

EXECUTIVE SUMMARY

This study analyses the demand and supply of higher-qualified labour in key manufacturing and services industries in Penang. This transpired from continued concerns raised by stakeholders with regard to skills availability in the market vis-à-vis the changing demand of firms and industries; skills proficiency level of current high-qualified employees in relation to the demand of firms; and labour mobility affecting the availability of skills.

The question of skills readiness was also raised by the Penang state government and industry players with the hope of growing new industries. While Penang is at a crossroad in terms of economic strategy, the fundamental question of the demand structure and availability of a high-qualified workforce remains unclear. Therefore, an examination of the current skill supply and its constraints, as well as an effective strategy on human capital development, is necessary.

The main objective of this study is to obtain insight into skill shortages and gaps, and to analyse high-qualified labour market dynamics. In particular, we aim to identify the types of skill shortages and skill gaps in different industries, and the role of labour mobility in skill shortages and gaps. A skills strategy is then proposed based on the skills issues and challenges faced by firms, and the current skills institutional setting.

Skill shortages and gaps are examined in three perspectives: macro (market), meso (industry) and micro (firm and worker) levels. For each perspective, the study has respectively devised methodologies for the analysis of market demand and supply; the analysis of skill demand and supply of industries and firms; and the analysis of worker mobility.

In terms of industry focus, the study covers the skill issues among these key development areas: High-Tech Manufacturing (industrial electronics, semiconductors and optoelectronics); Other High-Tech Manufacturing (electronics manufacturing services, telecommunication and digital storage); Precision Engineering and Automation; Medical Devices and Life Sciences; Global Business Services; Advanced Producer and Financial Services; Hospitality Services; Medical Tourism; Information Technology; Logistics and Transport; and Education and Training.

Market: Skill demand

The demand for high-qualified workers is expected to remain high as new investments continue to generate new jobs in Penang. The demand is shifting towards higher skills with more emphasis on specific hard and soft skills. The skill requirements are likely to embrace new technologies and business practices in leveraging the digital transformation of Industry 4.0. The key findings of the analysis is summarised as follow:

- According to the job vacancy database, recruitment activity is more prevalent in manufacturing industries than in services industries. In particular, high-tech manufacturing industries have the largest number of vacancies advertised, followed by other high-tech manufacturing and GBS. In essence, the pattern of vacancies reflects the state's growth areas. In addition, the advertised positions are generated as a result of the expansion of firms and the replacement of outgoing employees.
- Investments have continued to generate a significant number of new jobs: a total of over 86,000 jobs between 2011 and 2016, with the electronics and electrical (E&E) industry contributing about 57%. A majority of the jobs created require the workforce to have at least a certificate as educational qualification.
- The job vacancies are also reflected in labour circulation. Firm recruitment of high-qualified labour is for replacement rather than expansion. The actual and net demand is difficult to estimate due to a chain effect (job shifts). This study has found that labour circulation is high in Penang as a result of a constrained labour market coupled with the presence of worker behaviour and employability issues among workers (including youths) in Penang.
- Job openings are dominated by engineering-related positions – the functions of which include product development, manufacturing process and quality management.
- Positions that are in high demand, as revealed by job vacancies, combined with the persistency of vacancies, indicate the depth of labour shortage. Senior executives are particularly in high demand; most of the advertised positions require at least five years' work experience. Therefore, a substantial staff turnover is predicted to occur among experienced workers.

