



# ENGINEERING THE FUTURE

Presented by:

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# ENGINEERING THE FUTURE

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**Membina Kesiapsiagaan Masa Depan**

**Academician Tan Sri Dr. Ir.  
Ahmad Tajuddin Ali FASc.**

**BEM CONVENTION 2022**  
**25<sup>th</sup> October**





**The best way  
to predict the  
future is to  
invent it**



MASA DEPAN YANG  
**DIIDAMKAN**

**MAKMUR**  
PROSPEROUS

**SEJAHTERA**  
HARMONIOUS

**MAMPAN**  
SUSTAINABLE





# PEMACU UTAMA **BERSINERGI** SECARA HARMONI



This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. 9 key drivers towards realising SMART Communities as featured in the Malaysia 2050: Foresight Initiative

If you'd like to know more about this work, please go to [www.akademisains.gov.my](http://www.akademisains.gov.my) to contact us.

Sumber: ASM Envisioning Malaysia 2050 Foresight Narrative, 2017

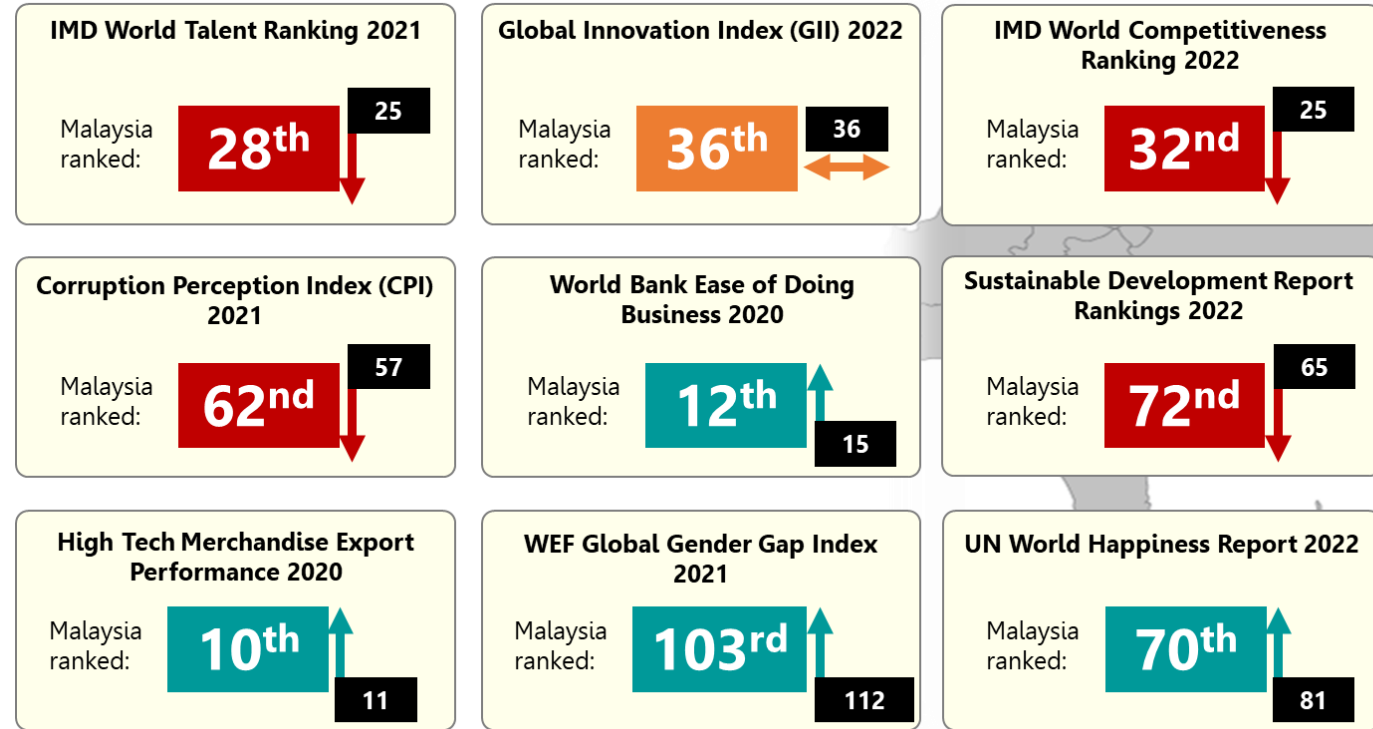


