9TH EDITION

ICT STRATEGIC REVIEW 2017/2018

Convergence of the Digital and Physical Worlds

New technologies and approaches are merging the physical, digital, and biological worlds in ways that will fundamentally transform humankind. The extent to which that transformation is positive will depend on how we navigate the risks and opportunities that arise along the way

- Klaus Schwab

PIKOM

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PIKOM, the National ICT Association of Malaysia, is a not-for-profit organisation. It is the largest association representing information and communications technology (ICT) players in Malaysia. Since its inception in 1986, PIKOM has come of age as the voice of the ICT industry. It has become an ICT referral centre for government and industry players, as well as international organisations. In this regard, PIKOM takes on the responsibility to publish ICT-relevant information in a periodic manner.

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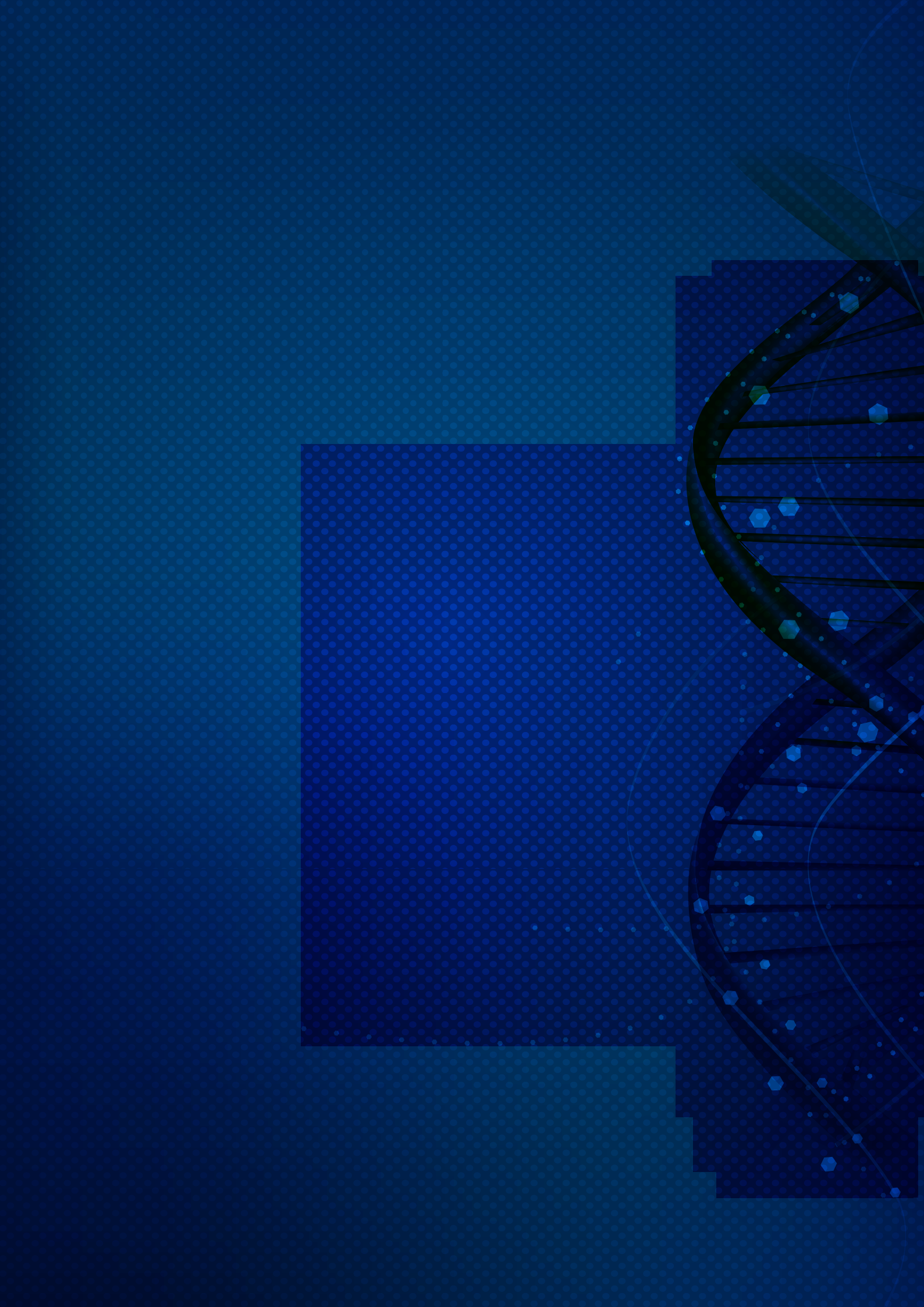

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FOREWORD BY THE
MINISTER OF COMMUNICATIONS AND MULTIMEDIA

Malaysia's Digital Economy (DE) continues to be the fastest-growing segment of the national economy. We are positive that the DE would be able to contribute at least 20% of our nation's gross domestic product (GDP) by 2020.

Yet, that is only one part of the story. The DE has always been larger than the sum of its parts, given its flow-on impact on the rest of the physical economy as well as to the communities.

Already, we are seeing a rapid convergence between the digital and physical economies with the increasing adoption of digital technologies across all economic sectors. We are confident that before long, the two will become two sides of the same coin having equal significance and interdependencies.

It is for this reason that the Government, in the recently-unveiled Budget 2018, placed such emphasis on the 4th Industrial Revolution, otherwise referred to as the 4IR. We are putting the pieces in place to drive industry towards automation and robotics through the use of the internet of things (IoT), big data analytics (BDA) and artificial intelligence (AI).

Beyond the 4IR, Budget 2018 is also focussed on the sustained development of the DE, with particular attention given to the Digital Free Trade Zone (DFTZ) as well as other tax incentives for the ICT industry.

We, at the Ministry of Communications and Multimedia, will continue to play a pivotal role in hastening the pace of the digital economy for the development of the nation.

I am pleased that PIKOM is collaborating with the Government and industry to produce a publication on technology trends and direction of the digital economy. Congratulations to PIKOM for its efforts in producing this report.

Senator Datuk Seri Dr. Salleh Said Keruak

MESSAGE BY THE
PIKOM CHAIRMAN

The pace at which the digital economy is evolving and new digital technologies are emerging is simply breathtaking! At times, it manages to take us all by surprise despite the fact that many of us at PIKOM are industry players.

Only a few years ago, we had never heard of technologies or concepts such as big data, the internet of things or cloud computing. Today, these terms are relatively old news. The new ones on everyone's lips now are Fourth Industrial Revolution (4IR), Industry 4.0, Fintech, Blockchain and so on.

Added to this is that what many of us anticipated would happen, is actually happening before our own eyes. More so than ever, the digital and physical worlds are coming together in a complementary and supplementary manner.

For this reason, the 9th edition of PIKOM's flagship publication, the ICT Strategic Review 2017/2018 carries the theme: Convergence of the Digital and Physical Worlds. The contents of this year's book are bold and exciting, a definite must-read for anyone and everyone in the industry and beyond!

Appropriately, we have a review of the 4IR and Industry 4.0, an exploration as well as an explanation on Blockchain, a discussion on Fintech, a discourse on the Sharing Economy, an insight into artificial intelligence, and our perennial economic as well as ICT industry outlook to start the ball rolling. I am pleased to inform that we have also compiled a special edition for cybersecurity to underscore its importance to the growing digital economy and spread of digital technologies. It would seem that we have left no stone unturned in our endeavour to pique your interest and whet your appetite for knowledge.

Let me then take this opportunity to congratulate the PIKOM Research Committee for leading this immense effort to produce this year's publication. Also, I would like to thank all the contributors from the many companies and organisations that time after time share their expertise and experience with the industry at large. To our sponsors - BDO, Dell, Epson, Fusionex, HP, Glocomp, EKTech, Iverson, Hitachi Sunway and PWS - once again, you have supported us in our efforts to galvanise the ICT industry to look to the future.

Finally, I would like to state PIKOM's appreciation to the Ministry of Communications and Multimedia Malaysia and the Minister Senator Datuk Seri Dr. Salleh Said Keruak for his continuing support of PIKOM and its activities.

Chin Chee Seong

EXECUTIVE SUMMARY

Woon Tai Hai
PIKOM Research Committee Chairman

The world today is increasingly seeing a convergence of the physical and digital environments to the extent that many physical products, services, devices and business models are disrupted and even becoming obsolete. It is this convergence that has opened the door to the Fourth Industrial Revolution (4IR), which is expected to transform just about every industry and bring together the physical, digital and biological realms.

Autonomous cars are perhaps the most visual example of this phenomenon. In this case, technologies such as sensors, data analytics and artificial intelligence work in concert to facilitate robotics.

The starting point has to be the internet of things (IoT), which is essentially a connected network of physical objects embedded with electronics, sensors and the software to collect and share data. Experts have projected that billions of physical objects will be connected to the internet in the next decade; consuming, generating and communicating data.

Given such a scenario, there is no doubt that those companies that reinvent themselves into digital companies will be the ones ahead of the game for the foreseeable future. Yet, while most businesses today realise they have to fuse the digital with the physical, most are unsure how this transformation can take place. Some are wary of the disruption despite understanding that they would be in a position to capitalise on a whole new set of opportunities. Meanwhile, others are keen to jump on this digital bandwagon, being dazzled by these exciting new innovations, ideas and concepts.

Nevertheless, change is inevitable and sooner or later, every business must follow this path. The traditional business strategy centred on the physical must now also encompass the digital component into the overall framework and business model. A key element in this digital strategy must be the inculcation of a customer-centric culture. It must be based on creating the best customer experience on these digital platforms and devices. As such, a digitally-savvy team is just as important when it comes to developing a strong and committed mindset in the new converged environment. There are obviously many business areas that will require transformation as we move towards a fused physical-digital business environment; from research & development to investment and marketing.

There are many publications and articles out there that expound on this further, with the main takeaway being that a converged physical-digital strategy can provide your business or organisation with the competitive edge it needs to survive and sustain itself in a future business landscape.

In line with the importance of such a convergence, PIKOM has adopted the theme 'Convergence of the Physical and Digital Worlds' in its ICT Strategic Review 2017/18. The 9th edition of this publication series covers a broad range of timely and interesting articles, ranging from 4IR and Industry 4.0 to Artificial Intelligence, Fintech, Blockchain and also the future of human resources. Here is a summary of the chapters to come.

Malaysian Economic and ICT Outlook for 2018

Malaysia is on the road to economic recovery, posting improved GDP figures in the first three quarters this year on the back of domestic demand

and robust exports. The economic outlook for 2017 and also 2018 is looking bright. Forecasts for GDP growth are frequently revised by financial analysts and international organisations in view of the better-than-expected results. The rakyat-centric Budget 2018 has fuelled talk that the general elections is around the corner. This will be an interesting development to watch and witness even as the country charges ahead to reach developed status within three years. The digital economy is expected to be one of the main contributors to our economy now that the Digital Free Trade Zone has come into effect and brought nearly 2,000 SMEs on board to perform cross border trade. Malaysia's digital economy is making progress and is expected to reach 20% contribution to the national economy much earlier than initially forecasted.

Fourth Industrial Revolution: A MIMOS Perspective

This article discusses the challenges Malaysia needs to address to embrace the digitalisation of industry sectors for greater growth (4IR). Written by MIMOS, the national ICT R&D institute, it also elaborates on the institute's readiness to support the country as it exploits the 4IR for the national good. Learn how the evolving stages leading to 4IR are coming into effect.

Industry 4.0: Where The Digital Drives the Physical

Not to be confused with the 4IR, Industry 4.0 is the data-driven autonomous decision-making and automation of manufacturing or industrial processes, creating what is known as 'smart manufacturing' or 'smart industry'. This article, contributed by PIKOM, looks at preliminary efforts by the Government to develop a digital enabling ecosystem that can drive the manufacturing sector towards Industry 4.0.

The Machine Intelligence that Everyone is Working Towards

Cars that drive on their own. Phones that talk back to you. Artificial Intelligence has marvelled the world and we can't seem to get enough of it. But the wonder technology is still a work in progress. There is challenge to getting the algorithms right to avoid problems like generating wrong search results. This article by Fusionex explores why there is a need to build an AI algorithm that can truly learn on its own and become smarter over time without human intervention.

ASOCIO Research Report: Reimagining the Digital Era

The Asian-Oceanian Computing Industry Organization (ASOCIO) unveiled its inaugural research report which explores the digital readiness and economic activity in 12 economies in the region. This is an executive summary of the report, which was unveiled at the World Congress on IT (WCIT) and ASOCIO Summit concurrent events in Taipei, Taiwan in September.

Sharing Economy: A Look at its Potential to Shape Businesses and Create Opportunities

The world is increasingly moving towards a Sharing Economy, where assets and resources are shared between individuals, businesses and governments via digital platforms. This article by PIKOM looks at its rapid emergence and some of the technologies involved in creating such sharing platforms. It also discusses the potential of Sharing Economy tools to shape businesses and create new opportunities.

Fast Forward: Rethinking Enterprises, Ecosystems and Economies with Blockchains

IBM presents its views on how to make Blockchains work for organisations to leverage their power to overcome friction and improve efficiency, trust and value. Businesses must carefully evaluate where Blockchains can provide the greatest gains and where they do not.

Blockchain: Early Signs of Viable Outcomes

This article by ThynkBlynk, the creator of www.CHAINtrail.com, breaks down Blockchain and the technologies that shape it in the hope of giving the readers a fundamental understanding of what it is and what it can do.

Fintech: A Perspective

Global investment in Fintech is in the billions of the dollars with the US leading the way. But what are the

challenges to deploy Fintech? This article explores a number of Fintech-related topics such as the common Fintech disruptions, the major challenges and also what the local landscape for Fintech looks like on the home front.

Behavioural Economics and the Risk of Technology Adoption in the Digital Age

How do we make decisions on whether we should adopt new technologies in light of cybersecurity threats disrupting and destroying data and information? Behavioural economics challenge the notion that human behaviour and decision making are generally rational. This article written by Jim Sailor, an independent strategic consultant, explores further on how behavioural economics is shaping our decision-making processes.

The Future and Challenges of Human Resources

There are a number of hurdles to overcome in the human resources space as the country prepares for developed nation status. A lack of skilled professionals, the drop in women in the workforce, and the mismatch of talents have been long-standing issues for nearly two decades. TalentCorp discusses how their programmes are helping industries and professionals address these challenges.

For the first time also, we have a special edition on cybersecurity brought to you by the PIKOM Cybersecurity Chapter on menacing threats that are crippling organisations and sectors worldwide. The articles are contributed by Cisco, Symantec, FireEye, LGMS and Trend Micro.

"We need an edge over cyber threats, and Advisors who really understand our business."

BDO Advisory Services

In the fast changing environment of security threats, organisations need to prove to stakeholders that they pay more than lip-service to cybersecurity. To do this they need to demonstrate two things: Firstly to 'raise their gaze' and establish better understanding of cybersecurity threats, coupled with greater self-awareness of their own failings and weaknesses. The second is to 'raise their game' - by developing a higher state of readiness and effective defence systems to deal with cybersecurity incidents.

Our approach incorporates several models for supporting organisations in developing and improving their defence systems. From establishing compliance and building towards a proactive approach, and through the ongoing development of capabilities, with effective security risk management; we work with our clients to quickly attain higher levels of resilience.

