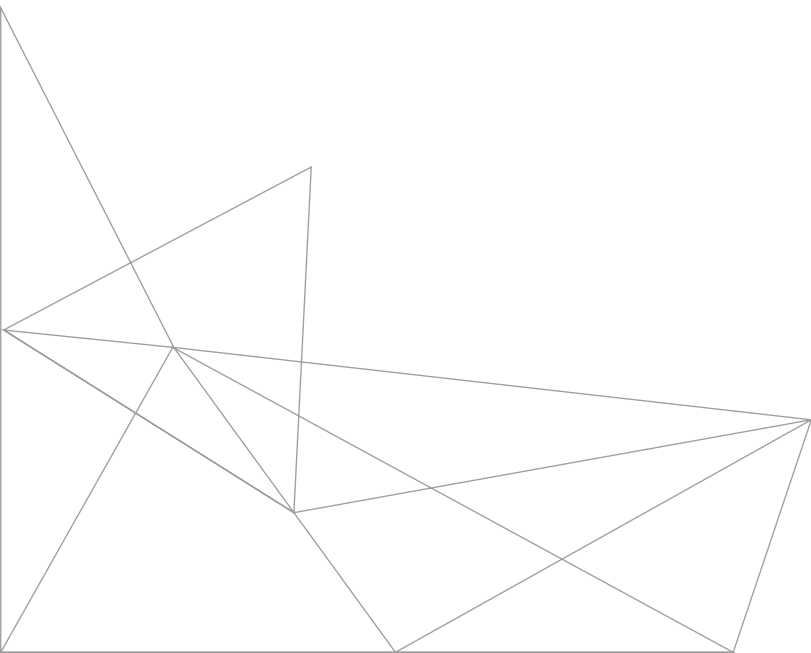


7

HIGH-QUALIFIED LABOUR AND SKILLS IN CORE MANUFACTURING INDUSTRIES



This chapter gives an in-depth analysis on the demand and supply of high-qualified labour in core manufacturing industries in Penang. The employer's hiring experience and job specifications are among the indicators for human capital landscape examined in this study. Measures taken by employers to mitigate skill shortages and skill gaps are discussed along with the future skill requirements.



7.1 High-tech manufacturing: Industrial electronics, semiconductors and optoelectronics

7.1.1 Industry overview

Investment structure

- Electronics & Electrical (E&E) Products remain the backbone of Penang's manufacturing investment. The industry accounted for about 61% of the total capital investment and created nearly 50,000 job opportunities, representing 57% of the total jobs created from 2011 to 2016.
- The industry is highly connected to the global economic events as foreign investment has consistently made up more than 90% of the total capital investment in E&E industry over past decades.
- Therefore, a shift in the world economy especially in advanced countries and industry cycles is likely to affect the global E&E demand, which will have a cascading impact on Penang's human capital landscape.

The steady-state industry with higher value-added activities

- High-tech manufacturing industry has experienced steady-state growth.
- Increased cost of operation has resulted in firms moving lower value-added manufacturing out of Penang. Moving up the value chain, many firms

have taken the step to downscale labour-intensive operations and shift to high value-added knowledge-oriented activities.

- Coupled with the emergence of Internet of Things (IoT) and wearable electronics, the nature of jobs has evolved following the shift in operations. At this juncture, more high value-added jobs are available in the fields of research, design and development.

Optimistic market growth in global semiconductors and LED

- Growth in the semiconductor industry is expected to accelerate in 2017 and 2018. The forecast by Gartner shows that worldwide semiconductor revenue is projected to increase by 12.3% in 2017, citing stronger commodity memory and improved unit production estimates for premium smartphones, graphics cards, and automotive applications.⁵⁷
- LED lighting is a growing industry. Malaysia's LED industry accounted for 10% of the global LED market and the industry was estimated to grow at 28% from 2013 to 2017 (PwC, 2013b). Penang-based LED companies are key contributors and have the largest share of research and development activities in Malaysia.

Industry composition and nature of operations

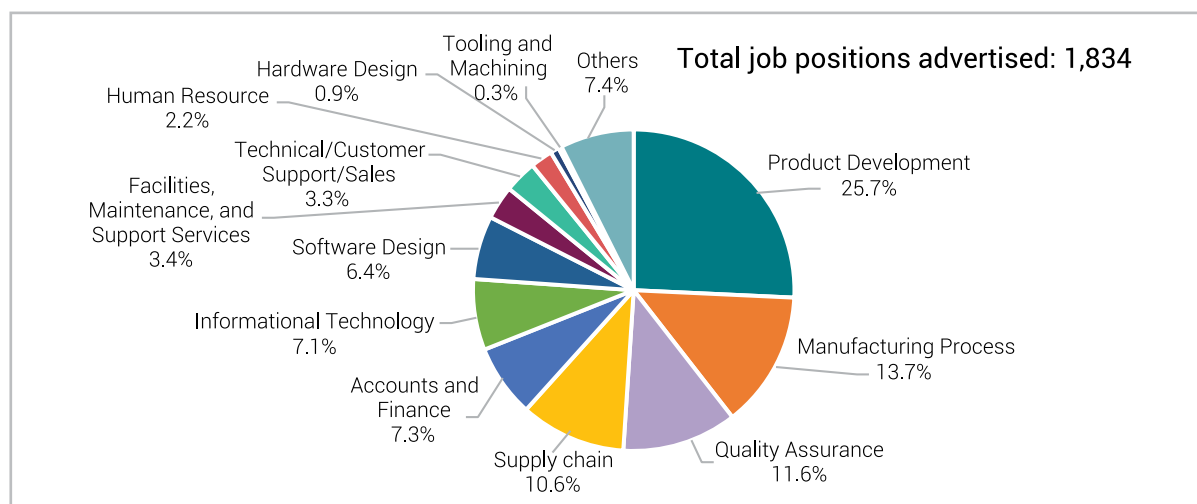
A majority of companies in this industry are located at the Bayan Lepas Free Industrial Zone, Penang. The industry can be divided into three main sub-industries as follows.

Table 7.1: Description of sub-industries of high-tech manufacturing in Penang

Sub-industry	Key industry players	Business activities	Operational activities
1. Industrial Electronics	Flextronics, Keysight Technologies, Dynacraft, Tai Ohm Electronic	Test and Measurement, Resistor, Plated Lead Frame, Printed Circuit Board Assemblies	Manufacturing, Order Management, R&D
2. Semiconductors	Intel Microelectronics, Renesas Semiconductor, Globetronics, ASE Electronics, Broadcom, Integrated Device Technology (IDT), Hewlett-Packard	Timing Devices, Semiconductor Chips, Semiconductor Solution	Manufacturing, Process Development, Product Development, R&D, Design Centre
3. Optoelectronics	OSRAM Opto Semiconductors, Lumileds Lighting, Itramas Manufacturing, Opulent Solutions	Light Emitting Diode (LED), Solid State Lighting, Printed Circuit Board, Thermal Solutions, Automotive Lighting	Design, R&D, Manufacturing, Engineering and Development

⁵⁷ Gartner (2017, April 13). Gartner says worldwide semiconductor revenue forecast to increase 12.3% in 2017. Press Release. Retrieved from <http://www.gartner.com/newsroom/id/3678417>

Figure 7.1: Major job titles advertised in high-tech manufacturing industry in Penang



Source: Vacancy database

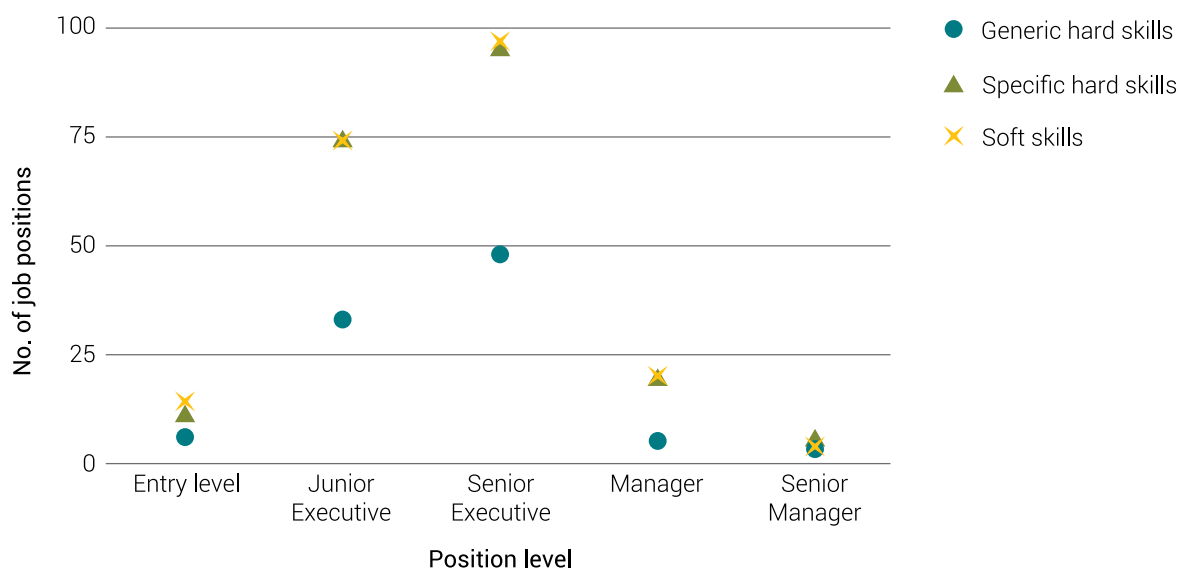
7.1.2 High-qualified labour demand

In Penang, high-tech manufacturing posted the largest number of job vacancies in the first half of 2016. Out of 4,455 job vacancies, firms advertised 41.2% or 1,834 where large foreign firms with more than 5,000 headcounts accounted for half of the top 10 recruiting companies. Flextronics advertised the highest number of job vacancies in Penang (13.5%), followed by OSRAM (11.8%), Keysight (8.3%), Plexus (7.5%) and Robert Bosch (6.3%) (Appendix A).

Product Development – largest share of high-qualified vacancies advertised

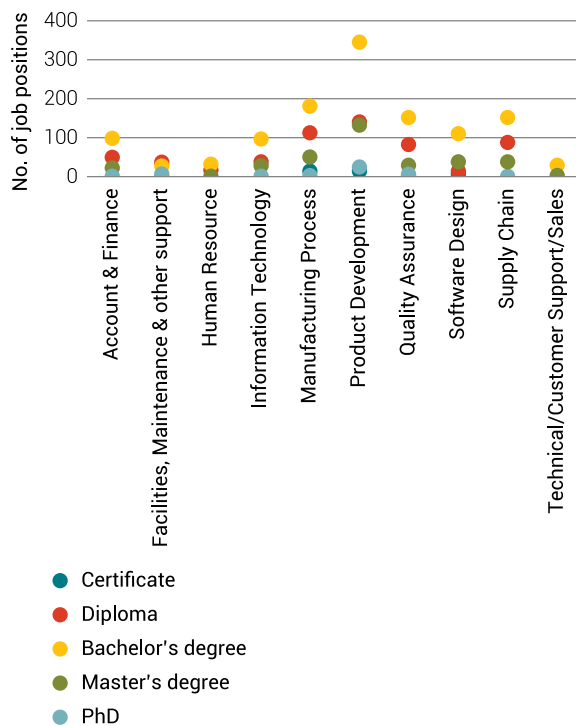
About one-fourth of the recruitment is made up of product development industry comprising Test Engineers, R&D Engineers, Mechanical Design Engineers and Process Development Engineers. This is then followed by manufacturing process (13.7%), quality assurance (11.6%) and supply chain (10.6%) (Figure 7.1).

