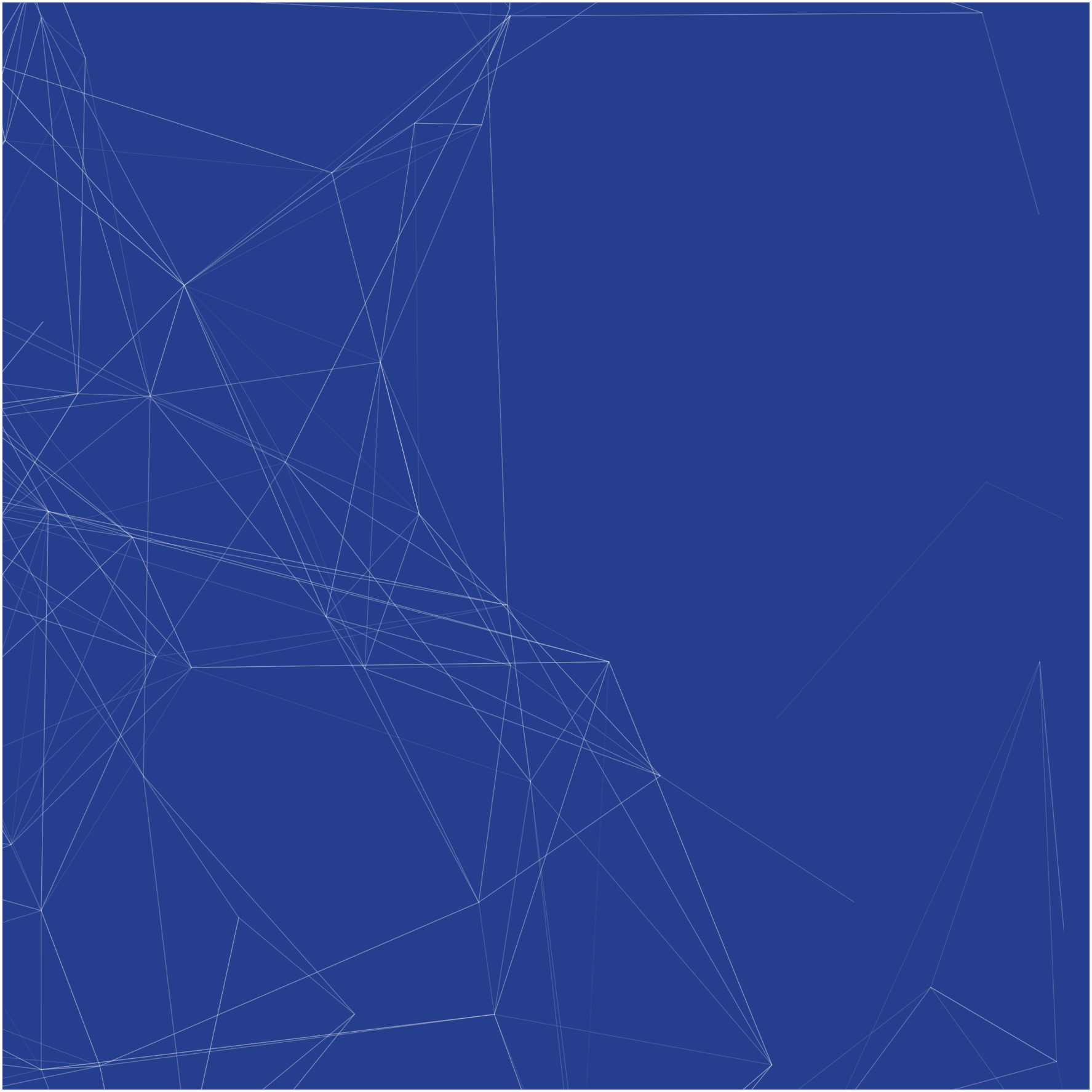


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FRAMING MALAYSIAN HIGHER EDUCATION 4.0 :

Future-Proof Talents

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First Printing, 2018

Published by :
Department of Higher Education Malaysia
Ministry of Higher Education Malaysia,
No. 2, Tower 2, Street P5/6, Precinct 5
62200 Putrajaya, Malaysia
www.jpt.mohe.gov.my

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FRAMING MALAYSIAN HIGHER EDUCATION 4.0: Future-Proof Talents

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data
FRAMING MALAYSIAN HIGHER EDUCATION 4.0 : Future-Proof Talents
ISBN 978-967-14585-6-3
1. Higher education and state--Malaysia.
2. Universities and colleges--Malaysia.
3. Education, Higher--Aims and objectives--Malaysia.
4. Government publications--Malaysia.
I. Malaysia.--Kementerian Pendidikan Tinggi.
378.9595

ISBN 978-967-14585-6-3



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What people said about the book...



PROF. TAN SRI DATO' DZULKIFLI ABDUL RAZAK
Immediate Past President,
International Association of University, Paris;
Chairperson, Board of Directors, USIM

"The 4IR is a complex phenomenon that is not easily fathomed, less still to be translated into educational perspectives for the future. Much is needed to be understood before the context is well clarified sans uncertainties. The compilation is a welcome attempt to provide readers with initial clues to focus on. It is hoped that the book will lead to more intellectual debates in contributing towards better decision-making process in humanising the 4IR. Kudos to MOHE for taking this commendable effort."



CHRISTINE ENNEW
Deputy Vice Chancellor of Warwick University, UK

"Enjoyed reading the book. I think it works really well. There's enough details to get into but it's not so long that it loses your attention. And I think it's really interesting to focus on the breadth of implications from social and digital change! I think it should be a really useful publication."



PROF. DATO' DR. MOHAMED AMIN EMBI
Chief Information Officer
Director, Centre for Teaching & Learning Technologies UKM

"A forward-looking framework by MOHE with achievable strategies and initiatives. It is also a testimony that MOHE is not only the Most Innovative Ministry in Malaysia but potentially, the world's Best Higher Education ecosystem. An awesome effort of redesigning higher education."

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ADAM BRIMO
Founder & CEO, OpenLearning

"4IR has arrived and this book articulates MOHE's strategies in producing future-proof graduates in these rapidly changing times. By building on the MEB (HE) 2025, this book identifies the marginal, adaptive and significant changes necessary towards a Future University Model to ensure that Malaysia benefits from all the opportunities presented by 4IR. Once again, MOHE has demonstrated that it is the most innovative ministry and a global leader in education policy."



K. RAMAN
Managing Director, Microsoft (Malaysia)

"As the Fourth Industrial Revolution unfolds, it is imperative to have technology at the forefront and at the core of education to hone our students' skills and equip them in this mobile-first, cloud-first world. This book provides great insights on the Ministry's continuous initiatives to build a digital workforce. I applaud MOHE's efforts for driving the digitalisation of education and fostering better learning outcomes in classrooms.



CHIN CHEE SEONG
PIKOM Immediate Past Chairman
PIKOM Academy Chair

"PIKOM applauds the initiative led by the Ministry of Higher Education in future proofing Malaysian talents. This will assist HLIs in providing conducive learning environments that inculcate innovation and creativity in students, therefore presenting the industry with an edge in the work force. The jobs of tomorrow will be very different from today and this calls for a change of mindset, both in the delivery of information and the application of knowledge. We congratulate the Ministry on its foresight."

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Framing Malaysian Higher Education 4.0: Future-Proof Talents operates in two ways:

1) A manuscript version with three supplementary pages of augmented reality (AR) contents.

- Page 73 – ICGPA initiative
- Page 81 – Transformative L & T Delivery
- Page 84 – Learning Analytics as technology - enhanced assesment

These AR contents are accessible by downloading the MyHE 4.0 mobile application (app).

2) A pdf version which can be obtained by scanning the cover page of the document. This can be performed by downloading the MyHE 4.0 mobile app. Alternatively, the pdf version can also be retrieved from the Department of Higher Education's website via the following link www.jpt.mohe.gov.

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How to download MyHE 4.0 Augmented Reality contents?

Just follow these simple steps.

ANDROID devices

FIRST:

1. Open the Play Store app in your android device.
2. Search and select MyHE 4.0 app.
3. Select the install icon.
4. Select the Accept icon after reviewing the app policy and regulations.
5. Download the app.
6. The app is available for use.

Once the app is downloaded, NEXT:

1. Open the QR Code reader on your phone.
2. Hold your device over the QR code or the picture on the page so that it is visible within your phone's screen.
3. The infographic or video will pop up on your phone screen.

iOS devices

FIRST:

1. Open the App Store in your iOS device.
2. Search and select MyHE 4.0 app.
3. Select the Free icon displayed at the right side of the app to download it.
4. The prompt will require your iTunes password.
5. Click OK and you will automatically leave the App Store.
6. The MyHE 4.0 icon will be displayed on your device.
7. The app is available for use.

Once the app is downloaded, NEXT:

1. Open the QR Code reader on your phone.
2. Hold your device over the QR code or the picture on the page so that it is visible within your phone's screen.
3. The infographic or video will pop up on your phone screen.

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Ultimately technology is a tool but people should come first. Its purpose should be centred on humanity and public interest. Eventually it boils down to culture and values where tolerance, respect, care and compassion come into play. Malaysia needs a collective wisdom to face the new cultural renaissance introduced by the 4IR.



YB DATO' SERI IDRIS BIN JUSOH
MINISTER OF HIGHER EDUCATION



The 4IR agenda can contribute to the society by humanising the innovation and technology through Higher Education 4.0.

YBHG. TAN SRI DR. NOORUL AINUR MOHD. NUR
SECRETARY GENERAL

The 4IR will have immense and profound impact on the Malaysian social, political and economic landscapes. Hence, now, more than ever, we need to prepare for future uncertainties in these areas.



YB DATUK DR. MARY YAP KAIN CHING
DEPUTY MINISTER OF HIGHER EDUCATION



We need to equip our graduates with future-proof skill sets by harnessing their humanistic, technological and data analytics competencies in embracing the 4IR. Lifelong learning must be embraced by all students through reskilling and upskilling opportunities.

YBHG. DATIN PADUKA IR. DR. SITI HAMISAH BINTI TAPSIR
DIRECTOR GENERAL, DEPARTMENT OF HIGHER EDUCATION

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4 WAY FORWARD : HIGHER EDUCATION 4.0 FRAMEWORK

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ACKNOWLEDGEMENT

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In preparing our nation's higher education ecosystem for the 4IR, the Ministry of Higher Education is guided by the Malaysia Education Blueprint 2015-2025 (Higher Education). At its launch in April 2015, the Prime Minister of Malaysia acknowledged the dynamic nature of the Blueprint and announced that it was central in
SHAPING THE FUTURE OF OUR NATION
DATO' SRI NAJIB RAZAK
PRIME MINISTER OF MALAYSIA
HIGHER EDUCATION BLUEPRINT LAUNCH
7 APRIL 2015



OUR MISSION

To sustain the higher education ecosystem in order to develop and enhance individual potentials and fulfil the nation's aspiration.

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OUR VISION

High quality tertiary education, excellent individuals, prosperous nation.

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PREAMBLE

The Fourth Industrial Revolution (4IR) represents new ways in which technologies such as Artificial Intelligence (AI), digitisation, automation and Internet of Things (IoT) are embedded in our daily experience. This phenomenon will fundamentally alter the way we live, work and relate to one another. The emerging technological breakthroughs derived from this progress, emphasise the need to redesign the education system and upgrade skills in the workplace. These transformations mean that education and industry will have to consider enhancing, reskilling and upscaling talents with the possibilities of synergising the core existence of humanistic values and intelligent machines. Hence, the issue of talent planning is critical to ensure Malaysia's long-term sustainable economic growth and development. This is largely due to the fact that the country is highly dependent on the capability of a values-driven workforce to innovate and apply advanced knowledge and technologies.

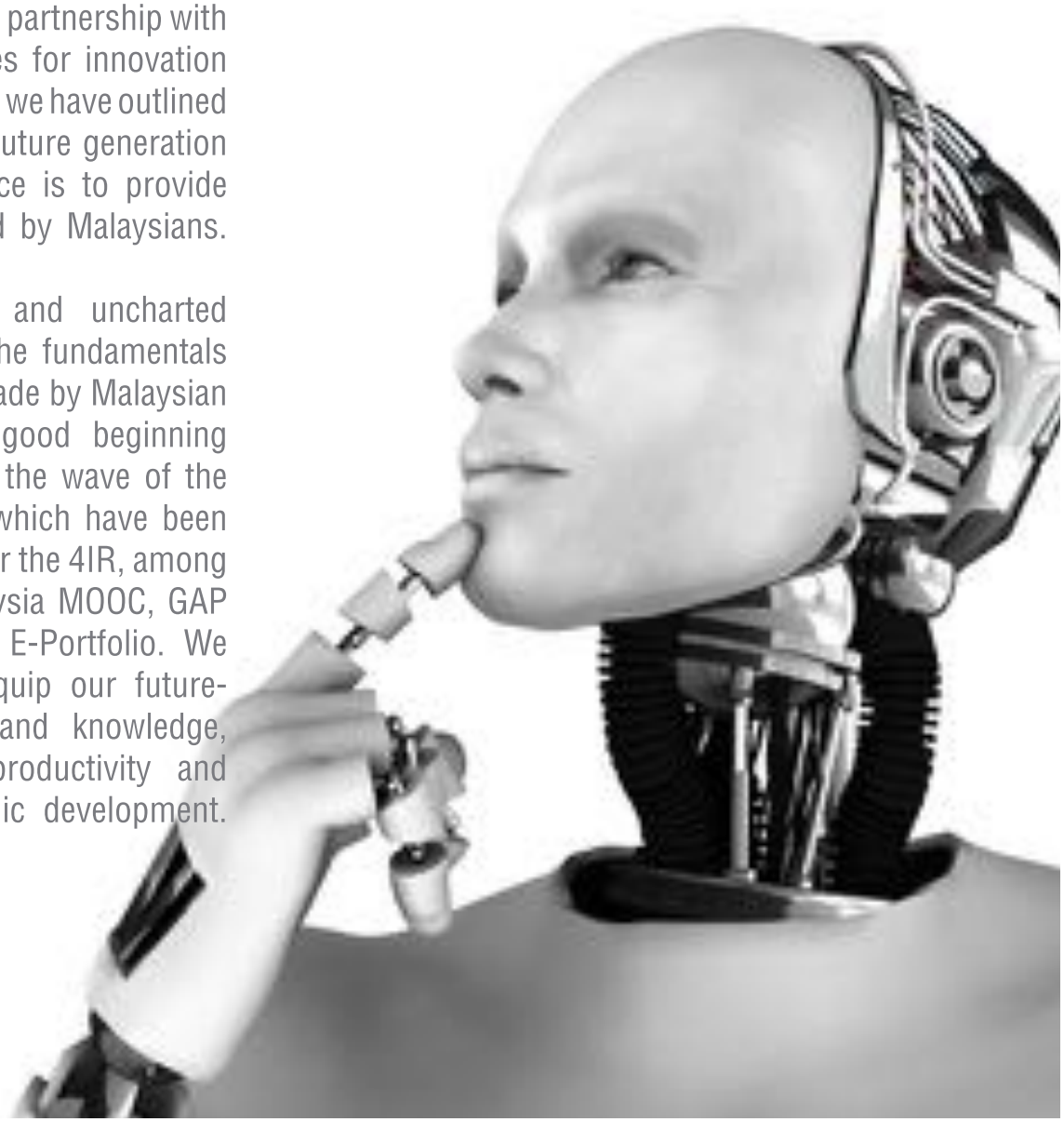
The technology convergence era necessitates effective and efficient mobilisation of resources in facing the possibility of jobs displacement due to automation, robotics and digitisation. The gig economy is getting more significant and the graduates will have to be aware of the need to engage in multiple sources of incomes and self-employment. The gig economy would require a deliberate policy design to protect the wellbeing and interests of those involved especially the graduates.



MOHE needs to play its role as a catalyst by focusing on pro-active skills transformation, both in the educational system and workplace, as well as emphasising the role of the younger generation ('digital natives' and 'robotic natives') in the future. MOHE advocates the notion that humans in the future will need to learn to exist and work in partnership with intelligent machines, and join forces for innovation and technological learning. At MOHE, we have outlined several strategies in preparing the future generation for the 4IR. The utmost importance is to provide the best higher education deserved by Malaysians.

The 4IR brings forward new and uncharted opportunities and challenges. The fundamentals outlined by MEB (HE) and efforts made by Malaysian academic circle demonstrate a good beginning for the education system in riding the wave of the 4IR. There are different solutions which have been undertaken by MOHE in preparing for the 4IR, among them are 2u2i, iCGPA, APEL, Malaysia MOOC, GAP Year, CEO@Faculty, MEA and My E-Portfolio. We are gearing up to prepare and equip our future-proof graduates with the skills and knowledge, empowering them to increase productivity and contribute to the nation's economic development.

It is imperative that these challenges are dealt with by redesigning the higher education system and upgrading the skills in the workplace. Policy incentives are needed to encourage businesses and education providers to engage in reskilling and upskilling through lifelong learning opportunities.



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This document provides the background information on the 4IR, its impacts and challenges, the current scenario and the future alternatives in redesigning Malaysian higher education. The basis of this document is to produce ethically and morally upright citizens who are spiritually grounded and caring to cope with the demands of the 4IR. It serves as a guide for public universities and private institutions in meeting the demands of the 4IR. It was developed through collaborative and consultative processes with various stakeholders. Numerous programmes, workshops and meetings involving more than 10,000 individuals comprising public and private university leaders, administrators, academics, students and industry players were conducted in the preparation of this document.

