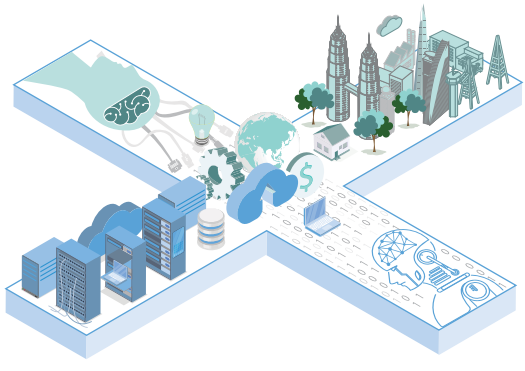
KHAZANAH NASIONAL

KHAZANAH MEGATRENDS FORUM 2017

Co-organised with
KHAZANAH RESEARCH INSTITUTE

CEREBRUM ALGORITHM

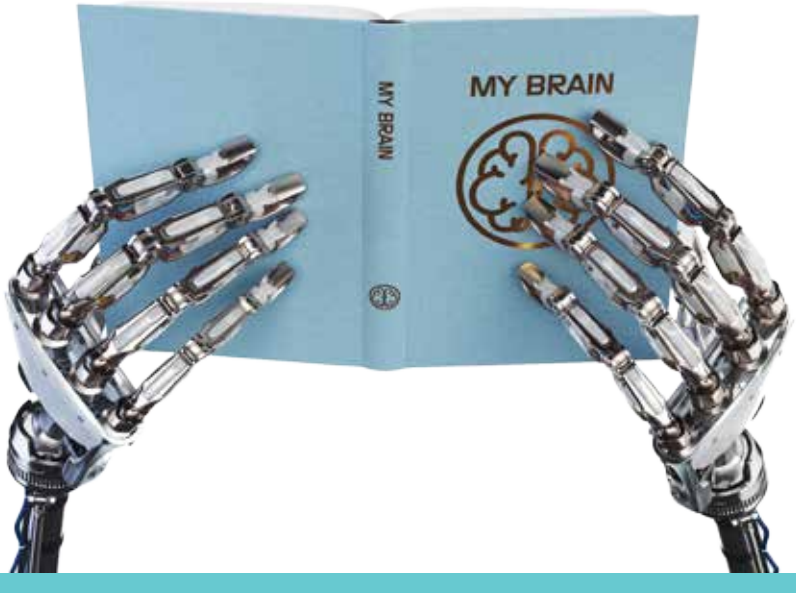


Building True Value in a Post-Truth World

2nd and 3rd October 2017

KMF2017 Primer

www.kmf.com.my



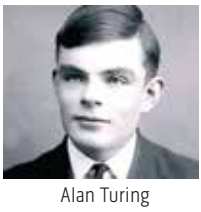
"Where machines such as steam engines and telephones attempt to replicate human brawn activities, Artificial Intelligence (AI), the Algorithm, attempts to replicate human brain activities or Human Intelligence ("HI"), the "Cerebrum"."

Context: Origins and Rise of AI

The first Artificial Intelligence

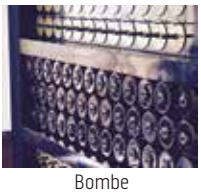
On September 4th 1939, Alan Turing reported to Bletchley Park to decrypt coded messages generated by the German military's cipher machine, the Enigma.

Turing Machine



Alan Turing

Alan Turing's "universal computing machine" ("Turing machine") could perform any computation so long as it was representable as an algorithm



Bombe

Breaking the code

Enigma

AIs first contribution
The Turing machine was pivotal in the design of the 'bombe', a machine that helped break the German Enigma

What is Artificial Intelligence?

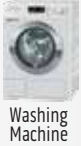
A subset of machine technology, defined roughly as the simulation of human intelligence processes by machines

From Machines to Artificial Intelligence

Machine

Machines replicate human brawn activities...