To know more about our IT Advisory Service, please contact the Head of CyberSecurity and Forensics at sanjay@bdo.my or dial +603 2616 2855.

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** To read more on BDO's Cybersecurity White Paper, go to https://www.bdo.global/en-gb/insights/advisory.*

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Malaysian Economic and ICT Outlook for 2018

PIKOM

Malaysia's economy kicked off to an encouraging start in 2017, showing gradual improvements quarter by quarter. The GDP growth year-on-year was 5.6% in the first quarter, 5.8% in the second and 6.2% in the third quarter, boosted by private sector spending and robust export growth (Table 1).

Overall Economic Highlights

Domestic demand grew by 6.7% in the first half of the year driven by private sector expenditure and robust export growth. From the supply side, all major sectors showed improvement.

Private consumption growth rose by 6.9% in the first half as a result of better private sector wages due to the increase in employment numbers. This improved consumer sentiment has led to higher household spending. Private investment rose by 10% in the first half mainly in the services and manufacturing sectors.

Exports rose by 9.7% in the first half of 2017 while imports grew 11.8%. In the second quarter, shipments of electric and electronic products accounted for about one third of the gross exports. Bank Negara is confident that Malaysia's growth prospects will be sustained by the more positive global growth outlook and stronger spillover from the external sector to the domestic economy.

The improved growth in advanced and regional economies also contributed to the growth in the economy during the first half. Growth in the US was supported by increase in investments while the recovery in exports in Asia supported GDP growth. Global trade is expected to grow to 4% in 2017, the fastest expansion since 2011.

The economy has been improving since the 3rd quarter of 2016 (Chart 1). The GDP performance from the third quarter of 2016 to the 2nd quarter of 2017 presents a better outlook than from 2014 to the second quarter of 2016. (Chart 1 and Chart 2)

Real GDP Annual Change (%)	Share % (2016)	2016	2017		
			Q1	Q2	1st Half
Domestic Demand (excluding stocks)	**91.6**	**6.1**	**7.7**	**5.7**	**6.7**
Private Sector	**70.1**	**6**	**8.2**	**7.2**	**7.7**
Consumption	53.2	6.2	6.6	7.1	6.9
Investment	16.9	5.6	12.9	7.4	10
Public Sector	**21.5**	**6.3**	**5.8**	**0.2**	**2.9**
Consumption	13.1	5.5	7.5	3.3	5.3
Investment	8.5	7.7	3.2	-5	-0.9
Net exports of goods and services	**8.4**	**-1.2**	**-14.5**	**1.4**	**-6.7**
Exports	70.4	2	9.8	9.6	9.7
Imports	62.1	2.4	12.9	10.7	11.8
Change in stocks (RM billion)	**0**	**-1.5**	**1.8**	**-0.4**	**1.5**
GDP (y-o-y)	**100**	**4.0**	**5.6**	**5.8**	**5.7**
GDP (q-o-q growth seasonally adjusted)		**1.1**	**1.8**	**1.3**	

Table 1: Malaysia's GDP and other economic indicators
Source: Bank Negara

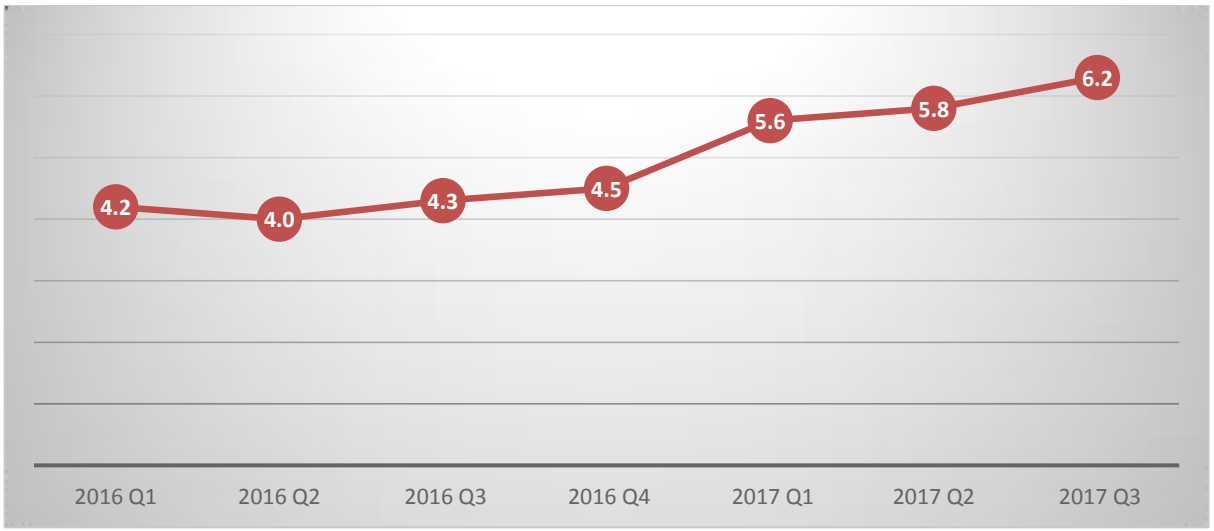


Chart 1: Malaysia GDP Growth Rate (2016-2017: Q2)
Source: Bank Negara and Department of Statistics Malaysia

Recently, the World Bank revised its forecast of Malaysia's GDP growth in 2017 from 4.9% to 5.2%. Likewise, the government has also revised its 2017 full-year growth projection to a range of 5.2% to 5.7%, up from a range of 4.3% to 4.8%. With the better than expected results in the third quarter, there is strong indication that the GDP for 2017 will be on the upper end of the forecast.

With the confidence of a continuing strong performance in the third quarter, PIKOM expects the 2017 GDP growth rate will exceed its 5.0% forecast made in June this year to a high of 5.3%. This is based on the continued improvement in private sector spending, the positive growth of the global economy, the performance of the supply side especially the services sector and also on the fast growth by the digital economy, especially in the eCommerce sub-sector.

Although PIKOM is bullish on the outlook of the overall economy for 2017, the Association is equally concerned over the inflation rate which is linked to the fuel price rising since October 2017. The impending general elections, which must be held by August next year, could also deter some of the foreign

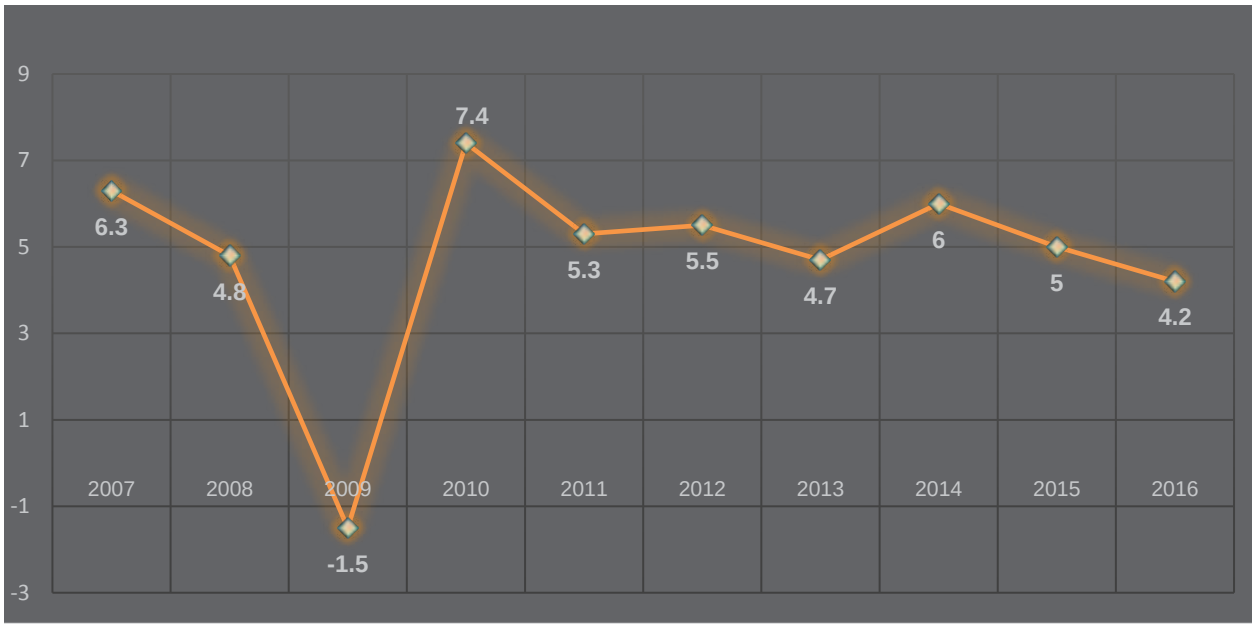


CHART 2: GDP Growth Rate (%) (2007 to 2016)
Source: Bank Negara and Department of Statistics Malaysia

direct investments as investors may stay on the sidelines while waiting for the political climate to settle. With these factors in mind, PIKOM is projecting a lower growth range of 4.8% to 5.0% in 2018 as compared to the revised forecast of 5.3% for 2017.

Barring any global upheaval or unforeseen circumstances, PIKOM is also projecting a lower growth range of 4.5% to 4.8% for 2019, largely due to an anticipated rise in costs which would impact on domestic consumption, lower than expected capital expenditure growth and the declining performance and continuing soft landing of the Chinese economy.

The impact from the economic performances of major trading partners in particular the US and China will certainly have a domino effect on the Malaysian economy over the next two years. Other long-term unfavourable factors include the decline in commodity and oil prices, which are not expected to rise from the current levels.

Foreign Direct Investment

Malaysia recorded higher foreign direct investment (FDI) of RM47.2 billion in 2016 compared with RM39.4 billion in 2015 on the back of higher net inflow in equity & investment fund shares, particularly from the Asia region. By end of 2016, the FDI into the country stood at RM546.6 billion.

More than half of the investments were channelled to the services sector (50.9%), mainly in the utilities sub-sector and financial & insurance/ takaful activities. The rest went to the manufacturing (25.8% and mining & quarrying (17.5%) sectors.

For the second quarter between April and June, FDI totalled RM8.3 billion, down from RM17 billion in the first quarter.

Mining, real estate, manufacturing, finance and ICT drew most of the flow and investors with China, US, Japan, Germany and the UK leading the pack.

Production Sectors

All production sectors also showed positive growth (Chart 3) in the first half of 2017 with construction growing the fastest at 7.4%, agriculture at 7.1%, Services at 6.1%, manufacturing at 5.8% and Mining and Quarrying at 0.9%.

Services Sector

As Malaysia moves to become a developed country in 2020, the government is placing much emphasis on this sector to grow by 6.8% per year and contribute 56.5% to the economy and provide 9.3 million jobs in 2020. In 2016, the services sector recorded 5.6% growth and contributed 54.6% to the economy. About 8.8 million

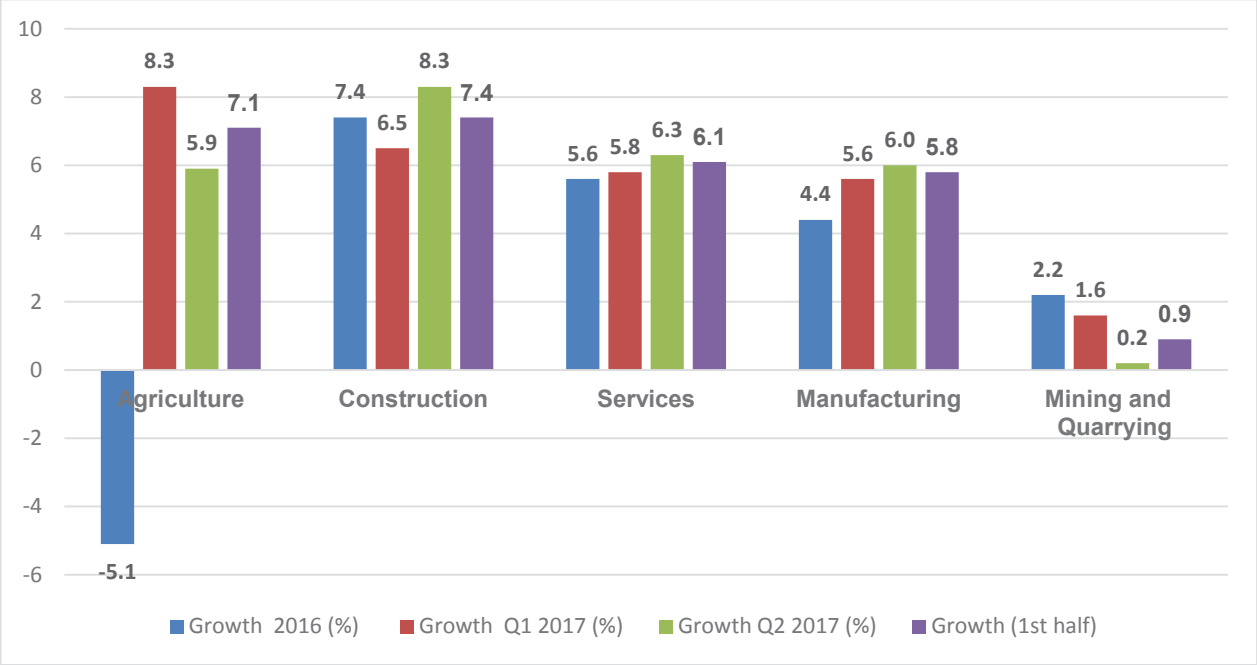


CHART 3: Performance of Economic Sector in 2016 and 2017 by Quarter
Source: Bank Negara and Department of Statistics Malaysia

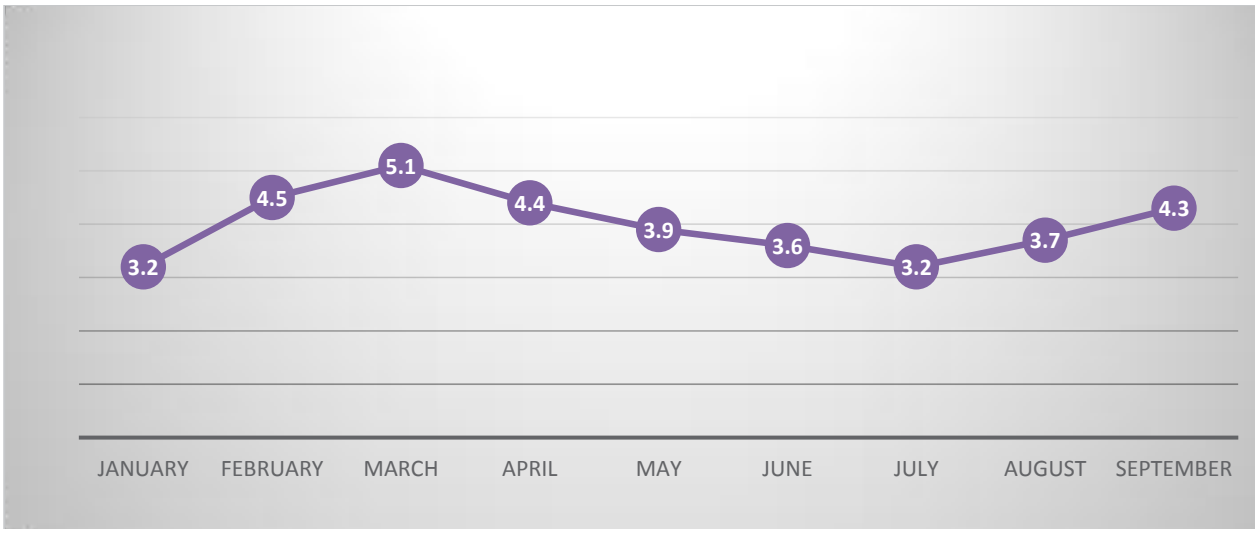


Chart 4: Inflation Rate from January 2017 to September 2017
Source: Bank Negara and Department of Statistics Malaysia

people were employed in this sector, making up about 62% of the total labour force. The sector is expected to grow by 5.9% and contribute 54.5% in 2017 and employ 8.9 million people.