- In terms of skill classes, soft skills are now widely required in most high-demand positions. These include achievements, relationships and services skills. Interestingly, as the level of job position becomes higher, soft skill requirements become more pronounced compared to hard skills.
- Many vacancies prioritise the importance of specific hard skills instead of generic hard skills. This is especially the case with software design positions.
- Language competencies (including both English and foreign languages such as Mandarin, Japanese and Thai), on the other hand, feature strongly in skill requirements. These are the most sought-after generic hard skills.
- In the coming years, skill demand of employers will shift towards hiring personnel with creativity and decision-making skills as well as technical and ICT expertise such as big data analysis and cybersecurity expertise. Existing employees are required to acquire new skills. This change has been evident in manufacturing industries, and changes in services sector may be seen in near future.
- Supply seems to be abundant as firms receive an average of 50-100 applications for each job opening in most job specifications. However, there is a misconception here.
- Individual jobseekers indiscriminately apply to a large number of advertised job openings. This translates into a high level of labour mobility in the market, and the prevalence of generic transferable skills.
- In addition, university output shows inconsistency in meeting the labour market's pattern of demand. Lacklustre interest in science and engineering programmes is of great concern as graduates select programmes that do not run in parallel with industry needs, resulting in high graduate unemployment in the field of arts and social sciences. Hence, the preference of students, including non-voluntary preference, leads to a mismatch in demand and supply.
- Work-readiness is at times attributed to fresh graduates who remain unemployed. Some employers are of the view that graduates are not well equipped with qualitative skills to enter the labour market; they are either partly or poorly prepared for the positions due to lack of required hard skills: English and foreign language skills, soft skills, and practical knowledge and experience.

Market: Skill supply

The supply of high-qualified labour and skills consists of four categories: fresh graduates (primary supply), existing workforce (secondary supply), unconventional workforce (tertiary supply) and international workforce (quaternary supply). Changes in labour force participation rates provide an indication of the labour and skills supply landscape. The key findings and observations are highlighted as follow:

- Penang's labour force has experienced resilient growth in the past three years. The participation rate amounts to 70%, which is the third highest in the country after Putrajaya and Selangor. A relative shift of workforce from the manufacturing sector to the services sector reflects the shift of growth areas towards non-production parts of the value chain.
- On the positive side, less working-age people are moving out of the state. There has been a significant drop in out-migration between 2013 and 2016, while intra-state migration has been on the rise.
- Colleges and universities overemphasise theoretical knowledge and focus too little on the application of knowledge in soft skills, critical thinking and problem solving skills, and a lifelong learning culture. Lack of hands-on and practical experience of entrants lower employability given recruitment preferences.
- In a constrained labour market, there is genuine labour shortage in fields of high skill-specificity, and shortage in areas of professional (job-) specific skills.
- While overall supply is moving in right direction, there is quantitative shortage in a number of critical occupations and functions. There is inadequate supply for positions that require specialised knowledge/skills. This is evident in positions within IT/software, cloud and web, and product development, as well as engineering positions.

- Failure in filling vacant high-qualified positions is due to qualitative issues rather than quantitative shortage.
- This is reflected in the persistency of vacancies advertised. Going by the criteria and applied analytical methods, some 13% of vacancies are considered to be hard to fill. While not excessive, it is still at a high level.
- Recruitment difficulties, as measured by length of time taken to fill a vacancy, particularly manifest in technical positions (taking a longer time to fill than non-technical positions). For example, the positions of software design, quality management and manufacturing process take a longer time to fill than accounts, finance and human resources positions. Specifically, software design ranks high in persistency, which is equivalent to hard-to-fill vacancies where genuine shortage is prevalent in positions of high specificity skills. Furthermore, these positions are also manifested in retention difficulties.
- Supply constraints lead to intense competition among firms for highly demanded skills and experienced workers. Firms remedy skill shortage through under-hiring, labour pinching and retention schemes. In particular, employers give a wide array of incentives including project-based bonuses and performance-based bonuses to retain skill-proficient employees.
- Some employers pinch workers from other firms where supply is scarce. This phenomenon impinges on retention difficulties. It must be noted that labour poaching is an unhealthy practice, yet it is not a critical issue as it is the least-favoured measure to mitigate skill shortages. This practice is also experienced by attractive firms.
- While MNCs may be perceived as buyers in the market (able to attract the best candidates), both MNCs and SMEs alike face a group of sellers in the market in possession of highly demanded skills. Firms respond at times by giving in to remuneration demands (substantially increasing costs); at other times they hire applicants that do not meet requirements, resulting in under-hiring and necessitating upskilling. They also resort to importing skills from abroad.
- Pertaining to under-hiring, employers have to 'pay the price' by providing upskilling as new hires do not meet job requirements; firms with international reputations can hardly afford to under-hire as quality standards are at stake.
- Some firms are themselves responsible for skill shortage as they tend to be picky in the recruitment process, less concerned with their proposition to prospective high-quality employees. Work practices should also increasingly adapt to appeal to a younger generation of workers.
- Skills deficiency is more prevalent in generic hard skills compared to specific hard and soft skills, and it is in the latter two that improvements are most needed. Skills proficiency of current employees is satisfactory.
- Lack of soft skills is in part a consequence of constraints faced by educational institutions as far as primary supply is concerned; upskilling of secondary supply is still insufficient.
- The prime constraint of educational institutions concerns the inflexibility of regulations and procedures pertaining to the contents of study programmes.
- With reference to the ability to meet future needs, a majority of employers believe that their employees are able to meet soft and generic hard skills but are less likely to fulfil the requirements of specific hard skills. In manufacturing, the latter are also highly associated with Industry 4.0.
- Pertaining to unconventional supply, there is an encouraging trend in female participation in the labour force. Over the past 10 years, the participation rate has increased by about 10%, reaching 60% from 50% in 2005. Meanwhile, male participation rate has been stable at 80%. The increase in female workforce participation rate may be associated with measures taken to encourage and enable women to return to the workforce.

