



# Skills Framework for Precision Engineering

A Guide to Occupations and Skills

An initiative of

**SKILLS**future



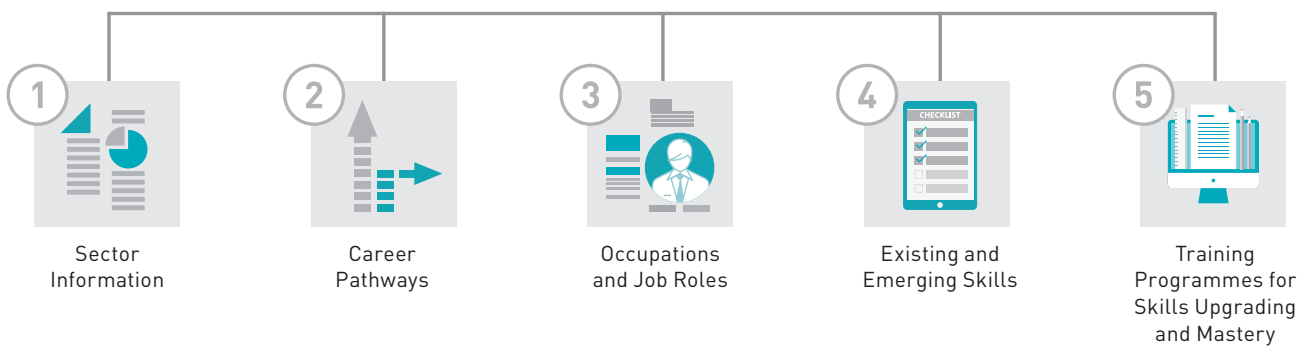
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# About the Skills Framework

The Skills Framework is a SkillsFuture initiative developed for the Singapore workforce to promote skills mastery and lifelong learning. Jointly developed by SkillsFuture Singapore (SSG), Workforce Singapore (WSG), the Singapore Economic Development Board (EDB) and Enterprise Singapore (ESG), together with employers, industry associations, education and training providers and unions, the Skills Framework for Precision Engineering provides useful information on:



**With the Skills Framework, individuals are equipped to make informed decisions about career choices, as well as take responsibility for skills upgrading and career planning.**



Assess Career Interests

- Understand career pathways
- Recognise personal attributes required



Prepare for Desired Jobs

- Understand skills and competencies required



Find Avenues to Close Skills Gaps

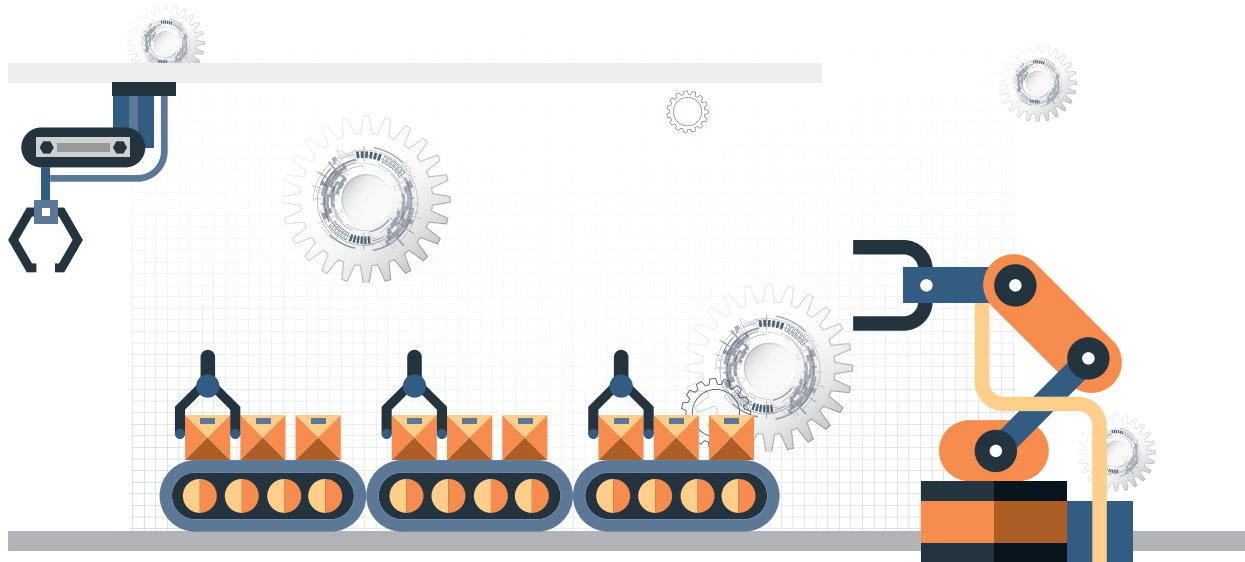
- Identify relevant training programmes to equip oneself with the required skills and competencies
- Participate in on-the-job training opportunities provided by companies



Renew, Upgrade and Deepen Skills

- Plan for career development/transition
- Recognise skills and competencies required for the intended job role
- Identify training programmes to upgrade and deepen skills

# Precision Engineering: Charting Growth and Opportunities



If you had ever inspected the components under the hood of a car, you would have seen some of the creations of the precision engineering (PE) sector.

PE enables custom pieces or moving parts to be designed, fabricated and assembled into end products or modules for other more complex components and equipment. It is a cornerstone of Singapore's manufacturing sector, which accounts for 20-25% of GDP annually, and produced S\$34 billion in output in 2015, a figure estimated to rise to S\$42 billion by 2020<sup>1</sup>.

PE plays an integral role in improving manufacturing processes and providing essential technical expertise across other manufacturing-related industries. Organisations servicing the oil and gas, aerospace and other manufacturing-related sectors, adopt sector-specific standards, such as AS 9100, IATF 16949 and the American Petroleum Institute (API) Q1, to meet customer requirements and move up the respective industry value chain.

Singapore's PE sector leverages strong engineering capabilities and cutting-edge manufacturing technology and systems. Through increasing automation, the sector has transformed over the years from a domestic supplier of built-to-print components, to become a leading exporter of high-value engineering and manufacturing solutions.

With the advent of technological disruption and the 'fourth industrial revolution' (Industry 4.0), traditional manufacturing machines are combined with digital technologies and data to create new and unprecedented business models. The digital manufacturing era calls for businesses to invest in new technologies and upskilling of workers to develop new capabilities in advanced robotics, additive manufacturing, advanced materials, sensors, lasers and optics, etc.

<sup>1</sup> Source: Singapore Economic Development Board, 2019

# Key Statistics

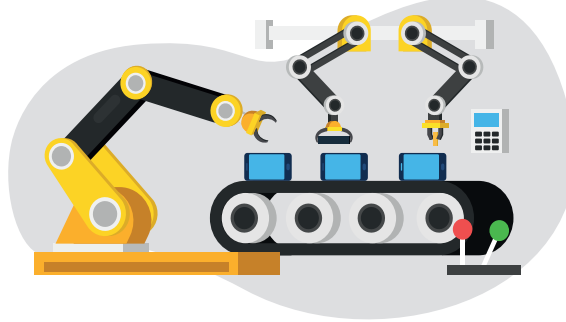
Over  
**2,700**  
establishments



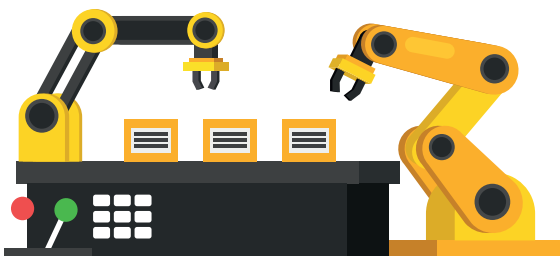
Employ about  
**95,000**  
workers



Contributed  
**\$44.28**  
**billion**  
to Singapore's total  
manufacturing output in 2017



Contributed  
**13.71%**  
to Singapore's  
manufacturing  
value-add



Contributed  
**2.63%**  
to GDP

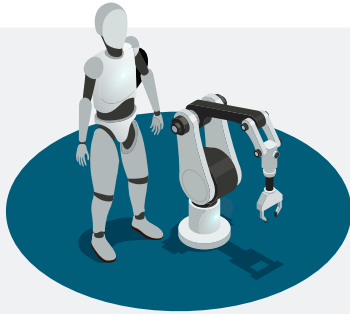


Source: Singapore Department of Statistics



# The Evolving Landscape

Industry 4.0 ushers in the 'smart factory', enabling companies to use automation and robots to perform routine work alongside workers who will focus on higher-level decision-making tasks, augmented by deeper and wider ranges of data and information through industrial internet of things.



## Robotics and Automation

As robots become smarter, more versatile and more affordable, manufacturers are moving towards integrated automation in daily operations. A new generation of collaborative robots working alongside humans will improve productivity and cost efficiency.



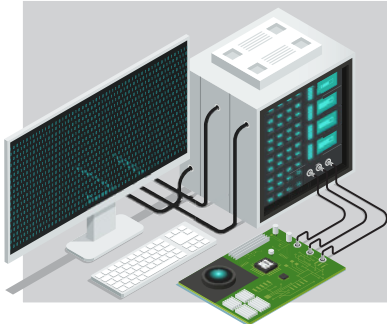
## Additive Manufacturing and Advanced Materials

Additive manufacturing and advanced materials will challenge the boundaries of conventional manufacturing. New product designs that were once considered impractical are now possible, with shorter time-to-market for new and exciting innovations.



## Digital Manufacturing

By enabling companies to analyse customer orders and optimise loads, digital technologies can help PE companies drive customisation and profitability. This will create new products, services and business models, with positive spill-over to the manufacturing ecosystem via the supply chain.



## Data Analytics

Advanced analytics help PE companies uncover new trends to improve yields, reduce defects, and optimise supply chain and market services.

# Desired Attributes and Skills in Demand

A career in the PE sector provides diverse opportunities to individuals seeking rewarding and enriching careers. If you enjoy working in a technologically advanced sector, formulating new products, and are keen to develop deep technical expertise, the PE sector offers opportunities to develop your passion and grow your career.

As the sector continues to transform, these are some examples of skills in demand which include existing skills augmented by emerging skills. Those seeking successful careers in the PE sector can set themselves apart by developing these attributes and acquiring these skills in demand.

## DESIRED ATTRIBUTES



### **Analytical**

Enjoys analysing things from all angles and thinking of ways to make things work better



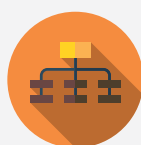
### **Meticulous**

Pays attention to fine details and accuracy



### **Creative**

Able to think of new and innovative ways to develop new systems and make existing ones work more effectively



### **Structured and Systematic**

Likes to work with numbers, records, or machines in an orderly manner and in compliance with procedures, regulatory and safety requirements



### **Inquisitive**

Always staying on top of developments in the industry and keeping abreast of new research and ideas



### **Team player**

Understands that each person is part of a larger team working together to bring about the success of any project

## SKILLS IN DEMAND



### **Robotics and Automation Skills**

- Automated Operation Monitoring
- Automated System Design
- Automation Process Control
- Automation System Maintenance



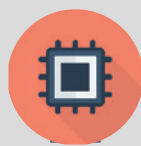
### **Digital Manufacturing Skills**

- Augmented Reality Application
- Internet of Things Management
- User Interface Design
- User Experience Design
- Virtual Reality Application



### **Advanced Manufacturing Skills**

- Additive Manufacturing
- Metal-based Additive Manufacturing
- Polymeric Additive Manufacturing
- Laser and Optics



### **Data Science Skills**

- Data Analytics System Design
- Data Synthesis



# Take Your Career Further - Initiatives and Schemes

A skilled workforce is essential in sustaining Singapore's global competitiveness as a leader in PE. There is a wide range of initiatives and schemes available to both individuals and employers to promote skills acquisition and upgrading.



## FOR INDIVIDUALS

### Education and Career Guidance

With the help of trained education and career guidance counsellors, students will be exposed to a wide range of education and career options, and given the opportunities to make informed post-secondary education choices. Singaporeans in the workforce can benefit from career coaching, employability skills workshops, networking sessions through the WSG Career Centres, and the Employment and Employability Institute.

### Enhanced Internships

Participating companies will work closely with the Institute of Technical Education (ITE) and polytechnics to deliver a positive and meaningful internship experience for their interns through more structured learning and support at the workplace.

### SkillsFuture Credit

Credit of \$500 for all Singaporeans aged 25 and above to defray costs for a wide range of skills-related courses to encourage skills development and lifelong learning.

### SkillsFuture Fellowships

Monetary award of \$10,000 to recognise Singaporeans with deep skills, who are champions of lifelong learning, and committed to contributing to the skills development of others.

### SkillsFuture Mid-Career Enhanced Subsidy

Singaporeans aged 40 and above will receive higher subsidies of up to 90% of course fees for over 8,000 SSG-supported courses and at least 90% of programme cost for Ministry of Education-subsidised full-time and part-time courses.

### SkillsFuture Work-Study Programmes

The SkillsFuture Work-Study Programmes offer various work-study opportunities for Singaporeans to gain a headstart in careers related to their discipline of study. These include Work-Study Diploma, Work-Study Post-Diploma, Work-Study Degree, Work-Study Post-Graduate and Work-Learn Bootcamp.

#### Initiatives and Schemes by:



SkillsFuture Singapore



Workforce Singapore

# Take Your Career Further - Initiatives and Schemes



## FOR INDIVIDUALS AND EMPLOYERS

### MySkillsFuture

MySkillsFuture is a one-stop online portal that enables Singaporeans to chart their own career and lifelong learning pathways, through access to industry information and tools to search for training programmes to broaden and deepen skills.

### P-Max

The Place-and-Train programme matches job-seeking Professionals, Managers, Executives and Technicians (PMETs) to suitable positions in small and medium-sized enterprises (SMEs), and assists SMEs to better recruit, train, manage and retain their newly-hired PMETs.

### Career Support Programme

The Career Support Programme helps experienced Singaporeans PMETs, who have been unemployed or made redundant for six months or more take on new jobs paying at least \$4,000 (\$3,600 in SMEs).

Companies can receive up to \$42,000 in salary support for up to 18 months when they hire eligible PMETs who are retrenched and/or unemployed for six months or more, in jobs that pay at least \$3,600.