The Government has drawn up the framework for the New Economic Model to move Malaysia from a middle-income to a high-income economy based on innovation, creativity and high value sources of growth. The main growth drivers are wholesale and retail trade, financial services and communications sub-sectors, supported by strong household spending and stable labour market conditions. There will also be a more emphasis on modern and knowledge-intensive industries, including halal, eco-tourism and information, communications and technology (ICT).

Inflation Rate

According to Bank Negara, the second quarter inflation rate moderated to 4.0% from a higher 4.3% in the first quarter due to lower fuel prices. Month by month, the inflation rate has dropped from a high 5.1% in March

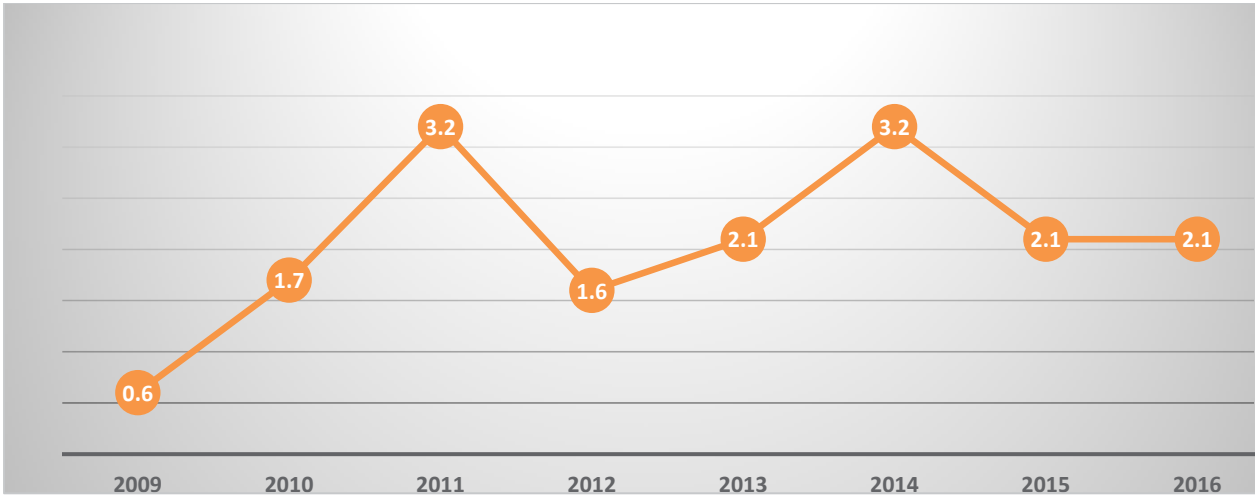


CHART 5: Inflation Rate in Malaysia (2009-2016)
Source: Bank Negara and Department of Statistics Malaysia

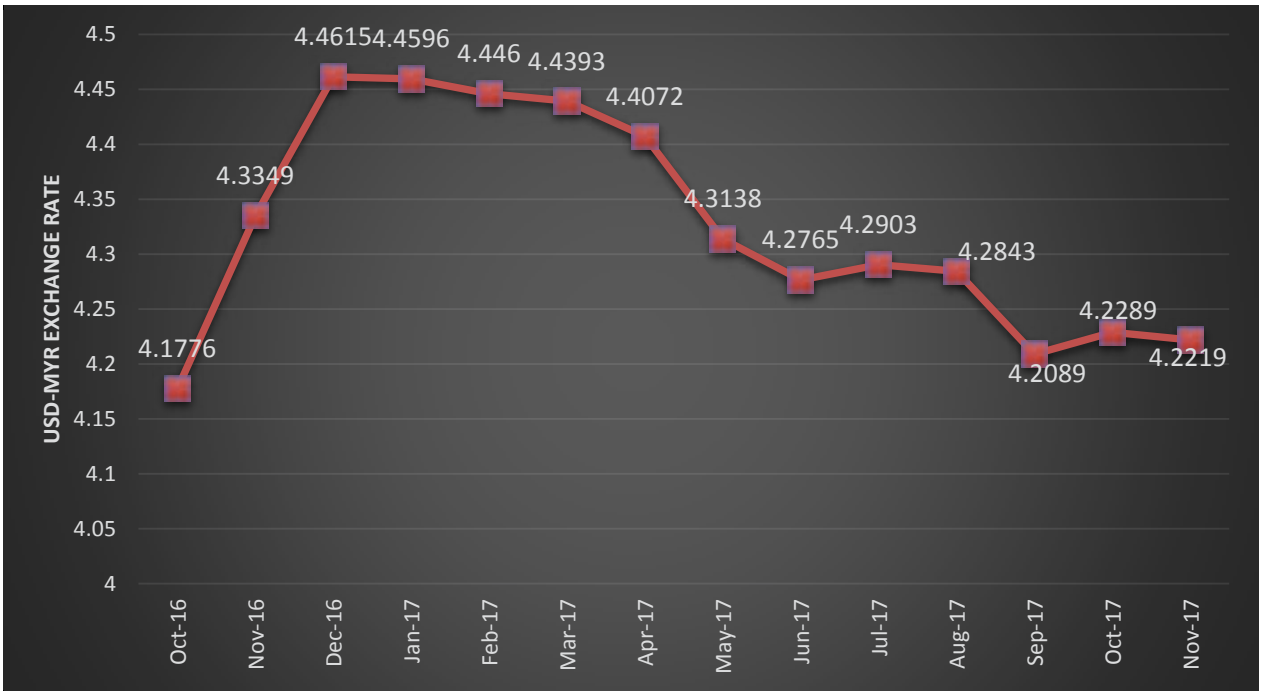


CHART 6: Exchange Rate (USD-MYR) from October 2016 to November 2017
Source: Bank Negara and Department of Statistics Malaysia

2017 to 3.2% in July before climbing further to 3.7% in August and 4.3% in September (Chart 4). The inflation rate in 2017 is expected to be higher than the 2.1% in 2015 and 2016 (Chart 5), due to rising transportation cost as a result of the increase in fuel prices. For example, in a short period from October 12 to November 22 this year, RON95 price and RON97 price per litre rose by 10.2% and 8.1% respectively.

Exchange Rate

The Ringgit continued to strengthen against the greenback month by month in 2017. According to Bank Negara, the Ringgit was the best performing currency in Asia in September, as it appreciated against all regional currencies by 0.3 to 3.1%.

It was also the best performing currency in Asia excluding Japan in the second quarter according to Standard Chartered Global Research.

On November 15 2017, the Ringgit was at its strongest level at 4.18 against the dollar compared with 4.4995 at the start of the year. Analysts predict the Ringgit can hit as low as 4.0 to the USD next year. The currency has been performing well due to the recovery in global oil prices and stronger export growth.

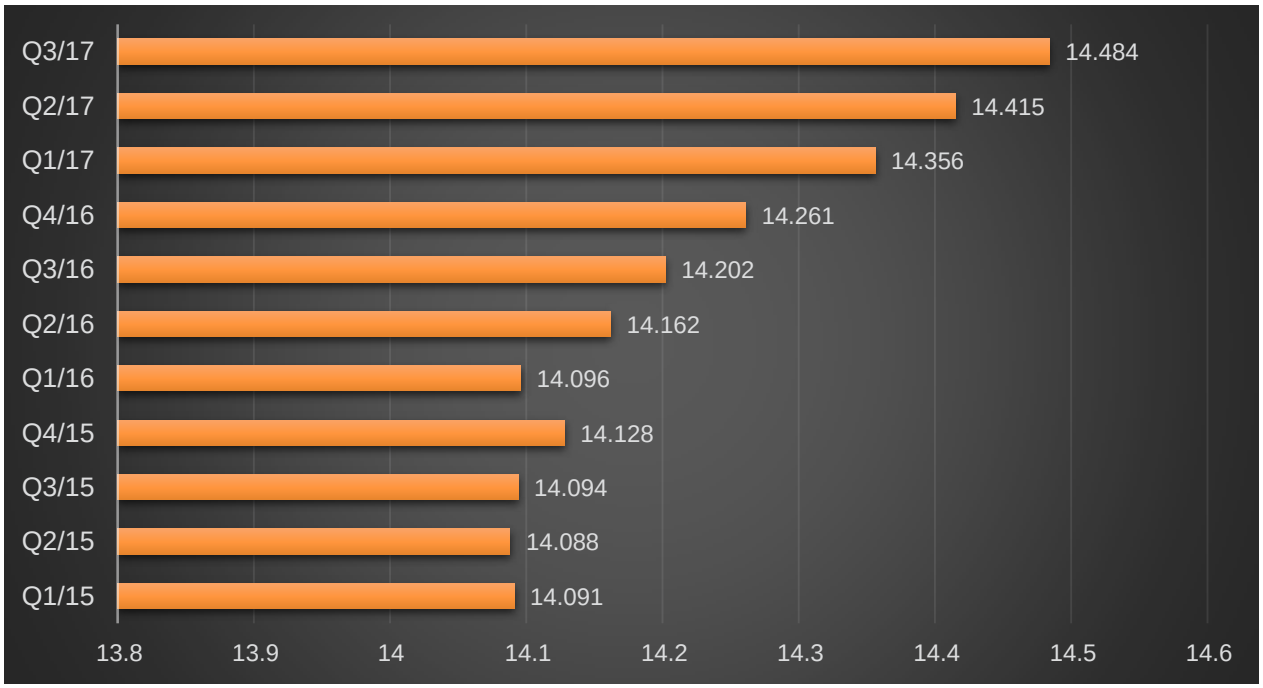


CHART 7: Employment Q1 2015 too Q3 2017 (in million)
Source: Bank Negara and Department of Statistics Malaysia

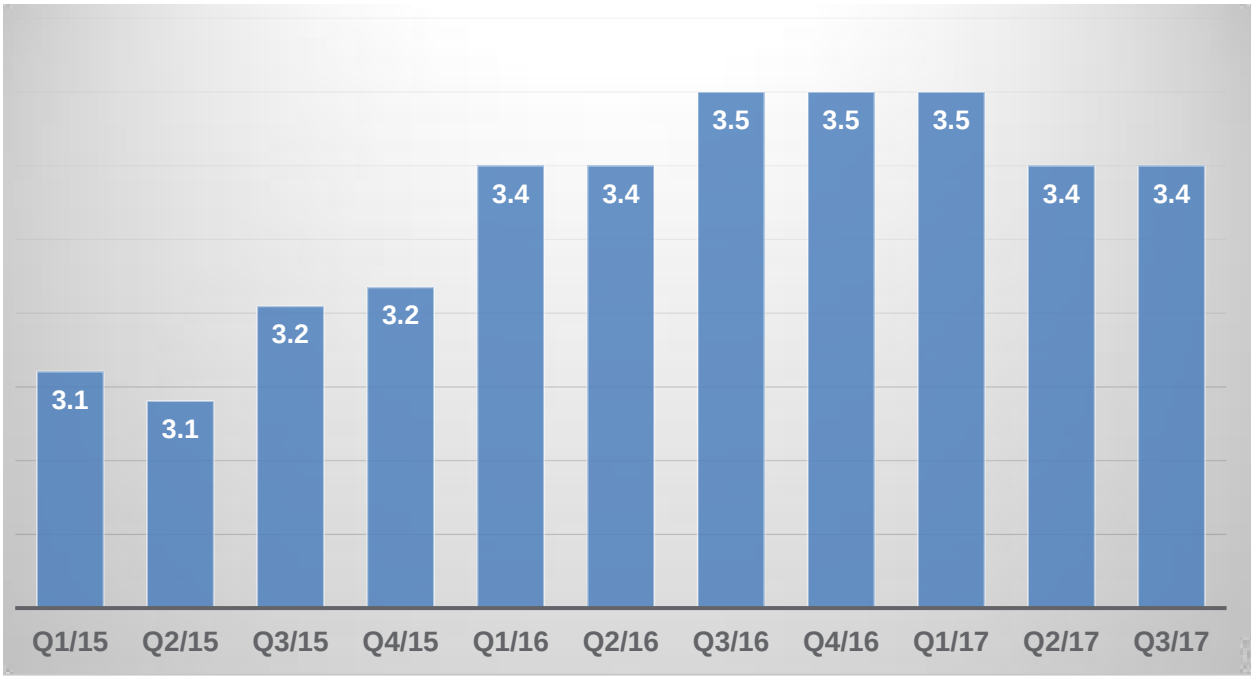


CHART 8: Unemployment rate(%) (Q12015 to Q32017)
Source: Bank Negara and Department of Statistics Malaysia

Employment Rate

Private sector consumption grew by 6.9% in the 2nd quarter of 2017 due to the rise in private sector wages mainly in the manufacturing sector (11.2% versus 3.2% in Q1 2017) and services sub-sector (5.4% versus 5.1% in (Q1 2017)). About 59,000 new workers were added in the second quarter of 2017, resulting in the drop in the unemployment rate from 3.5% to 3.4% of the labour force.

According to the Finance Ministry's Economic Report 2017/2018, the services sector has remained the top employer, grabbing more than 60% share of the employment market in 2016. This is followed by the manufacturing sector (16.9%, agriculture, forestry and fishing (11.4%) and construction (8.8%). This trend is expected to be similar in 2017. The unemployment rate began to cross the 3% mark beginning 2015. It reached a

high 3.5% between the third quarter 2016 and first quarter of 2017.

Budget 2018

There is renewed optimism that the year will end with a strong economic performance. However, growth is expected to moderate in 2018 in view of the uncertainties on the domestic and global fronts.

The better-than-expected GDP growth in the first half of this year and the recent unveiling of the Rakyat-centric Budget 2018 has also fuelled talk that GE14 is fast approaching.

We have to be mindful of a number of factors, such as the rising price of crude oil which could push up the inflation rate.