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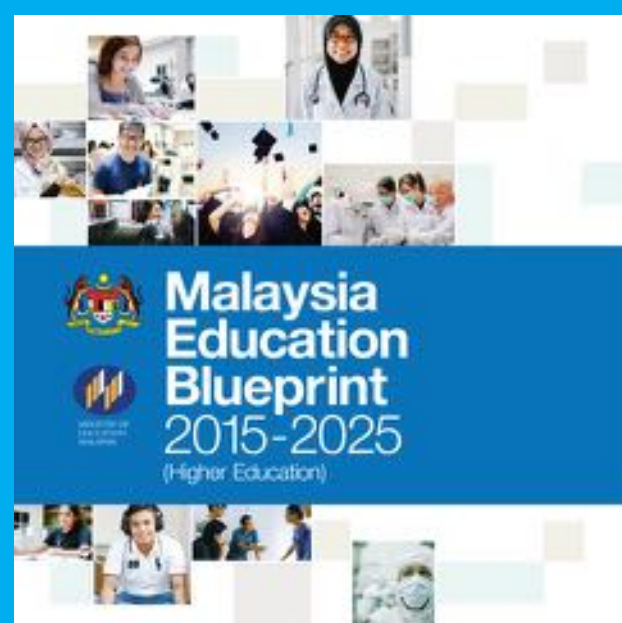
01 / Framing Malaysian Higher Education 4.0: Future-Proof Talents Chapter One

OVERVIEW

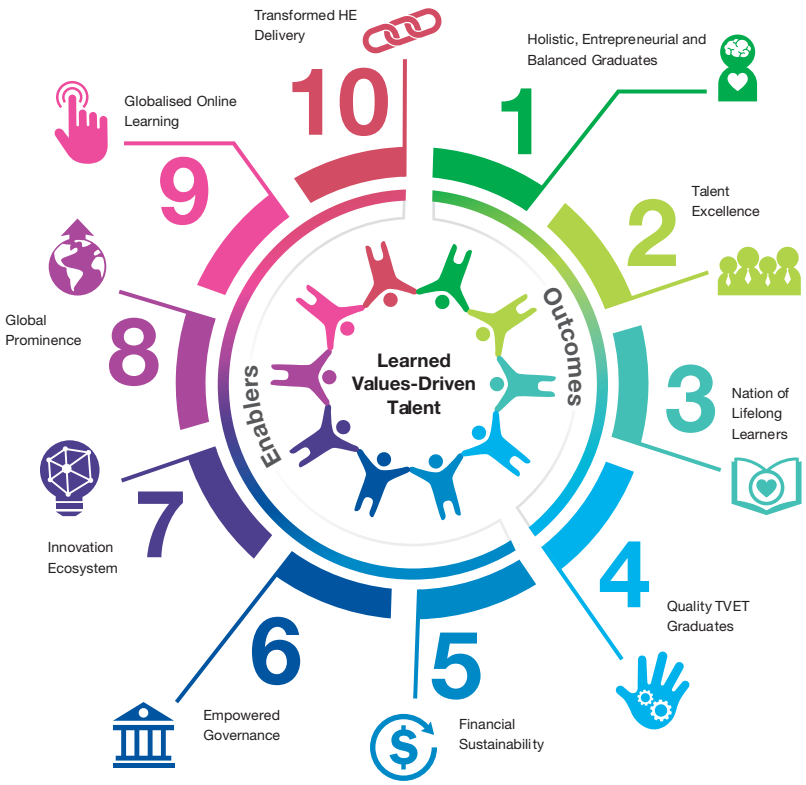
- Malaysia Education Blueprint 2015-2025 (Higher Education)
- The Fourth Industrial Revolution
- Historical Accounts of the Industrial Revolutions
- Delivery of Higher Education Programmes
- Humanising the Higher Education
- Conclusion

Malaysia Education Blueprint 2015-2025 (Higher Education)

The 4IR leverages on advancements in digital technology and is revolutionising the higher education sector worldwide. MOHE recognises that higher education needs to evolve in tandem with the 4IR in order to stay relevant and competitive. The MEB (HE) was launched in April 2015.



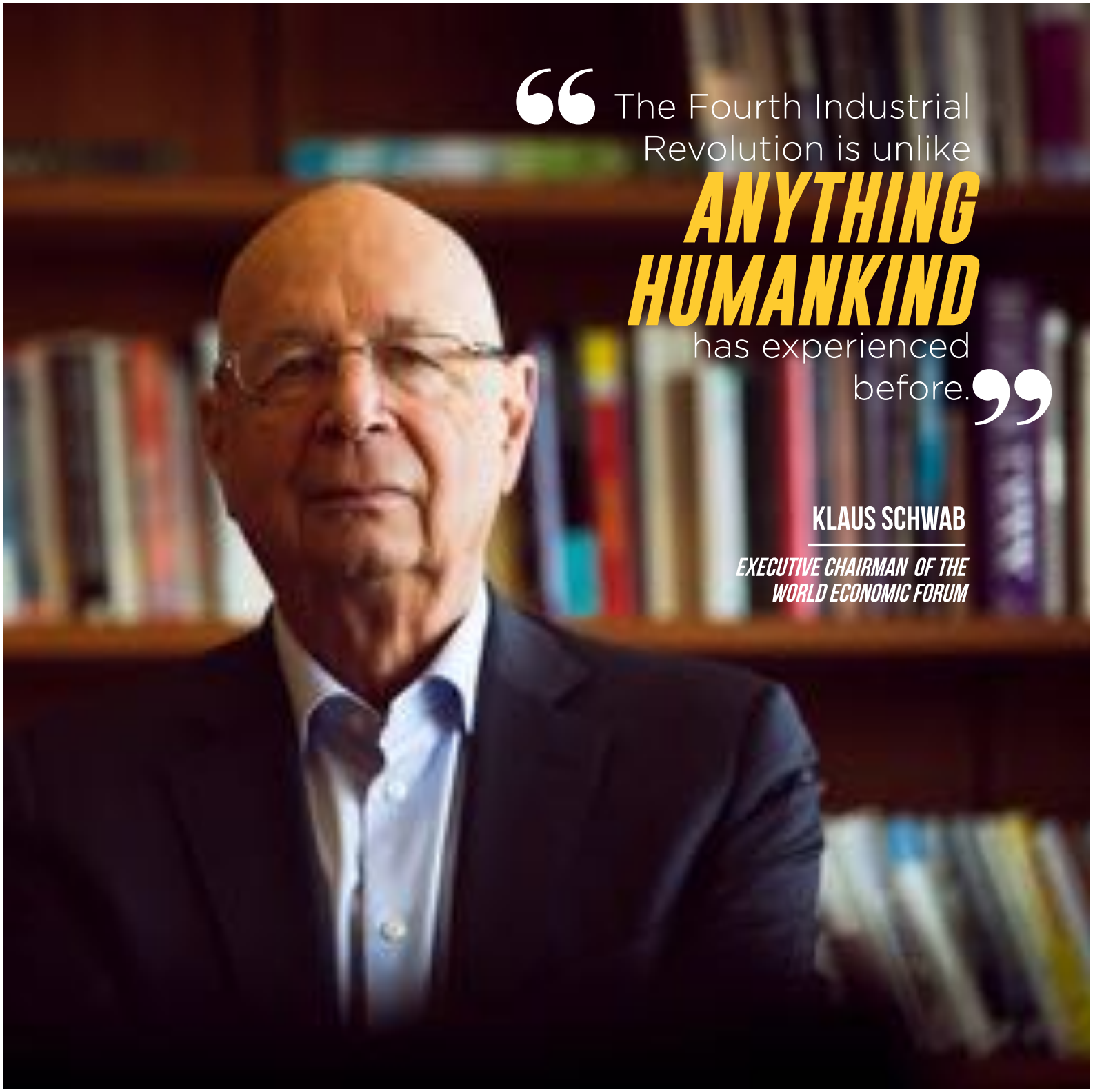
The 10 Shifts



Ten shifts were outlined to meet the advancement of the 4IR namely:

i. Holistic, Entrepreneurial and Balanced Graduates;
ii. Talent Excellence;
iii. Nation of Lifelong Learners;
iv. Quality TVET Graduates;
v. Financial Sustainability;
vi. Empowered Governance;
vii. Innovation Ecosystem;
viii. Global Prominence;
ix. Globalised Online Learning and
x. Transformed Higher Education Delivery

Framing Malaysian Higher Education 4.0: Future-Proof Talents serves as a guide for public universities and private institutions in meeting the demands of the 4IR. It was rigorously developed through several phases of collaborative and consultative processes with various stakeholders. This document is based on the Malaysia Education Blueprint 2015-2025 (Higher Education) (MEB (HE)) and the initiatives in Redesigning Malaysian Higher Education which are aligned with the vision and mission of the Ministry of Higher Education (MOHE). The goal of this document is to provide guidelines, strategies and aspirations for higher education stakeholders. (*Please refer to page 72 for further discussion on the Redesigning Initiatives).


“The Fourth Industrial Revolution is unlike ANYTHING HUMANKIND has experienced before.”
KLAUS SCHWAB
EXECUTIVE CHAIRMAN OF THE WORLD ECONOMIC FORUM



THE FOURTH INDUSTRIAL REVOLUTION

The Industrial Revolution paves the way for the process of change from an agrarian and handicraft economy to one that is dominated by manufacturing industry. The change gives birth to new emerging technologies which exerts an extensive impact on the various socio-economic domains. Emerging technology is defined as a new and fast growing technology which is characterised by its profound novelty and ability to leave a consistent and marked impact over a given time frame. Examples of this technology include automation, digitisation, AI and IoT. With the support of Big Data, these technologies grow at an exponential rate never before experienced by any of the industrial revolutions.

The human race has never been subjected to such an alarming growth of emerging technological changes as what is experienced in the 21st century. People are now connected on multiple mobile devices and experience virtual space (virtual reality). It challenges our lifestyle, values and our perception of the world. These technological changes are the result of the progression of the industrial revolution.

1ST INDUSTRIAL REVOLUTION



MECHANISATIONS, STEAM AND WATER POWER

started during the major industrialisation era which took place in the late 1700s and early 1800s. It began in Great Britain where water and steam power were used to mechanise production.

2ND INDUSTRIAL REVOLUTION



MASS PRODUCTION AND ELECTRICITY

is referred as the American Industrial Revolution. It started between 1820 and 1870. It used electric power to create mass production.

3RD INDUSTRIAL REVOLUTION



ELECTRONIC AND IT SYSTEMS, AUTOMATION

used electronics and information technology to automate and digitise production. The era started during the 1980s and is still ongoing.

4TH INDUSTRIAL REVOLUTION



CYBER-PHYSICAL SYSTEM

represents the combination of cyber-physical systems, the Internet of Systems (IoS) and the IoT. Building on the digital revolution of the third industrial revolution, it converges the physical, virtual and biological spheres enabled by digital technology. Its fundamentals include AI, Cloud Computing, IoT and Big Data Analytics.

DELIVERY OF HIGHER EDUCATION PROGRAMMES

Over the years, the delivery of Malaysian Higher Education Programmes (MyHE) has transformed significantly (refer to Figure 1.1):

MyHE 1.0 Centres on the teacher as the source of knowledge by employing chalk and talk teaching method[2];

MyHE 2.0 Establishes the utilisation of basic technology practices in the classroom and features students as receptacles of information who regurgitate and respond to knowledge.

MyHE 3.0 Encourages dynamic teaching approaches by requiring students' exploration of real-world problems and collaboration on social learning platforms.

MyHE 4.0 Promotes students' diversification of roles as curators of knowledge, content producers, connection-makers; the web as the open global curriculum and educators as the resource guide.



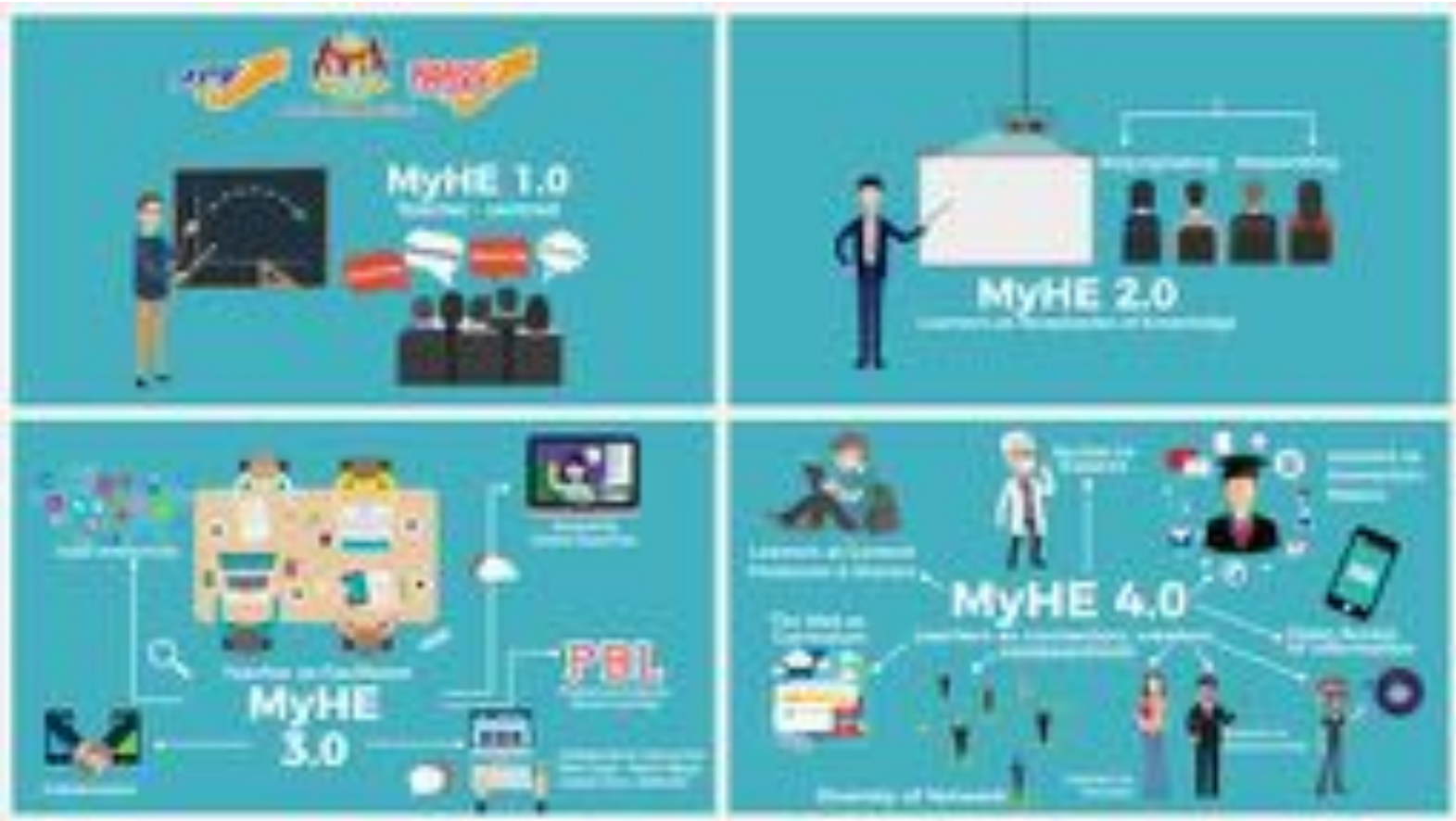


Figure: 1.1: Delivery of Higher Education Programmes

MyHE 4.0 emphasises higher order thinking skills (HOTS) than the lower order thinking skills (LOTS). The cognitive domain drives the goals of the learning process where learners are expected to acquire new skills, knowledge and attitude as well as construct their own new knowledge. Learners should actively contextualise and produce data instead of only acquiring it. They need to be able to generate knowledge based on personal experiences and environmental participation.

HUMANISING HIGHER EDUCATION



The 4IR is built on the division of values system that took place in the 15th century Europe giving rise to the scientific revolution as a precursor to the first Industrial Revolution. This scientific revolution led to the separation of the Church and the State based on the insistence of the secular and the religious, namely the "material" and the "spiritual". The Church held views which were scientifically disapproved, for example the outdated "geocentric" solar system. This is due to the presence of spiritual values that could not be attested by the "scientific method". Resulting from this, the subsequent industrial revolutions that took place over the next decades, have solely focused on the scientific enhancements and hence led to the breakdown of spiritual values system. Now, more than ever, we need to uphold the spiritual values as they are relevant to modern science in creating values-based society.

It is imperative that humanistic competencies such as emotional intelligence, mindfulness, empathy and social responsibility be nurtured at all learning stages. These competencies, which differentiate humans from robots or AI, will ensure the sustainability and continuity of human kind. Despite technological advancements in machine learning and deep learning, robots and AI are devoid of ethics and values. Thus, values-driven education is crucial to produce balanced graduates who will subsequently become ethical members of the society. Accordingly, MOHE stresses the development of moral values, a strong national identity, cultural and civilisational literacy, self-awareness and interpersonal skills. Its ultimate goal is to develop students with the ability to contribute to the Malaysian society and actively participate in the global arena.




JEM-ARM200F

CONCLUSION

The 4IR is built on the third Industrial Revolution which converges virtual, physical and biological spheres dominated by digital technology. MOHE has begun aligning to the needs of the 4IR through the development of the MEB (HE) and the initiatives in redesigning higher education. Focus is also given to the aspect of producing holistic and balanced graduates with humanistic competencies who can positively contribute to nation building efforts.

02 / Framing Malaysian Higher Education 4.0: Future-Proof Talents Chapter Two

Challenges and Impact Created by 4IR

OVERVIEW

- Impact of 4IR
- Impact of 4IR on Economy & Business
- Impact of 4IR on Society
- Impact of 4IR on Government
- Impact of 4IR to Malaysian Higher Education
- Impact of the Respective Domains on Higher Education
- Conclusion





IMPACT OF 4IR

The 4IR must be dealt with vigilance as it is characterised by the digital, physical and biological revolutions, and has a bigger impact on the economic, social and political landscapes of a country.

The most critical issues resulting from the 4IR are unemployment and displacement of jobs due to automation, digitisation, robotics and AI. A 2016 study by Oxford Martin School[3] projected the threat of job loss among developing countries to be 55 -85% while a United Nation agency disclosed that two-thirds of jobs in developing countries might be at risk. Likewise, McKinsey Global Institute[4] reported that 49% of present work activities can be automated and this represented $15.8 billion in wages and 1.1 billion jobs globally. Approximately, 60% of jobs could have more than 30% of the activities automated and 5% can be fully automated.