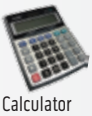
Steam Engine



Washing Machine

Telephone

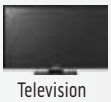
Spinning Jenny



Calculator

Toaster

Cotton Gin



Television

Aeroplane

Tractor

Artificial Intelligence

...while AI attempts to replicate human brain activities

Turing Machine

Aibo

Laptop

Smartphone

Roomba

amazon

NETFLIX

Deep Blue

Waze

Alexa

Grab

facebook

Tesla

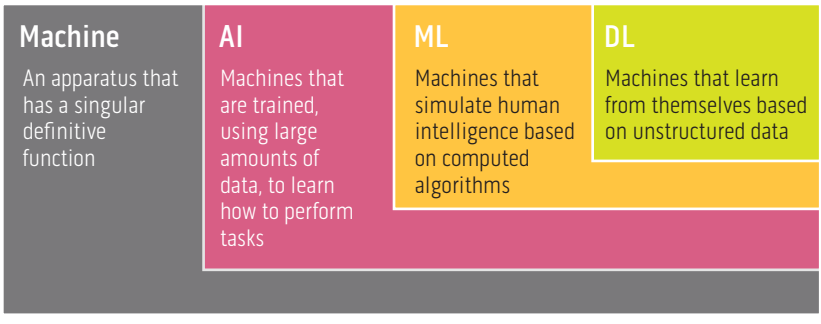
Alphago

- **The insufficiency of human abilities -** Alan Turing was chosen not just for his expertise in logical and mathematical cryptology, but for his conception of a "universal computing machine".
- **AIs first contribution to the human race -** The Turing Machine (and the 'bombe') decrypted coded messages generated by the Enigma. Had the codes not been broken, estimates quantify that World War 2 may have continued for another 2-3 years, costing another 14-21 million lives.
- **Machines replicate brawn, AI replicate brain -** Where machines such as steam engines and telephones attempt to replicate human brawn activities, AIs attempt to replicate human brain activities or Human Intelligence ("HI"), the "Cerebrum".

The AI of Today and Tomorrow

The Artificial Intelligence of Today

Proliferation of big data and exponential increase in computing power have rapidly expanded the field of AI to Machine Learning (ML) and then to Deep Learning (DL).



The rise of self-taught machines

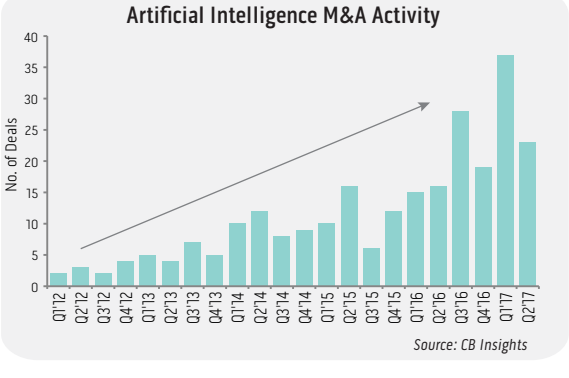
Massachusetts General Hospital's NVIDIA's DL supercomputer improves detection, diagnosis, treatment, and management of diseases

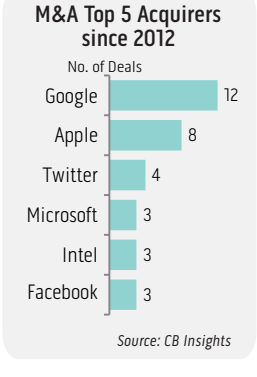
Deep Learning provides the basis for the development of driverless cars, as currently developed by Alphabet and Uber

Google's AlphaGo defeated Lee Sedol in a five-game Go match. It learned and trained for the match by playing against itself repeatedly

The Artificial Intelligence of Tomorrow

Corporates are taking note of AI, particularly the large technology firms.





