more than 50% of employees supported through development plans, training, and competency assessments to determine training readiness. In Industrial Robotics – Food, while no additional comments were provided, the data reflects full support for more than 50% of employees. In Industrial Robotics – Electronics, validators noted a range of practices: one organization supports 10–50% of employees, while another promotes a scientific system with no hiring limits and offers clear career paths for engineers, especially those with advanced degrees. Others implement a ranking system where promotions are based on relevant certifications, indicating a more structured and merit-based approach.

**Table 23.**
*Distribution of Employees Supported by Career/Structured Succession Planning Policy/Practices for Current and Future Development by Robotics Subsector*

| Robotics Sector | % | | | | |
|---|---|---|---|---|---|
| | None | Less than 10% | 10-50% | More than 50% | Total |
| **Service Robotics - Logistics** | 0.00% | 33.33% | 0.00% | 66.67% | 100.00% |
| **Industrial Robotics - Food** | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| **Industrial Robotics - Electric/Electronics** | 0.00% | 50.00% | 50.00% | 0.00% | 100.00% |

Table 24 presents the distribution of employees contributing to outstanding performance in robotics facilities across different subsectors. In Service Robotics – Logistics, 66.67% of organizations reported that 10–50% of their employees contributed significantly, while 33.33% indicated that more than 50% made outstanding contributions. In Industrial Robotics – Food, all organizations (100%) reported that over 50% of employees contributed to exceptional performance, suggesting a highly engaged workforce. In contrast, Industrial Robotics – Electric/Electronics showed limited engagement, with 100% of organizations stating that less than 10% of employees contributed significantly.

**Table 24.**
*Distribution of Employees Contributing to Outstanding Performance to the Robotics Facilities by Subsector*

| Robotics Sector | % | | | | |
|---|---|---|---|---|---|
| | None | Less than 10% | 10-50% | More than 50% | Total |
| **Service Robotics - Logistics** | 0.00% | 0.00% | 66.67% | 33.33% | 100.00% |
| **Industrial Robotics - Food** | 0.00% | 0.00% | 0.00% | 100.00% | 100.00% |
| **Industrial Robotics - Electric/Electronics** | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |

Table 25 shows the percentage of robotics facilities with structured programs for managing high-potential employees across subsectors, with additional context from validators. In Service Robotics – Logistics, 50% of facilities have such programs, with leadership training as a key component. Validators noted that underperforming employees may undergo a Performance Improvement Plan (PIP), while others benefit from structured learning and development plans. In Industrial Robotics – Food, all facilities (100%) have structured programs. Validators highlighted the use of Individual Development Plans (IDPs) to tailor learning opportunities based on employees' strengths and weaknesses. Some employers also invest in further education, such as sponsoring master's degrees for promising supervisory-level staff. Industrial Robotics – Electric/Electronics also reported full (100%) implementation of structured programs, though no additional comments were provided.

**Table 25.**
*Percentage of Robotics Facilities with Structured Program for Managing High Potential Employees by Robotics Subsector*

| Robotics Sector | % | Remarks |
|---|---|---|
| **Service Robotics - Logistics** | 50.00% | Leadership Training |
| **Industrial Robotics - Food** | 100.00% | |
| **Industrial Robotics - Electric/Electronics** | 100.00% | |

## 4.3 Skills in Your Business

The data in Table 26 shows that the majority of employees (75%) are viewed as having the potential to take on more demanding duties than their current roles require. This indicates a workforce with strong developmental capacity and suggests that many employees are underutilized or ready for career progression. A smaller portion, 22.22%, are considered able to perform their current roles but are not seen as exceeding expectations or ready for more complex tasks. Only 2.78% of employees are identified as unable to perform their jobs, reflecting a minimal performance gap within the workforce.

During the validation meeting, validators from the food sector noted that the results may reflect internal HR policies, particularly where performance evaluations are tied to salary increases. They also acknowledged that the distribution of evaluations could be consistent with broader industry norms. In Table 27, which presents the distribution of employee performance across robotics subsectors, the industrial robotics–food sector showed a highly favorable outcome: 100% of employees were assessed as having the potential to take on more demanding duties, with no employees rated below expectations.

In terms of breakdown by subsectors, in the service robotics–logistics subsector, the evaluation results were evenly split: 50% of employees were seen as able to perform their jobs but not beyond, while the other 50% were viewed as having higher potential. No employees in this group were assessed as unable to perform their duties, indicating a stable but moderately developing workforce. In contrast, the industrial robotics–electronics subsector showed a broader distribution: 75% of employees were considered to have potential for more demanding roles, 16.67% were performing adequately, and 8.33% were unable to meet job requirements. These figures reflect a more varied performance landscape, which may relate to the complexity or specialization of roles in this subsector.

Additional validators from the electronics sector supported these findings with mixed perspectives. While some organizations reported results closely aligned with the table—typically 25% performing adequately and 75% with greater potential—one stood out with 100% of employees rated as only meeting current expectations. Overall, the data points to a generally capable and promotable workforce across robotics subsectors, though sectoral and organizational context remains critical to interpretation.

**Table 26.**
*Distribution of the Employees by Performance Evaluation*

| Performance Evaluation | % |
|---|---|
| Able to perform the job but not beyond | 22.22% |
| Unable to perform the job | 2.78% |
| Have the potential to perform with more demanding duties than they currently have | 75.00% |
| **Total** | **100.00%** |

**Table 27.**
*Distribution of Employees by Performance Evaluation and by Robotics Subsector*

| Performance Evaluation | Able to perform the job but not beyond | Unable to perform the job | Have the potential to perform with more demanding duties than they currently have | Total |
|---|---|---|---|---|
| Service Robotics - Logistics | 50.00% | 0% | 50.00% | 100.00% |
| Industrial Robotics - Food | 0% | 0% | 100.00% | 100.00% |
| Industrial Robotics - Electric/Electronics | 16.67% | 8.33% | 75.00% | 100.00% |

***Robotics Facilities with Underperforming Employees per Reason***

Technical competencies primarily contribute to skill gaps among underperforming employees in the *Industrial Robotics - Electric/Electronics subsector*. There is a complete lack of both specialized technical skills and advanced robotics skills

necessary for the subsector. These skills typically include robotics programming, system integration, troubleshooting, and operation of sophisticated equipment.

Additionally, a lack of essential soft skills such as communication, problem-solving, and adaptability was reported, highlighting the importance of these attributes for effective teamwork and problem resolution in robotics environments. However, gaps in socio-emotional skills—like emotional stability, decision-making, and openness—were not observed. No significant deficiencies were identified in management, leadership, language, office, digital, or industry-specific STEM-related skills.

***Facilities that have Undertaken Actions or Interventions to Employees with the Potential to Perform More Demanding Duties by Robotics Subsector***

The validation meeting's validators confirmed that there is no recorded percentage of employees who cannot perform their jobs in their subsectors, explaining the lack of data.

Despite this, industry representatives shared information on existing support and development programs aimed at maintaining and improving employee performance. In the *logistics subsector*, companies implement a variety of initiatives that include both internal and external training, certification programs, and promotion schemes that are linked to performance, which encompasses salary increases and incentives such as travel allowances. The discussion also included mentions of government-related incentives and learning development opportunities. Cross-posting practices, along with other incentives, are implemented to promote skill development and enhance employee motivation. These efforts reflect proactive strategies to sustain workforce capability and minimize performance issues.

***Robotics Facilities that have Undertaken Actions or Interventions to Employees with the Potential to Perform More Demanding Duties by Type of Interventions***

Validators shared several strategies across subsectors to address interventions for employees with the potential to take on more demanding duties.

The *logistics subsector* did not provide any additional comments, indicating that standard employee development practices are in place.

The *food subsector* highlighted the use of various incentives to motivate and reward high performers. These include profit-sharing schemes linked to successful projects, travel opportunities, and performance incentives. Companies also implement salary

increases depending on company capacity and employee level, alongside job reassignments to better align roles with individual potential.

Validators from the electronics subsector reported a comprehensive approach incorporating multiple interventions. Incentives tied to business performance—such as management bonuses and recognition programs for cost-saving initiatives—are common. Job reassignments serve dual purposes: as a development tool, including job rotations for succession planning, and occasionally as a corrective measure, though the latter is viewed as less motivating. Recognition and discretionary bonuses are part of the incentive structure, though practices vary depending on company size and operational focus. In government-related entities, learning and development opportunities, research presentations abroad, and annual salary increases are typical forms of motivation, with promotion often linked to research productivity.

Some organizations emphasize delegation of tasks based on employee strengths, supported by organizational recognition through awards and acknowledgments of outstanding professionals. However, certain groups may not widely practice job reassignment, instead prioritizing task matching with the most suitable professional.

Table 28 indicates that 90% of job positions in robotics facilities require candidates to have a higher education degree (baccalaureate degree or above). Only 10% of positions are open to basic education graduates, while none accept applicants without formal education or those who only completed TechVoc courses.

According to validators, the pattern reflects the sector's emphasis on academic qualifications, especially for roles involving engineering, system design, and supervision. However, validators also shared that in certain operational roles—especially those involving machinery—there is some openness to hiring individuals with basic education or vocational training, provided they have relevant experience.

**Table 28.**
*Distribution of Positions by the Educational Attainment Policy of the Existing Job Positions*

| Requirements by Policy (Highest Educational Attainment) | % |
|---|---|
| No Requirement | 0.00% |
| Basic Education Graduate | 10.00% |
| TechVoc Course Graduate | 0.00% |
| Higher Education Graduate (Baccalaureate and above) | 90.00% |

Table 29 shows that when looking at different areas, both the industrial robotics–food and industrial robotics–electronics sectors require all job roles to have higher education, highlighting how technical and regulated these fields are. In comparison, the service robotics–logistics area is more flexible, with 30% of jobs available for those with basic education and 70% needing higher education. In contrast, the service robotics–logistics subsector appears more flexible, with 30% of positions open to basic education graduates and 70% requiring higher education.

Validator feedback reinforces this distinction. In more physically driven or process-based logistics roles, applicants with lower educational attainment may still qualify, especially if supported by relevant certifications or practical skills. However, in food and electronics, where quality control, programming, and system integration are more complex, higher education remains the baseline standard.

**Table 29.**
*Distribution of Positions by the Educational Attainment Policy of the Existing Job Positions by Robotics Subsector*

| Requirements by Policy (Highest Educational Attainment) | Service Robotics - Logistics | Industrial Robotics - Food | Industrial Robotics - Electric/Electronics |
|---|---|---|---|
| No Requirement | 0.00% | 0.00% | 0.00% |
| Basic Education Graduate | 30.00% | 0.00% | 0.00% |
| TechVoc Course Graduate | 0.00% | 0.00% | 0.00% |
| Higher Education Graduate (Baccalaureate and above) | 70.00% | 100.00% | 100.00% |

Table 30 presents data on key workforce-related requirements in robotics facilities, revealing insights into the sector's approach to employee preparedness and development. According to the survey, 57.5% of robotics facilities require employees to engage in continuous learning and development, reflecting a sector-wide recognition of the importance of upskilling and adaptability in a rapidly evolving technological environment. However, only 22.5% require induction training lasting more than two weeks, and just 20% mandate at least three years of industry-relevant experience for new hires.

These findings indicate that while robotics employers generally support ongoing learning, the depth and structure of formal training programs may be limited or role-dependent. Validation insights support this interpretation, noting that longer onboarding periods are typically reserved for technical or engineering roles—particularly where safety and equipment use are involved—whereas operational positions may have shorter, task-oriented training. Additionally, although industry experience is preferred, many companies remain open to hiring fresh

graduates if they have completed relevant training or internships (e.g., On-the-Job Training or OJT), suggesting that skills acquisition is often expected to continue post-hire.

When compared to the WSS survey in the Manufacturing sector, a clearer picture of sectoral differences emerges. In the Manufacturing sector, at least one company reported having a fully institutionalized internal training academy designed to provide structured, continuous learning. This academy includes compliance-based training (e.g., Good Manufacturing Practices, 6S), soft skills development, and a Foreman Program that prepares workers for supervisory roles by covering five key competency areas: Safety and Compliance, Operations, Quality, Critical Thinking, and Leadership. This approach illustrates a more comprehensive and systematized training model, where skills development is both formalized and strategically aligned with career progression. The contrast between the two sectors highlights the varying levels of institutionalization and investment in workforce development. Robotics facilities appear to take a more flexible, needs-based approach, particularly in contexts where rapid technological change may demand adaptability over standardized training. The Manufacturing sector, on the other hand, demonstrates a more mature workforce development system, with a clear emphasis on structured programs that support both operational efficiency and leadership development.

**Table 30.**
*Percentage of Robotics Facilities per Specific Policy Requirements of the Existing Job Positions*

| Requirements by Policy | % |
|---|---|
| Induction training of more than two weeks before the post-holder can perform assigned work | 22.50% |
| Continuous learning/developmental activities | 57.50% |
| At least 3 years of industry-relevant experience to do the job | 20.00% |

*Note: Note: There was no response gathered from the Service Robotics - Logistics*

Table 31 shows that continuous learning and development is more common in industrial robotics–food (65%) than in electronics (50%). Induction training of more than two weeks is required in 25% of food facilities and 20% of electronics facilities. In terms of experience, 30% of electronics facilities and 10% of food facilities require at least three years of industry-relevant experience.

These patterns reflect validator insights. In electronics, where roles can be highly technical or supervisory, experience is often seen as essential, particularly for maintaining quality and efficiency in high-precision environments. The food

subsector places more emphasis on ongoing learning, possibly due to evolving automation technologies and a focus on product safety. While induction training is used across both sectors, validators indicated that longer onboarding is typically reserved for more complex engineering roles. These findings point to sector-specific strategies in preparing and supporting robotics talent.

**Table 31.**

*Percentage of Facilities per Specific Policy Requirements of the Existing Job Positions by Robotics Subsector*

| Specific Policy Requirements of the Existing Job Positions | Industrial Robotics - Food | Industrial Robotics - Electric/Electronics |
|---|---|---|
| Induction training of more than two weeks before the post-holder can perform assigned work | 25% | 20% |
| Continuous learning/developmental activities | 65% | 50% |
| At least 3 years of industry-relevant experience to do the job | 10% | 30% |

*Note: There was no response gathered from the Service Robotics - Logistics; therefore, it was not included on the table*

The participants were given a list of relevant skills/jobs in the robotics subsector. This was used to determine which skills are relevant to the robotics facilities over the next five years. It projects trends such as shortage, no changes, surplus, hard-to-fill, and or not. For any applicable skills/jobs, it can be identified whether the skills/jobs could be addressed by TVET Program. Table 32 shows responses from robotics facilities within the Service Robotics – Logistics subsector and highlight the key skills identified.

In summary, the following job requirements per value chain are considered as applicable and anticipated to experience a shortage of workers by the majority (over 50%) of the participating facilities:

| Value Chain | Jobs/Skills |
|---|---|
| **Storage and Inventory Management** | • Supply Chain Automation Engineer<br>• AI Specialist for Logistics Robotics<br>• Robotics Logistics Consultant<br>• Robotics Maintenance Technician (Logistics)<br>• Robotics Integration Specialist (Logistics)<br>• Conveyor Automation Technician<br>• Automated Storage and Retrieval System (ASRS) Operator<br>• Quality Control Technician<br>• Data Annotators |
| **Warehousing and Distribution** | • Autonomous Mobile Robot (AMR) Technician<br>• Drone Operator (Logistics)<br>• Automated Storage and Retrieval System (ASRS) Operator<br>• Automation Technician<br>• AI Engineer<br>• Data Analyst |

**Table 32**

*Projected Distribution of the Jobs Supply for the next 5 years - Service Robotics - Logistics subsector*

| Value Chain | Jobs | Applicability % | Changes (%) | | | | |
|---|---|---|---|---|---|---|---|
| | | Yes | Shortage | No change | Surplus | No Answer | Total |
| Storage and Inventory Management | Supply Chain Automation Engineer | 100.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | AI Specialist for Logistics Robotics | 66.67 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Logistics Consultant | 83.33 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Maintenance Technician (Logistics) | 83.33 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Integration Specialist (Logistics) | 83.33 | 60.00 | 20.00 | 20.00 | 0.00 | 100.00 |
| | Conveyor Automation Technician | 50.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Automated Storage and Retrieval System (ASRS) Operator | 66.67 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Autonomous Mobile Robot (AMR) Technician | 66.67 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Quality Control Technician | 66.67 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Data Gathering Personnel | 100.00 | 33.33 | 50.00 | 16.67 | 0.00 | 100.00 |
| | Data Annotators | 83.33 | 60.00 | 40.00 | 0.00 | 0.00 | 100.00 |
| Warehousing and Distribution | Warehouse Automation Technician | 50.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Automated Picking and Packing System Operator | 66.67 | 50.00 | 25.00 | 0.00 | 25.00 | 100.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Robotic Sorting Systems Operator | 66.67 | 50.00 | 25.00 | 0.00 | 25.00 | 100.00 |
| Autonomous Mobile Robot (AMR) Technician | 83.33 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| Drone Operator (Logistics) | 83.33 | 60.00 | 40.00 | 0.00 | 0.00 | 100.00 |
| Fleet Automation Supervisor | 66.67 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| Automated Storage and Retrieval System (ASRS) Operator | 66.67 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| Automation Technician | 100.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| AI Engineer | 100.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| Data Analyst | 100.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |

Similar to the previous table, Table 33 also shows the responses from robotics facilities under the Industrial Robotics - Food subsector, which highlights the key skills identified. The following job requirements per value chain are considered as applicable and anticipated to experience a shortage of workers by the majority (over 50%) of the participating facilities:

| Value Chain | Jobs/Skills |
|---|---|
| **Food Processing** | • Robotics Technician<br>• Robotics Operator<br>• Automation Engineer |
| **Quality Control and Safety** | • Product Test Specialist<br>• Repair Technician |

**Table 33.**

*Projected Distribution of theJ obs Supply for the next 5 years - Industrial Robotics - Food subsector*

| Value Chain | Jobs | Applicability % | Changes (%) | | | | |
|---|---|---|---|---|---|---|---|
| | | Yes | Shortage | No change | Surplus | No Answer | Total |
| Food Processing | Robotics Engineer | 50.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Technician | 75.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Operator | 66.67 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Food Processing Robot Technician | 66.67 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| | Packaging Robot Operator | 66.67 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| | Automation Engineer | 100.00 | 66.67 | 0.00 | 33.33 | 0.00 | 100.00 |
| | Control Systems Engineer | 100.00 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| | Electrical and Instrumentation Technician | 100.00 | 33.33 | 33.33 | 33.33 | 0.00 | 99.99 |
| | Instrument and Automation Technician | 66.67 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| Quality Control and Food Safety | Product Test Specialist | 100.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Repair Technician | 66.67 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |

Table 34 which covers the Industrial Robotics - Electric/Electronics subsector, also presents data on the projected skills supply for the subsector over the next five years. The results indicate the following job requirements applicable and anticipated to have a shortage according to a majority of the participating facilities:

| Value Chain | Jobs/Skills |
|---|---|
| **Product and Service Development** | • Controls Engineer<br>• Product Test Specialist<br>• Programmer<br>• Test Engineering Technician<br>• MCU and PLC Programmer<br>• Computer Vision System Specialist |
| **Manufacturing** | • Automation Technician<br>• Machine / Robot Operator<br>• Instrument Specialist<br>• Instrument and Automation Technician<br>• Test Technician<br>• Quality Control Technician |
| **Maintenance, Repair, and Assembly** | • Electrical and Instrumentation Technician<br>• Instrument Technician<br>• Process Control Technician<br>• Robotic Technician<br>• Robotics Calibration Technician<br>• Equipment Engineering Maintenance |

**Table 34.**
*Projected Distribution of the Jobs Supply for the next 5 years - Industrial Robotics - Electric/Electronics subsector*

| Value Chain | Jobs | Applicability % | Changes (%) | | | | |
|---|---|---|---|---|---|---|---|
| | | Yes | Shortage | No change | Surplus | No Answer | Total |
| Product and Service Development | Controls Engineer | 85.71 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Product Test Specialist | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Programmer | 100.00 | 57.14 | 14.29 | 28.57 | 0.00 | 100.00 |
| | Test Engineering Technician | 85.71 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | New Product Introduction Engineer | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | MCU and PLC Programmer | 85.71 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Computer Vision System Specialist | 85.71 | 83.33 | 16.67 | 0.00 | 0.00 | 100.00 |
| Manufacturing | Automation Technician | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Machine / Robot Operator | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Instrument Specialist | 57.14 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Instrument and Automation Technician | 57.14 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Setup Operator | 50.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Test Technician | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Quality Control Technician | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Electronics Technician | 57.14 | 25.00 | 50.00 | 25.00 | 0.00 | 100.00 |
| | Instrument Technician | 57.14 | 75.00 | 0.00 | 25.00 | 0.00 | 100.00 |
| | Mechanical Technician | 57.14 | 50.00 | 25.00 | 25.00 | 0.00 | 100.00 |
| | Process Control Technician | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Repair Technician | 57.14 | 25.00 | 50.00 | 25.00 | 0.00 | 100.00 |
| | Rework / Custom Welder | 57.14 | 50.00 | 25.00 | 25.00 | 0.00 | 100.00 |
| | Robotic Technician | 71.43 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Calibration Technician | 57.14 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Field Service Technician | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Line Maintenance | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Preventive Maintenance Technician | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Equipment Engineering Maintenance | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |

Table 35 lists the skills projected to be difficult to fill by robotics facilities over the next five years. These skills/jobs were identified by respondents as positions they anticipate having trouble filling.