Here are the key highlights of Budget 2018

- Target Revenue: 239.8b
- Allocation: 280.2b
- Operating Expenditure: 234.2b
- Development Expenditure: 46.0b
- Reduction of income tax rates by 2% for RM20k-70k income group
- A 12-month tax exemption for women re-entering the workforce after a two-year break
- 50% rental tax exemption for rent RM2k and below
- Employer tax deduction for hiring PWDs (Persons With Disabilities)
- No GST for local authorities' services, magazines and comics, management and maintenance of stratified residential buildings. Building of schools and places of worships from donations will enjoy full GST relief
- The government has set up a Malaysian Children Trust Fund (ADAM50) with RM200 for each child born between 2018 and 2022
- Schooling Assistance of RM100 per child
- Civil Servants can each enjoy RM1,500 bonus; Retired Civil Servants: RM750
- Setting up of Science, Technology, Engineering, and Mathematics (STEM) Centre
- Introduction of computer science and programming modules for primary and secondary school students
- Upgrading of 2,000 classrooms to 21st Century Smart Classrooms
- RM250 book voucher assistance
- RM2.2b scholarships offered
- MyBrain: Post-graduate studies
- 14 new sports complexes
- PTPTN discount continued (20% full settlement; 10% for 50%; 10% regular deduction)
- Loan repayment begins 12 months after (previously 6 months)
- Combining of multiple higher study loans with repayment after completion of higher studies

ICT Industry Outlook 2017/2018

The ICT industry continued to boom in 2016, posting RM164.9 billion in ICT-GDP, an increase of 8.5% over RM152.1 billion in 2015. ICT Services contributed the biggest share at 40%, at RM66 billion, followed by ICT manufacturing at 36.1%. (See Table 2, Chart 9 and Chart 10)

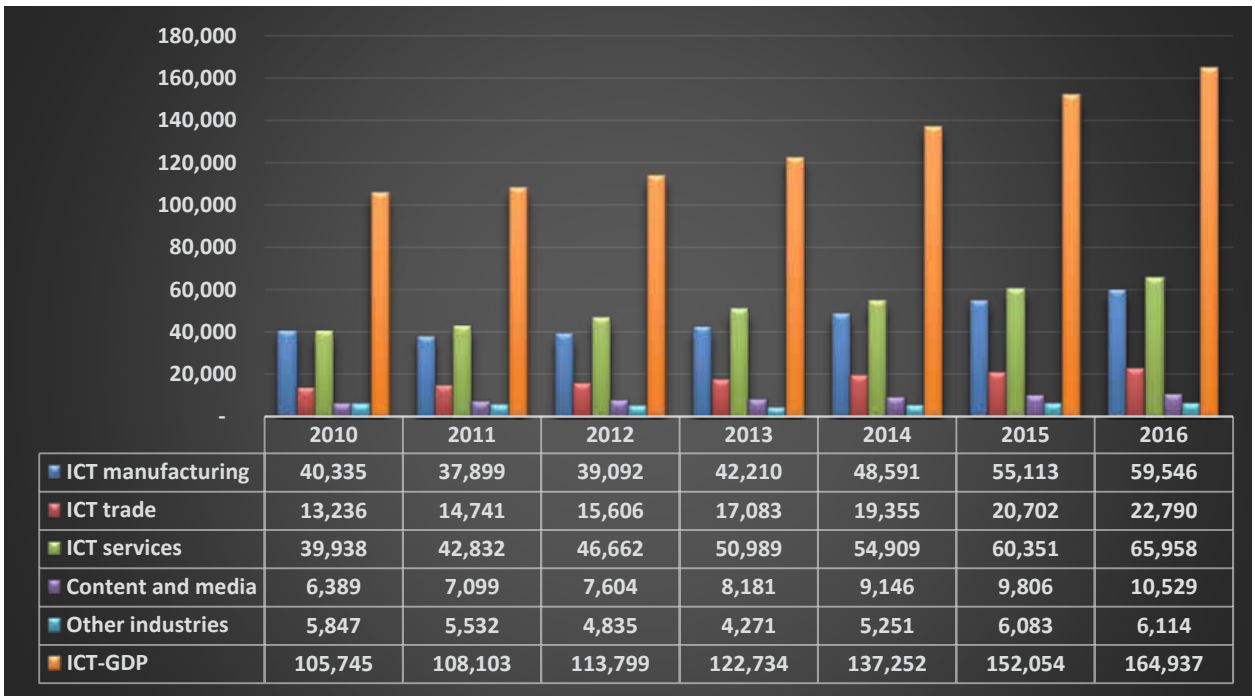
The biggest contributing component of ICT Services was Telecommunications which grew by 10% to RM47.1 billion. Electronic components & boards, communication equipment and consumer electronics contributed the most to the ICT manufacturing sector at 8.4% to RM54.8 billion.

However, of the four ICT-producing industries, ICT trade posted the highest year-on-year growth in 2016 at 10.1%. This was followed by ICT Services at 9.3%, ICT manufacturing at 8% and Content & Media at 7.4%.

The eCommerce industry, comprising ICT and non-ICT producing sectors, also performed well, growing by 9.3% over 2015 to RM74.6 billion. The eCommerce non-ICT industry was the bigger contributor, registering RM59 billion, a growth of 9.4% from 2015 (Table 2, Chart 11 and Chart 12).

In 2016, the ICT industry's contribution (ICT-GDP and eCommerce of non-ICT industry) to the national economy was RM224 billion, a 18.2% share.

PIKOM projects the ICT-GDP in 2017 to grow by 7.7% to RM177.7 billion, based on the Average Annual Growth of the ICT-GDP from 2010 to 2016 of 7.74%. The eCommerce industry is also expected to grow significantly by 12.1% to RM83.6 billion, with the eCommerce of non-ICT industry as the bigger contributor with a projected growth of 12.3% to RM66.3 billion (Table 2).



	2010	2011	2012	2013	2014	2015	2016
ICT manufacturing	40,335	37,899	39,092	42,210	48,591	55,113	59,546
ICT trade	13,236	14,741	15,606	17,083	19,355	20,702	22,790
ICT services	39,938	42,832	46,662	50,989	54,909	60,351	65,958
Content and media	6,389	7,099	7,604	8,181	9,146	9,806	10,529
Other industries	5,847	5,532	4,835	4,271	5,251	6,083	6,114
ICT-GDP	105,745	108,103	113,799	122,734	137,252	152,054	164,937

CHART 9: Breakdown of the ICT-GDP by industries (2010-2016)

Year	Contribution of ICT to the Economy (RM billon)	Share of ICT to the Economy (%)	ICT-GDP (billion)	Share of ICT to GDP (%)	eCommerce of non-ICT industry	Share of eCommerce of non-ICT ICT industry to the Economy	GDP at Current Prices (RM billion)	Share of eCommerce to GDP	eCommerce (RM billion)
2010	135.3	16.5	105,745	12.9	29,576	3.6%	821	4.6	37,729
2011	144.5	15.9	108,103	11.9	36,407	4.0%	911	4.9	44,605
2012	154.6	15.9	113,799	11.7	40,787	4.2%	971	5.1	49,760
2013	167.4	16.4	122,734	12.0	44,641	4.4%	1018	5.4	55,261
2014	188	17	137,252	12.4	50,723	4.6%	1106	5.8	63,636
2015	206.1	17.8	152,054	13.1	53,999	4.7%	1157	5.9	68,280
2016	224	18.2	164,937	13.4	59,049	4.8%	1230	6.1	74,603

Table 2: Snapshot of the ICT Industry (2010-2016)

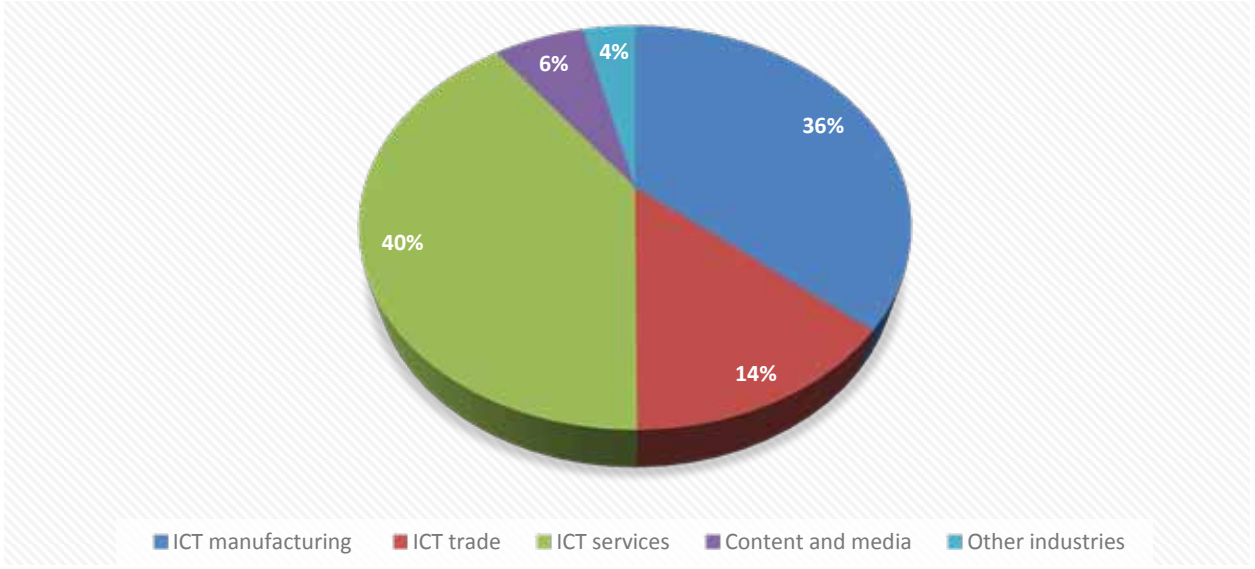


CHART 10: Share by ICT-Producing Industries in 2016

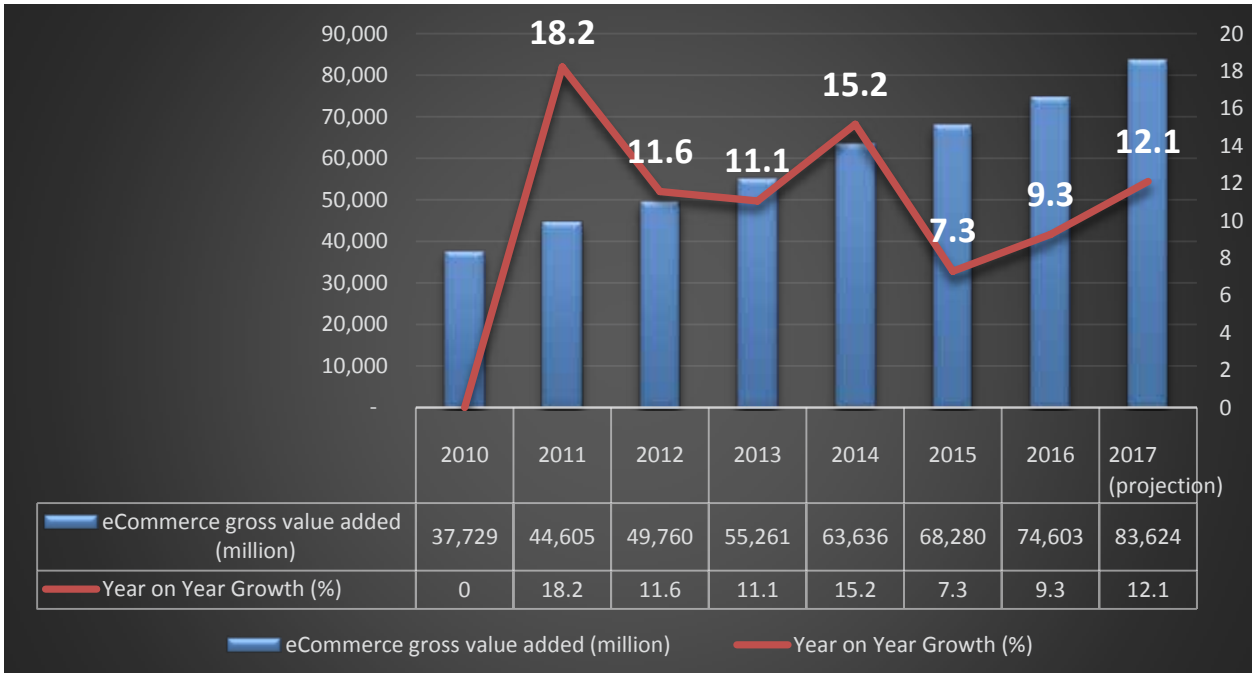


CHART 11: eCommerce Gross Value Added

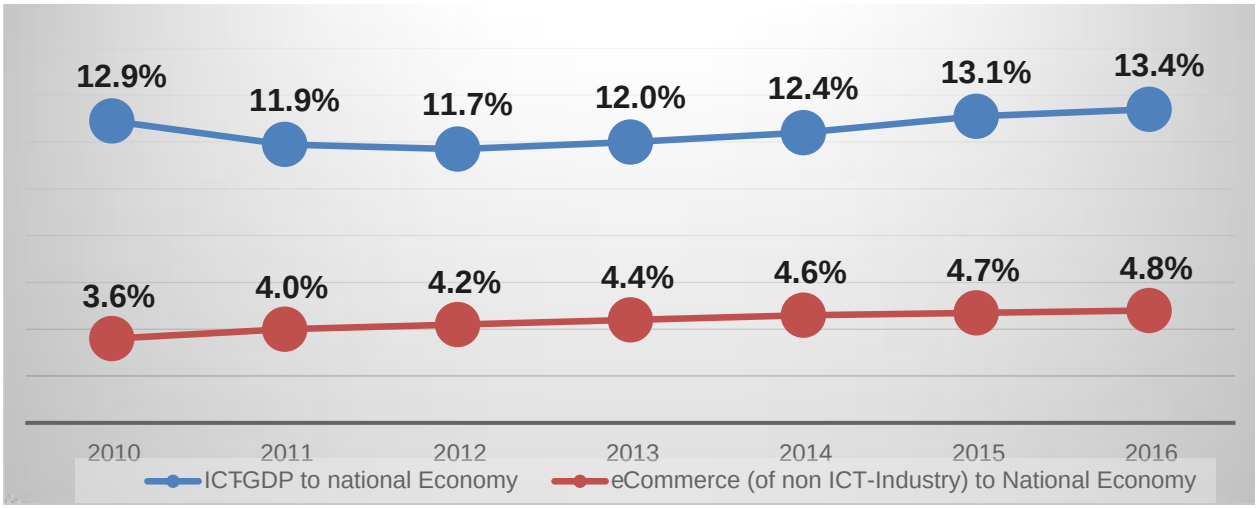


CHART 12: eCommerce non-ICT industry and ICT-GDP growth rates

With the performance of the ICT industry in 2016, PIKOM is hopeful that the targeted 20% contribution of the industry to the economy by 2020 will be achieved in 2017, which would be much sooner than expected.

This is based on the 20.1% average annual growth rate from 2010-2016. The growth rate is expected to yield RM244 billion for the ICT industry's contribution to the economy in 2017.

Employment in the ICT industry also grew by 0.7% with 1.07 million employees, a 7.6% of the total employment. (Chart 13)

The ICT manufacturing sector was the biggest employer at 407,000 followed by ICT services sector at 290,000, ICT trade sector at 220,000 and content and media sector at 155,000 (Chart 14).

Key Developments in the Industry

Digital Free Trade Zone

One of the biggest stories this year was Malaysia's first Digital Free Trade Zone (DFTZ) launched on 3 November this year, with more than 1,900 export-ready SMEs on board the state-of-the-art eCommerce hub.