- **The rise of a more complex and intelligent form of AI -** The proliferation of big data and exponential increase in computing power birthed "Deep Learning ("DL")" - a machine able to self-learn from unstructured data such as images, sound, video, and text.
- **DL aims to replicate human consciousness -** In essence, DL software tries to mimic the activity in the human 'Cerebrum', the wrinkly 80 percent of the brain where conscious taught takes place.
- **The AI of tomorrow will be more complex -** Greater capital allocation from corporates will improve AI sophistication, enabling it to perform more complex tasks and maybe, even develop a sense of 'consciousness'.

The improbable victories of Trump and Brexit: A post-truth world?

The victories of Trump and Brexit were both improbable events

Donald Trump's Presidential victory

The Vote-Leave campaign

One of the key narratives arising from Trump's Presidential victory and the Brexit vote was the notion of 'rhetoric overpowering facts'.

The era of post-truth politics

Political culture in which objective facts are less influential in shaping public opinion - and firing up voters - than appeals to emotion and personal belief.

	What was said	What is true
TRUMP	"They're (Mexican immigrants) taking our jobs. They're taking our manufacturing jobs. They're taking our money. They're killing us."	According to data cited by the Wall Street Journal, every 1 new immigrant creates 1.2 new jobs for local (native) workers.
	"Because we now have the lowest unemployment rate we've had in 17 years...they (wages) haven't gone up for a long time."	For all private workers, average weekly earnings rose 4% during Obama's last few years in office.
BREXIT POLITICS	"The EU now costs the UK over GBP350m every week - nearly GBP20bn a year." - Vote-Leave campaign	In 2015, the UK only paid the EU an estimated GBP13bn, or GBP250m a week.
	"The UK consistently loses in the EU because other members favour a highly regulated and protectionist economy." - Jacob Rees-Mogg, Somerset MP	The UK is not consistently outvoted in the EU - since 1999, the UK has supported 2474 acts, and has been in the minority (voting "No") on 57 acts.

Source: Factcheck

Source: Telegraph

To what extent is post-truth politics attributed to human error?

Cerebrum
Cerebrum is prone to cognitive biases and identity fusion...

Algorithm
...but did the Algorithm and the rise of social technology play a part?

- **The improbable victories of Trump and Brexit -** Two hugely improbable events defined 2016, first, the UK's "Brexit" vote, and second, Donald Trump's Presidential victory.
- **Post-truth politics, Trump and Brexit -** Post-truth politics (a political culture where objective facts are less influential in shaping public opinion than appeals to emotion and personal belief) was a significant factor in Trump's Presidential victory and the Brexit vote.
- **Cerebrum or Algorithm?** While human error - cognitive biases, identity fusion, emotional ties - clearly contribute to post-truth politics, the role of the Algorithm in social technology was also key.

A post-truth world: The role of the Algorithm

Algorithmic social engineering

While it is true that the Cerebrum is not perfectly rational...

...it is also true that humans can be socially conditioned...

...and hence, Algorithm can potentially socially engineer our environment.

"The Vote Leave campaign owes a great deal of its success to the work of AggregateIQ. We couldn't have done it without them."

BREXIT

Brexit campagn paid £3.5m...

£3.5m...

AGGREGATEIQ

...to AggregateIQ (specialist in Facebook advertising and profiling) ...

=

...to determine political leanings via Big Data analytics and Machine Learning.

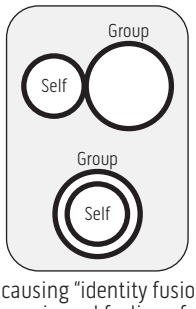
Do social media and technology integrate or segregate?

YouTube Google

Social media may be integrating more people around the world but is it integrating only the same types of people?

Is social media also segregating the world?

The 'echo chamber (a situation where information is amplified or reinforced)' forms when like-minded individuals are integrated together...



...causing "identity fusion - a visceral feeling of 'oneness' with the group"...

Source: Harvey Whitehouse

Polarised communication between Republicans & Democrats on Twitter

...manifesting in, for instance, Twitter communications between Americans that are mostly among those of similar political alignments.