### Capability Transfer Programme

This programme helps build deeper capabilities in the local workforce through the transfer of specialised knowledge and skills from foreign experts. Funding support may include salary and training subsidy for the foreign specialist, and local training, for the Singaporean trainee who is on overseas attachment. In the case of industry level projects, funding of equipment will be considered on a case-by-case basis.

### Career Trial

Jobseekers can gain experience and confidence through a short-term career trial to be assessed for employment paying \$1,500 or more and receive training allowance and retention incentives.

Employers can assess a jobseeker's job fit via a short-term career trial before offering formal employment for jobs paying \$1,500 or more. Companies can receive up to \$5,400 of salary support to hire eligible Singaporeans who have been unemployed for six months or more.

### MyCareersFuture.sg

MyCareersFuture.sg is a portal which aims to provide Singaporean jobseekers with a fast and smart search service to match them with relevant jobs, based on the jobseekers' skills and competencies.

The portal enables Singaporeans to be more aware of the skills they possess, and connect them to relevant jobs based on current skills and competencies. It also highlights jobs which are eligible for Government support through WSG's Adapt & Grow programmes.

### Professional Conversion Programme

Professional Conversion Programme is a career conversion programme targeted at PMETs, including mid-career switchers, to undergo skills conversion and move into new occupations or sectors that have good prospects and opportunities for progression.

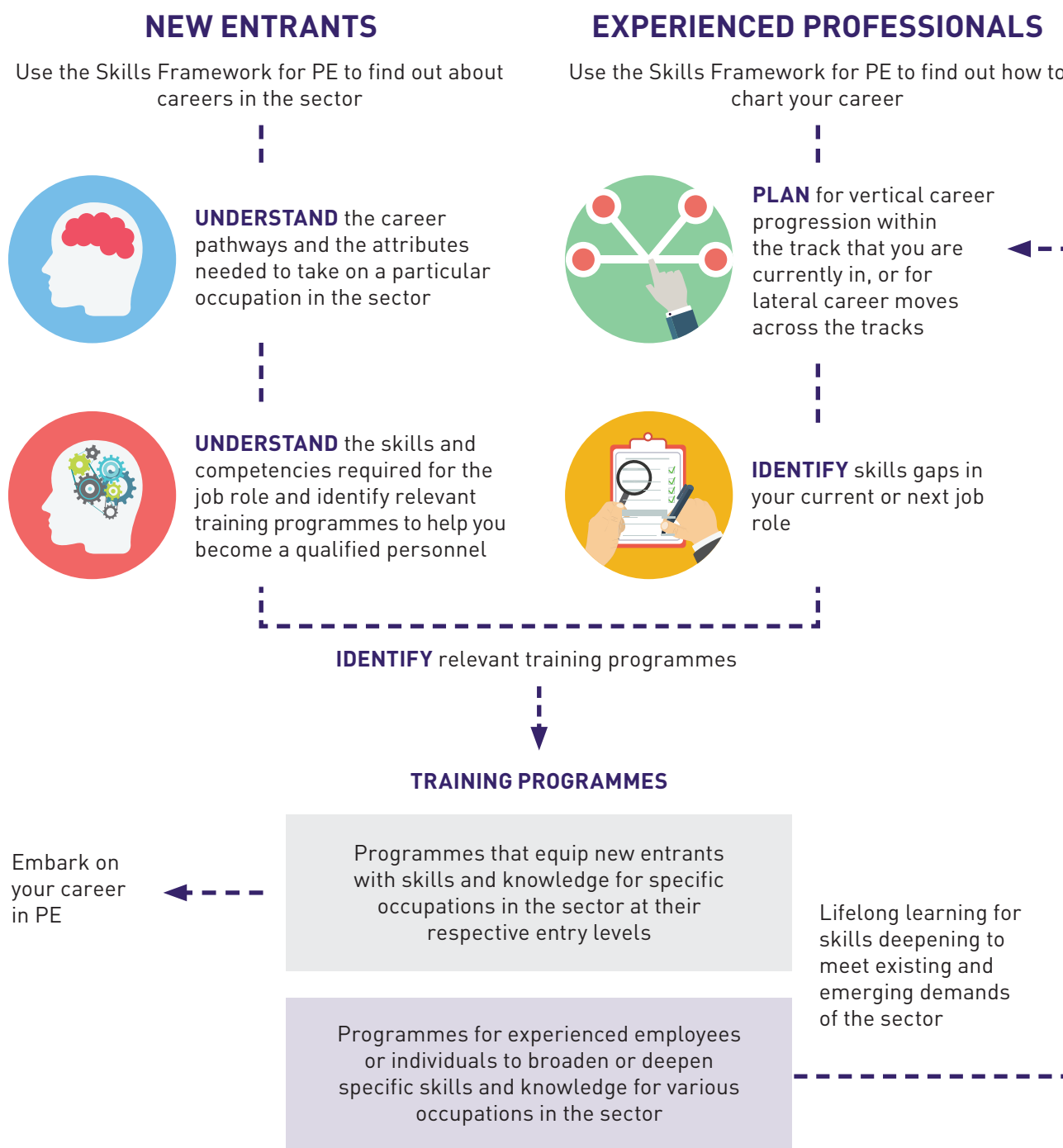
#### Initiatives and Schemes by:

 SkillsFuture Singapore

 Workforce Singapore

# Realise Your Potential - Take the Next Step Forward

Now that you have some idea of what a career in the PE sector can offer, and the available government initiatives and schemes to support your career goals, you are ready to take the next step!



# Precision Engineering Career Tracks

## Technical and Engineering



The Technical and Engineering function is primarily responsible for the design and maintenance of equipment and systems used in the manufacturing of products and components. It utilises scientific expertise to design new products and leverages on new technologies to continuously improve the efficiency of mass production processes.

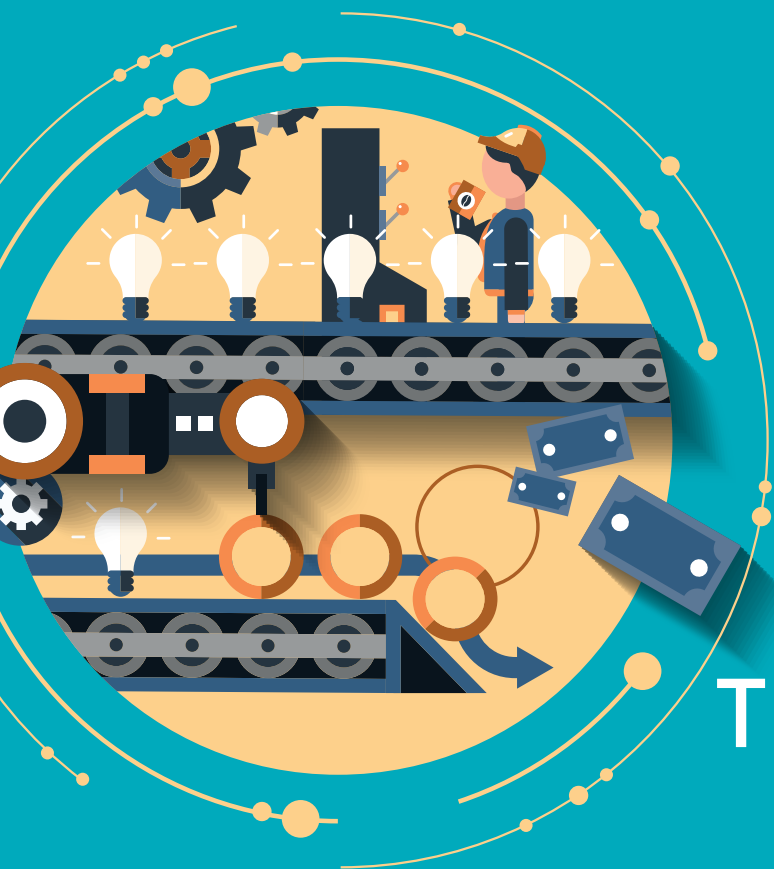
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## Management



The Management function oversees production operations, resource planning and manages production schedules. It combines intimate knowledge of manufacturing processes and business strategy to ensure continued business competitiveness and commercial success.

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# TECHNICAL AND ENGINEERING

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Process Specialist/Shift Leader/Team Leader	17
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Master Craftsman	21
Assistant Engineer/Associate Engineer	23
Engineer	25
Senior Engineer	27
Product Engineer/Product Designer	29
Chief Engineer	31



## Automation Engineer

Alvin Lee Wei Hang  
Makino Asia Pte Ltd

### SHAPING THE FACTORY OF THE FUTURE

Fuelled by his strong interest in Industry 4.0 and the firm belief that it would greatly benefit Singapore's manufacturing sector, Alvin joined Makino Asia as an Automation Engineer over two years ago. "Not every engineer can say that they are part of an industry revolution. I wanted to participate in the change," he shares. Armed with a degree in mechanical engineering, Alvin joined the team with almost no experience in automation. He trained in Singapore and Japan for over four months, learning advanced robotics programming, the usage of vision with robots, force sensor application and basic deburring robot application, all of which are part of his current responsibilities.

Alvin works in a nine-man team, coordinating different automation systems for in-house production use, including casting parts that are metres-tall and weigh in the tonnes — rare sights in Singapore.

He works on and manages projects for the use of industrial robot arms and Automated Guided Forklifts. As a senior team member, he guides junior members by providing technical help and advice. Due to his proficiency in Japanese, he also helps in translating documents and communicating with Japanese colleagues in Makino Asia (Singapore).

"I think one must have a lot of patience in this role," Alvin shares. "We qualify an entire automation system by testing parts individually, and it's only a success

when it makes it through an entire production line without stopping. Everything can be solved through troubleshooting and experience, but patience is the key."

Today, Alvin is also a tour ambassador to Makino's new smart factory, having guided over 500 visitors through its concepts and benefits. He hopes to advance into a managerial position in the future— "The Skills Framework for Precision Engineering will be useful in guiding me on the various management tiers, and how to prepare for them," Alvin says. In the meantime, he is keen to take up courses such as "Learning Programmable Logic Controller (PLC) from Scratch" and "Robot Operating System Fundamentals", areas in which demand is high for skilled workers.

**The Skills Framework for Precision Engineering will be useful in guiding me on the various management tiers, and how to prepare for them.**



# Machinist/Technician

## JOB ROLE DESCRIPTION

The Machinist/Technician works under close supervision to carry out structured work while adhering closely to standard work instructions and procedures. He/She sets up and operates special purpose equipment to fabricate components and parts. In the process, he is required to read and interpret sketches, drawings, manuals and specifications to determine the dimensions and tolerances of finished work pieces, sequences of operations and set-up requirements. He also observes the machines, detects malfunctions and makes adjustments to ensure smooth operations.

The Machinist/Technician may be required to work on rotating shifts in a factory setting, and is responsible for providing basic engineering technical support to ensure smooth production flow and process flow, in accordance with organisational requirements.

He is able to work in a team to achieve production and quality targets, and interacts effectively with others to ensure that all issues are resolved appropriately and efficiently.

CRITICAL WORK FUNCTIONS, KEY TASKS AND PERFORMANCE EXPECTATIONS	CRITICAL WORK FUNCTIONS	KEY TASKS	PERFORMANCE EXPECTATIONS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Interpret technical drawings and blue prints</li> <li>• Perform dimensional and geometric measurements</li> <li>• Operate manufacturing equipment, tools and machinery</li> <li>• Perform general machining and assembly tasks</li> <li>• Perform computer numerical control (CNC) programming for manufacturing tasks</li> </ul>	In accordance with: <ul style="list-style-type: none"> <li>• Workplace Safety and Health (WSH) Act</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Apply workshop practices, cleanliness and housekeeping protocols in accordance with standard operating procedures (SOPs)</li> <li>• Apply organisational quality systems in manufacturing production tasks</li> <li>• Apply standards and SOPs related to manufacturing safety policies and procedures</li> </ul>	
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Apply productivity methods and practices to improve efficiency in manufacturing production tasks</li> <li>• Install electrical sensors, electrical devices and components to operate control circuitry</li> </ul>	
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Take initiative to seek opportunities for improvements and implement corrective actions</li> <li>• Keep records of defective final products</li> </ul>	

# Machinist/Technician

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 2	Geometric Dimensioning and Tolerancing	Level 2
Augmented Reality Application	Level 1	Hydraulic Systems Management	Level 1
Automated Operation Monitoring	Level 1	Internet of Things Management	Level 2
Automated System Design	Level 1	Machining	Level 1
Automation System Maintenance	Level 1	Manufacturing Process Management	Level 2
Cleanliness and Contamination Control	Level 1	Non-destructive Testing	Level 2
Computer-aided Design	Level 1	Material Joining	Level 1
Computer-aided Manufacturing	Level 1	Pneumatic Systems Management	Level 1
Continuous Process Improvement	Level 1	Precision Measurement	Level 1
Cutting	Level 1	Product and Machine Assembly	Level 1
Data Synthesis	Level 3	Quality System Management	Level 2
Embedded System Integration	Level 2	Surface Preparation and Protection	Level 1
Emergency Response Management	Level 2	Virtual Reality Application	Level 2
Equipment Maintenance	Level 1	Workplace Safety and Health Practice	Level 2
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Communication	Basic	Problem Solving	Basic
Digital Literacy	Basic	Teamwork	Basic
Lifelong Learning	Basic		

# Senior Machinist/Senior Technician

## JOB ROLE DESCRIPTION

The Senior Machinist/Senior Technician operates a variety of equipment and/or machines to fabricate components and parts. He/She adapts procedures to troubleshoot and diagnose routine problems, and handles the maintenance of machines. He actively contributes to innovation by suggesting areas of improvement to enhance productivity and efficiency of work processes.

He may be required to work on rotating shifts in a factory setting, and under strict compliance to workplace safety and health requirements, organisational quality control and other parameters.

He is able to work in a team to achieve production and quality targets, and interacts effectively with others to ensure that all issues are resolved appropriately and efficiently.