# NAMUN BEGITU...



# KEDUDUKAN MALAYSIA DI PERSADA DUNIA MASA KINI **KURANG** MEMBERANGSANGKAN

Persepsi berkaitan daya saing sesebuah negara adalah berdasarkan indeks global



Sumber MIGHT, 2022



Persekitaran dunia  
yang semakin

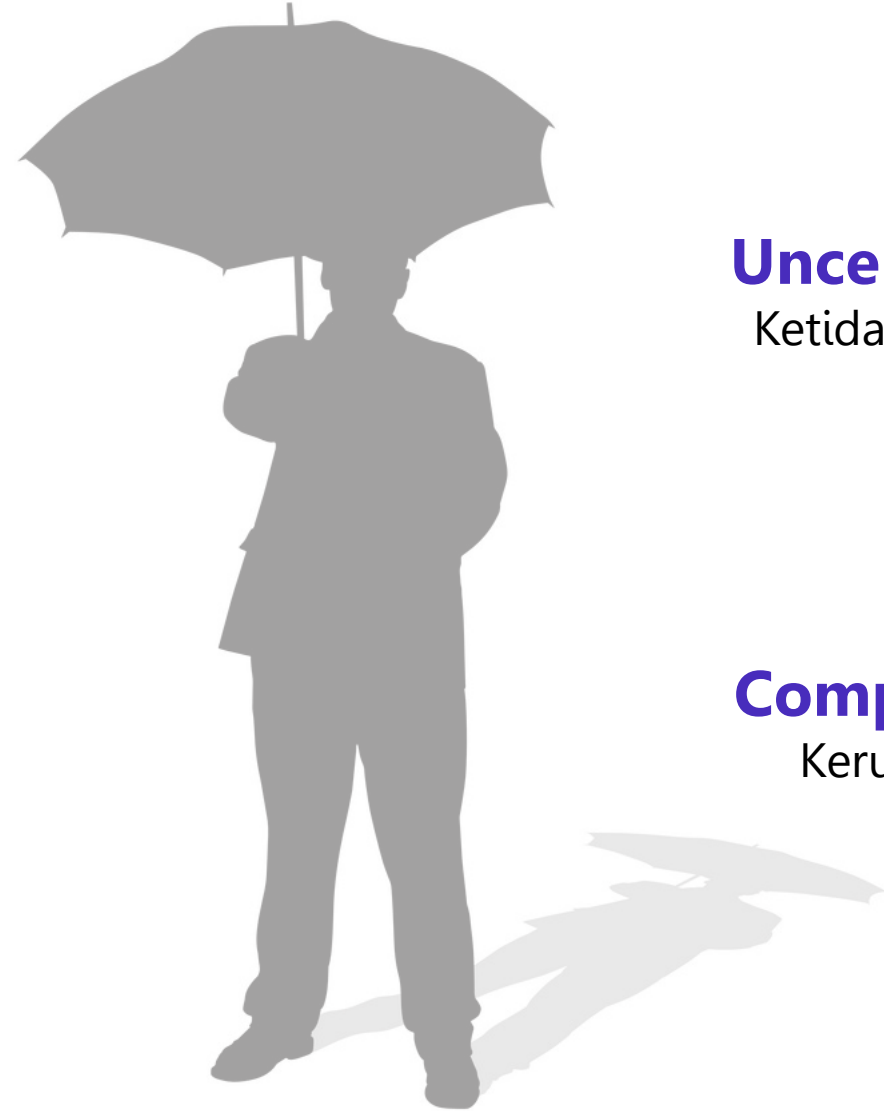
**MENCABAR**  
& **SENGIT**  
TOUGH & CHALLENGING

**Volatility**  
Ketidakstabilan

**Ambiguity**  
Kekaburan

**Uncertainty**  
Ketidakpastian

**Complexity**  
Kerumitan







Persekitaran dunia  
yang semakin

**MENCABAR**  
**& SENGIT**  
**TOUGH & CHALLENGING**

## Volatility

### Ketidakstabilan

Kecepatan perubahan...

- **Pasaran kewangan**
  - RM vs USD, KLCI
- **Harga komoditi**
  - CPO, Minyak mentah, Gas
- **Trend sosial**
  - Popularism, Generasi sanwic





Persekitaran dunia  
yang semakin  
**MENCABAR**  
& **SENGIT**  
TOUGH & CHALLENGING



## Uncertainty

Ketidakpastian

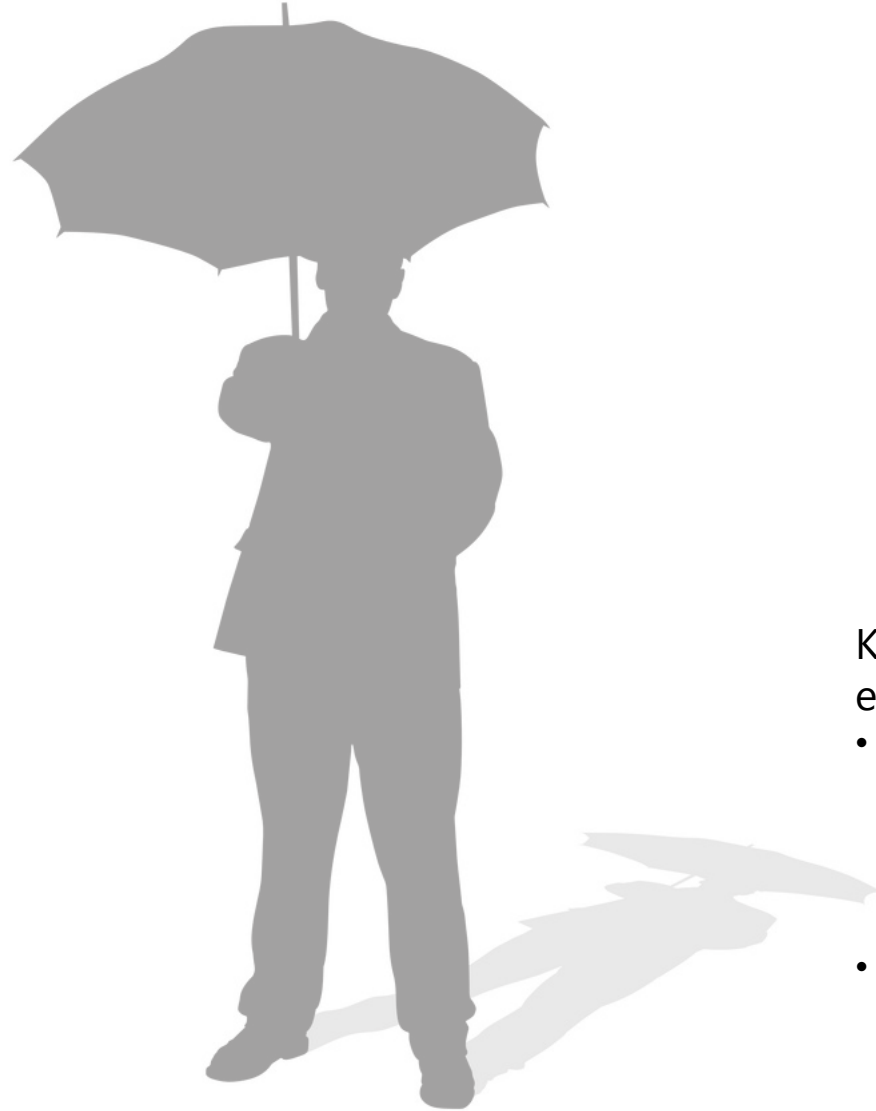
Ketidaktentuan isu dan peristiwa...