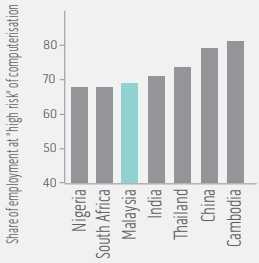
Source: Proceedings of The National Academy of Sciences

- **Technology can be used to advance social narratives -** The Brexit Leave campaign paid £3.5 million to Aggregate IQ to profile public political leanings by targeting Facebook advertising and profiling.
- **Social media may integrate, but also segregate -** Facebook's News Feed is a learning algorithm that buckets users according to their similarities, creating an 'echo chamber', integrating people of similar interests but segregating them from those of differing interests.
- **Technology may exacerbate a sense of tribalism -** While human tribal behaviour is not new, the reach of technology and social media has allowed this sense of tribalism to be harnessed more effectively for a given purpose.

Technology and developing nations: Is there such a thing as too much innovation?

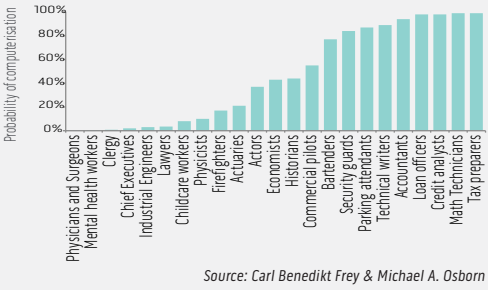
1 Automation may cause widespread unemployment

Developing countries' susceptibility to automation



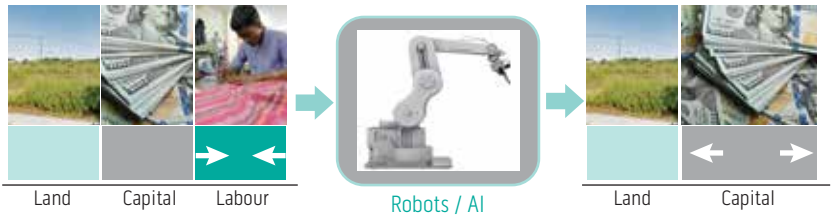
Source: Citi, Oxford Martin School

Which jobs are most at risk of automation?



Source: Carl Benedikt Frey & Michael A. Osborn

2 AI may deepen wealth inequality



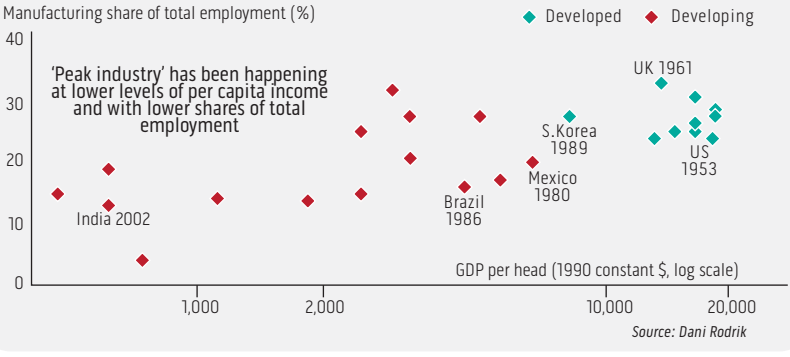
The standard production inputs are land, capital and labour...

If robots replace labour and are owned by capital owners, then labour share in production decreases while capital share increases

Therefore, returns to production accrue even more to capital owners

3 AI may increase the risk of premature deindustrialisation

"Stitched Up By Robots": Premature deindustrialisation



Source: Dani Rodrik

Low-skilled manufacturing jobs disappear as automation becomes cheaper in developed markets, kicking away the development ladder. The demographic dividend may become a demographic burden for many developing countries in South Asia and Sub-Saharan Africa.