CRITICAL WORK FUNCTIONS, KEY TASKS AND PERFORMANCE EXPECTATIONS	CRITICAL WORK FUNCTIONS	KEY TASKS	PERFORMANCE EXPECTATIONS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Apply computer-aided design (CAD) to produce assembly, detail and layout drawings</li> <li>• Perform geometric tolerance and inspection</li> <li>• Perform non-conventional or specialised tasks for product and/or component manufacturing</li> <li>• Set up computer-aided manufacturing (CAM) processes</li> <li>• Perform non-destructive testing</li> <li>• Perform surface preparation and coating on manufacturing components and products</li> </ul>	In accordance with: <ul style="list-style-type: none"> <li>• Workplace Safety and Health (WSH) Act</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Apply workshop practices, cleanliness and housekeeping protocols in accordance with standard operating procedures (SOPs)</li> <li>• Apply organisational quality systems in manufacturing production tasks</li> <li>• Apply standards and SOPs related to manufacturing safety policies and procedures</li> </ul>	
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Contribute to the design of manufacturing processes</li> <li>• Contribute to manufacturing process optimisation through technology</li> <li>• Maintain and repair manufacturing tools and equipment</li> <li>• Apply lean techniques to enhance manufacturing operations</li> </ul>	
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Take initiative to seek opportunities for improvements and implement corrective actions</li> <li>• Keep records of defective final products</li> </ul>	

# Senior Machinist/Senior Technician

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 2	Laser and Optics Application	Level 2
Augmented Reality Application	Level 1	Lean Manufacturing	Level 3
Automated Operation Monitoring	Level 2	Machining	Level 2
Automated System Design	Level 2	Manufacturing Process Management	Level 2
Automation System Maintenance	Level 2	Material Joining	Level 1
Cleanliness and Contamination Control	Level 2	Non-destructive Testing	Level 3
Computer-aided Design	Level 1	Plastic Injection Moulding	Level 2
Computer-aided Manufacturing	Level 2	Pneumatic Systems Management	Level 2
Continuous Process Improvement	Level 2	Precision Measurement	Level 2
Cutting	Level 1	Product and Machine Assembly	Level 2
Data Synthesis	Level 3	Production Line Set-Up	Level 2
Embedded System Integration	Level 2	Quality System Management	Level 2
Emergency Response Management	Level 2	Surface Preparation and Protection	Level 1
Equipment Maintenance	Level 2	Virtual Reality Application	Level 2
Geometric Dimensioning and Tolerancing	Level 3	Welding	Level 1
Hydraulic Systems Management	Level 2	Workplace Safety and Health Practice	Level 3
Internet of Things Management	Level 2		
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Communication	Basic	Problem Solving	Basic
Digital Literacy	Basic	Teamwork	Basic
Lifelong Learning	Basic		

# Process Specialist/Shift Leader/Team Leader

## JOB ROLE DESCRIPTION

The Process Specialist/Shift Leader/Team Leader coordinates the day-to-day operations of a production team to meet production and quality standards, while ensuring compliance with workplace safety and health (WSH) procedures. He/She also works with the team to assess the feasibility of improvements to enhance productivity and efficiency at the workplace. He also diagnoses faults, maintains machines and oversees the housekeeping of machine tools and devices.

He may be required to work on rotating shifts in a factory setting. He possesses good communication and leadership skills to guide his team and ensure compliance to WSH requirements, organisational quality control and other parameters.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"><li>• Apply three-dimensional (3D) computer modelling and programming to create models and drawings for manufacturing</li><li>• Determine appropriate processes, tools and equipment for manufacturing products</li><li>• Monitor and adjust process parameters to maintain or enhance production systems</li></ul>
	Conform to management system requirements	<ul style="list-style-type: none"><li>• Oversee shop floor operations for conformance to product and process specifications</li><li>• Implement organisational quality systems in manufacturing production processes</li><li>• Supervise manufacturing activities for workplace safety and health (WSH)</li></ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"><li>• Investigate issues in manufacturing processes and product designs to formulate corrective measures</li><li>• Coordinate maintenance of equipment and machinery</li><li>• Apply lean techniques to enhance manufacturing operations</li></ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"><li>• Assist in implementation of improvement projects</li><li>• Identify opportunities for continuous improvement projects</li><li>• Perform evaluations and/or experiments</li><li>• Collect data for analysis</li></ul>

# Process Specialist/Shift Leader/Team Leader

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 2	Laser and Optics Application	Level 2
Augmented Reality Application	Level 2	Lean Manufacturing	Level 3
Automated Operation Monitoring	Level 2	Machining	Level 2
Automated System Design	Level 2	Maintenance Coordination	Level 2
Automation Process Control	Level 3	Manufacturing Process Management	Level 3
Automation System Maintenance	Level 2	Manufacturing Technology	Level 2
Change Management	Level 3	Material Joining	Level 2
Cleanliness and Contamination Control	Level 2	Non-destructive Testing	Level 4
Computer-aided Design	Level 2	Plastic Injection Moulding	Level 2
Computer-aided Manufacturing	Level 2	Pneumatic Systems Management	Level 3
Continuous Process Improvement	Level 3	Precision Measurement	Level 3
Cutting	Level 2	Product and Machine Assembly	Level 2
Data Synthesis	Level 3	Production Line Set-Up	Level 2
Embedded System Integration	Level 2	Production Shut-down and Re-start	Level 3
Emergency Response Management	Level 3	Quality Process Control	Level 3
Equipment Maintenance	Level 3	Quality System Management	Level 3
Failure Analysis	Level 3	Surface Preparation and Protection	Level 2
Geometric Dimensioning and Tolerancing	Level 3	Virtual Reality Application	Level 3
Hydraulic Systems Management	Level 3	Welding	Level 2
Innovation Management	Level 3	Workplace Safety and Health Practice	Level 3
Internet of Things Management	Level 3		

GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Communication	Intermediate	Managing Diversity	Intermediate
Leadership	Basic	Teamwork	Intermediate
Interpersonal Skills	Intermediate		



# Automation Coordinator/Robot Coordinator

## JOB ROLE DESCRIPTION

The Automation Coordinator/Robot Coordinator oversees automated equipment and robots used in manufacturing processes. He/She is the primary responder, responsible for troubleshooting automated production systems and performing preventive and predictive maintenance on equipment. He also contributes to process optimisation by managing data from automated manufacturing systems to facilitate real-time insight gathering and decision-making.

He may be required to work on rotating shifts in a factory setting, and under strict compliance to workplace safety and health requirements, organisational quality control and other parameters.

He is able to work independently, and as part of a team, to achieve production and quality targets, and interacts effectively with others to ensure that all issues are resolved appropriately and efficiently.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Apply computer-aided design (CAD) to produce assembly, detail and layout drawings</li> <li>• Determine appropriate processes, tools and equipment for manufacturing products</li> <li>• Monitor and adjust process parameters to maintain or enhance production systems</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Oversee shop floor operations for conformance to product and process specifications</li> <li>• Implement organisational quality systems in manufacturing production processes</li> <li>• Apply standards and standard operating procedures (SOPs) related to manufacturing safety policies and procedures</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Contribute to the design of manufacturing processes</li> <li>• Contribute to manufacturing process optimisation through technology</li> <li>• Investigate issues in manufacturing processes and product designs to formulate corrective measures</li> <li>• Coordinate maintenance of equipment and machinery</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Assist in implementation of improvement projects</li> <li>• Identify opportunities for continuous improvement projects</li> <li>• Perform evaluations and/or experiments</li> <li>• Collect data for analysis</li> </ul>

# Automation Coordinator/Robot Coordinator

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 2	Lean Manufacturing	Level 3
Augmented Reality Application	Level 2	Machining	Level 2
Automated Operation Monitoring	Level 3	Maintenance Coordination	Level 2
Automated System Design	Level 2	Manufacturing Process Management	Level 3
Automation Process Control	Level 4	Manufacturing Technology	Level 2
Automation System Maintenance	Level 3	Material Joining	Level 2
Cleanliness and Contamination Control	Level 2	Non-destructive Testing	Level 4
Computer-aided Design	Level 2	Plastic Injection Moulding	Level 2
Computer-aided Manufacturing	Level 2	Pneumatic Systems Management	Level 2
Continuous Process Improvement	Level 2	Precision Measurement	Level 3
Cutting	Level 3	Product and Machine Assembly	Level 2
Data Synthesis	Level 3	Production Line Set-Up	Level 2
Embedded System Integration	Level 3	Production Shut-down and Re-start	Level 3
Emergency Response Management	Level 3	Quality Process Control	Level 3
Equipment Maintenance	Level 3	Quality System Management	Level 3
Failure Analysis	Level 3	Surface Preparation and Protection	Level 2
Innovation Management	Level 3	Virtual Reality Application	Level 3
Internet of Things Management	Level 3	Workplace Safety and Health Practice	Level 3
Laser and Optics Application	Level 2		
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Communication	Intermediate	Lifelong Learning	Intermediate
Digital Literacy	Intermediate	Interpersonal Skills	Intermediate
Teamwork	Intermediate		

# Master Craftsman

## JOB ROLE DESCRIPTION

The Master Craftsman is an experienced subject matter expert in manufacturing techniques, and leverages on his/her expertise to resolve technical issues and serve as an expert resource to others. He optimises production activities, processes and systems to increase manufacturing productivity. He supervises a team to meet production targets and product quality standards while ensuring compliance to workplace safety and health, and other regulatory requirements.

He may be required to work on rotating shifts in a factory setting, and may engage the organisation's management and customers on technical aspects of projects. He should possess communication and negotiation skills for this purpose. He also trains and coaches other colleagues and subordinates in the technical aspects of work.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Apply computer-aided design (CAD) techniques to design parts and assemblies</li> <li>• Conduct tests to assess materials' suitability for manufacturing components</li> <li>• Verify conformance of product dimensions against specifications</li> <li>• Formulate machining strategies to fulfil product specification requirements</li> <li>• Manage manufacturing activities</li> <li>• Produce and post-process the tool path data into machine-specific codes for multi-axis computer numerical control (CNC) machining</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Monitor process performance data to establish control parameters</li> <li>• Monitor internal quality systems</li> <li>• Coordinate with external suppliers and customers on quality matters</li> <li>• Enforce compliance of safety and good manufacturing practices and processes in production areas</li> <li>• Conduct technical presentations</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Design mechanical fixtures and moulds to facilitate manufacturing processes</li> <li>• Optimise manufacturing processes by leveraging on technology and specialised expertise</li> <li>• Manage new technology and innovations within manufacturing processes</li> <li>• Design components for equipment building and automation of machinery</li> <li>• Apply mechanical components and support maintenance equipment within automated assembly systems</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Evaluate and recommend process changes for improvements to help improve yield, quality and cycle times</li> <li>• Lead continuous improvement projects</li> <li>• Lead working level community to explore opportunities for improvement projects</li> </ul>
	Influence organisational development and strategies	<ul style="list-style-type: none"> <li>• Negotiate with customers to reconcile product requirements with manufacturing parameters and business needs</li> <li>• Contribute to business analytics to facilitate data gathering and decision-making</li> </ul>

# Master Craftsman

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 3	Internet of Things Management	Level 4
Automated System Design	Level 4	Jigs and Fixture Design	Level 3
Automation Process Control	Level 4	Learning and Development	Level 4
Automation System Maintenance	Level 4	Machining	Level 4
Change Management	Level 4	Manufacturing Process Management	Level 4
Computer-aided Design	Level 4	Manufacturing Technology	Level 4
Computer-aided Manufacturing	Level 4	Metallic Material Characterisation	Level 4
Continuous Process Improvement	Level 4	Networking	Level 5
Cutting	Level 3	Plastic Injection Moulding	Level 4
Data Analytics System Design	Level 4	Polymeric Material Characterisation	Level 3
Data Synthesis	Level 4	Precision Measurement	Level 3
Emergency Response Management	Level 2	Project Management	Level 3
Engineering Product Design	Level 5	Quality System Management	Level 5
Equipment Maintenance	Level 4	User Experience Design	Level 3
Geometric Dimensioning and Tolerancing	Level 3	User Interface Design	Level 3
Injection Mould Design	Level 4	Vision Leadership	Level 4
Innovation Management	Level 4	Workplace Safety and Health Practice	Level 4
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Managing Diversity	Advanced	Teamwork	Intermediate
Leadership	Intermediate	Interpersonal Skills	Intermediate
Problem Solving	Advanced		

# Assistant Engineer/Associate Engineer

## JOB ROLE DESCRIPTION

The Assistant Engineer/Associate Engineer adapts and applies engineering techniques to support the design, development and manufacture of machinery and components and/or machine repair and maintenance. He/She works closely with colleagues to generate mechanical and system designs, equipment prototyping and conduct tests and inspections, while complying with workplace safety and health and other regulatory requirements.

His duties require him to work on the shop floor, and may be required to work on rotating shifts. He possesses good communication skills, teamwork and an analytical mind to perform his role and achieve the desired organisational outcomes.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Design manufacturing and assembly processes to meet product requirements</li> <li>• Conduct tests to select suitable materials for required engineering applications</li> <li>• Verify conformance of component or product dimensions and finishing against requirement specifications</li> <li>• Assemble mechanical machines</li> <li>• Implement engineering activities and processes</li> <li>• Execute part programmes on computer numerical control (CNC) machines to produce components</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Enforce compliance of safety and good manufacturing practices and processes in production areas</li> <li>• Conduct technical presentations</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Assist in designing and enhancing manufacturing processes and tools</li> <li>• Apply new technology and innovations in manufacturing processes</li> <li>• Design components for equipment building and automation of machinery</li> <li>• Apply sensors and robotic systems within automated manufacturing systems</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Assist in implementation of improvement projects</li> <li>• Identify opportunities for continuous improvement projects</li> <li>• Perform evaluations and/or experiments</li> <li>• Collect data for analysis</li> </ul>
	Influence organisational development and strategies	<ul style="list-style-type: none"> <li>• Support negotiations with customers to reconcile product requirements with manufacturing parameters and business needs</li> <li>• Support decision-making to resolve business problems</li> </ul>

# Assistant Engineer/Associate Engineer

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 3	Laser and Optics Application	Level 3
Augmented Reality Application	Level 3	Lean Manufacturing	Level 4
Automated Operation Monitoring	Level 3	Machining	Level 3
Automated System Design	Level 3	Manufacturing Process Management	Level 3
Automation Process Control	Level 4	Manufacturing Technology	Level 3
Automation System Maintenance	Level 3	Metallic Material Characterisation	Level 3
Change Management	Level 3	Material Joining	Level 3
Cleanliness and Contamination Control	Level 3	Metrology Management	Level 3
Computer-aided Design	Level 3	Organisational Analysis	Level 4
Computer-aided Manufacturing	Level 3	Plastic Injection Moulding	Level 3
Continuous Process Improvement	Level 3	Pneumatic Systems Management	Level 3
Cutting	Level 3	Polymeric Material Characterisation	Level 3
Data Analytics System Design	Level 3	Precision Measurement	Level 3
Data Synthesis	Level 3	Product and Machine Assembly	Level 3
Embedded System Integration	Level 3	Production Line Set-Up	Level 3
Emergency Response Management	Level 3	Project Management	Level 3
Engineering Product Design	Level 3	Quality Process Control	Level 3
Equipment Maintenance	Level 4	Quality System Management	Level 4
Failure Analysis	Level 4	Surface Preparation and Protection	Level 2
Geometric Dimensioning and Tolerancing	Level 3	User Experience Design	Level 2
Heat Treatment Processing	Level 3	User Interface Design	Level 3
Hydraulic Systems Management	Level 3	Virtual Reality Application	Level 4
Injection Mould Design	Level 3	Welding	Level 3
Internet of Things Management	Level 3	Workplace Safety and Health Practice	Level 3
Jigs and Fixture Design	Level 3	Workplace Safety and Health System Management	Level 4

GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Problem Solving	Basic	Digital Literacy	Intermediate
Teamwork	Intermediate	Virtual Collaboration	Intermediate
Communication	Intermediate		



# Engineer

## JOB ROLE DESCRIPTION

The Engineer adapts and applies engineering principles and techniques to design and develop machinery and components, generate prototypes and implement system modifications. He/She leverages on technical and engineering skills to resolve technical and engineering issues and manage simple engineering projects. He also implements plans for improvements in production efficiency and effectiveness, while ensuring compliance with workplace safety and health procedures and other regulatory requirements.