Industry: Skill shortages and gaps

The labour intake in high-qualified positions is larger in manufacturing industries than that of in services industries. The skills demand structure is also different in manufacturing and services industries. Likewise, the

in manufacturing and services industries. Likewise, the depth of skill shortages and gaps are also vary across industries. We compare these issues within the services and manufacturing sectors, and the main findings of this analysis are presented as follows.

Penang's core manufacturing industries

- The demand for high-qualified worker skills is different across manufacturing industries. Firms in semiconductor and electronics industries generate vacancies far above the average rate of all firms; firms in medical devices and precision engineering and automation industries show a contrasting picture.
- Senior executive positions are important in the demand and recruitment structure of high-tech manufacturing and medical devices and life sciences industries, while recruitment in precision engineering and automation industries leans towards the lower segment of high-qualified employees.
- Across all manufacturing industries, product development job functions dominate advertised vacancies. In this job function, the level of skill specificity – and thus requirements – increase as products and operations upgrade.
- Recruitment is due to both the expansion of operations and the replacement of employees who have left the company; the former is somewhat more prevalent in other high-tech manufacturing, precision engineering and automation, and medical devices industries than in high-tech manufacturing. All industries face the issue of replacement due to labour circulation; to a larger extent this is experienced by less-reputable companies.
- With regard to supply, semiconductor/electronics and medical devices companies are more successful in filling vacancies compared to other high-tech manufacturing and precision engineering and automation companies. Even so, most firms have difficulty filling positions according to skill requirements. This is primarily due to qualitative shortage.
- Semiconductor/electronics companies register a percentage of hard-to-fill vacancies that are above the overall average (16%). In contrast, precision engineering and automation firms encounter this issue less, given the fact that only 7% of vacancies are

hard-to-fill. Specifically, positions in quality assurance and product development take a long time to fill.

- Proficiency in job-specific skills is rated highest in companies in the precision engineering and automation industry. This probably reflects the operational level of firms where skills demand and intake are more flexible. Proficiency in soft skills is rated better by companies in high-tech manufacturing compared to those in precision engineering and automation, and medical devices and life sciences.
- Most industries and firms envisage new skill requirements in the coming years. In view of meeting future needs, they are more optimistic with respect to soft and generic hard skills compared to function-specific skills.

Penang's growing services industries

- The growth of the GBS industry is evident as it takes the highest share of job openings. Medical tourism, on the other hand, has the lowest number of job openings.
- Junior executive positions are widely demanded across the services industry except in advanced producer services. High-demand positions also concern senior executives in GBS, education and training services, and advanced producer and financial services.
- Both GBS and info-tech firms have a relatively higher demand for software developers, engineers, programmers, as well as technical support engineers.
- The notion that preferred industries and companies attract more applications to advertised job vacancies is also valid across the services sector. Advanced producer services and GBS companies score significantly higher compared to the rest of the services industry.
- Being rather new industries, a large proportion of positions available and vacant in medical tourism, info-tech, and advanced producer and financial services have been created because of expansions. Vacancies in GBS and hospitality services stem from not only the emergence of new establishments and the expansion of existing operations, but also turnover, necessitating the replacement of employees.