Figure 7.2: High-demand jobs by types of skills and position levels



Source: Vacancy database

Figure 7.3: Top 10 jobs advertised by major job titles and educational requirements



Source: Vacancy database

The characteristics of high-demand vacancies are summarised as follows.

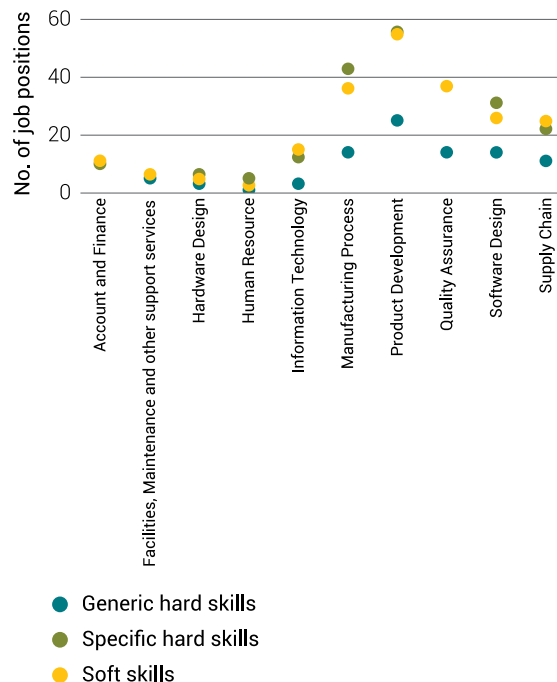
Position level: Senior executives

- A total of 46.5% comprise senior executive positions.
- Employees at senior positions are prone to circulate across larger firms due to the substantial vacant positions available.
- In the first six months of 2016, over half of these positions were advertised by large firms with more than 5,000 employees.

Skill-specificity: Technical positions

- Skill-specificity is particularly important in technical positions such as product development (R&D Engineers, Product Development Engineers and IC Designers) and software design (Software Engineers, Mobile Application Developers and Embedded Software Development Engineers).
- About 98% of job vacancies in software design and 83.5% in product development require specific hard skills.
- Software design positions include programming

Figure 7.4: Persistent job vacancies by types of skills and major job titles



Source: Vacancy database

languages (C++, ASP.Net, AJAX etc.) and knowledge in ERP system (Oracle, SAP, and Siebel).

- Product development positions require experience in mechanical drawings, SPC monitoring, IC design and product test technology.

Educational level: Bachelor's degree

- A majority of the advertised positions require Bachelor's degree except positions in facilities maintenance and other support services – higher number of positions requiring diploma education (Figure 7.4).
- Product development records the largest number of positions requiring Master's degree and PhD.

Most sought-after skills: Soft and specific hard skills

- For higher level positions, specific hard and soft skills gain more importance (Figure 7.2).
- Soft skills include achievement skills (self-motivation and results-oriented), relationship and service skills (communication, team player and interpersonal skills).

Generic hard skills: Foreign and English language skills needed

- Although generic hard skills are less emphasised by companies, foreign and English language skills are among the hard skills highly demanded.
- Foreign language skills such as Mandarin, Japanese and Korean are not only found in customer-related positions, but also in technical vacancies such as Mechanical Engineers, Electronic Project Engineers and Process Engineers.
- This means that these vacancies not only required candidates to have specific degree in engineering programmes, but also the ability to use foreign language is equally important.

Average length of job postings: more than three months

- While vacancies are advertised for 2.7 periods, high-demand vacancies take 6.7 periods, which correspond to slightly more than three months.
- For example, senior positions from software design are advertised for an average of 8.4 periods, equivalent to more than four months especially in Advanced R&D Software Engineers and Senior PHP Programmers and Expert C# Software Engineers.

7.1.3 High-qualified labour supply

Supply characteristics

The supply source

- Employers cast a wider net by recruiting workers not only in Penang, but also from other states in Malaysia. The workers comprise fresh university graduates – that is primary supply – in Penang and other parts of Malaysia, as well as by those who are currently employed – secondary supply.
- Employers also recruit workers from abroad when they cannot find suitable candidates locally.
- However, according to an interview with MIDA Penang, employers are encouraged to hire local workers rather than hiring expatriates. It is important that they explore all avenues to fill the position by a local before looking outside the country – regardless of the establishment's country of origin.

Abundance of job applications

- The majority of the surveyed employers receive an average of close to 100 job applications (45.5%) for

each job opening. Besides that, it is also striking to note that some firms collect an average of about 100–300 job applications for each advertised position (36.4%). These firms could be reckoned as “preferred” firms by jobseekers.

- This is consistent with JobStreet's analysis for Malaysia where an average of 218 job applications was received for engineering positions in 2016.

Recruitment profiles

Reasons for recruitment: Replacement of outgoing employees

- Replacing employees who have left the company is the main reason for job vacancies.
- This reason is cited by less reputable companies handling mid- to high- end manufacturing activities.
- The next key reason mainly highlighted by more reputable companies in high-end operations is business expansion. This coincides with the new investment plans announced by high-tech manufacturing companies – estimated to create approximately 1,000 new jobs.
- Strategic re-orientation of company activities is often referred to by well-established, large foreign companies embracing high-end manufacturing operations.

Other recruitment channels: Employee network

- Apart from using JobStreet.com for recruiting new hires, the majority of respondents also use employee network as one of the key avenues to tap into the potential recruiting high-qualified employees.
- Nearly 83% of the total respondents make use of their employee network for this reason.
- Some companies implement an employee referral programme where they incentivise their existing workforce to recommend new employees using their personal network and reward them when the new employees pass their probation period.

7.1.4 Human capital issues and challenges

Quantitative supply constraints

About 16% of total job vacancies can be defined as persistent. These vacant positions could potentially be hard-to-fill, holding all other assumptions constant. The characteristics of positions that require a longer duration to fill are summarised below.

Position level: Senior executives

- A longer time is required to fill vacancies if employers demand higher-qualified candidates with more work experience.
- Senior executive positions have the highest level of persistent vacancies (46.1%) followed by junior executives (35.6%).
- A high percentage of jobs require more than five years of experience, which records at 42%; 23.1% require workers to have two to five years of work experience; and 30.8% required less than two years of work experience.

Most affected job functions: Software design

- Software design has the largest proportion of persistent vacancies.
- Over one-quarter of the vacancies are advertised for more than four periods of mining – equivalent to two months. This is then followed by positions in quality assurance (19.8%) and manufacturing process

(19%), while accounts and finance have the least occurrence of persistency (11.2%).

More specific hard and soft skills in technical positions than non-technical positions

- Technical positions with lower requirements in hard skills (Figure 7.4) include information technology, manufacturing process, product development, quality assurance and software design.
- In non-technical positions, only supply chain has shown a big difference between the requirement of generic hard skills and non-generic hard skills.
- All job positions highly value the importance of soft skills along with specific skills except positions in manufacturing process and software design.

Most affected skills: Specific and soft skills

- Over 80% of persistent vacancies require applicants to have specific hard skills and soft skills.

Box 7.1: Employer surveys of high-tech manufacturing: Hard-to-fill vacancies

The majority of respondents cite that recruitment can be different in terms of **length of time taken** to fill a vacancy. About 64% of them find differences in time across job functions.

- Jobs taking the least time to fill: Administrative, fresh engineers, process and product operation engineers, support services such as finance, human resources and facility.
- Jobs taking the longest time to fill: Engineers, chargemen, IC designers and product development engineers taking about 4-5 months and senior positions.

All hard-to-fill positions mentioned are technical ones (Table 7.2). These closely correspond with the critical occupation list (COL) identified by MIDA Penang specifically in high-tech manufacturing sub-industries. **Hard-to-fill positions** such as IC Design Engineers cut across both junior and senior positions.

Table 7.2 Hard-to-fill job positions over the past two years

No.	Hard-to-fill positions	Position level
1	Reliability Engineers	Senior Executives
2	Product Optimisation	Senior Executives
3	Product Development Engineers	All
4	Process Engineers	Directors
5	IC Design Engineers	All
6	Data Scientists	Mid-level
7	Robotics and Automation	Mid-level

Source: Employer survey

The majority of hard-to-fill vacancies involve **experienced workers**, signaling the difficulty to hire senior or higher level workers. Hence, the undersupply of high-qualified experienced labour remains a key challenge in high-tech manufacturing industries.

The key reasons for the inability to fill vacant positions relate to qualitative reasons. These include too specialised skill requirements, insufficient work experience, soft skills deficiency and rigid terms and conditions. These make up the most-cited qualitative skill shortages.

Conclusion: The shortage of experienced workers in the field of engineering is particularly more critical than the shortage of non-experienced workers.

Partly prepared fresh graduates, and “satisfactory” skill integration of experienced hires

- While a majority of graduates are poorly prepared for the positions offered to them, 27.3% of total employers quote fresh graduates as being ill-equipped for the positions.
- Reasons for poor preparation include lack of required hard skills, soft skills and English language skills. Poor attitude/personality and lack of working experience or maturity are the next most cited reasons.
- As for the level of skill integration of experienced hires, there is some degree of skill-relatedness among companies in Penang, which intensifies labour movement. Skills acquired from previous employment could be highly related to skills required by current employers.
- 54.5% of the respondents cite “good” for experienced hires and 36.4% state “satisfactory”.

Experienced hires demand for high salaries

- The majority of the respondents note that applicants demand high salaries. Most experienced candidates expect a substantially higher salary (10–15% more than their current salaries) with some demanding even more. Meanwhile, others request a high salary and less work load.

Skill gaps

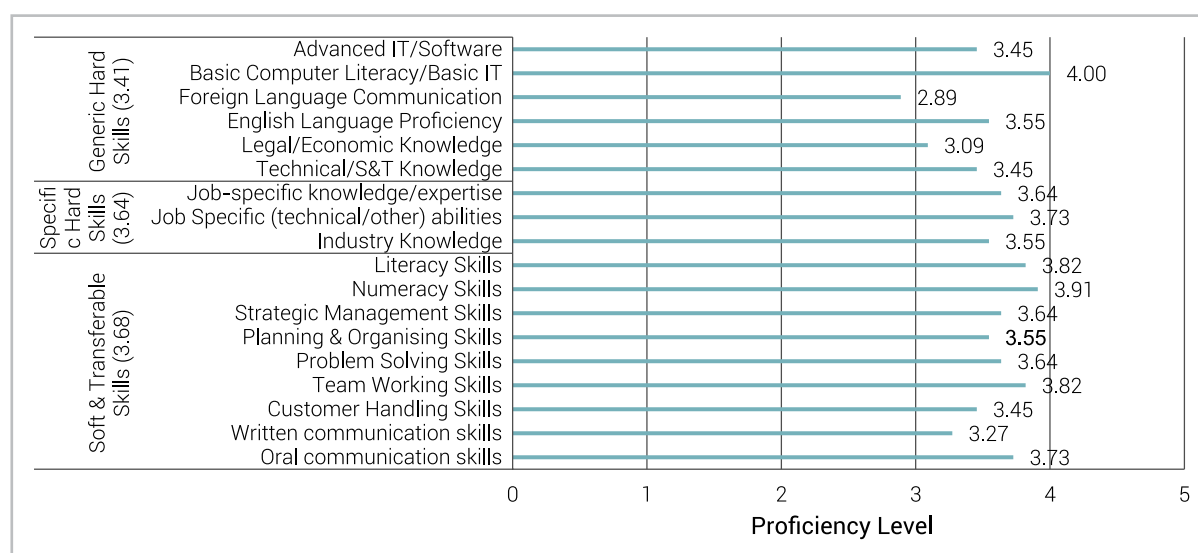
Proficiency levels: Deficiency in generic hard skills

- In a scale of one to five with five being highly proficient, current employees, on average, are relatively more proficient in soft and transferable skills (3.68) than in specific hard skills (3.64) and generic hard skills (3.41). Scoring the lowest in proficiency, generic hard skills are yet to fulfill employers' needs. Foreign language communication accounts for the lowest skills proficiency (2.89), followed by legal/economic knowledge (3.09). In contrast, basic computer literacy or IT is rated the highest in generic hard skills (4.0). This shows that a higher education system is able to produce workers with high competencies in basic computer skills, but not in foreign language communication and economic knowledge.