His duties require him to work on the shop floor, and may be required to work on rotating shifts. He is required to have strong communication skills to lead a team, and is expected to guide and mentor subordinates under his charge.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Provide design solutions to satisfy product requirements</li> <li>• Evaluate material suitability for manufacturing and processes for improving characteristics</li> <li>• Analyse cumulative effects of tolerances to determine appropriate engineering interventions</li> <li>• Develop process plans for manufacturing operations</li> <li>• Produce and post-process the tool path data into machine specific codes for multi-axis computer numerical control (CNC) machining</li> <li>• Develop cleaning and finishing processes for manufactured products</li> <li>• Evaluate product finishing for fulfilment of preservation requirements</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Develop control plans for shop floor tracking</li> <li>• Track quality performance of products and/or services</li> <li>• Conduct quantitative evaluation of quality performance measures</li> <li>• Establish safety and good manufacturing practices and processes in production areas</li> <li>• Conduct technical presentations</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Design manufacturing processes and tools to fulfil product specification requirements</li> <li>• Review performance of manufacturing processes and technologies for enhancement and optimisation</li> <li>• Develop lean manufacturing plans for the organisation</li> <li>• Evaluate new technology for feasibility of adoption in manufacturing processes</li> <li>• Design modules and controls for automation of manufacturing operations</li> <li>• Set up sensors and interface systems to automate manufacturing processes</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Evaluate and recommend process changes for improvements to help improve yield, quality and cycle times</li> <li>• Lead continuous improvement projects</li> <li>• Lead working level community to explore opportunities for improvement projects</li> </ul>
	Influence organisational development and strategies	<ul style="list-style-type: none"> <li>• Negotiate with customers to reconcile product requirements with manufacturing parameters and business needs</li> <li>• Contribute to business analytics to facilitate data gathering and decision-making</li> <li>• Provide technical guidance to peers and subordinates</li> <li>• Develop training programmes for staff</li> </ul>

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 4	Manufacturing Process Design	Level 4
Augmented Reality Application	Level 3	Manufacturing Process Management	Level 5
Automated Operation Monitoring	Level 4	Manufacturing Technology	Level 4
Automated System Design	Level 5	Material Joining	Level 3
Automation Process Control	Level 5	Metal Forming	Level 4
Automation System Maintenance	Level 4	Metal-based Additive Manufacturing	Level 4
Change Management	Level 4	Metallic Material Characterisation	Level 4
Cleanliness and Contamination Control	Level 4	Metrology Management	Level 4
Computer-aided Design	Level 4	Networking	Level 5
Computer-aided Manufacturing	Level 4	New Product Introduction	Level 3
Continuous Process Improvement	Level 4	Organisational Analysis	Level 5
Cutting	Level 4	Plastic Injection Moulding	Level 5
Data Analytics System Design	Level 4	Pneumatic Systems Management	Level 3
Data Synthesis	Level 4	Polymeric Additive Manufacturing	Level 4
Embedded System Integration	Level 4	Polymeric Material Characterisation	Level 4
Emergency Response Management	Level 4	Precision Measurement	Level 4
Engineering Product Design	Level 4	Production Line Set-Up	Level 4
Equipment Maintenance	Level 5	Project Management	Level 4
Failure Analysis	Level 4	Quality Process Control	Level 4
Geometric Dimensioning and Tolerancing	Level 4	Quality System Management	Level 4
Heat Treatment Processing	Level 4	Surface Preparation and Protection	Level 3
Hydraulic Systems Management	Level 3	User Experience Design	Level 3
Internet of Things Management	Level 4	User Interface Design	Level 3
Jigs and Fixture Design	Level 4	Value Analysis	Level 4
Laser and Optics Application	Level 4	Virtual Reality Application	Level 4
Lean Manufacturing	Level 4	Vision Leadership	Level 4
Learning and Development	Level 4	Welding	Level 4
Machining	Level 4	Workplace Safety and Health System Management	Level 5
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Teamwork	Intermediate	Transdisciplinary Thinking	Intermediate
Communication	Intermediate	Interpersonal Skills	Intermediate
Problem Solving	Intermediate		

# Senior Engineer

## JOB ROLE DESCRIPTION

The Senior Engineer provides design solutions for products and establishes product specifications to satisfy requirements and meet organisational goals. He/She is responsible for formulating mass production processes to ensure operations meet both internal and external parties' quality requirements, evaluating processes to optimise production capabilities and reviewing the technical environment to meet business needs.

He leads in managing cross-functional teams in continuous improvement projects and assists in implementing process improvement projects.

He possesses an analytical mind and leadership skills to steer the team to achieve the desired organisational outcomes.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Create designs for engineering products and processes</li> <li>• Evaluate material suitability for manufacturing and processes for improving characteristics</li> <li>• Analyse measurement requirements to determine need for metrology systems</li> <li>• Formulate suitable manufacturing processes to meet product requirements</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Introduce quality improvements into engineering products and/or processes</li> <li>• Propose improvements to workplace safety and health within operations</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Design precision machinery to satisfy manufacturing requirements</li> <li>• Formulate manufacturing process improvements for quality enhancement and waste reduction</li> <li>• Develop integration plans to incorporate new technologies into manufacturing processes</li> <li>• Refine control performance of automated precision machines</li> <li>• Implement computer-integrated manufacturing processes</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Formulate strategies for manufacturing process performance improvements</li> <li>• Lead cross-functional teams in continuous improvement projects</li> <li>• Collaborate with stakeholders in improvement activities to meet organisational goals</li> </ul>
	Influence organisational development and strategies	<ul style="list-style-type: none"> <li>• Analyse data to identify business insights</li> <li>• Establish strategies for the business function</li> </ul>

# Senior Engineer

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 5	Metal-based Additive Manufacturing	Level 5
Automated System Design	Level 5	Metallic Material Characterisation	Level 5
Automation Process Control	Level 6	Metrology Management	Level 5
Automation System Maintenance	Level 5	Networking	Level 5
Change Management	Level 4	New Product Introduction	Level 5
Cleanliness and Contamination Control	Level 5	Organisational Analysis	Level 5
Continuous Process Improvement	Level 5	Polymeric Additive Manufacturing	Level 5
Cyber Risk Management	Level 4	Polymeric Material Characterisation	Level 5
Data Analytics System Design	Level 5	Precision Measurement	Level 5
Data Synthesis	Level 5	Production Line Set-Up	Level 5
Embedded System Integration	Level 5	Project Management	Level 5
Emergency Response Management	Level 2	Quality Process Control	Level 4
Engineering Product Design	Level 5	Quality System Management	Level 5
Equipment Maintenance	Level 5	Research and Development	Level 4
Failure Analysis	Level 5	Surface Preparation and Protection	Level 4
Heat Treatment Processing	Level 5	User Experience Design	Level 3
Internet of Things Management	Level 5	User Interface Design	Level 3
Laser and Optics Application	Level 5	Value Analysis	Level 5
Lean Manufacturing	Level 5	Virtual Reality Application	Level 4
Machining	Level 5	Vision Leadership	Level 5
Manufacturing Process Management	Level 5	Welding	Level 5
Manufacturing Technology	Level 4	Workplace Safety and Health System Management	Level 5
Metal Forming	Level 5		

GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Teamwork	Intermediate	Interpersonal Skills	Advanced
Communication	Advanced	Leadership	Advanced
Problem Solving	Advanced		

# Product Engineer/Product Designer

## JOB ROLE DESCRIPTION

The Product Engineer/Product Designer drives the development of new products to maintain commercially viable product lines and meet business objectives of the organisation. He/She is responsible for delivering projects from concept through to manufacture, with a thorough understanding of the product development process and new technologies. He also engages with internal and external parties in the design and development, costing and recommendations of new machinery and/or components.

He manages new product development by liaising with relevant departments, and is able to lead his team effectively. He also possesses excellent interpersonal, communication, and technical writing and presentation skills.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Create designs for engineering products and processes</li> <li>• Verify new product designs using physical models</li> <li>• Evaluate material suitability for manufacturing and processes for improving characteristics</li> <li>• Verify conformance of product dimensions against specifications</li> <li>• Formulate suitable manufacturing processes to meet product requirements</li> <li>• Produce and post-process the tool path data into machine-specific codes for multi-axis computer numerical control (CNC) machining</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Develop control plans for shop floor tracking</li> <li>• Introduce quality improvements into engineering products and/or processes</li> <li>• Propose improvements to workplace safety and health within operations</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Design manufacturing processes and tools to fulfil product specification requirements</li> <li>• Develop new product manufacturing process design strategies</li> <li>• Assess effectiveness of manufacturing processes for new products</li> <li>• Evaluate new technology for feasibility of adoption in manufacturing processes</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Evaluate and recommend process changes for improvements to help improve yield, quality and cycle times</li> <li>• Lead continuous improvement projects</li> <li>• Lead working level community to explore opportunities for improvement projects</li> </ul>
	Influence organisational development and strategies	<ul style="list-style-type: none"> <li>• Negotiate with customers to reconcile product requirements with manufacturing parameters and business needs</li> <li>• Analyse data to identify business insights</li> <li>• Provide technical guidance to peers and subordinates</li> </ul>

# Product Engineer/Product Designer

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 5	Metal Forming	Level 6
Automated System Design	Level 5	Metal-based Additive Manufacturing	Level 5
Business Innovation	Level 4	Metallic Material Characterisation	Level 5
Change Management	Level 4	Metrology Management	Level 5
Cleanliness and Contamination Control	Level 4	Networking	Level 5
Computer-aided Design	Level 4	New Product Introduction	Level 5
Computer-aided Manufacturing	Level 4	Polymeric Additive Manufacturing	Level 5
Continuous Process Improvement	Level 4	Polymeric Material Characterisation	Level 5
Cyber Risk Management	Level 4	Precision Measurement	Level 4
Data Analytics System Design	Level 5	Production Line Set-Up	Level 5
Data Synthesis	Level 5	Project Management	Level 5
Embedded System Integration	Level 5	Quality Process Control	Level 4
Emergency Response Management	Level 2	Quality System Management	Level 4
Engineering Product Design	Level 5	Research and Development	Level 4
Failure Analysis	Level 5	Surface Preparation and Protection	Level 4
Heat Treatment Processing	Level 5	User Experience Design	Level 4
Internet of Things Management	Level 5	User Interface Design	Level 4
Laser and Optics Application	Level 5	Value Analysis	Level 5
Machining	Level 5	Virtual Reality Application	Level 4
Manufacturing Process Design	Level 4	Vision Leadership	Level 5
Manufacturing Process Management	Level 5	Welding	Level 4
Manufacturing Technology	Level 5	Workplace Safety and Health System Management	Level 5
Material Joining	Level 3		

GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Teamwork	Intermediate	Interpersonal Skills	Advanced
Communication	Advanced	Creative Thinking	Advanced
Problem Solving	Advanced		



# Chief Engineer

## JOB ROLE DESCRIPTION

The Chief Engineer is responsible for developing, enhancing, and influencing the organisation's technical roadmap. He/She establishes the organisation's technical vision and leads in all aspects of technology development, while providing directions in technology-related issues. He establishes the organisation's engineering quality management systems and evaluates quality engineering processes to satisfy business and legislative requirements.