On the local scene, TalentCorp – the National Agency assigned to drive Malaysia's talent agenda has lead the conversation on the future of work. It has identified in-demand jobs that are associated with Malaysia's growing knowledge-based economy and has come up with the Critical Occupations List (COL) for 2017/2018. The COL is one of the key initiatives under the Critical Skills Monitoring Committee (CSC) which was established under the 11th Malaysia Plan to address skill mismatches in the labour market. It is jointly led by TalentCorp







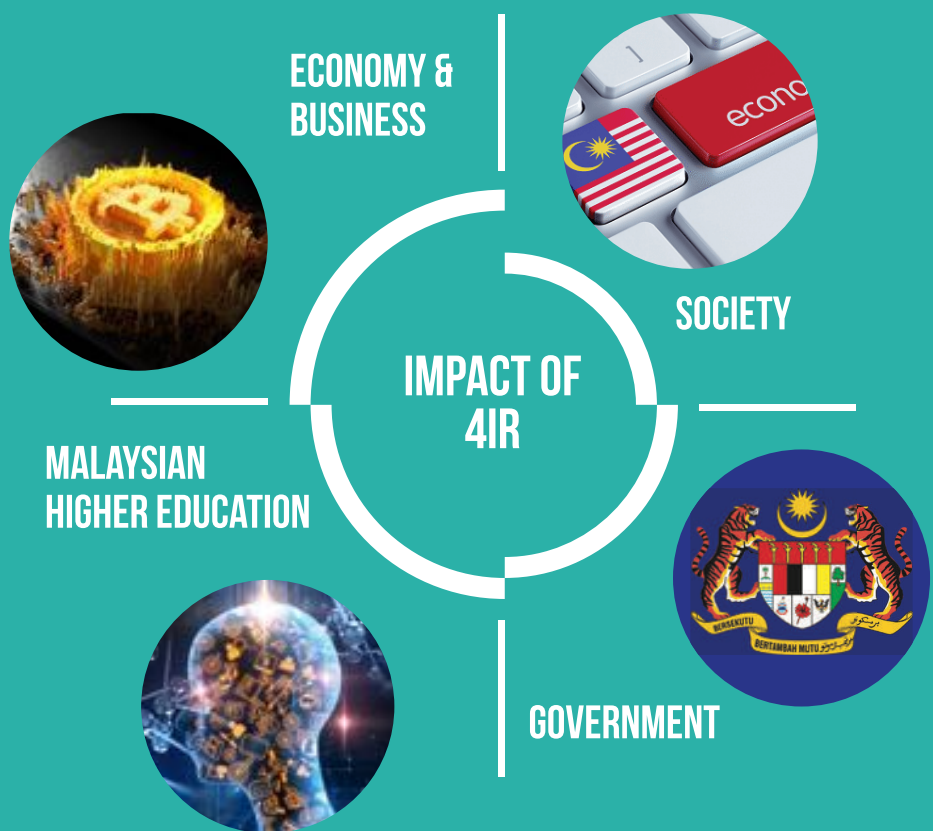


and the Institute of Labour Market Information and Analysis (ILMIA), an agency under the Ministry of Human Resources. Engineering and technologically occupations related to 4IR which are on the rise include AI and IoT linked occupations such as software developers, application programmers, systems analysts and data scientists as well as engineering occupations e.g. electrical and mechanical engineering as well as engineering science. In 2016, TalentCorp has launched the Nurturing Expert Talent (NEXT), the national talent analytics platform which consists of the attributes and competencies of the Malaysian workforce in meeting the demands of the evolving jobs.

Malaysian graduates will have to adapt quickly and acquire digital-focused skills which will determine their future marketability. For example, in 2016, Uber has embarked in testing driverless cars and eventually driverless Uber will be providing urban transportation. Automation enhanced by digital technology and human cognitive function will be a global trend which may cause 4 to 5 million truck and taxi drivers to lose their jobs in the US alone[5]. These examples demonstrate that the 4IR has created a new digital order through a host of platforms which may alter social, economic and political landscapes. Malaysians cannot afford to ignore such global development in preparing a workforce for the future of work.

This chapter addresses the impact and challenges brought by the technological advancements of the 4IR on three important domains namely Economy and Business, Society and Government. It also discusses how these respective domains shape the bearing of the Malaysian Higher Education system in the future, and ultimately help the country achieve the vision of becoming the top 20 nation by 2050 as outlined in Transformasi Nasional 2050 (TN50).

The 4IR begets infrastructure and innovation ecosystem as well as technology upgrading. The combination of AI, Big Data, Cloud Computing and IoT enables the development of automated, intelligent and connected products and services. Despite its enormous potential, the speed, scale and force of 4IR on Economy and Business, Society, and Government will largely depend on the country's readiness. New regulations and governance are crucial in addressing the challenges.



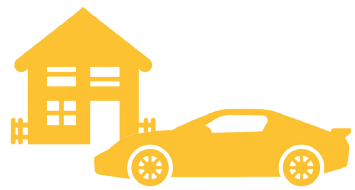
The 4IR should also be able to facilitate the Sustainable Development Goals (SDGs) – the collection of 17 global goals and 169 targets associated to them set by the United Nations[6]. The SDGs are also known as 2030 Agenda. The goals were developed to replace the Millennium Development Goals (MDGs) which ended in 2015. The 2030 Agenda refers to a plan of action for people, planet and prosperity (3Ps). It also seeks to strengthen universal peace and eradicate poverty in all its forms and dimensions, including extreme poverty. All these require sustainable development as the platform for change through bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path. The SDGs are of critical importance for humanity supported by the 3Ps with the addition of 2 other Ps – partnership and peace, focusing on the needs of the poorest and most vulnerable.



Figure 2.1: Sustainable Development Goals

IMPACT OF 4IR ON ECONOMY & BUSINESS





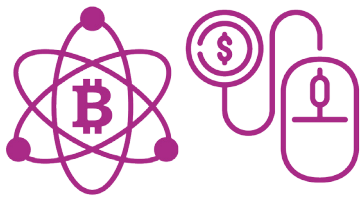
Developing countries will not only be affected by automation but also by relocation of industries. The boost of automation and AI are expected to increase productivity at a lower cost. When this happens, the third world and developing countries would be hit the hardest especially those hosting multinational companies operating on their shores. As a result, there is a tendency for these companies to relocate their industries closer to home (e.g. **WALMART** and **FORD RELOCATED TO THE USA**) Countries that will gain most from these technology advancements are the USA, Europe and Japan while the worst hit would be the developing countries such as China and India.

Inequity of corporate power and resources between developing countries (South) and developed countries (North) is widening. The global digital economy is monopolised by the USA and China-based multinational companies. These companies dominate various social and economic sectors such as **GOOGLE** (information sector), **AMAZON** and **ALIBABA** (e-commerce) and **UBER** (urban transport). Currently these data are being collected from the South by these giant multinationals from the North at no cost and this results in digital dependency and virtual invasive domination.

Emergence of a new socio-economic model - Gig economy, promotes employees who are independent of employers and are in full control of their time and their services. Gig economy frees the companies of any responsibilities, benefits and relationship with the employees. On top of that, employees will need to provide the tools themselves e.g. **GRAB** (cars) and **AIRBNB** (accommodation). Whilst the employees may seem independent, they are actually void of safety net (retirement funds, hospitalisation benefits, etc.) In Gig economy, companies bid for the cheapest services offered by individuals. In some cases, the fees for services have gone down below the minimum wage. Hence, individuals may suffer the risk of manipulation by those companies.



The emergence of informal economies through global platforms provides opportunities for anyone to become an entrepreneur. E-commerce promotes commercial transactions electronically on the Internet for individuals to capitalise on the convergence of exponential growth of Internet economy and cross-border e-commerce activities e.g. **MALAYSIA'S DIGITAL FREE TRADE ZONE**.



The emergence of digital currencies that operate independently of a central bank may promote greater privacy and security for businesses and individuals[7] through a digital ledger (blockchain), but may also run the risks of hacking and abuse. e.g. digital currencies include **BITCOIN**, **ETHEREUM** and **LITECOIN**.



Investment in talent planning is becoming more important than capital because of **THE SCALE AND BREADTH OF TECHNOLOGICAL INNOVATION** which revolutionises the way businesses are being conducted.

IMPACT OF 4IR ON ECONOMY & BUSINESS



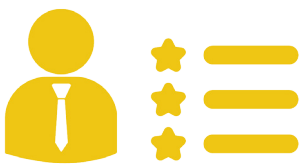


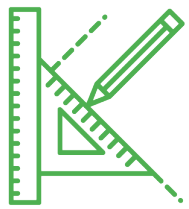


In digital economy, businesses transform by shifting from a Transactional Model, which focuses solely on selling products, to **A RELATIONSHIP MODEL WHICH CENTRES ON SELLING SERVICES AND CREATING DEEPER CONNECTIONS WITH THE CUSTOMERS.**

The emergence of Big Data as a result of data integration **SUPPORTED BY AI, DIGITISATION AND CONNECTIVITY DRIVES INNOVATION ACROSS GROWING NUMBER OF PRODUCT AND SERVICES**. For example, machine learning algorithms analyse billions of transactions, understand the markets, address the clients' needs and demands as well as make businesses smarter by anticipating trends in consumer behaviour. This is particularly important for retail, finance, travel, healthcare and manufacturing industries.

Non-automatable jobs such as sales and marketing that require **NEGOTIATION SKILLS** are sought after and those who possess the skills are at an advantage.





The emergence of new technologies creates entirely new ways of serving existing needs and significantly disrupts existing industry value chain. Apart from that, there is a greater demand for **HIGH-SKILLED TALENTS IN SERVICE INDUSTRIES** (as currently being practiced by Malaysia) rather than manufacturing industries.

Despite concerns for job displacements, automation and digitisation create new jobs, e.g. **DATA SCIENTISTS**, **DATA ANALYSTS**, **ROBOT DESIGNERS** and **MAINTENANCE ENGINEERS**.

IMPACT OF 4IR ON SOCIETY

Society will be highly reliant on connectedness, automation and technological advancement through social media platforms namely Facebook, WhatsApp, YouTube, Facebook, WeChat, Instagram and Snapchat. These social platforms promote the creation and sharing of information, ideas, and other forms of communication via virtual communities and networks. Hence, societal experience and lifestyles will be revolutionised.

Digital revolution provides people with opportunities to connect, learn and earn in unconventional ways. The ubiquitous content and broadening access to education and information will change and improve the lives of many people.

The digital socio-economic platform will bring billions of people into the informal and formal global economy, with access to products and services and to entirely new markets (such as Alibaba, Etsy and Lelong) without going through middlemen.

Advances in biomedical technology will also improve the quality of life due to better medical and healthcare, thus the average lifespan is also expected to increase accordingly.









Social inequality is expected to widen due to potential disruption of the labour market caused by digitisation and automation.

While technological advances may improve the scope of surveillance by the authority, privacy and trust will become greater issues of concern due to massive interconnectivity. Similarly, as more data are shared and captured on daily basis, society may lose its privacy. More transparency and governance of technology are needed as security models to boost confidence of society.

Intelligent and connected automation may become a disruptive force and raise questions about the relationship between humans and machines.

The revolutions in biotechnology and AI redefine the notion of life span, health, cognition and capabilities which will subsequently reshape our moral and ethical boundaries.



IMPACT OF 4IR ON GOVERNMENT

The government is highly susceptible to cyber security threats. This creates pressure for the government to increase leverage on security measures. For example, the WannaCry ransomware which affected more than 150 countries in May 2017 was originally a country's cyber weapon that was hacked.

Social media provides platforms especially among the youths to demonstrate social discontent and attitude against establishments. For example, the Arab Spring revolutionary waves which involved a series of anti government protests, uprising and armed rebellions that spread across the Middle East in early 2011.

Instability of labour market and inequality of wealth distribution may affect social cohesion. This phenomenon gave rise to anti-establishment behaviour such as Brexit in the UK and the US Presidential Election of Donald Trump and could impact nation-building efforts.

The 4IR results in the government's existence and sustainability being challenged in areas such as governance, systems and processes, strategies and policies. For example, should a government move towards digitisation or remain the status quo?

Intense and more innovative use of web technologies will impact government's regulation and transparency. As the physical, digital, and biological worlds continue to converge, new technologies and platforms will increasingly enable citizens to engage with governments, voice their opinions, coordinate their efforts, and even circumvent the supervision of public authorities and decentralisation of power.



IMPACT OF 4IR ON MALAYSIAN HIGHER EDUCATION

The economic interest in the industrial revolution and advancement of technology has labelled individuals as human capital rather than human talent. This affects the perceptions towards the current educational system which envisages Higher Learning Institutions (HLIs) to produce workers who can fit the needs of the industry. Hence, education has become a commodity, with the expectation to produce industry-ready graduates for the market.

The industrial featured education promotes specialised courses with heavy reliance on the Western understanding of knowledge, which often downplays the elements of ethics and values.

Higher education is confronted with the following issues:

1) Changing landscape of employment trends. Jobs that are available now may be obsolete in the future but new types of jobs will emerge to meet the demands of the 4IR.

2) Changing landscape of technologies. The exponential digital age brings with it unfamiliar technologies, hence there is a need to consistently anticipate and prepare for changing skills and new knowledge.

3) Changing landscape of demands. We may be confronted with unforeseen problems and issues in the future. Therefore, there is a need for a paradigm shift in dealing with the new demands.

Higher education sector is pressured to accommodate the needs of digital natives who demonstrate the following criteria[8] :

1) 20% are addicted to the Internet.

2) 90% of children and adults play video games.

3) 28% of people aged 18-34 engage in literary reading.

4) Bored by traditional lectures in the classroom.

5) Demonstrated differences in the use of Internet - females use the Internet for social reasons, while males use the Internet for virtual games.

6) Manifested 8 seconds of attention span compared to a goldfish with 12 seconds.





IMPACT OF THE RESPECTIVE DOMAINS ON HIGHER EDUCATION

Table 2.1 summarises the impact of the three domains which are Economy and Business, Society as well as Government on Higher Education. Possible measures to be considered by Higher Education providers are also listed.



Table 2.1: Impact of the Three Domains on Higher Education

DOMAIN	IMPACT ON HIGHER EDUCATION	MEASURES BY HIGHER EDUCATION PROVIDERS
ECONOMY & BUSINESS	• Change in the labour market impacting job creation and employability of graduates. • Change in job patterns where industries are increasingly offering part-time, contract or crowd sourcing work instead of full time employment. • IoT and AI impact on business planning e.g. utilisation of data analytics to address clients' demands. • Ability for anyone to invent new products and services cheaply and quickly. • Transformation of business models of industry.	• Re-visit university-employer relationship for greater engagement and collaboration • Embrace high quality learning within theory-praxis nexus. • Employ data analytics in teaching, learning & research. • Render assistance to Malaysia's Small and Medium Enterprises (MSMEs) in leapfrogging from current technological approach to 4IR. • Encourage simulations, exposure and establishment of business sites to engage students in entrepreneurial thinking and practice. • Redesign learning environment and learning experiences to attain learning outcomes required for future economy and business.
SOCIETY	• Transform societal experience, enhance lifestyles and broaden gaps in society through IoT. • Solve diverse problems in the rapidly changing economy and society using critical and creative means through trans-disciplinary approach. • Result in joblessness, low productivity and inequality. • Result in diverse students (Generation Z and Alpha) who are savvy at solving complex issues. • Impact on values, integrity and ethics.	• Support digital-based economy through provision of graduates. • Undertake the essential role of developing a just and progressive society. • Deliver research and development (R&D) which promotes research discoveries into values that accelerate the social transformation. • Develop new pedagogical tools and learning experiences aimed at fostering transdisciplinary and multicultural approaches to develop social skills with the right values.
GOVERNMENT	• Use web technologies to improve government's overall performance. • Increase redistribution and decentralisation of power via digital technologies. • Bridge the digital divide and ensure basic infrastructure in providing economic opportunities to the public. • Attract entrepreneurs and investors in innovative start-ups through investment as launch pad for digital transformation. • Design policy environment to foster innovation.	• Enhance online interaction to foster a paradigm shift when engaging with the stakeholders. • Render expertise and assistance in designing policy recommendations. • Collaborate with main stakeholders namely Ministry of Education in understanding the visions of higher education which address the needs of 4IR. • Collaborate with various agencies in providing condusive innovative ecosystem and hyper-connectivity.





It is imperative that the higher education ecosystem puts into place the right education, networks of people and infrastructure to enable better management of the impact. Digital natives among younger Malaysians whether they are from urban or rural area, rich or poor, normal or limited by physical or intellectual capabilities should not be left behind in the age of cyber-physical connectedness. UNESCO commenced a study[9] on digital natives and highlight the following:

A) Digital natives are the new citizens of digital societies.

B) Digital societies lead to information societies and knowledge societies.

C) Digital natives are involved in networks, collaborative working and collective intelligence.

D) Digital natives learn in a new way and must be taught in a different way.

E) Digital natives are informed about the political stakes in a digital society.

Malaysian higher education institutions must play their role in producing future-proof graduates tailored and prepared for the immersive education which combines the virtual worlds, simulators, learning games and sophisticated digital media. Learning and Teaching (L&T) must incorporate 21st Century learning skills in line with the MEB (HE) which include collaboration, digital literacy, critical thinking and problem solving that help students to thrive in the 4IR and necessitates future-proof graduates.



CONCLUSION

While digitisation and automation are expected to cause significant job displacements all over the world, new jobs are going to be created as well. Job displacements, as a result of digitisation and automation, can be addressed through a reform in education that would affect curriculum design, delivery and assessment. Another impact of the 4IR is inequalities between countries as a result of technologies that are owned by a handful multinationals. Developing countries therefore need to address the inequalities through domestic and international policies and regulations in maintaining their interest and sovereignty.

Regardless of the creation of AI as a disruption in many fields of life such as Economy and Business, Society and Government, the element of humanity must be the foundation of its existence.

03 / Framing Malaysian Higher Education 4.0: Future-Proof Talents Chapter Three

OVERVIEW

- The Desired Future
- Future University Model
- Features of 4-Quad Future University Model
- Conclusion

Future Alternatives For Malaysian Higher Education





THE DESIRED FUTURE

Scenario setting is not intended to predict the future. However, it serves as a tool for thinking and basis for action. The journey to the preferred future will require time and concerted effort from all parties. With the advancement of technology in education, HLIs need to prepare the talents/ graduates who are agile and adaptive to the changing demands of the 4IR. Some of the changes will be disruptive and may witness revolutionary changes in the higher education landscape such as the introduction of augmented reality and mobile application in L&T. Hence, MOHE needs to embark on a transformational roadmap in charting higher education in order to continuously remain relevant to the nation.

The key concepts in transforming

MALAYSIAN HIGHER EDUCATION SYSTEM[10]

A CHALLENGING THE "USED FUTURE"

In order to move forward, Malaysian HLIs need to confront the "used future". "Used future" refers to initiatives which appear to be futuristic, but in actual fact they are merely current. An example of "used future" initiatives is viewing universities as the sole degree awarding institutions. In the future, it is expected that any entity can be a higher education provider.