Positions where skills need the most improvement – Engineering

- Engineering positions (which include package development, material development, reliability lab, robotic and automation and IC design) are frequently mentioned by employers in regard to areas where improvement is needed. Engineers are required to improve communication skills, problem-solving, critical thinking, customer service, and presentation skills. Hard skills that need most improvement include product knowledge, test and package development, and software programming concept.

Figure 7.5: The skills proficiency level of current high-qualified employees by types of skills in high-tech manufacturing in Penang



Note: 1=Very low proficiency; 2=Low proficiency; 3=Satisfactory; 4=Proficient; 5=High proficiency
Source: Employer survey

7.1.5 Moving forward: Future skill requirements

Acquiring new skills due to newly emerging tasks

- Most employers believe that employees need to acquire new skills as a result of newly emerging tasks in the next 12 months. "The development of new products and services", "the introduction of new technologies or equipment" and "increased competitive pressure" are expected to introduce new emerging tasks. This finding corroborates with the results highlighted in the overall industries where manufacturing value chain is expected to impact the operation of R&D, IT software and programming, and sales and marketing.

Ability to meet future needs – generic hard skills but not in specific hard skills

- The prospective generic hard skills and soft skills will be able to meet future needs. Generic hard skills make up the activities of optical engineering, process improvement, SAP knowledge, phosphor technology, procurement and IT application development. Specific skills, on the other hand, may have little potential to meet future needs. These skills are related to the areas of robotic engineering, programming languages, scripting languages and test application. This future skill-set is in fact consistent with industrial evolution, which gears towards artificial intelligence, big data and cloud computing.

7.2 Other high-tech manufacturing: Electronics manufacturing services, telecommunication products, and magnetic & optical recording storage

7.2.1 Industry overview

Labour retrenchment due to firm closure and downsizing

- In the storage market, shipments of hard-disk drives

(HDD) have seen a sharp decline in recent years. It has been overtaken by solid-state drive (SSD) in storage solutions for ultrabooks and ultrathin notebook PCs.

- In view of this shift, Penang, which used to be home to hard-disk drive makers, experienced closures and employee layoffs in the past two years. Re-orientation of organisation has also caused communication equipment producers to close down part of its facility.
- Nearly 3,000 employees were retrenched or had accepted voluntarily separation scheme (VSS) in the manufacturing sector in 2016; more than double the number in 2015.
- In particular, data storage producers have laid off the most number of employees with a total of 4,650 workers affected (Table 7.3). In light of the demand for skills, the majority of these workers have been absorbed by other companies, as over 10,000 jobs have been created in the past three years, according to MIDA figures.

Increased demand of Electronics Manufacturing Services (EMS)⁵⁸

- The activity of outsourcing production of parts and components for electronics products has continued popularity in recent years. Due to the rapid change in "smart" electronics, the role of EMS providers is to integrate the change and vertically complement the needs of Original Equipment Manufacturers (OEMs) in the manufacturing value chain.
- Within the Automotive and Lighting sector, growth is projected at 23.6% annually until 2020.⁵⁹

Industry composition and nature of operations

Electronics Manufacturing Services (EMS) makes up nearly 40% of other high-tech manufacturing firms in Penang. This is then followed by consumer electronics (21.9%), data/telecommunication & IT products (17.1%), computer peripherals (15.2%), and magnetic and optical recording/storage media (7.6%). Other high-tech manufacturing industries can be categorised into four main sub-industries, and the nature of business operational activities are presented in Table 7.4.

⁵⁸ EMS involves multiple industries. These include computing, consumer devices, avionics, medical, robotics services, cloud server, and automotive.

⁵⁹ PwC (2017). Market analysis for EMS/Distributors. Technology Scorecard. Retrieved from <https://www.pwc.com/gx/en/industries/technology/scorecard/ems-distributors.html>

Table 7.3: List of firms exiting manufacturing operations in Penang as of October 2016

Exit companies (reported)	Type of manufacturing activities	Number of workers affected
Seagate Technology Plc ⁶⁰	Disk drive maker	3,000
Western Digital Corporation	Disk drive maker	1,200
Rubicon Technology Inc	LED substrate	-
Amphenol Corporation	Communication equipment	150
HGST Technologies Malaysia	Hard-disk drive maker	450
Fairchild Semiconductor	Semiconductor	1,000
Total workers affected		5,800

Source: Various news reports. Only companies that reported their status are captured.

Table 7.4: Description of sub-industries of other high-tech manufacturing in Penang

Sub-industry	Key industry players	Business activities	Operational activities
1. Computer peripherals	Smart Modular Technologies, Scarmel, Unico Electronics	Designer, manufacturer and supplier of speciality of memory and storage solutions, computer hardware	R&D; manufacturing; logistics.
2. Electronics Manufacturing Services (EMS)	Alliance Contract Manufacturing, Cincaria, Inari, Paramit, Sanmina-SCI Systems, Polar Electro, Schott Glass, Venture, Kontron, Benchmark Electronics	Contract manufacturing, Electro-mechanical assembly, technical services	Design and manufacturing; global procurement and supply management; product functional testing and validation; packaging, and logistics.
3. Data/ Telecommunication & Information Technology products (hardware)	Amphenol TCS, G-Tek Electronics, Motorola Solutions, TF-AMD	Communication solutions; Connectors; Telecommunication equipment & related products; micro devices	Design, precision engineering; Manufacturing and R&D; Supporting operations: global purchasing operations, global procurement.
4. Magnetic & optical recording/storage media	National Instrument, Sandisk Storage Malaysia, TS Matrix	Electronics, flash memory storage, memory modules	Manufacturing, R&D and IT.

7.2.2 High-qualified labour demand

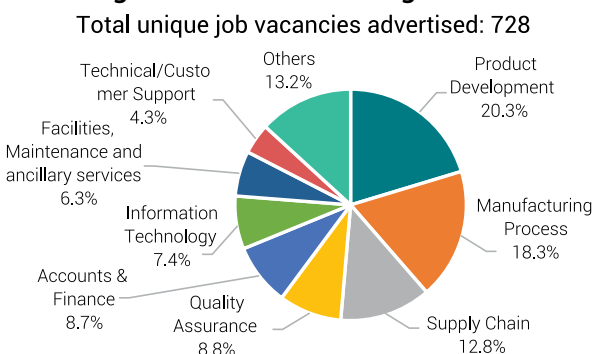
In the first half of 2016, a total of 728 job vacancies have been advertised by recruiting firms. Of this, Motorola advertised the highest number of job vacancies in Penang (12.5%), marginally followed by Sandisk (11.7%), National Instruments (8.0%) and Sanmina-SCI Systems (7.3%).

Product development – the key high-qualified vacancies

Product development accounts for the largest share of high-qualified vacancies advertised by other high-tech manufacturing industries: approximately one-fifth (Figure 7.6). This is then followed by manufacturing process (18.3%), supply chain/procurement (12.8%), quality assurance (8.8%), accounts and finance (8.7%) and information technology (7.4%). This suggests

that recruitment is actively concentrated on product innovation, which requires knowledgeable workers to undertake research, design and development activities.

Figure 7.6: Major job titles advertised in other high-tech manufacturing industries



Source: Vacancy database

⁶⁰ Job vacancies posted by Penang Seagate made up 6.5% of the total vacancies in this industry despite restructuring plan on the closure of its manufacturing facility – where job cuts reportedly affect mainly employees in production.

Figure 7.7: High-demand jobs by types of skills and position levels



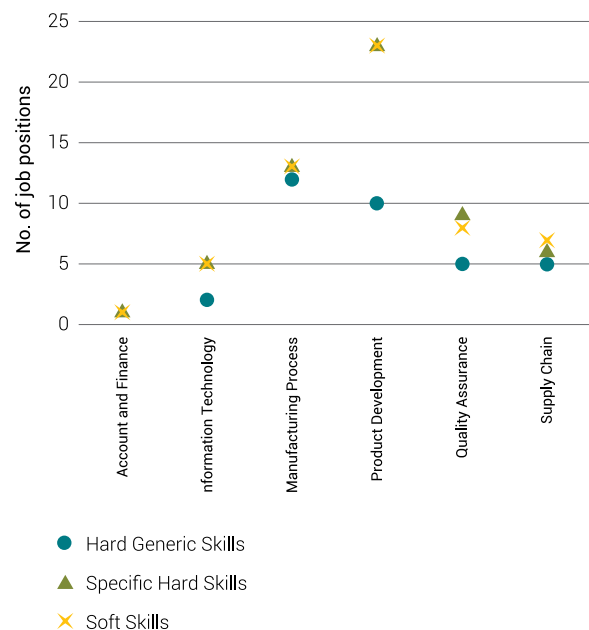
Source: Vacancy database

The characteristics of high-demand vacancies are illustrated as follows.

Position level: Junior executives

- Nearly 43% of positions concern junior executives, followed by senior executives (34.5%).
- In junior positions, the majority of vacancies require up to five years of work experience; they are mostly advertised by firms with 1,001–2,000 headcounts.
- According to the employer survey, while fresh graduates and applicants with more than two years of work experience are mentioned by most companies, the latter remain as the predominant target in hiring.
- Recruitment of junior positions is largely in the job functions of manufacturing process, supply chain/procurement, quality assurance, and accounts and finance.
- Unlike technical positions, non-technical positions such as supply chain/procurement, and accounts and finance are less restrictive as most of these

Figure 7.8: High-demand major job titles by types of skills in other high-tech manufacturing industries



Source: Vacancy database

positions require less than five years work experience.

Skill-specificity: More prevalent in junior, senior, and technical positions

- In contrast to the junior positions in high-tech manufacturing, this industry witnesses a great number of junior positions requiring specific hard skills along with soft skills. This trend is clear in the technical job functions, namely product development, quality assurance and information technology.
- For instance, a PCB Layout Development Engineer in Robert Bosch is required to possess basic knowledge in product engineering and problem-solving skills such as FMEA, DFMA, 8D, etc.
- Meanwhile, a QA Engineer in Sandisk Storage is required to have knowledge in PCBA manufacturing process and experience in manufacturing product quality management; and an IT Programmer Analyst in NI Malaysia is required to be proficient in multiple technologies including database systems, PL/SQL, Java and Oracle applications.

Educational level: Bachelor's degree

- Candidates with Bachelor's degree are highly demanded across all major job functions. This is then followed by requirement for Diplomas.

Highly sought-after skills: Soft skills

- Soft skills are highly sought-after across all levels of job positions (Figure 7.7).
- Similar to the results found in high-tech manufacturing, companies put greater emphasis in soft skills as the level of position becomes higher.
- Specifically, achievement skills are the most frequently requested soft skills; this involves 64.3% of the high-demand vacancies.
- For example, a PCB Design Engineer in Motorola Solutions is required to be self-motivated while Product Engineers are required to possess analytical and problem-solving skills.

Generic hard skills: English language and legislative and regulatory awareness skills

- A good command of English language is predominantly mentioned by other high-tech manufacturing companies; about 27.4% of the vacant positions require fluency in technical English. Interestingly, this proportion is higher than the overall vacancies posted in the industry (26.2%), indicating that English language skills are key generic hard skills preferred by other high-tech firms.
- Competencies in legislative and regulatory rank the second-highest sought-after requirement across generic hard skills; about 16.7% of high-qualified positions need these competencies to ensure compliance with corporate and government policies and procedures. This is highly needed in supply chain/procurement positions where about one-quarter of the vacant positions asked for these skills.
- For example, Supply Chain Security Specialists in Motorola Solutions are required to understand regulatory licensing and requirements in relation to supply chain security and trade compliance certification.