Consistent with the information presented in the preceding tables, the following list outlines anticipated skill/job shortages and hard-to-fill positions, organized by robotics subsector:

**Service Robotics - Logistics subsector**

**Storage and Inventory Management**

- Supply Chain Automation Engineer
- AI Specialist for Logistics Robotics
- Robotics Logistics Consultant
- Robotics Maintenance Technician (Logistics)
- Robotics Integration Specialist (Logistics)
- Conveyor Automation Technician
- Automated Storage and Retrieval System (ASRS) Operator
- Autonomous Mobile Robot (AMR) Technician
- Quality Control Technician
- Data Annotators

**Warehousing and Distribution**

- Warehouse Automation Technician
- Automated Picking and Packing System Operator
- Robotic Sorting Systems Operator
- Autonomous Mobile Robot (AMR) Technician
- Drone Operator (Logistics)
- Fleet Automation Supervisor
- Automated Storage and Retrieval System (ASRS) Operator
- Automation Technician
- AI Engineer
- Data Analyst

**Industrial Robotics - Food subsector**

**Food Processing**

- Robotics Engineer
- Robotics Technician
- Robotics Operator
- Food Processing Robot Technician
- Packaging Robot Operator
- Palletizing Robot Engineer
- Food Sorting Robot Specialist
- Automation Engineer
- Control Systems Engineer
- Electronics Technician
- Instrument and Automation Technician
- Instrument Specialist
- Instrument Technician

**Quality Control and Food Safety**

- Robotics Safety Specialist
- Automated Cleaning Systems Technician
- Product Test Specialist
- Repair Technician

**Storage**

- Autonomous Mobile Robot (AMR) Technician
- Palletizing Robot Engineer

**Industrial Robotics - Electric/Electronics subsector**

**Product and Service Development**

- Controls Engineer
- Product Test Specialist
- Programmer
- Test Engineering Technician
- New Product Introduction Engineer
- MCU and PLC Programmer
- Computer Vision System Specialist

**Manufacturing**

- Automation Technician
- Machine / Robot Operator
- Instrument Specialist
- Instrument and Automation Technician
- Setup Operator
- Robotic Soldering Technician
- Test Technician
- Quality Control Technician

**Maintenance, Repair, and Assembly**

- Electrical and Instrumentation Technician
- Mechanical Technician
- Process Control Technician
- Rework / Custom Welder
- Robotic Technician
- Robotics Calibration Technician
- Line Maintenance
- Preventive Maintenance Technician
- Equipment Engineering Maintenance

**Table 35**

*Hard-to-Fill Jobs by Robotics subsectors*

| Service Robotics - Logistics subsector | Industrial Robotics - Food subsector | Industrial Robotics - Electric/Electronics subsector |
|---|---|---|
| Supply Chain Automation Engineer | Robotics Engineer | Controls Engineer |
| AI Specialist for Logistics Robotics | Robotics Technician | Product Test Specialist |
| Robotics Logistics Consultant | Robotics Operator | Programmer |
| Robotics Maintenance Technician (Logistics) | Food Processing Robot Technician | Test Engineering Technician |
| Robotics Integration Specialist (Logistics) | Packaging Robot Operator | New Product Introduction Engineer |
| Conveyor Automation Technician | Palletizing Robot Engineer | MCU and PLC Programmer |
| Automated Storage and Retrieval System (ASRS) Operator | Food Sorting Robot Specialist | Computer Vision System Specialist |
| Autonomous Mobile Robot (AMR) Technician | Automation Engineer | Automation Technician |
| Quality Control Technician | Control Systems Engineer | Machine / Robot Operator |
| Data Gathering Personnel | Electrical and Instrumentation Technician | Instrument Specialist |
| Data Annotators | Electronics Technician | Instrument and Automation Technician |
| Warehouse Automation Technician | Instrument and Automation Technician | Setup Operator |
| Automated Picking and Packing System Operator | Instrument Specialist | Robotic Soldering Technician |

| | | |
|---|---|---|
| Robotic Sorting Systems Operator | Instrument Technician | Test Technician |
| Autonomous Mobile Robot (AMR) Technician | Robotics Safety Specialist | Quality Control Technician |
| Drone Operator (Logistics) | Automated Cleaning Systems Technician | Electrical and Instrumentation Technician |
| Fleet Automation Supervisor | Product Test Specialist | Instrument Technician |
| Automated Storage and Retrieval System (ASRS) Operator | Repair Technician | Mechanical Technician |
| Automation Technician | Autonomous Mobile Robot (AMR) Technician | Process Control Technician |
| AI Engineer | Palletizing Robot Engineer | Rework / Custom Welder |
| Data Analyst | | Robotic Technician |
| | | Robotics Calibration Technician |
| | | Field Service Technician |
| | | Line Maintenance |
| | | Preventive Maintenance Technician |
| | | Equipment Engineering Maintenance |

According to Table 36, the top job roles that require TVET graduates vary across the different robotics subsectors. In the Service Robotics – Logistics subsector, the most in-demand roles include Robotics Maintenance Technician (Logistics), Conveyor Automation Technician, Warehouse Automation Technician, Automated Picking and Packing System Operator, Robotic Sorting Systems Operator, and Drone Operator (Logistics). These positions reflect the growing need for technical skills in managing automated logistics and delivery systems.

In the Industrial Robotics – Food subsector, the key roles suited for TVET graduates are Robotics Technician, Robotics Operator, Food Processing Robot Technician, Packaging Robot Operator, Electrical and Instrumentation Technician, Electronics Technician, Instrument and Automation Technician, Instrument Technician, Automated Cleaning Systems Technician, Repair Technician, and Autonomous Mobile Robot (AMR) Technician. These jobs highlight the importance of technical maintenance and operational skills in food manufacturing environments where automation is increasingly adopted.

Meanwhile, in the Industrial Robotics – Electronics/Electrical subsector, a broader range of specialized technical roles is needed. These include Product Test Specialist, Test Engineering Technician, MCU and PLC Programmer, Automation Technician, Machine/Robot Operator, Instrument Specialist, Instrument and Automation Technician, Setup Operator, Robotic Soldering Technician, Test Technician, Quality Control Technician, Electrical and Instrumentation Technician, Electronics Technician, Instrument Technician, Mechanical Technician, Process Control Technician, Repair Technician, Rework/Custom Welder, Robotic Technician, Field Service Technician, and Line Maintenance personnel. This reflects the complex and high-tech nature of electronics and electrical manufacturing, which relies heavily on precise automation and maintenance skills—areas where TVET graduates are well-positioned to contribute.

**Table 36.**
*Distribution of the Projected Jobs Supply for the Next 5 years by Highest Educational Qualification Needed, by Robotics subsector*

| Robotics Subsectors | Value Chain | Jobs | Highest Educational Qualification Needed (%) | | |
|---|---|---|---|---|---|
| | | | Basic education graduate (HS Grad Old Curriculum or SHS Graduate K-12 Curriculum) | Technical education (TVET Graduate) | Higher education on graduate (college degree and above |
| | | Supply Chain Automation Engineer | 0.00 | 0.00 | 100.00 |
| | | AI Specialist for Logistics Robotics | 0.00 | 0.00 | 100.00 |
| | | Robotics Logistics Consultant | 0.00 | 0.00 | 100.00 |
| | | Robotics Maintenance Technician (Logistics) | 0.00 | 60.00 | 40.00 |
| Service Robotics - Logistics | Storage and Inventory Management | Robotics Integration Specialist (Logistics) | 0.00 | 0.00 | 100.00 |
| | | Conveyor Automation Technician | 0.00 | 66.67 | 33.33 |
| | | Automated Storage and Retrieval System (ASRS) Operator | 0.00 | 25.00 | 75.00 |

| | | | | |
|---|---|---|---|---|
| | Autonomous Mobile Robot (AMR) Technician | 0.00 | 25.00 | 75.00 |
| | Quality Control Technician | 0.00 | 25.00 | 75.00 |
| | Data Gathering Personnel | 0.00 | 33.33 | 66.67 |
| | Data Annotators | 0.00 | 40.00 | 60.00 |
| | Warehouse Automation Technician | 0.00 | 66.67 | 33.33 |
| | Automated Picking and Packing System Operator | 0.00 | 75.00 | 25.00 |
| | Robotic Sorting Systems Operator | 0.00 | 75.00 | 25.00 |
| Warehousing and Distribution | Autonomous Mobile Robot (AMR) Technician | 0.00 | 40.00 | 60.00 |
| | Drone Operator (Logistics) | 0.00 | 60.00 | 40.00 |
| | Fleet Automation Supervisor | 0.00 | 0.00 | 100.00 |
| | Automated Storage and Retrieval System (ASRS) Operator | 0.00 | 25.00 | 75.00 |

| | | | | | |
|---|---|---|---|---|---|
| | | Automation Technician | 0.00 | 42.86 | 57.14 |
| | | AI Engineer | 0.00 | 0.00 | 100.00 |
| | | Data Analyst | 0.00 | 0.00 | 100.00 |
| Industrial Robotics - Food | Food Processing | Robotics Engineer | 0.00 | 33.33 | 66.67 |
| | | Robotics Technician | 0.00 | 75.00 | 25.00 |
| | | Robotics Operator | 0.00 | 100.00 | 0.00 |
| | | Food Processing Robot Technician | 0.00 | 50.00 | 50.00 |
| | | Packaging Robot Operator | 0.00 | 50.00 | 50.00 |
| | | Palletizing Robot Engineer | 0.00 | 0.00 | 100.00 |
| | | Food Sorting Robot Specialist | 0.00 | 0.00 | 100.00 |
| | | Automation Engineer | 0.00 | 0.00 | 100.00 |
| | | Control Systems Engineer | 0.00 | 0.00 | 100.00 |
| | | Electrical and Instrumentation Technician | 0.00 | 66.67 | 33.33 |
| | | Electronics Technician | 0.00 | 100.00 | 0.00 |
| | | Instrument and Automation Technician | 0.00 | 50.00 | 50.00 |

| | | | | | |
|---|---|---|---|---|---|
| | | Instrument Specialist | 0.00 | 0.00 | 100.00 |
| | | Instrument Technician | 0.00 | 100.00 | 0.00 |
| | Quality Control and Food Safety | Robotics Safety Specialist | 0.00 | 0.00 | 100.00 |
| | | Automated Cleaning Systems Technician | 0.00 | 100.00 | 0.00 |
| | | Product Test Specialist | 0.00 | 0.00 | 100.00 |
| | | Repair Technician | 0.00 | 100.00 | 0.00 |
| | Storage | Autonomous Mobile Robot (AMR) Technician | 0.00 | 100.00 | 0.00 |
| | | Palletizing Robot Engineer | 0.00 | 0.00 | 100.00 |
| Industrial Robotics - Electric/Electrical | Product and Service Development | Controls Engineer | 0.00 | 16.67 | 83.33 |
| | | Product Test Specialist | 0.00 | 50.00 | 50.00 |
| | | Programmer | 0.00 | 42.86 | 57.14 |
| | | Test Engineering Technician | 0.00 | 66.67 | 33.33 |
| | | New Product Introduction Engineer | 0.00 | 0.00 | 100.00 |
| | | MCU and PLC Programmer | 0.00 | 50.00 | 50.00 |

| | | | | |
|---|---|---|---|---|
| | Computer Vision System Specialist | 0.00 | 16.67 | 83.33 |
| Manufacturing | Automation Technician | 0.00 | 80.00 | 20.00 |
| | Machine / Robot Operator | 20.00 | 60.00 | 20.00 |
| | Instrument Specialist | 50.00 | 50.00 | 0.00 |
| | Instrument and Automation Technician | 0.00 | 75.00 | 25.00 |
| | Setup Operator | 33.33 | 66.67 | 0.00 |
| | Robotic Soldering Technician | 0.00 | 50.00 | 50.00 |
| | Scale Technician | 0.00 | 0.00 | 100.00 |
| | Test Technician | 0.00 | 50.00 | 50.00 |
| | Quality Control Technician | 0.00 | 50.00 | 50.00 |
| Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | 0.00 | 60.00 | 40.00 |
| | Electronics Technician | 0.00 | 75.00 | 25.00 |
| | Instrument Technician | 0.00 | 75.00 | 25.00 |
| | Mechanical Technician | 0.00 | 75.00 | 25.00 |
| | Process Control Technician | 0.00 | 60.00 | 40.00 |

| | | | |
|---|---|---|---|
| Repair Technician | 0.00 | 75.00 | 25.00 |
| Rework / Custom Welder | 25.00 | 50.00 | 25.00 |
| Robotic Technician | 0.00 | 80.00 | 20.00 |
| Robotics Calibration Technician | 100.00 | 0.00 | 0.00 |
| Field Service Technician | 0.00 | 75.00 | 25.00 |
| Data Gathering Personnel and Data Annotators | 33.33 | 33.33 | 33.33 |
| Line Maintenance | 25.00 | 50.00 | 25.00 |
| Preventive Maintenance Technician | 25.00 | 0.00 | 75.00 |
| Equipment Engineering Maintenance | 25.00 | 25.00 | 50.00 |

Table 37 presents data on whether the identified skills/jobs require a technical vocational certificate or national certification. At least 50% of the responding robotics facilities indicated that the following skills/jobs require such certification.

**Table 37.**
*Percentage of Robotics Facilities based on the Technical Vocational Certificate/National Certificate Requirement per Robotics Subsector*

| Robotics Subsectors | Value Chain | Job | % |
|---|---|---|---|
| Service Robotics - Logistics | Storage and Inventory Management | Autonomous Mobile Robot (AMR) Technician | 50.00 |
| | Warehousing and Distribution | Warehouse Automation Technician | 66.67 |
| | Warehousing and Distribution | Automated Picking and Packing System Operator | 50.00 |
| | Warehousing and Distribution | Robotic Sorting Systems Operator | 50.00 |
| | Warehousing and Distribution | Automated Storage and Retrieval System (ASRS) Operator | 50.00 |
| | Warehousing and Distribution | Automation Technician | 50.00 |
| Industrial Robotics - Food | Food Processing | Robotics Engineer | 50.00 |
| | Food Processing | Robotics Technician | 100.00 |
| | Food Processing | Robotics Operator | 50.00 |
| | Food Processing | Food Processing Robot Technician | 100.00 |
| | Food Processing | Electrical and Instrumentation Technician | 100.00 |

| | | | |
|---|---|---|---|
| | Food Processing | Electronics Technician | 100.00 |
| | Food Processing | Instrument and Automation Technician | 100.00 |
| | Food Processing | Instrument Technician | 100.00 |
| | Quality Control and Food Safety | Automated Cleaning Systems Technician | 100.00 |
| | Quality Control and Food Safety | Product Test Specialist | 50.00 |
| | Quality Control and Food Safety | Repair Technician | 50.00 |
| | Storage | Autonomous Mobile Robot (AMR) Technician | 100.00 |
| Industrial Robotics - Electric/Electronics | Product and Service Development | Test Engineering Technician | 50.00 |
| | Manufacturing | Automation Technician | 60.00 |
| | Manufacturing | Instrument Specialist | 50.00 |
| | Manufacturing | Instrument and Automation Technician | 50.00 |
| | Manufacturing | Robotic Soldering Technician | 50.00 |
| | Manufacturing | Test Technician | 50.00 |
| | Manufacturing | Quality Control Technician | 50.00 |
| | Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | 60.00 |
| | Maintenance, Repair, and Assembly | Electronics Technician | 50.00 |

| | | |
|---|---|---|
| Maintenance, Repair, and Assembly | Instrument Technician | 50.00 |
| Maintenance, Repair, and Assembly | Mechanical Technician | 50.00 |
| Maintenance, Repair, and Assembly | Process Control Technician | 60.00 |
| Maintenance, Repair, and Assembly | Repair Technician | 50.00 |
| Maintenance, Repair, and Assembly | Rework / Custom Welder | 50.00 |
| Maintenance, Repair, and Assembly | Robotic Technician | 60.00 |
| Maintenance, Repair, and Assembly | Robotics Calibration Technician | 75.00 |
| Maintenance, Repair, and Assembly | Field Service Technician | 50.00 |

Table 38 shows the geographic distribution of skill/job needs. Majority of the identified skills requirements across all robotics subsectors are needed both nationwide and in some specific areas in the locality.

**Table 38.**
*Area where skills/jobs are needed by Robotics subsectors*

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| Service Robotics - Logistics | Storage and Inventory Management | Supply Chain Automation Engineer | 50.00 | 50.00 | Not specified |
| | Storage and Inventory Management | AI Specialist for Logistics Robotics | 50.00 | 50.00 | Not specified |
| | Storage and Inventory Management | Robotics Logistics Consultant | 40.00 | 60.00 | Not specified |
| | Storage and Inventory Management | Robotics Maintenance Technician (Logistics) | 40.00 | 40.00 | Not specified |
| | Storage and Inventory Management | Robotics Integration Specialist (Logistics) | 60.00 | 40.00 | Not specified |
| | Storage and Inventory Management | Conveyor Automation Technician | 66.67 | 33.33 | Not specified |
| | Storage and Inventory Management | Automated Storage and Retrieval System (ASRS) Operator | 50.00 | 50.00 | Not specified |
| | Storage and Inventory Management | Autonomous Mobile Robot (AMR) Technician | 50.00 | 50.00 | Not specified |

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| | Storage and Inventory Management | Quality Control Technician | 50.00 | 50.00 | Not specified |
| | Storage and Inventory Management | Data Gathering Personnel | 66.67 | 33.33 | Not specified |
| | Storage and Inventory Management | Data Annotators | 60.00 | 40.00 | Not specified |
| | Warehousing and Distribution | Warehouse Automation Technician | 66.67 | 33.33 | Not specified |
| | Warehousing and Distribution | Automated Picking and Packing System Operator | 75.00 | 25.00 | Not specified |
| | Warehousing and Distribution | Robotic Sorting Systems Operator | 75.00 | 25.00 | Not specified |
| | Warehousing and Distribution | Autonomous Mobile Robot (AMR) Technician | 60.00 | 40.00 | Not specified |
| | Warehousing and Distribution | Drone Operator (Logistics) | 80.00 | 20.00 | Not specified |
| | Warehousing and Distribution | Fleet Automation Supervisor | 75.00 | 25.00 | Not specified |
| | Warehousing and Distribution | Automated Storage and Retrieval System (ASRS) Operator | 50.00 | 50.00 | Not specified |
| | Warehousing and Distribution | Automation Technician | 66.67 | 33.33 | Not specified |

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| | Warehousing and Distribution | Others: | 0.00 | 0.00 | |
| | Warehousing and Distribution | AI Engineer | 100.00 | 0.00 | |
| | Warehousing and Distribution | Data Analyst | 100.00 | 0.00 | |
| Industrial Robotics - Food | Food Processing | Robotics Engineer | 100.00 | 0.00 | |
| | Food Processing | **Robotics Technician** | **100.00** | 0.00 | |
| | Food Processing | Robotics Operator | 100.00 | 0.00 | |
| | Food Processing | Food Processing Robot Technician | 50.00 | 0.00 | |
| | Food Processing | Packaging Robot Operator | 50.00 | 0.00 | |
| | Food Processing | Palletizing Robot Engineer | 100.00 | 0.00 | |
| | Food Processing | Food Sorting Robot Specialist | 100.00 | 0.00 | |
| | Food Processing | Automation Engineer | 66.67 | 0.00 | |
| | Food Processing | Control Systems Engineer | 50.00 | 0.00 | |
| | Food Processing | Electrical and Instrumentation Technician | 66.67 | 0.00 | |
| | Food Processing | Electronics Technician | 100.00 | 0.00 | |
| | Food Processing | Instrument and Automation Technician | 50.00 | 0.00 | |

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| | Food Processing | Instrument Specialist | 100.00 | 0.00 | |
| | Food Processing | Instrument Technician | 100.00 | 0.00 | |
| | Quality Control and Food Safety | Robotics Safety Specialist | 100.00 | 0.00 | |
| | Quality Control and Food Safety | Automated Cleaning Systems Technician | 100.00 | 0.00 | |
| | Quality Control and Food Safety | Product Test Specialist | 66.67 | 0.00 | |
| | Quality Control and Food Safety | Repair Technician | 100.00 | 0.00 | |
| | Storage | Autonomous Mobile Robot (AMR) Technician | 100.00 | 0.00 | |
| | Storage | Palletizing Robot Engineer | 100.00 | 0.00 | |
| Industrial Robotics - Electric/Electronics | Product and Service Development | Value Chain: Product and Service Development | 0.00 | 0.00 | |
| | Product and Service Development | Controls Engineer | 66.67 | 0.00 | |
| | Product and Service Development | Product Test Specialist | 75.00 | 0.00 | |
| | Product and Service Development | Programmer | 85.71 | 0.00 | |

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| | Product Development and Service | Test Engineering Technician | 83.33 | 0.00 | |
| | Product Development and Service | New Product Introduction Engineer | 50.00 | 0.00 | |
| | Product Development and Service | MCU and PLC Programmer | 66.67 | 0.00 | |
| | Product Development and Service | Computer Vision System Specialist | 66.67 | 0.00 | |
| | Manufacturing | Automation Technician | 80.00 | 20.00 | Not specified |
| | Manufacturing | Machine / Robot Operator | 80.00 | 0.00 | |
| | Manufacturing | Instrument Specialist | 75.00 | 0.00 | |
| | Manufacturing | Instrument and Automation Technician | 75.00 | 25.00 | Not specified |
| | Manufacturing | Setup Operator | 66.67 | 0.00 | |
| | Manufacturing | Robotic Soldering Technician | 50.00 | 0.00 | |
| | Manufacturing | Scale Technician | 0.00 | 0.00 | |
| | Manufacturing | Test Technician | 75.00 | 25.00 | Not specified |
| | Manufacturing | Quality Control Technician | 75.00 | 25.00 | Not specified |

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| | Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Electronics Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Instrument Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Mechanical Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Process Control Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Repair Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Rework / Custom Welder | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Robotic Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Robotics Calibration Technician | 100.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Field Service Technician | 100.00 | 0.00 | |

| Robotics Subsectors | Value Chain | Skills/Job | Nationwide | Specific Area | Areas |
|---|---|---|---|---|---|
| | Maintenance, Repair, and Assembly | Data Gathering Personnel and Data Annotators | 66.67 | 0.00 | |
| | Maintenance, Repair, and Assembly | Line Maintenance | 75.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Preventive Maintenance Technician | 50.00 | 0.00 | |
| | Maintenance, Repair, and Assembly | Equipment Engineering Maintenance | 75.00 | 0.00 | |

In Table 39, the representation of women in STEM-related roles across robotics subsectors varies significantly, reflecting both structural and cultural factors. In the service robotics–logistics subsector, representation is split evenly, with half of the facilities reporting less than 25% of their STEM workforce as women, and the other half reporting 25% or more. This shows some progress in inclusivity, though the low availability of women in the field remains a key limiting factor. Validators in the logistics sector emphasized gender inclusivity efforts, though no additional comments were provided.