- **Kesan alam sekitar**
  - Perubahan iklim
- **Globalisasi & desentralisasi**
  - Russia vs Ukraine
  - US vs China
- **Kemajuan teknologi**
  - Hyper-connectivity



Persekitaran dunia  
yang semakin

**MENCABAR**  
& **SENGIT**  
TOUGH & CHALLENGING



## Complexity Kerumitan

Kesalingbergantungan  
ekosistem...

- **Perubahan demografi**
  - Penuaan & depopulasi
  - Penurunan populasi warga kerja
- **Penumpuan teknologi**
  - Automasi & kepintaran buatan
  - Perpindahan kerja
  - Ketaksamaan digital



Persekitaran dunia  
yang semakin  
**MENCABAR**  
& **SENGIT**  
**TOUGH & CHALLENGING**

## Ambiguity

Kekaburan

Kekaburan potensi kesan  
dan implikasi...

- **Kepimpinan dan arah politik**
  - GE15
- **Pembangunan bakat**
  - Bakat tidak sepadan keperluan industry
  - Kemahiran masa hadapan





# ISU & CABARAN YANG KITA HADAPI

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# ISU & CABARAN YANG KITA HADAPI

**F**UNDING & FINANCING

**I**

**R**

**S**

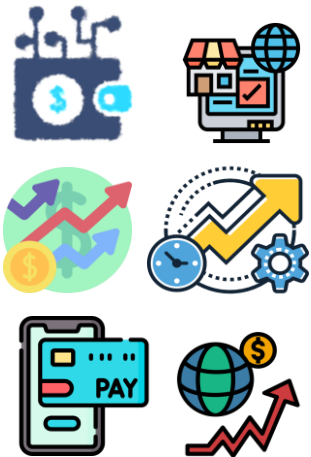
**T**

# TREND UNTUK DANA DAN PEMBIAYAAN MENUJU 2030

## POINT US IN THE DIRECTION OF:

Advancements in digitalised Infrastructure allow for tapping into new market opportunities and foreign investments. The ease of doing business is improved with the cashless economy and increased labour productivity to spur innovation and improve livelihoods in Malaysia.

### SIGNALS OF CHANGE IN FUNDING & FINANCING



1. Drive in digital economy towards achieving high income nation
2. Growth in e-commerce
3. Towards cashless economy
4. Increase in non-traditional funding and financing options
5. Rising importance of gig economy
6. Increase in national debt
7. Declining attractiveness to investors

## WHY DOES IT MATTER?

### Future of Engineering

- Creation of hubs as a catalyst for innovation and R&D to support the industry and economic development towards diversified products and services and development of world-class start-ups.
- Improved regional collaboration where Malaysian companies focus on niche areas in the value chain.
- Increased business and industry competition with the increase in goods and services allows the business and industry to grow with better crowds and markets

### Engineering the Future

- Improved Malaysia's industry landscape and change talent and skill requirements with improved digital infrastructure.
- Enhanced education system to produce students or talent with better fit-for-purpose skill sets that meet industry requirements.

Source: MIGHT, 2022



# ISU & CABARAN YANG KITA HADAPI

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NFRASTRUCTURE & INSTITUTION

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# TREND UNTUK INFRASTRUKTUR DAN INSTITUSI MENUJU 2030

## POINT US IN THE DIRECTION OF:

Reducing the digital gap in society that bring better connectivity and information. At the same time improve the quality of life of the citizens by having a work-life balance and facilitate the elderly community to live in a harmonious environment with adequate physical and health facilities.

### SIGNALS OF CHANGE IN SOCIAL



1. Any city to be smart cities
2. High-quality education with digitalised education
3. Improving social connectivity
4. Recovery for middle income class
5. Need for infrastructure for silver economy
6. Towards less working hours

## WHY DOES IT MATTER?

### Future of Engineering

- To have a work-life balance as digitalisation and automation reduce unnecessary tasks and improve efficiencies for people to live their life.
- Increased demand for health and well-being business and technology areas like therapeutic robots, telemedicine, AI in healthcare, prioritised care and mental health.