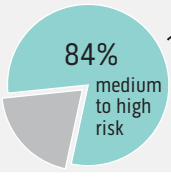
- **Jobs are susceptible to automation -** In developing countries, a huge portion of jobs is at risk from automation, across all levels of skill.
- **AI in production may exacerbate inequality -** As robots take over human labour, and robots are owned by capital owners, returns to production will accrue even more to capital owners (relative to labour).
- **Kicking away the development ladder -** As automation becomes cheaper, the need for outsourcing to developing nations decreases, leading to countries failing to industrialise fully, a key component of development.

"It is only via harnessing the best of both Cerebrum and Algorithm that we can potentially build a new form of Super-Intelligence."

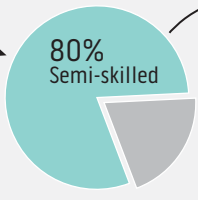
Technology and developing nations: The case of Malaysia

Occupations across the skill spectrum are at high risk of displacement in Malaysia...

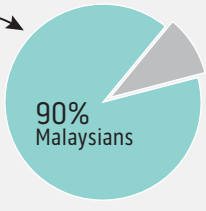
An estimated 84% of all jobs in Malaysia are at medium to high risk of being displaced by technology in the next 10-20 years



~80% of these jobs are semi-skilled



~90% of all semi-skilled jobs are held by Malaysians



Source: Khazanah Research Institute

...with entire industries potentially impacted by AI.

Precision manufacturing

Palm oil harvesting

Power generation & distribution

Semiconductor/E&E testing & inspection

TN50 aims to drive Malaysia forward by turning the risks Malaysia faces into opportunities, based on several thrusts:

Economy & Jobs	Life and Well-Being	Governance	People	Lifestyle
Industrial Policies	Digital Transformation	Safety of Food and Environment	Racial and Cultural Harmony	Cultural Heritage
Education Policies	Green Surroundings	Cyber Security	Equality of Opportunity	Arts, Crafts and Sports

- **Malaysian jobs will not be spared -** In Malaysia, the primary bulk of jobs that are at high risk of automation are semi-skilled jobs, of which 90% of these jobholders are Malaysians.
- **Entire industries may be at risk as well -** Several key economic industries could be at risk, including semiconductors, E&E goods, precision manufacturing and even oil palm plantations.
- **Turning risks into opportunities -** The forward-looking TN50 initiative aims to chart a holistic development path for Malaysia, covering a wide range of national development imperatives.

Cerebrum X Algorithm: Where next?

Existential threats to humanity?

Overstated
AI is human-created, and we are several breakthroughs short of creating a machine that truly thinks like a human

Ray Kurzweil

"If AI becomes an existential threat, it won't be the first one."

Mark Zuckerberg

"AI is going to make our lives better in the future.. doomsday scenarios are pretty irresponsible."

Real
AI could use its superior hacking abilities to take control of robotic manipulators and automated labs.

Stephen Hawking

"The development of full AI could spell the end of the human race."

Elon Musk

"We need to be super careful with AI. Potentially more dangerous than nukes."

AI can be either beneficial or destructive, depending on how we programme it.

Plastic accumulating on Henderson Island: AI and satellites can be used to identify gyres in the ocean where plastic collects and to search for efficient collection points.

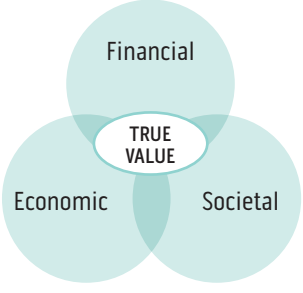
AI could search for alternative, cost-effective, robust systems such as more efficient rail systems, by taking topography into account.

OR.. Sentient AI could evolve into something more menacing and eventually become destructive.

- **Opinions on AI are divided -** Some opine that AI is human-created for human purposes, and it will take decades for AI to think like a true human. Others are more fearful of AI's negative consequences, warning of AI that could threaten the planet and human existence.
- **AI can be beneficial -** AI can be a force for good, deployed to help solve problems that threaten human existence such as climate change, fossil fuel decline or solutions to global plastic pollution.
- **BUT AI can also be destructive -** Just like nuclear power, which can be used for energy generation or to level entire cities, AI can also be a force for destruction, if weaponised for war. It is a double-edged sword.

