



PENANG STEM TALENT BLUEPRINT

A Roadmap for Workforce Development



PENANG
2030



Science • Technology • Engineering • Mathematics

TALENT BLUEPRINT

A Roadmap for Workforce Development

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- Dato' Loo Lee Lian, CEO of InvestPenang
- Dr. Hari Narayanan, CEO of Penang Skills Development Centre (PSDC)
- Mr. Solomon Lorthu, Managing Director of Motorola Solutions Malaysia
- Mr. Richard Chung, CEO of Penang STEM
- Mr. SK Fong, Founder and CEO of SkyeChip
- Dato' CB Chuah, Founder and CEO of Pentamaster Corporation
- Ms. AK Chong, Managing Director of Intel Malaysia
- Mr. Suresh Kumar Dass, Vice President, Design Engineering Group of Intel Malaysia (a guest)

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Over 10 stakeholder engagements and consultations were conducted from April to June 2024, which brought together industry associations, boards of state-linked STEM centres, educational institutions, and federal government agencies such as MIDA, MITI, MoF, and more. We are grateful to the over 300 industry leaders who participated in these sessions. Their willingness to share their industry expertise was essential in crafting this comprehensive roadmap for nurturing and empowering Malaysia's future STEM talent.

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This Blueprint is prepared by



The working group members include



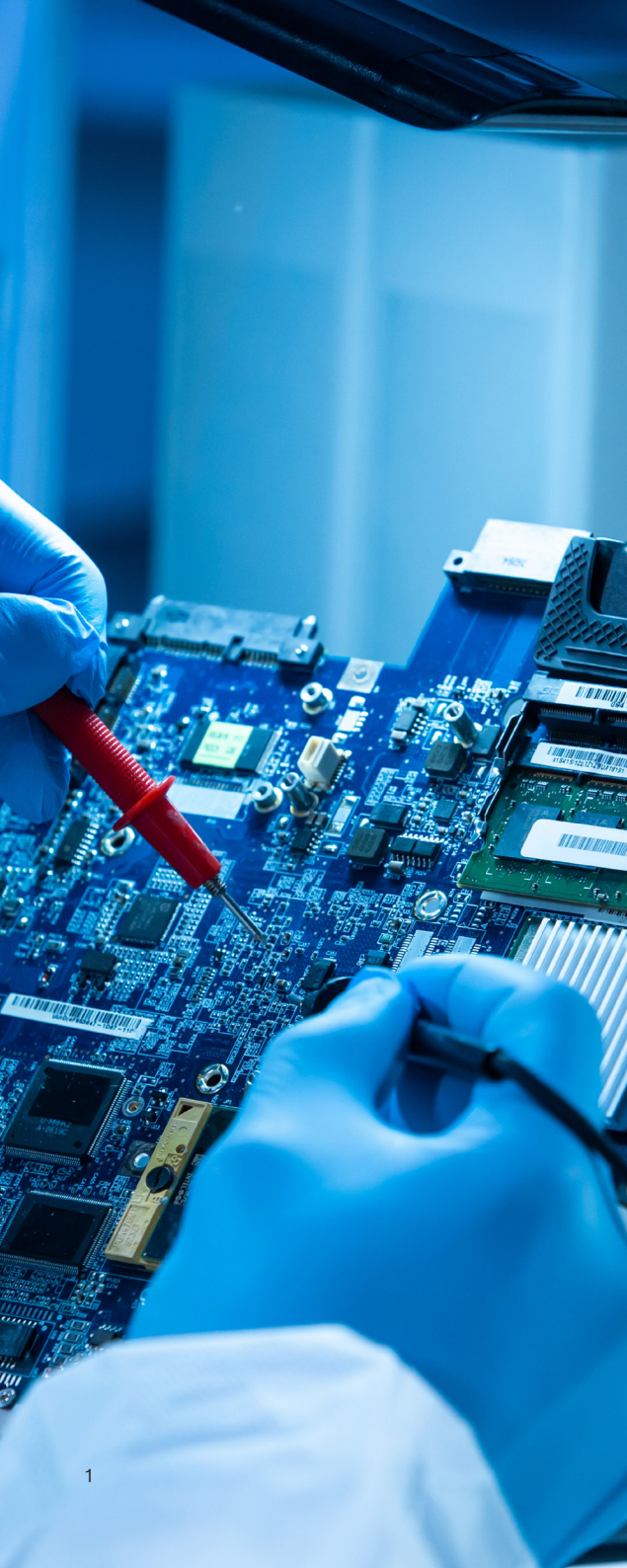
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EXECUTIVE SUMMARY



The Penang STEM Talent Blueprint addresses the long-term talent and skills development of Penang's Science, Technology, Engineering and Mathematics (STEM) workforce, in support of the New Industrial Master Plan (NIMP) 2030 and the National Semiconductor Strategy (NSS). Being a major contributor to Malaysia's and the world's E&E sector, Penang's stakeholders understand the need for a strategic plan to meet that sector's growing talent and skill needs.