Average length of job postings: Exceeding three months for high-demand vacancies

- On average, while companies advertise for 2.6 periods, high-demand vacancies take 6.4 periods, which correspond to slightly more than three months.
- Senior positions in product development post an

average of 6.6 periods or more than three months, particularly Software Engineers, Electrical Engineers and Digital Design Engineers.

7.2.3 High-qualified labour supply

Supply characteristics

The supply source

- Firms prioritise offering job offers to local high-qualified workforce.
- According to the employer survey, half of respondents recruit employees from Penang who are attached to Malaysian companies in mid- to high- end manufacturing constituting the majority.

Recruitment profiles

Reasons for recruitment: Firm's expansion

- Firm's expansion is the main reason for recruitment. Four out of five firms that cite firm's expansion originate from the United States (US).
- When the US companies are active in hiring new staff due to firm's expansion, other high-tech manufacturing performs relatively better than other industries.
- Meanwhile, replacement of employees who have left the company is cited as the next reason for high-qualified job openings.

Other recruitment channels: Employment agencies

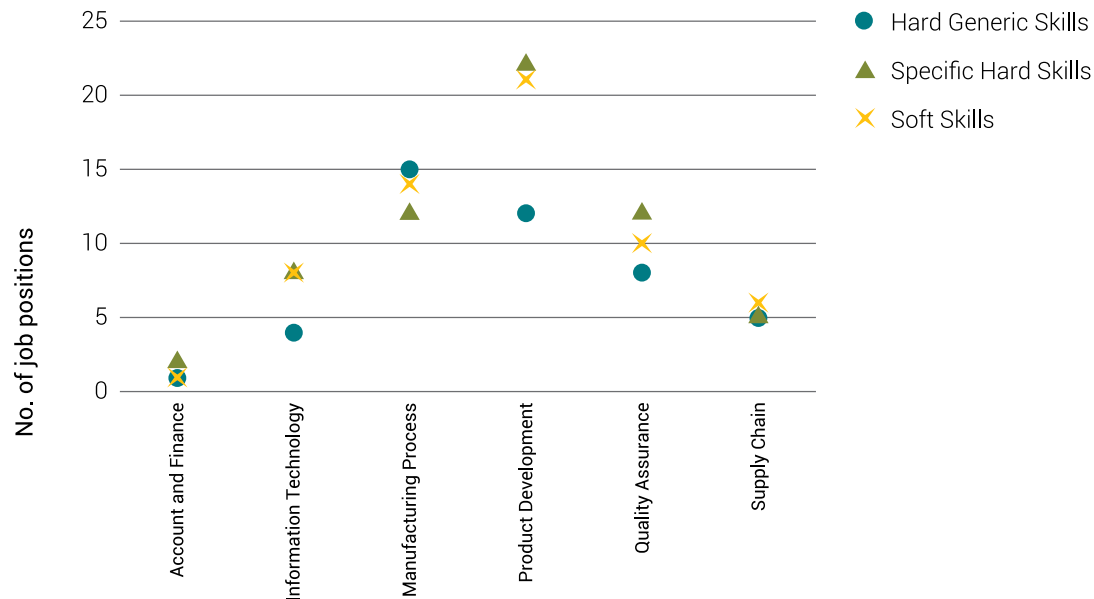
- Apart from using JobStreet.com, a majority of the respondents also engage agencies to recruit high-qualified employees.
- About 80% of the total respondents make use of these agencies.

7.2.4 Human capital issues and challenges

Quantitative supply constraints

The constraints of high-qualified supply are examined in positions that require a longer duration to fill. About 12.5% of unique job vacancies are reported to be persistent – advertised for a period of at least two months. The characteristics of hard-to-fill high-qualified vacancies are presented as follows.

Figure 7.9: Persistent job vacancies by types of skills and major job titles



Source: Vacancy database

Position level: Senior executives

- While junior positions are high in demand, these positions relatively do not take as long to fill as vacancies for senior positions.
- Senior positions constitute about 43% and the same proportion goes to positions that require more than five years of work experience.
- As an example, Sandisk Storage advertised for six consecutive periods – which is approximately three months – for a Senior Production Planner with at least five years of work experience.

Harder to fill positions require specific skills

- Technical positions such as product development (Staff/Senior Electrical Engineers, Product Engineers) and quality assurance (QA Engineers, Experienced Debug Engineers) are harder to fill, requiring more specific skills than soft skills (Figure 7.9).
- Unlike high-demand vacancies, persistent vacancies seek candidates with specific skills to meet job requirements. While the skill requirements for information technology (IT Analysts, Senior Java Analyst Programmers) are comparable, persistent vacancies in manufacturing process (Manufacturing Equipment Engineers, Industrial Engineers) require more generic hard skills for high-demand vacancies in general.

Most affected skills: Soft skills

- About 82% of the high-qualified vacant positions weigh the importance of soft skills followed by specific hard skills (76.9%) and generic hard skills (62.2%).
- Within soft skills, vacant positions requiring achievement skills take a longer time to fill followed by relationship and service skills.
- Personal effectiveness, which is equivalent to the ability to work independently and handle stress is the next most affected soft skills.

Most affected job functions: Product Development

- While quality assurance field makes up the largest share of persistent vacancies, they take marginally shorter time to fill compared with product development and information technology, which are advertised for an average six periods – corresponding to three months.
- Product development and information technology on the other hand post as long as 6.2 periods and 6.1 periods respectively – more than three months.
- Within product development, Senior Electrical Engineers (Power Amplifier), Senior Electronics FPGA Engineers and Staff Engineers (Application) are advertised for four consecutive months.
- Strikingly, entry level IT Programmer Analysts are advertised longer than five consecutive months while Senior Programmer Analysts are advertised continuously for more than four months (see Box 7.2).

Box 7.2: Employer survey of other high-tech manufacturing: Hard-to-fill vacancies

Some companies have not succeeded in filling all the vacant high-qualified positions. From Table 7.5, it can be seen that the unfilled positions are largely attributable to lack of applicants in highly demanding specialised skills. This refers to job functions in product development, information technology and supply chain.

Table 7.5: Reasons for high-qualified positions not being filled

Reasons not being filled	Job titles
Qualitative	
Positions require highly demanding specialised skills	RF Sustaining Engineers, Supply Chain Managers,
Applicants wrongly qualified	RD Debug Technicians, Product
Applicants are too demanding	Managers/Supervisors, CMM/CNC Programmers,
Applicants lack generic skills (hard)	Senior Programmer Analysts
Applicants lack the right attitude	Electrical Design Engineers
Quantitative	Engineers, Supervisors
	IT Executives
	Supervisors
Quantitative	
Too much competition	NPI Engineers, Machinists, Welders, QA Engineers

Source: Employer survey

Some job vacancies can remain unfilled due to too much competition. This competition can likely be explained by the skill similarity among job positions leading to the quantitative shortage of skill supply. The job vacancies involve a number of areas: product development (NPI Engineers), quality assurance (QA Engineers) and machining (Machinists and Welders).

The majority of the respondents mention that recruitment differentiates in terms of the **length of time taken** to fill a vacancy.

- Jobs requiring the least time to fill: Junior engineers, manufacturing engineers, technicians and sales.
- Jobs requiring the longest time to fill: Embedded software engineers, NPI engineers, test engineers and R&D engineers.

Hard-to-fill positions consist of technical and non-technical positions (Table 7.6). In particular, **hard-to-fill positions** such as Embedded Software Engineers, Hardware Designers and PCB Design Engineers cut across both junior and senior positions while R&D Hardware Engineers are hard to fill at managerial level. Meanwhile, non-technical positions such as Regulatory Compliance Officers are difficult to fill at director level.

Table 7.6: Hard-to-fill job positions over the past two years

Hard-to-fill positions	Position level
Product Development and manufacturing process	
R&D Hardware Engineers	Managers
NPI Engineers; Debugging Engineers	Mid-Level
Electrical Design	Senior
Hardware Designers; Embedded Software Engineers;	Junior & Senior
PCB Design Engineers,	
Process Engineers	Engineers
CNC/CMM Programmers	Executives
Supply Quality Engineers; Tool & Die Engineers	-
Information Technology	
System Analysts; SAP-FICO	Executives
IT Engineers	Mid-Level
Database Admin	Junior & Senior
Non-technical positions	
Regulatory Compliance Officers	Directors
Program Directors	Directors
Safety & Compliance Officers	Junior & Senior

Source: Employer survey

Conclusion: Hard-to-fill vacancies are more likely to affect junior and senior technical positions than non-technical positions.

Partly prepared fresh graduates; "satisfactory" skill integration of experienced hires

- Respondents collectively indicate that not all positions that had been filled fully match the job requirements in advertisements.
- Particularly, six out of 10 employers indicate that fresh graduates are partly prepared for the tasks.
- For underprepared fresh graduates, lack of required hard skills such as technical knowledge or job-specific knowledge is the most cited reason. This finding also reflects the necessity to improve practical training by schools and universities supplementing teaching and learning of theory.
- Despite the fact that the majority of the respondents are satisfied with employees' existing skill integration in the establishments, lack of soft skills such as problem-solving and teamwork are the reasons for the poor integration of experienced hires. Half of them cite "good" for the level of skill integration while the rest state "satisfactory".

Employees' preferences towards multinational corporations

- About 80% of the respondents on average receive close to 100 applicants for individual job vacancies posted. One respondent reports 100–300 job applications.
- Looking at the firms' countries of origin, more than 50

job applications per vacancy are from non-Malaysian companies, mainly originating from the United States. This further emphasises labour preferences towards multinational corporations.

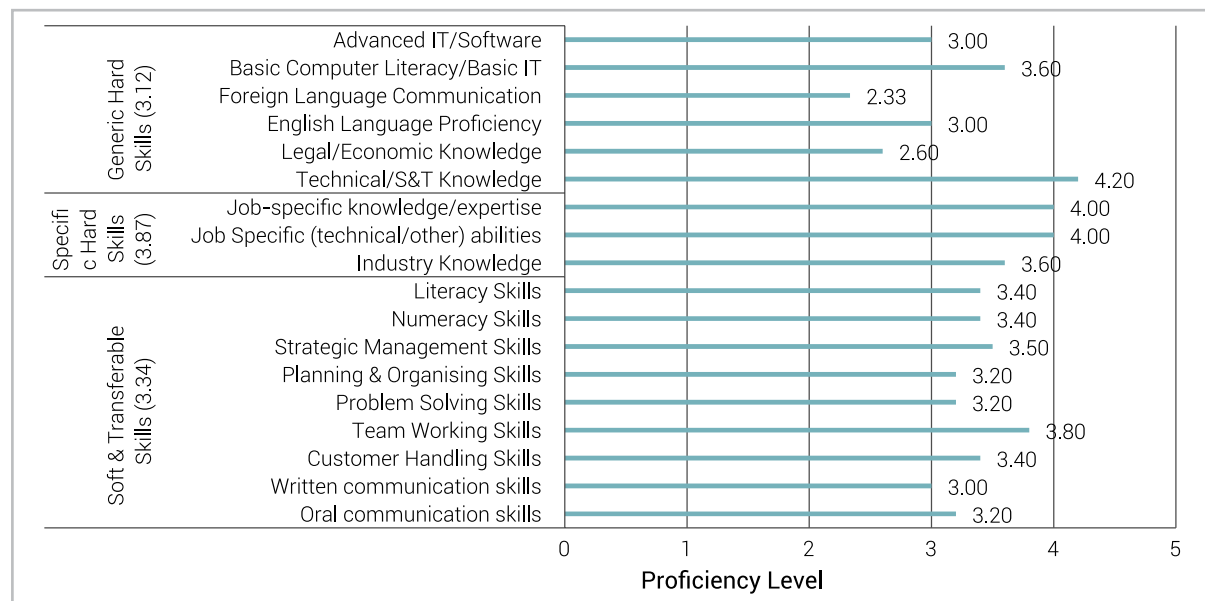
- Jobs in more reputable multinational corporations tend to be more attractive than others. Competitive pay structure and opportunities for overseas training are among the reasons diverting many high-qualified jobseekers away from SMEs.