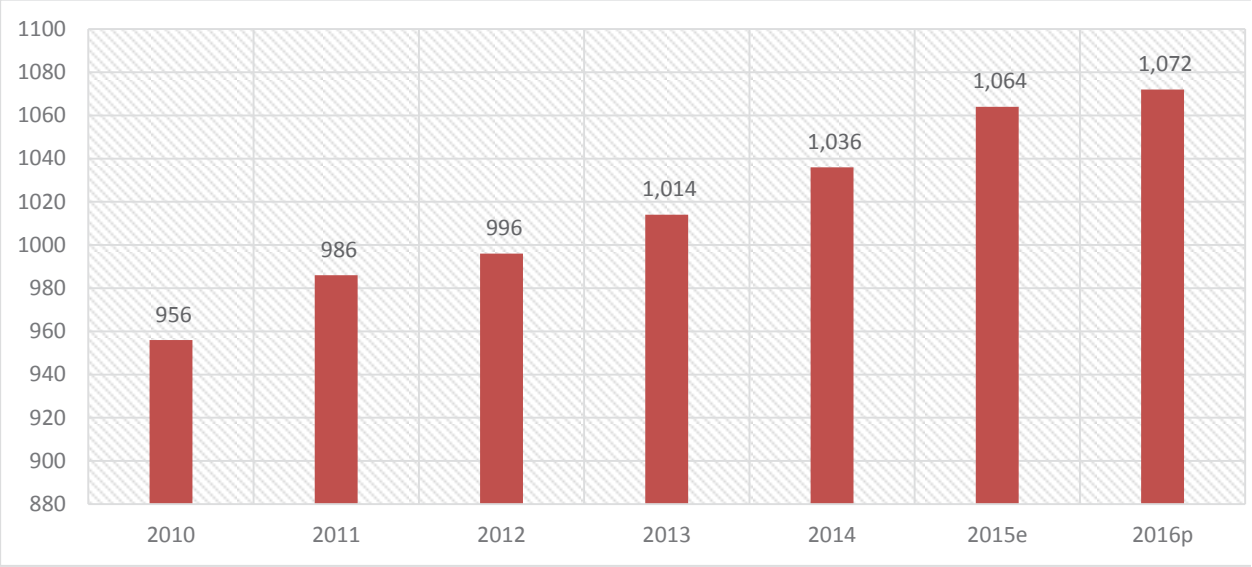
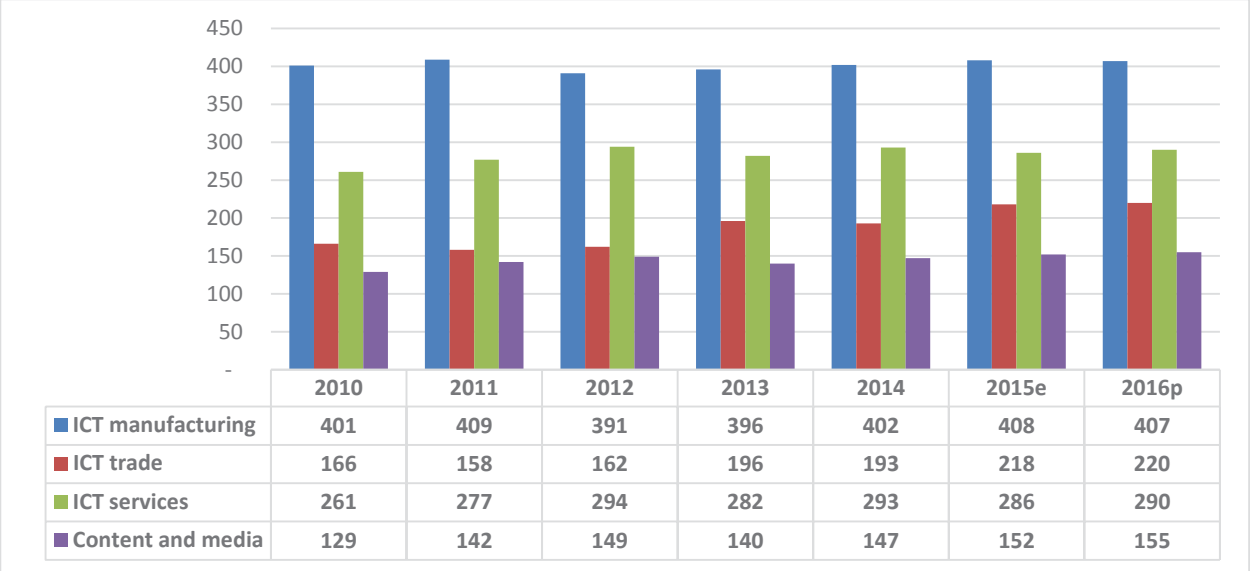


CHART 13: Employment in the ICT industry



	2010	2011	2012	2013	2014	2015e	2016p
ICT manufacturing	401	409	391	396	402	408	407
ICT trade	166	158	162	196	193	218	220
ICT services	261	277	294	282	293	286	290
Content and media	129	142	149	140	147	152	155

CHART 14: Breakdown of Emploment in the ICT industry

DFTZ was introduced in Malaysia to make a significant impact on the Digital Economy, particularly to empower the SMEs to embrace eCommerce and perform cross border trade.

Through this channel, SMEs will be able to export their products overseas and overseas marketplaces will be able to gain access to Malaysian manufacturers and sellers.

Malaysia will act as a regional fulfilment hub to enable global brands to access ASEAN buyers.

There are about 646,000 SMES in Malaysia and although there is a growing interest among them to start online businesses, the adoption rate is still low. According to SME Corp Malaysia, the eCommerce rate among them is about 35% but it expected to reach 50% in 2020.

DFTZ aims to break down barriers and overcome regulations that have been holding back SMEs from launching online businesses.

DFTZ has been targeted to increase the SME goods export to US$38 billion (approx.. RM160 billion),

create more than 60,000 jobs and support US$65 billion (approx.. RM273 billion) worth of goods moving through DFTZ by 2025.
The government is placing importance on this initiative as it believes strongly that SMEs can power the economy and move Malaysia to become a high-income nation.

In 2016, the SME-GDP growth was 5.2%, higher than the national GDP growth of 4.2%. The SME sector's contribution to the national economy also rose 36.3% from 2015 to 36.6% last year.

PIKOM believes the DFTZ will benefit their members as more than half of them are SMEs. DFTZ will also complement PIKOM's own eCommerce chapter launched this year, whose objectives include promoting Malaysian eCommerce players through regional and global initiatives.

eCommerce Malaysia: #MCyberSale 2017

ECommerce, is expected to be a key driver in the digital economy and Malaysians are already embracing the online shopping culture with much enthusiasm. This is shown especially in the growing Gross Merchandise Value (GMV) of #MYCYBERSALE online sale event recorded from year to year since 2014 when it was first organised by MDEC.

After three years of running #MYCYBERSALE, MDEC has handed over the reins to PIKOM to make it a self-sustainable and private-sector led initiative.

The project was undertaken by PIKOM's eCommerce Malaysia Chapter launched in January this year. It was a great start for PIKOM as over 40% of #MYCYBERSALE was funded by the private sector. The five-day online sale event in October attracted over 1,000 merchants and achieved a GMV of RM311 million, exceeding the target of RM300 million and representing more than 45% increase from the GMV of RM211 million in 2016.

Its export revenue of RM39 million was a whopping 254% increase from 2016. The performance of #MYCYBERSALE is an encouraging growth story for eCommerce in Malaysia and we can expect the momentum to continue with the mobile-savvy young Malaysians leading the way in clicking and tapping deals in the years to come.

Budget 2018

Budget 2018 was announced by Prime Minister Dato' Sri Mohd Najib Razak in Parliament in October 2017. There were a slew of incentives for the ICT Industry aimed at catalysing the ICT adoption in rural areas, industrial revolution 4.0, SME industries and much more. There were also measures to provide internet access to the rural and marginalised areas, incentives for ICT in education, and extension of the adoption of ICT in the public sector.

PIKOM welcomes these initiatives and hopes the industry will leverage on them further to achieve the intended results. Here is a list of perks the industry can look forward to:

- RM200 million allocation to Malaysian Investment Development Authority (MIDA) for high impact projects;
- RM2 billion fund for Industrial Revolution (IR) 4.0 with 70% govt guarantee;
- RM200 million for training for SME Corp;
- RM150 million for exports including the Market Development Grant (MDG);
- Startup funds for VCs including RM1 billion fund.

PIKOM is also pleased to note that the government has placed more emphasis on human capital development in 2018 especially on coding in schools; STEM education, with RM250 million for teachers' training and RM190 mil to upgrade 2,000 classes into 21st century smart classrooms in order to enhance creative-based learning and innovative thinking.

The association gave the thumbs up to the Capital Allowances for ICT equipment, which will include spending on software development, claimable for a period of four years as this will boost the companies' productivity and reduce the cost of operation.

The other incentives that will benefit the ICT Industry are:

- RM1 billion for Sabah and Sarawak for broadband infrastructure;
- ICT projects in PDRM of RM170 mil and RM100 mil for communications systems;
- RM100 million allocation for e-rezeki, e-usahawan and e-ladang;
- Industry 4.0 and Digital Economy – RM245 mil for smart manufacturing;
- Cyberjaya Futurise Centre to be strengthened;
- DFTZ focus on 1500 SMEs and RM83.5 mil funding and de minimis increased to RM800;
- Boost start ups with setting up of regulatory sandboxes.

Looking Ahead

The ICT industry is expected to continue on a healthy progressive growth in 2018, with eCommerce playing a much bigger role in the industry. eCommerce has been steadily growing the past six years and in 2017, the growth is expected to be markedly higher at more than 12%, about 3% more than the projected growth of ICT-GDP of about 7 to 8%. The young, bold and mobile-savvy generation will also be an attributing factor to the future growth of eCommerce.

With the government's added push and incentives in IoT, Big Data, Fintech and IR 4.0, we can expect Malaysia to be a leading player in the region in driving transformation in the country especially in the public and private sectors and society. It is beginning to look as if the convergence of the digital and physical will be more pronounced in the near future.

However, there are concerns and issues that may impede the progress. The slow adoption of eCommerce among SMEs and the manufacturing sector, the low unemployment rate among the youth and fresh graduates and the regular incidences of cyber threats which can disrupt the concerted efforts made by stakeholders to advance the ICT industry. These issues need to be addressed consistently and effectively.

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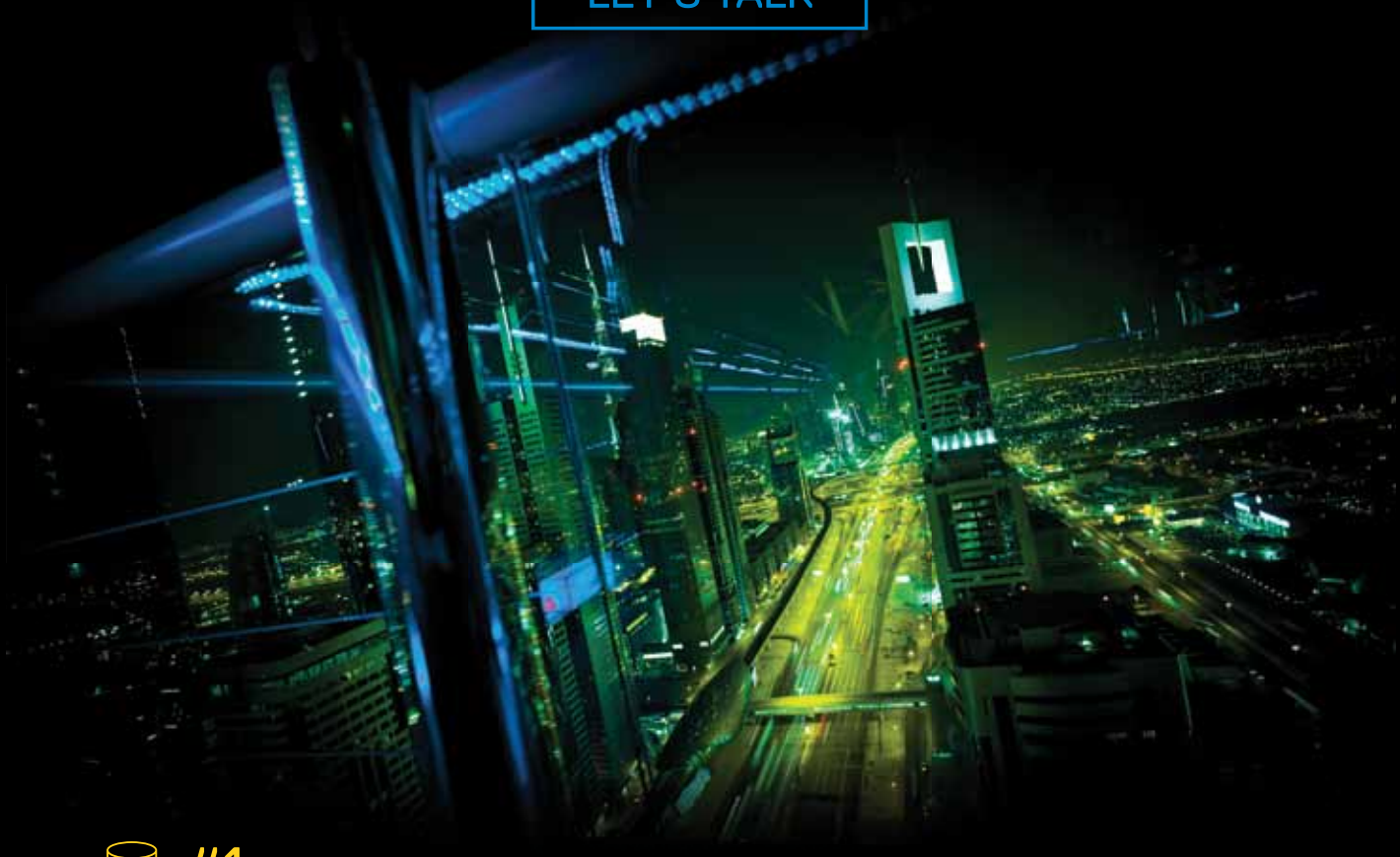

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[1]Source: WW Quarterly Server Tracker, 2016 Q2 Historical Release, September 14 2016.
[2]Source: IDC WW Quarterly Enterprise Storage, March 2016. EMC is #1 in external storage and total storage.
[3]Source: Based on Dell / EMC / VCE aggregate revenue, March 2016.
[4]Source: Based on Dell / EMC aggregate revenue, April 2016.
[5]Source: IDC Tracker. "Worldwide Quarterly Enterprise Storage Systems Tracker." June 2016.

Fourth Industrial Revolution:
A MIMOS PERSPECTIVE

MIMOS Berhad

Abstract

The digital economy began with the advent of Information and Communication Technology (ICT) when computers, networks and the Internet came along. Digital technology or ICT became a cross-cutting enabler for practically all economic/industry sectors. This enabling effect is now mushrooming at a greater intensity and speed due to exponential growth and innovation in ICT. Technologies such as big data analytics, artificial intelligence, internet-of-things, augmented reality, 3-D printing and others are making it possible to digitalise and transform entire industries to become more effective and productive. In addition, they are also disrupting existing businesses and creating new ones. The collective impact worldwide to society and economy is expected to be so great that pundits are claiming that the Fourth Industrial Revolution (4IR) has begun. This paper highlights the challenges Malaysia needs to address in embracing the 4IR and also elaborates on the readiness of MIMOS Berhad, the national ICT R&D institute, to support the country in exploiting the 4IR for the national good.

1.0 4IR – The New Kid on the Block

The latest 'happening' phrase buzzing around academia, industry and government circles seems to be the 4IR. So, what is it?