He possesses a high level of technical and engineering competence, as well as social and leadership skills to champion organisational development interventions, and is able to address ethical and professional issues facing the organisation, in accordance with current professional and ethical codes of practice.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manufacture components and end products	<ul style="list-style-type: none"> <li>• Verify new product designs using physical models</li> <li>• Incorporate quality management from product conception to disposal</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Develop strategies and plans to implement integrated quality management systems</li> <li>• Propose improvements to workplace safety and health within operations</li> </ul>
	Manage manufacturing process workflow	<ul style="list-style-type: none"> <li>• Carry out design of experiments</li> <li>• Manage overall manufacturing performance</li> <li>• Develop application strategies for new technologies within manufacturing processes</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Evaluate the organisation's approach towards a lean enterprise</li> <li>• Review innovation practices to enhance business competitiveness</li> </ul>
	Influence organisational development and strategies	<ul style="list-style-type: none"> <li>• Align staff development activities with manufacturing and business needs</li> <li>• Analyse data for business insights identification</li> <li>• Manage tripartite relations for the organisation</li> </ul>

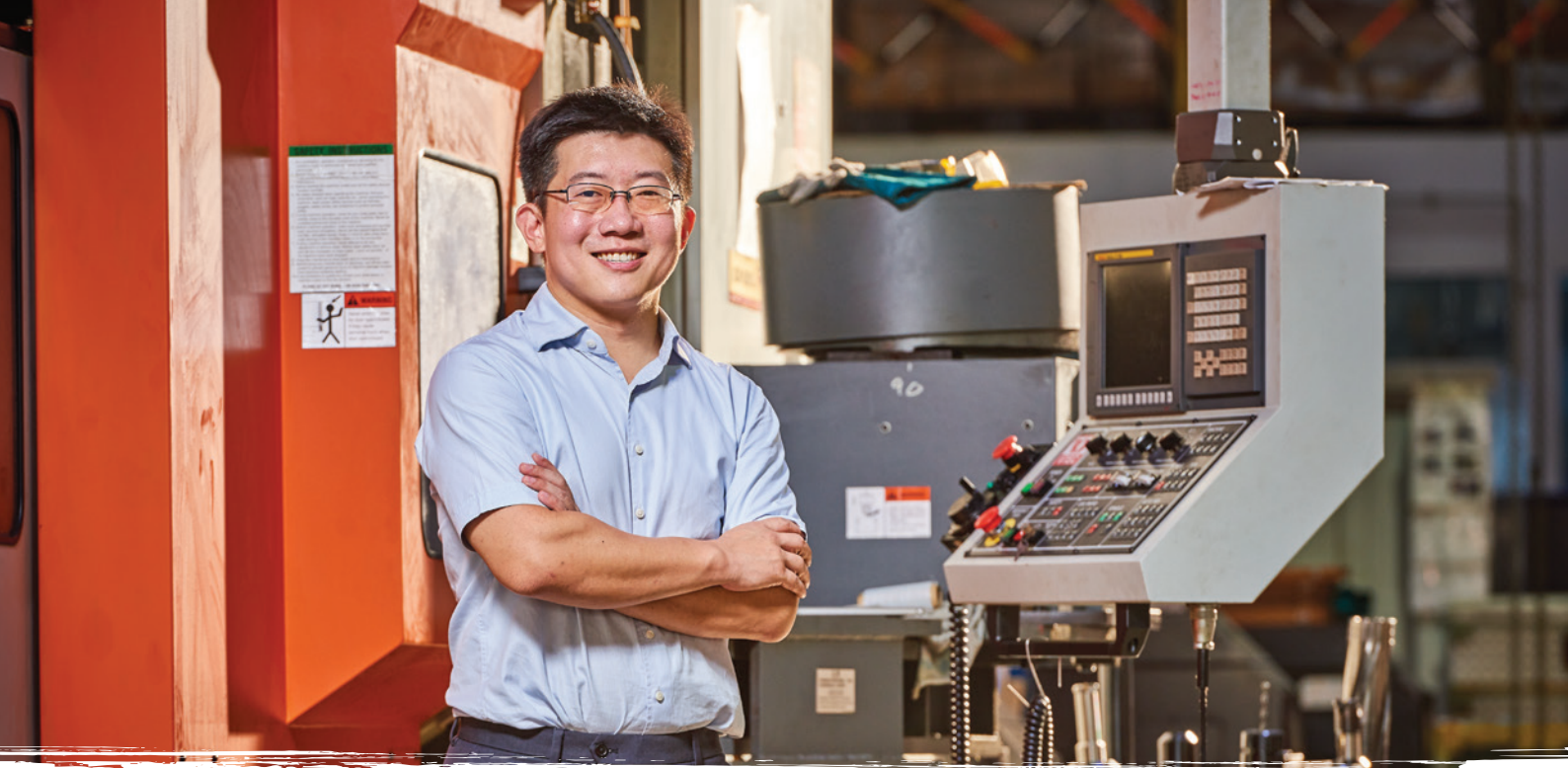
# Chief Engineer

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 6	Lean Manufacturing	Level 6
Automated System Design	Level 5	Manufacturing Technology	Level 5
Automation Process Control	Level 6	Metal Forming	Level 6
Business Innovation	Level 5	Networking	Level 6
Change Management	Level 5	New Product Introduction	Level 6
Conflict Management	Level 6	Organisational Analysis	Level 6
Cyber Risk Management	Level 5	Production Line Set-Up	Level 6
Data Synthesis	Level 6	Project Management	Level 6
Emergency Response Management	Level 2	Quality Process Control	Level 5
Engineering Product Design	Level 6	Quality System Management	Level 6
Failure Analysis	Level 5	Research and Development	Level 5
Innovation Management	Level 6	Virtual Reality Application	Level 4
Internet of Things Management	Level 5	Vision Leadership	Level 5
Laser and Optics Application	Level 6	Workplace Safety and Health System Management	Level 6
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Leadership	Advanced	Communication	Advanced
Transdisciplinary Thinking	Advanced	Interpersonal Skills	Advanced
Decision Making	Advanced		



# MANAGEMENT

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## Enterprise Development Manager

Kwan Li Feng  
CKE Manufacturing Pte Ltd

### DRIVING THE PASSION FOR PRECISION

Li Feng grew up spending his weekends and school holidays in the factory of his family business. “I did not possess any relevant knowledge before joining the business, but I was familiar with the noise, sights and smell of the factory,” he muses.

It has been 12 years since Li Feng joined CKE Manufacturing—during which he undertook multiple courses and graduate diplomas in the field. He works with a team of six as an Enterprise Development Manager, communicating with clients to understand their market and supply chain needs. Li Feng holds regular contract and production status meetings with his Sales and Procurement Engineers, and Production Supervisor, and reviews the company’s technology capabilities and human capital training to align with market demands.

“I see my role as a catalyst and a team builder,” he shares. As part of a family business, Li Feng’s work is evaluated based on how well he preserves the values and cultures of the company, besides a strong top and bottom line. He therefore works closely with the factory’s senior and younger generation of engineers, and adds, “My greatest job satisfaction is meeting veterans, graduates and academics who live and breathe their work. They inspire me with their passion and knowledge.”

Passion, discipline and empathy are essential to the business and craft of precision engineering for Li Feng. “The responsibility is huge - we make and contribute to products that must work without fail in daily life,” he states.

Li Feng believes that you must have the ability to constantly reinvent yourself to remain a talent in any field. He speaks from personal experience, having graduated with a Diploma in Technical Theatre Arts, and enrolled himself in a series of precision engineering programmes to be able to contribute to the business. “Learning, adopting and applying new skills are the key variables in our innovation-driven economy. In Industry 4.0, engineers and technicians will rely on data, rather than the traditional five senses,” he says.

The Skills Framework helps individuals to recognise the skill sets required to perform certain roles within the industry and also enables them to acquire the necessary skills to progress in their desired career pathway. His advice for those starting out: “Don’t wait until you are academically qualified. As long you are committed, Singapore’s ecosystem for continuous learning will enable you.”

**Learning, adopting and applying new skills are the key variables in our innovation-driven economy.**

# Production Supervisor

## JOB ROLE DESCRIPTION

The Production Supervisor supervises production staff to ensure production targets are met, in accordance with organisation policies and workplace safety and health regulations. He/She is responsible for planning, assigning and directing work, coordinating weekly meetings, addressing product and employee complaints, and resolving problems. He also implements policies and procedures and recommends improvements with a view to increase efficiency and productivity in production methods, equipment, operating procedures and working conditions.

He works with his colleagues in a manufacturing plant setting. He possesses leadership and communication skills to set direction to achieve organisational goals.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manage production operations	<ul style="list-style-type: none"> <li>• Manage production planning and scheduling</li> <li>• Manage the installation and conduct of trials for new product manufacturing processes</li> <li>• Implement proactive maintenance strategies</li> <li>• Implement sustainable manufacturing practices</li> <li>• Manage operating finances and resources</li> <li>• Manage organisational supply chain and logistics processes</li> <li>• Plan cost estimates for products</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Manage quality systems and processes governing manufacturing operations</li> <li>• Coordinate shop floor operations to facilitate workplace safety and health enforcement</li> <li>• Apply organisational risk management procedures in manufacturing operations</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Assist in implementation of improvement projects</li> <li>• Identify opportunities for continuous improvement projects</li> <li>• Collect data for analysis</li> </ul>
	Influence organisational development and strategy	<ul style="list-style-type: none"> <li>• Contribute to business analytics to facilitate data gathering and decision-making</li> <li>• Manage employee relations and development</li> </ul>

# Production Supervisor

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 3	New Product Introduction	Level 2
Budgeting	Level 3	Organisational Analysis	Level 4
Business Data Analysis	Level 2	Procurement Performance Monitoring	Level 3
Competitive Business Strategy	Level 3	Production Performance Management	Level 3
Conflict Management	Level 4	Production Planning	Level 3
Continuous Process Improvement	Level 4	Production Resource Management	Level 3
Data Analytics System Design	Level 3	Production Shut-down and Re-start	Level 4
Data Synthesis	Level 3	Project Management	Level 3
Emergency Response Management	Level 3	Quality System Management	Level 4
Enterprise Risk Management	Level 3	Supply Chain Solutioning	Level 3
Innovation Management	Level 4	Sustainable Manufacturing	Level 3
Internet of Things Management	Level 3	Value Analysis	Level 3
Lean Manufacturing	Level 4	Virtual Reality Application	Level 2
Learning and Development	Level 3	Vision Leadership	Level 3
Maintenance Coordination	Level 3	Workplace Safety and Health Practice	Level 4
Networking	Level 4	Workplace Safety and Health System Management	Level 4
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Problem Solving	Intermediate	Sense Making	Intermediate
Decision Making	Intermediate	Communication	Intermediate
Leadership	Intermediate		

# Assistant Manufacturing Manager/ Section Manager

## JOB ROLE DESCRIPTION

The Assistant Manufacturing Manager/Section Manager supports the coordination of day-to-day production operations and schedules. He/She collates and analyses production and budget data, resolves production-related issues and oversees workplace safety and health compliance for his assigned production area.

He also contributes to production efficiency through the implementation of new and/or enhanced production processes and the acquisition of new machinery.

He is a team player, possessing good communication skills, and provides direction to achieve organisational goals.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manage production operations	<ul style="list-style-type: none"> <li>• Develop production plans</li> <li>• Develop new product manufacturing process design strategies</li> <li>• Develop maintenance plans for manufacturing equipment</li> <li>• Assist in developing shop floor tracking and control plans</li> <li>• Develop sustainable manufacturing and waste reduction plans</li> <li>• Prepare operating budgets for the business unit</li> <li>• Identify gaps in the organisation's supply chain to propose improvements</li> <li>• Determine appropriate marketing mix and manufacturing organisation structure to support the organisation's targeted competitive advantage</li> </ul>
	Conform to management system requirements	<ul style="list-style-type: none"> <li>• Develop quality management systems for manufacturing and business operations</li> <li>• Oversee manufacturing functions for compliance with workplace safety and health standards</li> <li>• Manage compliance with corporate governance policies and legislative requirements</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Lead continuous improvement projects</li> <li>• Lead working level community to explore opportunities for improvement projects</li> <li>• Define cost reduction and/or productivity programmes relating to product engineering and drive execution</li> </ul>
	Influence organisational development and strategy	<ul style="list-style-type: none"> <li>• Contribute to business analytics to facilitate data gathering and decision-making</li> <li>• Manage industrial relations with stakeholders</li> </ul>

# Assistant Manufacturing Manager/ Section Manager

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 4	Manufacturing Process Management	Level 5
Budgeting	Level 4	Networking	Level 5
Business Data Analysis	Level 3	New Product Introduction	Level 3
Business Planning	Level 4	Organisational Analysis	Level 4
Carbon Footprint Management	Level 4	Procurement Performance Monitoring	Level 4
Change Management	Level 4	Production Performance Management	Level 4
Competitive Business Strategy	Level 3	Production Planning	Level 4
Conflict Management	Level 4	Production Resource Management	Level 4
Continuous Process Improvement	Level 5	Project Management	Level 4
Data Analytics System Design	Level 4	Quality System Management	Level 5
Data Synthesis	Level 4	Research and Development	Level 4
Emergency Response Management	Level 3	Risk Compliance and Governance	Level 4
Enterprise Risk Management	Level 4	Supply Chain Solutioning	Level 4
Innovation Management	Level 4	Sustainable Manufacturing	Level 4
Internet of Things Management	Level 4	Value Analysis	Level 4
Lean Manufacturing	Level 5	Virtual Reality Application	Level 3
Learning and Development	Level 4	Vision Leadership	Level 4
Maintenance Coordination	Level 4	Workplace Safety and Health Practice	Level 4
Manufacturing Process Design	Level 4	Workplace Safety and Health System Management	Level 5
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Resource Management	Intermediate	Leadership	Intermediate
Problem Solving	Intermediate	Communication	Intermediate
Decision Making	Intermediate		



# Manufacturing Manager/Operations Manager/Production Manager

## JOB ROLE DESCRIPTION

The Manufacturing Manager/Operations Manager/Production Manager oversees the entire manufacturing process, to ensure that production is on schedule and within budget. His/Her responsibilities include determining workplace safety and health strategies, and overseeing manpower, financial and resource planning. He analyses production data and determines new strategies to enhance the efficiency of processes, which includes assessing the viability of new machinery.