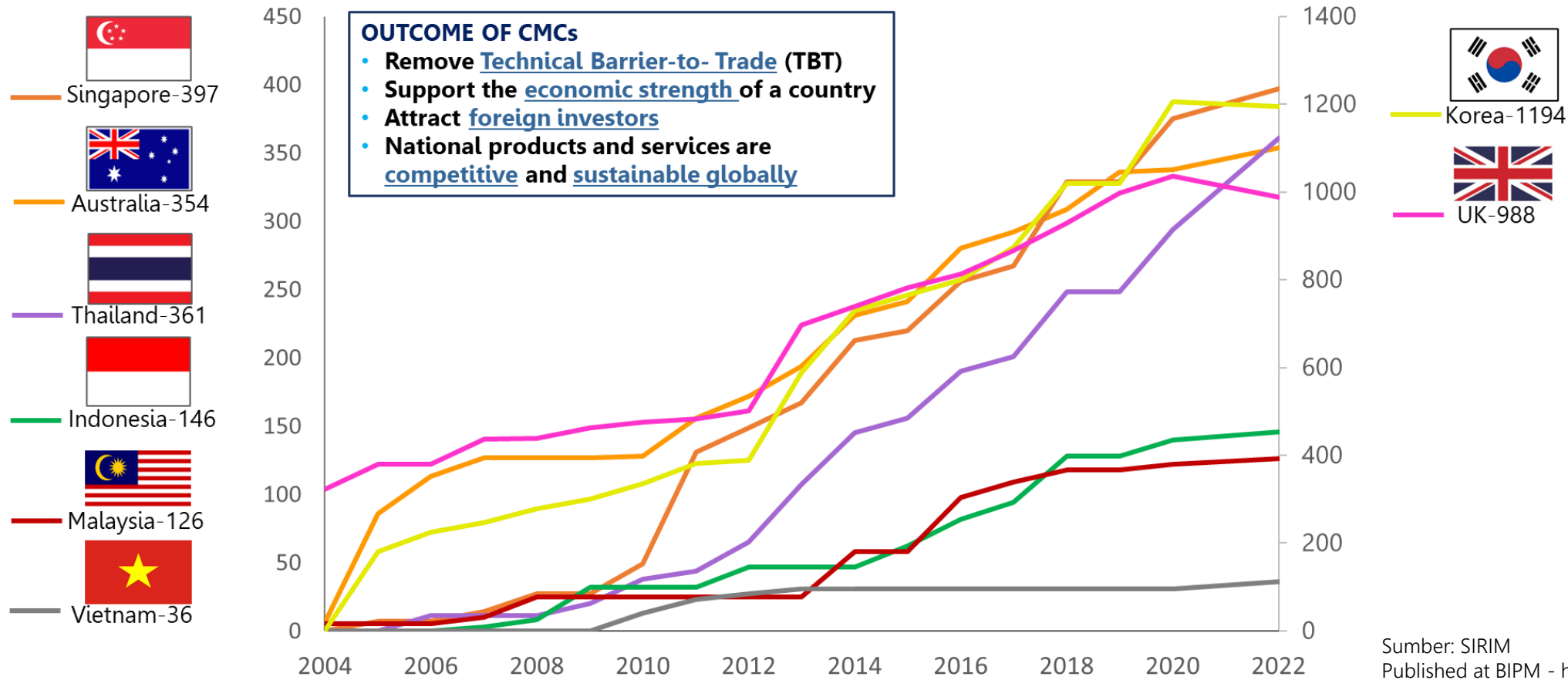
### Engineering the Future

- Multi-generational workforce will consist of an ageing workforce and longer retirement age and retirees returning to work
- Facilities and arrangements will be required for a digital workforce
- The community is technologically savvy and enjoys a higher quality of life with easy access to education, knowledge, and information for developing talents.

Source: MIGHT, 2022

Malaysia vs Regional Calibration and Measurement Capabilities (CMCs)

NUMBER OF PUBLISHED CMCs







# ISU & CABARAN YANG KITA HADAPI

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REGULATORY & POLICIES

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# TREND UNTUK REGULASI DAN DASAR MENUJU 2030

## POINT US IN THE DIRECTION OF:

Enhancement in e-Governance for better service delivery. Processes are simplified and access to government information is easier allowing for society's participation in government initiatives. Potential opportunities from empowerment of youth in politics and cryptocurrency.

### SIGNALS OF CHANGE IN POLITICS & GOVERNANCE



1. Decrease in military spending
2. Decrease trend in terrorism in Malaysia
3. E-government services to focus on citizen
4. Improvement in Global Peace Index
5. Lowering voting age for better Parliamentarians
6. Regulating digital and sharing economy

## WHY DOES IT MATTER?

### Future of Engineering

- Improvement in e-government in providing accurate information and data management to enable industry and business to make better decisions and investments.
- Better political stability that allows for improvement in handling internal conflict, low cases of violent crime and good neighbouring country relationships.
- Having the right incentives and strategic policies to sustain and attract new investment to Malaysia.

### Engineering the Future

- Improved transparency of policies, regulations and standards for better development and management of resources and increase citizen participation in policy making.

*Source: MIGHT, 2022*

## COVID-19 SPECIAL

### Coronavirus: Flip-flops in aid policies dent faith in Malaysian govt as it looks to reopen economy





# ISU & CABARAN YANG KITA HADAPI

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S KILLS & TALENTS

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# TREND UNTUK BAKAT DAN KEMAHIRAN MENUJU 2030

## POINT US IN THE DIRECTION OF:

Continuous learning workforce that will see the rise of gig workers and new jobs that previously did not exist. Roles that cannot be automated will continue to require increasing number of talents with the right skills that could be boundaryless

### SIGNALS OF CHANGE IN SKILLS & TALENTS



1. Shrinking lifespan of skills
2. Entry of digital natives into the workforce
3. Decline in tertiary enrolment
4. Rise of gig workers and digital workforce
5. Increase in women labour force participation
6. Rise in mental health issues

## WHY DOES IT MATTER?

### Future of Engineering

- Need for constant reskilling and upskilling due to shorter lifespan of skills from 26 years to 5 years, with more technical skills at just 2.5 years.
- Increased importance on value-driven work in the new generation workforce
- Attracting and retaining skilled local talents while leveraging on digital global workforce
- Different teaching methods for future engineers

### Engineering the Future

- Need for updates in education system for the development of future skills & talents
- Emphasis on benefits and social safety net
- Need to increase labour productivity