To understand what the 4IR is, we need to go back in history to comprehend how the industrial landscape evolved over time.

Literature says the invention of the *steam engine* kicked off the first *industrial revolution (1IR)*. Steam power was followed by electricity which drastically changed the manufacturing process with the introduction of *assembly lines* and *mass production*. This came to be known as the *second industrial revolution (2IR)*. Next came *electronics* and *computers* which ushered in *automation*. With computers came *networks, the internet* and the ubiquitous world-wide-web in rapid succession. Thus began the *third industrial revolution (3IR)*, seeding the growth of the *digital economy*.

The 3IR digital activities led to the bourgeoning of *digital data*. The initial people-centered digital activities led to machine-centered activities which, in combination, have led to an explosive growth in digital data. Enter Big Data into the game! And, hence the manifestation of the *data-driven digital economy*.

This brings us to the 4IR – the digitalisation of industry sectors for greater growth. In this context, by digitalisation, we mean the use of digital technology or ICT for end-to-end transformation of industries.

Other popular terms used with regards to this 'digitalisation of industry' trend include *Industrial Internet-of-Things (IIOT), Industrial Internet* and *Industry 4.0 (or Industrie 4.0*[1]*)*. The former two are of American origin and the latter, German. Note that although initially Industrie 4.0 meant the creation of *smart factories*[2], in some circles now it is taking on a wider meaning to include total industry transformation.

All things said, the takeaway is that *data-driven digitalisation is the fuel that is powering the 4IR*.

2.0 National 4IR Challenges

The 4IR is essentially ICT driven and since Malaysia has a healthy dose of ICT in its system and has been advocating the *knowledge, innovation* and *digital -based economies*, in theory therefore, the nation's march towards embracing and exploiting 4IR should be smooth. But would this be the case?

Let us look at some of the potential challenges.

1. Focus, Direction and Scope

The 4IR development in the country cannot just be left to market forces. There is a need for a national 4IR agenda by the government to identify where we want to go and what we want to achieve as a nation. Only the government can catalyse the growth and transform the various economic/industry sectors. This agenda should form part and parcel of the TN50 plan. The challenge would lie in developing a comprehensive agenda that is far reaching yet at the same time realistic and implementable.

1. Spelt thus by Germans for branding purposes.
2. The smart factory is one where computers, cyber-physical system, and automation are harmoniously blended to make the production line smarter and more independent.

2. Champion and Little Napoleons

Once the agenda is developed, it has to be driven by a national champion. Specific ministries and government agencies oversee the development of the various economic/industry sectors such as health, education, human capital, tourism, finance, etc. Appointment of a national champion from among these government entities may prove to be tricky since many would vie for this mantle. Assuming the champion is appointed, the entity has to work with the various leads of the industry sectors. Coordination may prove to be a big challenge when it comes to implementation. Being overly sensitive and cautious so as not to step on the toes of others may not give the desired results. We need to break silos! Business as usual cannot be the new normal!

3. Ecosystem for Innovation

The implementation of the agenda would involve a number of players including the academia, research institutes, industry, venture capitalists and government bodies. This ecosystem of players need to work together to ensure the right technologies, tools, products, solutions, services and business models are continuously developed to implement the agenda successfully. The challenge here lies in sustaining innovation in all its various facets.

4. People – Capability and Capacity

Implementation of the agenda, of course, depends very much on the people available. Since 4IR is technology intensive, the right talents need to be developed in terms of capability (competency) and capacity (volume). This would also be a major challenge since good talent may go to the highest bidders, who could very well be outside the country. This would be a critical challenge.

5. Funding and Accountability

Since the 4IR agenda would be an industry transformational plan and there are a number of industry sectors to consider, the number of projects may potentially be large. Funding these projects could be a challenge. New funding models may have to be explored. Prudence and good governance is also critical so as to forestall funds becoming 'fluidic' and springing leaks.

6. Awareness and Participation

The immense impact and implication of 4IR to the socio-economic development of the country should not be underestimated. If the country does not take a proactive role, the nation may be left behind in its quest for national prosperity. Therefore, every stakeholder should be made to understand this to ensure full participation. Creating this awareness may prove to be another big challenge.

3.0 MIMOS Readiness for 4IR

How ready is MIMOS to meet the national 4IR challenges?

3.1 Background

MIMOS Berhad is the national R&D organisation focused on ICT[3], including microelectronics. Our mission is to research and develop technologies, products and solutions for the domestic ICT industry to take up and further innovate and commercialise.

As an R&D organisation, we continually track and monitor global technology and market trends. This ensures we stay at the forefront of technology development and at the same time carry out useful and relevant R&D that meets industry and market needs.

As such, since its advent in 1984, MIMOS has been part of the 3IR and now is well positioned, technology-wise, to enter the 4IR seamlessly.

3.2 Technology Development

MIMOS adopts an *open-innovation* approach to R&D. We collaborate with universities to source state-of-the-art research results which we transform into technology components for our *strategic technology platforms*. We also work with industry vendors to obtain market inputs to strengthen our technology platforms in terms of features and functions. The technology platforms, designated as *open innovation platforms* (OIPs), form the foundation for product, solution and service development.

This R&D modus operandi ensures that we remain at the cutting-edge of technology development.

3. At MIMOS, we take ICT to mean the entire spectrum from sand and silicon all the way to systems and solutions.

3.3 Technology Ware

Figure 1 provides an overview of the technology focus areas (TFAs) in which MIMOS is working on. For the record, all TFAs are 4IR relevant.

All TFAs are platform driven and the platforms are being used to develop products and solutions, as depicted in Figure 2.

Our R&D Strategy for rapidly developing products and end-to-end solutions involves the re-use, reconfiguration and customisation of technology platforms.

Note that MIMOS's technologies, platforms, products and solutions are strongly backed by patents and copyrights.

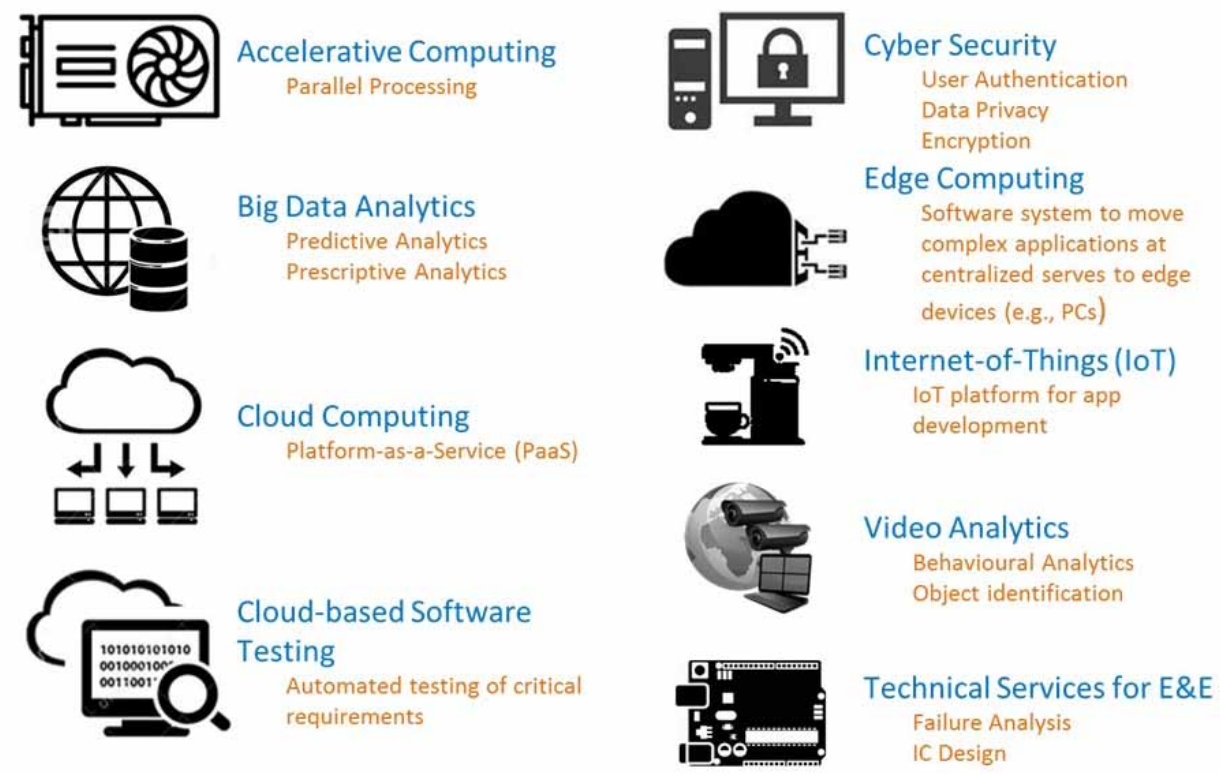


Figure 1: MIMOS Technology Focus Areas

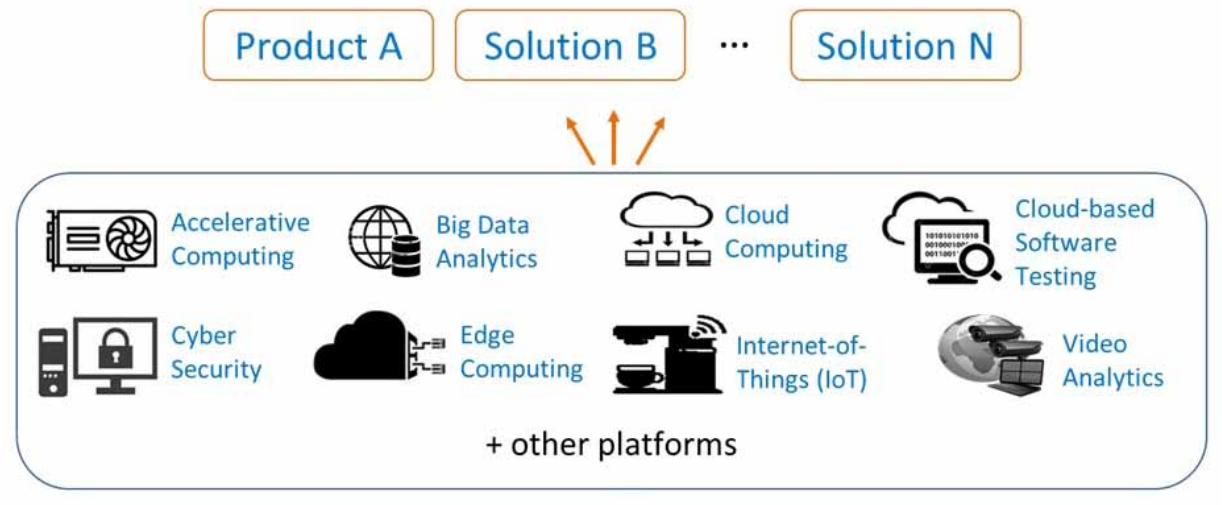


Figure 2: Platform-driven Solution Development

3.4 Digital Solutions

At the most basic level, digitalisation is the use of digital technology or ICT to provide end-to-end solutions to complex problems. Table 1 lists some of the solutions that MIMOS has developed and deployed.

You can see that MIMOS has built and successfully installed digital solutions at a number of industry sectors such as agriculture, health, public safety as well as the government.

Solution	Description of Solution
MyTrace	A system that offers visibility and traceability through supply chain from farm to consumer.
AgroBazaar	An intelligent eCommerce and online business matching platform for agriculture-based products that connects the buyers and sellers, rendering middlemen less relevant.
PadiPedia	A web-based portal with data analysis, reporting and searching capabilities designed to support MARDI's Research, Development and Technology Transfer activities in the area of paddy farming.
iVLS (intelligent Virtual Learning System)	A framework to develop and integrate cloud-enabled applications such as: • Content Management System; • Learning Management System; • Campus Management System; • Cognitive Profiling System; and, • Collaboration tools.
Medical Treatment Information System	A web-based medical treatment report system linking all hospitals under the Malaysian Ministry of Health.
MyHDW (Malaysia Health Data Warehouse)	A trusted source for comprehensive healthcare data structured for query and analysis purposes.
PRIS (Patient Registry Information System)	A centralised system of various patient registries that enables the collection of secondary data related to patients with specific diagnoses, conditions or medical procedures.
TPC-OHCIS (Tele Primary Care – Oral Health Clinics Information System)	A complete healthcare IT system addressing the needs of Primary Care for Clinical Health and Oral Health Care. The integrated system will allow the sharing of patients' medical records, clinical management plan, laboratory and radiological investigations results, drug prescriptions and referrals.
Fiscal BDA	A system to automate the process of publishing the annual, quarterly and monthly fiscal data.
Big Data Middleware Framework	Framework focuses on providing big data middleware for planning, simulation and predictive analytics related to public safety, healthcare, human resource and agriculture sectors.
Smart Lock-up	An innovative surveillance management system, employing advanced Video Analytics technology, which automatically highlights and notifies the authority of suspicious activities that may lead to crime or violence in detention facilities.
JobsMalaysia 2.0	A portal that provides efficient job matching services.
Government Online Services (GOS) Gateway	A one-stop center for delivery of government services.

Table 1: A selected list of MIMOS's Digital Solutions

3.5 Facilities

MIMOS hosts five national technology facilities that serve as reference centers for technology, product, solution and service development. Universities, industry players and government agencies could avail themselves of the services of these centers. These five centers are highlighted in Figure 3 and are briefly explained below.

Big Data Analytics Digital Government Laboratory (BDA-DGL)

This is a 2015 initiative resulting from a tripartite Memorandum of Understanding between MIMOS, the Modernisation and Management Planning Unit (MAMPU) and the Malaysia Digital Economy Corporation (MDeC). The laboratory has the capability to conduct end-to-end processing of voluminous data, viz.: data cleansing; data harmonisation; data anonymisation, security and protection; accelerated data computing; data analytics, and data visualisation. All these activities are aimed at gaining insights on data amassed from the government as well as social media.

All Big Data R&D activities in this laboratory are conducted in strict adherence to the Government's data security, integrity and sovereignty guidelines.

Big Data IoT Technology Accelerator (BITX) Laboratory

BITX is an *open innovation* laboratory that provides end-to-end services and necessary technologies for the development of innovative IoT applications. The laboratory assists technopreneurs in accelerating market entry and maximising business performance through organised programmes in product upscaling, quality enhancement and branding. It offers an open but safe and controlled sandbox environment where innovation and experimentation on cutting-edge Big Data and IoT-related technologies can take place without the need for big investment.

Figure 3: National Technology Centers hosted at MIMOS

Nano-semiconductor Fabrication and Smart Manufacturing

As the country's foremost provider of micro-nano product fabrication and services, the Nanofabrication Laboratory at MIMOS is backed by state-of-the-art equipment that can meet industrial and research requirements. It provides turnkey design support, customised processes, Multi Project Wafer (MPW) programmes as well as product development and fabrication in CMOS, Power MOS, digital, analogue and Micro/Nano Electro-Mechanical Systems (MEMS/NEMS) technology.

The laboratory also assists the industry in the implementation of smart manufacturing and deployment of sustainable action plans for small and medium-sized enterprises (SMEs).

Housed in the same complex as the Nanofabrication Laboratory is MIMOS's Advanced Shared Service facilities that offer the following services:

- Failure Analysis;
- Material Analysis;
- IC Design;
- Wafer and IC Testing;
- Wafer Prototyping; and,
- Hands-on industrial upskilling programme.