In contrast, all facilities in the industrial robotics–food subsector reported 25% or more women in STEM roles. One validator estimated a workforce gender ratio of 30:70 (women to men) and suggested that with increased automation, female participation could rise, potentially outpacing that of males in certain areas. Meanwhile, the industrial robotics–electronics subsector presented the opposite trend, with all respondents reporting less than 25% female representation. Although some companies reported women in advanced roles—such as programming, technical management, and field application—others noted the gap remains substantial, with practical representation falling short of the 50:50 ideal promoted by gender policies. Factors such as the highly technical nature of roles and workplace culture may contribute to this under-representation.

**Table 39.**
*Percentage of Women in STEM-related Occupations by Robotics Subsector*

| Robotics Subsector | Percentage of Robotics Facilities (%) | | |
|---|---|---|---|
| | less than 25 | 25 or more | Total |
| **Service Robotics - Logistics** | 50.00% | 50.00% | 100.00% |
| **Industrial Robotics - Food** | 0.00% | 100.00% | 100.00% |
| **Industrial Robotics - Electric/Electronics** | 100.00% | 0.00% | 100.00% |

*Note: the Reasons for Low Representation of Women in STEM-related Occupations by Robotics Subsector is only Low availability of women in the field this is from Service Robotics - Logistics*

The list of STEM-related occupations with low female representation reflects persistent gender imbalances in technical and operational roles across robotics subsectors. In the service robotics–logistics subsector, underrepresentation of women is most visible in roles such as technicians, engineers, machine operators, maintenance staff, and software programmers. These positions often require specialized training and may involve physical tasks or fieldwork, which have traditionally seen lower female participation.

In the industrial robotics–food subsector, only operation assistant roles were flagged as having low female representation. However, feedback from validators suggested optimism about future gender balance improvements as automation progresses and roles become less physically demanding and more skill-based.

For the industrial robotics–electronics subsector, occupations such as Technical Specialists Manager and Field Application Manager were identified as areas with fewer women. Some validators noted that highly technical and managerial positions continue to be male-dominated, although there are women in advanced programming and specialist roles. Cultural expectations and company structures may be contributing factors to this disparity.

**Table 40.**
*STEM-related Occupations with Low Representation of Women by Robotics Subsector*

| Robotics Subsector | Occupations |
|---|---|
| **Service Robotics - Logistics** | 1. Technician<br>2. Engineer<br>3. Machine Operator<br>4. Maintenance<br>5. Programming (Software) |
| **Industrial Robotics - Food** | 1. Operation Assistant |
| **Industrial Robotics - Electric/Electronics** | 1. Technical Specialists Manager<br>2. Field Application Manager |

## 4.4 Emerging Skills Associated with Industry Development

Table 41 shows the percentage distribution of the impact of skills demand in emerging skills related to industry development over the next 5 years: the following is the list of emerging skills identified by at least 50% of the participating robotics facilities across all robotics subsectors as either more skills demanded:

- Robotics Programming
- Machine Vision
- Sensor Integration
- Internet of Things (IoT)
- Technical and Programming Skills (C++, Python, Java, etc.)
- Autonomous Systems
- Human-Robot Interaction
- Simulation and Modeling

- Robotic Process Automation (RPA)
- Data Analysis for Robotics
- Artificial Intelligence in Robotics
- Collaborative Robotics (Cobots)
- Empathy/Humanistic Programmer
- System Integration
- Machine Design
- Cyber Threats
- Blockchain
- Maintenance Programming

Industry validators provided important contextual clarifications, suggesting revisions to skill classifications and terminology to better align with practical realities and training viability. For instance, during the Food subsector validation meeting, it was raised to change “Robotics Programming” to “Robotics Integration Programming.” The reasoning was that programming a robot in isolation is typically brand-specific and often included in vendor training. However, programming that involves integrating robots into complex automation lines requires higher-level skills and justifies a structured training intervention. Similarly, “Machine Vision” was suggested to be renamed as “Machine Integration Vision,” emphasizing its role within integrated systems rather than as a standalone product-driven solution.

Conversely, some skills were recommended for removal from short-term training, such as “Autonomous Systems” and “Human-Robot Interaction,” seen as too broad or theoretical. Robotic Process Automation (RPA) was excluded as it relates more to digital business processes. AI in robotics was suggested to be merged with machine vision due to its theoretical nature and limited short-term training applicability. Validators also questioned standardizing skills like sensor integration, IoT, and data analysis because of vendor dependence and narrow use cases.

In Logistics, similar concerns were raised, supporting the integration of Machine Vision and AI under Machine Integration Vision and removing broad topics like Autonomous Systems. In Electronics, challenges in standardizing training for Machine Vision, Sensor Integration, and IoT were noted, with suggestions to include them in AI training. Robotics Programming and Autonomous Systems were considered unsuitable for short courses, recommended for removal or integration into focused areas.

**Table 41.**
*Percentage Distribution on the Impact of Skills Demand and its Vacancy Category for the Emerging Skills in the Next Five Years by robotics subsector*

| Robotics Subsector | Emerging Skills | Impact | | | Vacancy Category | |
|---|---|---|---|---|---|---|
| | | More skills demanded | Staying the same | Fewer skills demanded | Not Applicable | Easy-to-Fill | Hard-to-Fill |
| Service Robotics - Logistic | Robotics Programming | 87.50% | 6.25% | 0.00% | 6.25% | 0.00% | 93.75% |
| | Machine Vision | 81.25% | 18.75% | 0.00% | 0.00% | 18.75% | 81.25% |
| | Sensor Integration | 62.50% | 31.25% | 0.00% | 6.25% | 25.00% | 68.75% |
| | Internet of Things (IoT) | 62.50% | 31.25% | 0.00% | 6.25% | 31.25% | 56.25% |
| | Technical and Programming Skills (C++, Python, Java, and etc.) | 50.00% | 43.75% | 6.25% | 0.00% | 56.25% | 37.50% |
| | Autonomous Systems | 87.50% | 0.00% | 6.25% | 6.25% | 0.00% | 93.75% |
| | Human-Robot Interaction | 75.00% | 12.50% | 0.00% | 12.50% | 6.25% | 81.25% |
| | Simulation and Modeling | 68.75% | 12.50% | 6.25% | 12.50% | 18.75% | 75.00% |
| | Robotic Process Automation (RPA) | 68.75% | 12.50% | 6.25% | 12.50% | 6.25% | 81.25% |
| | Data Analysis for Robotics | 62.50% | 18.75% | 6.25% | 12.50% | 25.00% | 62.50% |
| | Artificial Intelligence in Robotics | 81.25% | 12.50% | 0.00% | 6.25% | 6.25% | 87.50% |
| | Collaborative Robotics (Cobots) | 81.25% | 0.00% | 6.25% | 12.50% | 0.00% | 87.50% |
| Industrial Robotics - Food | Robotics Programming | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Machine Vision | 66.67% | 33.33% | 0.00% | 0.00% | 33.33% | 66.67% |
| | Sensor Integration | 33.33% | 66.67% | 0.00% | 0.00% | 66.67% | 33.33% |
| | Internet of Things (IoT) | 33.33% | 66.67% | 0.00% | 0.00% | 100.00% | 0.00% |
| | Technical and Programming Skills (C++, Python, Java, and etc.) | 50.00% | 25.00% | 25.00% | 0.00% | 100.00% | 0.00% |
| | Autonomous Systems | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Human-Robot Interaction | 66.67% | 33.33% | 0.00% | 0.00% | 33.33% | 66.67% |
| | Simulation and Modeling | 33.33% | 0.00% | 33.33% | 33.33% | 33.33% | 66.67% |
| | Robotic Process Automation (RPA) | 66.67% | 33.33% | 0.00% | 0.00% | 33.33% | 66.67% |

| Robotics Subsector | Emerging Skills | Impact | | | | Vacancy Category | |
|---|---|---|---|---|---|---|---|
| | | More skills demanded | Staying the same | Fewer skills demanded | Not Applicable | Easy-to-Fill | Hard-to-Fill |
| | Data Analysis for Robotics | 75.00% | 25.00% | 0.00% | 0.00% | 33.33% | 66.67% |
| | Artificial Intelligence in Robotics | 66.67% | 33.33% | 0.00% | 0.00% | 33.33% | 66.67% |
| | Collaborative Robotics (Cobots) | 66.67% | 0.00% | 0.00% | 33.33% | 0.00% | 100.00% |
| | Cyber Threats | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| | Blockchain | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| | Maintenance Programming | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Industrial Robotics - Electric/Electronics | Robotics Programming | 71.43% | 14.29% | 0.00% | 14.29% | 0.00% | 85.71% |
| | Machine Vision | 85.71% | 14.29% | 0.00% | 0.00% | 14.29% | 85.71% |
| | Sensor Integration | 42.86% | 42.86% | 0.00% | 14.29% | 28.75% | 57.14% |
| | Internet of Things (IoT) | 71.43% | 14.29% | 0.00% | 14.29% | 14.29% | 71.43% |
| | Technical and Programming Skills (C++, Python, Java, and etc.) | 42.86% | 57.14% | 0.00% | 0.00% | 57.14% | 42.86% |
| | Autonomous Systems | 85.71% | 0.00% | 0.00% | 14.29% | 0.00% | 85.71% |
| | Human-Robot Interaction | 57.14% | 14.29% | 0.00% | 28.57% | 0.00% | 71.43% |
| | Simulation and Modeling | 71.43% | 14.29% | 0.00% | 14.29% | 14.29% | 71.43% |
| | Robotic Process Automation (RPA) | 57.14% | 14.29% | 0.00% | 28.57% | 0.00% | 71.43% |
| | Data Analysis for Robotics | 57.14% | 14.29% | 0.00% | 28.57% | 14.29% | 57.14% |
| | Artificial Intelligence in Robotics | 71.43% | 14.29% | 0.00% | 14.29% | 0.00% | 85.71% |
| | Collaborative Robotics | 85.71% | 0.00% | 0.00% | 14.29% | 0.00% | 85.71% |

Table 42 shows that several other emerging skills have been identified as more in demand and hard to fill in the next five years across various robotics subsectors. The Service Robotics - Logistics subsector identified skills like system integration and machine design as critical and challenging to source. Even though empathy/humanistic programming was first listed as a needed skill, experts suggested taking it off the list because it fits better with research and ideas rather than practical skills that can be taught, especially in TVET programs.

In the Industrial Robotics - Food sector, additional emerging skills were identified, including system integration, machine design, cyber threats, blockchain, and maintenance programming. However, only system integration and machine design were confirmed as both in-demand and hard-to-fill. Validators pointed out that cyber threats, blockchain, and maintenance programming, while potentially relevant in the long term, currently lack a clear vacancy profile, suggesting their inclusion should be reconsidered or monitored as part of future labor market developments.

Moreover, validators emphasized the importance of prioritizing integrative and foundational skills. For instance, Sensor Integration was recommended for removal, as it is typically embedded within broader robotics integration and not treated as a standalone capability. In contrast, technical and programming skills—particularly Python, C++, and Java—were strongly endorsed, with specific recommendations to formalize Python under a Training Regulation (TR) due to its global relevance and growing application in robotics, AI, and automation.

**Table 42.**
*Other Emerging Skills Identified as More Skills Demanded and Hard-to-Fill Skills in the Next Five Years, by Robotics Subsector*

| Robotics Subsector | Other Emerging Skills |
|---|---|
| Service Robotics - Logistics | Empathy/Humanistic Programmer<br>System Integration<br>Machine Design |
| Industrial Robotics - Food | Cyber Threats<br>Blockchain<br>Maintenance Programming<br>System Integration<br>Machine Design |

Table 43 shows that several futuristic job roles applicable within the next 5–10 years have been identified across the robotics subsectors of logistics, food, and electronics. In the Service Robotics – *Logistics subsector*, jobs such as Warehouse Gamification Specialist, Autonomous Goods Verifier, and Circular Logistics Specialist

received the highest response rates, reflecting a growing focus on automation, user-centered warehouse design, and sustainable supply chain systems. Additionally, participants viewed roles such as Autonomous Logistics Traffic Controller, Post-Human Collaborative Designer, and Robot Fleet Management as highly relevant. The validators observed that "Robot Fleet Management" functions primarily through software and is also known academically as "Robotic Swarm Coordination." Similarly, roles like predictive routing architects were considered part of existing fleet management systems and could be integrated under the broader concept of digital twin technologies.

Validators emphasized that while these roles are labeled "futuristic," the development cycle for robotics technologies often spans decades, and true mainstream deployment of some roles may extend beyond the 5–10 year window. Nonetheless, they highlighted that Augmented Reality (AR)/Virtual Reality (VR) and Digital Twin technologies are already being integrated into logistics operations—particularly in quality checks and process simulations—and should be added to the list of applicable future roles for the logistics sector.

In the Industrial Robotics – *Food subsector*, job roles such as Robotic Flavor Profile Designer, Self-Sterilizing Robotics Technician, Autonomous Food Sorting Specialist, and Sensory Robotics Integration Expert received high response rates (75%), indicating strong alignment with future food safety. customization, and sensory application trends. Validators did not raise objections to any roles listed under this sector, suggesting overall agreement with the projected relevance of these functions.

For the Industrial Robotics – *Electric/Electronics subsector*, roles like AI-Driven Anomaly Detection Specialist and AI-Driven Predictive Quality Analyst garnered moderate support. However, validators urged caution on several other futuristic roles, particularly those heavily grounded in speculative technologies. Roles such as Nano-Robotics Fabrication Specialist, Quantum Circuit Robotics Engineer, Photonic Robotics Integrator, and 3D Electronics Printing Engineer were flagged for removal due to either being too far ahead of current capabilities or not immediately translatable into TVET-level training programs. While certain positions like the AI Ethics Compliance Officer for Robotics were acknowledged as important, they were not recommended for inclusion in TVET programs due to their policy- and ethics-oriented nature.

**Table 43.**

*Futuristic Jobs Applicable in the Next 5-10 Years, by Robotics Subsector*

| Subsector | Job Requirement | Response Rate % |
|---|---|---|
| Service Robotics - Logistics | Warehouse Gamification Specialist | 100.00% |
| | Autonomous Goods Verifier | 83.33% |
| | Circular Logistics Specialist | 83.33% |
| | Autonomous Logistics Traffic Controller | 66.67% |
| | Post-Human Collaborative Designer | 66.67% |
| | Robot Fleet Management | 66.67% |
| | Digital Marketplace Curator for Robotic Services | 33.33% |
| Industrial Robotics - Food | Robotic Flavor Profile Designer | 75.00% |
| | Self-Sterilizing Robotics Technician | 75.00% |
| | Autonomous Food Sorting Specialist | 75.00% |
| | Sensory Robotics Integration Expert | 75.00% |
| | Human-Robot Collaboration Specialist in Food Handling | 75.00% |
| | Temperature-Sensitive Logistics Coordinator | 75.00% |
| | Sensory Data Analyst for Food Robotics | 75.00% |
| | Precision Food Processing Specialist | 50.00% |
| | Automated Allergen Detection Specialist | 50.00% |
| | Smart Packaging Robotics Engineer | 50.00% |
| | Digital Twin Food Processing Specialist | 50.00% |

| Subsector | Job Requirement | Response Rate % |
|---|---|---|
| | Fermentation Robotics Engineer | 50.00% |
| | AI-Powered Food Safety Analyst | 50.00% |
| | Robotic Waste Reduction Strategist | 25.00% |
| | Robotic Hydroponics Engineer | 25.00% |
| | Plant-Based Protein Robotics Developer | 25.00% |
| Industrial Robotics - Electronics | AI-Driven Anomaly Detection Specialist | 71.43% |
| | AI-Driven Predictive Quality Analyst | 57.14% |
| | Augmented Reality Robotics Trainer | 42.86% |

Table 44 shows that awareness and readiness for emerging skills associated with robotics industry developments vary notably across subsectors. The Industrial Robotics – Electronics sector reported 100% readiness. The Service Robotics – Logistics sector showed 50% awareness and readiness, reflecting a moderate level of preparedness amid ongoing adaptation to emerging technologies.

The Industrial Robotics – Food subsector, on the other hand, is not yet ready for the accommodation of the emerging skills associated with the industry, which includes the fact that many people in the food manufacturing industry are actually small-scale operators. The validators confirmed this finding, pointing out a disconnect between awareness and actual application, noting that certain food sector facilities are aware of emerging skills but have not yet attained readiness.

**Table 44.**

*Percentage of Facilities that are Aware of and Ready for the Emerging Skills Associated with the Industry Developments*

| Robotics Subsectors | % |
|---|---|
| Service Robotics - Logistics | 50.00% |
| Industrial Robotics - Food | 0.00% |
| Industrial Robotics - Electric/Electronics | 100.00% |

Table 45 presents the percentage of facilities that have taken concrete actions toward emerging skills adoption across robotics subsectors. The Industrial Robotics – Electronics subsector leads with full implementation at 100%, demonstrating active steps in workforce preparation and skills development. The Service Robotics-Logistics subsector shows partial progress at 50%, reflecting ongoing initiatives, but further work is needed for broader adoption. Conversely, the Industrial Robotics – Food subsector indicated that they have not yet taken actions to the emerging skills required thus the absence of readiness for their facilities as indicated in the previous table.

Validators in the food subsector highlighted that incentives for adopting Industry 4.0 technologies, such as those offered by investment promotion agencies, typically require project registration before commercial operations commence. New investments utilizing Industry 4.0 are prioritized under the highest classification tier, potentially granting extended tax incentives and other benefits to encourage modernization in food manufacturing. However, the readiness to leverage these incentives depends heavily on timely project registration and adherence to strategic investment guidelines expected to be formalized soon.

In the electronics subsector, validators noted active efforts to upgrade and meet emerging skills requirements, including targeted human resources. preparation and training plans. Industry stakeholders emphasized the importance of attracting large-scale investments to support semiconductor and electronics growth, highlighting both the readiness of facilities and existing infrastructural challenges that may affect project execution. Broader policy initiatives such as the Chips Act are viewed positively as potential catalysts for further development, although some programs are currently paused pending executive orders.