The Blueprint focuses on:

- a. Attracting and retaining talent for multi-billion dollar investments in electrical and electronics (E&E)
- b. Addressing the concerns of manufacturers and investors regarding talent availability and skill preparedness
- c. Formulating a framework for identifying resources to meet specific STEM talent needs in Penang

The Vision

To build a highly skilled and sustainable STEM workforce for long-term success in an evolving industrial and technological landscape.

The Mission

The Blueprint follows the THRIVE principles (Transform, Hire, Retain, Invest, Value and Enable), which emphasise collaboration across government agencies to implement policies and frameworks to support STEM development. The six principles are elaborated below:

- 1** **TRANSFORM** the education system in
 - a. primary and secondary schools
 - b. higher learning institutions to specialise and focus on specific domains
- 2** Enhance the **HIRING** of STEM talents by enabling mobility in the country and international talents
- 3** Attract and **RETAIN** talents in STEM
- 4** **INVEST** in STEM education and upskilling/reskilling programmes to reduce skills mismatch
- 5** Optimise **VALUE** creation by adopting the latest technology across the manufacturing sector to move up the value chain
- 6** **ENABLE** governance framework to accelerate an ecosystem that attracts, retains and develops the STEM workforce

Emerging Trends

Fuelled by shifting global trade dynamics, Penang continues to be a major player in the E&E industry. The state's robust supply chain network, honed by over 50 years of industrial excellence, constitutes a compelling advantage. With a skilled workforce and supportive government policies, Penang has become a magnet for major foreign direct investments (FDIs), which continues to strengthen its position as the leading centre for the E&E and related supply chains within northern Peninsular Malaysia.

The huge influx of FDIs happens alongside at least five related trends:

a. Rising demand for skilled talents

- Following the implementation of de-risking, friend-shoring and China Plus One strategies by large economies, the flow of FDIs into Penang has intensified, increasing the demand for skilled talents within the state.
- The total approved manufacturing investments for Penang over the last five years (2019-2023: RM184 billion) have been more than twofold the investment approved in the decade of 2009-2018 (RM66 billion). The requirement for skilled talents has correspondingly increased.

b. Global swift and tactical response to talent-building initiatives

- Taiwan, South Korea, China and Vietnam have started various new STEM-related talent-building initiatives.
- This active intervention and investment in STEM education and talent development is in anticipation of an increasing shortage of talent and a widening skills gap in the semiconductor and technology industry. These countries also progressively look into government-industry-academia partnerships in semiconductor science, engineering and technology.

c. Lack of STEM interest

- The declining overall interest in STEM among the young is concerning. There have been lower student enrolments in the pure sciences over the past decade and the share of students in the sciences has shrunk considerably in secondary schools.
- Universities also face challenges filling the capacity of science and engineering programmes.

d. Demographic shift towards old-age population and progressive migration policies in other countries

- There is a prevalent shift in demography towards aging populations. The working-age population is growing at a slower rate than the old-age population.
- This is in addition to the progress of migration and attractive upskilling opportunities in neighbouring countries, which continuously attract Malaysians to work overseas.

e. Shift towards the gig economy

- The rise of the gig economy creates alternative work arrangements and attracts talent away from mainstream jobs.
- Global remote work options provide more flexibility for skilled workers.

Challenges

Key challenges in Malaysia's labour market include:

a. Fragmented governance framework

- There is a lack of clear leadership and collaboration between federal and state agencies on STEM initiatives.
- Duplication of initiatives and programmes has led to inefficient resource allocation.

b. Lack of STEM talent-building strategies for engineering and technology

- Universities appear to lack the agility to introduce targeted programmes to meet the needs of evolving talent requirements e.g. high-value areas: IC design and advanced packaging.

- Local universities are not recognised for the best specific disciplines locally and internationally.

c. Quantitative mismatch between demand and supply for STEM graduates

- Student enrollment in STEM programmes is declining at all levels.
- Universities struggle to fill available engineering degree seats.

d. Mismatch of competencies between university graduates and job requirements

- University curricula do not keep pace with industry needs, leaving graduates with outdated skills.
- Graduates lack hands-on experience and struggle to find relevant jobs.

e. Non-competitive compensation packages

- The lack of attractiveness in compensation packages has led to a brain drain out of Penang.

Opportunities

Penang's economy thrives on the electrical and electronics (E&E) sector, and encompasses its entire value chain, from chip design (fabless/integrated design manufacturing) to final assembly and testing (back-end manufacturing, including advanced packaging, outsourced semiconductor assembly and test (OSAT), and equipment making).