Skill gaps

Proficiency levels: Satisfactory in specific hard and soft skills but not in generic hard skills

- In a scale of one to five with five being highly proficient, current employees are relatively more proficient in specific hard skills and soft skills (3.78) than generic hard skills (3.27). All specific hard skills score not less than 3.5, implying that employers are satisfied with the industry knowledge and job-specific abilities and knowledge possessed by their current employees (Figure 7.10).
- Foreign language communication on the other hand rates the lowest in generic hard skills (only 1.78) with legal and economic knowledge also trailing behind others (2.67). Meanwhile, English language proficiency scores the highest at 4.17.

Figure 7.10: The skills proficiency level of current high-qualified employees by types of skills in other high-tech manufacturing in Penang



Note: 1=Very low proficiency; 2=Low proficiency; 3=Satisfactory; 4=Proficient; 5=High proficiency
Source: Employer survey

Positions where skills need the most improvement – Engineering

Engineering positions (which include R&D Engineers, RF Debug Engineers, FPGA Engineers, PCB Design Engineers, Manufacturing Engineers, E&E Engineers, etc.) are often mentioned by employers in response to skills needing that the most improvement. Both hard and soft skills need to be improved. Employees are required to enhance hard skills such as RF knowledge, Cardence Allegro, PLC automation and Auto CAD tool, while soft skills include problem-solving, organisational and communication skills.

7.2.5 Moving forward: Future skill requirements

Acquiring new skills due to newly emerging tasks

- All respondents to the survey indicate that current employees need to acquire new skills in anticipation of newly emerging tasks in the next 12 months. “The development of new products and services” is expected to lead to emerging of new tasks followed by “the introduction of new technologies or equipment”.

Ability to meet future needs – selected specific hard skills

- The prospective skills needed in the future on gravitates towards generic hard and specific hard skills but not soft skills. Generic hard skills include electronic skills, root cause analysis, data automation and predictive maintenance, which are expected to meet future needs whereas hardware design, CAD, Cardene Allegro mentor graphics, RF sustaining, RF debug and electrical design are not expected by employers to meet future needs. Additionally, high-demand positions in the next two years include **Software Engineers, QA Engineers, CNC Technicians, Process Engineers, Mechanical Engineers, System Analysts and Electrical Design.**

7.3 Precision engineering, machining and automation

7.3.1 Industry overview

A solid locally grown industry with foreign and large

local companies support

- The precision engineering, machining, and automation industry has made an attempt to develop beyond a position as support industry to MNC establishments with varying success. It continues to play an important role in making manufacturing processes more efficient and sustainable. With more than 150 companies operating in this industry, the majority of them are small and medium enterprises (SMEs).
- This industry constitutes the second-largest capital investment after E&E products. It contributed about 7.2% of Penang's total investment and created 5,440 jobs from 2011 to 2016.
- Unlike high-tech manufacturing, this industry is primarily driven by local companies where in 2016 alone, approved domestic capital accounted for over 90% of investment. However, a number of locally established companies in this industry have been taken over by foreign firms.

New cluster development – Penang Automation Cluster (PAC)

- To support local SMEs, three large local companies (LLCs) – ViTrox, Pentamaster Technology and Walta Engineering – are jointly investing RM63 million to develop the Penang Automation Cluster (PAC) on a five-acre piece of land in SME Village in Batu Kawan by 2019. Being marked as the first in Malaysia, the automation cluster aims to support local SMEs in precision metal fabrication, and to turn the SME Village into a one-stop metal component supply hub.⁶¹
- PAC plans to accommodate 18 SME companies equipped with state-of-the-art machinery and world-class metal component supply chain management, which will benefit the semiconductor, electronics, aerospace and medical devices industries.
- Some 500 skilled jobs will be created by the cluster, with qualified employees given the opportunity to attend German Dual Vocational Training – or Meister Programme.

Industry composition and nature of operations

This industry is divided into two sub-industries – precision engineering, tooling & machining and Automation the details of the sub-industries are presented in Table 7.7.

⁶¹ Invest-in-Penang (2017, February 8). Penang announces RM63 million Penang Automation Cluster. News and Events. Retrieved from http://www.investpenang.gov.my/news-detail.php?group=2017&sub_group=February&pid=31

Table 7.7: Description of sub-industries of precision engineering, tooling & machining and automation

Sub-industry	Key industry players	Business activities	Operational activities
1. Precision engineering, tooling & machining	Eng Technologies, Sam Engineering, UWC Group of Companies, Uni-Vessel Engineering, AT Precision Tooling, Kobay Technology, Rapid Precision Technology	Manufacturing of sheet metal; hard disk; machining & medical devices	Precision components & tool & die fabrication; Manufacturing of machineries & equipment; Research & development
2. Automation	ViTrox, Micro Modular System, Esmo Automation (M), BBS Automation, Pentamaster Technology	Advanced Automated Vision Inspection System; Industrial automation for LED & semiconductor	Research & development; Design & manufacture

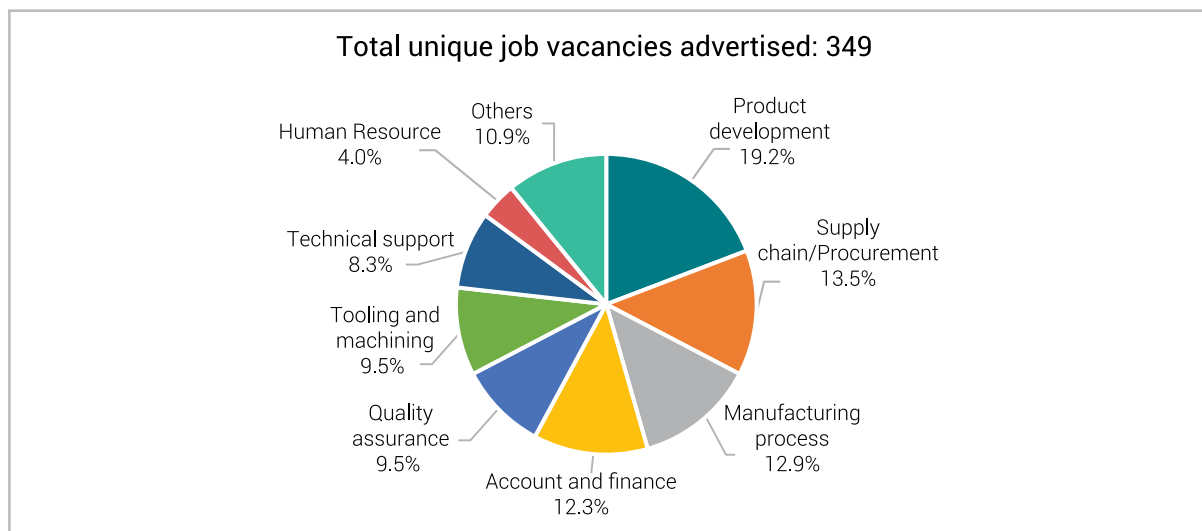
7.3.2 High-qualified labour demand

In the first half of 2016, this industry had the least number of job openings in manufacturing industries, accounting for 349 vacancies. ViTrox advertised the highest number of job vacancies in Penang (16.9%), followed by SAM Engineering (8.3%) and Mattel (6.9%).

Product development as the key high-qualified workers needed

The hiring activity is largely seen in job functions of product development in the fields of machinery design and industrial system solutions. Out of 349 positions advertised, product development made up almost 20% of vacancies (Figure 7.11). R&D Engineers, Mechanical Design Engineers and System Control Engineers are the typical vacancies advertised in this area. This was followed by supply chain/procurement (13.5%), manufacturing process (12.9%), accounts and finance (12.3%) and quality assurance (9.5%).

Figure 7.11: Major job titles advertised in precision engineering, tooling & machining and automation



Source: Vacancy database

Figure 7.12: High-demand job positions by types of skills and position levels



Source: Vacancy database

Going by the frequency of advertising, nearly 13% of high-qualified vacancies can be considered as high-demand. The characteristics of these vacancies are illustrated as follows.

Position level: Junior executives

- Junior executive positions make up the largest proportion of vacancies advertised across all firm sizes; nearly 60% of the high-demand vacancies recruit junior executives followed by senior executives (26.7%).
- Recruitment for junior positions is slightly larger in the job functions of product development than in technical support, accounts and finance.

Skill-specificity: All job positions except technical support

- Over 80% of job positions in product development, accounts and finance, and tooling and machining require specific skills.
- For example, candidates who apply for a junior R&D Engineer in ViTrox must have specific skills in basic machine design, PLC programming, and motion control. A senior CNC Machining Programmer in

Fourte International Technology requires experience in CNC programming.

Educational level: Diploma

- Unlike high-tech manufacturing, the highest education level required is a Master's degree. With the exception of product development and manufacturing process, all advertised vacancies look for candidates with a minimum of diploma qualification.

Highly sought-after skills: Specific and soft skills

- 75.6% of the high-demand vacancies require candidates who possess specific hard skills and soft skills.
- Specific skills are highly sought after at entry and junior levels of positions while soft skills are more sought after for senior executive and managerial levels (Figure 7.12).
- Soft skills include achievement skills such as self-motivation and result-oriented skills; while relationship and service skills include good communication and interpersonal skills.

Generic hard skills: Foreign language – Mandarin

- Positions in technical support highly require generic hard skills.
- In particular, a good command of foreign languages is predominantly required by companies.
- Within the high-demand vacancies, about one-third require a good command of Mandarin Chinese language.
- These job functions involve CNC machinists, Quality Assurance Engineers, Accountants, Material Planners and Mechanical Engineers.

Average length of job postings: Exceeding two months for high-demand vacancies

- On average, while firms advertise for 2.3 periods, high-demand vacancies advertise for 4.7 periods, which correspond to slightly more than two months.
- Junior positions in product development are advertised for an average of five periods, or more than two months, particularly for Project Engineers and System Control Engineers.

7.3.3 High-qualified labour supply

Supply characteristics

The supply source

- Labour recruitment primarily focuses on Penang, followed by other states in Malaysia.
- Firms target fresh graduates and applicants with more than two years of work experience in the high-qualified segment.

Horde of job applications

- The masses of applications do not necessarily represent the availability of high-qualified workers, due to the fact that first, one applicant can apply for multiple job vacancies, and second, in large part under-skilled entrants are attracted.
- On average, most firms receive close to 100 job applications for each job opening. One firm receives an average of over 300 job applications for a single opening.

Recruitment profiles

Reasons for recruitment: Firm's expansion

- Employer survey indicates that job openings are significantly attributed to the expansion of company activities. A number of firms state that recruitment

of new employees is largely due to replacement of employees who have left the company.

Other recruitment channels: Employee network

- Apart from using JobStreet.com as an advertising platform, the majority of the respondents use employee network as an alternative avenue to recruit high-qualified employees, followed by unsolicited applications.