**Table 45.**
*Percentage of the Facilities that have Taken Actions relative to the Emerging Skills by Robotics Subsector*

| Robotics Subsector | % |
|---|---|
| Service Robotics - Logistics | 50.00% |
| Industrial Robotics - Food | 0.00% |
| Industrial Robotics - Electric/Electronics | 100.00% |

The percentage of robotics facilities that are prepared and have taken particular steps pertaining to the development of emerging skills is shown in Table 46. A considerable effort to upskill the workforce is evident in the relative actions of the Service Robotics-Logistics (50%) and Industrial Robotics-Electronics subsector (100%), which are the facilities that have initiated initiatives or programs aimed at preparing their human resources. Nevertheless, no facilities reported having started initiatives to acquire pertinent equipment and materials or developed comprehensive plans to address the emerging skill requirements. The numbers for formal plans and equipment acquisition are consistent with the food subsector's lack of response on this issue, and it is noteworthy that multiple responses were permitted.

Validators from the logistics subsector shared that several organizations are already conducting internal and external training programs and have plans to pursue formal TESDA accreditation to further institutionalize skills development. They also pointed out that many organizations still view improving physical infrastructure as an achievable short-term goal. Meanwhile, representatives from TESDA highlighted ongoing efforts to promote facility-based training and explore partnerships to expand capacity, although equipment limitations within accredited institutions continue to pose challenges.

For the food subsector, no additional comments were provided, which aligns with earlier observations regarding awareness and readiness gaps. In the electronics subsector, some discussions were deferred in favor of addressing green jobs, but validators emphasized the difficulties in replicating actual facility environments for training purposes. Funding constraints were also identified as a significant barrier to scaling up equipment acquisition and infrastructure development necessary for comprehensive training programs.

**Table 46.**

*Percentage of the Robotics Facilities that are Ready and Have Taken Actions for the Emerging Skills by Relative Actions Taken*

| Relative Actions Taken | % | | |
|---|---|---|---|
| | Service Robotics - Logistics | Industrial Robotics - Food | Industrial Robotics - Electric/Electronics |
| Established plans to address the requirements. | 0.00% | 0.00% | 0.00% |
| Started some initiatives/programs in terms of preparing your human resource. | 50.00% | 0.00% | 100.00% |
| Started some initiatives/programs for the acquisition of equipment and materials relevant for the requirements. | 0.00% | 0.00% | 0.00% |

*Note: Multiple responses are allowed.*

Table 47 presents the percentage of robotics facilities that have taken actions related to human resource preparations for emerging skills in the industry. According to the data, 100% of facilities in the Industrial Robotics-Electronics subsector are actively reskilling employees to meet new skill demands, while the majority of facilities are concentrating on upskilling their current workforce to meet new competency requirements for Service Robotics-Logistics (50.00%) and Industrial Robotics-Electronics (100.00%). Interestingly, none of the facilities reported hiring new workers specifically for these emerging skills, indicating a preference for developing current staff rather than expanding their workforce. It should also be noted that the food subsector is not included in the table due to a lack of responses, which may reflect ongoing readiness and awareness challenges identified in previous sections.

**Table 47.**

*Percentage of the Robotics Facilities that are Ready and Have Taken Actions for the Emerging Skills by Preparations on Human Resource*

| Preparations on Human Resource | % | |
|---|---|---|
| | Service Robotics - Logistics | Industrial Robotics - Electric/Electronics |
| Hire new worker/s who have the required skills | 0.00% | 0.00% |
| Reskill existing worker/s to acquire the required competencies | 0.00% | 100.00% |
| Upskill existing worker/s to acquire the required competencies | 50.00% | 100.00% |

*Note/s: Multiple responses are allowed.*
*Responses covered logistics and electronics only since Industrial Robotics - Food subsector has no response to Table 45.*

Table 48 highlights the key reasons cited by robotics facilities for not taking action on emerging skills development. The absence of physical infrastructure or facilities for conducting training and learning initiatives is the most significant barrier identified in the Industrial Robotics - Food and Industrial Robotics - Electric/Electronics subsector, with a result of 100.00%. In addition, 25.00% of respondents in the Service Robotics - Logistics and 100.00% in the industrial Robotics - Electric/Electronics subsector identified budget constraints as a significant impediment to the implementation of training programs. Lastly, 50.00% of Service Robotics - Logistics identified insufficient digital infrastructure as a barrier to the delivery of effective learning and development activities. Multiple responses are allowed for this item.

**Table 48.**
*Percentage of Robotics Facilities by Reasons Why No Action Is Taken for the Emerging Skills*

| Reasons | % | | |
|---|---|---|---|
| | Service Robotics - Logistics | Industrial Robotics - Food | Industrial Robotics - Electric/Electronics |
| No budget to conduct the training/learning and development initiatives | 25.00% | 0.00% | 100.00% |
| No physical infrastructure/facility to conduct training/learning and development initiatives | 25.00% | 100.00% | 100.00% |
| No digital infrastructure/facility to conduct training/learning and development initiatives | 50.00% | 0.00% | 0.00% |

*Note: Multiple responses are allowed.*

## 4.5 Green Jobs and the Robotics Sector

Table 49 illustrates the distribution of robotics facilities according to the extent of their implementation of a variety of green job aspects. The data indicates that in the item "Contribute to decarbonization," 100.00% of respondents have indicated that there are no plans in the near future and no action has been taken thus far in the field of Service Robotics - Logistics. However, the other items, such as the protection of the ecosystem and biodiversity, the reduction of energy, materials, and water consumption, and the reduction of waste and pollution, yielded a 50% response of "No action so far but planning to act" and a 50% response of "Have created/changed some jobs as described."

The data for Industrial Robotics - Food demonstrates a distinct perspective from that of the previous subsector. It has been demonstrated that they have not taken any action, but they have a plan to contribute to decarbonization (100.00%). Additionally, they have already created or modified certain jobs, as previously mentioned (100.00%). While decarbonization remains a longer-term goal for many, there is tangible progress in integrating green job practices related to resource efficiency and environmental protection within the robotics sector. The table below provides examples of organizational provisions across various aspects of green jobs, as shared during the validation. Additionally, it is important to mention that the Industrial Robotics - Electric/Electronics subsector has not provided a response to this

particular item. However, they have identified organizational provisions in any aspect of green jobs, as seen in Table 50.

**Table 49.**
*Distribution of the Robotics Facilities by Extent of Implementation of Different Aspects of Green Jobs by robotics subsectors*

| Subsector | Aspects of Green Jobs | Extent of Implementation (%) | | |
|---|---|---|---|---|
| | | No action so far and no plan in the near future | No action so far but planning to act | Have created/changed some jobs as described |
| Service Robotics - Logistics | Contribute to decarbonization | 100.00% | 0.00% | 0.00% |
| | Contribute to protecting the ecosystem and biodiversity | 0.00% | 50.00% | 50.00% |
| | Contribute to reducing energy, materials and water consumption | 0.00% | 50.00% | 50.00% |
| | Contribute to minimizing waste and pollution | 0.00% | 50.00% | 50.00% |
| Industrial Robotics - Food | Contribute to decarbonization | 0.00% | 100.00% | 0.00% |
| | Contribute to protecting the ecosystem and biodiversity | 0.00% | 0.00% | 100.00% |
| | Contribute to reducing energy, materials and water consumption | 0.00% | 0.00% | 100.00% |
| | Contribute to minimizing waste and pollution | 0.00% | 0.00% | 100.00% |
| Industrial Robotics - Electric/Electronic | Contribute to decarbonization | 0.00% | 0.00% | 0.00% |
| | Contribute to protecting the ecosystem and | 0.00% | 0.00% | 0.00% |

| | | | | |
|---|---|---|---|---|
| s | biodiversity | | | |
| | Contribute to reducing energy, materials and water consumption | 0.00% | 0.00% | 0.00% |
| | Contribute to minimizing waste and pollution | 0.00% | 0.00% | 0.00% |

*Note: The Industrial Robotics - Electric/Electronics subsector did not respond to this item, resulting in a 0% score in the results.*

Table 50 provides examples of organizational provisions across different robotics subsectors that align with various aspects of green jobs. In the service robotics–logistics subsector, common initiatives include the installation of solar panels and other clean energy systems, plans for waste and pollution reduction, designation of Pollution Control Officers, and adherence to Occupational Safety and Health (OSH) standards. Validators shared that some facilities have formally assigned environmental officers and are compliant with regulations on sustainability, while others are exploring initiatives such as traceability and real-time tracking to improve logistics transparency and environmental accountability.

In the industrial robotics–food subsector, the key provision identified was the integration of food technologists to support sustainability through better resource handling and food safety—although detailed feedback in this subsector was limited during validation.

Meanwhile, the industrial robotics–electronics subsector demonstrated more advanced and diverse green practices. Facilities reported efforts in reverse engineering for component reuse, low power optimization, and the adoption of solar energy and electric vehicles (EVs). Validators also cited programs and training related to the circular economy, underscoring the sector's proactive approach to embedding green principles in both design and operational processes.

**Table 50.**
*Examples of Organizational Provisions from any Aspects of Green Jobs by Robotics Subsector*

| Robotics Subsector | Provisions |
|---|---|
| Service Robotics - Logistics | 1. Solar panel and installation of clean energy generating facilities<br>2. Management has plans on the waste and pollution minimization<br>3. Designation of Pollution Control Officers<br>4. Occupational Safety Standards |
| Industrial Robotics - Food | 1. Food Technologist |
| Industrial Robotics - Electric/Electronics | 1. Reverse engineering through component reuse and low power optimization<br>2. Electronics vehicles |

The percentage of robotics facilities that have received or sought support from any government agency, as disaggregated by subsector, is presented in Table 51. It is important to note that only the Industrial Robotics – Food subsector reported any engagement, with 100% of facilities indicating that they had either received or sought support. Conversely, the Industrial Robotics - Electric/Electronics reported that they did not receive or request assistance from any government agency. In the meantime, Service Robotics – Logistics did not submit any responses, as evidenced by the "N/A" in the table, which denotes that no response was received for the specific survey item.

During the validation process, several reasons were provided to explain this disparity. Logistics companies shared that while they are exploring green initiatives—such as subsidies for hybrid vehicles, electric deliveries, and sustainable packaging—they have not experienced direct or structured support from government agencies. Validators also noted growing client demand for sustainability practices, including traceability and cleaner fuel use. However, despite this shift, formal engagement with relevant government programs remains absent. Furthermore, the Industrial Robotics - Electric/Electronics validators reported that the support and engagement of government agencies are more likely to be focused on the R&D than the actual operation of the industry.

Despite the fact that all surveyed facilities in the Industrial Robotics - Food subsector had either received or sought government support, the validators identified critical gaps in information dissemination. They emphasized that communication between government and private stakeholders is often informal or inconsistent. To address this, it was suggested by the validators that quarterly industry association meetings could be used as structured channels for agencies like DTI and DA to provide

regular updates. Drawing from international examples, validators also recommended using official channels—such as chambers of commerce or a centralized “one-stop” government website—to improve access to programs, training, and incentives. The DICT was identified as a key player in supporting the development of such a digital platform.

**Table 51.**
*Percentage of Facilities that have Received/Sought Support from any Government Agency by Robotics Subsectors*

| Robotics Subsectors | % |
|---|---|
| Service Robotics - Logistics | N/A |
| Industrial Robotics - Food | 100.00% |
| Industrial Robotics - Electric/Electronics | 0.00% |

*Note/s: N/A for Service Robotics - Logistics since there is no response on this table.*

Table 52 presents the government agencies from which robotics facilities have received or sought support related to green jobs, disaggregated by subsector. The Industrial Robotics – Food subsector provided responses, identifying multiple agencies as sources of support: the Department of Science and Technology (DOST), Department of Trade and Industry (DTI), Department of Agriculture (DA), Bureau of Customs, Food and Drug Administration (FDA), Department of Labor and Employment (DOLE) and Department of Information and Communications Technology (DICT).

This range of agencies reflects the food sector’s broader engagement with government bodies. According to validators, it is often driven by the need to comply with regulatory requirements related to food safety, trade, labor, and technological innovation. It also suggests a relatively proactive approach to seeking government assistance in support of green job creation and sustainability practices.

However, the Industrial Robotics - Electric/Electronics are designated N/A in the table due to the fact that no government agencies were identified on the survey. On the other hand, the Service Robotics – Logistics are designated as "N/A" in the table because these facilities did not submit responses to this particular survey item.

**Table 52.**
*Government Agencies where the Facilities Received/Sought Support in Relation to Green Jobs by Robotics Subsector*

| Robotics Subsectors | Government Agencies |
|---|---|
| Service Robotics - Logistics | N/A |

| | |
|---|---|
| Industrial Robotics - Food | 1. Department of Science and Technology (DOST)<br>2. Department of Trade and Industry (DTI)<br>3. Department of Agriculture (DA)<br>4. Bureau of Customs<br>5. Food and Drug Administration<br>6. Department of Labor and Employment (DOLE)<br>7. Department of Information and Communications Technology (DICT) |
| Industrial Robotics - Electric/Electronics | N/A |

*Note: N/A for Service Robotics - Logistics and Industrial Robotics - Electric/Electronics since they have no response in the previous table*

Table 53 presents the percentage of robotics facilities that have received or sought government support across various areas related to green jobs. The responses came solely from the Industrial Robotics – Food subsector, as facilities in the logistics and electronics subsectors did not provide responses to the previous table. Notably, only one area—program registration, assessment, and certification including green goods and services—registered a response, with 100% of food sector facilities indicating engagement. All other categories, such as tax incentives, technical assistance for labor law compliance, green skills development, and support for environmentally friendly transport or technologies.

According to validators, the high response rate for program registration is largely due to mandatory regulatory compliance requirements, such as licensing and certification from agencies like the FDA and Bureau of Customs. Environmental or sustainability objectives may not necessarily drive these activities, but they are necessary for business operations and food safety. The finding highlights a critical distinction: while facilities are engaging with government agencies, the nature of that engagement is largely compliance-based rather than sustainability-focused.

The complete lack of responses in all other categories indicates a significant gap in awareness, availability, or uptake of government programs that directly support green job development. This trend matches earlier results from Tables 44 and 45, which revealed little engagement outside the food sector and pointed out issues like poor communication, informal sharing of information, and a lack of awareness about programs. Validators pointed out that this gap isn't because companies aren't interested, but because there aren't enough well-promoted or easy-to-access programs—especially those that provide incentives, technical help, or support for green practices.

**Table 53.**
*List of Support Received/Sought from the Government Agencies by Robotics Subsector*

| | Ways/Aspects of Support |
|---|---|
| Service Robotics - Logistics | N/A |
| Industrial Robotics - Food | • Program registration, assessment, and certification including green goods and services |
| Industrial Robotics - Electric/Electronics | N/A |

*Note: The response only came from the industrial robotics - food subsector*

Table 54 shows the percentage of robotics facilities that are aware of emerging skills associated with green jobs, segmented by subsector. Awareness is highest in the service robotics– logistics subsector, with 83.33% of facilities indicating familiarity with green-related skills requirements. This is followed by the industrial robotics– food subsector at 66.67%, while the industrial robotics– electronics subsector lags behind with 42.86% awareness.

The higher awareness in service robotics- logistics may be attributed to the subsector's exposure to sustainability-linked operations, such as green packaging, electric vehicle deployment, and environmental tracking mechanisms. In the food sector, awareness is present but is often tied to compliance with statutory regulations, as indicated by validators during consultations. For electronics, the relatively lower percentage could reflect the subsector's stronger focus on technical upgrades and automation efficiency, with less direct visibility into the green skills agenda—despite implementing some sustainable practices.

**Table 54.**
*Percentage of Facilities that are Aware of Emerging Skills Resulting from Green Jobs by Robotics Subsector*

| Robotics Subsectors | % |
|---|---|
| Service Robotics - Logistics | 83.33 |
| Industrial Robotics - Food | 66.67 |
| Industrial Robotics - Electric/Electronics | 42.86 |

Table 55 outlines the identified green emerging skills across the different robotics subsectors as a result of the growing emphasis on green jobs. The skills listed reflect a convergence of environmental priorities and technological expertise, driven by industry-specific needs and broader sustainability goals.

In the service robotics – logistics subsector, the emphasis is on operational efficiency, environmental compliance, and sustainable systems. Key roles identified include Pollution Control Officers, Compliance Auditors, and Sustainability Coordinators, which align with regulatory adherence and sustainability reporting requirements. Technical roles such as Control System Designers and professionals in Precise and Automated Packing signal a demand for system-level integration that minimizes waste and energy use. Validators also highlighted the relevance of Data Analytics in monitoring and optimizing logistics processes, as well as Electric Vehicles and Green Packaging as central technologies supporting greener transportation and delivery systems.

For the industrial robotics – food subsector, green skills are heavily linked to food safety, waste management, and resource optimization. These include Supply Chain Tracing, a critical function in ensuring food traceability and sustainability; Product Design, particularly for sustainable packaging and efficient processes; and Waste Valorization, which involves converting food waste into usable resources. Food Technology is also noted as a foundational discipline, supporting innovations in both production efficiency and environmental impact reduction.

In the industrial robotics – electronics subsector, green innovation is more technically driven. Skills such as Low Power and Energy Efficient Hardware Design and Reverse Engineering for Component Reuse point to engineering approaches for minimizing resource consumption and electronic waste. Additionally, the inclusion of Solar Energy, Electric Vehicles, and E-Waste to Energy suggests an expanding ecosystem of sustainable energy applications in electronics manufacturing. Validators underscored the relevance of these skills, referencing global benchmarks such as European models of waste-to-energy solutions.

Finally, Energy Auditors were identified as a common requirement across all subsectors, reinforcing the universal need for monitoring and optimizing energy use in robotics operations. This role exemplifies the cross-cutting nature of green jobs, bridging both environmental performance and cost efficiency across industries.

**Table 55.**
*Identified Green Emerging Skills as a Result of Green Jobs by Robotics Subsectors*

| Robotics Subsectors | Identified Green Jobs |
|---|---|
| Service Robotics - Logistics | 1. Data Analytics<br>2. Compliance Auditors<br>3. Pollution Control Officer<br>4. Emerging Managing Head (Envi)<br>5. Control System Designer<br>6. Sustainable Transportation<br>7. Sustainability Coordinator<br>8. Electric Vehicles<br>9. Green Packaging<br>10. Precise and Automated Packing |
| Industrial Robotics - Food | 1. Supply Chain Tracing<br>2. Product Design<br>3. Waste Valorization<br>4. Food Technology |
| Industrial Robotics - Electric/Electronics | 1. Green Auditors<br>2. Low Power and Energy Efficient Hardware Design<br>3. Reverse Engineering for Component Reuse<br>4. Solar Energy<br>5. Electrical Vehicles<br>6. E-Waste to Energy |
| Common to All Subsectors | 1. Energy Auditors |

Table 56 presents the level of preparedness of robotics facilities across subsectors in relation to select “green” industry developments that are increasingly relevant to current and near-future business needs. The developments were assessed based on their required levels of knowledge, skills, and competencies, with facilities indicating whether these were already being addressed or considered not applicable.

In the Service Robotics – Logistics subsector, none of the surveyed facilities reported current readiness in terms of knowledge, skills, or competencies for developments such as cleaner fuels, precise picking and packing, or carbon-neutral delivery systems. However, there was some recognition of the reduction or elimination of waste, where 50% of facilities identified it as a need in terms of knowledge, 25% in terms of skills, and 25% in terms of competencies. Validators noted that while there are already industry-level implementations of automated picking and packing, such as by MNCs, these are not yet widely reflected in facility-level responses.

For the Industrial Robotics – Food subsector, facilities predominantly marked their responses under competency—with 100% indicating that developments such as energy-efficient robots, automated waste reduction systems, and use of renewable energy in robotics are relevant and being worked toward as operational competencies. Validators pointed out that this may reflect a practical orientation toward process-level improvements rather than theoretical training.

In the Industrial Robotics – Electric/Electronics subsector, a similar pattern was observed. All relevant green developments such as energy-efficient robots, waste-reduction systems, and recycling tech integration were reported at 100% under competencies, signaling that actions are largely implementation-driven. Notably, robots powered by renewable energy and electric robots replacing fuel-powered machines were marked as not applicable, which may reflect either a lack of immediate relevance or perceived technological constraints in the sector. Across subsectors, competency was the most consistently reported area of action, especially for high-impact green initiatives.