Penang's target growth areas include:

a. IC design

- Penang to be positioned as a globally renowned hub for IC design through the **Penang Silicon Design @5KM+** initiative.

b. Machinery & equipment and IoT solutions

- Penang's E&E ecosystem expertise in electronics, mechanics, precision tooling and metal fabrication is to be raised.
- Local automation solutions serving Tier-1 multinational corporations (MNCs) to be scaled up.

c. Medical technology

- Penang to become a MedTech hub for Asia.
- Penang's high concentration of MedTech companies relative to the rest of Malaysia and Southeast Asia, which specialise in consumables, implants, surgical instruments, equipment and devices, and sterilisation, is to be taken advantage of.

Framework: Roadmap for a STEM Talent Pipeline

The Penang government is focused on constructing a robust and comprehensive STEM talent pipeline based on certain key elements for success:

- **IGNITE** interest in STEM through early education and a holistic, hands-on science learning experience among primary school children
- **EMBED** real-world science applications and vocational education through interactive pedagogy among secondary school children
- **IMMERSE** talents in real-world challenges by closing the gap between lecture and lab to industry reality
- **EMBRACE** lifelong learning through a proactive upskilling and reskilling approach to stay relevant in the job market
- **ENABLE** talent attraction and retention through state and federal policies

Key enablers, action plans and programmes are suggested based on the specific strategic outcomes required. These involve joint efforts from various STEM learning centres in the state, and federal ministries cutting across the Ministry of Finance, the Ministry of Investment, Trade and Industry, the Ministry of Home Affairs, the Ministry of Education, the Ministry of Digital, and the Ministry of Higher Education.

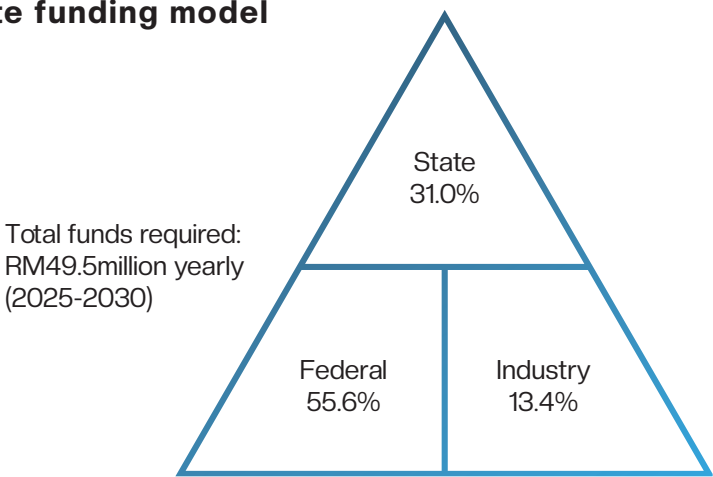
Penang STEM Governance and Delivery Framework

The Penang government has over the years established a collaborative and cohesive approach to STEM education. The structure led by Penang STEM prioritises close collaboration with schools, universities and industry partners.

Penang STEM is set to be a catalyst for a thriving STEM ecosystem that fosters collaboration and facilitates resource allocation, particularly for large-scale impact programmes tailored for diverse needs from lower-secondary to post-secondary education. Delivery of these programmes is entrusted to the three STEM centres: Tech Dome Penang (TDP), Penang Science Cluster (PSC) and Penang Math Platform (PMP) in partnership with universities, colleges and technical training institutions. Each centre brings its unique expertise towards ensuring a well-rounded learning experience.

Consistent funding is required for its three centres to achieve programme outcomes. A tripartite funding model is proposed, with the federal government contributing the most (55.6%), followed by state government and industry partners (31% and 13.4%, respectively) (Figure 1).

Figure 1: Tripartite funding model



To ensure effective programme delivery, the STEM centres are guided by outcome-based KPIs to eliminate programme duplication and the resource allocation is to follow **IGNITE**, **EMBED**, **IMMERSE**, and **EMBRACE** framework.

Table 1: Annual estimated funding requirements for STEM initiatives from 2025-2030 (RM million)

Initiatives	State	Federal	Industry
Penang STEM	0.2	10.8	-
Tech Dome Penang	10.5	6.0	2.1
Penang Science Cluster	0.4	0.8	4.0
Penang Math Platform	0.6	-	0.5
Penang Future Foundation	3.6	-	-
Penang Chip Design Academy*	-	-	-
TVET programmes	-	10.0	-
Total	15.3	27.6	6.6
% share	31.0%	55.6%	13.4%

Note: * This initiative is funded as part of the Penang Silicon Design @5KM+ initiative.