Hardware Prototyping and Testing Services

MIMOS Rapid Prototyping Laboratory is equipped with facilities to carry out prototype fabrication, reverse engineering and part-inspection analysis. The laboratory currently uses 3D Systems Selective Laser Sintering (SLS) Rapid Prototyping Machine for producing accurate, quality, durable and stable parts for a variety of materials including metal. The ATOS II SO 3D Digital Scanner is used for reverse engineering and to scan any surface for conversion into 3D digital surface data.

Complementing the Prototyping Laboratory is the Reliability Laboratory, which provides internationally-compliant hardware reliability testing services. The laboratory furnishes comprehensive technical support for a wide range of industries from telecommunications and automotive to consumer electrical and electronic products and appliances for multinational corporations, local industries and universities. The Reliability Laboratory is accredited with MS ISO/IEC 17025 Testing Lab Competency by Standards Malaysia (DSM), and staffed by highly competent R&D engineers in testing, international standards and product qualification.

Industrial Design and User Experience

The MIMOS Industrial Design Studio is an award-winning pioneer in industrial design in the country. It has the capability to deliver process-driven results by researching user requirements and needs, and houses contemporary 2D and 3D digital software as well as complex surface modelling and detailed solid modelling tools.

As part of industrial design, the User Experience (UX) laboratory offers usability and user experience testing and evaluation, apart from conducting research in innovative test methodologies and sharing usability best practices. The laboratory is the first Malaysian ISO17025:2005 accredited software testing laboratory.

4.0 Digitalising Industry Sectors

Our brief discussion in Section 3 distinctly demonstrates four things i.e., MIMOS:

1. Is working in the right technology areas to venture into the realm of developing large scale end-to-end digital solutions for various industry sectors.
2. Has developed a key set of tested technologies and technology platforms that could be used immediately for crafting new digital solutions.
3. Has the people and facilities to continuously experiment and develop new technologies and for new needs.
4. Has the experience in collaborating with universities and industry to carry out R&D as well as design, develop and deploy industry-strength solutions in the field.

Based on the above four factors, you can see that MIMOS is quite capable of contributing substantially to the digitalisation of the nation's industry sectors.

5.0 Showcasing a Smart Factory

Again, from Section 3, you can see that MIMOS's nanofabrication laboratory is in fact a production facility. Taking this and our expertise in big data analytics, IoT, cloud computing and artificial intelligence into consideration, MIMOS evidently possesses the complete set of tools, talents and means to build a true-blue smart factory.

This smart factory showcase could serve as a reference center for the local industry to study, learn and improve their factories.

That said, the realisation of the showcase depends very much on whether the sun smiles warmly upon us, and the planets align auspiciously, and the twinkling stars bestow their benign grace … meaning … if we are accorded sufficient funding!

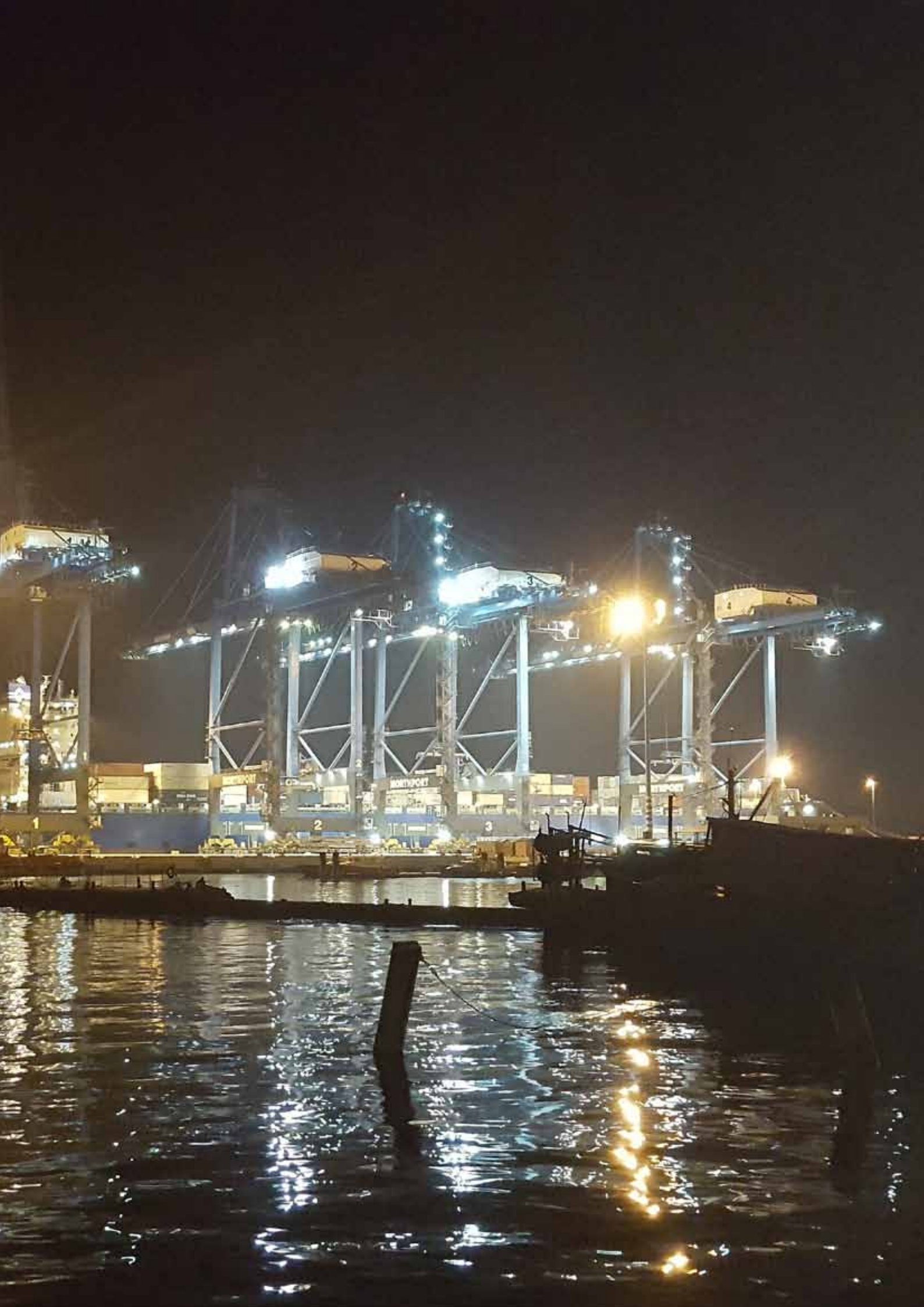
6.0 Way Forward

Coming back to buzz words/phrases, there is a tendency among some government entities to latch on to the latest trends, wanting to champion them. This is to be lauded for the enthusiasm shown. On the other hand, it tends to create little 'Napoleonic' turf wars which waste energy and time since everyone would be targeting the same limited resources, especially funding.

Exploiting the 4IR needs the expertise and cooperation of all key stakeholders in the country so that collective and focused action could be taken.

Being in the forefront of digital technologies relevant to 4IR, MIMOS is in the position to support the nation in this endeavor.

Chandran Elamvazuthi (PhD) *is the Senior Director of MIMOS Berhad.*



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Industry 4.0:
WHERE THE DIGITAL DRIVES THE PHYSICAL

PIKOM

Let's get one thing straight from the get-go. The Fourth Industrial Revolution (4IR) and Industry 4.0 are not the exact same thing although many tend to arbitrarily interchange between the two terms.

The 4IR is the disruption and transformation of every industry through the "fusion of technologies that is blurring the lines between the physical, digital and biological spheres", as concisely described by the World Economic Forum (WEF).

On the other hand, Industry 4.0 is the data-driven autonomous decision-making and automation of manufacturing processes, creating what is known as 'smart manufacturing'. Forbes refers to this as "cyber-physical systems that monitor the physical processes of the factory to make decentralised decisions". In effect, Industry 4.0 is a subset or component of the 4IR revolving specifically (but not exclusively) around manufacturing activities.

Despite the confusion in nomenclature, at least everyone can agree that both concepts harness digital technologies to make independent decisions in order to drive physical processes.

Against this backdrop, the Government has spun the wheels to place Malaysia on the transformational path prescribed by the 4IR. This is a task that has been taken up by various government agencies and government-owned or government-linked organisations.

As part of this endeavour, these agencies and organisations looked into the challenge of accelerating Industry 4.0 given that manufacturing remains a major segment of the local economy and significant contributor to gross domestic product (GDP).

They reviewed existing obstacles and challenges to transforming industry and subsequently outlined the need for a digital enabling ecosystem while also recommending the key strategies necessary to drive such an ecosystem.

Roadblocks to Industry 4.0

In their review of challenges, the agencies and organisations found that digitisation lacks uniformity across the various economic sectors. In particular, the manufacturing sector suffers from low levels of digital adoption in contrast with industry segments such as ICT, business services and financial services.

The stumbling blocks to digitisation were identified as lack of awareness; lack of strategy, lack of capabilities and capacities, lack of use cases to justify investment in digital adoption, concerns over cybersecurity, inadequate infrastructure and a lack of courage to undertake transformation.

In particular, digital adoption is hampered especially by three critical barriers: awareness; capabilities; and cost.

In the case of awareness, it was found that less than 10% of businesses automate operations to improve productivity as well as use analytics to derive insights while less than 20% of businesses leverage on cloud computing. This would seem to indicate a lack of awareness or buy-in of the range of benefits related to digital adoption. There is also the issue of integrating technology with core strategies and business operations.

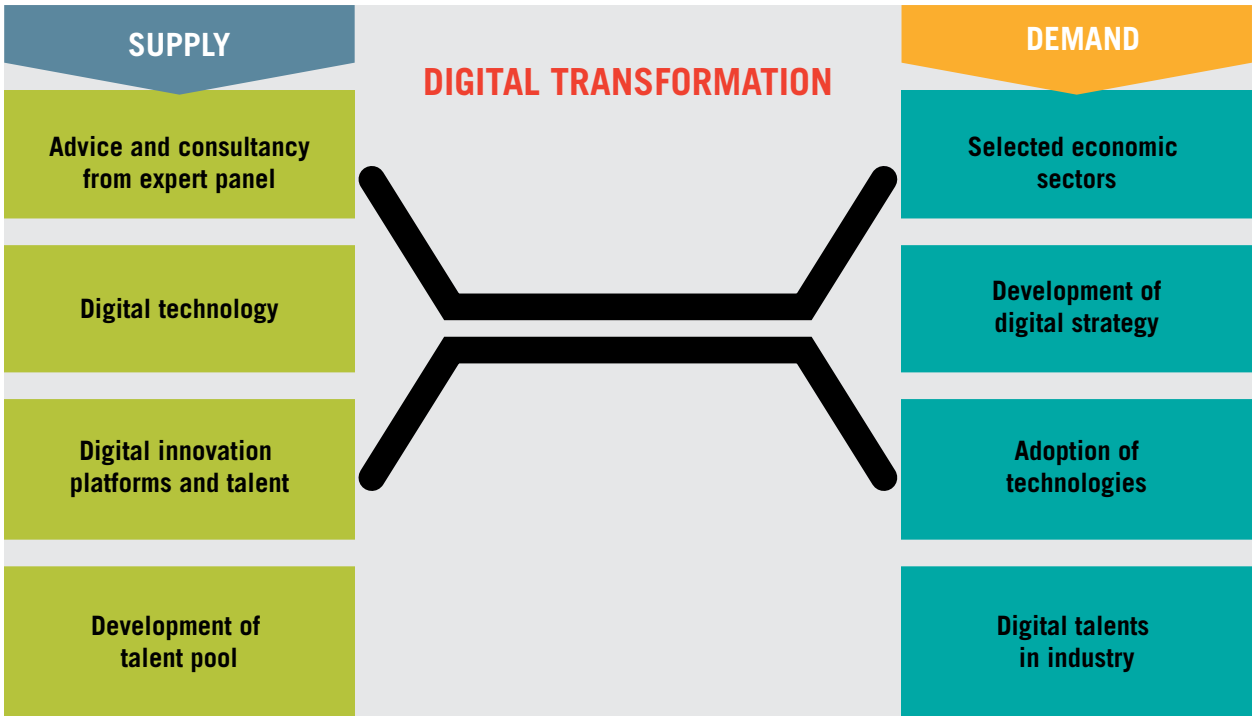
Not surprisingly, the lack of digital talent is a major reason why so few businesses are committed to embark on a digital transformation. Slightly more than two thirds of employers rated their employees' digital capabilities at the basic level, with few having any expertise or experience in analytics and the internet of things (IoT). At the same time, most business managements do not prioritise digital strategies and capabilities, with about half of employers surveyed operating without an IT department or a CIO/CDO.

When it comes to cost, more than half the employers see this as their main impediment to adopting digital technologies in their processes.

Bridging the Gap Between Demand and Supply

To address these issues in order to accelerate Industry 4.0, the agencies and organisations stressed the need for a digital enabling ecosystem that can bridge the gap between the demand and supply ecosystems.

Such an ecosystem would drive digital transformation via collaboration between the industry and government, the development of capabilities as well as intervention in the form of policies, regulations and outcome-based incentives *(Refer to graphics)*.



Preliminary Framework for a Digital Enabling Ecosystem

Referring to the graphics, the focus on the supply side would be on having a panel of business and technology experts to advise on digital transformation and implementation; facilitating the development of technology solutions in IoT, analytics, cloud, mobile, cybersecurity and other emerging technologies; driving innovation through the support of start-ups and via accelerator programmes; and developing the necessary talent at various levels of education as well as through reskilling and upskilling courses.

Meanwhile, demand would be generated through digital transformation efforts in high-priority economic sectors; development of outcome-based digital strategies, driving digital adoption across industries; and the continued nurturing of digital talents in industry.

Digital Technologies Critical to Industry 4.0

Several key digital technologies are required to drive Industry 4.0 across the manufacturing sector. They include cloud, IoT, big data analytics, cybersecurity, robotics and other solutions to alleviate existing concerns among businesses of data hacking.

Cloud

Businesses on the road to automating their processes now have additional reasons to go on the cloud beyond the standard reasons of cost, scalability and security. Many technologies such as analytics and artificial intelligence (AI) are available on the cloud and can be harnessed and applied with relative ease.

Data Economy

The data economy is driven by digital technologies like IoT and BDA and revolves around creating value from data. Connecting a host of data-gathering devices to the internet provides the opportunity for data to be analysed so as to yield insights that, in turn, can be used to optimise processes whether in manufacturing or otherwise. The outcome from this sequence of events has the potential to singularly or collectively increase revenue, lower cost and enhance efficiency.

When applied to manufacturing operations, these data-centric technologies have the potential to convert manual and isolated processes to full automation with autonomous decision making.

Currently, Malaysia has a dedicated data analytics hub in the ASEAN Data Analytics Exchange (ADAX). As a focal point of development and adoption, ADAX has a target to train and develop 20,000 data professionals including 2,000 data scientists by 2020.

ADAX intends to achieve this through a combination of formal tertiary education initiatives as well as professional training courses.

Cybersecurity

In order to ensure sustainable growth of the data economy leading to Industry 4.0, cybersecurity needs to be prioritised.