B IDENTIFYING EMERGING ISSUES

HLIs need to identify emerging issues in higher education in order to embrace change and stay relevant. This can be achieved via personalised learning, establishment of University 42 (operates without teachers, books or tuition fees and driven by gamification approach), new brain sciences, as well as changing trends such as driverless cars, 4D printing, IoT and disruptive technologies.

C CREATING FUTURE ALTERNATIVES

The future alternatives of higher education affect the functions of universities as educational establishments and generators of knowledge and technology. Through the application of the Forecasting method, several future alternatives for Malaysian HLIs can be developed.

D LINKING FUTURE ALTERNATIVES TO POLICIES AND STRATEGIES

Once the future alternatives for Malaysian higher education are identified, it is imperative for HLIs to map out the strategies and formulate relevant policies to drive the changes needed in realising Higher Education 4.0 agenda.

Figure 3.1 depicts four possible future scenarios of Malaysian higher education. It should be noted that several deliberations and workshops were carried out in designing the diverse university models appropriate for Malaysia in the next few decades.

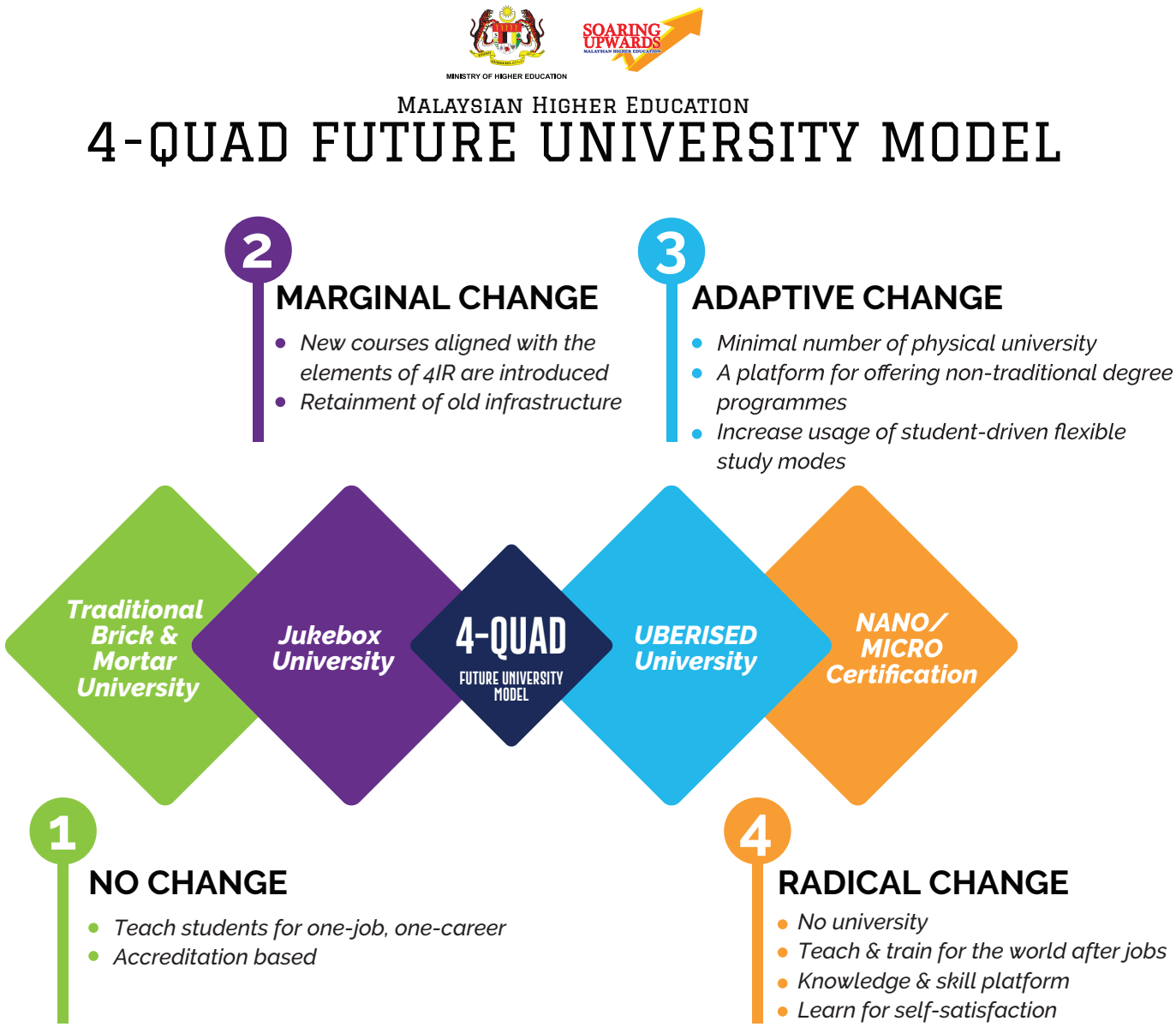


Figure 3.1: Four-Quad Future University Model
(adapted from Inayatullah, 2017)[11]

Traditional L&T approaches will likely be dominated by technology, innovation and personalised learning mode. By 2030, the traditional brick and mortar institutions will probably be available in the field of hard sciences such as medicine and engineering which still require clinical and experimental practices as well as in the field of soft sciences such as education and religious studies.

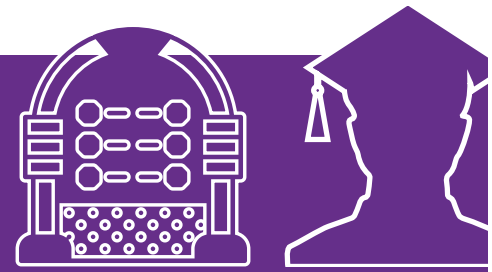
NO CHANGE

TRADITIONAL BRICK & MORTAR UNIVERSITY

Universities choose to engage in "business as usual" mode in delivery of education and dependency on the government for financial assistance. The traditional brick and mortar university may have the tendency of not responding to the demands of 4IR. However, it will undergo minimal changes in order to remain relevant and sustainable. Innovative approaches to partnership and collaboration between universities and industries will materialise but will less likely be sustainable in the long run.

MARGINAL CHANGE

JUKEBOX UNIVERSITY



The model allows students to select courses and educational programmes from various institutions using a concept similar to a musical 'jukebox'. The certification is awarded by the universities that have mutual recognitions on the programmes offered.

FUTURE UNIVERSITY MODEL

ADAPTIVE CHANGE

UBERISED UNIVERSITY



This type of university model provides cost-effective education through learning platforms. This model mimics the Uber urban transportation service concept whereby education is demand-driven, self-tailored, hassle free, highly accessible and convenient. The focus of this model is flexible education which promotes access to lifelong learning.

RADICAL CHANGE

NANO/MICRO CERTIFICATION

Nano/Micro certification model is a non-traditional certification programme offered by organisations/individuals that is recognised by the industry. It uses modular concept where certifications and credentials are stackable. These industry-driven certifications are capturing the interest of the digital natives.



FEATURES OF FUTURE UNIVERSITY MODEL

Table 3.1: 7 Features of 4-Quad Future University Model

FEATURES	NO CHANGE TRADITIONAL BRICK & MORTAR UNIVERSITY	MARGINAL CHANGE JUKEBOX UNIVERSITY	ADAPTIVE CHANGE UBERISED UNIVERSITY	RADICAL CHANGE NANO CERTIFICATION
FACULTY MEMBERS	Professors and lecturers	Professors and lecturers	Mobilise/freelance professors & lecturers	Professional practitioners / experts in the field of study
LEARNING MATERIALS	Books and journals	Books,journals, blended learning, MOOCs 4.0	MOOCs 4.0	User generated contents
KNOWLEDGE PHILOSOPHY	Specialisation and sub-specialisation	Specialisation and sub-specialisation	Adaptive, embedded, Appreciation of social, cross-disciplines	Integration of cross-disciplines, appreciation of knowledge and wisdom
STUDENTS	School leavers and mid-career mobility	School leavers and mid-career mobility	School leavers, mid-career mobility and lifelong learners	Lifelong learners, early and mid-career, knowledge seekers Basic education and higher education combined
LEARNING VENUES	Campus and internet	Multiple campuses and internet	Multiple campuses, industry and internet	No physical campus needed, industry and internet
LEARNING MODELS	Lectures, tutorials, labs and studios	Lectures, tutorials, labs and studios	MOOCs 4.0, on-demand courses	Online lectures, peer teaching, students as MOOCs 4.0 co-creators
ACADEMIC OUTCOMES	Academic certificate and expertise	Academic certificate and expertise	Academic certificate from multiple universities, e-Portfolio	Certification by professional bodies/ community / industries/ e-Portfolio




KPT

CONCLUSION

University models are becoming more distinct and technology-driven. There are several questions that the university management needs to answer before adopting any particular model to be relevant in the era of 4IR.

- Which scenarios are most desirable for your institution?
- What would it take to get closer to the most desirable scenario?
- What are the pros and cons of the different scenarios in terms of quality, access, equity and innovation to your institution?
- How would your institution react to each scenario?
- What are the requirements that your institution needs to survive under each scenario?

In addressing the questions listed above, the attributes of balanced graduates become central. Values-driven education which emphasises on ethics, morality, appropriate behaviours and mindsets as well as civilisational literacy should be the basis for consideration.

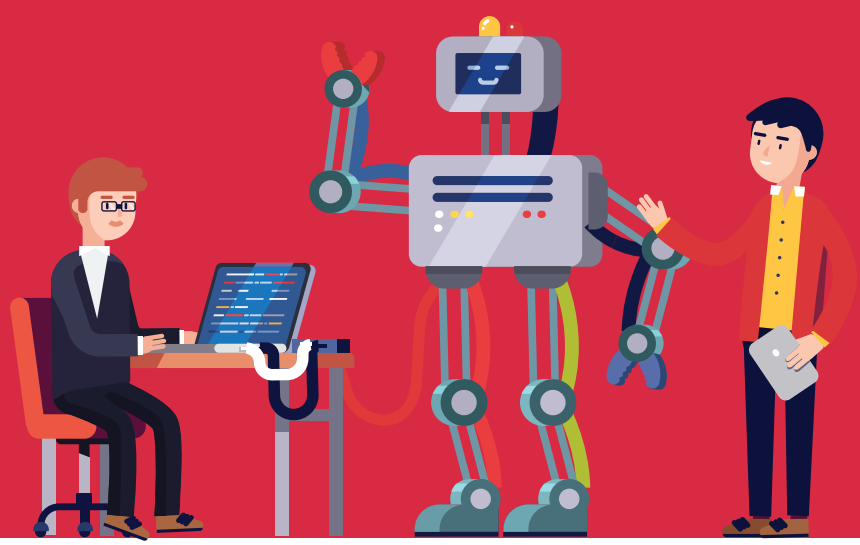
04/

Framing Malaysian Higher Education 4.0: Future-Proof Talents
Chapter Four

OVERVIEW

- Higher Education 4.0 Framework
- FOCUS 1: Future Ready Curriculum
- FOCUS 2: Agile Governance
- FOCUS 3: Research & Innovation
- FOCUS 4: Talent Planning
- Conclusion

Way Forward: Higher Education 4.0 Framework





HIGHER EDUCATION 4.0 FRAMEWORK

The future of education should not only concentrate on information and facts, but also the connection of heart and soul towards wisdom. The Higher Education 4.0 Framework (Figure 4.1) intends to encapsulate the institutional elements in addressing the challenges identified earlier. The basis of this framework is to produce ethically and morally upright citizens who are spiritually grounded to cope with the demands of the 4IR.

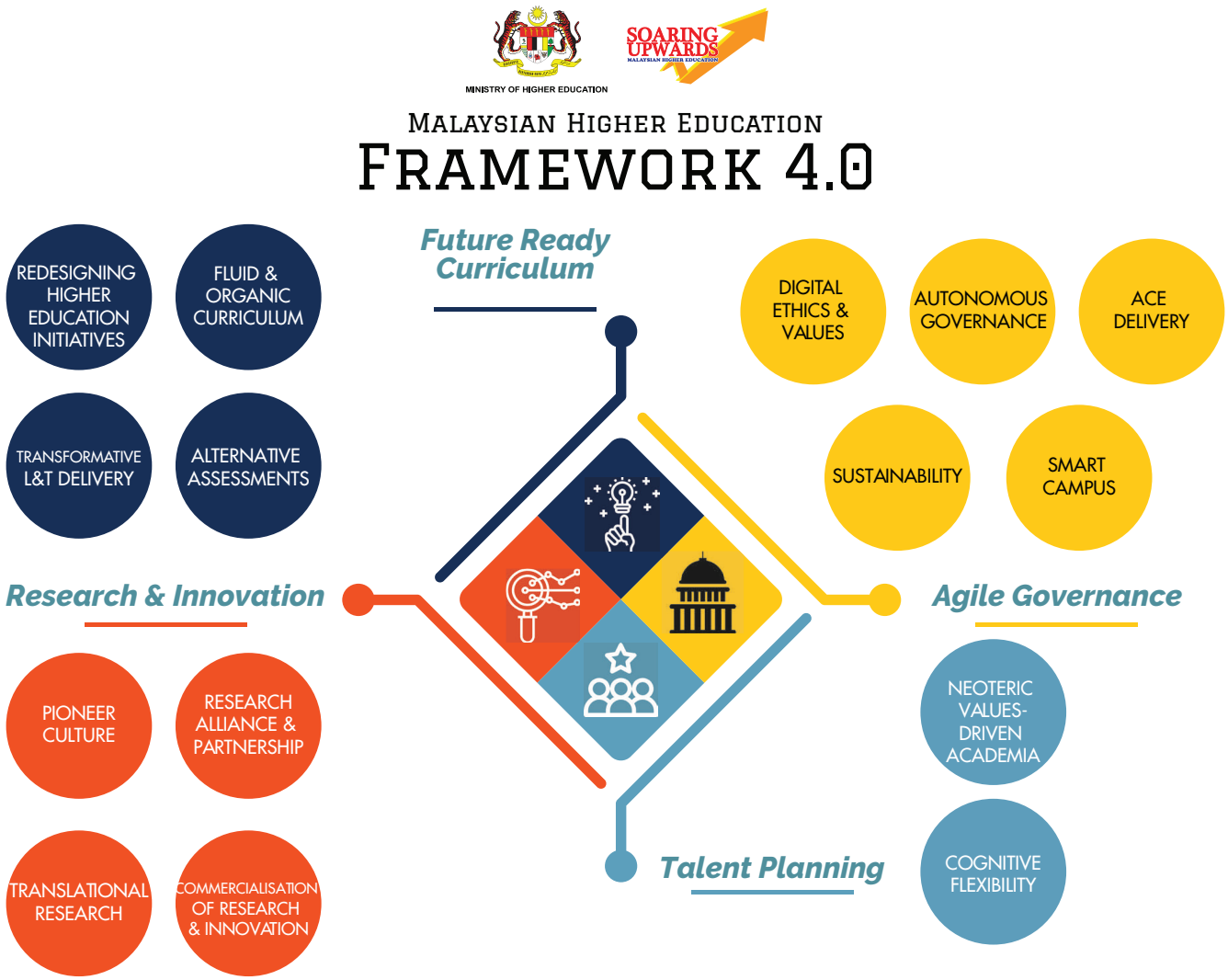


Figure 4.1: Malaysia Higher Education 4.0 Framework

Five (5) future trending fields in higher education have been identified namely a) AI, Machine Learning, Automation, Cyber Security, Big Data and Data Analytics; b) Hybrid of Technical Fields – Biotechnology, Biomedical Science & Biomedical Engineering, IT, Computer Science and Healthcare; c) Climate, Energy, Natural Resources and Environment; d) Liberal Arts, Design and Creative Technologies; and e) Education and Skill Training. Hence, we must be prepared to cope with uncertainties to adapt to the ever-changing demands in the higher education. The elements to address the challenges of 4IR for the higher education sector constitute four foci; Future Ready Curriculum, Agile Governance, Research & Innovation and Talent Planning. Each of these comprises detailed approaches which further translate into how each focus is achievable.

FOCUS 1:

Future Ready Curriculum

A future ready curriculum is a framework that highlights the elements within a curriculum structure, learning delivery and assessment which are constructively aligned to prepare graduates in meeting the challenges of the 21st century. As knowledge is growing exponentially and new jobs that do not currently exist will be created in the future, the curriculum framework, especially in the structure and content, needs to be Fluid and Organic, and not rigid and fixed. A future ready curriculum promotes transformative 21st century L&T delivery through redesigning the learning spaces, leveraging the latest 4IR technologies and promoting immersive learning towards achievement of the learning goals. Four (4) approaches were identified to achieve Focus 1.

1. APPROACH A
REDESIGNING HIGHER EDUCATION INITIATIVES

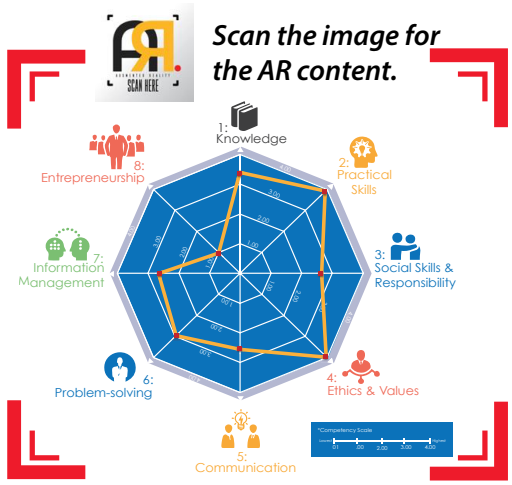
The focus of Malaysian higher education in 2016 was on flexible education which introduced Massive Open Online Courses (MOOCs) and Accreditation of Prior Experiential Learning (APEL) initiatives. In 2017, a purposeful pursuit to redesign higher education[12] was devised in recognition that the digital era is changing the way higher education is managed and giving rise to new expectations (refer to Figure 4.2). In developing and strengthening our talent, MOHE has introduced several initiatives that highlight the transformation namely 2u2i, CEO@Faculty Program, iCGPA, Malaysia MOOCs, APEL, Gap Year, Malaysia English Assessment (MEA) and E-Portfolio.