- Notwithstanding being preferred employers, advanced producer services and GBS show a rate of hard-to-fill vacancies higher than the overall average. Meanwhile, going by their hard-to-fill vacancies rate, among all the manufacturing and services industries, hospitality, transport and logistics, education and training, and medical tourism are least confronted with skill shortages. This reverse situation from advanced producer services and GBS can be explained from the skills specificity of a segment of the job function that available skills have difficulty to meet.
- The services industry shows similarity to the manufacturing industry in terms of skill deficiencies. Generic hard skills are rated as more limited relative to soft and specific hard skills in all services industries except info-tech, and education and training services. Foreign languages and advanced IT are the skills rated most deficient in advanced producer and financial services, GBS and hospitality services.
- Compared to advanced and financial services, hospitality services, info-tech, and transport and logistics, proficiency in soft skills is rated lower in GBS, medical tourism and education and training.

Worker: The role of mobility in the labour market

Mobility plays a large role in the functioning of Penang's labour market as a process of shaping labour and skill shortage and gaps. Generation-Y employees, in particular, consider mobility as an integral part of their values, norms and lifestyle. The key observations of mobility analysis are highlighted as follow:

- Intra-industry and inter-firm labour flows have been evolving significantly. The emergence and rise of sectors apart from manufacturing have engendered significant labour flow from manufacturing to these sectors, in part catering to labour needs.
- Labour circulation is a vehicle of function-specific skills acquisition and employability improvement towards preferred industries/firms, rather than reflecting acquired skills and experience. This means that mobile workers still have skill deficiencies. This situation resembles a "positions carousel" where employees try to change employment in a designated trajectory of job functions over a period of time. This also shows a significant degree of skill-relatedness under a constrained labour market.
- Offering better remuneration packages, reputable firms are able to appropriate skills that are available and in demand in the market; less reputable firms in general experience recruitment difficulties.
- While financial reward is important, the role of career development clearly comes to the fore. This is parallel with other studies, and may be linked to the ubiquity of generic skills in the market. There are issues in this area.
- The ubiquity of generic skills still means that there is worker competition for available desired jobs. While this provides an incentive to move, lack of application skills and ill-defined specific skills constitute a hindrance. This may contribute to random job applications.
- Substantial mobility also appears to reflect a lack of information about the right opportunities, the lack of opportunities for career development with existing employers, and a perceived necessity to move to acquire new skills.
- High inclination to move has a negative impact on employability – more so as workers tend to 'over-exploit' transferability when demand shows a significant degree of skill-relatedness.
- However, mobility is not always desirable as employers perceive low commitment from employees, which could be counter-productive for skills and career advancement. Perceived low worker commitment has negatively influenced upskilling and training investment efforts.
- Employers indicate that a majority of younger workers have unrealistic expectations and possess declining loyalty and commitment vis-à-vis willingness to contribute.
- Individual mobility translates to various degrees of labour turnover. Engineering positions from high-tech manufacturing, precision engineering and medical devices industries suffer a particularly high rate of employee turnover.
- Chain effects also lead to skill shortages and gaps;

skill-relatedness is an important determinant of the 'location' where these effects occur.

- Taking GBS as a case study, the work histories of employed persons show heterogeneity of job functions and inter-firm skill-relatedness, which has promoted lateral – intra-industry – mobility.
- Mobility towards GBS operations affects accountancy, customer services, and executive roles and management positions in other industries, forcing firms to recruit such positions from a more constrained market.
- Consequently, the high-mobility inclination of workers may produce positive outcomes for firms in both existing and new industries to acquire skills within the secondary supply – more so when skill-relatedness is significant. However, there are also downsides.
- Mobility dynamics in the secondary labour market present significant burden to employers and generates negative perceptions of mobile workers. Labour loss through turnover contributes to skill gaps and has negative impact on incentives for upskilling. However, many firms are 'dual' in their attitude: on one hand, they frown upon job-hopping; on the other hand, engage in labour pinching.