Source: MIGHT, 2022



# TREND UNTUK BAKAT DAN KEMAHIRAN MENUJU 2030

**Pertumbuhan guna tenaga dalam sektor tertentu akan menyusut atau merosot**

Industries	CAGR 2005-2020	CAGR 2020-2030	Employment 2030	Share of Employment 2030
Research & Development Services Industry	22.4%	5.0%	31,127	0.3%
Medical Devices Industry	8.5%	4.9%	50,979	0.5%
Petroleum Industry	10.9%	4.3%	25,553	0.3%
Machinery & Equipment Industry	6.2%	3.3%	212,464	2.2%
Construction Industry	5.4%	3.3%	1,720,110	17.4%
Metal-based	4.4%	2.8%	351,365	3.6%
Information & Communication Technology Services Industry	6.4%	2.8%	298,900	3.0%
Automotive Industry	4.1%	2.7%	588,375	6.0%
Chemical Industry	3.3%	2.3%	322,853	3.3%
Electric & Electronic (E&E) Industry	1.7%	1.4%	650,210	6.6%
Shipbuilding & Ship Repair Industry	3.6%	-9.0%	86,141	0.9%
Rail Industry	3.9%	-15.6%	44,303	0.4%
Aerospace Industry	6.1%	-16.3%	34,796	0.4%

*Source: MIGHT, 2021*



# ISU & CABARAN YANG KITA HADAPI

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**S**  
**T** **ECHNOLOGIES**

# TREND UNTUK TEKNOLOGI MENUJU 2030

## POINT US IN THE DIRECTION OF:

Malaysia is gaining opportunities in adopting technology like automation, robotics, AI and IoT in industry. Also, exploring the potential in E-waste and autonomous vehicle development. At the same time, strengthening the effort to fight cybercrime to remain competitive.

### SIGNALS OF CHANGE IN TECHNOLOGY



1. Adoption of online entertainment
2. Improvement in cybersecurity to curb cybercrimes



3. Increasing cloudification - public clouds.
4. Opportunities from the Internet of Things (IoT)



5. Autonomous vehicles
6. The rise of robots

## WHY DOES IT MATTER?

### Future of Engineering

- Increased investment in R&D and be open to more innovative technological products and services.
- More creative ideas and innovation with the use of technology and digitalisation.
- Use of real time big data to enable industry and business to make better decisions and investments.
- Evolving into the metaverse workplace.

### Engineering the Future

- Increased accessibility to education in remote areas with improved industry awareness with the advancement in internet connection.
- Increased digitalisation technologies will create digital workforce and teams that is boundaryless.
- Increased policy and governance processes transparency with advanced technology features such as AI, blockchain, machine learning, and sensors.

Source: MIGHT, 2022

## GLOBAL SKILLS INDEX 2022



OVERALL RANK

39<sup>th</sup>

43

BUSINESS SKILLS

● 27<sup>th</sup>

TECHNOLOGY SKILLS

● 50<sup>th</sup>

DATA SCIENCE SKILLS

● 42<sup>nd</sup>

CUTTING EDGE

COMPETITIVE

EMERGING

LAGGING

Source: Coursera, MIGHT, 2022



# **BAGI MENCAPAI ASPIRASI KITA**





MASA DEPAN YANG  
**MAKMUR**  
**SEJAHTERA**  
**MAMPAN**  
MEMERLUKAN...

# 1 PEMBANGUNAN EKONOMI

Kejayaan Malaysia terletak pada  
kemampuan kita untuk  
**MENGINDUSTRIALISAKAN**  
**KEKUATAN DAN**  
**KEMAMPUAN KITA**



# MASA DEPAN YANG MAKMUR SEJAHTERA MAMPAN MEMERLUKAN...

## 2 MENINGKATKAN 3Cs

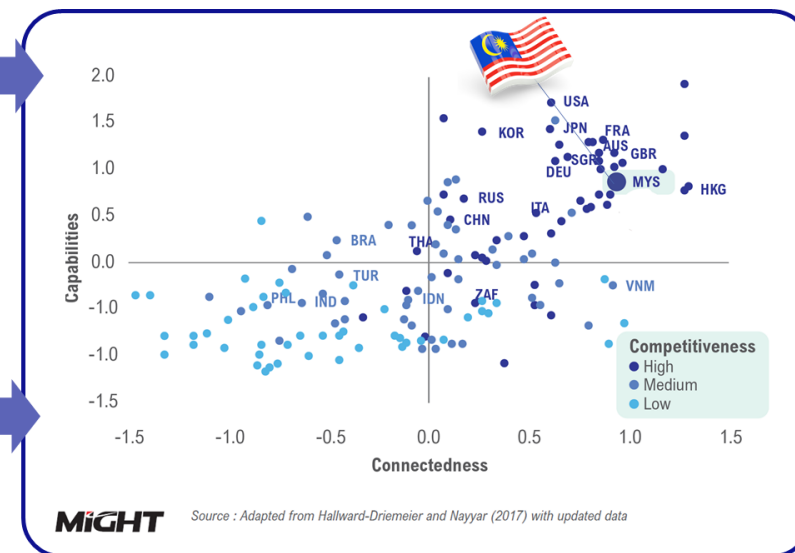
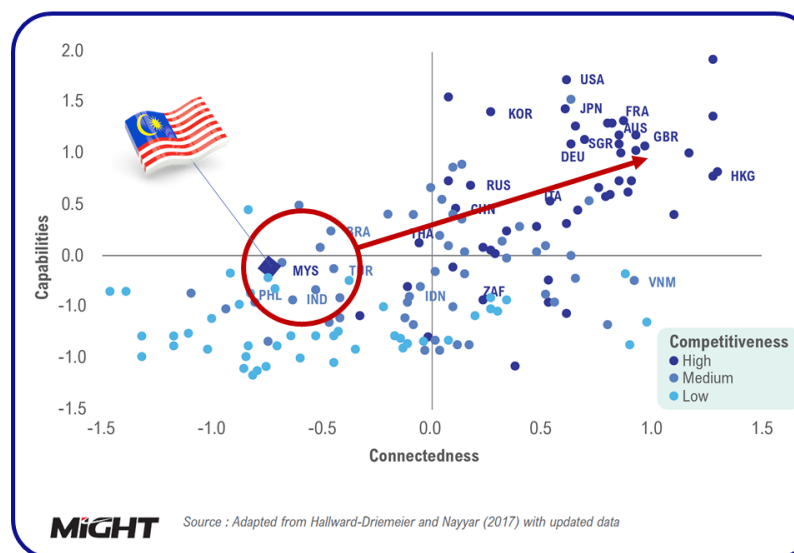
2020