Partly prepared fresh graduates, and "bad" skill integration of experienced hires

- Respondents collectively indicate that not all advertised positions that had been filled fully match the job requirements in advertisements.
- Fresh graduates are only partly prepared for the offered positions. The reasons for this include poor attitude, lack of motivation and lack of practical experience.
- As for the integration of experienced hires in the establishments, employers highlight "bad" skill integration due to poor attitude and high demands in terms of salary and working hours.

7.3.4 Human capital issues and challenges

Quantitative supply constraints

The recruitment issues and challenges are examined using positions that require a longer duration to fill. In this industry, only 6.9% vacancies are persistent vacancies due to employers' hiring flexibility. The characteristics of hard-to-fill high-qualified vacancies are discussed below.

Position level: Junior executives

- Unlike high-tech manufacturing, junior positions require longer time to fill than other positions in this industry.
- Junior positions constitute about 62.5% and the majority of these positions require less than two years of work experience.
- This indicates that skill-equipped workers are scarce at junior level.
- However, according to MIDA Penang, the lack of supply happens not only at entry, but also at mid and experienced level of positions in the areas of machining, forging, surface engineering, and machinery and equipment.

Accounts & finance and quality assurance requiring specific skills take a longer duration to fill

- Accounts & Finance (Accountants) and quality assurance (QA Engineers, QA Technicians) requiring more specific skills than soft skills and generic hard skills (Figure 7.13) are identified as hard-to-fill positions.
- Compare with high-demand positions, persistent vacancies in technical support (Assembly & Field Service Engineers, Application Sales Engineers) require more generic hard skills than other skills; while those in manufacturing and supply chain require soft and specific skills to the same degree.

Most affected skills: Soft skills

- Among the persistent vacancies, 75% require soft skills, followed by specific hard skills (62.5%) and generic hard skills (50%).
- Within soft skills, positions requiring impact and influence skills (problem-solving, organisational, leadership, etc.) do not take as long to fill as positions requiring achievement skills (self-motivation and

result-orientation), the latter constituting the largest share of positions taking a longer duration to fill, next to those requiring relationship and service skills (good communication, teamwork, etc.).

Most affected job functions: Product Development

- While product development encompasses the largest share of vacancies that are persistent, it takes marginally shorter time to fill compared with technical support. The former makes up 10.6% of the total vacant positions and is advertised for an average of five periods corresponding to 2.5 months, while the latter accounts for 10.3% taking an average of 5.7 periods (more than 2.5 months) to fill.
- Within product development, Senior Vision Software Engineer position is advertised for four consecutive months.
- Positions for Technical Sales and Application Engineers in technical support functions are advertised for three consecutive months (see Box 7.3).

Box 7.3: Employer survey of precision engineering and automation: Hard-to-fill vacancies

This industry appears more successful than high-tech manufacturing filling vacant high-qualified positions. Failure to fill vacant high-qualified positions is lower than high-tech firms. Firms cited that lack of high-qualified workers is primarily due to qualitative issues: positions require knowledge that is too specialised and applicants are too demanding in salary expectations.

Half of the employers cited that recruitment differentiates in terms of **length of time taken** to fill a vacancy. But those who responded otherwise provide the following information.

- Jobs requiring the least time to fill: Accountants and R&D Engineers.
- Jobs requiring the longest time to fill: CNC Machinists and Technical Support.

Hard-to-fill positions range from technical to non-technical positions across all position levels (Table 7.8). Specifically, CNC Machinists and Technical Support Engineers are hard to fill at junior and senior executive level while quality assurance, R&D, purchasing and sales are difficult to fill at managerial level. Interestingly, vacancies for R&D Engineers take the least time to fill in this industry, but R&D Managers are proven to be hard to fill over the past two years.

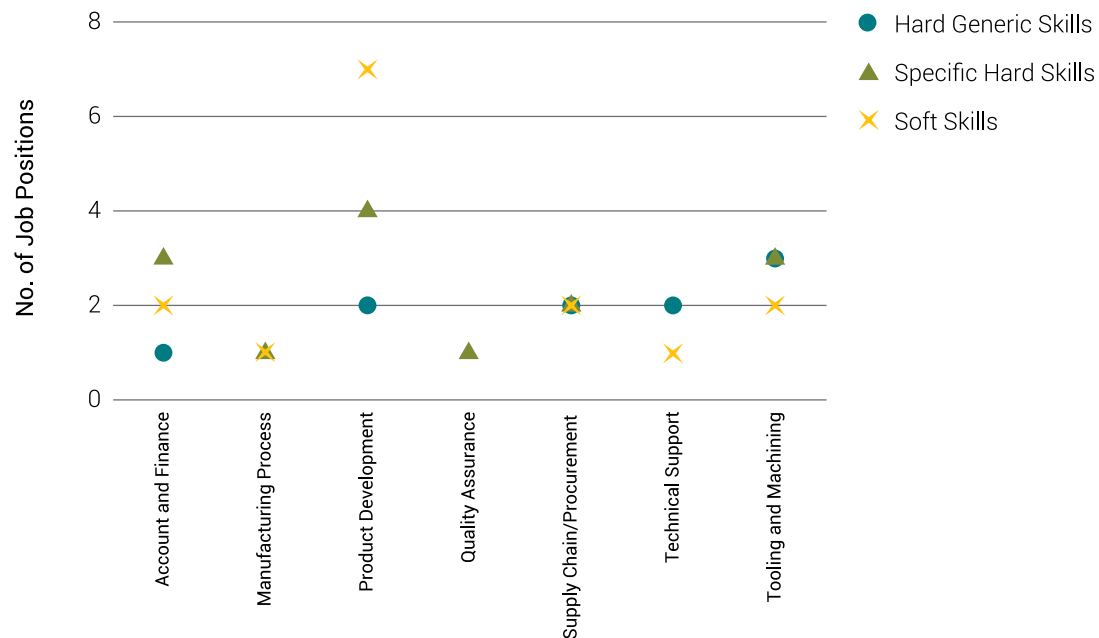
Table 7.8: Hard-to-fill job positions over the past two years

Hard-to-fill positions	Position level
Foremen	Senior Executives
Mechanical Design Engineers	Senior Executives
QA Managers	Managers
Technical Support Engineers	Junior & Senior
CNC Machinists	Junior & Senior
Purchasing Managers	Managers
R&D Managers	Managers
Mobile Crane Operators	Junior
Sales Managers	Managers

Source: Employer survey

Conclusion: Hard-to-fill vacancies are more likely to affect junior and senior positions in technical support and tooling & machining.

Figure 7.13: Persistent vacancies by types of skills and major job titles



Source: Vacancy database

Skill gaps

Skill deficiencies: Less satisfactory in generic hard than specific hard and soft skills

- Skill deficiencies are more prevalent in generic hard skills than specific hard and soft skills. In a scale of one to five with five being highly proficient, specific hard skills scored the highest (3.87), followed by soft skills (3.34) and generic hard skills (3.12).
- Specific hard skills seem to be sufficient for the needs of employers with industry knowledge. It is rated the lowest, scoring 3.6 while job-specific knowledge and technical abilities are rated at 4.00.
- As for generic hard skills, foreign language communication is rated the lowest at 2.33 with legal and economic knowledge second-lowest (2.60). Meanwhile, technical or science and technology knowledge scores the highest at 4.20.
- As for soft skills, teamwork is given the highest score at 3.80 while written & communication skills have the lowest score at 3.00. Improvement is needed for these skills.

Positions where skills need the most improvement –

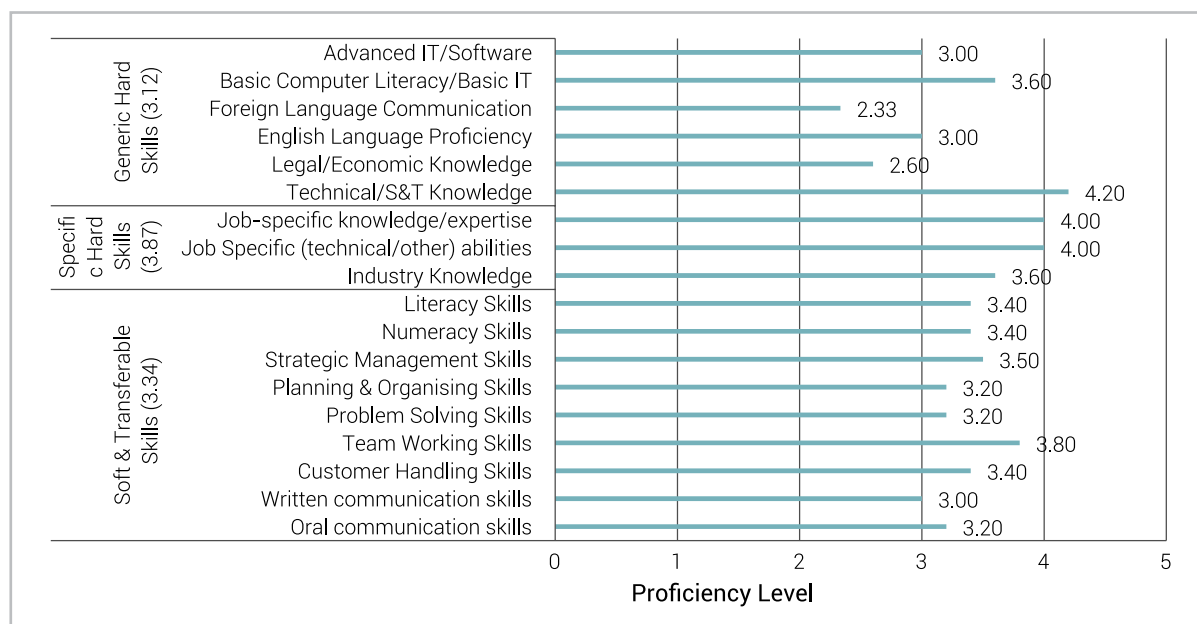
Engineering and non-engineering

- Skill deficiencies are more evident in non-engineering positions. Technical Support Engineers and R&D Engineers are required to enhance their problem-solving skills; only 60% of employees in the positions meet the ideal skill requirements. Meanwhile, CNC Programmers/Machinists and Planners need to improve on CNC Programming skills and production planning skills respectively as half of the employees do not meet the ideal skill requirements. As for Software Development Engineers, System Control Engineers, Mechanical Designers, Draughtsmen and Vision System Engineers, at least 80% of employees meet the required skill-set.
- Two main reasons for the low level of proficiency: first, experienced and proficient employees leave the company to work in other companies; second, rapid technological changes, making it difficult to keep pace.

Applicants' perceived negative behaviour

- The less positive traits of high-qualified employees include: unrealistic salary expectations where expected salary does not align with experience and expertise; lack of passion and hands-on experience.

Figure 7.14: The skills proficiency level of current high-qualified employees by types of skills in precision engineering, machining and automation in Penang



Note: 1=Very low proficiency; 2=Low proficiency; 3=Satisfactory; 4=Proficient; 5=High proficiency
Source: Employer survey

7.3.5 Moving forward: Future skill requirements

Acquiring new skills due to newly emerging tasks

- A majority of employers state that current employees need to acquire new skills in anticipation of newly emerging tasks in the next 12 months. "New legislative or regulatory requirements" and "increased competitive pressure" are the reasons leading to the emergence of new tasks.

Ability to meet future needs – selected specific hard skills

- The skills needed in the near future will concentrate on specific hard skills. These include CNC Machining, machine learning and robotic welding. Employers predict that these requirements will likely be met. High-demand positions in the next two years include **R&D Engineers, Technical Support Engineers** and **Machinists**.