**Table 56.**
*Percentage of the Facilities by 'Green' Industry Developments Relevant to (Current and Near-future) Business Needs by Robotics Subsector*

| "Green" Industry Development | Business Need | | | |
|---|---|---|---|---|
| | Knowledge (Critical understanding, theories and principles) | Skills (Skills mastery and innovation for solving complex problems) | Competencies (Managing activities and tasks) | Not Applicable |
| **Service Robotics - Logistics** | | | | |
| Cleaner fuel for autonomous logistics vehicles | 0.00% | 0.00% | 0.00% | 0.00% |
| Precise Picking and Packing | 0.00% | 0.00% | 0.00% | 0.00% |
| Optimized Inventory Management | 0.00% | 0.00% | 0.00% | 0.00% |
| Carbon-neutral autonomous delivery systems | 0.00% | 0.00% | 0.00% | 0.00% |
| Biodegradable Packaging | 0.00% | 0.00% | 0.00% | 0.00% |
| Reduction, if not elimination of waste | 50.00% | 25.00% | 25.00% | 0.00% |

| "Green" Industry Development | Business Need | | | |
|---|---|---|---|---|
| | Knowledge (Critical understanding, theories and principles) | Skills (Skills mastery and innovation for solving complex problems) | Competencies (Managing activities and tasks) | Not Applicable |
| **Industrial Robotics - Food** | | | | |
| Energy-efficient robots for packaging/processing. | 0.00% | 0.00% | 100.00% | 0.00% |
| Automated systems for waste reduction. | 0.00% | 0.00% | 100.00% | 0.00% |
| Robots powered by renewable energy. | 0.00% | 0.00% | 100.00% | 0.00% |
| Robotics to monitor/reduce emissions in food processing. | 0.00% | 0.00% | 100.00% | 0.00% |
| Electric robots replacing fuel-powered machines. | 0.00% | 0.00% | 100.00% | 0.00% |
| Biodegradable materials in food packaging robots. | 0.00% | 0.00% | 100.00% | 0.00% |
| **Industrial Robotics - Electric/Electronics** | | | | |
| Energy-efficient robots for packaging/processing. | 0.00% | 0.00% | 100.00% | 0.00% |
| Automated systems for waste reduction. | 0.00% | 0.00% | 100.00% | 0.00% |
| Robots powered by renewable energy. | 0.00% | 0.00% | 0.00% | 100.00% |
| Electric robots replacing fuel-powered machines. | 0.00% | 0.00% | 0.00% | 100.00% |
| Recycling tech integrated with robotics in Electronics. | 0.00% | 0.00% | 100.00% | 0.00% |
| Reduction, if not elimination of waste | 50.00% | 25.00% | 100.00% | 0.00% |

## 4.6 Learning and Development

This section presents information such as the percentage of payroll expenditure/funds allotted for training and the facility's capacity-building services.

Table 57 illustrates the distribution of operating expenditures for learning and training programs developed and conducted both by the company and by external providers.

For in-company learning and training programs, half of the respondents (50%) from Service Robotics - Logistics reported allocating 10-50% of their operating expenditure. In contrast, 100% of respondents from Industrial Robotics - Food allocated less than 10% of their operating expenditure. Additionally, all respondents from Industrial Robotics - Electric/Electronics stated that they did not allocate any payroll expenditures.

The results show that sectors more established with in-house facilities like Service Robotics - Logistics, allocate a higher proportion of their budgets to internal training, whereas sectors like Industrial Robotics - Food may rely more on external providers or have fewer in-house training needs. As a respondent in the industrial robotics-food subsector emphasized, why are companies opting to train employees in-house when facilities and equipment are nonexistent? In addition, it has been observed that certain facilities may have reported an allocation of less than 5% of their operating expenditure as part of the options.

Half of the respondents from Service Robotics - Logistics reported that they allocate 10-50% of their operating expenditures to payroll expenditures for learning and training programs conducted by external providers. At the same time, respondents from Industrial Robotics - Food allocate less than 10% of their operating expenditure, while those from Industrial Robotics - Electric/Electronics allocate 10-50% of their operating expenditure. This implies a more diverse approach to external training investment across sectors, particularly in light of the availability of technical experts and physical infrastructure that could provide the training.

It is also important to note that some companies invest heavily in external training, particularly given the nature of robotics as a relatively new and advanced technology. Companies frequently need to send their employees abroad to gain specialized knowledge, as robotics training is often considered foreign. In the Philippines, there is a shortage of local training offerings in robotics, especially from local experts. This gap makes it more practical for companies to send their people overseas, as international expertise in this field is limited within the country. As a result, it is more common for companies to allocate significant portions of their training budgets for external programs abroad, where training resources and experts are more readily available.

**Table 57.**
*Distribution of Operating Expenditure Allocated for Learning and Development Programs Developed and Conducted by Various Providers by Robotics Subsector*

| Learning and Development Programs | Robotics Subsector | Operating Expenditure (%) | | | | |
|---|---|---|---|---|---|---|
| | | None | <10% | 10-50% | >50% | Total |
| Developed and conducted by the company | Service Robotics - Logistics | 0.00% | 50.00% | 50.00% | 0.00% | 100.00% |
| | Industrial Robotics - Food | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |
| | Industrial Robotics - Electric/Electronics | 100.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| Developed and conducted by external providers (public and private training providers) | Service Robotics - Logistics | 0.00% | 50.00% | 50.00% | 0.00% | 100.00% |
| | Industrial Robotics - Food | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |
| | Industrial Robotics - Electric/Electronics | 0.00% | 0.00% | 100.00% | 0.00% | 100.00% |

For the next table, learning and development programs are strongly supported by all three robotics subsectors. In both in-house training and programs conducted by external providers, 100% of respondents strongly agree that these are provided and supported. In the Service Robotics - Logistics subsector, 100% strongly agree that employees have a say in their own training needs and that the programs cover future skills. However, when it comes to only providing job-required training and covering STEM skills, the respondents are split, with 50% agreeing and 50% strongly agreeing. For Industrial Robotics - Food, all respondents (100%) agree that employees have input on their training and that the sector supports external training providers.

Interestingly, when asked about limiting training to only job-required programs, 100% of respondents remain neutral. They also show full agreement (100% agree) that their training programs include STEM skills. Lastly, in the Industrial Robotics - Electric/Electronics subsector, 100% of respondents strongly agreed to all statements, indicating full support for in-house and external training, employee involvement, future skills coverage, job-required training, and STEM competencies. This strong commitment to learning and development validates the results in Table 50, where subsectors like Service Robotics - Logistics and Industrial Robotics - Electric/Electronics allocate higher proportions of their operating expenditures toward both internal and external training programs. In contrast, the more neutral or

moderate responses from Industrial Robotics - Food correspond with their lower budget allocation for training seen in Table 57.

**Table 58.**
*Distribution of Robotics Facilities by Rating Various Statements related to Learning and Development*

| Subsector | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|---|
| Service Robotics - Logistics | We provide in-house learning and training programs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | We support learning and training programs conducted by private and public training providers. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | We only provide or support learning and training programs that are required by the job (includes both in-house and external programs). | 0.00% | 0.00% | 0.00% | 50.00% | 50.00% |
| | Employees have a say in their own learning and training needs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Our learning and training programs cover future skills needs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Our learning and training programs specifically cover STEM skills and competencies. | 0.00% | 0.00% | 0.00% | 50.00% | 50.00% |
| Industrial Robotics - Food | We provide in-house learning and training programs. | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% |
| | We support learning and training programs conducted by private and public training providers. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | We only provide or support learning and training programs that are | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% |

| | | | | | | |
|---|---|---|---|---|---|---|
| | required by the job (includes both in-house and external programs). | | | | | |
| | Employees have a say in their own learning and training needs. | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% |
| | Our learning and training programs cover future skills needs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Our learning and training programs specifically cover STEM skills and competencies. | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% |
| Industrial Robotics - Electric/Electronics | We provide in-house learning and training programs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | We support learning and training programs conducted by private and public training providers. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | We only provide or support learning and training programs that are required by the job (includes both in-house and external programs). | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Employees have a say in their own learning and training needs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Our learning and training programs cover future skills needs. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| | Our learning and training programs specifically cover STEM skills and competencies. | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |

## 4.7 Work and Employment Practice

The overall distribution shows that robotics facilities are generally on track when it comes to having structured policies in place to guide business operations, employee development, and training. The consistent 75% figures across key documents (business plan, training plan, training budget, and staff development policy) indicate that while many companies are investing in their workforce and strategic planning, the numbers are reflective of the situation and the automation capability and requirements, as one of the validators noted.

The fact that all companies (100%) are focused on developing high-potential staff is an encouraging sign, as it shows a proactive approach to talent management and internal growth. This can help ensure that these companies are preparing for the future and building a robust leadership pipeline, particularly as earlier sections indicated that 75% of the facilities' employees have the potential to perform more demanding duties than they currently have.

**Table 59.**
*Percentage of Robotics Facilities with Policies Covering Various Documents*

| Documents | % |
|---|---|
| Business Plan | 75.00% |
| Training Plan | 75.00% |
| Training Budget | 75.00% |
| Staff Development Policy/Plan | 75.00% |
| Development for High Potential Staff | 100.00% |

Meanwhile, the way robotics facilities have policies for important organizational documents differs a lot between different subsectors, showing variations in how advanced they are, their industry practices, and their size. Among the three subsectors, the Industrial Robotics – Electric/Electronics subsector is revealed to be more organized in terms of standards across all the indicated policies.

In the Service Robotics – Logistics subsector, there is strong evidence of structured planning, with 100% of facilities having both business and training plans in place. However, only 50% report having a training budget and staff development policy. Nonetheless, the full coverage of development for high-potential staff indicates a commitment to future leadership and skills sustainability.

In contrast, the Industrial Robotics–Food subsector shows a more fragmented approach. While all facilities report having a training budget, staff development

policy, and high-potential staff development (100%), none report having a business or training plan. This absence of formal planning structures is consistent with feedback from industry stakeholders, who noted that some food sector facilities adopt an ad hoc training style. Rather than implementing proactive training strategies, companies often wait until problems arise—such as machinery breakdowns or post-installation of automated systems—before conducting training. This reactive model is seen as risky and inefficient, as it lacks foresight and integration with business planning. Moreover, in these facilities, automation is often treated as a "black box," with limited emphasis on how workforce training should evolve alongside technological upgrades. Training decisions are often made after technology has been installed, which reflects a retrospective approach rather than a strategic one. The perceived lack of a business plan is also considered dangerous, especially as the validators shared that the said document contains who the company shall train, what training shall be conducted, etc., based on the vision and the short, medium, and long term strategic direction of the facility.

Meanwhile, the Industrial Robotics – Electric/Electronics subsector stands out with full coverage across all policy areas (100%). Facilities in this group consistently have a business plan, training plan, training budget, staff development policy, and high-potential development programs. This comprehensive structure is likely driven by the highly technical nature of the industry and the greater presence of standardized practices, often modeled after those in multinational corporations. These companies typically operate with well-established HR frameworks, aligning business strategy with workforce development through individual development plans and structured career pathways.

These results confirm the ones indicated on Table 59, which indicates that the three subsectors within the robotics sector have policies that encompass these diverse documents. The contrasting patterns across subsectors may also reflect differences in company size and maturity. Many respondents in the food sector may represent micro, small, or medium-sized enterprises (MSMEs), which often have limited resources and rely more heavily on production-led decision-making. In such cases, business plans are driven by immediate operational needs, such as output targets, rather than broader strategic visions that include human capital planning. This stands in contrast to the electric/electronics sector, where long-term planning and structured documentation are more deeply embedded in the organizational culture.

**Table 60.**
*Percentage of Facilities with Policies Covering Various Documents by Robotics Subsector*

| Robotics Subsector | Document (%) | | | | |
|---|---|---|---|---|---|
| | Business Plan | Training Plan | Training Budget | Staff Development Policy/Plan | Development for High Potential Staff |
| Service Robotics - Logistics | 100.00% | 100.00% | 50.00% | 50.00% | 100.00% |
| Industrial Robotics - Food | 0.00% | 0.00% | 100.00% | 100.00% | 100.00% |
| Industrial Robotics - Electric/Electronics | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

The data presented in Table 61 highlights the percentage of full-time employees in robotics facilities who are entitled to various rewards and opportunities. A significant finding is that all surveyed robotics facilities (100%) offer **bonuses based on overall organizational performance**, **share options for employees**, **eligibility for internal promotion**, and **overtime pay**. However, only 66.67% of facilities provide individual performance-related pay, non-pay benefits such as child-care, health insurance, travel allowance, study leave, and food subsidies, as well as opportunities for job rotation at other locations, including overseas. These figures indicate that while broader organizational incentives are widely implemented, personalized or flexible benefits are less consistently available across facilities.

In terms of flexible work arrangements, only 33.33% of facilities offer work-from-home options, revealing a limited adoption of remote work practices despite the technological nature of the industry. When comparing facility offerings to the actual percentage of full-time employees entitled to these benefits, there is a notable disparity. For example, only 23.33% of employees are entitled to bonuses based on organizational performance, 26.67% to share options, and 28.33% to internal promotions. Even fewer employees—20.00% and 16.67%—are entitled to job rotation opportunities and work-from-home options, respectively. This gap between company policy and employee coverage highlights a potential area for improvement in ensuring equitable benefit distribution.

It is also worth noting that some validators questioned the inclusion of overtime pay as part of the rewards and opportunities. Under Department of Labor and Employment (DOLE) regulations, overtime pay is a mandatory entitlement and not an optional incentive. This likely explains its 100% response rate across all facilities and suggests it should not be categorized alongside voluntary company-provided benefits. Overall, while most robotics facilities prioritize traditional rewards and

career growth, there is a clear opportunity to enhance support for more individualized, flexible, and accessible benefits to better align with the evolving needs of employees.

**Table 61.**
*Percentage of Full-time Employees in the Robotics Facilities Entitled to Various Rewards or Opportunities*

| Rewards or Opportunities | Percentages | |
|---|---|---|
| | Robotics Facilities % | Entitled Full-time Employees (%) |
| Individual performance related pay | 66.67% | 33.33% |
| Bonuses based on overall organizational performance | 100.00% | 23.33% |
| Share options for employees | 100.00% | 26.67% |
| Eligible for internal promotion | 100.00% | 28.33% |
| Non-pay benefits (such as child-care, health insurance, travel allowance, study leave, food subsidies etc.) | 66.67% | 33.33% |
| Opportunities for job rotation at other locations (including overseas) | 66.67% | 20.00% |
| Overtime pay | 100.00% | 66.67% |
| Others: Work From Home | 33.33% | 16.67% |

*Note: The table only reflects responses from the Service Robotics - Logistics and Industrial Robotics - Food subsectors*

Further, when disaggregated by subsector, Table 62 shows differences in reward structures across the robotics subsectors, particularly between Service Robotics - Logistics and Industrial Robotics - Food. In the Service Robotics - *Logistics subsector*, the rewards and opportunities available to employees are extensive and inclusive. All full-time employees in this subsector are entitled to individual performance-related pay, bonuses based on overall organizational performance, share options, eligibility for internal promotion, and non-pay benefits such as child-care, health insurance, travel allowance, study leave, and food subsidies. Additionally, all employees are offered overtime pay and opportunities for job rotation, including placements in other locations or overseas. There is also a degree of flexibility in work arrangements, with 50% of employees entitled to work-from-home options. This comprehensive rewards package reflects a strong emphasis on both financial and non-financial incentives, supporting employee retention and motivation.

While the Industrial Robotics - Food subsector offers a significantly more limited set of rewards. While facilities in this subsector report the availability of most benefits, only a small percentage of full-time employees are actually entitled to receive them. Just 10% of employees are entitled to bonuses based on organizational performance, share options, and opportunities for internal promotion, while only 5% are eligible for internal promotion. Moreover, employees in this subsector receive no non-pay benefits or opportunities for job rotation. The only reward universally provided to all employees is overtime pay.

Although the Industrial Robotics - *Electric/Electronics subsector* did not receive survey responses and is therefore not represented in Table 62, insights from validation meetings provide relevant context. In this subsector, share options are typically granted to a limited group of employees, such as executives or senior staff, rather than being offered broadly. Certain roles—particularly managers, consultants, and sales employees—are often excluded from overtime pay, as their compensation is more closely tied to performance outcomes like sales commissions. Additionally, organizations operating in specialized or academic domains within this subsector may not offer specific rewards, such as share options, due to the unique nature of their operations. These findings highlight the sector-specific differences in reward practices that are shaped by organizational structure, role types, and industry norms.

**Table 62.**
*Percentage of Full-Time Employees in Facilities Entitled to Various Rewards and Opportunities by Robotics Subsector*

| Rewards or Opportunities | Robotics Sector | | | | | |
|---|---|---|---|---|---|---|
| | Service Robotics - Logistics | | Industrial Robotics - Food | | Industrial Robotics - Electric/Electronics | |
| | Robotics Facilities % | Entitled Full-time Employees (%) | Robotics Facilities % | Entitled Full-time Employees (%) | Robotics Facilities % | Entitled Full-time Employees (%) |
| Individual performance related pay | 100.00% | 100.00% | 0.00% | 0.00% | - | - |
| Bonuses based on overall organizational performance | 100.00% | 60.00% | 100.00% | 10.00% | - | - |
| Share options for employees | 100.00% | 70.00% | 100.00% | 10.00% | - | - |
| Eligible for internal promotion | 100.00% | 80.00% | 100.00% | 5.00% | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| Non-pay benefits (such as child-care, health insurance, travel allowance, study leave, food subsidies etc.) | 100.00% | 100.00% | 0.00% | 0.00% | - | - |
| Opportunities for job rotation at other locations (including overseas) | 100.00% | 60.00% | 0.00% | 0.00% | - | - |
| Overtime pay | 100.00% | 100.00% | 100.00% | 100.00% | - | - |
| Others: Work from home | 100.00% | 50.00% | 0.00% | 0.00% | - | - |

In terms of the distribution of robotics facilities by extent of sharing various information, Table 63 reveals distinct patterns in how key information is shared within facilities. For financial information, 100% of facilities share it only with select employees, typically management, indicating a highly controlled approach. No facilities share financial data with all workers, likely to protect confidentiality.

Regarding business plans, 80% of companies share this only with some workers, while 20% extend it to all employees. Similarly, for operational challenges, 60% of facilities restrict this to certain employees, but 40% share it with everyone, which may reflect a more open and collaborative culture in those organizations.

For market analysis, the pattern mirrors that of business plans, with 80% sharing it only with select workers and 20% sharing it broadly. This limited sharing often points to a protective approach to sensitive market information.

One of the validators highlighted that the extent of information sharing is heavily influenced by company culture. More hierarchical organizations tend to restrict information flow, while those with a culture of openness and collaboration share information more widely, fostering trust and employee engagement.

**Table 63.**
*Distribution of Robotics Facilities by Extent of Sharing Various Information*

| Information | Extent of Sharing (%) | | | |
|---|---|---|---|---|
| | Not generally shared | Only with some workers(e.g., management only) | Shared with ALL workers | Total |
| Financial Information | 0.00% | 100.00% | 0.00% | 100.00% |
| Business Plans | 0.00% | 80.00% | 20.00% | 100.00% |
| Operational Challenges | 0.00% | 60.00% | 40.00% | 100.00% |
| Market Analysis | 0.00% | 80.00% | 20.00% | 100.00% |

## 4.8 Business Strategy

Generally, robotics facilities focus on quality and innovation rather than price in competing with the market. In terms of the specific business strategies applied, the majority (83.33%) of respondents agree that their products and services are positioned in a market for premium quality, and the same percentage believe their success relies on developing unique or innovative offerings. While there is some indication of customization, with 33.33% of facilities acknowledging a "more-than-average" amount of customization in their products, price competitiveness is a significant factor for 66.67% of respondents. Overall, the sector seems to prioritize differentiation through high-quality and innovative products, with less emphasis on price as the primary competitive driver.

Additionally, the table below may indicate that while most facilities focus on innovation and premium quality, having a few robotics facilities that are able to provide highly customized products or services may suggest its impact on cost, technological constraints, and efficiency, among other factors. During the series of consultations, the industry shared how robotics and automation are being utilized mostly by facilities for mass production and that those who are not yet on this level will most likely not invest yet on these technologies. Since customization will often require additional resources and standardized products and services are more efficient for production at a larger scale, robotics facilities may prioritize more on research and development to innovate systems and processes.