Capabilities = Low  
Connectedness = Low  
Competitiveness = High

If we are to enhance current 3Cs  
and prepare for future 3Cs

2030

Capabilities = High  
Connectedness = High  
Competitiveness = High



## 3Cs

### COMPETITIVENESS

#### Parameters

*How well we adjust to changes*

1. Products and Services
2. Business Environment
3. Sustainability and Inclusiveness

### CAPABILITIES

#### Parameters

*Our ability to adopt to new technologies*

1. Skills and Knowledge Talents
2. R&D and Innovation
3. Productivity
4. Technology Advancement

### CONNECTEDNESS

#### Parameters

*How synergised we are in global value chains*

1. Trade and Logistics
2. Supply-chain
3. Infrastructure and eco-system support

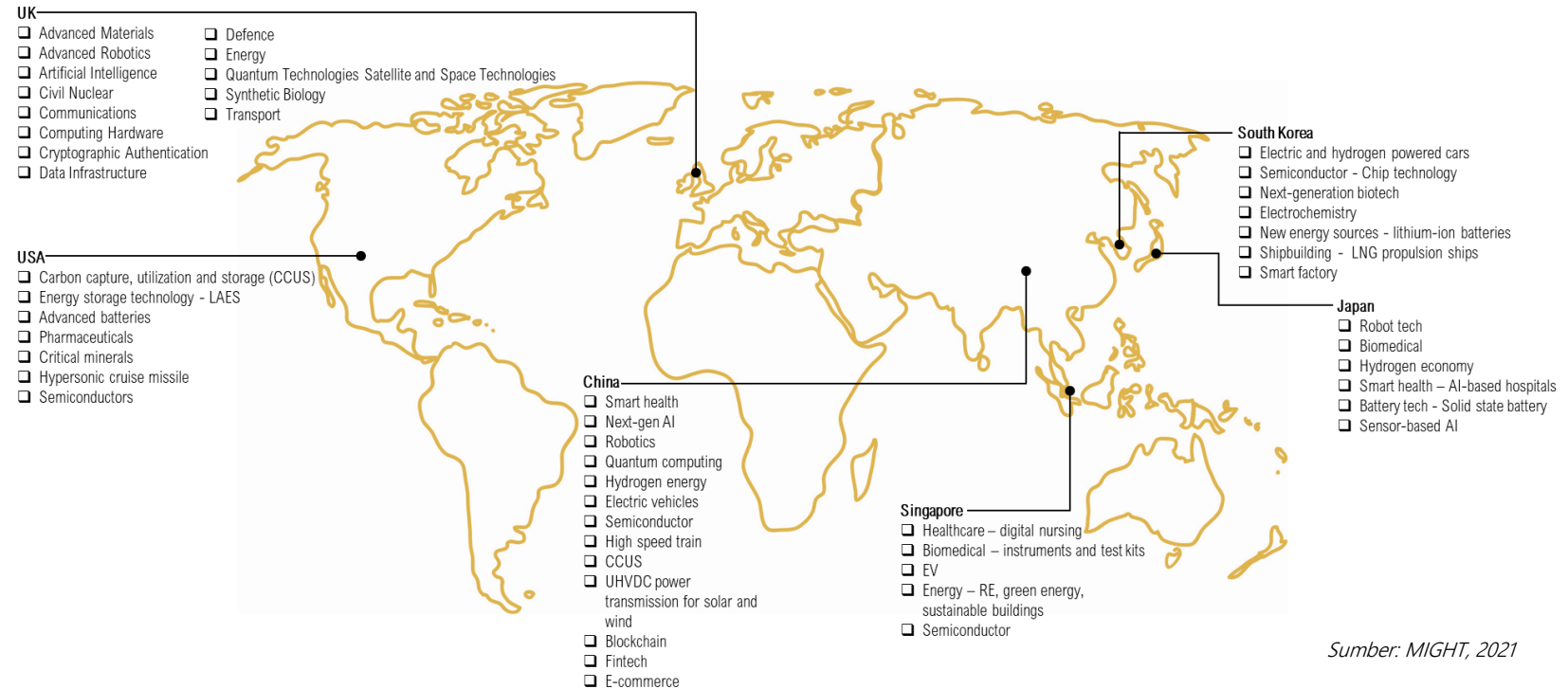
Sumber: Future of Malaysian Manufacturing Report, World Bank, MIGHT, 2020



MASA DEPAN YANG  
**MAKMUR**  
**SEJAHTERA**  
**MAMPAN**  
MEMERLUKAN...