7.4 Life sciences and medical devices

7.4.1 Industry overview

Strengthening the presence of fast-growing industry

- The industry is now an emerging driving force for the Penang's economy despite its long historical presence. We see more medical device manufacturers setting up facilities. Of the global top 30 medical device manufacturers, Penang boasts the presence of five companies: Cardinal Health, Abbott Laboratories, Boston Scientific, B. Braun and St. Jude Medical. The majority of them are American companies.⁶²
- Penang hosts the largest medical device manufacturers' manufacturing hub in Malaysia. It comprises more than 55 companies including support industries, accounting for one-third of total members of the Association of Malaysian Medical Industries (AMMI).

⁶² Medical Product Outsourcing (2017). Top 30 Medical Devices Manufacturers. Retrieved from http://www.mpo-mag.com/issues/2016-07-01/view_features/top30-medicaldevice-manufacturers/

Table 7.9: Description of sub-industries of life sciences and medical devices

Sub-industry	Key industry players	Business activities	Operational activities
1. Biopharmaceutical	Agilent Technologies, Hong Kong Ban Kah Chai Medical Factory, Knowles, Abbott Laboratories, Boston Scientific	Life sciences; diagnostics & applied chemical; Chinese medicine; medical solutions	Research & development; sales & services; manufacturing;
2. Medical Devices	Abbott Laboratories, Boston Scientific, B Braun Medical Industries, Cardinal Health, Lake Region Medical, Haemonetics, Orthomedic Medical Devices, St. Jude Medical	Medical solutions	Manufacturing

Upswing of medical technology and its spillovers

- Manufacturing and exporting high-end medical device products become the next phase of development of this industry. These products include orthopedic implants, pacemakers, surgical instruments and intravenous cannula.
- The industry will generate high spillover benefits in other industries such as E&E, automation and IT industries in Penang. With the state-of-the-art digital technology, cloud-based solutions and connectivity will enter healthcare solutions in the future.

Industry composition and nature of operations

The industry can be divided into two main sub-industries. Table 7.9 presents the details of business activities and some industry players.

7.4.2 High-qualified labour demand

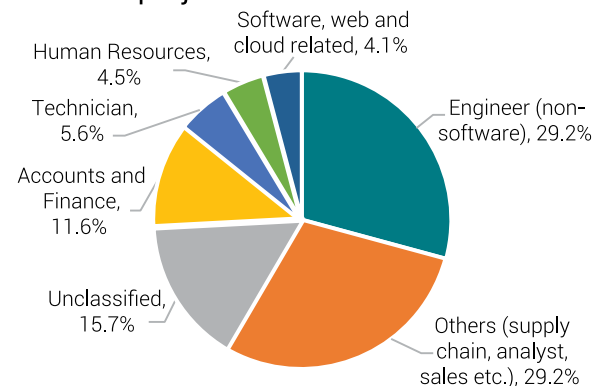
In the first half of 2016, one-third of 267 job openings were advertised by B. Braun followed by Agilent (20.6%), Knowles (12.7%) and St. Jude (9.4%).

(Non-software) engineers as the key high-qualified workers needed

Hiring is more aggressive in the areas of (non-software) engineers such as Automation/Tooling Engineers, Process Engineers and Quality Engineers. Out of 225 vacant positions, (non-software) engineers accounted for the largest share (Figure 7.15). This was followed by accounts and finance.

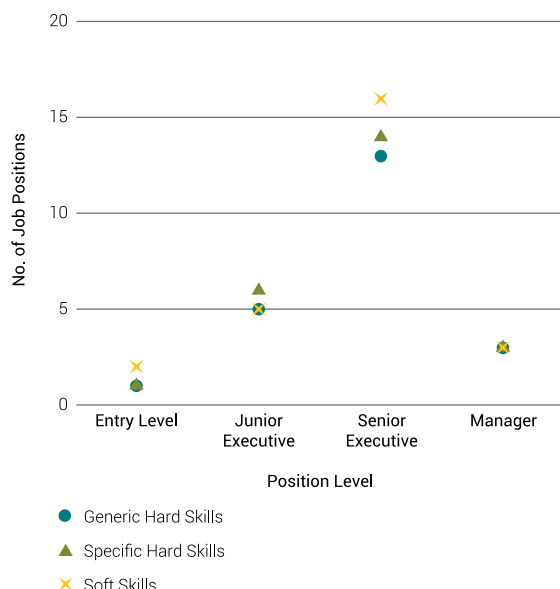
Figure 7.15: Major job titles advertised in life sciences and medical devices

Total unique job vacancies advertised: 267



Source: Vacancy database

Figure 7.16: High-demand job positions by types of skills and position levels



Source: Vacancy database

The characteristics of high-demand vacancies are depicted below.

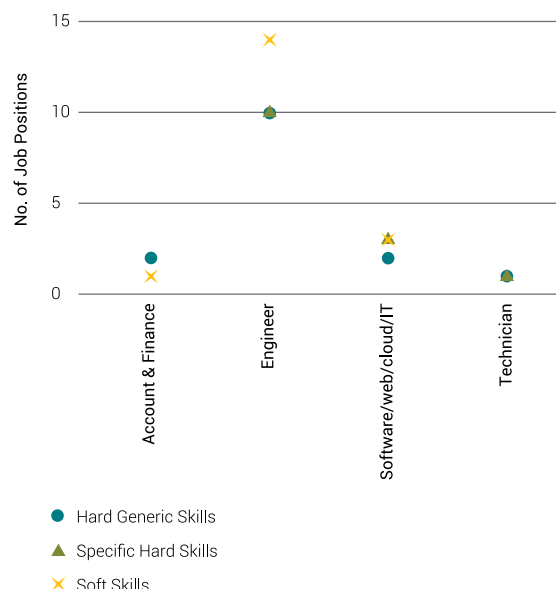
Position level: Senior executives

- Senior executive positions account for more than half of the total job vacancies advertised in this industry.
- Senior positions are more prevalent in the job functions of engineers than technicians, accounts and finance, and human resources.
- 41.2% of the high-demand positions require candidates who possess at least five years of work experience.

Skill-specificity: Junior level in technician and software-related positions

- While the number of high-demand positions is small, skill-specificity is highly needed in software-related positions where all job openings require candidates with relevant specific hard skills.
- For instance, an R&D Embedded Software Engineer position advertised by Agilent Technologies requires candidate to possess good knowledge of C++ programming and modern programming language such as C# and XML.
- More than 70% of the total job vacancies for Technicians ask for specific skills.
- For example, candidates who apply for an IE

Figure 7.17: High-demand of major job functions by types of skills



Source: Vacancy database

Technician position must have specific skills in AutoCAD.

Educational level: Bachelor's degree

- A majority of high-demand positions require at least a Bachelor's degree except Technicians. Candidates must have a certificate or diploma with desired generic hard skills for Technician positions. The highest educational level for engineering positions in the field of R&D such as firmware and mechanical is PhD.

Highly sought-after skills: Soft skills

- Soft skills are highly sought after compared with generic hard and specific hard skills.
- They are highly sought after at entry-level, senior executive and managerial levels while specific skills are much needed in junior executive positions (Figure 7.16).
- As for soft skills, achievement skills are highly demanded followed by relationship and service skills.
- These skills are largely required in (non-software) engineering positions. For example, a position for Senior Machining Engineer in Knowles Electronics requires excellent verbal and written communication skills, including presentation, organisational and management skills.

Generic hard skills: Legislative and regulatory awareness – Accounts and Finance

- As for generic hard skills, 44% of the high-demand positions seek candidates with legislative and regulatory knowledge.
- The majority of positions in accounts and finance frequently ask for generic hard skills such as cost accounting process in compliance with GMP and SOX.
- Recruiters weigh foreign language skills as more sought-after than legislative and regulatory and English language skills particularly for engineers and human resources positions.

Average length of job postings: Exceeding two months for high-demand positions

- While firms on average advertise for 2.5 periods, high-demand positions post at five periods, which correspond to more than two months.
- Senior positions in software design post an average of 4.9 periods, or more than four months. This is the case particularly for Industrial Engineers and Process Engineers.

7.4.3 High-qualified labour supply

The supply source

- Firms prioritise the hire of high-qualified workers from Penang and other states in Malaysia. They receive an average number of 100 job applications for each vacancy advertised.

Reasons for recruitment: Firm's expansion and replacement of employees

- Revealed by employer survey, job openings are mainly attributable to the replacement of employees who have left the company and expansion of company activities. The latter coincides with the new capital investment announced by medical device manufacturers B Braun, Boston Scientific and Toshiba Medical Systems.

7.4.4 Human capital issues and challenges

Quantitative supply constraints

The recruitment issues and challenges are examined using vacancies that require a longer duration to fill. In this industry, some 10.5% of vacancies can be defined as persistent. The characteristics of hard-to-fill high-qualified vacancies are described below.

Position level: Senior executives

- Senior positions take longer time to fill than other

position levels.

- Junior positions constitute about 57.1% and a majority of these positions require more than two years' work experience.
- This indicates that high-qualified workers are scarce at senior level inducing significant employee mobility.
- According to MIDA Penang, critical occupations include Biomedical Researchers, Implants Researchers, Machinists, Regulatory Affairs, to name a few.

Generic hard and specific hard skills: Equally scarce for medical technology

- Persistent vacancies advertised by medical devices firms demand candidates to have generic and specific hard skills.
- Inadequate supply of high-qualified labour with relevant knowledge and training in medical technology constitutes a significant constraint for the industry to upgrade towards high value-added activities.

Most affected skills: Soft skills, then specific and generic hard skills

- Over 70% of persistent vacancies require soft skills, followed by specific and generic hard skills (both 67.9%).
- As for soft skills, positions asking for impact and influence skills (problem-solving, organisational, leadership, etc.) do not take as long to fill as positions asking for achievement skills (self-motivation and results-orientation).
- Positions asking for achievement skills account for the largest proportion of those requiring longer time to fill followed by those that ask for relationship and service skills (good communication, teamwork, etc.).

Most affected job functions: Software-related positions

- Talent shortage occurs at the high-skilled job functions. While the number of persistent vacancies is relatively small, software-related vacancies (e.g. R&D Web Developers) comprise a larger proportion of hard-to-fill vacancies compared with engineers and accounts & finance positions.
- For example, Agilent advertised R&D Embedded Software/Web/Cloud Developers vacancies for more than 2.5 consecutive months.
- In comparison with other manufacturing industries, the medical devices industry has fewer persistent vacancies. The analysis of vacancy database also shows that none of the job openings in accounts & finance and human resources are persistent, as they are filled after one month.

Box 7.4: Focus group discussion of life sciences: Recruitment difficulties

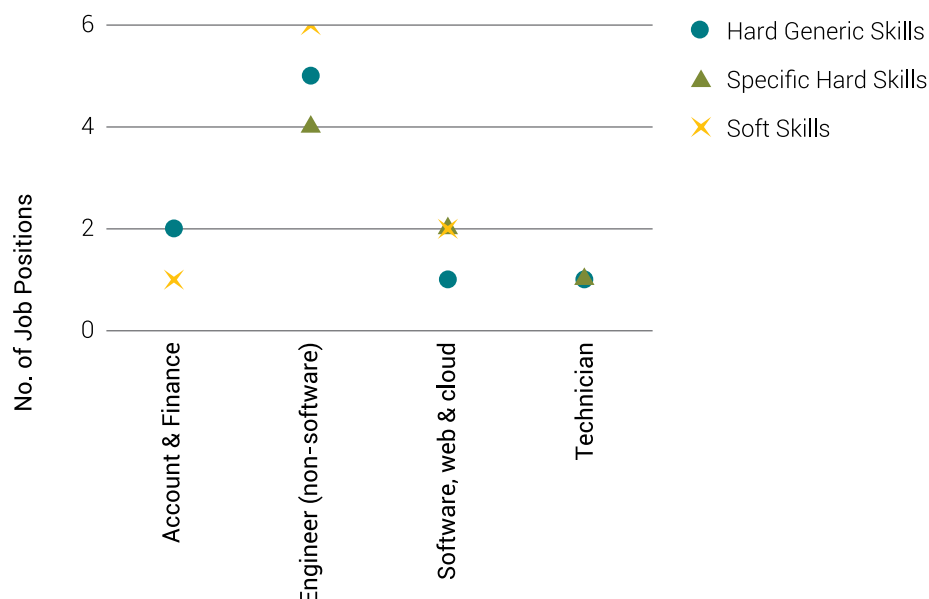
The recruitment challenges faced in hiring suitable persons for high-qualified positions are summarised below.