As a people manager, he directs and motivates colleagues to achieve production goals. He is expected to be a team leader, and possesses communication skills to lead production teams to achieve organisational goals.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manage production operations	<ul style="list-style-type: none"> <li>• Establish organisation-wide planning and production scheduling</li> <li>• Assess effectiveness of manufacturing processes for new products</li> <li>• Evaluate maintenance strategies and systems for improvements</li> <li>• Develop shop floor tracking and control plans</li> <li>• Evaluate organisation's energy usage and waste generation patterns for improvements</li> <li>• Establish financial budget and plans for the organisation</li> <li>• Evaluate suppliers' effectiveness for performance improvements</li> <li>• Develop sales and marketing operational plans, performance targets and measurements</li> </ul>
	Establish management system requirements	<ul style="list-style-type: none"> <li>• Evaluate the effectiveness of organisational quality management system for improvements</li> <li>• Assess organisational workplace safety and health system and propose improvements</li> <li>• Develop organisational risk management frameworks, policies and processes</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Lead cross-functional teams in continuous improvement projects</li> <li>• Evaluate the organisation's approach towards a lean enterprise</li> <li>• Assist in implementation of process improvement projects</li> <li>• Analyse data for business insights identification</li> </ul>
	Influence organisational development and strategy	<ul style="list-style-type: none"> <li>• Strategise improvements to manufacturing processes for business advantage</li> <li>• Strategise products and services for competitive advantage</li> <li>• Develop business continuity strategies, policies and guidelines</li> </ul>

# Manufacturing Manager/Operations Manager/ Production Manager

TECHNICAL SKILLS AND COMPETENCIES			
Additive Manufacturing	Level 4	Manufacturing Process Design	Level 5
Budgeting	Level 5	Manufacturing Process Management	Level 5
Business Data Analysis	Level 4	Networking	Level 5
Business Innovation	Level 4	New Product Introduction	Level 4
Business Planning	Level 5	Organisational Analysis	Level 5
Carbon Footprint Management	Level 5	Procurement Performance Monitoring	Level 4
Change Management	Level 4	Production Performance Management	Level 5
Competitive Business Strategy	Level 4	Production Planning	Level 4
Conflict Management	Level 4	Production Resource Management	Level 5
Continuous Process Improvement	Level 5	Project Management	Level 5
Cyber Risk Management	Level 4	Quality System Management	Level 6
Data Analytics System Design	Level 5	Research and Development	Level 4
Data Synthesis	Level 5	Risk Compliance and Governance	Level 4
Emergency Response Management	Level 4	Supply Chain Solutioning	Level 4
Enterprise Risk Management	Level 5	Sustainable Manufacturing	Level 5
Innovation Management	Level 5	Value Analysis	Level 5
Internet of Things Management	Level 5	Virtual Reality Application	Level 4
Lean Manufacturing	Level 5	Vision Leadership	Level 5
Learning and Development	Level 4	Workplace Safety and Health Practice	Level 4
Maintenance Coordination	Level 5	Workplace Safety and Health System Management	Level 6
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Leadership	Advanced	Decision Making	Advanced
Resource Management	Intermediate	Interpersonal Skills	Intermediate
Problem Solving	Advanced		

# Plant Manager

## JOB ROLE DESCRIPTION

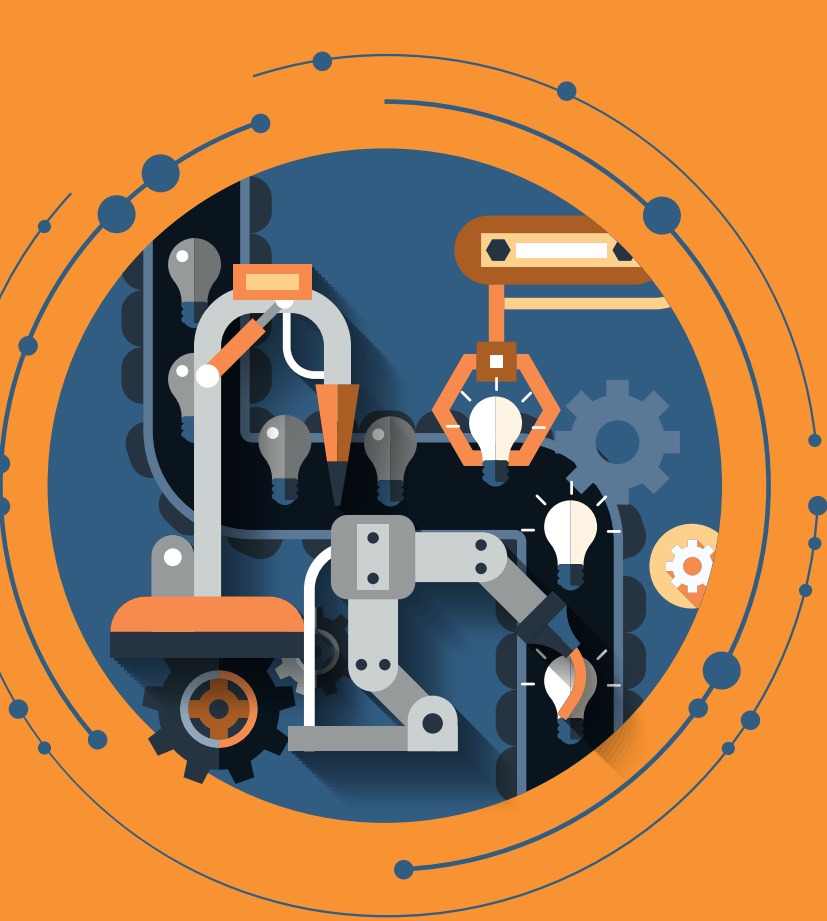
The Plant Manager leads all manufacturing and engineering activities in the organisation to ensure that production objectives are achieved in a timely and cost-effective manner. He/She formulates and recommends manufacturing policies and programmes to guide the organisation in maintaining and improving its competitive position and profitability.

He manages all aspects of the employees of the department and is responsible for performance management, and building high-performance teams that work collaboratively. He possesses abilities to develop and execute functional strategies, and acts as a change leader.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Manage production operations	<ul style="list-style-type: none"> <li>• Direct the creation of flexible production and manpower systems</li> <li>• Lead installation and commissioning of new product manufacturing processes</li> <li>• Establish the organisation's maintenance strategies and systems</li> <li>• Establish shop floor execution and control parameters</li> <li>• Establish organisation's green manufacturing strategies</li> <li>• Establish the organisation's supply chain and logistics management processes</li> <li>• Direct organisational sales and marketing strategies</li> </ul>
	Establish management system requirements	<ul style="list-style-type: none"> <li>• Design the organisational quality management systems</li> <li>• Update the organisational quality management system for relevant industry benchmarks for best practices</li> <li>• Implement organisational workplace safety and health strategies</li> <li>• Manage organisational workplace safety and health audit programmes</li> <li>• Establish processes for managing corporate non-compliances</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Manage innovation practices within the organisation</li> <li>• Review manufacturing processes to reduce working capital and optimise inventory levels</li> <li>• Analyse data for business insights identification</li> </ul>
	Influence organisational development and strategy	<ul style="list-style-type: none"> <li>• Establish strategies for the business function</li> <li>• Review strategic technology and operation road mapping processes</li> <li>• Direct negotiation policies</li> </ul>

# Plant Manager

TECHNICAL SKILLS AND COMPETENCIES			
Budgeting	Level 5	Manufacturing Process Management	Level 6
Business Data Analysis	Level 5	Networking	Level 6
Business Innovation	Level 5	New Product Introduction	Level 4
Business Planning	Level 6	Organisational Analysis	Level 6
Carbon Footprint Management	Level 6	Procurement Performance Monitoring	Level 5
Change Management	Level 5	Production Planning	Level 5
Competitive Business Strategy	Level 5	Production Resource Management	Level 6
Conflict Management	Level 5	Project Management	Level 6
Cyber Risk Management	Level 5	Quality System Management	Level 6
Data Analytics System Design	Level 5	Research and Development	Level 5
Data Synthesis	Level 6	Risk Compliance and Governance	Level 5
Emergency Response Management	Level 5	Supply Chain Solutioning	Level 5
Enterprise Risk Management	Level 6	Sustainable Manufacturing	Level 6
Innovation Management	Level 6	Technology Road Mapping	Level 5
Lean Manufacturing	Level 6	Value Analysis	Level 6
Learning and Development	Level 5	Vision Leadership	Level 5
Maintenance Coordination	Level 6	Workplace Safety and Health System Management	Level 6
Manufacturing Process Design	Level 6		
GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Problem Solving	Advanced	Interpersonal Skills	Advanced
Decision Making	Advanced	Sense Making	Advanced
Communication	Advanced		



#### JOB ROLES

#### PAGE

Chief Executive Officer/Chief Operating Officer/Chief Technology Officer/Managing Director/General Manager/Vice-President

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## Executive Director

Steven Koh

Singapore Precision Engineering and Technology Association (SPETA)

### TRANSFORMING THE FUTURE OF PRECISION ENGINEERING

Steven has been the Executive Director of Singapore Precision Engineering and Technology Association (SPETA) since December 2015, tripling its member numbers from 132 to nearly 400.

With a stellar and long-running background in business development and growth, Steven was the General Manager of a local bank's Seoul outpost before he made the switch to the field of precision engineering (PE) 17 years ago. These achievements, and a prior term as the Deputy Chairman of SPETA, have led to his current role, where he is responsible for transforming a joint tooling association into a technology-driven industry force. Steven also served previously as a panel advisor to the Inland Revenue Authority of Singapore and Enterprise Singapore.

In his current role, Steven utilises the rich experiences he has gained to address the problems, interests and needs of local PE small and medium-sized enterprises (SMEs). He is involved in troubleshooting their main issues of resources, risk and cost management.

To ensure that these key success factors are in place, Steven is of the opinion that the leader or key managers of a PE company must possess two important traits: Passion and Endurance. He believes that the traits were cornerstones to his business successes, and still continue to drive his dedication to the PE sector today. In particular, he makes it a point to visit SPETA's SME member firms to provide strategic advice,

share various assistance programmes, and push for adoption of SPETA standards.

"Competency has huge influence on productivity. The success of driving technology-led transformation depends on the skills of our workforce," Steven says. "The Skills Framework for Precision Engineering's coverage of in-demand skills, and the re-training and redevelopment of human capital is of utmost importance," he emphasises.



**The Skills Framework for Precision Engineering's coverage of in-demand skills, and the re-training and redevelopment of human capital is of utmost importance.**



# Chief Executive Officer/Chief Operating Officer/ Chief Technology Officer/Managing Director/General Manager/Vice-President

## JOB ROLE DESCRIPTION

The Chief Executive Officer/Chief Operating Officer/Managing Director/General Manager/Vice-President provides the overall direction of the organisation. As a systems thinker, he/she strategises and directs operational activities at the highest level of management with the help of a management team. He translates broad goals into achievable steps, anticipates and stays ahead of trends and takes advantage of opportunities. He also represents the organisation before customers, investors and business partners.

He also formulates ideas and drives change in an organisation, while maintaining a culture of innovativeness to sustain value creation in meeting the organisation's competitive position and long-term objectives. With a nurturing mindset, he also mentors and develops talent as future leaders.

CRITICAL WORK FUNCTIONS AND KEY TASKS	CRITICAL WORK FUNCTIONS	KEY TASKS
	Establish management system requirements	<ul style="list-style-type: none"> <li>• Champion green manufacturing practices for sustainability</li> <li>• Champion quality management in the organisation</li> <li>• Champion workplace safety and health policy adoption within the organisation</li> <li>• Set corporate risk philosophy, appetite and goals</li> </ul>
	Contribute to continuous improvement	<ul style="list-style-type: none"> <li>• Challenge new ideas while actively balancing risks and opportunities</li> <li>• Innovate and create an environment that encourages innovation</li> <li>• Maintain a culture of innovative thinking and practices</li> <li>• Champion the adoption of lean manufacturing for the organisation</li> </ul>
	Influence organisational development and strategy	<ul style="list-style-type: none"> <li>• Set organisation's finance philosophy and strategies</li> <li>• Formulate strategies to enhance the organisation's business competitiveness</li> <li>• Drive value and sustainability in the organisation's supply chain</li> <li>• Formulate organisational marketing strategies for competitive advantage</li> </ul>

# Chief Executive Officer/Chief Operating Officer/ Chief Technology Officer/Managing Director/ General Manager/Vice-President

TECHNICAL SKILLS AND COMPETENCIES			
Budgeting	Level 6	Learning and Development	Level 6
Business Data Analysis	Level 5	Networking	Level 6
Business Innovation	Level 6	Organisational Analysis	Level 6
Business Planning	Level 6	Procurement Performance Monitoring	Level 5
Change Management	Level 6	Quality System Management	Level 6
Competitive Business Strategy	Level 6	Research and Development	Level 6
Conflict Management	Level 6	Risk Compliance and Governance	Level 6
Cyber Risk Management	Level 6	Sustainable Manufacturing	Level 6
Emergency Response Management	Level 2	Technology Road Mapping	Level 6
Enterprise Risk Management	Level 6	Vision Leadership	Level 6
Innovation Management	Level 6	Workplace Safety and Health System Management	Level 6

GENERIC SKILLS AND COMPETENCIES (TOP 5)			
Global Mindset	Advanced	Decision Making	Advanced
Leadership	Advanced	Lifelong Learning	Advanced
Resource Management	Advanced		



# Overview of Technical Skills and Competencies

## Technical Skills and Competencies (TSCs)

TSC Category	TSC Title	TSC Description	Proficiency Levels					
			1	2	3	4	5	6
Automation Management	Automated Operation Monitoring	Ensure smooth automation operations by maintaining and monitoring the automated systems and manufacturing process flows	●	●	●	●		
	Automated System Design	Design and commission automated systems as well as evaluate the system design specification against functional requirements	●	●	●	●	●	
	Automation Process Control	Apply automation process control to monitor performance metrics and quality of manufacturing outputs to determine the optimal settings as well as productivity improvement strategies			●	●	●	●
	Automation System Maintenance	Maintain automation systems to meet operation requirements as well as propose strategies for the automation systems performance improvement	●	●	●	●	●	
Big Data Analytics	Data Analytics System Design	Integrate the use of data analytics in the production environment for the identification of bottlenecks and system improvements			●	●	●	
	Data Synthesis	Analyse factory automation and manufacturing data to monitor the manufacturing processes for operations and product or process flow optimisation			●	●	●	●
Business and Organisational Management	Budgeting	Prepare organisational budgets to support short- and long-term business plans through forecasting, allocation and financial policy setting			●	●	●	●
	Business Data Analysis	Implement data analytics within the organisation to generate business insights and intelligence through the use of statistical and computational techniques and tools, algorithms, predictive data modelling and data visualisation		●	●	●	●	
	Business Innovation	Identify and evaluate digitisation and innovative business opportunities provided by new advancements in information and communication technology to establish new services or businesses to bridge the physical and digital worlds				●	●	●
	Business Planning	Develop business plans by reviewing existing resources to identify growth opportunities to achieve sustainable competitive advantage leading to a high exit valuation				●	●	●
	Competitive Business Strategy	Formulate and implement competitive marketing strategies in a manufacturing organisation			●	●	●	●
	Enterprise Risk Management	Develop and implement risk management strategies to support business operations			●	●	●	●
	Networking	Identify and establish industry stakeholder relationships at all levels of business operations to further the organisation's strategies and objectives				●	●	●
	Organisational Analysis	Evaluate factors that can affect the organisation's performance as well as strategically assessing the organisation's own resources and potential for improvement				●	●	●
	Project Management	Execute projects by managing stakeholder engagement, resources, budgets and resolving problems			●	●	●	●
	Risk Compliance and Governance	Enforce corporate governance and risk compliance within the organisation through the establishment of policies, compliance programmes and management systems				●	●	●