Figure 4.2: Redesigning Higher Education Initiatives

2u2i
Work-based learning degree programmes

Ceo @ FACULTY PROGRAMME



2u2i

2u2i[13] or 3u1i programmes is a work-based learning programmes that aims at increasing students' employability after graduation and intensifies academia and industry collaborations. It provides undergraduate students enhanced industry exposure during the course of their studies where students spend two or three years focusing on the theoretical aspects of the course in the university and two years or one year of hands-on practice in the industry. Industry exposure includes incorporating companies and running start-ups, which the students can continue to operate upon graduation. The 2u2i programme aims to inculcate the spirit of entrepreneurship via academia and industry collaborations through "Work-based Learning" concept. 2u2i is an initiative under Shift 1 (Holistic, Entrepreneurial and Balanced Graduates) and Shift 7 (Innovation Ecosystem) of the MEB (HE).

Ceo@Faculty

The CEO@Faculty Programme[14] brings together top local and international CEOs and industry players into Malaysian HLIs to share their knowledge and experiences with students and university communities. CEO@Faculty 1.0 with the theme "Learn from the Pros" intensifies participation from the industrial sector through the sharing of experiences and expertise from industry leaders. "Learn from the Pros" saw the CEOs who committed more than 30 hours a year to provide mentorship to university students and lecturers, and even guide universities on matters such as curriculum development to ensure industry relevance. Subsequently, CEO@Faculty 2.0 with the theme "Coached by the Pros" exposed young university lecturers to the operations of high-profile companies. A number of CEOs took up the mantle of coaches to mentor young university lecturers in becoming future leaders. By bridging the private-public gap and strengthening industry-academia links, MOHE hopes to enhance university programme offerings and knowledge transfer initiatives with the industry. The CEO@Faculty Programme is an initiative under Shift 2 (Talent Excellence) of the MEB (HE).

iCGPA

The iCGPA initiative is an integrated grading system for assessing and reporting students' academic performance and the professional skills attained during the course of their studies. The iCGPA adopts a holistic approach to assessment across eight domains of learning outcomes such as knowledge; psychomotor skills; social responsibility; values, attitude and professionalism; communication, leadership and teamwork; problem solving and scientific skills; information technology and lifelong learning; and management and entrepreneurial skills. It enables students to identify their strengths and improve their weaknesses, allows universities to provide better feedback and improvement opportunities, and facilitates potential employers to better understand future employees and their needs. The iCGPA is an initiative under Shift 1 (Holistic, Entrepreneurial and Balanced Graduates) of the MEB (HE).

MOOC

The Malaysia MOOCs[15] (Massive Open Online Courses) initiative was launched in September 2014. It is the world's first nationally coordinated online learning initiative. Malaysia MOOCs is intended to encourage online and lifelong learning pursuits among Malaysians through diversification of classroom experience and unlimited open access participation via the Internet.

In September 2016, the Malaysian Qualifications Agency released the guidelines on awarding credits for MOOCs programmes, enabling anyone who completes a MOOC to obtain credits transfer to formal academic programme. This could lead to shorter duration of studies and savings of tuition fees. Accredited MOOCs do not necessarily originate from Malaysia and can also be awarded by International MOOCs providers, further encouraging students to obtain knowledge from diverse educational sources. Malaysia MOOC is an initiative under Shift 3 (Nation of Lifelong Learners) and Shift 9 (Globalised Online Learning) of the MEB (HE).

APEL

APEL is the Ministry's initiative to cultivate lifelong learning among Malaysians. Those who do not possess formal degree qualifications are allowed to pursue higher education via APEL. APEL advocates the formal recognition and assessment of prior experiential learning in determining whether an individual has achieved the desired learning outcomes for access to a programme of study (APEL A) and/or award of credits (APEL C). APEL is an initiative under Shift 3 (Nation of Lifelong Learners) of the MEB (HE).

GAP YEAR

Gap Year is an initiative introduced in September 2017. It allows students to take a year or two semesters off their formal education in pursuit of personal growth. It is optional and open to all students where they are encouraged to participate after completing their first year academic session. The Gap Year programme enables students to reflect profoundly on their life purposes, careers and roles in the society as well as promotes the culture of responsibility, patriotism, unity and caring among them. Gap Year programme is an initiative under Shift 1 (Holistic, Entrepreneurial and Balanced Graduates) of the MEB (HE).

MALAYSIA ENGLISH ASSESSMENT

MyE-PORTFOLIO

MEA

Shift 1 of the MEB (HE) spells out the aim to develop holistic, entrepreneurial and balanced graduates who are work ready, competent and able to communicate well. MEA is a continuation of the aspiration targeted at reinforcing the English language aptitude through increased use. MEA is a holistic assessment ecosystem which will transform students' experience in mastering English. The integration of formal and informal learning and assessment is expected to produce graduates aligned with the Common European Framework of Reference (CEFR). The assessment is critical for learning because not only it provides the bridge between teaching and learning, but enhances the learning process and drives a student's educational experience in the university. MEA is an initiative under Shift 1 (Holistic, Entrepreneurial and Balanced Graduates) of the MEB (HE).

MyE-Portfolio

MyE-Portfolio is a digital CV that will assess students' skills and abilities through their reflection, experience and learning outcomes. It is another national initiative in confronting the 4IR and useful for industry as well as employers because the features exhibited are based on student empowerment and industry-driven. MyE-Portfolio is a new medium to help undergraduates face the 21st century employment, which is increasingly more challenging. MyE-portfolio portal allows students to expand their talents through reflective journals, images, videos, animation or multimedia which would enhance their digital resume. Apart from becoming a platform for students to expand their potential, the portal would also help the industry to explore their portfolios and eventually increase the students' marketability. MyE-portfolio is an initiative under Shift 1 (Holistic, Entrepreneurial and Balanced Graduates) of the MEB (HE).



2. APPROACH B
FLUID & ORGANIC CURRICULUM

The organic curriculum is the "soft core" of the curriculum, which grows naturally, not requiring the systematic and structured approaches, typical of a standard curriculum. A fluid and organic curriculum is designed with a flexible structure. It can be updated and shaped as and when necessary in order to respond to the changing needs of the industry and students' educational experience. There are four (4) initiatives for Approach B.

Convergence of Disciplines

Fluid and organic curriculum structure should allow for convergence as well as multi/inter/trans disciplinary content areas. A future ready curriculum promotes the convergence of disciplines where at least two disciplines are combined e.g. a combination of cyber / digital and physical / engineering from the physical cybersecurity system. A fluid and organic curriculum also allows multidisciplinary blends of several academic disciplines in approaching the curriculum contents i.e. a topic or problem. However, these multiple disciplines do not promote much interaction across the disciplines. Interdisciplinarity, on the other hand, integrates two or more academic disciplines in a mutually agreed subject. It is no longer a simple mixture of different discipline components because each discipline can affect the academic output of the other. In contrast, the transdisciplinary aspect of the future ready curriculum implies full interaction between, among and beyond disciplines to form a holistic approach in the fluid and organic curriculum structure. The outcome will result in a completely new programme.

Future ready curriculum should allow for flexible and non-conventional curriculum elements with the following focus: a) to enhance inter-university collaboration; b) to embrace student mobility via Gap Year implementation and; c) to promote access to education at any time and any place. On the right are four examples of programmes which address the Convergence of disciplines :

- ***Hybrid Technical Programmes***

MOHE is prepared to confront the 4IR with the offering of a hybrid technical programmes which focus on the combination of conventional, computer science and pure science academic programmes. The provision of conventional engineering (civil, electrical, mechanical and chemical) and existing engineering technology programmes will be enhanced, improvised and replaced with hybrid technical programmes such as bioinformatic and biomedical engineering programmes.

- ***Liberal Arts Programme***

The liberal arts programme provides a comprehensive overview of humanities-related knowledge. This general degree provides a strong background for students to work in a variety of fields. Students with a degree in liberal arts are well-rounded candidates who are prepared to adapt to the needs of the 21st century. The areas of study include basic classes in Mathematics, Sciences, Modern Languages, Fine Arts, Business, Economy, Psychology and Music as well as elements of spirituality.

- ***Joined Cluster***

A curriculum that incorporates aspects from multiple academic clusters/disciplines, therefore addressing any problems that may surface from narrow focus within specialised fields of study.

- ***Data Science-embedded Curriculum***

This curriculum prepares students to understand, access, evaluate, create and communicate in the digital world. The rapid change in the industry causes some industries to evolve into multifaceted and dynamic fields. Students, therefore have to be prepared for the evolution of the industry. Components of data science incorporated in the curriculum will help to prepare them with the ability to analyse and interpret data.

Flexible & Non Conventional

A flexible and non-conventional curriculum is an innovative measure in adopting the global environment to meet the needs of future-proof talents. Students can take any prescribed or on-demand courses at any degree level from any programmes offered by local and foreign HLIs. Flexible and non-conventional curriculum comprises two elements namely Undeclared/ Flexible Major and Floating Curriculum.

Undeclared/ Flexible Major

Undeclared/ flexible major comprises two characteristics namely a) implementation and; b) conferment of degree. In the implementation aspect, students will choose courses offered in different universities based on their own interests; learn anywhere and at anytime; coached by any educators; and will not be physically present in the university. Students design their own combinations of disciplinary majors, minors and electives within and outside their academic faculties under proper academic advising. In addition, the conferment of degree will be awarded by the University which students completed most courses.

Floating Curriculum

Floating curriculum allows for at least 30% of non-prescribed content/ courses in a particular programme. The non-prescribed portion of the curriculum caters for the emerging body of knowledge in a particular discipline.

Industry Partnership

In addition, the flexible curriculum needs to be developed in collaboration with the industry in ensuring that the students are equipped with future-proof skills and competencies. An example of an industry-led curriculum is when students are immersed in the real workplace scenario available in the 2u2i programmes, internship placement and practical or clinical training opportunities. The curriculum that is developed based on the input will be beneficial for expanding knowledge and experience of the future-proof talents. Four dimensions of curriculum flexibility are External Engagement and Partnerships; Anytime, Anywhere Learning; Entry, Transition, Progression and Exit; and Learning Model, Personalisation and Learner Engagement.

Global

A global curriculum provides students with different level of exposures to the academic offerings in other countries. It delivers education where the local students engage in activities that advocate global cooperation with international universities. This includes internationalisation programmes such as dual degree, joint degree, major-minor and dual major programmes. Co-supervisory arrangement between local and international universities is also included in the global curriculum structure where it provides opportunities for the local students to undertake a global perspective on contemporary events and issues.

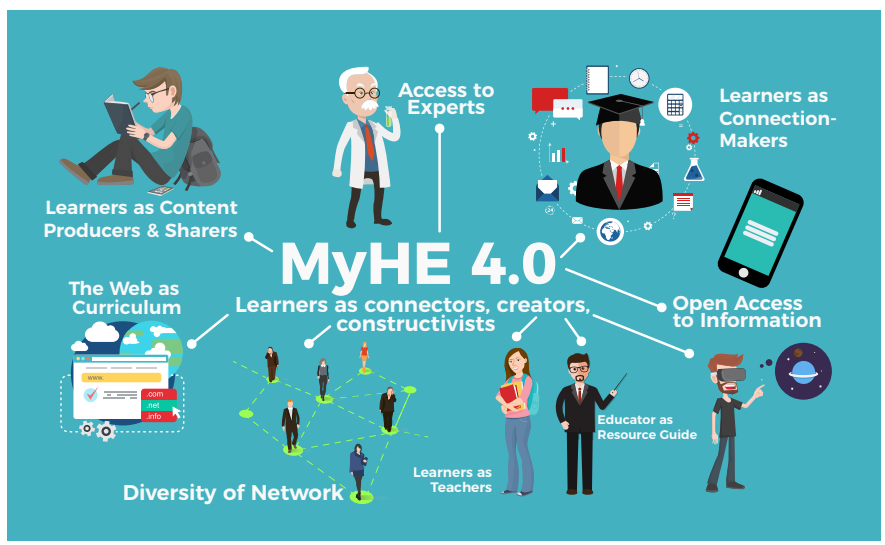






3. APPROACH C
TRANSFORMATIVE L&T DELIVERY

Future Ready Curriculum promotes 21st century L&T delivery. This includes self-determined learning, peer-oriented learning, virtual-based learning and experiential learning which advocate learning without lectures and learning outside the classroom. These L&T learning processes and methods can be made possible by conducting cooperative learning, problem-based learning, case-study learning, academic service learning, work-based L&T approaches. They are three (3) initiatives for Approach C:



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21ST CENTURY MODES (HEUTAGOGY/PEERAGOGY/CYBERGOGY)

Heutagogy or student-directed learning focuses on students' independent learning experience. Students use their own experiences and internal processes such as reflection, environmental scanning and interaction with others to engage in meaningful and relevant learning activities driven by their interests[16]. ICT is a powerful tool for heutagogy as it allows students to access information as well as to provide a mechanism for communication, debate and recording of learning achievements.

Paragogy is also referred as peeragogy. It involves students' interaction with their peers in accomplishing their educational goals. They discover and share the learning contents among themselves through the co-creation of communities of learning. The digital media is used to connect with each other, to co-construct knowledge and to co-learn[17].

In line with the advancement brought forth by 4IR, cybergogy promotes a new teaching and learning practices in the virtual environment. It generates meaningful and engaging virtual learning experience through online presence and facilitation. It focuses on helping adults and young people to learn through technologically-enabled, learner-centered, autonomous and collaborative learning in a virtual setting[18].

FUTURISTIC LEARNING SPACES & ENHANCED-TECHNOLOGY DELIVERY

In coping with a future ready curriculum, changes in learning space design is necessary in order to accommodate new learning paradigms. Fluid and organic curriculum should advocate L&T approaches which are supported by physical and virtual collaborative learning spaces such as learning commons and makerspaces. In addition, enhanced technology delivery should explore state-of-the-art technologies that can provide opportunities to engage students in a variety of ways and promote fresh areas of practice and innovation in L&T. One example of transformative L&T Delivery is Learning Analytics.



- ***Learning Analytics***

In the era of 4IR, learning analytics will be utilised at a greater level. Students' academic performance will be further incorporated with the integrated grading system through iCGPA Learning Analytics Ecosystem. Availability of information through IoT and digitisation will allow transfer and consolidation of data from diverse databases in the institution. It could be performed over a network without requiring human-to-human or human-to-computer interaction. Analysis of data combined with students' programmes and L&T activities will enable the presentation of digital dashboards on students' real-time performance. Hence, interventions could be performed prior to the learning assessment. Thus, assessing content at the lower level of Bloom's taxonomy may no longer be relevant in future.

IMMERSIVE EXPERIENTIAL LEARNING

Futuristic learning spaces and technologies promote immersive learning in accomplishing the learning goals. Regardless of technology advancement and changes, the best way of learning is through doing and integration. One good example is the 2u2i program that was introduced by MOHE in 2016 where students spend two or three years learning the fundamentals at the university and later spend two years or one year in the industry learning through reflection on doing activities. Experiential learning focuses on the individuals and can be done through hands-on via technology-enabled learning approaches such as virtual reality for hospitality or augmented reality for medical students. The development of values and ethics is to be preserved and enhanced via experiential learning curriculum through immersive community engagement. Gap Year is an example of an effort to inculcate attributes of humility, empathy and openness.



4. APPROACH D
ALTERNATIVE ASSESSMENTS

Alternative assessments promote a holistic assessment of the outcomes as well as the learning processes. It emphasises on what the students can and are not able to do, rather than merely focusing on the mastery of knowledge. Future Ready Curriculum assessment is part of learning to produce dynamic, balance and holistic graduates in various domains. There are eight (8) types of assessments for Approach D:

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TYPE 1: AUTHENTIC ASSESSMENT

Authentic assessment is a form of assessment that demonstrates the application of criteria related to the construction of knowledge, disciplined inquiry and the value of achievement beyond the classroom learning context[19]. This assessment emphasises on the contextualised tasks, in which requires students to exhibit their competency in a more authentic environment[20,21]. Portfolio-based assessment is one example of authentic assessment. It involves students' work compilation relating to their academic progress[22,23]. It is used to diagnose the students' needs. There are two major types of portfolios: working portfolio and showcase/model portfolio. A working portfolio contains documents related to students' assignments, tests and evaluations by teachers and peers. The information presented in the working portfolio is extremely helpful to define future instruction and curriculum structure. In contrast, showcase/model portfolio emphasises students' highest level of achievements. Besides showcasing works related to curriculum objectives, this portfolio may also include proof of activities beyond academic setting.

TYPE 2: PERFORMANCE-BASED ASSESSMENT

Performance-based assessment measures students' abilities to apply the knowledge and skills which they have learned[24,25]. It addresses the strategies for the application of knowledge and skills through meaningful and engaging tasks[26]. This type of assessment evaluates students' ability to execute certain tasks by gathering relevant feedbacks from others[27,28] Typically, this assessment also fosters the applications of real world scenarios in eliciting and strengthening students' critical-thinking, problem-solving, self-evaluation and HOTs.

TYPE 3: PERSONALISED ASSESSMENT

Personalised assessment measures the students' readiness to be assessed. It is done flexibly and adaptively in terms of assessment time and questions structure in measuring the achievement of learning outcomes. Through this type of assessment, students are more responsible in their own learning processes. Students' competencies will be measured over time when they are ready to be assessed. On-demand learning is one example of personalised assessment. The global classroom and distributive learning raise the need for the assessment materials to be prepared and aggregated in a unified online repository as well as accessible by demand. For example, pre-recorded lessons are made available on YouTube. This cloud-based approach ensures the availability of the assessment materials and resources to be reachable at anytime and anywhere.

TYPE 4: INTEGRATED ASSESSMENT

Integrated assessment is an interdisciplinary approach to assessment. It provides an engaging and creative learning platform that connects students with real-life situations. It also integrates the summative and formative evaluations through the provision of meaningful data on student learning prior to the design of appropriate L&T interventions. This assessment can also be implemented in courses where real problems are applied. Industry involvement in this type of assessment is critical because it prepares the students for a great workplace experience. Examples of integrated assessments include Capstone projects and the integration between iCGPA and portfolio-based assessments.

TYPE 5: CONTEMPORARY ASSESSMENT

Contemporary assessment differs significantly from traditional assessments. It focuses on multiple aspects – students' mastery of knowledge, skills and values that will enable them to function in the gig economy[29]. The needs and preferences of the digital natives will make this assessment type more meaningful because they prefer to engage in more contemporary types of assessment including the apprenticeship model, presentation, project-based, case-based, take-home and oral examination.