## Competitiveness

### 3 PELABURAN UNTUK INDUSTRI BAHARU



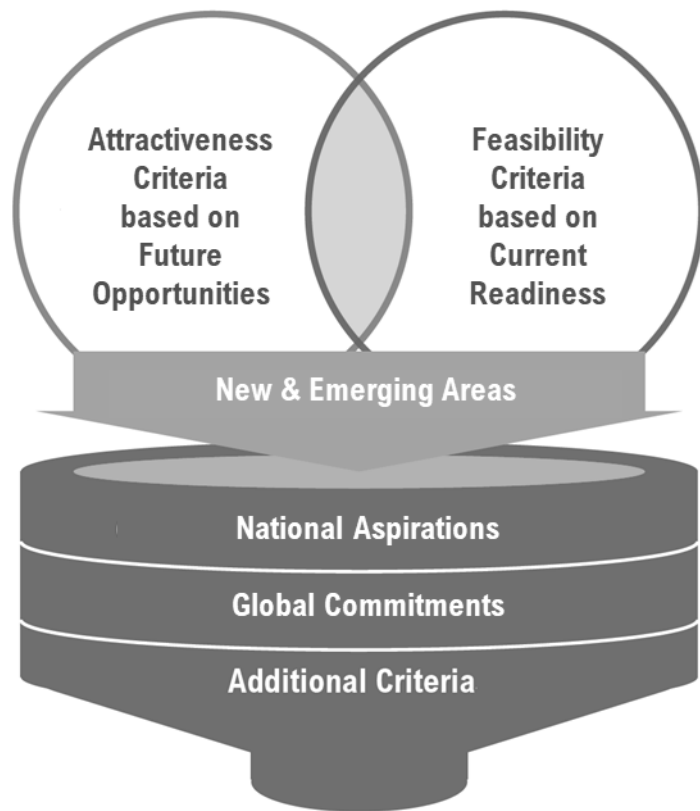
Sumber: MIGHT, 2021

Pelaburan baharu mempamerkan  
bagaimana negara menangani cabaran  
pembangunan perindustrian dalam era 4IR,  
penumpuan industri dan teknologi baharu



# MASA DEPAN YANG MAKMUR SEJAHTERA MAMPAN MEMERLUKAN...

## Competitiveness 3 PELABURAN UNTUK INDUSTRI BAHARU



Moonshots have the potential to **accelerate development, leapfrog Malaysia's competitiveness** and **propel socio-economic mobility**.

Pursuing Moonshots requires **balancing**:

- i. **Transformative over Pragmatic**
- ii. **High Risk over Low Risk**
- iii. **Prioritising of Resources**
- iv. **Long Term over Quick Wins**



COMMODITIES  
FOR THE FUTURE



EVERYTHING-AS-  
A SERVICE



HYDROGEN  
ECONOMY



NEW  
ENERGY



NEXT-GEN  
MOBILITY



SMART  
MANUFACTURING



SUPPLY-CHAIN  
TRACEABILITY



URBAN  
MINING



MASA DEPAN YANG  
**MAKMUR  
SEJAHTERA  
MAMPAN**  
MEMERLUKAN...

## Competitiveness

### 4 MEMANFAATKAN GELOMBANG TEKNOLOGI TINGGI



PERNIAGAAN  
MODEL BAHARU



PEMBUATAN  
PINTAR



MOBILITI  
PINTAR



PERANTI  
PINTAR



EKONOMI  
LESTARI





MASA DEPAN YANG  
**MAKMUR  
SEJAHTERA  
MAMPAN**  
MEMERLUKAN...

Capabilities  
**5** PEKERJA  
BERKEMAHIRAN





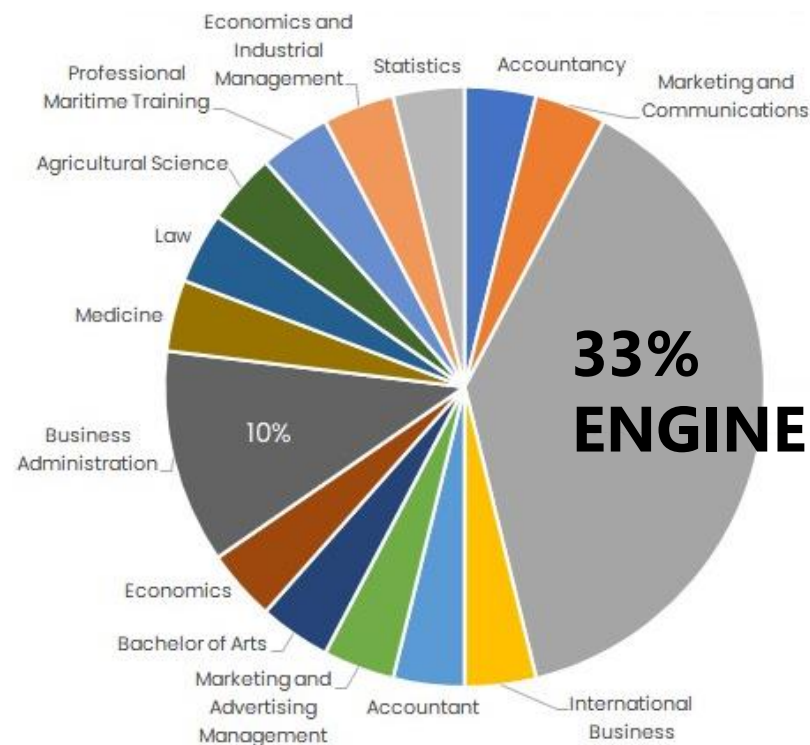


MASA DEPAN YANG  
**MAKMUR**  
**SEJAHTERA**  
**MAMPAN**  
MEMERLUKAN...