# Overview of Technical Skills and Competencies

## Technical Skills and Competencies (TSCs)

TSC Category	TSC Title	TSC Description	Proficiency Levels					
			1	2	3	4	5	6
Engineering and Manufacturing Fundamentals	Computer-aided Design	Use computer-aided design software and tools to design products, components and machine parts for manufacture	●	●	●	●		
	Computer-aided Manufacturing	Manage computer-aided manufacturing systems and perform computer numerical control part programming to manufacture components and products	●	●	●	●		
	Geometric Dimensioning and Tolerancing	Define and verify acceptable engineering tolerances of products' and parts' geometry		●	●	●		
	Heat Treatment Processing	Analyse effects of heat treatments to determine suitable materials and treatment processes to achieve required material properties for manufactured components and products				●	●	
	Hydraulic Systems Management	Design, repair and operate hydraulic systems within a manufacturing environment	●	●	●			
	Metallic Material Characterisation	Conduct tests and measurement taking to evaluate suitability of metallic materials for uses in manufacturing			●	●	●	
	Pneumatic Systems Management	Design, repair and operate pneumatic systems within a manufacturing environment	●	●	●			
	Polymeric Material Characterisation	Conduct tests and measurement taking to evaluate suitability of polymeric materials for uses in manufacturing			●	●	●	
Maintenance	Equipment Maintenance	Maintain tools and equipment to meet operation requirements as well as propose strategies for tools and equipment performance improvement	●	●	●	●	●	
	Maintenance Coordination	Establish and implement organisational maintenance strategies and systems for equipment and plant		●	●	●	●	●
Manufacturing and Operations	Cleanliness and Contamination Control	Establish and implement contamination and cleanliness controls in the manufacturing work environment	●	●	●	●	●	
	Manufacturing Process Management	Perform process engineering and ensure the stability of the manufacturing process as well as troubleshoot process deviations and propose strategies for process performance improvement		●	●	●	●	●
	Manufacturing Technology	Optimise manufacturing processes, utilising available and applicable technologies		●	●	●	●	
	Metrology Management	Manage metrology techniques for process performance measurement as well as develop metrology recipes for process optimisation			●	●	●	
	Precision Measurement	Perform precision measurements with relevant techniques and equipment to meet conformity requirements	●	●	●	●	●	
	Production Line Set-up	Design mechanism units, systems and drives for industrial manufacturing applications		●	●	●	●	●
	Production Shut-down and Re-start	Manage shutdown and restarting of production process to minimise loss and/or damage of assets as well as ensure the safety of personnel during shutdown and restarting			●	●	●	●

# Overview of Technical Skills and Competencies

## Technical Skills and Competencies (TSCs)

TSC Category	TSC Title	TSC Description	Proficiency Levels					
			1	2	3	4	5	6
Network Technology Management	Augmented Reality Application	Facilitate the design and implementation of augmented reality applications to increase efficiency of work processes	●	●	●			
	Cyber Risk Management	Develop cyber risk assessment and treatment techniques that can effectively pre-empt and identify significant security loopholes and weaknesses, demonstration of the business risks associated with these loopholes and provision of risk treatment and prioritisation strategies to effectively address the cyber-related risks, threats and vulnerabilities identified to ensure appropriate levels of protection, confidentiality, integrity and privacy in alignment with the security framework				●	●	●
	Internet of Things Management	Interrelate computing devices, equipment and machines' data in a networked environment to provide specific solutions		●	●	●	●	
	User Experience Design	Conceptualise, project and make enhancement of the user's interaction and engagement with an IT product and/or service based on a robust analysis and understanding of the product and/or service's performance vis-a-vis the user's desired experience and outcomes. This involves creating wire frames to adequately guide and inform subsequent planning and development processes, and making enhancements to optimise the user's experience of the product and/or service		●	●	●		
	User Interface Design	Design user interfaces for machines and software, incorporating visual, technical and functional elements that facilitate ease of access, understanding and usage. This would involve adding, removing, modifying or enhancing elements to make the user's interaction with the product as seamless as possible			●	●		
	Virtual Reality Application	Employ the use of virtual reality technology in work-related applications, training and to support organisational decision-making in relation to new designs for products, work procedures, workspace layouts and other experiments		●	●	●		
Organisational Development	Change Management	Implement organisational change smoothly as well as manage reactions to ensure seamless transition during change			●	●	●	●
	Conflict Management	Perform conflict management within the organisation to assist members in resolving grievances and disputes				●	●	●
	Learning and Development	Plan employees' learning and development activities to maximise employee contribution as well as building a skilled workforce			●	●	●	●
	Vision Leadership	Articulate clear, inspiring organisational goals, plans and priorities, as well as, display behavioural characteristics within the workplace in accordance to organisational values			●	●	●	●
Precision Manufacturing Process	Additive Manufacturing	Design and apply additive manufacturing workflows to create three-dimensional objects		●	●	●	●	●
	Cutting	Manage and implement material removal processes and activities to manufacture components and products	●	●	●	●		

# Overview of Technical Skills and Competencies

## Technical Skills and Competencies (TSCs)

TSC Category	TSC Title	TSC Description	Proficiency Levels					
			1	2	3	4	5	6
	Injection Mould Design	Design moulds for manufacturing of products through plastic injection moulding processes			●	●		
	Jigs and Fixture Design	Facilitate implementation of production operations through the design of jigs and fixtures required for manufacturing activities			●	●		
	Laser and Optics Application	Use of laser and optics to automate manufacturing processes by introducing amplified electromagnetism and optical technologies for steelwork and alignment processes		●	●	●	●	●
	Machining	Manage and perform machining activities to manufacture components and products, incorporating computer numerical control and computer-aided manufacturing processes	●	●	●	●	●	
	Material Joining	Fabricate components and construct different structures by bringing together parts of different properties, dimensions and compositions	●	●	●	●		
	Metal Forming	Develop and optimise metal forming processes for manufacturing of quality products				●	●	●
	Metal-based Additive Manufacturing	Evaluate potential applications of additive manufacturing with a specialised emphasis on metallic product manufacturing				●	●	
	Non-destructive Testing	Execute non-destructive tests to ensure structural integrity, insulation resistance, continuity and satisfactory performance of electrical equipment and installations against organisational and regulatory standards and requirements		●	●	●		
	Plastic Injection Moulding	Manage and implement injection moulding systems and processes to manufacture polymer-based products		●	●	●	●	
	Polymeric Additive Manufacturing	Evaluate potential applications of additive manufacturing with a specialised emphasis on polymeric product manufacturing				●	●	
	Product and Machine Assembly	Utilise component preparation, assembly and troubleshooting techniques to assemble manufacturing equipment, end-products and sub-components	●	●	●			
	Surface Preparation and Protection	Apply appropriate surface preparation and protection techniques, based on surface material, operating conditions and maintenance requirements	●	●	●	●		
	Welding	Manage the application of welding, as a specialised subset of technologies, tools and processes for joining of metallic parts and components in manufacturing operations	●	●	●	●	●	
Procurement	Procurement Performance Monitoring	Monitor procurement performance to cut costs, alleviate risks, and drive continuous process improvement by measuring and analysing vendor and process efficiency			●	●	●	
	Supply Chain Solutioning	Develop new operating models and solutions for customers to manage their supply chain needs as well as improve inventory levels, delivery time and cost saving			●	●	●	
Product Development	Engineering Product Design	Facilitate the design of products to meet requirements for functionality and performance			●	●	●	●
	Manufacturing Process Design	Analyse the design of the product to identify potential manufacturing risks and problems for the reduction of manufacturing costs				●	●	●

# Overview of Technical Skills and Competencies

## Technical Skills and Competencies (TSCs)

TSC Category	TSC Title	TSC Description	Proficiency Levels					
			1	2	3	4	5	6
	New Product Introduction	Support new production by validating build plan to achieve cost-effective production and assembly as well as meeting design specifications		●	●	●	●	●
	Research and Development	Optimising manufacturing processes, material developments and development of new product line				●	●	●
Production Management	Production Performance Management	Plan and manage resources to optimise production performance as well as manage production constraint and improve manufacturing efficiency			●	●	●	
	Production Planning	Establish and execute the production plan to meet production targets and cycle time indices			●	●	●	
	Production Resource Management	Plan and control capacity and quality issues to meet organisational needs as well as schedule resources to synchronise production processes			●	●	●	●
Productivity and Innovation	Continuous Process Improvement	Apply continuous improvement processes to improve products, services or processes seeking incremental improvement over time or breakthrough improvement all at once	●	●	●	●	●	
	Innovation Management	Respond to external or internal opportunities and apply creativity to introduce new ideas, processes or products			●	●	●	●
Quality Management	Failure Analysis	Examine the electrical and physical defects evidence to verify the causes of failure as well as identify the failure modes			●	●	●	
	Quality Process Control	Implement quality process controls to improve and stabilise production in order to avoid or minimise issues leading to defects			●	●	●	
	Quality System Management	Coordinate and direct the organisation's activities to meet customer and regulatory requirements as well as identify opportunities for improvement		●	●	●	●	●
System Integration	Embedded System Integration	Implement control systems to perform pre-defined tasks and also real-time monitoring for the real world		●	●	●	●	
Technology Road Mapping	Technology Road Mapping	Plan short-term and long-term goals with specific technology solutions to help meet those goals in order to make capital out of future market needs					●	●
Value Engineering	Carbon Footprint Management	Quantify and reduce the organisational carbon footprint				●	●	●
	Lean Manufacturing	Apply concepts, tools and techniques of 'lean' manufacturing to improve efficiency in a manufacturing organisation			●	●	●	●
	Sustainable Manufacturing	Manage efficient use of energy and other utility resources to promote sustainable manufacturing operations			●	●	●	●
	Value Analysis	Establish the organisational value stream, enhance value-add and reduce costs			●	●	●	●
Workplace Safety and Health Management	Emergency Response Management	Implement emergency management to ensure the readiness of the stakeholders in addressing emergencies that may arise in the workplace		●	●	●	●	
	Workplace Safety and Health System Management	Ensure systematic process in the managing of workplace safety and health-related activities in the workplace				●	●	●
	Workplace Safety and Health Practice	Implement workplace safety and health practices in the manufacturing environment		●	●	●		

# Overview of Technical Skills and Competencies

## General Descriptors for Technical Skills and Competencies (TSCs)

Level	Responsibility (Degree of supervision and accountability)	Autonomy (Degree of decision-making)	Complexity (Degree of difficulty of situations and tasks)	Knowledge and Abilities (Required to support work as described under Responsibility, Autonomy and Complexity)
6	Accountable for significant area of work, strategy or overall direction	Empowered to chart direction and practices within and outside of work (including professional field/ community), to achieve/ exceed work results	Complex	<ul style="list-style-type: none"> <li>• Synthesise knowledge issues in a field of work and the interface between different fields, and create new forms of knowledge</li> <li>• Employ advanced skills, to solve critical problems and formulate new structures, and/or to redefine existing knowledge or professional practice</li> <li>• Demonstrate exemplary ability to innovate, and formulate ideas and structures</li> </ul>
5	Accountable for achieving assigned objectives, decisions made by self and others	Provide leadership to achieve desired work results; Manage resources, set milestones and drive work	Complex	<ul style="list-style-type: none"> <li>• Evaluate factual and advanced conceptual knowledge within a field of work, involving critical understanding of theories and principles</li> <li>• Select and apply an advanced range of cognitive and technical skills, demonstrating mastery and innovation, to devise solutions to solve complex and unpredictable problems in a specialised field of work</li> <li>• Manage and drive complex work activities</li> </ul>
4	Work under broad direction  Hold accountability for performance of self and others	Exercise judgment; Adapt and influence to achieve work performance	Less routine	<ul style="list-style-type: none"> <li>• Evaluate and develop factual and conceptual knowledge within a field of work</li> <li>• Select and apply a range of cognitive and technical skills to solve non- routine/abstract problems</li> <li>• Manage work activities which may be unpredictable</li> <li>• Facilitate the implementation of innovation</li> </ul>
3	Work under broad direction.  May hold some accountability for performance of others, in addition to self	Use discretion in identifying and responding to issues, work with others and contribute to work performance	Less routine	<ul style="list-style-type: none"> <li>• Apply relevant procedural and conceptual knowledge, and skills to perform differentiated work activities and manage changes</li> <li>• Able to collaborate with others to identify value-adding opportunities</li> </ul>
2	Work with some supervision  Accountable for a broader set of tasks assigned	Use limited discretion in resolving issues or enquiries. Work without frequently looking to others for guidance	Routine	<ul style="list-style-type: none"> <li>• Understand and apply factual and procedural knowledge in a field of work</li> <li>• Apply basic cognitive and technical skills to carry out defined tasks and to solve routine problems using simple procedures and tools</li> <li>• Present ideas and improve work</li> </ul>
1	Work under direct supervision  Accountable for tasks assigned	Minimal discretion required. Expected to seek guidance	Routine	<ul style="list-style-type: none"> <li>• Recall factual and procedural knowledge</li> <li>• Apply basic skills to carry out defined tasks</li> <li>• Identify opportunities for minor adjustments to work tasks</li> </ul>

# Overview of Generic Skills and Competencies

## Generic Skills and Competencies (GSCs)

GSC	GSC Description	Proficiency Levels		
		Basic	Intermediate	Advanced
<b>Communication</b>	Convey and exchange thoughts, ideas and information effectively through various mediums and approaches.	Communicate information with others to respond to general inquiries and to obtain specific information.	Articulate and discuss ideas and persuade others to achieve common outcomes.	Negotiate with others to address issues and achieve mutual consensus.
<b>Computational Thinking</b>	Develop and use computational models, tools and techniques to interpret and understand data, solve problems and guide decision-making.	Use computational models, tools and techniques to identify patterns in a problem and develop a solution.	Modify existing computational models, tools and techniques to develop different solutions.	Develop and create computational models, tools and techniques to implement new solutions and apply to other problems.
<b>Creative Thinking</b>	Adopt a fresh perspective to combine ideas or information in new ways and make connections between seemingly unrelated fields to create new ideas and applications.	Connect ideas or information from related fields or applications to address an immediate issue.	Connect or combine ideas or information from unrelated fields or applications to generate multiple ideas to bring about a specific outcome.	Create original applications or ideas to reveal new possibilities and reshape goals through high level of innovativeness.
<b>Decision Making</b>	Choose a course of action from various alternatives using a reasoned process to achieve intended goals.	Make decisions of simple or routine nature to achieve intended goals using given information and guidelines.	Make decisions in a complex setting to achieve intended goals using a structured process and multiple sources of available information.	Make decisions in a volatile and ambiguous setting using a structured process and limited sources of available information to achieve intended goals.
<b>Developing People</b>	Help others to learn and develop their capabilities to enhance their performance and achieve personal or professional goals.	Use demonstration and explanation to teach a familiar task to inexperienced co-workers.	Provide coaching to others to develop their skills and knowledge on their jobs to enhance performance.	Provide mentorship to help others in their professional and personal development to improve performance and further their careers.
<b>Digital Literacy</b>	Use ICT tools, equipment and software to create, evaluate and share information digitally with others.	Perform basic functions using software programmes pertaining to computer operating systems and file management, and search online information.	Use available software features to create and edit documents, customise templates and reports and evaluate online information.	Use available software features to enhance documents, analyse and manipulate data, and use ICT to organise, share and communicate information clearly and coherently.
<b>Global Mindset</b>	Awareness of diversity across global cultures and markets. Seek opportunities to adopt successful practices and ideas.	Demonstrate understanding of global challenges and opportunities and how to transfer best practices across cultures. Respect cultural differences and needs of a diverse workforce.	Develop global networks and manage virtual relationships while balancing both local and global perspectives. Adopt a local and global perspective when making decisions.	Build the organisation's capabilities to compete in a global environment. Manage tension between corporate requirements, global and cultural differences.