TYPE 6: REAL-TIME ASSESSMENT

Real-time assessment requires the instructors to analyse students' mastery of contents and skills during the learning process[30]. This enables the instructors to adjust the teaching approaches appropriate to the students' level of understanding. Several methods to assess students' learning include observation, thinking aloud and diagnosing students' strengths and weaknesses. Surveys can also be carried out to assess students' competencies and deficiencies in order to provide immediate feedback to both teachers and students.

TYPE 7: CHALLENGED-BASED ASSESSMENT

This type of assessment emphasises on collaboration, cooperation and group competition. For example, 'Hackathon' can be a model for a competitive and challenge-based assessment to encourage students to collaborate with each other and solve a common problem. This type of assessment has been developed primarily in the Computer Science field, with the 'hackathons' held for programming and coding competition. Educators can imitate this type of event and adapt it into their own assessment to encourage competitiveness among students.

TYPE 8: PROFILING ASSESSMENT

Profiling assessment analyses students' values, interests, preferences, basic English proficiency test as well as basic computing test. It adopts the 21st century skills and abilities in assessing the students' competencies and states of mind[31]. The outcome of this type of assessment is the students' holistic profile including their academic motivations. It also assists the students in appreciating and interpreting their competencies as well as helping them to uplift their employability skills. A few universities have adopted this type of assessment.

This section has explored Thrust 1 on Future Ready Curriculum in addressing the challenges of 4IR for the higher education sector. All the four strategies and 23 initiatives for Thrust 1 can be used as reference by the HLIs in revising and reviewing their academic programmes in order to align with the requirements of 4IR. This initiative calls for actions in ensuring all programmes are fluid and organic especially in relation to 4IR and future changes. HLIs should revise their curriculum and contrive the curriculum structure, content, teaching and learning as well as the assessment schemes.

The fluid and organic curriculum must include the features of flexible curriculum structure, innovative delivery and constructive alternatives assessments (Refer to Figure 4.3). It applies the constructive alignment principle where the L&T activities and assessment tasks directly address the intended learning outcomes (ILOs), which are not typically achieved in traditional lectures, tutorial classes and examinations[32].

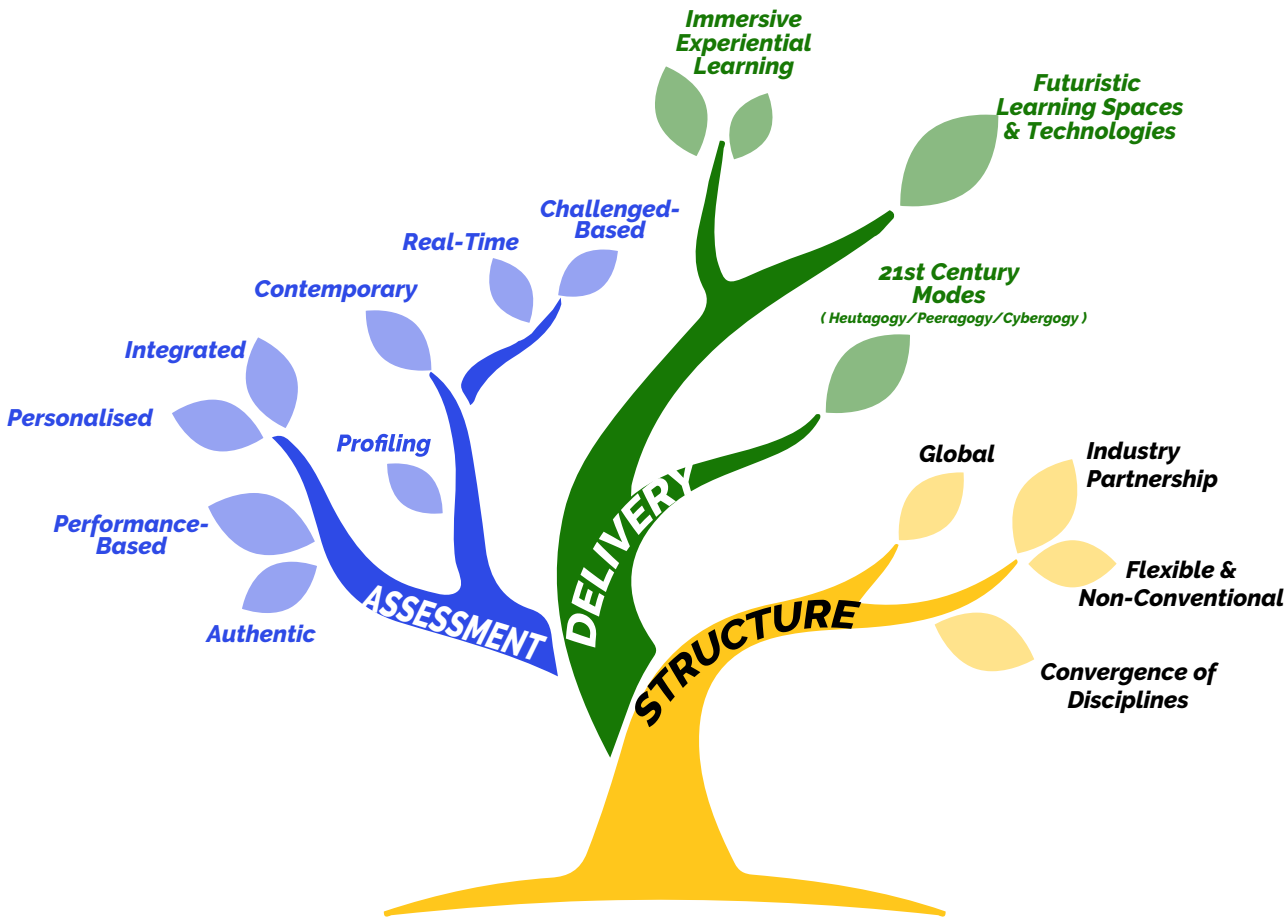


Figure 4.3 Fluid and Organic Curriculum Structure

Future Ready Curriculum must be designed to ensure that the programme learning outcomes are achieved and aligned with the broad descriptors and outcomes stated in the Malaysian Qualifications Framework (MQF). The Malaysian Qualification Agency (MQA) is the statutory body authorised to accredit academic progammes offered by HLIs and facilitate the accreditation and articulation of qualifications. MQA allows the HLIs to revise up to 30% of the curriculum with just formal notification of the changes, following the internal processes and procedures in making these changes. The 30% policy on curriculum changes provides the HLIs with adequate scope to incorporate the adjustments as often and as quickly needed. Most changes are minor to the curriculum structure. Hence, delivery or assessment, should be handled through an internal process. Only when more than 30% of the overall curriculum is structurally changed and involving the core components, it needs to be verified by the MQA. Additionally, programme standards (COPPA, 2008; and discipline specific programme standards) require the providers to regularly review their curriculum by consulting the industry, employers, students, alumni and subject-matter experts to ensure that the curricula remain current and future-focused.

FOCUS 2:
Agile Governance

1. APPROACH A
DIGITAL ETHICS & VALUES

Digital trust is a key enabler of the overall digital economy. It is defined as the confidence placed in an organisation to collect, store and use the digital information of others in a manner that benefits and protects those involved. It is also related to the ethics and values of the governing institution because a breach of digital trust can result in harmful consequences.

DIGITAL AUTHENTICATION
Digital authentication refers to a group of processes where document identities are established and presented via mobile applications or electronic methods to an information system (e.g. water marking and blockchain technology). Digital authentication is about having suitable and secured mechanisms in place to confirm the authenticity of documents.

CYBER SECURITY
HLIs must be prepared for the threat of cyber attacks. This is to ensure the security and integrity of the information especially when dealing with students' grades and personal information. Examples include abuse of personal data and academic results. Hence, there is a need for HLIs to train and re-train employees in coping with these ever changing threats.

2. APPROACH B
ACE DELIVERY

i-SPEED (INNOVATIVE, SPEED, PRODUCTIVITY, EFFECTIVENESS, EFFICIENCY, DELIVERY)

HLI governance must be innovative and must exercise i-SPEED in increasing productivity (e.g. Intake Graduation on Time – iGoT and cost efficiency – annual cost per Full-Time Student Equivalent[33]) and effectiveness of delivery. In line with the 4IR, all acts and processes will need to be reviewed in order to reflect the intelligence cycle and process, reduced bureaucracy as well as paperless and automated process. These processes must be client-focused in promoting work-life balance.

3. APPROACH C
SMART CAMPUS

Infostructure

The term infostructure refers to information infrastructure that is used in multiple disciplines. It is a component of Information System (IS)related to a range of functional elements[34]. In the context of HLIs, examples of usage of infostructure include learning management system (LMS), integrated time-tabling system and innovative course registration system.

Quick Respond Code

The QR Code promotes a new form of seamless smart campus services where students and staff are given a unique digital identification. The usage of QR code is currently limited to class attendance, on-campus payment, library borrowings and facility consumption. However, the employment of QR code on the smart campus is endless.

MYREN-X

MYREN-X is a Giganet network, computing and storage infrastructure dedicated to learning and research activities. The bandwidth of MYREN-X has been expanded to 100gbps from 10gbps to support network of contacts, cloud computing, L&T, research and innovation. This enables 150 HLIs to have connectivity and direct access to international learning and teaching networks.



4. APPROACH D
AUTONOMOUS GOVERNANCE

SELF-GOVERNING

Self-governing can be defined as the freedom given to the HLIs to govern their own institutions and manage their resources which include talent planning, infostructure and infrastructures, academic management, student intake and finance. Another important additional responsibility of HLIs is to generate income in ensuring their sustainability. The Code of University Good Governance and University Good Governance Index[35] are useful for the HLIs to align to the demands of the 4IR.

CO-REGULATORY

MOHE, HLIs and other stakeholders will collaborate in developing, administering and formulating the higher education policies. The introduction of this initiative constitutes a shift of function from MOHE being the sole regulator to MOHE sharing the regulatory functions with HLIs.

SELF-ACCREDITATION/CROWD ACCREDITATION

Self-accreditation provides the HLIs the autonomy to self-accredit their own programmes whereas crowd accreditation gives the opportunity to the universities to accredit programmes from other HLIs. These types of accreditations move away from a single accreditation body to an open review platform that encourages institutional diversity and sharing of expertise.







5. APPROACH E
SUSTAINABILITY

INCOME GENERATION, WAQF/CROWD FUNDING/ DONATION/ENDOWMENT

In line with the University Transformation Programme (Purple Book)[36], HLIs should refine and facilitate the management of income generation activities, waqf/crowd funding/donation/endowment agreed upon with central agencies namely the State Islamic Affairs Department, the Inland Revenue Board and the Ministry of Finance. Besides public and private funding, waqf is currently the third type of emerging economy that is growing globally.

FOCUS 3:
Research & Innovation

1. APPROACH A PIONEER CULTURE

Malaysian researchers must embrace change and critical challenges as well as become pioneers in creating and innovating technologies. The current strengths and expertise should propel Malaysian HLIs to become global innovators in Research and Innovation. Most importantly, key ethical principles must underlie all research endeavours to ensure integrity for a sustainable future.

INFUSING DIGITAL TECHNOLOGY IN EVERY SPECTRUM OF RESEARCH

Convergence and divergence of technologies lead to the diffusion of IT in every spectrum of research. With digital technology, the power of doing research can be extended at extreme scales of space, time and spectrum. Accordingly, it promotes new research areas such as software-defined anything, 4D printing for tissues and organs engineering, augmented artificial life and smart dust. However, it is important to emphasise that promoting positive social change should be the core of all research initiatives and technology development.

2. APPROACH B
RESEARCH ALLIANCE & PARTNERSHIP (RAPAT)

WEB OF CO-LABORATORIES

Research laboratories, research centres and project teams all over the world need to be connected in order to stay relevant. This is to ensure real-time sharing of data and resources. These groups can be complimentary, supplementary or competitive in working towards the solutions to human problems and challenges. Open access, democratisation of data and seamless collaboration are crucial to support the potential disruptive and adaptive modes of future research.

SYMBIOSIS OF TEACHING & LEARNING WITH RESEARCH AND INDUSTRY COLLABORATION

A symbiosis between research, L&T and industrial experience for skills development (education and training), acquisition and adoption of knowledge (innovation and technology transfer) and the promotion of entrepreneurship (start-ups and spin-offs) is the way forward. Apart from assisting educators to develop practical solutions to pedagogical problems, the university-industry collaboration (UNIC) coordinates the R&D agendas to avoid duplications; stimulates additional private R&D investment, and exploits synergies and complementary capabilities on scientific resources. UNIC helps expand the relevance of research, foster the commercialisation of R&D outcomes, and increase the mobility of talent between the public and private sectors. It also increases the propensity of firms to introduce and patent new products. Therefore, HLIs and industry are one.

RESEARCH DATA MANAGEMENT (RDM)

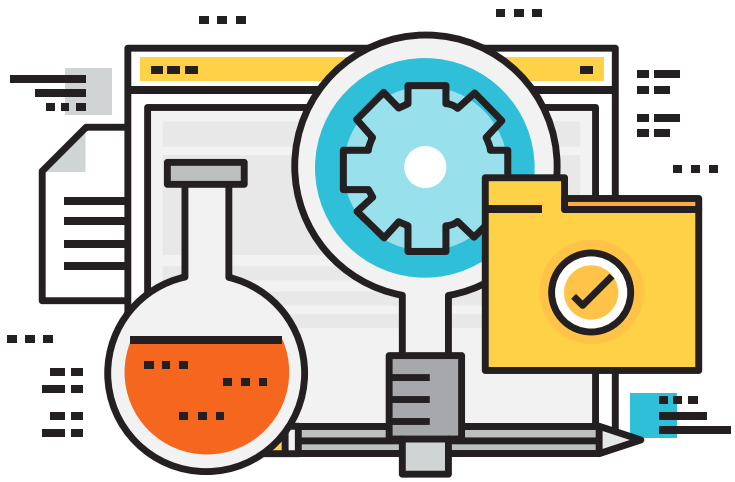
RDM involves data organisation, from its entry to the research cycle to the dissemination and archiving of valuable results. RDM aims to make the research process as efficient as possible by meeting the expectations and requirements of HLIs, research funders and legislators. It involves: 1) mining of data and planning for use; 2) organising, structuring and labelling of data; 3) making them secured, accessible as well as properly stored and backed up; 4) archiving information resources; and 5) sharing with collaborators, publishing and getting them cited.

OPEN SCIENCE

Open science peer review is a movement to make the dissemination of scientific research findings and data accessible to all levels of an inquiring society, amateurs or professionals. It encompasses practices such as publishing open research, campaigning for open access, encouraging scientists to practice open science and generally making it easier to publish and communicate scientific knowledge. Open science peer review encompasses open data, open source, open peer review, open access and open educational resources.

3. APPROACH C
TRANSLATIONAL RESEARCH

Translational Research is research with outcomes that impact the government, community, industry and academia (quadruple helix) which brings positive impacts to the quadruple helix ecosystem. Blockbuster research is one initiative under Approach C.



BLOCKBUSTER RESEARCH

It is an initiative to identify high impact research conducted by HLIs which are beneficial to the socio-economic well-being of the community. The outcomes of Blockbuster research are directly adopted by the community and the implementation efforts will be funded by MOHE.

4. APPROACH D
COMMERCIALISATION OF RESEARCH & INNOVATION



MOHE INC.

To ensure that research findings are commercialised in enhancing the socio-economy of the people, the Government will establish MOHE Incorporated (MOHE Inc.). MOHE Inc. covers the following objectives: a) to commercialise identified Blockbuster R&D products; and b) to function as an intermediary between universities with communities, communities and industries through the assimilation of knowledge and technologies.



FOCUS 4:
Talent Planning

1. APPROACH A
NEOTERIC VALUES-DRIVEN ACADEMIA

The 4IR promotes massive transformation in the way we work and live. The digital era requires the academia to utilise contemporary methods in pursuit of education, research and scholarship. In order to survive and stay relevant, faculty members are expected to uphold new teaching philosophies, utilise contemporary innovative learning materials and apply state-of-the-art learning modes to achieve the learning outcomes aligned with the 21st century in humanising higher education 4.0. Emphasis on personalised learning, trans-disciplinary approaches, learning analytics and technology tools are focal in delivering the best education to the students. The following are several initiatives in producing Neoteric Academia.

QALB - GUIDED LEADERSHIP
QALB - Guided Leadership is a crucial element in preserving high moral demeanour, integrity, modesty and respect of others, within leaders. It advocates the concept of a balanced and harmonious human being and underlines the devotion to God and services to the society. Qalb is fundamental to an individual's beliefs, undertakings, conducts, manners and emotions.[37] The desired leadership traits, behaviours and core competencies are the manifestations of Qalb-guided leaders who are values-driven and demonstrate a wholesome and balanced personality.

TRAINING OF TRAINERS 4.0
This initiative focuses on the professional development of the academics. It aims at training academics from HLIs in rethinking teaching and redesigning learning through experiential learning, blended learning and virtual learning experience. It promotes interactive and immersive learning in order to remain relevant to the constantly changing needs of digital natives and exponential change of technology.

REIMAGINING & REDESIGNING MALAYSIAN HIGHER EDUCATION AWARD
The award is a platform that promotes outstanding innovations in L&T implemented by academics or HLIs. It aims to recognise and promote the culture of innovation and creativity in L&T as well as celebrating academics who respond to the call of MOHE, in line with the policies and aspirations of higher education.

STORM (STRATEGIC TRAINING OF RESEARCH MANAGERS)
STORM aims at ensuring that research managers are trained in areas relevant to the needs of R&D in Malaysia. Areas covered include strategic research areas, data curation, proposal evaluation, financial management, human management and ethics.

2. APPROACH B
COGNITIVE FLEXIBILITY

Cognitive flexibility emphasises that knowledge is distributed across a network of connections. Academia are expected to specialise in their expertise while simultaneously increase their personal flexibility and ability to innovate in a constantly changing world. Cloud-based applications and web-based flexibility offer increased visibility and opportunities for academia to enhance their cognitive flexibility and collaborative initiatives.

IMMERSIVE TRAINING (INDUSTRIAL ATTACHMENT)

The 4IR promises complex problems and challenges. Hence, academia should undergo immersive training in preparation for Transformative L&T Delivery. Immersive training provides the most realistic scenarios and environments with goal-driven strategy. Academia will be exposed to hands-on exploration and analysis in solving complex problems. Immersive training will help them to develop higher order thinking skills, critical thinking, creativity, problem solving, and intellectual independence, all of which in turn contribute toward advancing an innovation-oriented pedagogical approaches.