## Capabilities

### 6 JURUTERA SEBAGAI PEMIMPIN

#### Kelayakan MD/CEO Syarikat 30 Teratas di Malaysia



MANAKALA  
**40%** DI PERINGKAT  
GLOBAL

# MASA DEPAN YANG MAKMUR SEJAHTERA MAMPAU MEMERLUKAN...

## Capabilities

# 7 MENINGKATKAN RANTAIAN NILAI: INVENTION & INNOVATION







MASA DEPAN YANG  
**MAKMUR**  
**SEJAHTERA**  
**MAMPAN**  
MEMERLUKAN...

Connectedness

**8** PENGUKUHAN  
INFRASTRUKTUR & EKO-SISTEM







MASA DEPAN YANG  
**MAKMUR**  
**SEJAHTERA**  
**MAMPAN**  
MEMERLUKAN...

Connectedness

**9** RANTAIAN BEKALAN  
(SUPPLY CHAIN)  
YANG MAMPAN





# ANJAKAN TRANSFORMASI DIPERLUKAN...

## FROM

## TO

### LEADERSHIP & GOVERNANCE

- |                                 |   |
|---------------------------------|---|
| Administrative delivery         | • Innovative services                                       |
| Post-truth decision making      | • Evidence-based decision making                            |
| Gradual governance and policies | • Agile and responsive governance and policies              |
| Centralised decision making     | • Empowered, facilitative and decentralised decision making |

### ECONOMIC GROWTH & EQUITABLE DISTRIBUTION

- |                                       |  |
|---------------------------------------|--|
| Industry-driven economy               | • People-driven economy                    |
| Resource intensive                    | • Knowledge intensive                      |
| Mass production of goods and services | • Mass customisation of goods and services |
| Low wage employees                    | • High wage employees                      |
| Low value-added products and services | • High value-added products and services   |

### EDUCATION & TRAINING

- |                                |   |
|--------------------------------|---|
| Classroom and curriculum based | • On-demand learning and democratisation of knowledge |
| Rote learning                  | • Critical thinking and problem solving               |
| Formal education               | • Informal life-long learning education and skills    |

### STI CAPACITY & COMPETENCY

- |  |  |
|--|--|
| Scientifically aware society                                 | • Scientifically engaged society             |
| Consumer of goods and services                               | • Prosumers of goods and services            |
| Silo approach in research, development and commercialisation | • Collaborative network approach in R, D & C |

Source: ASM Malaysia 2050, 2017





# ANJAKAN TRANSFORMASI DIPERLUKAN...

FROM

TO

## PEOPLE & VALUES

- |   |  |
|---|--|
| Tolerant of the differences in a plural society | • Respect and understanding of the differences in a plural society |
| Focusses on the bad                             | • Highlights the good  |
| Individualistic and materialistic worldview     | • Societal and for the greater good worldview                      |
| Wait-and-see attitude towards changes           | • Proactive attitude towards changes                               |

## TALENTS

- |                             |  |
|-----------------------------|--|
| Job seekers                 | • Job creators                                   |
| Low skilled migrant talents | • High skilled local talents                     |
| One skillset for a lifetime | • Many skillsets for lifelong through reskilling |
| One job for one career      | • Different roles for one career                 |
| Permanent employment        | • Freelancers in a gig economy                   |

## POPULATION & DEMOGRAPHICS

- |   |   |
|---|---|
| Centralised services  | • Decentralised services  |
| Services and infrastructure catered to a young growing population | • Services and infrastructure catered to ageing slow population |
| Reactive healthcare   | • Preventive healthcare   |
| Social protection for a young and productive population           | • Social protection for a rising dependency ratio               |

## URBANISATION & RISE OF MEGACITIES

- |  |  |
|--|--|
| Concentrated development                 | • Well-balanced and well-spread development  |
| Disconnected infrastructure and services | • Well-connected infrastructure and services |

## GREEN & SUSTAINABLE PRACTICES

- |  |  |
|--|--|
| Practices towards short-term gains               | • Practices towards long-term sustainability     |
| Waste and linear economy                         | • Circular and shared economy                    |
| Over-consumption society                         | • Sustainable consumption society                |
| Green & sustainable practices out of enforcement | • Green & sustainable practices out of awareness |

Source: ASM Malaysia 2050, 2017





# JURUTERA MASA DEPAN

## MEMERLUKAN

**1** Upaya  
**BERADAPTASI**

**3** ANTARA  
**DISIPLIN**

**2** PENGAJARAN & PEMBELAJARAN  
yang berbeza

**4** PEMBELAJARAN  
**BERTERUSAN**

## UNTUK

- Mewujudkan industri baharu
- Menyelesaikan masalah
- Mengubah kehidupan

*The future isn't a choice... it is inevitable!  
It is how we face the future and its challenges, and do  
what is needed to rise above the competition in a  
future we engineer to succeed*





# PENGAMBILAN UTAMA

- 1 Masa depan yang diidamkan
- 2 Cabaran yang perlu ditangani
- 3 Persekitaran yang mencabar
- 4 Tidak ada pilihan kecuali membina kejayaan bersama
- 5 Peluang keemasan bagi yang bersedia ke hadapan
- 6 Membina masa depan sendiri



*At this point I am pessimistic.  
But I hope my pessimism will lead to  
actions being taken, actions that will  
prove 30 - 50 years from now –  
although I may not be around to see it  
– that I'm wrong... then I will be happy.*



# THANK YOU



Committed to Engineering Excellence

**BOARD OF ENGINEERS MALAYSIA**

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