- Lack of relevant educational qualifications and work experience;
- Salary comparison between local jobs and jobs offered in neighbouring countries put Penang at a disadvantage;
- Lack of willingness to learn; and
- Unavailability of candidates with the right expertise in Malaysia.

As the industry upgrades towards more capital-intensive activities, Penang should have sufficient labour supply to fulfil the needs of employers in this industry.

Graduates are not sufficiently trained in colleges and universities. Studies in colleges and universities place too much emphasis on theory while neglecting practical knowledge, which is highly needed. Students should be exposed to programmes related to new technologies. Most importantly, the qualifications and professional development skills of lecturers should be upgraded in keeping pace with technological advancements.

Figure 7.18: Persistent job vacancies by types of skills and major job titles



Source: Vacancy database

Other recruitment channels: Other online platforms such as LinkedIn

- Apart from using JobStreet.com to advertise vacant positions, a majority of firms employ other online channels as an alternative avenue to attract high-qualified hires. These include LinkedIn and Glassdoor.
- Other recruitment methods used include employee network, unsolicited applications, recruitment agencies and internal transfer.

Well prepared fresh graduates; and "good" skill integration of experienced hires

- Not all filled positions completely meet the stipulated job requirements.
- Surprisingly, fresh graduates are rated well prepared for the offered positions.
- Despite the fact that the majority of the firms are satisfied with experienced hires, they still lack the required hard skills and soft skills. Fresh graduates are also considered too demanding relative to what they can bring as they lack practical experience.

Skill gaps

Skill deficiencies: Less satisfactory in generic hard than in specific hard and soft skills

- Skill deficiencies are more prevalent in generic hard skills rather than specific hard and soft skills. In a scale of one to five with five being highly proficient, specific hard skills score the highest (3.50) followed by soft skills (3.30) and generic hard skills (3.25).
- Specific hard skills seem to satisfy the needs of employers scoring at 3.5 parallel with job-specific knowledge and technical abilities and industry knowledge.
- As for generic hard skills, employees should put in more effort to improve their advanced IT/Software skills and foreign language communication and English language proficiency. Basic computer literacy, legal and economic knowledge, and technical knowledge are less problematic. The former scores at 3.00 for hard skills while the latter is valued slightly higher at 3.50.
- As for soft skills, employees need to improve on oral communication skills as employers on average rate proficiency low with a score of 2.00 only. The same applies to written and communication skills and problem-solving skills.

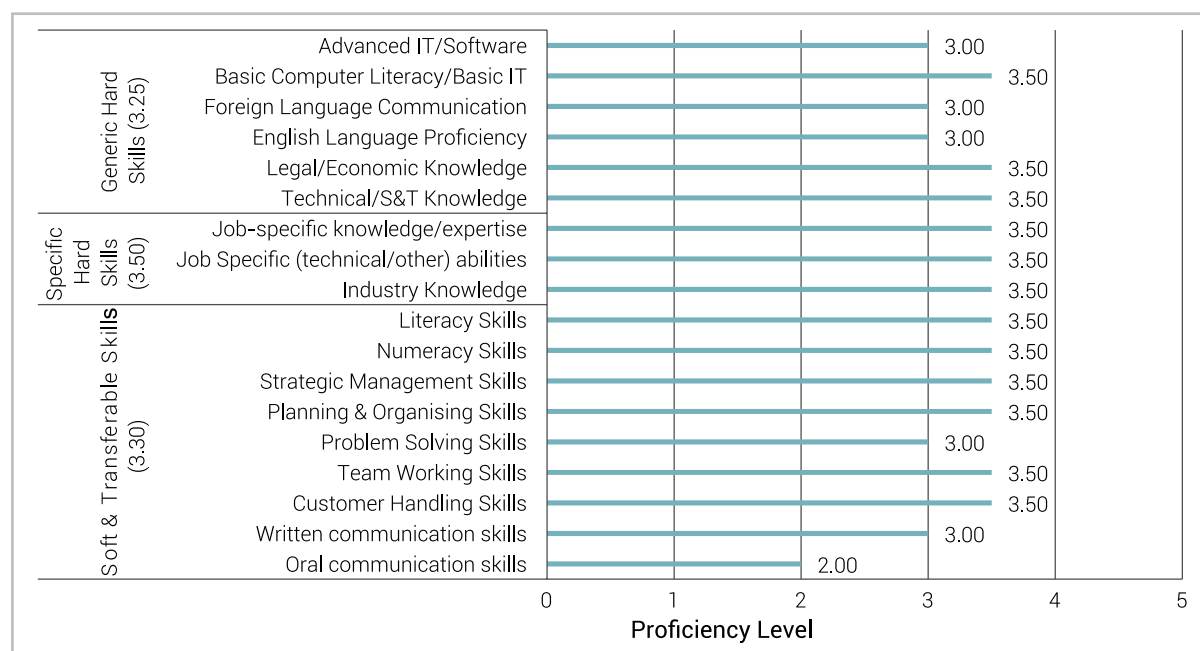
Positions where skills need the most improvement – Engineering and managerial positions

- Engineering and managerial positions were mentioned by employers in response to deficiencies in soft skills. Engineers should improve on written and spoken English, while managers are required to improve on coaching and mentoring on top of critical thinking and problem-solving skills.
- Two main reasons for low levels of proficiency: first, proficient and experienced employees leave for other companies; and second, rapid technological changes, making it difficult to keep pace.

Applicants' behaviour

- The less favourable behaviour of high-qualified employees is similar to that of employees in high-tech manufacturing industries, which include: demand for high salary and a high-level position. Firms also comment that higher wages offered by newly established MNCs result in applicants and existing employees expecting higher salaries.
- Experienced jobseekers are mature. They value career advancement, growth, and stability. As they are experienced and confident with their skill-set, a higher compensation is expected. Some employers cannot afford this.
- Fresh entrants on the other hand lack basic knowledge and practical experience. They also lack the willingness to learn or work more, self-motivation and responsibility. Poor attitude is also caused by low job satisfaction.

Figure 7.19: The skills proficiency level of current high-qualified employees by types of skills



Note: 1=Very low proficiency; 2=Low proficiency; 3=Satisfactory; 4=Proficient; 5=High proficiency
Source: Employer survey

7.4.5 Moving forward: Future skill requirements

Acquiring new skills due to newly emerging tasks

- Current employees need to acquire new skills in anticipation of newly emerging tasks in the next 12 months. "The development of new products and services", "the introduction of new technologies or equipment", "new legislative/regulatory requirements" and "increased competitive pressure" are areas that will lead to newly emerging tasks. High-demand positions in the next two years include **R&D Engineers, Production Planners** and **QA Engineers**. Further, product markets are shifting as new technologies are integrated; future vacancies will involve biomedical engineers and digital imaging talent.

7.5 Comparative analysis across core manufacturing industries

7.5.1 High-qualified demand structure

Penang's manufacturing sector still generates the largest number of high-qualified job vacancies with 71.5% of the total. Within the sector, semiconductor and electronics remain the largest industry in employee recruitment (41.2% of the total) followed by other high-tech manufacturing (16.3%), precision engineering & automation (7.8%), and medical devices & life sciences (6.2%). As far as high-demand vacancies are concerned, the majority of these are advertised by large companies with at least 1,000 headcounts, except precision engineering & automation. Firms in semiconductor and electronics have vacancies far above the average of all firms; medical devices and precision engineering & automation firms contrast with this.

Only high-tech manufacturing and medical devices & life sciences considerably recruit senior executive positions. For such positions, companies prefer applicants with at least five years of work experience. It is also interesting to note that precision engineering & automation recruit lower segment of high-qualified employees.

Across all manufacturing industries, product development dominates frequently advertised job

vacancies. In this job function, the level of skill-specificity increases as products and operations upgrade. Demand in precision engineering & automation industry is characterised by functional specialisations, which is less prevalent in other manufacturing industries.

Corroborating with observations on mobility, recruitment is attributable to the expansion of operations and replacement of employees who have left the company. Among the core manufacturing industries, the former reason is more prevalent in other high-tech manufacturing, precision engineering & automation, and medical devices than in high-tech manufacturing. Finding the right candidates is a big challenge for all industries. Further, firms seeking to replace workers who have left are to a larger extent less reputable. At the same time, the diversity and complexity observed compel a refined view.

7.5.2 Supply characteristics

A large number of applications are received for each vacancy, amounting to 100. Although there is some variation between manufacturing industries, the pattern of application and supply conforms to a large extent to what has been outlined in Chapter 2.

Firm size and brand matter. Large reputable firms are able to attract a high number of applicants who are considered as relatively "good" and skilled. Less reputable companies receive a lower (yet still sizeable) number of job applications, and applicants on average have different characteristics. Skill profiles of ideal employees for key positions are critical to the execution of business plan as they determine the success rate in filling vacant positions. Semiconductor/electronics and medical devices companies are more successful in filling vacancies compared with other high-tech manufacturing and precision engineering & automation. Even so, most of these firms have difficulty filling positions according to skill requirements, primarily due to qualitative shortage.

7.5.3 Positions that require a longer duration to fill (hard-to-fill vacancies)

High-tech manufacturing such as semiconductors industry registers an above average percentage of hard-to-fill vacancies: 16% compared with the overall average of 13% as discussed in Chapter 5. In contrast,

precision engineering & automation firms encounter relatively less difficulties in recruitment, given the fact that only 7% of vacancies are hard to fill. As explained above, the lower segment of high-qualified vacancies appears relatively less critical to fill.

Circuit and software designers/engineers prevail in hard-to-fill job functions in semiconductor/electronics while software designers are also significant in medical devices. On the other hand, in other high-tech manufacturing and precision engineering & automation industries, quality assurance and product development respectively take the longest time to fill.

7.5.4 Skill gaps

There is little difference between manufacturing industries for skill in proficiency levels of existing employees. Generic hard skills are rated lower than specific hard and soft skills. Specifically, foreign language communication and legal/economic knowledge show by far the highest deficiency.

Specific hard skills achieve above average scores in all industries except in medical devices & life sciences. Most likely this reflects upskilling given to existing employees. However, a number of firms in some industries indicate the inability to train employees. The fact that job-specific skills are rated highest in precision engineering & automation probably reflects the operational level of firms where skill demand and

intake are more flexible. It is implied that precision engineering and automation industry can apply the technical abilities and skills of current output of our education system.

In line with the trend noted above, proficiency in soft skills is better in high-tech manufacturing than in precision engineering & automation and medical devices & life sciences. Various professional training programmes are available in the market. Enhancing soft skills, which include leadership, management, planning, customer handling, communication, critical thinking and problem-solving, is very much given attention by firms that have the resources to invest in such skill development.

7.5.5 Future skill requirements and ability to meet needs

Given that the industries discussed in this chapter are subject to rapid technological changes, equipping employees to deal with changing times is imperative for an effective workforce. Business processes are highly dynamic with a high succession of products and services. Most industries and firms envisage new skill requirements in the coming years. Collectively, firms are more optimistic in meeting soft and generic hard skill needs than function-specific skill needs in the future. The latter though, is crucial to Penang's economic upgrading in manufacturing.