Building True Value: Doing the right things, right, in the right way

Building True Value



True Value to Khazanah goes beyond that of intrinsic financial value and economic performance to include the broader impact to society, encapsulating the principles of sustainability, inclusiveness as well as transformativeness.

Doing The Right Things ...

Choosing the appropriate mandate and objective. HI is superior to AI in deciding which tasks are worth doing. For example, nuclear technology could either be used to produce electricity or it could be used to create an atomic bomb.


Nuclear power plants


Bombing of Hiroshima

... Right ...

Executing solutions in the most efficient manner. Given the immense computing power that AI possesses, AI would outperform humans in most tasks but HI could contribute via strong design.

...In The Right Way

Doing things with proper ethical and governance considerations. HI must play the role of guiding moral uses of AI, since AI is inherently amoral. HI must set moral parameters.


The use of robots and AI to help elderly people in Japan


The use of AI by hackers to shut down grids

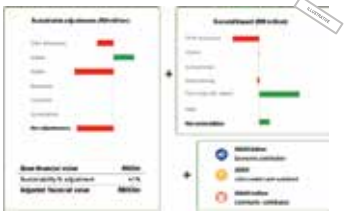
- **Building True Value -** A focus on value creation that goes beyond just financial returns, incorporating economic and societal returns as well.
- **Doing the Right Things... -** When it comes to picking what to do, AI has little say; it is the Cerebrum that must decide what actions are worth doing.
- **...Right... -** When it comes to efficient execution, AI possesses far more capacity, but humans could contribute by ensuring good Design.
- **...In the Right Way -** In the question of Ethics, the Algorithm is amoral and ambivalent; the onus is therefore on us, the human race, to maintain the highest standards of moral integrity.

Case Studies on Building True Value: Selected Khazanah Nasional Initiatives

1 Project Chronos - Measuring True Value

A proprietary sustainability valuation methodology that encapsulates financial, economic and societal values

True Value Dashboard



Aligned to various global and national sustainability and responsible investing agenda

2 Innovation & Technology Investments

blippAR
AI - An augmented reality and image recognition platform

Alibaba.com
E-commerce - Digital wholesale marketplace

generalfusion
Fusion Energy - Develops scale power using magnetised target fusion

sea connecting the dots
Online Games Platform - A consumer internet company

Fractal
Big Data - Specialises in predictive analytics

MARCH CAPITAL PARTNERS
Sector agnostic fund - An early-stage focused fund

3 Innovation & Entrepreneurship Initiatives

To discover innovative ideas and entrepreneurial talent, address funding gaps in VC space, provide innovation platforms, promote innovation culture and entrepreneurs to scale up businesses.

Khazanah's IxE Initiatives

- Project Brainchild
- Project Cornerstone
- Project Firestorm
- Project Ground-breaker
- Project Greenshoots
- Project Watershed/ Project TIDE
- Project Silverstone

4 Negaraku, Negara Kita Campaign

Khazanah Nasional's 'Negaraku, Negara Kita' campaign celebrates Malaysia's journey and progress as a nation, through several initiatives intended to promote unity and patriotism.

Communications and Awareness

Grit & Grace Photobook & Exhibition

Hari Hasanah

Anak Merdeka

- **Investing in Tech & Entrepreneurship -** Khazanah's I&T work goes beyond investing, developing the Malaysian entrepreneurial ecosystem.
- **Measuring True Value via Project Chronos -** Developing a rigorous tool to measure True Value for Khazanah and its investee companies on both shareholder and stakeholder value.
- **'Negaraku, Negara Kita' Campaign -** Initiatives include advertisements in conjunction with Hari Kebangsaan and Hari Malaysia; Hari Hasanah, where Khazanah, its flagship foundations, investee companies, partners and staff contributed time and effort to do good deeds for the benefit of others; the six-episode Anak Merdeka miniseries; and the Grit & Grace photobook and public exhibition.