LEARN, UNLEARN, RELEARN

Lifelong learning is crucial in order to stay current and ahead in this digital age. Hence, academia need to learn to unlearn and relearn to support the need for upskilling and re-skilling of competencies. This tallies with Alvin Toffler who quoted, “the illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.”

CEO@FACULTY 2.0

The first phase of the CEO@Faculty Programme (CFP 1.0) was “Learn from the Pros”. The second phase was launched in 2017 with the theme “Coached by the Pros” (CFP 2.0). The CEOs in the CFP 2.0 programme were engaged in coaching and mentoring selected young university lecturers with potentials to become future leaders. They are placed at the CEOs’ offices with a dedicated assignment for six months in order to learn, understand and capture the corporate culture in managing a high-profile company. Industry has always been present in academia, but with the CFP, the approach is more structured and purposeful. Greater synergy between academic and industry will lead to a better higher education system in the long run.



CONCLUSION

The 4IR is expected to impact the higher education system. The digital and technological advancements will disrupt the higher education services, resources and best practices including the formulation of a fluid and organic curriculum that matches the requirements of producing graduates who are able to adapt and survive the challenges of an uncertain future.

The Higher Education 4.0 Framework addresses the challenges of 4IR for the higher education sector. It consists of four (4) critical foci and fifteen (15) comprehensive approaches with detailed initiatives. The Framework is designed with two primary objectives; a) to assist institutions in analysing the present institutional structure; and b) to guide institutions in formulating suitable strategies towards the desired future university model. The basis of this framework is to produce ethically and morally respectable Malaysians who are values-driven to cope with the demands of the 4IR.

05 / Framing Malaysian Higher Education 4.0: Future-Proof Talents Chapter Five

OVERVIEW

- Unlocking the Malaysia Higher Education Blueprint
- Mapping the Future-Proof Skills
- Future-Proof Attributes
- Conclusion

Future-Proof Talents







UNLOCKING THE MALAYSIA HIGHER EDUCATION BLUEPRINT

MOHE acknowledges the importance of humanising new technologies as depicted in Shifts 1, 2, 3 and 4 of the MEB (HE). The balance between AKHLAK and ILMU is crucial to shape the 4IR to meet the nation's needs. Hence, the three (3) components of AKHLAK (ethics & spirituality, leadership skills and national identity) as well as the three components of ILMU (language proficiency, thinking skills and knowledge) should be embedded with the 11 elements of technological advancement in the era of 4IR (refer to Figure 5.2). In 2017, the Penang Skills Development Centre has classified 11 elements of industry 4.0 which include Horizon & Vertical Integration, Industrial IoT, Cybersecurity, AI, New Business Models, Cloud, Additive Manufacturing, Supply Chain, Big Data Analytics, Autonomous Robot and Simulation & Augmented Reality.[38]

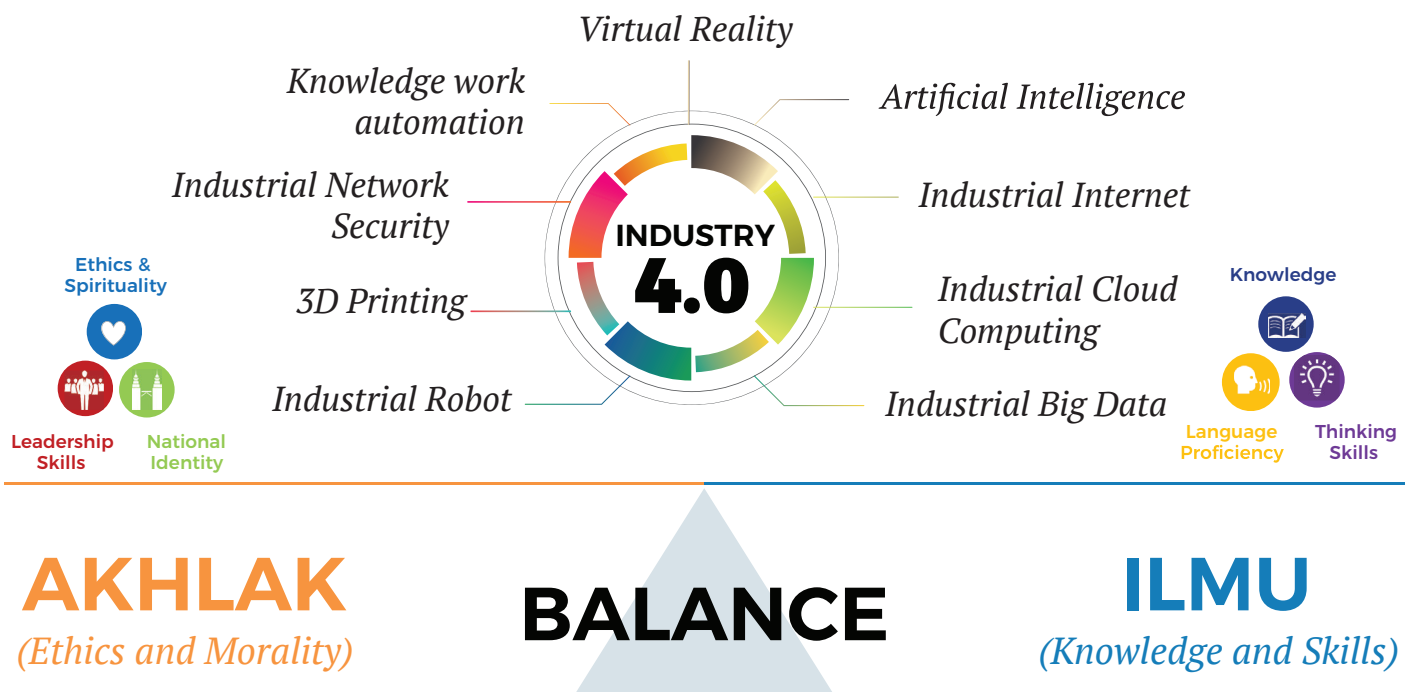


Figure 5.1: AKHLAK and ILMU and elements of 4IR

MAPPING THE FUTURE-PROOF SKILLS

In addressing the future challenges, HLIs should not only produce graduates who are problem solvers, job creators and technology inventors, but also individuals who possess intangible human elements such as civilisational literacy, compassion, resilience, adaptability, values and ethics. These are the fundamental elements needed to survive in this exponential age. Graduates will be global citizens with a strong Malaysian identity, ready and willing to contribute to the harmony and betterment of the family, society, nation, and global community. Graduates who possess strong positive values, skills, and knowledge will become wholesome individuals who will contribute to the global well-being. They will devote their efforts, intelligence, creativity and skills towards the betterment of the society.

Entrepreneurial graduates will be able to create job opportunities for themselves and others. They will not only become job seekers, but also job providers that can transform challenges and obstacles into opportunities that will benefit the community. In harnessing Malaysia's technological competitiveness, it is crucial to expose and encourage graduates to embark into technopreneurship – the merging of technology and entrepreneurship talent and skills. Technopreneurs are catalysts to the technology advancements and innovations which in turn contribute to economic growth and social well-being.



An overview of the 21st century skills and attributes of graduates outlined in the MEB (HE) demonstrates that there is a common set of skills needed by future graduates in facing the 4IR. A mapping of the MEB (HE) graduate attributes against the World Economic Forum's 21st Century Skills is shown in Table 5.1.

Table 5.1: Mapping the Future-Proof Skills

GRADUATE ATTRIBUTES MEB 2015-2025 (HE)	21ST CENTURY SKILLS (SOFFEL, 2016) [39]		
	LEARNING & INNOVATION	DIGITAL LITERACY	CAREER & LIFE
1. ETHICS & SPIRITUAL	1. CRITICAL THINKING & PROBLEM SOLVING	1. INFORMATION LITERACY	1. FLEXIBILITY & ADAPTABILITY
2. LEADERSHIP SKILLS	2. CREATIVITY & INNOVATION	2. MEDIA LITERACY	2. INITIATIVE & SELF-DIRECTION
3. NATIONAL IDENTITY	3. COMMUNICATION	3. ICT LITERACY	3. SOCIAL & CROSS-CULTURAL INTERACTION
4. LANGUAGE PROFICIENCY	4. COLLABORATION		4. PRODUCTIVITY & ACCOUNTABILITY
5. THINKING SKILLS			5. LEADERSHIP & RESPONSIBILITY
6. KNOWLEDGE			









NINE MALAYSIA FUTURE-PROOF SKILLS

Based on the list of mapped skills illustrated in Table 5.1, nine (9) Malaysian future-proof skill sets are identified and need to be learned and practised by Malaysian students.



Figure 5.3: Future-Proof Skills Sets for Malaysian Graduates

FUTURE-PROOF ATTRIBUTES

Graduates need to be equipped with the following personal qualities or the future-proof attributes to face the challenges of the 4IR:

1) LIFELONG LEARNERS

Graduates who embrace lifelong learning will continue developing their knowledge and skills in their multidisciplinary areas of interest. This practice will continue upon graduation as the graduates find interest in numerous other disciplines. They will have the capabilities to learn, unlearn and relearn new things as required by their jobs. Hence, HLIs and industries will have to continuously contribute in enhancing, reskilling, upgrading and up-scaling of graduates.

2) MULTIPLE INTELLIGENCE AND COMPETENCIES

Multiple intelligence and competencies are crucial attributes of future-proof graduates. These graduates must be trained to comprehend and process information in different ways. Technological competencies must be enhanced as the world is enfold in fast changing technologies. Efforts to harness technological competencies should encompass graduates from all fields (Science and Technology as well as Social Science). Also, instead of relying on a single Intellectual Intelligence (IQ)[40], graduates must embrace other types of intelligences namely Emotional Intelligence (EQ) and Spiritual Intelligence (SQ).

EQ determines the way individuals identify and manage their emotions and the emotions of others. EQ consists of compassion, quotient of love, empathy, QALB-Guided leadership and mindfulness which are social and humanistic competencies in nature.

In the world of robots, AI and digitisation, EQ is relevant as it is one of the top skills needed by future-proof graduates. It is a crucial attribute which affects the success of behavior management, navigation of social complexities and decision-making.

SQ is increasingly regarded as complementary to IQ and EQ. SQ looks at the spiritual intelligence of an individual in solving issues that affect the ability of the person to take values-based decisions and actions. It recognises that humans are essentially spiritual beings, a notion rejected by 'modern' science. In moving forward into the future, an in-depth understanding of SQ will present a consistent balance between the three types of intelligence – IQ, EQ and SQ. Our future-proof graduates must grow holistically and bridge the gaps between the intelligence types in facing the new challenges that await them.

3) COMPUTATIONAL THINKING

In the age of rapidly rising computer power, ability to work with data and make data-based decisions will become vital. Computational Thinking is a problem solving process not only essential to the development of computer applications, but also applicable to support problem solving across all disciplines. Computational thinking ability enables students to apply the knowledge across the curriculum and connect the relationship with life events.



CONCLUSION

The 4IR brings forth a new range of jobs such as AI, Machine-learning, Robotics, Nanotechnology, 4-D printing, Genetics and Biotechnology. This will cause widespread changes not only to business models but also to labour market, with enormous change predicted in the skill sets needed to thrive in the new landscape[41].

Future-proof talents for the 4IR must possess the nine (9) skill sets and the three (3) future-proof attributes identified in this chapter for them to remain competitive. Additionally, they must be exposed to technopreneurship skills which involve the merging of technology as well as entrepreneurship talent and skills. Hence, there is a pressing need to ensure that our graduates are equipped with the future-proof skill sets and attributes which would help them to cope with the new revolution that will take place in the working world.





06 / Framing Malaysian Higher Education 4.0: Future-Proof Talents Chapter Six

OVERVIEW

- Conclusions
- Humanising Malaysian Higher Education

Conclusions























“In order for Higher Education 4.0 to be successful, **THE WHOLE ECOSYSTEM** will have to **WORK TOGETHER** in ensuring that positive changes can truly happen.”

DATO’ SERI IDRIS JUSOH

MINISTER OF HIGHER EDUCATION, 2017



CONCLUSIONS

The 4IR is radically changing the landscape of HLIs all over the world and Malaysia is without exception. Most of the challenges and opportunities of the 4IR are moving at high speed. For instance, data science is now the key pre-requisite of knowledge in automation and Big Data Analytics. It also provides the background in the understanding of how cyberspace will become a new dimension for the governments and the extent to which traditional approaches will soon become obsolete. MOHE's successful entry into the 4IR is dependent on its ability to respond to change, master new knowledge as well as engage in frontier R&D and innovation on a continuous basis. HLIs with strong innovation capabilities will have a culture that translates innovation strategies into actions. They will also need a well-defined yet flexible process to collect and evaluate ideas in order to develop them further into products, services or business models.

There are three clusters of 4IR challenges facing the higher education sector. The first challenge relates to institutional awareness and readiness. Education providers must review their current organisational model in order to stay relevant and competitive. These institutions need to align with the technological advancement by leveraging on technology competency, data analytics, experiential learning as well as the humanistic values of the entire system. The second challenge involves the explosion of data where more data will be transmitted over wireless connection and linked to various devices. Building a digital ecosystem will require seamless connectivity, data sharing, and agreed standards for the exchange of data and components that are parts of the institutional systems.

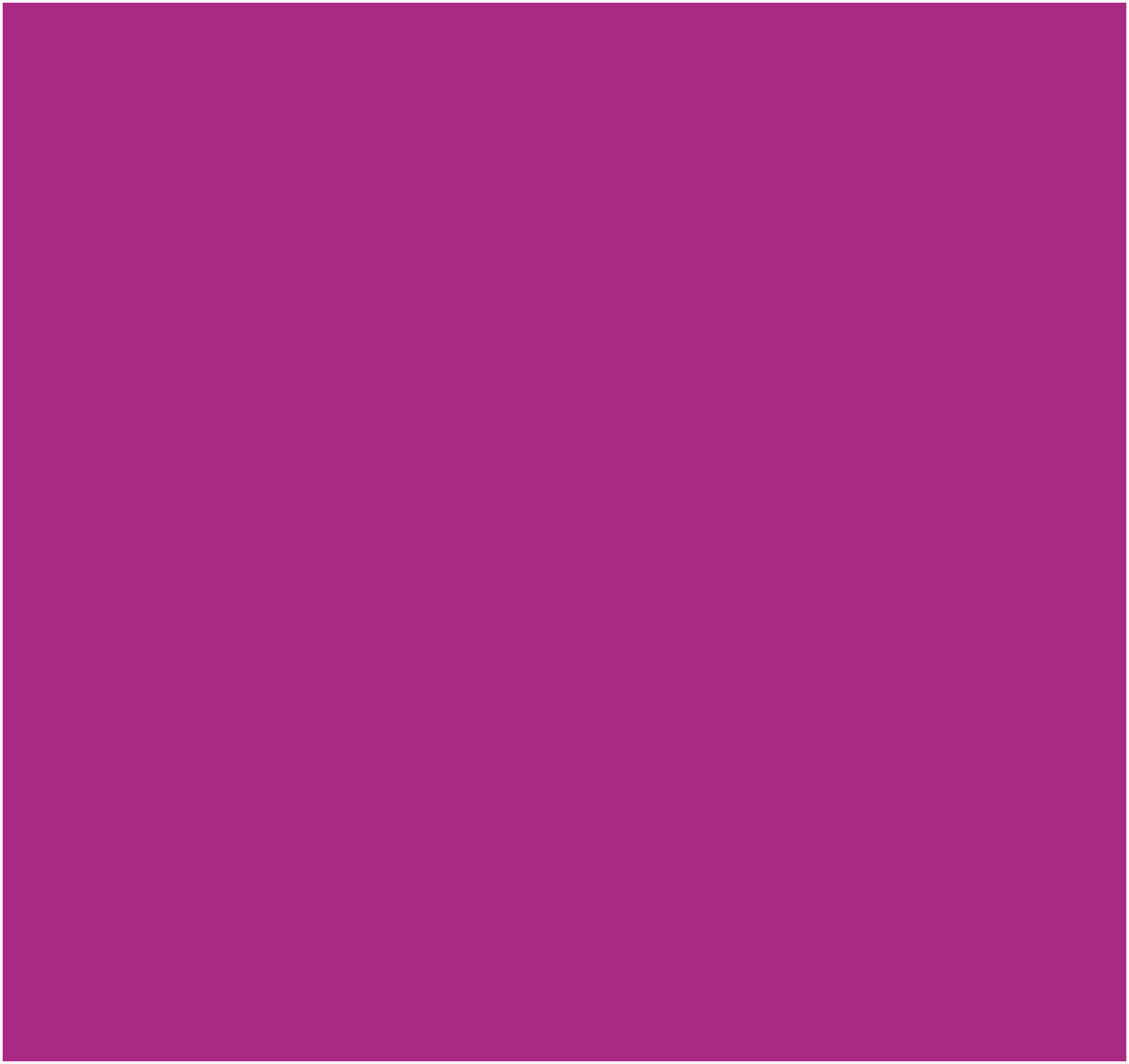
As data start to accumulate and be shared, other issues emerge such as data security and privacy. The government will have to design policies to safeguard massive data accumulated from multiple sources. The third and important challenge is the transformation of the workforce. New industrial sectors such as digital medicine and precision agriculture as well as new jobs such as medical robot designers and grid modernisation managers will emerge. On top of that, the government will have to provide an economic safety net in ensuring that the interest, competitiveness and sustainability of the Malaysian economy are protected. Transformation of existing jobs will also take place where virtual reality and augmented reality environments will provide a more productive and safer work conditions.

The 4IR requires a change in the society and a transformation of civilisation. The emergence of disruptive innovations can change the higher learning ecosystem and needs. Disruptive innovations can impact many fields of life such as education, economics, social and politics. Hence, the element of humanity must be the foundation of its existence. This document has elaborated on QALB - Guided Leadership of the neoteric academia, the shift of engineering and technology-focused core contents towards Liberal Arts and humanities-related knowledge as well as Spiritual intelligence as one of the attributes of the future proof graduates. These are some of the recommendations in fronting the challenges brought forth by the 4IR.

Those elements highlight the human values and the spiritual appeal of the students and academia - a major gap that has to be fulfilled today because technology advancements cannot replace the human values and the role of educators.