**Table 64.**

*Distribution of Robotics Facilities by Rating Various Approaches to Business*

| Approach to Business | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Not Applicable |
|---|---|---|---|---|---|---|
| Compared to other facilities in the Robotics Sector, there is a 'more-than-average' amount of customization in our products and services | 0.00% | 16.67% | 33.33% | 16.67% | 16.67% | 16.67% |
| Compared to other facilities in Robotics Sector the competitive success of our products and services is dependent on price in the vast majority of cases | 0.00% | 0.00% | 16.67% | 33.33% | 33.33% | 16.67% |
| Our business mostly competes in a market of premium quality products or services | 0.00% | 0.00% | 16.67% | 50.00% | 33.33% | 0.00% |
| Our products and services rely on developing unique or innovative products or services | 0.00% | 0.00% | 16.67% | 50.00% | 33.33% | 0.00% |

Table 65. highlights varying levels of engagement across different subsectors in the robotics industry. In the Service Robotics - Logistics subsector, 50% of facilities are planning to act in collaboration with academe and government agencies, while the other 50% have already created or changed jobs to address future skills needs, indicating a proactive approach to skills development and partnerships. In the Industrial Robotics - Food subsector, 100% of facilities have already taken action, having created or changed jobs to align with future skills requirements, suggesting a strong focus on adapting to evolving industry needs. However, in the Industrial Robotics - Electric/Electronics subsector, 66.67% of facilities have not yet taken any action or made plans, while 33.33% have already created or changed jobs, indicating that while some companies are ahead in addressing future skills, others are still in the early stages of planning or have yet to engage with these partnerships.

However, it shall not be necessarily interpreted that the industrial robotics - electric/electronics subsector is lagging behind in view of preparing the future skills supply. While the majority of the facilities for the Industrial Robotics - Electric/Electronics subsector have no ongoing or future plans for academe and

government collaborations, it may be recalled in Table 57 that while there is no allocation for in-company training, 10%-50% of the operating expenditure is allocated to external providers. It may be possible that the particular subsector currently focuses more on private sector collaboration for human resource preparation and development. Further, the specific subsector invests in employee training abroad.

**Table 65.**
*Distribution of Facilities by Extent of Implementation on Collaborating with the Academe and the Government Education Agencies for Future Skills Supply by Robotics Subsectors*

| Robotics Subsector | Extent of Implementation (%) | | | |
|---|---|---|---|---|
| | No action so far and no plan in the near future | No action so far but planning to act | Have created/ changed some jobs as described | Total |
| Service Robotics - Logistics | 0.00% | 50.00% | 50.00% | 100.00% |
| Industrial Robotics - Food | 0.00% | 0.00% | 100.00% | 100.00% |
| Industrial Robotics - Electric/Electronics | 66.67% | 0.00% | 33.33% | 100.00% |

When asked about plans to expand on other areas of development, results show that plans for expansion are varied across subsectors. Service Robotics - Logistics has 40% of facilities planning to expand into other areas, with some industry insights suggesting that logistics companies are focused on regional expansions, such as extending operations into southern regions of the Philippines (e.g., Bicol and Tacloban). There is also a noted interest in diversifying strategies, including the "Hub and Spoke" model for logistics, which may contribute to this expansion trend. However, challenges related to standardization and hesitance toward adopting new technologies, as well as concerns over e-commerce-induced traffic congestion, could influence the pace of growth in this subsector.

For the Industrial Robotics - Food subsector, 25% of facilities have plans to expand into other areas. A notable development is the focus on waste valorization, such as maximizing the use of mango by-products, which shows an increasing emphasis on sustainability and innovation in the food sector. The shift towards incorporating waste into production processes aligns with broader industry trends aimed at reducing waste and improving efficiency.

In the Industrial Robotics - Electric/Electronics subsector, 50% of facilities have plans to expand, driven by efforts to integrate advanced technologies such as AI in

manufacturing processes. Facilities are also investing in new robotics infrastructure, including new buildings and enhanced training programs for employees across various regions.

In summary, the other areas of development can be grouped as follows:

1) Geographical expansion;
2) Infrastructure development (i.e, hard infra for buildings, equipment, training centers and soft infra for new and automated systems and processes); and
3) Product development and expansion

Moreover, other government initiatives may provide incentives to the robotics facilities to pursue other areas of development. Among others is the DTI - BOI's Strategic Investment Development Plan which identifies priority sectors that are eligible for investment incentives, thereby attracting both local and foreign investments. The DOST - MIRDC's Industry 4.0 initiatives and pilot projects like Automation Laboratories indicate significant expansion in both technology and infrastructure for the industry, particularly under the electric/electronics subsector. These efforts highlight the push towards modernization and technological integration, with a strong focus on both equipment upgrades and training development.

**Table 66.**
*Percentage of Facilities with Plans to Expand on Other Areas of Development by Robotics Subsector*

| Robotics Subsector | % |
|---|---|
| Service Robotics - Logistics | 40.00% |
| Industrial Robotics - Food | 25.00% |
| Industrial Robotics - Electric/Electronics | 50.00% |

**Table 67.**
*Areas of Development for Expansion by Robotics Subsector*

| Robotics Subsector | Identified Areas of Development |
|---|---|
| Service Robotics - Logistics | 1. Expansion in southern regions (e.g., Bicol) and Tacloban<br>2. Company diversification (hub and spoke strategy)<br>3. Development of vertical warehouses |
| Industrial Robotics - Food | 1. Waste valorization |
| Industrial Robotics - Electric/Electronics | 1. New building for robotics facility<br>2. Conduct of foreign training<br>3. Purchasing new equipment (e.g., Cobots)<br>4. AI integration in manufacturing processes<br>5. Establishment of training centers nationwide<br>6. Expansion to contract manufacturing |

## 4.9 Work Processes and Technology

With regard to the status of the equipment within the country and overseas per robotics subsector, all subsectors reported that 100% of their facilities' equipment is "up to date," suggesting a high level of local modernization in these sectors. However, when comparing with overseas standards, Service Robotics - Logistics and Industrial Robotics - Electric/Electronics still meet international benchmarks, but still with 50% of facilities in the latter subsector being over five years behind. In contrast, the Industrial Robotics - Food subsector is entirely reported as being more than five years behind, indicating significant gaps in technological advancement relative to global standards.

In the electronics sector, there is a clearer gap, with one facility reporting being 15 years behind international standards, particularly in comparison to neighboring countries like Thailand. This delay is attributed to a late start in adopting robotics and automation technologies. On the other hand, some companies have managed to upgrade their equipment to match international standards, as seen with those using up-to-date technology, comparable to Japan's standards.

Despite the numbers indicating that equipment is up to date, particularly when compared within the country, the validators noted that it does not mean that the

current status of equipment is enough. Not all facilities are able to adapt with robotics, and in the quest to push for robotics and automation, the requirement of the actual industry on the ground is unequal.

Regardless, the industry validation reveals that the food sector is notably lagging in technology adoption, with some facilities still operating at an Industry 1.0 or 2.0 level and having limited connectivity or automation. The challenge is not only financial but also due to the long return-on-investment (ROI) periods required before companies can invest in more advanced technology, which can take 2–3 years or more. Even if the machine is installed using the most recent technology, companies need to make sure that previous machines and equipment reached an ROI first before utilizing new ones. Furthermore, food industry stakeholders have indicated that while local equipment may appear modern, it often still lags behind global standards, particularly in areas such as packaging, efficiency, and sustainability.

Three factors are identified that primarily cause the divide in robotics and the status of existing equipment: 1) Cost for purchasing the robots, which will also necessitate the expansion of sales and other production operations; 2) Manpower, which refers to the availability of a skilled workforce who will be able to use and maintain the equipment; and 3) servicing.

But the industry hopes that government programs and initiatives such as those under the Comprehensive Recovery and Tax Incentives for Enterprises (CREATE) law would be able to encourage more facilities to invest in robotics and automation.

**Table 68.**
*Distribution of the Facilities by Core Equipment Condition as Compared with the Best Commonly Available Technology by Robotics Subsector*

| Comparison | Robotics Subsector | How up-to-date is the equipment (%) | | | |
|---|---|---|---|---|---|
| | | Up to date | 1 to 5 years behind | More than 5 years behind | Total |
| Within the Country | Service Robotics - Logistics | 100.00 | 0.00 | 0.00 | 100.00 |
| | Industrial Robotics - Food | 100.00 | 0.00 | 0.00 | 100.00 |
| | Industrial Robotics - Electric/Electronics | 100.00 | 0.00 | 0.00 | 100.00 |
| Overseas | Service Robotics - Logistics | 100.00 | 0.00 | 0.00 | 100.00 |
| | Industrial Robotics - Food | 0.00 | 0.00 | 100.00 | 100.00 |
| | Industrial Robotics - Electric/Electronics | 50.00 | 0.00 | 50.00 | 100.00 |

*Note: One respondent under the electronics subsector did not answer on how up to date their equipment is when compared to those in the country.*

When asked about the level of automation, all the facilities under the Industrial Robotics - Food subsector are partially automated. In the Industrial Robotics - Electric/Electronics subsector, automation is more advanced, with 33.33% of facilities being mostly automated and the remaining 66.67% being partially automated. This indicates a more moderate but growing trend toward automation in the electronics industry.

The industry further emphasizes these trends during the validation. For logistics, the Supply Chain Management Association of the Philippines (SCMAP) shared that the majority of companies report being partially automated, although multinational companies are already achieving full automation. There is also an indication that many logistics companies are planning to fully automate within the next 3 to 5 years in order to remain competitive, signaling a clear push towards greater automation.

In the food sector, some respondents hesitated to fully disclose their automation levels, which might reflect the sector's slower adoption of automation. Despite the less direct responses, it is evident that the food industry is not yet as advanced in automation compared to other subsectors.

The electronics subsector shows more variability. Some companies are partially automated, while others have mostly automated key production lines, such as those for Surface-Mount Devices (SMD), indicating a stronger push towards automation in certain areas of electronics manufacturing.

**Table 69.**
*Distribution of the Facilities by Level of Automation per Robotics Subsector*

| Robotics Subsector | Level of automation (%) | | | | |
|---|---|---|---|---|---|
| | **Fully automated** | **Mostly automated** | **Partially automated** | **Minimally automated** | **Not automated at all** |
| Industrial Robotics - Food | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% |
| Industrial Robotics - Electric/Electronics | 0.00% | 33.33% | 66.67% | 0.00% | 0.00% |

*Note: No response from Service Robotics - Logistics, therefore not included in the table.*

## 4.10 Organizational Performance

In terms of profitability, the Service Robotics – Logistics subsector showed a split, with 50% of facilities reporting an increase and 50% a decrease. This indicates a divergent impact, possibly due to differences in how facilities manage costs or implement new technologies. The Industrial Robotics – Food subsector showed no reported changes in profitability, which may suggest operational stability, but qualitative input from respondents indicated underlying inefficiencies and increased costs that could erode profit margins in the long term. For Industrial Robotics – Electric/Electronics, 75% of facilities reported increased profitability, though one respondent clarified this is an anticipated outcome rather than a realized one, with actual figures still pending collection.

Looking at total sales/revenue, the pattern mirrors profitability in each subsector. Facilities under Service Robotics – Logistics were evenly split between increased and decreased revenue. In the Food subsector, all respondents reported no change, reflecting stagnant market activity. In contrast, 75% of facilities in the Electric/Electronics subsector reported revenue increases. However, some validators noted that while sales are up, the actual collection of payments is still in progress, indicating potential short-term cash flow issues despite long-term growth expectations.

For market share, the Logistics subsector reported increases in 50% of the facilities, while the other half remained unchanged. In the Food subsector, all facilities experienced an increase in market share, although respondents noted that this did not translate to proportional gains in profitability, possibly due to rising distribution costs. In the Electric/Electronics subsector, 50% reported increased market share, 25% saw no change, and 25% marked it as not applicable, reflecting varied experiences in market positioning within that group.

**Table 70.**
*Distribution of the Facilities by Rating of Different Outcomes from 2023 to 2024, by Robotics Subsector*

| Outcomes | Robotics Subsector | Rating (%) | | | | |
|---|---|---|---|---|---|---|
| | | Decreased | No change | Increased | Not Applicable | Total |
| Profitability | Service Robotics - Logistics | 50.00% | 0.00% | 50.00% | 0.00% | 100.00% |
| | Industrial Robotics - Food | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |
| | Industrial Robotics - Electric/Electronics | 0.00% | 0.00% | 75.00% | 25.00% | 100.00% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total Sales/ Revenue | Service Robotics - Logistics | 50.00% | 0.00% | 50.00% | 0.00% | 100.00% |
| | Industrial Robotics - Food | 0.00% | 100.00% | 0.00% | 0.00% | 100.00% |
| | Industrial Robotics - Electric/Electronics | 0.00% | 0.00% | 75.00% | 25.00% | 100.00% |
| Market Share | Service Robotics - Logistics | 0.00% | 50.00% | 50.00% | 0.00% | 100.00% |
| | Industrial Robotics - Food | 0.00% | 0.00% | 100.00% | 0.00% | 100.00% |
| | Industrial Robotics - Electric/Electronics | 0.00% | 25.00% | 50.00% | 25.00% | 100.00% |

Table 71 shows a generally high level of employee engagement across robotics facilities, with most employees demonstrating behaviors that go beyond their formal job descriptions. For instance, when it comes to going above and beyond the call of duty, no facility reported a complete absence of this behavior. Instead, one-third of facilities observed this behavior in more than 50% of their employees, another third in 10% to 50%, and the remaining third in less than 10%. A similar pattern was observed in employees taking up the duties of colleagues without being asked, again with equal distribution across the three engagement levels and no reports of it being entirely absent.

Regarding employees putting in more hours than contractually expected, two-thirds of facilities reported this behavior among 10% to 50% of their staff, while the remaining third observed it in less than 10%. Interestingly, none reported this behavior in more than half of their workforce, possibly indicating some level of balance between work expectations and employee well-being, or that overtime is practiced selectively. In terms of contributing ideas to improve operations, no facility reported an absence of this behavior. Two-thirds indicated that between 10% to 50% of their employees actively offer suggestions, while one-third observed this behavior in more than half of their workforce. This highlights a positive, though not yet universal, orientation toward continuous improvement.

Qualitative feedback from validators aligns with these findings. In the logistics subsector, respondents emphasized that customer service orientation and employee roles significantly influence workplace behavior and efficiency. They also noted that employee attitudes directly affect operational outcomes. Although there were no additional comments from the food subsector, the responses in electronics—while not represented in the quantitative table—revealed strong engagement, particularly among employees involved in improvement initiatives and structured programs.

Some validators clarified that certain behaviors may not apply uniformly, especially among production-level staff, suggesting variability based on job roles.

**Table 71.**
*Distribution of Robotics Facilities by Percentage of Employees Exhibiting Various Behavior at Work*

| Behavior | Facilities (%) | | | | |
|---|---|---|---|---|---|
| | None | Less than 10% | 10% - 50% | More than 50% | Total |
| Go above and beyond the 'call of duty' without being asked | 0.00% | 33.33% | 33.33% | 33.33% | 100.00% |
| Take up the duties of a colleague without being asked | 0.00% | 33.33% | 33.33% | 33.33% | 100.00% |
| Regularly put in more hours than contractually expected into their jobs | 0.00% | 33.33% | 66.67% | 0.00% | 100.00% |
| Make helpful suggestions for improving the operation within the organization | 0.00% | 0.00% | 66.67% | 33.33% | 100.00% |

*Note: There is no response from the industrial robotics - electronics subsector.*

## 4.11 Workforce Matters

***Satisfaction and Performance of TVET Graduates and Certified Employees'***

The distribution of TVET graduates and certified employees across robotics subsectors varies significantly, reflecting different levels of integration of technical-vocational skills in the workforce.

In the Service Robotics - Logistics subsector, while there are no reported TVET graduates, there is a small proportion (less than 10%) of TVET-certified employees among the total workforce. Despite the low percentage, employers in this sector expressed a high level of satisfaction with the work performance of these certified individuals.

The Food subsector, on the other hand, shows a different pattern. There are reports of TVET graduates being present within the workforce, but no TVET-certified employees have been identified. Validators also raised concerns regarding the actual capability of certified workers, noting that a certification, such as an NC II, does not

always guarantee job readiness or high-quality performance. This underscores a gap between certification standards and industry expectations in food robotics applications, where performance consistency and reliability are critical.

In the Electronics subsector, the integration of TVET-certified and graduate employees is more pronounced. Some facilities report that 10% to 50% of their employees are either TVET graduates or certified, with certification often being a requirement prior to graduation. Notably, there may be more certified individuals than graduates, as students are encouraged or even mandated to acquire National Certificates (e.g., Mechatronics NC) before completing their studies. Employers in this sector generally expressed satisfaction with these employees, even equating their performance to that of engineering graduates. This reflects a higher alignment between TVET competencies and the advanced technical demands of electronics and industrial robotics.

# CHAPTER 5
# CONCLUSION AND RECOMMENDATIONS

The survey collected data on various areas, including facility profiles, employee demographics, competencies and skills gaps, and employer satisfaction with TVET graduates and certified employees. It also explored broader sectoral insights such as jobs and skills projections, emerging skill sets, and readiness for automation, among others. These findings provide essential input to the SNA study.

The participating robotics facilities such as Service Robotics - Logistics Subsector, Industrial Robotics - Electric/Electronic Subsector, and Industrial Robotics - Food Subsector, reflect the country's early but growing adoption of automation technologies. The majority of facilities have a workforce that is small to medium in size, with varying levels of technological maturity and skill proficiency. Notably, the robotics workforce is distinguished by a higher proportion of male employees, and a significant number of the positions are in technical or associate professional occupations. This points out the sector's need for specialized STEM-related skills. Moreover, this doesn't mean that the role of women in this field is not inclusive. Validators emphasized that certain industries favored women due to their attention to detail; it's just that there is a low number of females in this field. In terms of education, the majority of employees hold degrees in engineering or technology-related fields, with relatively limited representation of TVET graduates in the workforce, typically ranging from 10% to 15%. This limited representation of TVET graduates in robotics roles is a significant challenge because many enterprises lack confidence in hiring TVET graduates due to the absence of targeted NC or TVET programs focused on robotics integration, programming, or AI applications. Without such content, TVET programs risk becoming outdated and irrelevant to modern industry needs.

Furthermore, several initiatives address emerging skills in the sector; however, reservations regarding budget and physical infrastructure for training remain, impacting both emerging and green job skills. Despite the industry's awareness of green jobs, a small number of them are not yet prepared due to the same reason as the emerging skill. It is evident that the implementation cost is expensive. This highlights a major challenge in the cost and accessibility of training, especially for small and medium-sized businesses (MSMEs), who struggle with the high costs, lack of local providers, and insufficient specialized programs for robotics. Additionally, there's a lack of standardized training programs and credentials recognized across all areas of robotics. This also impacts the readiness for green robotics and sustainability integration; although robotics has the potential to support green transitions, awareness of emerging green skills among robotics enterprises remains low, with few facilities incorporating sustainability metrics into their workforce development strategies.

Despite this, employer satisfaction with existing TVET graduates is moderate to high, particularly for those in operational and technician roles. However, during the validation, industry representatives mentioned that current TVET curricula are often not aligned with real-world robotics applications, especially in areas such as programming, mechatronics integration, and system diagnostics. This misalignment contributes to a multidisciplinary skills gap, as the robotics sector requires workers with knowledge across mechanical engineering, electronics, control systems, and programming, which current training programs often do not sufficiently integrate. This creates hiring difficulties for companies seeking talent with broad, cross-functional skills, with some firms even needing to send employees overseas for training. Most facilities report that training for high-potential employees is delivered on-site or through external vendor partnerships, although smaller facilities face significant constraints in doing so due to resource limitations.

In light of the moderate to high employer satisfaction with current TVET graduates, there is an increasing demand for reskilling, particularly for workers transitioning back into the industry. As automation and technology evolve, TechVoc programs play a vital role in supporting reskilling, especially in fast-developing subsectors like logistics. While college degrees remain the primary qualification, TechVoc programs are essential for targeted upskilling, workforce adaptability, and improving job readiness.

Additionally, skilled robotics workers experience consistently high demand and rarely face unemployment, a trend particularly evident in the food subsector and reflective of broader patterns across Southeast Asia. This highlights the sector's resilience and the strong marketability of robotics-related competencies both locally and abroad.

The industry identifies several jobs, particularly in robotics integration, MCU programming, automation control, and AI data analytics, as hard-to-fill. These positions require a hybrid of mechanical, electronic, and software engineering skills. Employers have also noted the challenge of forming multidisciplinary teams, an essential requirement in robotics. Most facilities reported intentions to expand or upgrade their robotics systems, which will further increase demand for highly skilled workers.

The significance of developing a workforce that is capable of adapting to the rapid pace of technological change and automation is also emphasized in the study. Philippine robotics adoption is anticipated to increase over the next five years, with a particular emphasis on electronics manufacturing and logistics, in line with the global Industry 4.0 trends. Nevertheless, the adoption of advanced robotics solutions is still uneven, as MSMEs frequently lack the necessary financial or human resources to implement them. This uneven adoption points to digital maturity and technological infrastructure gaps, as many small and mid-sized facilities operate with outdated

machines and lack modern data infrastructure, hindering robotics integration. Furthermore, robotics systems are highly dependent on large-scale investment, often beyond the reach of MSMEs, leading to a clustering of technologies within larger firms and excluding smaller businesses from innovation benefits. Finally, there's a weak pipeline for talent development and industry linkages, with limited and fragmented partnerships between training institutions and industry, resulting in graduates lacking the practical competencies required by employers and contributing to job mismatches. The geographic and sectoral concentration of robotics adoption, primarily in select industries and urban areas, also makes it difficult to design scalable workforce interventions for broader job creation through automation across the country.