Table 1 illustrates the federal government is the biggest contributor to funding STEM initiatives in Penang, followed by the state government and industry. This suggests that the Malaysian government places a high priority on STEM education. The initiatives funded by the state and federal government include Penang STEM, Tech Dome Penang, Penang Science Cluster, and Penang Math Platform. Industry funding goes towards the three STEM centres for implementing STEM programmes and initiatives. Besides funding the large-scale programmes such as StepUP (RM3 million a year), STEM Future-Proofing (RM800,000 a year) and Technical Skill Learning (TSL) (RM7 million a year), Technical and Vocational Education and Training (TVET) programmes and Penang Chip Design Academy are proposed to be funded by the federal government.

Penang Future Foundation Scholarship: Cultivating Penang's Future Talent

Penang Future Foundation (PFF) is a scholarship programme run by the Penang state government to support outstanding and deserving Malaysians in pursuing their undergraduate studies. Since 2015, the scholarship programme has awarded a total of 751 scholarships. The programme supports approximately 60 outstanding students in each intake, giving each a generous RM60,000 scholarship. Notably, 80% of these scholarships go towards studies in Engineering, Science, Technology, and Mathematics (STEM), with the remaining 20% supporting students pursuing degrees in Accounting and Finance.

Over the next six years, from 2025 to 2030, about RM21.6 million in funds (or RM3.6 million yearly) are required to finance a maximum of 60 scholars per intake.

Penang Chip Design Academy: Building a World-Class Chip Design Workforce

Penang Chip Design Academy (PCDA) is one of the end-to-end semiconductor design development initiatives established by the Penang state government to address the growing demand for chip design engineers. It offers industry-focused training programmes to train fresh engineers and working professionals who may need upskilling or reskilling to move into the IC design discipline. PCDA's training programmes are developed in partnership with industry and premier Electronic Design Automation (EDA) tools vendor(s). PCDA will be equipped with state-of-the-art infrastructure and EDA tools to conduct the training programmes.

A matching fund model is proposed, with the government contributing initial funding and private sector co-funding in exchange for benefits such as curriculum development and recruitment opportunities. The Academy's initial establishment will require approximately RM3.4 million in capital expenses. To encourage graduates who are unemployed and have basic qualifications to embark on a career in IC design, **PCDA will require government funding of approximately RM2.3 million to train 100 engineers every year. In summary, RM11.5 million is needed to train 500 fresh engineers over the next five years.** PCDA will continue to enhance its portfolio of training programmes to cater to the needs of the industry.

PCDA is a strategic initiative that enables Penang's semiconductor design and development workforce. Essentially, it aims to attract Tier-1 IC design investments that offer high-paying jobs and thus position Penang as a leader in the chip design industry. This initiative is aligned with the national goals in the NIMP 2030 and the NSS of cultivating local IC design champions.

Tertiary education and TVET programmes: Bridging the Gap between Education and Industry

While the Penang STEM governance delivery framework focuses on igniting STEM interest and embedding real-world science applications, immersing students in tertiary education with industry reality is crucial for preparing a sustained and future-ready talent supply. For this, integrating AR/VR as part of the university's pedagogical approach and importing top-notch professors from overseas are among the key enablers proposed in this Blueprint. Additionally, new university degree programmes in IC design, semiconductor technology, AI and data analytics are also recommended for higher education institutions to keep pace with the rapid technological change.

Similarly, there is a need for greater emphasis and a new facelift on TVET programmes to support the increased requirements of technicians. The three most sought-after TVET programmes needed by industry in Penang include Precision Machining Technology (PMT), Industrial Automation Technology (IAT) and Quality Assurance Technology (QAT). Penang Skills Development Centre (PSDC) offers both certificate and diploma levels in these programmes. A unified grants approach to TVET institutions and allowances for TVET students are badly needed. There is increasing demand for technicians; about 3,000 technicians are needed to be trained from 2024, with an incremental increase of 500 technicians yearly.

Training an additional 2,500 TVET graduates is estimated to cost RM60 million from 2025-2030 (or RM10 million annually). This amount accounts for a training cost of RM24,000 per student for 2.5 years.

In conclusion, the Penang STEM Talent Blueprint outlines the opportunities and strategic directions for nurturing Penang's future STEM workforce. It identifies recommendations for policy change for the state and federal governments across various ministries to address the root causes of talent shortages and build the STEM talent pipeline. A whole-of-government and cohesive collaboration between government agencies, industry leaders and educational institutions is essential to attract and retain top talent, narrow the skills gap through targeted training programmes and promote STEM education at all levels. By implementing the initiatives outlined in this Blueprint, Penang can position itself as a leading hub for innovation and talent, and help Malaysia strengthen its STEM talent pipeline.



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