That said, the key to being successful in the 4IR is the mindset that is open to constant change because of the unpredictable future. Hence, there is a need to train students who are resilient and emotionally intelligent. Educational programmes must be geared towards enhancing the students' values, empathy, creativity, original thinking and leadership qualities in preparing for future-proof graduates. Graduates of today will be able to shape the future global workforce and create a change in the societies they live in for the better.

The path to the 4IR will not be the same because every country will move along the digital transformation at its own pace. Since technology has now become an integral aspect of human life, Malaysian HLIs must be proactive in adapting to the current developments. Collaborative and concerted efforts need to be escalated to unprecedented levels. The academia, MOHE, government agencies, and industries need to work together in embracing the 4IR in order to ensure that the future generation will be key players in the global race.




HUMANISING MALAYSIAN
HIGHER EDUCATION
RESEARCH & INNOVATION
FUTURE READY CURRICULUM
TALENT PLANNING
AGILE GOVERNANCE
FOCI
HUMANISING
HE 4.0
GRADUATES
LIFELONG LEARNERS
COMPUTATIONAL THINKING
ATTRIBUTES
MULTIPLE INTELLIGENCE & COMPETENCIES


APPROACHES
FUTURE-PROOF SKILLS
FLUID & DYNAMIC CURRICULUM
ALTERNATIVE ASSESSMENTS
RESEARCH COMMERCIALISATION OF RESEARCH & INNOVATION
TRANSLATIONAL RESEARCH
COGNITIVE FLEXIBILITY
CREATIVITY & INNOVATION
RESILIENCE
LEADERSHIP

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ABBREVIATIONS

Abbreviations

AI	Artificial Intelligence
APEL	Accreditation of Prior Experiential Learning
CFP 1.0	CEO@Faculty Programme 1st Phase – Learn from the PROs
CFP 2.0	CEO@Faculty Programme 2nd Phase – Coached by the PROs
CEFR	Common European Framework of Reference
COL	Critical Occupation List
CSC	Critical Skills Monitoring Committee
EQ	Emotional Intelligence
4IR	Fourth Industrial Revolution
HLIs	Higher Learning Institutions
HOTs	Higher Order Thinking Skills
ILMIA	Institute of Labour Market Information and Analysis
ICGPA	Integrated Cummulative Grade Point Average
ILOS	Intended Learning Outcomes
IoS	Internet of System
IoT	Internet of Things
IQ	Intellectual Intelligence
L&T	Learning & Teaching
LMS	Learning Management System
LOTs	Lower Order Thinking Skills
MDGs	Millennium Development Goals
MEA	Malaysia English Assessment
MEB (HE)	Malaysia Education Blueprint (Higher Education)
MOHE	Ministry of Higher Education
MOHE Inc.	MOHE Incorporated
MOOCs	Massive Open Online Courses
MQA	Malaysian Qualification Agency
MQF	Malaysian Qualification Framework

ABBREVIATIONS

Abbreviations

MSMEs	Malaysia Small and Medium Enterprises
MyHE 4.0	Malaysian Higher Education 4.0
NEXT	Nurturing Expert Talent
QR Code	Quick Response Code
RAPAT	Research Alliance and Partnership
R&D	Research & Development
RDM	Research Data Management
SDGs	Sustainable Development Goals
SQ	Spiritual Intelligence
STORM	Strategic Training of Research Managers
3Ps	People, Planet & Prosperity
TN50	Transformasi Nasional 2050
UNIC	University-Industry Collaboration

ACKNOWLEDGEMENT

MINISTRY OF HIGHER EDUCATION LEADERSHIP

MINISTER DATO' SERI IDRIS JUSOH

DEPUTY MINISTER DATUK DR. MARY YAP KAIN CHING

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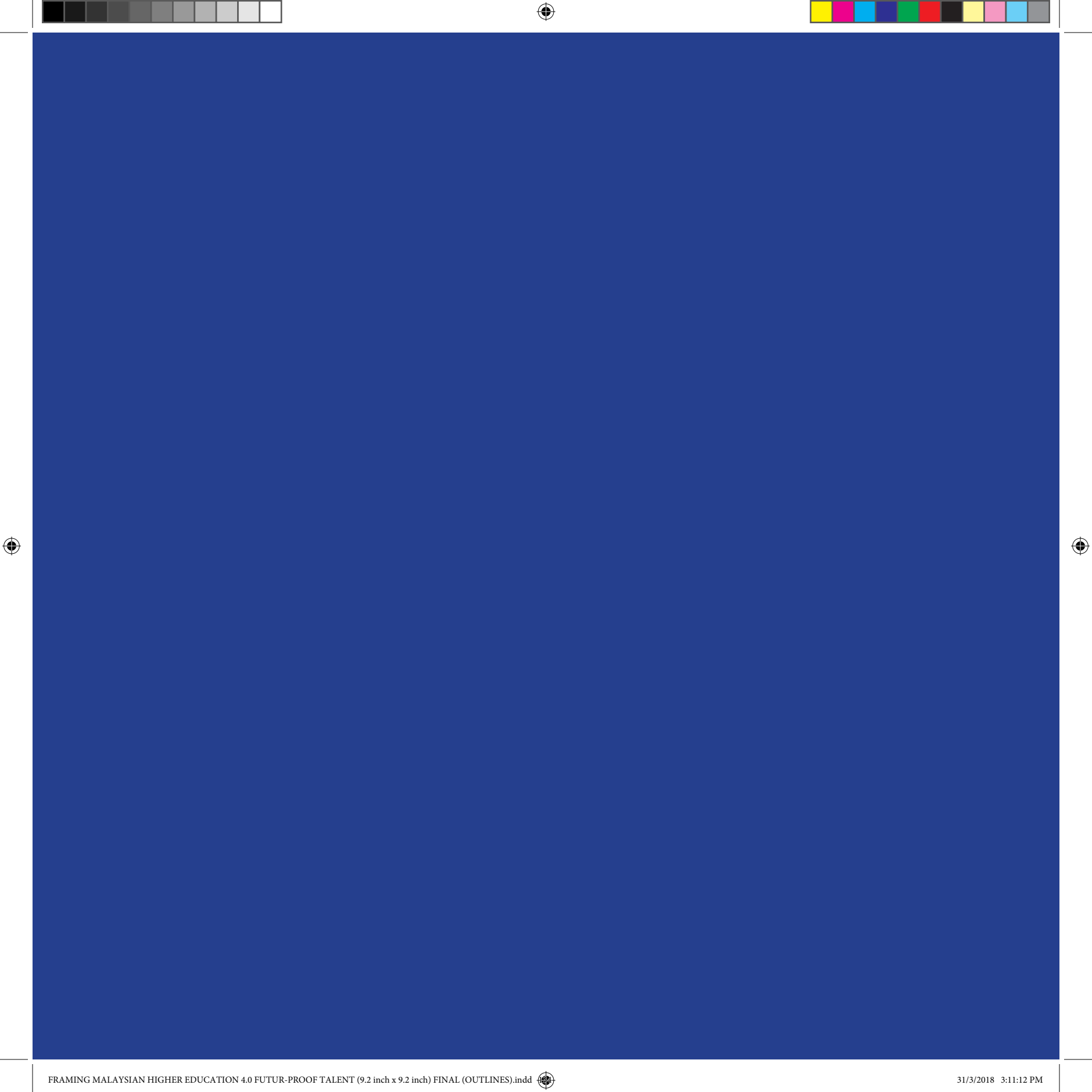
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...and those who have contributed directly or indirectly in the process of producing this book.

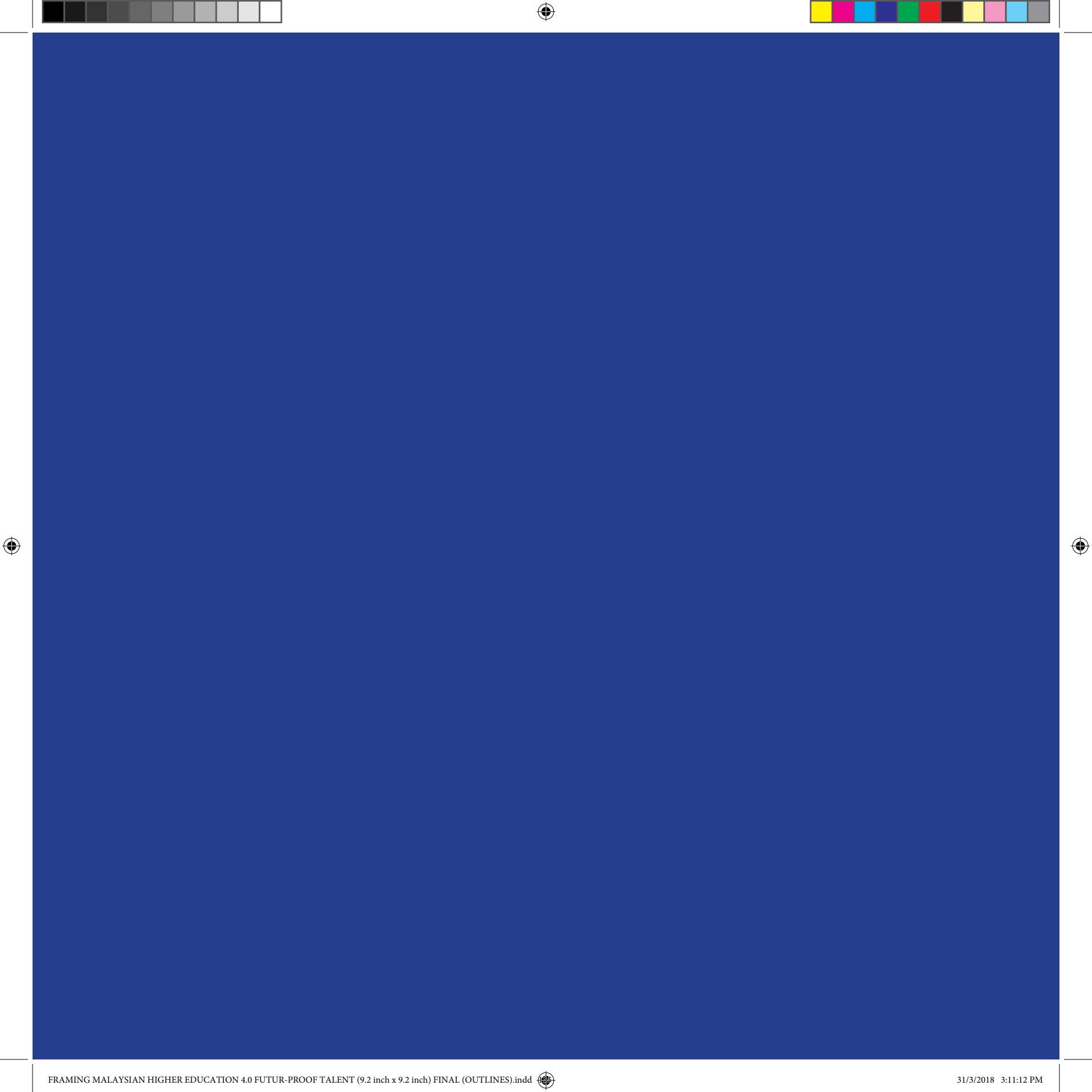
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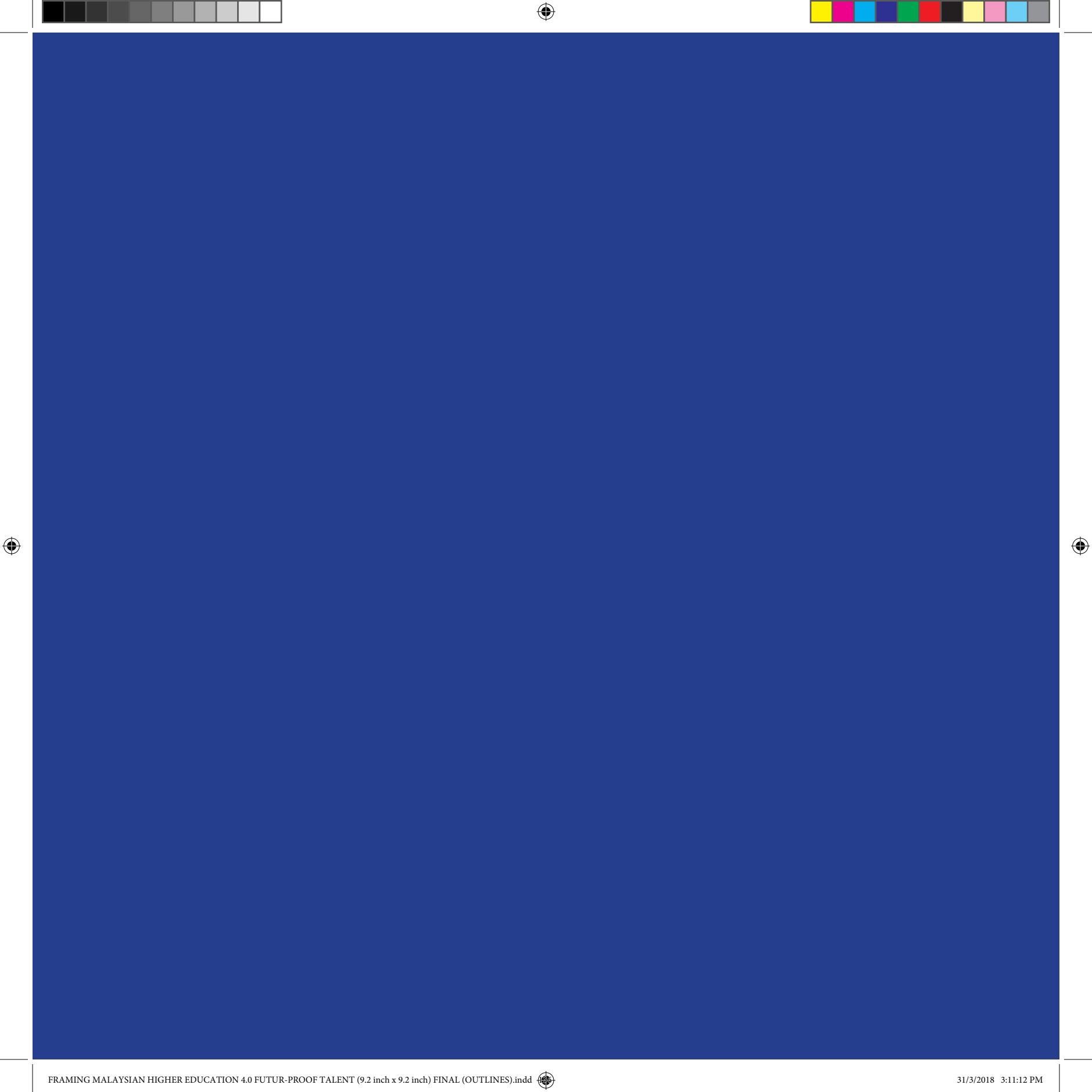
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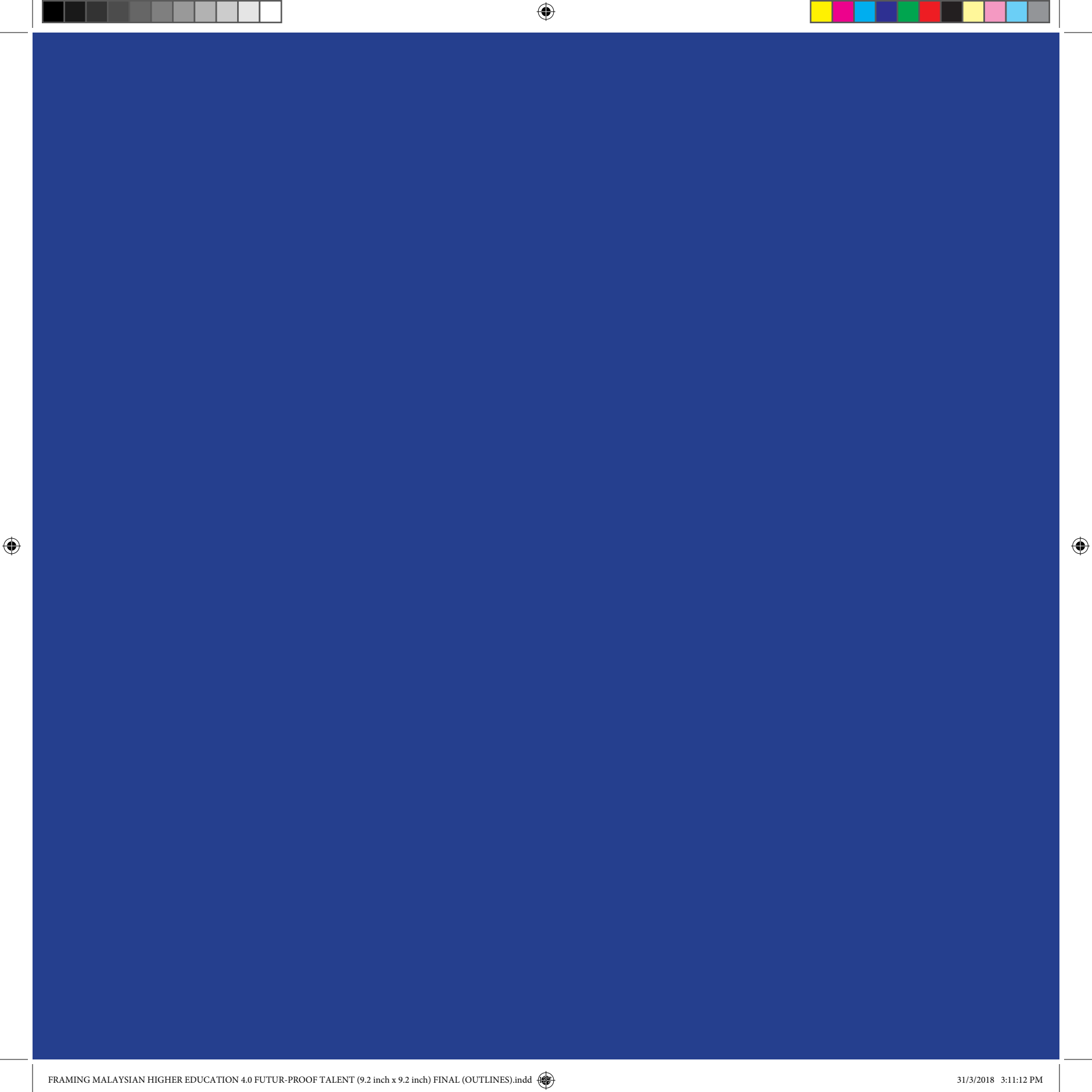
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