# Overview of Generic Skills and Competencies

## Generic Skills and Competencies (GSCs)

GSC	GSC Description	Proficiency Levels		
		Basic	Intermediate	Advanced
<b>Interpersonal Skills</b>	Manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes.	Recognise own internal feelings and emotional states to manage interpersonal relationships in social situations.	Detect and decipher emotions of others to manage interpersonal relationships in social situations.	Influence, guide and handle others' emotions to build instrumental relationships and manage conflicts and disagreements.
<b>Leadership</b>	Lead others to achieve objectives in the most effective way. Provide an inclusive workplace that cultivates workplace relationships and teamwork, and foster the development of others.	Demonstrate professionalism to set a good example at peer level. Support others through own initiative and enthuse others through own positive and energetic approach.	Lead by example at team level. Encourage and guide others to adopt a point of view, make changes or take action. Provide a team environment that facilitates relationships building, teamwork and the development of others.	Lead by example at organisational level. Inspire, motivate and guide others to adopt a point of view, make changes or take action. Cultivate an open, cooperative and collaborative learning culture for the organisation.
<b>Lifelong Learning</b>	Seek out opportunities to enhance one's knowledge and skills. Access and acquire new knowledge and skills actively for continual learning.	Organise and manage own learning by setting learning targets. Identify learning approaches to achieve work or career goals.	Engage in collaborative learning by discussing one's learning with others and soliciting feedback to continually improve oneself.	Conduct self-reflective practices to review one's learning to facilitate continual growth in one's career or profession.
<b>Managing Diversity</b>	Work well with people from different ethnic, social, cultural and educational backgrounds and understand the concerns and interests of diverse work groups.	Demonstrate sensitivity to the cultural characteristics, values, beliefs, and behaviors of another ethnic or cultural group.	Build relationships with different ethnic or cultural groups by engaging in cross-cultural cooperative projects.	Manage conflicts arising from different ethnic or cultural groups and work effectively in cross-cultural settings.
<b>Problem Solving</b>	Generate feasible and efficient solutions to solve problems and capitalise on new opportunities.	Identify easily perceivable problems and follow given guidelines and procedures to solve the problems.	Identify less perceivable problems and use problem solving tools and techniques to solve the problems.	Anticipate potential problems beyond the current scope and apply higher order problem solving tools and techniques to turn problems into opportunities.
<b>Resource Management</b>	Efficient and effective deployment and allocation of resources when and where they are needed. Include planning, allocating and scheduling of resources to tasks, which typically include manpower, machines, money and materials.	Use resources to ensure optimum and efficient use of resources.	Deepen insights into the planning, allocation and deployment of resources to anticipate needs. Plan the allocation and deployment of resources efficiently and effectively.	Establish strategies for the allocation and deployment of resources efficiently and effectively.



# Overview of Generic Skills and Competencies

## Generic Skills and Competencies (GSCs)

GSC	GSC Description	Proficiency Levels		
		Basic	Intermediate	Advanced
<b>Sense Making</b>	Organise and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making.	Identify relationships and linkages within different components of data.	Interpret data to uncover patterns and trends between various sources of data.	Analyse data relationships, patterns and trends to gain important insights and make informed decisions.
<b>Service Orientation</b>	Commit to exceeding both internal and external customers' needs. Proactively identify customer needs and sustain a culture of service excellence within the organisation.	Exceed customer needs and expectations and handle service challenges with a positive mindset. Demonstrate an understanding of the organisation's service vision, mission and values.	Anticipate customer needs and expectations and elicit feedback from customers to improve service. Build relationships with customers to create and sustain customer loyalty.	Model, lead, train and motivate staff with a focus on sustaining a culture that encourages commitment to service excellence and high performance.
<b>Teamwork</b>	Work collaboratively and effectively with others to contribute to group efforts to achieve identified objectives.	Contribute to a positive and cooperative working environment by fulfilling own responsibilities and providing support to co-workers to achieve team goals.	Facilitate work team activities, provide assistance and support needed by team members and promote ownership and commitment among team members to work goals to improve team performance.	Establish teams, design and assess tasks to continually improve team effectiveness and cultivate a sense of organisational ownership and a cooperative working environment.
<b>Transdisciplinary Thinking</b>	Understanding of concepts across multiple disciplines, with the capacity to synthesise the knowledge and insights to guide decisions and foster cooperation.	Research and adapt concepts from outside one's field of expertise to supplement one's core knowledge and proficiency.	Co-relate material from diverse knowledge bases to guide decisions and policy making. Participate in reflective and trans-disciplinary communities within and outside the organisation.	Synthesise knowledge and insights across disciplinary boundaries to aid strategic decisions and foster cooperation within and outside of the organisation.
<b>Virtual Collaboration</b>	Use online collaborative communication tools to work as teams to accomplish tasks or projects.	Participate and contribute in a virtual team. Set up appropriate online collaborative tools and supporting equipment.	Use interactive collaborative tools to foster cohesion and commitment among virtual team members to achieve goals. Keep up-to-date with innovative online collaborative tools and applications to enhance one's proficiency in engaging in virtual collaboration.	Leverage on diverse team talent, latest online collaborative technologies and virtual platforms to produce collaborative behaviour and achieve technological savviness in virtual collaboration.

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- Education and Training Providers for the input on skills and competencies development
- Organisations for their contributions in the development and validation of the Skills Framework for Precision Engineering

# Notes

[illegible]

# Notes

[illegible]

# Wage Information

## Monthly Gross Wages of Selected Occupations in Manufacturing, June 2018

Job Roles	Gross Wage	
	25th Percentile (\$)	75th Percentile (\$)
<b>Technical and Engineering</b>		
Electrical and Electronic Equipment Assembler	1,564	2,550
Machine-Tool Setter-Operator	1,960	4,157
Machinery Mechanic	2,716	3,980
Machinery Fitter	1,968	2,780
Electrical Engineering Technician	2,989	5,538
Electronics Engineering Technician	2,367	3,813
Manufacturing Engineering Technician	3,006	5,020
Mechanical Engineering Technician	2,941	4,516
Tool and Die Maker	2,385	3,576
Assistant Manufacturing Engineer	3,150	5,163
Assistant Mechanical Engineer	3,121	5,010
Electrical Engineer	4,416	6,945
Electronics Engineer	4,750	8,439
Mechanical Engineer	3,939	6,131
Industrial and Production Engineer	4,468	7,105
Product and Industrial Designer	2,960	4,863
<b>Management</b>		
Production Clerk	2,058	3,246
Management Executive	3,000	4,726
Managing Director/Chief Executive Officer	5,000	17,000
Manufacturing Plant/Production Manager	5,760	10,727
Technical/Engineering Services Manager	5,940	11,008
Chief Operating Officer/General Manager	8,534	17,843

Source: Occupational Wage Survey, Manpower Research & Statistics Department, Ministry of Manpower

### Notes:

- 1) Data pertain to full-time resident employees in the private sector establishments each with at least 25 employees.
- 2) Monthly Gross Wage refers to the sum of the basic wage, overtime payments, commissions, allowances, and other regular cash payments. It is before deduction of employee CPF contributions and personal income tax and excludes employer CPF contributions, bonuses, stock options, other lump sum payments and payments-in-kind.
- 3) 25th Percentile Wage refers to the wage level which divides the bottom 25% of wage earners from the rest.
- 4) 75th Percentile Wage refers to the wage level which divides the top 25% of wage earners from the rest.

# SKILLS FRAMEWORK FOR Career

## TECHNICAL AND ENGINEERING

Chief Executive Officer/Chief Operating Officer/Chief Technology Officer/

Chief Engineer

Product Engineer/Product Designer

Senior Engineer

Master Craftsman

Engineer

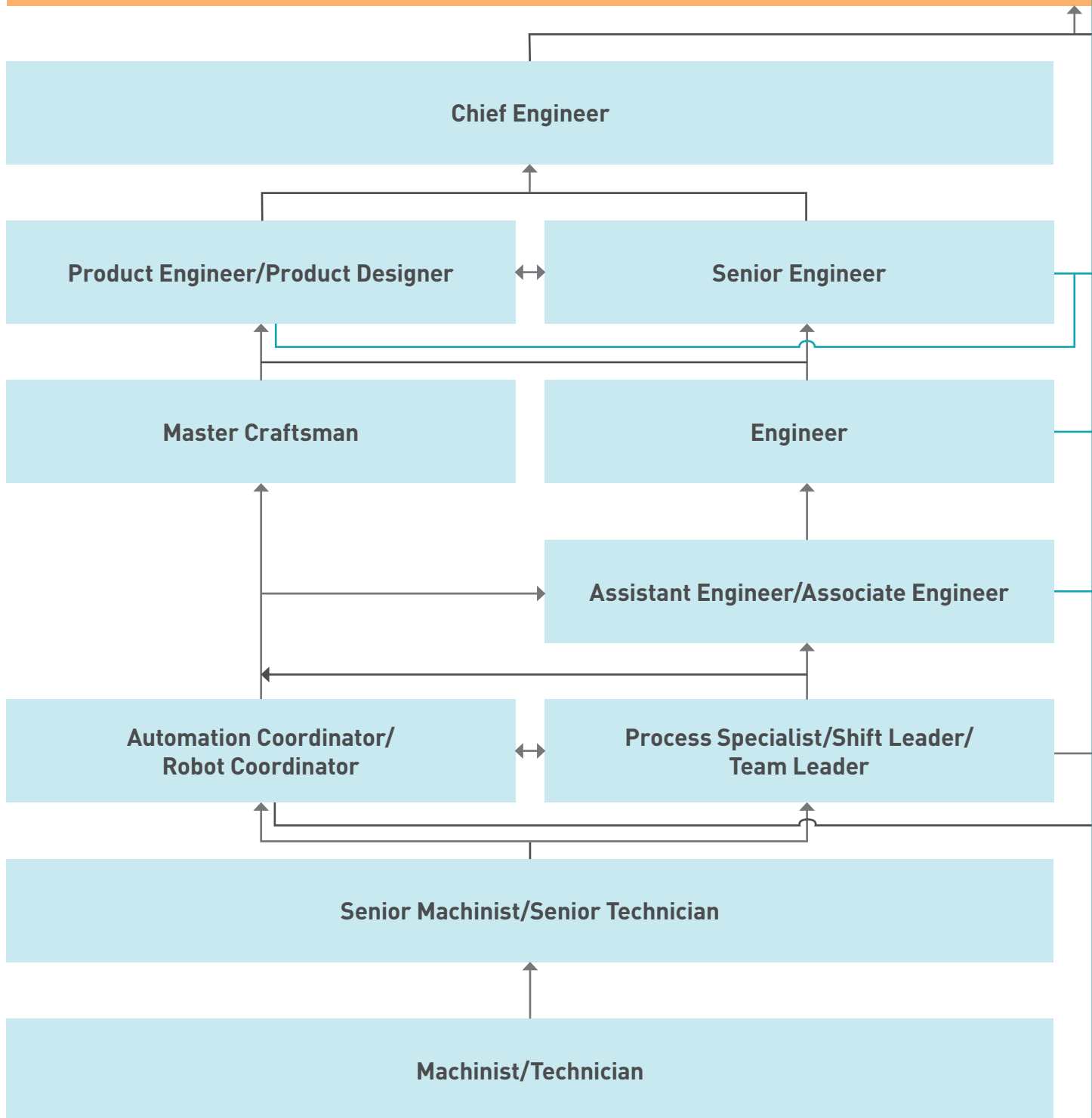
Assistant Engineer/Associate Engineer

Automation Coordinator/  
Robot Coordinator

Process Specialist/Shift Leader/  
Team Leader

Senior Machinist/Senior Technician

Machinist/Technician



# PRECISION ENGINEERING

## Pathways

### MANAGEMENT

Managing Director/General Manager/Vice-President

Plant Manager

Manufacturing Manager/Operations Manager/Production Manager

Assistant Manufacturing Manager/Section Manager

Production Supervisor

LEGEND

→ Vertical Progressions      → Lateral Progressions

The Career Map serves as a reference to reflect the available job roles and possible career pathways in the precision engineering sector, which may vary depending on each organisation's structure and business context. The career progression pathways would depend on individual performance, capability, experience, aspiration, as well as organisation needs.



# SKILLS FRAMEWORK FOR PRECISION ENGINEERING Career Pathways



Scan this QR code to find out more  
about the Skills Framework for  
Precision Engineering