**Recommendations on the Identified Issues and Policy Implications**

To address the gaps and challenges identified in this study and to build a more resilient and future-ready robotics workforce, the following recommendations are put forward:

1. Develop New Robotics-related TVET Programs
    a. There is a need to develop new TVET programs in the sector to address the current and anticipated skills gap. The following tables list the job requirements identified as a priority of the sector and have no corresponding TVET programs; thus recommended for the development of either a Training Regulation or a Competency Standard. The list of priorities is listed per Robotics subsector and priority status as follows:

**Table 72.**
*Programs recommended for Training Regulations Development*

| Subsector | Value Chain | TR for Development |
|---|---|---|
| | | High Priority (Priority 1) |
| Industrial Robotics - Food | Food Processing | Electrical and Instrumentation Technician |
| Industrial Robotics - Food | Food Processing | Robotics Specialist |
| Industrial Robotics (Electric/Electronics) | Product and Service Development | MCU and PLC Programmer |
| Industrial Robotics (Electric/Electronics) | Product and Service Development | Computer Vision System Specialist |

| | | |
|---|---|---|
| Industrial Robotics (Electric/Electronics) | Manufacturing | Automation Technician |
| Industrial Robotics (Electric/Electronics) | Manufacturing | Instrument Specialist |
| Industrial Robotics (Electric/Electronics) | Manufacturing | Robotic Soldering Technician |
| Industrial Robotics (Electric/Electronics) | Manufacturing | Test Technician |
| Industrial Robotics (Electric/Electronics) | Manufacturing | Quality Control Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Robotic Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Process Control Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Robotics Calibration Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Preventive Maintenance Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Equipment Engineering Maintenance |

| Subsector | Value Chain | TR for Development |
|---|---|---|
| | | Medium Priority (Priority 2) |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Field Service Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Mechanical Technician |

| | | |
|---|---|---|
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Rework / Custom Welder |

**Table 73**.
*Programs recommended for Competency Standards Development*

| Subsector | Value Chain | CS for Development |
|---|---|---|
| | | High Priority (Priority 1) |
| Service Robotics - Logistics | Storage and Inventory Management | Conveyor Automation Technician |
| Industrial Robotics - Food | Food Processing | Robotics Technician |
| Industrial Robotics - Food | Food Processing | Food Processing Robot Technician |
| Industrial Robotics - Food | Food Processing | Electronics Technician |
| Industrial Robotics - Food | Food Processing | Instrument and Automation Technician |
| Industrial Robotics - Food | Food Processing | Instrument Technician |
| Industrial Robotics - Food | Storage | Mobile Robot Technician |
| Industrial Robotics (Electric/Electronics) | Manufacturing | Machine / Robot Operator |
| Industrial Robotics (Electric/Electronics) | Manufacturing | Setup Operator |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Line Maintenance |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Repair Technician |

| Subsector | Value Chain | CS for Development |
|---|---|---|
| | | Medium Priority (Priority 2) |
| Service Robotics - Logistics | Storage and Inventory Management | Robotics Maintenance Technician (Logistics) |
| Service Robotics - Logistics | Storage and Inventory Management | Autonomous Mobile Robot (AMR) Technician |
| Service Robotics - Logistics | Storage and Inventory Management | Data Annotators |
| Service Robotics - Logistics | Warehousing and Distribution | Warehouse Automation Technician |
| Service Robotics - Logistics | Warehousing and Distribution | Automated Picking and Packing System Operator |
| Service Robotics - Logistics | Warehousing and Distribution | Robotic Sorting Systems Operator |
| Service Robotics - Logistics | Warehousing and Distribution | Drone Operator (Logistics)* |
| Service Robotics - Logistics | Warehousing and Distribution | Automation Technician |
| Industrial Robotics (Electric/Electronics) | Maintenance, Repair, and Assembly | Electronics Technician |

b. In the advent of industry developments, the emerging skills requirements necessary for workforce development were likewise identified. These emerging skills requirements can be undertaken through the development of new competency standards, microcredentials, and/or specialized training modules reflecting current industry demands and emerging technologies. As gleaned from the results of the study, the following programs in Table 74 are recommended for development of TVET programs, along with its prioritization status. As it may be observed that some of the job requirements have minor differences on the naming convention based

on the industry's responses during the consultation meetings (e.g. Robotics Programming vs Robotics Integration Programming), it is recommended that these shall undergo further industry validation during the conduct of functional analysis to determine whether the competencies are the same, and if the said job requirements are peculiar to a specific subsector or applies to all.

**Table 74.**
*Programs recommended for Training Regulations and Competency Standards Development for the identified emerging skills by robotics sub sectors*

| SUBSECTOR | Emerging Skills | TR/CS | PRIORITIZATION RESULT |
|---|---|---|---|
| Service Robotics - Logistics | Robotics Programming | TR | High Priority (Priority 1) |
| | Internet of Things (IoT) | TR | High Priority (Priority 1) |
| | Autonomous Systems | TR | High Priority (Priority 1) |
| | Artificial Intelligence in Robotics (Machine Vision) | TR | High Priority (Priority 1) |
| | System Engineer | TR | High Priority (Priority 1) |
| | Machine Design | TR | High Priority (Priority 1) |
| Industrial Robotics - Food | Robotics Integration Programming | TR | High Priority (Priority 1) |
| | Machine Integration Vision | TR | High Priority (Priority 1) |
| | Data Analysis for Robotics | TR | High Priority (Priority 1) |
| | System Integration | TR | High Priority (Priority 1) |
| | Machine Design | TR | High Priority (Priority 1) |
| | Internet of Things (IoT) | CS | Medium Priority (Priority 2) |
| Industrial Robotics - Electric/Electronics | Simulation and Modeling | TR | High Priority (Priority 1) |
| | Data Analysis for Robotics | TR | High Priority (Priority 1) |
| | Robotics Programming | TR | Medium Priority (Priority 2) |
| | Autonomous Systems | TR | Medium Priority (Priority 2) |
| | Human-Robot Interaction | TR | Medium Priority (Priority 2) |
| | Robotic Process Automation (RPA) | TR | Medium Priority (Priority 2) |
| | Artificial Intelligence in Robotics | TR | Medium Priority (Priority 2) |
| Common to All Subsectors | Collaborative Robotics (Cobots) | TR | High Priority (Priority 1) |

| | | | |
|---|---|---|---|
| Technical and Programming Skills (C++, Python, Java, and etc.) | TR | High Priority (Priority 1) | |

c. To support workforce transitions, it is recommended to strengthen reskilling and upskilling pathways by expanding TechVoc programs, particularly for existing workers and professionals re-entering the industry or adapting to new robotics technologies. This is especially critical in fast-evolving subsectors such as logistics, where ongoing innovation and R&D demand a blend of theoretical understanding and practical expertise. While a Bachelor's degree remains the primary qualification for the majority of the job requirements in the robotics sector, the industry considers several job requirements as applicable to TVET, highlighting the need to continuously reskill and upskill. The industry noted their preference for training staff or those with previous experience in the field rather than hiring new ones due to the fast-paced and technology-driven nature of the industry. Further, with the deployment of the Implementing Guidelines for Microcredential Programs, the industry and training institutions may refer to the list of priority jobs and emerging skills requirements as part of the supermarket of competencies to develop standalone microcredentials where applicable.

2. Boost the Integration of TVET Graduates and Certified Workers into the Robotics sector
    a. Promote the recognition of TVET certification in the industry to boost the employment prospects of TVET-certified workers. Provided the nature of the sector where most job requirements still look for a college degree as the minimum qualification, the possibility that certain certificate programs of TESDA may only be needed for upskilling but not as a requirement to enter a robotics facility must be considered.
    b. TESDA is recommended to foster collaboration with the robotics sector to establish clear pathways from post secondary education through TVET into robotics sector employment, thereby enhancing their employability.
    c. TVET must be promoted as a viable career path. This can be achieved through the strengthening of the partnership between TESDA and the robotics companies, wherein they collaborate in conducting awareness campaigns and providing career guidance to highlight robotics sector opportunities for TVET graduates and certified workers, while establishing job placement services tailored to their needs and engaging with employers to facilitate hiring.
    d. It is also recommended to support lifelong learning and skills upgrading for TVET graduates by offering opportunities for continuous education and adapting to industry changes, alongside implementing Recognition of Prior Learning (RPL) systems to acknowledge their skills and ease their transition into more advanced roles.

3. Strengthen Industry Partnerships and Implementation of Enterprise-Based Education and Training (EBET)

a. Findings from the employer survey and the conduct of validation shows that across robotics subsectors—particularly food and electric/electronics subsector—a large share of employers require continuous learning/developmental activities. This reflects a sector-wide recognition of the importance of upskilling and adaptability in a rapidly evolving technological environment. Thus, it is recommended to leverage the Enterprise-Based Education and Training to be implemented across all robotics subsectors, especially in fields requiring immersive learning like robotics maintenance technician (Logistics), conveyor automation technician, robotics technician, robotics operator, product test specialist, MCU and PLC programmer. Further, the three categories of the EBET Framework–General EBET, Apprenticeship, and Upskilling Programs—make this program more adaptable across workforce levels (NC I–NC IV and above). Partnerships with industry provide real-world exposure and workplace simulation to trainees to develop socio-emotional and collaborative capabilities.
b. TESDA shall encourage the implementation of EBET, especially for companies with more mature skills development systems and equipment in place. Some of the companies and robotics facilities already expressed willingness to pursue program recognition with TESDA. This will particularly be beneficial, given the capital-intensive requirements of the robotics sector, to ensure that the new programs to be developed will also be implemented.
c. Relative to this is the formalization and expansion of industry partnerships through the establishment of Industry TVET Boards in the Robotics Sector and its subsectors.

4. Actively Promote Green Jobs, Sustainable Practices, and Government-Related Initiatives
    a. Green robotics and sustainability practices shall be integrated into the standards and curriculum for all robotics-related programs such as in the area of energy efficiency, circular production systems, and environmentally responsible innovation.
    b. Further, there is a need to address the gaps in information dissemination to increase industry engagement on green jobs-related government initiatives. The communication between the government and private stakeholders was often regarded as informal or inconsistent. Utilizing structured channels ,such as visibility on quarterly industry association meetings, may be explored. The industry suggests for the Department of Information and Communications Technology to take the lead in forming a centralized one-stop shop, leveraging on digital platforms for increased promotion and access.

5. Encourage Participation of Women in STEM related occupations in robotics sector

a. There is a low percentage of women working in STEM-related occupations in the robotics sector, particularly in the Logistics and Electric/Electronics subsectors. According to the Logistics subsector, 50% of facilities report that less than 25% of their workforce are women. The situation is even more critical in Electric/Electronics, where 100% of surveyed facilities indicate that women comprise less than 25% of their staff. This highlights an urgent need for interventions to increase female participation in these crucial and rapidly expanding areas of the robotics industry.

b. TESDA may be able to support this aspect as the agency has been continuously advocating for women in non-traditional sectors. With this, it is recommended to continue gender mainstreaming through the integration of gender perspectives into all programs and projects, ensuring that gender considerations are central to planning, implementation, monitoring, and evaluation.
c. Gender-Sensitive Policies and Practices must be strengthened. Relative to the implementation of Enterprise-Based Education Training, a thorough review of existing policies of these companies must be conducted to ensure they promote gender equality and implement new policies where gaps are identified. This includes policies related to recruitment, training, workplace environment, and career progression. Moreover, the enterprises must be encouraged to develop recruitment campaigns specifically aimed at attracting women to STEM roles in the sector.

6. Enhance the Capability of TVET Trainers
    a. To build a robust foundation for robotics skills development, TESDA shall capacitate individuals and industry experts to become regional lead trainers. A training of trainers shall also be facilitated, leveraging on available local expertise as the industry noted that large companies investing in robotics rely more on sending people abroad for training due to the lack of equipped experts.

7. Intensify the Implementation of the Area-Based Demand-Driven TVET Programs related to the Robotics Sector
    a. With the perceived regional disparity in job availability and facility location, TESDA Regional and Provincial Offices that specifically include Manufacturing (i.e. electric/electronics and food) and Transportation and Logistics sectors shall align with the industry-identified job and emerging skills requirements and ensure that robotics-related requirements are included in the list of priorities, as applicable in the area.

8. Leverage on Government Initiatives for Strengthening and Expanding Needed Infrastructure
    a. The The robotics facilities' readiness for emerging requirements relies on the availability of equipment and needed technologies. Marked by ongoing transition towards automation and with the anticipated growth in the next 5-10 years, leveling the playing field would necessitate leveraging the existing policy initiatives and incentives from other government agencies.
        i. DTI-BOI's Strategic Investment Development Plan
        ii. DOST-MIRDC Industry 4.0 Initiatives
        iii. CREATE Law
    b. Particularly needed for those operating in small-scale operations and MSMEs, such as the food subsector.

Collectively, these recommendations form the basis for a National Robotics Workforce Roadmap that aligns workforce development with industrial transformation, sustainability, inclusivity, and global competitiveness. The roadmap requires close collaboration between TESDA, DTI, DOST, DICT, and private sector partners to harmonize policy reforms, investment priorities, and workforce pathways.

## Recommendations on the Conduct of the Survey

In conducting the survey within the Robotics Sector, several challenges were encountered that may have influenced the comprehensiveness and accuracy of the data gathered. These difficulties primarily stem from issues related to the scope of the survey, participant engagement, and the limitations of the survey tool used. Addressing these concerns is critical for future assessments in ensuring robust and reliable findings.

1. Coverage of Sub-Sectors
    a. The survey did not cover all subsectors of Robotics, as the focus was narrowed based on specific justifications and conditions such as employment, economic contribution, and industry growth. Future surveys should aim for a more inclusive scope to ensure representation of additional subsectors, capturing a broader spectrum of the sector's dynamics.
2. Response Rate and Participant Engagement
    a. A significant challenge encountered was the low response rate, which can be attributed to the length and perceived tediousness of the questionnaire. Many respondents either declined to participate or did not complete the survey due to its complexity and the time commitment required. To address this, it is recommended to streamline the survey instrument by reducing the length and complexity of the questions while maintaining their relevance. Offering incentives or clearly communicating the potential benefits of participation could also enhance engagement.
    b. Due to low engagement, it is also recommended to conduct face-to-face surveys by visiting the industry or enterprise offices. This approach ensures that probing questions are clearly discussed, potentially improving the accuracy of responses and enhancing the quality of the write-up.
    c. The non-participation of the Agriculture subsector stems from the reason that it remains largely under the Research and Development phase. Future surveys may consider tailored outreach efforts or collaborations with agricultural research institutions to improve representation.
    d. A significant number of respondents expressed concerns about the survey's length. However, given the objective of the study to be as comprehensive as possible, it is recommended to offer a simple token of appreciation to encourage participation and completion—such as a certificate of participation or a small incentive.
    e. Although assistance from organizations was helpful in reaching out to respondents and obtaining their contact information, it would be best to follow up directly with enterprises/respondents if no feedback is

received after a specific time frame. Direct communication can ensure better response rates and improve the completeness of the data collected.

f. Pre-test the questionnaire with a small group of respondents to identify and address potential issues in length or clarity.

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# ANNEX A

## Projected Distribution of the Skills Supply for the next 5 years for the Robotics Sector

| Service Robotics - Logistics subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Value Chain** | **Skills Jobs** | **Applicability %** | **Changes (%)** | | | | |
| | | **Yes** | **Shortage** | **No change** | **Surplus** | **No Answer** | **Total** |
| Storage and Inventory Management | Supply Chain Automation Engineer | 100.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | AI Specialist for Logistics Robotics | 66.67 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Logistics Consultant | 83.33 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Maintenance Technician (Logistics) | 83.33 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Integration Specialist (Logistics) | 83.33 | 60.00 | 20.00 | 20.00 | 0.00 | 100.00 |
| | Conveyor Automation Technician | 50.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Automated Storage and Retrieval System (ASRS) Operator | 66.67 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Autonomous Mobile Robot (AMR) Technician | 66.67 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Quality Control Technician | 66.67 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Data Gathering Personnel | 100.00 | 33.33 | 50.00 | 16.67 | 0.00 | 100.00 |
| | Data Annotators | 83.33 | 60.00 | 40.00 | 0.00 | 0.00 | 100.00 |
| Warehousing and Distribution | Warehouse Automation Technician | 50.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Automated Picking and Packing System Operator | 66.67 | 50.00 | 25.00 | 0.00 | 25.00 | 100.00 |
| | Robotic Sorting Systems Operator | 66.67 | 50.00 | 25.00 | 0.00 | 25.00 | 100.00 |
| | Autonomous Mobile Robot (AMR) Technician | 83.33 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |

| Service Robotics - Logistics subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Drone Operator (Logistics) | 83.33 | 60.00 | 40.00 | 0.00 | 0.00 | 100.00 |
| | Fleet Automation Supervisor | 66.67 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Automated Storage and Retrieval System (ASRS) Operator | 66.67 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Automation Technician | 100.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | AI Engineer | 100.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Data Analyst | 100.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |

| Industrial Robotics - Food subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Value Chain** | **Skills Jobs** | **Applicability %** | **Changes (%)** | | | | |
| | | **Yes** | **Shortage** | **No change** | **Surplus** | **No Answer** | **Total** |
| Food Processing | Robotics Engineer | 50.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Technician | 75.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Operator | 66.67 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Food Processing Robot Technician | 66.67 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| | Packaging Robot Operator | 66.67 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| | Automation Engineer | 100.00 | 66.67 | 0.00 | 33.33 | 0.00 | 100.00 |

| Industrial Robotics - Food subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Control Systems Engineer | 100.00 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| | Electrical and Instrumentation Technician | 100.00 | 33.33 | 33.33 | 33.33 | 0.00 | 99.99 |
| | Instrument and Automation Technician | 66.67 | 50.00 | 0.00 | 50.00 | 0.00 | 100.00 |
| Quality Control and Food Safety | Product Test Specialist | 100.00 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Repair Technician | 66.67 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |

| Industrial Robotics - Electric/Electronics subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Applicability % | Changes (%) | | | | |
| Value Chain | Skills Jobs | Yes | Shortage | No change | Surplus | No Answer | Total |
| Product and Service Development | Controls Engineer | 85.71 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Product Test Specialist | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Programmer | 100.00 | 57.14 | 14.29 | 28.57 | 0.00 | 100.00 |
| | Test Engineering Technician | 85.71 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | New Product Introduction Engineer | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | MCU and PLC Programmer | 85.71 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Computer Vision System | 85.71 | 83.33 | 16.67 | 0.00 | 0.00 | 100.00 |

| Industrial Robotics - Electric/Electronics subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Specialist | | | | | | |
| Manufacturing | Automation Technician | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Machine / Robot Operator | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Instrument Specialist | 57.14 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Instrument and Automation Technician | 57.14 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Setup Operator | 50.00 | 66.67 | 33.33 | 0.00 | 0.00 | 100.00 |
| | Test Technician | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| | Quality Control Technician | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |
| Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Electronics Technician | 57.14 | 25.00 | 50.00 | 25.00 | 0.00 | 100.00 |
| | Instrument Technician | 57.14 | 75.00 | 0.00 | 25.00 | 0.00 | 100.00 |
| | Mechanical Technician | 57.14 | 50.00 | 25.00 | 25.00 | 0.00 | 100.00 |
| | Process Control Technician | 71.43 | 80.00 | 20.00 | 0.00 | 0.00 | 100.00 |
| | Repair Technician | 57.14 | 25.00 | 50.00 | 25.00 | 0.00 | 100.00 |
| | Rework / Custom Welder | 57.14 | 50.00 | 25.00 | 25.00 | 0.00 | 100.00 |
| | Robotic Technician | 71.43 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Robotics Calibration Technician | 57.14 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| | Field Service Technician | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Line Maintenance | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |
| | Preventive Maintenance Technician | 57.14 | 50.00 | 50.00 | 0.00 | 0.00 | 100.00 |

| Industrial Robotics - Electric/Electronics subsector | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Equipment Engineering Maintenance | 57.14 | 75.00 | 25.00 | 0.00 | 0.00 | 100.00 |