Stakeholder responses and strategies

Labour upskilling programmes are made available to address skill shortages and gaps in the labour market. As part of the initiative to retain employees, to attract the right talent and to upgrade under-skilled workers, private training agencies and individual firms adopt a variety of strategies in responding to these skill issues. The main observations on labour upskilling are described as such:

- Despite the fact that Penang's upskilling infrastructure is sizeable and diverse, it inevitably reflects skill deficiencies of high-qualified workers. Beyond the formal education system, skill augmentation programmes are developed by private agencies and public institutions such as the Northern Corridor Implementation Authority (NCIA) and TalentCorp.
- Firms overcome skill gaps using multi-pronged measures. These include changing of work hours,

re-allocation of tasks, more supervision by experienced employees and labour training. In particular, upskilling is widely used by most firms, and it is either carried out internally and/or by external providers.

- It should be noted that universities and colleges necessarily prepare graduates to become proficient in generic skills instead of training on industry- and job-specific skills. Unconventional skill training programmes provided by private upskilling firms and public institutions complement specific skills that are not taught at universities. A substantial skills training and upskilling infrastructure gears towards higher-qualified labour in specific hard and soft skills.
- With regard to skills that are not available in the market, several interventions have been in place by actors and stakeholders. However, they have controlled over their own programmes and schemes, with limited coordination with other institutions in upskilling programmes.
- The effectiveness of upskilling programmes, schemes and interventions are still immature. Given a multitude of skill-related actors and stakeholders, visibility, coordination and monitoring of upskilling infrastructure are necessary. Therefore, little can be said about the effectiveness of interventions (programmes and schemes, activities of the range of actors) given the fragmented nature of information on the skills situation and interventions.

Augmenting skills: Recommendations and policy initiatives

A joint effort by all stakeholders, and institutional and private agencies is necessary to streamline and complement existing interventions. The core recommendation is to:

Develop a coherent, encompassing state skills strategy, departing from a clear vision – shared by stakeholders – and reflecting ambitions

This report offers ideas for a **short-term skills strategy** as practical elaboration of a set of recommendations, which are illustrated in the following diagram.

Ideas for a short-term skills strategy

Market: Demand

- Implement avenues to ease high-qualified labour demand;
- Further implementation of labour-saving technologies in work processes; and
- Accelerate phasing out of operations in industries that are cost-based or incompatible with upgrading ambitions.

Market: Supply

- Devise opportunities for more effective labour capture through the regional labour field;
- Increase intake of students in areas of shortage;
- Increase supply by tapping tertiary supply (unconventional sources);
- Redirect preferences of students towards fields of study that are more in line with labour market needs (esp. areas of shortage of critical occupations); and
- Reorient education and training (teaching and learning) towards less emphasis on qualification(s) and more on skills and exposure that come with the qualification.

Industry and firm

- Increase intake of students specifically in areas that show high persistent vacancy rates;
- Enhance opportunities for students/entrants to acquire industry- and function-specific skills and practical experience before entering the labour market;
- Change and improve entrants and existing employees' skill sets towards more specificity;
- Tap avenues for new sources of supply that bring experience;
- Level the playing field on which companies operate in the aspect of improving access to skills, labour recruitment and retention; and
- Devise ways to lower the quit rate of employees.

Worker

- Improve the infrastructure for information, career advice and job application skills learning by expanding the role of the Career Assistance and Training (CAT) centre;
- Devise and implement programs to instill different values in jobseekers/employees; and
- Employers to get better acquainted with, recognise and act upon new generation values.

Organisational framework

- Establish a Penang Employment and Skills Unit at state level, dedicated to oversee a skills strategy including policies, programmes and plans of actors and stakeholders in a coordinated and coherent fashion; and
- Develop and implement an (institutional) structure or Skills Information System through which timely and reliable information on skills demand and supply trends are recorded.