# ANNEX B-1

| Service Robotics - Logistics subsector | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Value Chain** | **Jobs** | **C6.1.** *Is the job requirement applicable, or will be applicable in your facility in the next 5 years?* | | **C6.1.1** *Is the job requirements/ highly demanded abroad?* | | **C6.2.** *Will there be shortage, no change, or surplus in the skills supply?* | | | **C6.3.** *Is the job hard to fill or not?* | |
| | | **Yes** | **No** | **Yes** | **No** | **Shortage** | **No change** | **Surplus** | **Hard to fill** | **Easy to fil** |
| Value Chain: Storage and Inventory Management | Supply Chain Automation Engineer | **100.00** | | **100.00** | | **66.67** | **33.33** | | **100.00** | |
| | AI Specialist for Logistics Robotics | 66.67 | 33.33 | 100.00 | | 100.00 | | | 100.00 | |
| | Robotics Logistics Consultant | 83.33 | 16.67 | 80.00 | 20.00 | 80.00 | 20.00 | | 100.00 | |
| | Robotics Maintenance Technician (Logistics) | 83.33 | 16.67 | 100.00 | | 80.00 | 20.00 | | 80.00 | 20.00 |
| | Robotics Integration Specialist (Logistics) | 83.33 | 16.67 | 100.00 | | 60.00 | 20.00 | 20.00 | 80.00 | |
| | Conveyor Automation Technician | 50.00 | 50.00 | 100.00 | | 100.00 | | | 100.00 | |
| | Automated Storage and Retrieval System (ASRS) Operator | 66.67 | 33.33 | 100.00 | | 75.00 | 25.00 | | 100.00 | |
| | Autonomous Mobile Robot (AMR) Technician | 66.67 | 33.33 | 100.00 | | 50.00 | 50.00 | | 75.00 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Quality Control Technician | 66.67 | 33.33 | 100.00 | | 75.00 | 25.00 | | 75.00 | |
| | Data Gathering Personnel | 100.00 | | 83.33 | 16.67 | 33.33 | 50.00 | 16.67 | 50.00 | 33.33 |
| | Data Annotators | 83.33 | 16.67 | 100.00 | | 60.00 | 40.00 | | 80.00 | |
| Value Chain: Warehousing and Distribution | Warehouse Automation Technician | 50.00 | 50.00 | 100.00 | | 66.67 | 33.33 | | 66.67 | |
| | Automated Picking and Packing System Operator | 66.67 | 33.33 | 100.00 | | 50.00 | 25.00 | | 50.00 | 25.00 |
| | Robotic Sorting Systems Operator | 66.67 | 33.33 | 100.00 | | 50.00 | 25.00 | | 50.00 | 25.00 |
| | Autonomous Mobile Robot (AMR) Technician | 83.33 | 16.67 | 80.00 | 20.00 | 80.00 | 20.00 | | 100.00 | |
| | Drone Operator (Logistics) | 83.33 | 16.67 | 80.00 | 20.00 | 60.00 | 40.00 | | 80.00 | 20.00 |
| | Fleet Automation Supervisor | 66.67 | 33.33 | 100.00 | | 50.00 | 50.00 | | 100.00 | |
| | Automated Storage and Retrieval System (ASRS) Operator | 66.67 | 33.33 | 75.00 | 25.00 | 75.00 | 25.00 | | 100.00 | |
| | Automation Technician | **100.00** | | **83.33** | **16.67** | **66.67** | **33.33** | | **100.00** | |
| | Others: | | | | | | | | | |
| | AI Engineer | 100.00 | | 100.00 | | 100.00 | | | 100.00 | |
| | Data Analyst | 100.00 | | 100.00 | | 100.00 | | | 100.00 | |

| Industrial Robotics - Food subsector | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Value Chain** | **Jobs** | **C6.1.** ***Is the job requirement applicable, or will be applicable in your facility in the next 5 years?*** | | **C6.1.1** ***Is the job requirements/highly demanded abroad?*** | | **C6.2.** ***Will there be shortage, no change, or surplus in the skills supply?*** | | | **C6.3.** ***Is the job hard to fill or not?*** | |
| | | **Yes** | **No** | **Yes** | **No** | **Shortage** | **No change** | **Surplus** | **Hard to fill** | **Easy to fil** |
| Food Processing | Robotics Engineer | 50.00 | 50.00 | 100.00 | | 100.00 | | | 100.00 | |
| | Robotics Technician | 75.00 | 25.00 | 100.00 | | 100.00 | | | 100.00 | |
| | Robotics Operator | 66.67 | 33.33 | 50.00 | 50.00 | 100.00 | | | 100.00 | |
| | Food Processing Robot Technician | 66.67 | 33.33 | 100.00 | | 50.00 | | 50.00 | 100.00 | |
| | Packaging Robot Operator | 66.67 | 33.33 | 100.00 | | 50.00 | | 50.00 | 50.00 | 50.00 |
| | Palletizing Robot Engineer | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | Food Sorting Robot Specialist | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | Automation Engineer | 100.00 | | 100.00 | | 66.67 | | 33.33 | 100.00 | |
| | Control Systems Engineer | 100.00 | | 100.00 | | 50.00 | | 50.00 | 100.00 | |
| | Electrical and Instrumentation Technician | 100.00 | | 100.00 | | 33.33 | 33.33 | 33.33 | 66.67 | 33.33 |
| | Electronics Technician | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | Instrument and Automation Technician | 66.67 | 33.33 | 100.00 | | 50.00 | | 50.00 | 100.00 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Instrument Specialist | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | Instrument Technician | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| Quality Control and Food Safety | Robotics Safety Specialist | | | | | | | | | |
| | Automated Cleaning Systems Technician | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | Product Test Specialist | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | Repair Technician | 100.00 | | 100.00 | | 66.67 | 33.33 | | 100.00 | |
| **Storage** | **Autonomous Mobile Robot (AMR) Technician** | **66.67** | **33.33** | **100.00** | | 50.00 | 50.00 | | 100.00 | |
| | Palletizing Robot Engineer | | | | | | | | | |
| | Others: | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | 1. Robotics Cyber Threats Specialist/ Engineer | 33.33 | 66.67 | 100.00 | | 100.00 | | | 100.00 | |
| | 2. Robotics Maintenance Specialist/ Engineer | | | | | | | | | |

| Industrial Robotics - Electric/Electronics subsector | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Value Chain** | **Jobs** | **C6.1.** ***Is the job requirement applicable, or will be applicable in your facility in the next 5 years?*** | | **C6.1.1** ***Is the job requirements/highly demanded abroad?*** | | **C6.2.** ***Will there be shortage, no change, or surplus in the skills supply?*** | | | **C6.3.** ***Is the job hard to fill or not?*** | |
| | | **Yes** | **No** | **Yes** | **No** | **Shortage** | **No change** | **Surplus** | **Hard to fill** | **Easy to fil** |
| Product and Service Development | Controls Engineer | 85.71 | 14.29 | 100.00 | | 66.67 | 33.33 | 0.00 | 100.00 | |
| | Product Test Specialist | 57.14 | 42.86 | 75.00 | 25.00 | 75.00 | 25.00 | 0.00 | 100.00 | |
| | Programmer | 100.00 | | 100.00 | | 57.14 | 14.29 | 28.57 | 57.14 | 28.57 |
| | Test Engineering Technician | 85.71 | 14.29 | 83.33 | 16.67 | 66.67 | 33.33 | 0.00 | 66.67 | 33.33 |
| | New Product Introduction Engineer | 57.14 | 42.86 | 50.00 | 50.00 | 50.00 | 50.00 | 0.00 | 75.00 | 25.00 |
| | MCU and PLC Programmer | 85.71 | 14.29 | 100.00 | | 66.67 | 33.33 | 0.00 | 83.33 | 16.67 |
| | Computer Vision System Specialist | 85.71 | 14.29 | 100.00 | | 83.33 | 16.67 | 0.00 | 100.00 | |
| Manufacturing | Automation Technician | 71.43 | 28.57 | 100.00 | | 80.00 | 20.00 | 0.00 | 100.00 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Machine / Robot Operator | 71.43 | 28.57 | 100.00 | | 80.00 | 20.00 | 0.00 | 80.00 | 20.00 |
| | Instrument Specialist | 57.14 | 42.86 | 100.00 | | 100.00 | 0.00 | 0.00 | 75.00 | 25.00 |
| | Instrument and Automation Technician | 57.14 | 42.86 | 100.00 | | 100.00 | 0.00 | 0.00 | 100.00 | |
| | Setup Operator | 50.00 | 50.00 | 66.67 | 33.33 | 66.67 | 33.33 | 0.00 | 66.67 | 33.33 |
| | Robotic Soldering Technician | 28.57 | 71.43 | 100.00 | | 100.00 | 0.00 | 0.00 | 100.00 | |
| | Scale Technician | 14.29 | 85.71 | 100.00 | | 0.00 | 100.00 | 0.00 | 100.00 | |
| | Test Technician | 57.14 | 42.86 | 75.00 | 25.00 | 75.00 | 25.00 | 0.00 | 50.00 | |
| | Quality Control Technician | 57.14 | 42.86 | 100.00 | | 75.00 | 25.00 | 0.00 | 50.00 | |
| Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | 71.43 | 28.57 | 100.00 | | 80.00 | 20.00 | 0.00 | 60.00 | |
| | Electronics Technician | 57.14 | 42.86 | 75.00 | 25.00 | 25.00 | 50.00 | 25.00 | | 50.00 |
| | Instrument Technician | **57.14** | **42.86** | **75.00** | **25.00** | 75.00 | 0.00 | 25.00 | 25.00 | 25.00 |
| | Mechanical Technician | 57.14 | 42.86 | 100.00 | | 50.00 | 25.00 | 25.00 | | 50.00 |
| | Process Control Technician | 71.43 | 28.57 | 100.00 | | 80.00 | 20.00 | 0.00 | 60.00 | |
| | Repair Technician | 57.14 | 42.86 | 75.00 | 25.00 | 25.00 | 50.00 | 25.00 | 50.00 | 25.00 |
| | Rework / Custom Welder | 57.14 | 42.86 | 75.00 | 25.00 | 50.00 | 25.00 | 25.00 | | 75.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Robotic Technician | 71.43 | 28.57 | 100.00 | | 100.00 | 0.00 | 0.00 | 80.00 | |
| | Robotics Calibration Technician | 57.14 | 42.86 | 100.00 | | 100.00 | 0.00 | 0.00 | 100.00 | |
| | Field Service Technician | 57.14 | 42.86 | 100.00 | | 50.00 | 50.00 | 0.00 | 25.00 | 50.00 |
| | Data Gathering Personnel and Data Annotators | 42.86 | 57.14 | 100.00 | | 33.33 | 66.67 | 0.00 | 33.33 | 33.33 |
| | Line Maintenance | 57.14 | 42.86 | 75.00 | 25.00 | 50.00 | 50.00 | 0.00 | 50.00 | 25.00 |
| | Preventive Maintenance Technician | 57.14 | 42.86 | 75.00 | 25.00 | 50.00 | 50.00 | 0.00 | 50.00 | 50.00 |
| | Equipment Engineering Maintenance | 57.14 | 42.86 | 100.00 | | 75.00 | 25.00 | 0.00 | 75.00 | 25.00 |

# ANNEX B-2

| Service Robotics - Logistics subsector | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Value Chain** | **Jobs** | **C6.4.** *What is the highest educational qualification needed perform the job?* | | | **C6.5** *Is Technical Vocational Certificate/national Certificate required?* | | **C6.6.** *Is this job needed nationwide or only to a specific area?* *Please specify the area.* | |
| | | **Basic education graduate (HS Grad Old Curriculum or SHS Graduate K-12 Curriculum** | **Technical education (TVET Graduate)** | **Higher education on graduate (college degree and above** | **Yes** | **No** | **Nation-wide** | **Specific Area Only** |
| Value Chain: Storage and Inventory Management | Supply Chain Automation Engineer | | | **100.00** | | **66.67** | **50.00** | **50.00** |
| | AI Specialist for Logistics Robotics | | | 100.00 | | 100.00 | 50.00 | 50.00 |
| | Robotics Logistics Consultant | | | 100.00 | | 60.00 | 40.00 | 60.00 |
| | Robotics Maintenance Technician (Logistics) | | 60.00 | 40.00 | 40.00 | 20.00 | 40.00 | 40.00 |
| | Robotics Integration Specialist (Logistics) | | | 100.00 | 20.00 | 40.00 | 60.00 | 40.00 |
| | Conveyor Automation Technician | | 66.67 | 33.33 | 33.33 | 66.67 | 66.67 | 33.33 |
| | Automated Storage and Retrieval System (ASRS) Operator | | 25.00 | 75.00 | 25.00 | 50.00 | 50.00 | 50.00 |
| | Autonomous Mobile Robot (AMR) | | 25.00 | 75.00 | 50.00 | 25.00 | 50.00 | 50.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Technician | | | | | | | |
| | Quality Control Technician | | 25.00 | 75.00 | 25.00 | 25.00 | 50.00 | 50.00 |
| | Data Gathering Personnel | | 33.33 | 66.67 | 16.67 | 66.67 | 66.67 | 33.33 |
| | Data Annotators | | 40.00 | 60.00 | 40.00 | 40.00 | 60.00 | 40.00 |
| Value Chain: Warehousing and Distribution | Warehouse Automation Technician | | 66.67 | 33.33 | 66.67 | 33.33 | 66.67 | 33.33 |
| | Automated Picking and Packing System Operator | | 75.00 | 25.00 | 50.00 | 50.00 | 75.00 | 25.00 |
| | Robotic Sorting Systems Operator | | 75.00 | 25.00 | 50.00 | 50.00 | 75.00 | 25.00 |
| | Autonomous Mobile Robot (AMR) Technician | | 40.00 | 60.00 | 20.00 | 60.00 | 60.00 | 40.00 |
| | Drone Operator (Logistics) | | 60.00 | 40.00 | 40.00 | 60.00 | 80.00 | 20.00 |
| | Fleet Automation Supervisor | | | 100.00 | | 100.00 | 75.00 | 25.00 |
| | Automated Storage and Retrieval System (ASRS) Operator | | 25.00 | 75.00 | 50.00 | 25.00 | 50.00 | 50.00 |
| | Automation Technician | | **42.86** | **57.14** | **50.00** | **33.33** | **66.67** | **33.33** |
| | Others: | | | | | | | |
| | AI Engineer | | | 100.00 | | 100.00 | 100.00 | |
| | Data Analyst | | | 100.00 | | 100.00 | 100.00 | |

| Industrial Robotics - Food subsector | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Value Chain** | **Jobs** | **C6.4.** ***What is the highest educational qualification needed perform the job?*** | | | **C6.5** ***Is Technical Vocational Certificate/national Certificate required?*** | | **C6.6.** ***Is this job needed nationwide or only to a specific area?*** ***Please specify the area.*** | |
| | | **Basic education graduate (HS Grad Old Curriculum or SHS Graduate K-12 Curriculum** | **Technical education (TVET Graduate)** | **Higher education on graduate (college degree and above** | **Yes** | **No** | **Nation-wide** | **Specific Area Only** |
| Food Processing | Robotics Engineer | | 33.33% | 66.67% | 50.00% | 50.00% | 100.00% | |
| | Robotics Technician | | 75.00% | 25.00% | 100.00 % | | 100.00% | |
| | Robotics Operator | | 100.00% | | 50.00% | 50.00% | 100.00% | |
| | Food Processing Robot Technician | | 50.00% | 50.00% | 100.00 % | | 50.00% | |
| | Packaging Robot Operator | | 50.00% | 50.00% | | 100.00% | 50.00% | |
| | Palletizing Robot Engineer | | | 100.00% | | 100.00% | 100.00% | |
| | Food Sorting Robot Specialist | | | 100.00% | | | 100.00% | |
| | Automation Engineer | | | 100.00% | | 100.00% | 66.67% | |
| | Control Systems Engineer | | | 100.00% | | 100.00% | 50.00% | |
| | Electrical and Instrumentation Technician | | 66.67% | 33.33% | 100.00 % | | 66.67% | |
| | Electronics Technician | | 100.00% | | 100.00 | | 100.00% | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | % | | | |
| | Instrument and Automation Technician | | 50.00% | 50.00% | 100.00 % | | 50.00% | |
| | Instrument Specialist | | | 100.00% | | 100.00% | 100.00% | |
| | Instrument Technician | | 100.00% | | 100.00 % | | 100.00% | |
| Quality Control and Food Safety | Robotics Safety Specialist | | | | | | | |
| | Automated Cleaning Systems Technician | | | 100.00% | | 100.00% | 100.00% | |
| | Product Test Specialist | | 100.00% | | 100.00 % | | 100.00% | |
| | Repair Technician | | | 100.00% | 50.00% | 50.00% | 66.67% | |
| Storage | Autonomous Mobile Robot (AMR) Technician | | 100.00% | | 50.00% | 50.00% | 100.00% | |
| | Palletizing Robot Engineer | | | | | | | |
| | Others: | | 100.00% | | 100.00 % | | 100.00% | |
| | 1. Robotics Cyber Threats Specialist/ Engineer | | | 100.00% | | 100.00% | 100.00% | |
| | 2. Robotics Maintenance Specialist/ Engineer | | | | | | | |

| Industrial Robotics - Electric/Electronics subsector | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Value Chain** | **Jobs** | **C6.4.** ***What is the highest educational qualification needed perform the job?*** | | | **C6.5** ***Is Technical Vocational Certificate/national Certificate required?*** | | **C6.6.** ***Is this job needed nationwide or only to a specific area?*** ***Please specify the area.*** | |
| | | **Basic education graduate (HS Grad Old Curriculum or SHS Graduate K-12 Curriculum** | **Technical education (TVET Graduate)** | **Higher education on graduate (college degree and above** | **Yes** | **No** | **Nation-wide** | **Specific Area Only** |
| Product and Service Development | Controls Engineer | | 16.67 | 83.33 | 16.67 | 50.00 | 66.67 | |
| | Product Test Specialist | | 50.00 | 50.00 | 25.00 | 50.00 | 75.00 | |
| | Programmer | | 42.86 | 57.14 | 28.57 | 71.43 | 85.71 | |
| | Test Engineering Technician | | 66.67 | 33.33 | 50.00 | 50.00 | 83.33 | |
| | New Product Introduction Engineer | | | 100.00 | | 50.00 | 50.00 | |
| | MCU and PLC Programmer | | 50.00 | 50.00 | 33.33 | 66.67 | 66.67 | |
| | Computer Vision System Specialist | | 16.67 | 83.33 | 33.33 | 33.33 | 66.67 | |
| Manufacturing | Automation Technician | | 80.00 | 20.00 | 60.00 | 40.00 | 80.00 | 20.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Machine / Robot Operator | 20.00 | 60.00 | 20.00 | 40.00 | 40.00 | 80.00 | |
| | Instrument Specialist | 50.00 | 50.00 | | 50.00 | 50.00 | 75.00 | |
| | Instrument and Automation Technician | | 75.00 | 25.00 | 50.00 | 50.00 | 75.00 | 25.00 |
| | Setup Operator | 33.33 | 66.67 | | 33.33 | 33.33 | 66.67 | |
| | Robotic Soldering Technician | | 50.00 | 50.00 | 50.00 | | 50.00 | |
| | Scale Technician | | | 100.00 | | | | |
| | Test Technician | | 50.00 | 50.00 | 50.00 | 50.00 | 75.00 | 25.00 |
| | Quality Control Technician | | 50.00 | 50.00 | 50.00 | 50.00 | 75.00 | 25.00 |
| Maintenance, Repair, and Assembly | Electrical and Instrumentation Technician | | 60.00 | 40.00 | 60.00 | 40.00 | 100.00 | |
| | Electronics Technician | | 75.00 | 25.00 | 50.00 | 50.00 | 100.00 | |
| | Instrument Technician | | 75.00 | 25.00 | 50.00 | 50.00 | 100.00 | |
| | Mechanical Technician | | 75.00 | 25.00 | 50.00 | 50.00 | 100.00 | |
| | Process Control Technician | | 60.00 | 40.00 | 60.00 | 40.00 | 100.00 | |
| | Repair Technician | | 75.00 | 25.00 | 50.00 | 50.00 | 100.00 | |
| | Rework / Custom Welder | 25.00 | 50.00 | 25.00 | 50.00 | 50.00 | 100.00 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Robotic Technician | | 80.00 | 20.00 | 60.00 | 40.00 | 100.00 | |
| | Robotics Calibration Technician | 100.00 | | | 75.00 | 25.00 | 100.00 | |
| | Field Service Technician | | 75.00 | 25.00 | 50.00 | 50.00 | 100.00 | |
| | Data Gathering Personnel and Data Annotators | 33.33 | 33.33 | 33.33 | 33.33 | 33.33 | 66.67 | |
| | Line Maintenance | 25.00 | 50.00 | 25.00 | 25.00 | 50.00 | 75.00 | |
| | Preventive Maintenance Technician | 25.00 | | 75.00 | 25.00 | 25.00 | 50.00 | |
| | Equipment Engineering Maintenance | 25.00 | 25.00 | 50.00 | 25.00 | 50.00 | 75.00 | |

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