Talent

Attention must also be given to the continuous development of digital skills necessary for the digital economy. The strategies in this case cut across the education and training spectrum, with programmes in schools, institutions of higher learning (IHL) and also for professionals in the workforce.

Building Momentum from Industry 4.0 to 4IR

As the voice of the ICT industry, PIKOM will continue to play its role as a launchpad to match industry players with the various parties involved in pushing Industry 4.0 to the manufacturing sector.

For now, it is all about bringing parties together as collaboration and cooperation would be critical in ensuring that the manufacturing sector gains momentum in driving towards Industry 4.0.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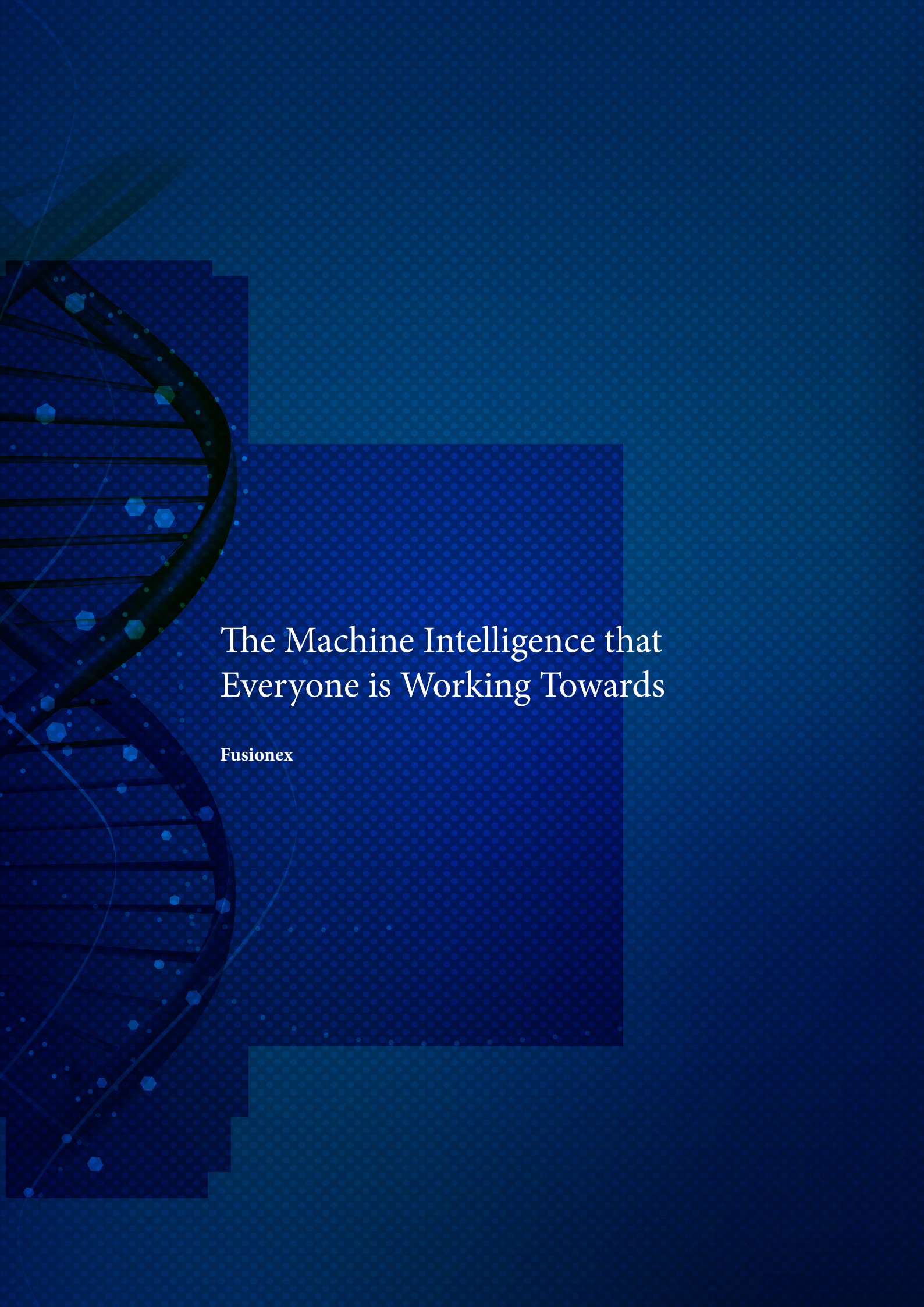

The Machine Intelligence that Everyone is Working Towards

Fusionex

Why Artificial Intelligence is still largely artificial

We can't seem to get enough of artificial intelligence these days. We're now having conversations about vehicles that drive themselves and gadgets that can talk back to us. Just a few years ago, the biggest concern regarding cars was replacement of the combustion engine with an electric one. And as for phones, the hope was to get the battery to last just a little longer.

But our expectations have been revised upwards alongside the heights that technology has risen to.

Artificial intelligence is big business. California-based Nvidia, who makes the graphic processors in your PCs and laptops, also supplies the tech that powers AI applications on Facebook, Google, Amazon, and Microsoft.

Nvidia founder and CEO Jensen Huang said, "AI is the most important technology development of our time, with the greatest potential to help society." Huang's company has a lot to look forward to as China tech giants Alibaba Cloud, Baidu, and Tencent recently upgraded to new Nvidia chipsets that reportedly run AI 5x faster than before.

But what is AI actually used for?

Just a Very Intelligent System

AI is being used for various applications, from commercial to R&D and even personal ones. Facebook's founder, Mark Zuckerberg, built an AI to run his home in the same vein as Iron Man's digital butler Jarvis.

He spent hundreds of hours building this simple AI, which he talks to through the phone and computer. The AI can control many aspects of his home such as the lights, temperature, electronic appliances, music, and security. However, Zuckerberg said, "Even if I spent 1,000 more hours, I probably wouldn't be able to build a system that could learn completely new skills on its own."

In other words, an AI may attempt to learn one's tendencies by accumulating and analysing data to pinpoint trends and patterns. But it needs to be initially properly programmed especially in understanding context.

Zuckerberg tries to describe the difficulty and intricacies of teaching an AI how to learn things on its own – "Consider these requests related to Adele: 'play someone like you', 'play someone like Adele', and 'play some Adele'. Those sound similar, but each is a completely different category of request."

Building an AI algorithm that can truly learn on its own and become smarter over time without human intervention is a complex undertaking. This then begs the question: apart from slip-ups like accidentally playing a song you don't like, how might inaccurate algorithms cause bigger problems?

Algorithms Are a Work in Progress

Google Vice President of Engineering Ben Gomes said that "our algorithms help identify reliable sources from the hundreds of billions of pages in our index. However, it's become very apparent that a small set of queries in our daily traffic (around 0.25%) has been returning offensive or clearly misleading content."

The shocking incident of the shooting in Las Vegas on the October 1, 2017 generated tens of millions of search results on Google in just a matter of hours. Journalists posted real-time updates while pundits and politicians reacted with posts and comments on social media.

However, what topped Google's News section was a link that wrongly identified an innocent man as the shooter. But Google's system was not doing anything contrary to its programming. In essence, Google's algorithm trawls the web and discovers information that's gaining popularity. Its AI picked up on fake news which accused the wrong man as the shooter. It broadcast this news, increasing the erroneous accusation's virality.

As more and more people searched for news concerning the accused, this wrong information was further intensified by the search algorithm. After the incident, Google announced that they would "make algorithmic improvements to prevent this from happening in the future."

So we know that AI is still a work in progress. But this leads one back to the question as to why AI is becoming so important? How can accomplished AI intrinsically help make our lives better?

Help Wanted: AI Butler

Curated, bespoke, artisanal – these are terms allowing consumers to be aware that their needs will be well taken care of. They bring to mind an expert practitioner of a particular craft – a barista brewing coffee perfectly catered to suit your taste profile, or a tailor customising perfectly-fitted suits that take into consideration the precision of your body's symmetry.

In many ways, AI is that expert. As we spend more time online, we leave more data trails behind. A powerful AI can capture such data. Companies may then use this data to offer products and services that are better suited to our preferences without having to ask us about them. Customer personalisation has the potential for a quantum leap thanks to AI.

Some ways in which AI is already our own personal butler are those automatically generated shopping lists that accompany our online purchases. Thanks to AI, your previous purchase of a printer now results in a suggestion for purchasing printer ink refills a month later. And as it learns your commuting schedule, Waze automatically generates routes to work, or back home, based on the time of day. In other words, AI has proven it has the ability to make our individual lives easier by tailoring preferences to us. The next question then arises – how may it benefit organisations?

Driving Personalisation with AI

International hotel search engine, Trivago, recently acquired an AI-powered startup company called Tripl that consolidates social media data. Trivago wanted to improve its personalisation capabilities and this acquisition helped provide more personalised results to Trivago's 120 million monthly users.

By identifying user trends on social media such as what was posted and shared, Trivago is able to offer tailored travel recommendations. Much like how a traveler consults with an agent on accommodation, food, and entertainment options, Trivago's AI would likewise recommend personalised travel experiences.

This technology has interesting ramifications. Would a 'single' or 'in a relationship' status conjure 'platonic' or 'romantic' destinations? By having an interest in Tom Yum Goong and Sakura flowers, which recommended visit would be suggested – Thailand or Japan?

Tripl founder Hendrik Kleinwachter explains: "When visiting a restaurant, I prefer those with few hand-picked entries on the menu that exactly match my taste. That is what I believe a modern travel website should look like. There are billions of combinations, but the user is really only interested in the most relevant ones – we offer them through our algorithm."

It is evident as to the immense potential benefits organisations could derive if they adopt AI and put it to identifying individual user preferences. A more intuitive, personalised experience encourages users to return to an organisation that repeatedly provides the best, most accurately tailored products and services.

So, what Trivago and Tripl are doing is basically recreating the 'AI butler' experience – amplifying what was originally a very personal service to giving millions of people their very own 'AI travel agent curator'.

Lessons Learnt

With some recent AI-related public gaffes, one could be forgiven for assuming that intelligent machines cause more harm than good. As the adoption of AI is so widespread and carried out by many reputable international companies, any misstep in machine learning gets heralded as the beginning of an AI-driven apocalyptic future. At this current juncture however, AI is only as smart as how humans programme them to be.

Writing algorithms that work takes time; writing algorithms that work exactly as intended takes trial and error – what more an AI that works in relation to different expectations, cultural norms, and legal requirements across the world. But pursuing AI stands to unearth many potential benefits which may not be presently attainable due to the limits of our own cognitive capabilities and resources.

The benefits, or repercussions, of an advanced AI may be difficult to accurately determine as of now. Undoubtedly however, many will continue to observe and anticipate the unveiling of the next 'smart' machine touting to 'change our lives forever'. Interestingly, at the present rate, the rollout of such machines appears to be every other month, demonstrating not only the potential, but also the speed of change in which this generation will need to start getting accustomed to.

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ASOCIO Research Report:
REIMAGINING THE DIGITAL ERA

Asian-Oceanian Computing Industry Organization (ASOCIO)

On September 12 2017, the Asian-Oceanian Computing Industry Organization (ASOCIO) launched its inaugural research report on the state of digital adoption in the Asia Pacific Region. The report was unveiled at the concurrent World Congress on IT (WCIT) and the ASOCIO Summit in Taipei, Taiwan. This initiative is in collaboration with its research partner, the World Information Technology & Services Alliance (WITSA).

Titled, *Reimagining the Digital Era: Digital Transformation Agendas & Initiatives Within The Asia Pacific Economies,* the report covers 12 economies, namely Australia, Bangladesh, India, Japan, Korea, Malaysia, New Zealand, Singapore, Sri Lanka, Taiwan, Thailand and Vietnam.

The objectives of the research paper can be described as follows:

a) Recognise the significance of digital transformation in some of the countries in the Asia Pacific region;
b) Learn and leverage from each other's success;
c) Propose affirmative actions and initiatives towards a truly digital region.

The research focuses on a number of core areas in the ICT industry comprising IT services and software, hardware, telecommunications, eCommerce and fintech.

The report also outlines the countries' strategies, roadmaps and key initiatives in their digitalisation agenda including the accompanying challenges and hurdles. Some of the common challenges cited include digital infrastructure, digital security and human resources.

After providing an understanding of the landscape for the digital transformation of these 12 economies, deep-dive analyses were carried out on these data collectively; followed by an endeavour to draw some parallels and synergies among these countries in their journey towards a digitised world.

Learning from success and avoiding 'pitfalls' are the guiding principles of this analysis. As a result, eight key proposals have been developed for consideration and these are reflected in the final section of the report. In essence, it is fair to note that the value propositions of this inaugural research are entrenched in these eight proposals.

Digital Transformation in Asia Pacific

At a population of over 4.5 billion people, Asia Pacific is home to about 60% of the world's population. It has some of the fastest growing economies in the world and the ICT sector in APAC is expected to register phenomenal growth in the years to come. With a strong vibrant economy, favourable demographics, ongoing ASEAN integration and collaboration, there are certainly opportunities for the region to "leapfrog" and become the global leader in the digital economy.

To realise this goal, barriers will need to be addressed and removed and some of these include building broadband, regulations inhibiting innovations in mobile financial services, cross border regulations affecting eCommerce activities, lack of a single digital market and weak local digital ecosystems. Despite these challenges, it is imperative for APAC countries to continually embrace this digital age leveraging on the leaders in this region such as Australia, Taiwan, Singapore and Korea. They are among the developed countries that can provide the necessary leadership and impetus to this drive to become a global digital player in the Asia Pacific region.

Specifically on eCommerce, these were the findings in the report:

- Australia's eCommerce market was the 10th largest in the world in 2015 due to its robust infrastructure, strong economy and large spending power. About 49% of Australian businesses sold their products online in 2015.
- Taiwan's eCommerce penetration rate is among the highest in the world, with about 62% of residents purchasing products online. Singapore too, is considered to be a dream market for eCommerce businesses as the average annual spending per user in 2016 was S$1,375 (approx. RM4,260).
- Korea has the 6th largest eCommerce market in the world and second highest digital buyer percentage in the Asia Pacific region. Their fulfillment rate is among the fastest in the region due to the size of the country and high population density.

To provide our reader an essence of the report, the following is a reproduction from the Executive Summary of the research report:

Digital transformation is essential for economies to attain a sustainable growth. This can be observed in many APAC economies who have witnessed robust economic growth in recent years due to rapid adoption of internet and mobile technologies. Digital transformation in APAC is driven by a growing middle class, rising levels of urbanisation, technological innovation and government support for the digital economy.

Most countries in the Asia Pacific region are continuing on their own journey towards a digital future, Several Asian countries are clearly seen as global leaders in different aspects of digitalisation, yet if one measures the overall progress, there is still a great deal of uncertainty. Countries in the Asia Pacific region are increasingly plagued by the rising incidents of cyber security and associated threats. Also, the adequate digital infrastructure is not in place in many countries, which is considered to be the backbone of digital transformation. The other most common challenge observed in Asia Pacific economies is the lack of availability of skilled ICT human resources.

In addition to the above, the other major hindrances for the growth of ICT in the region include lack of a robust ecosystem for start-ups, low usage of new and emerging technologies such as fintech, IoT, AI, etc., less than expected success with regards to smart city development, lower cross-border trade and investments compared to the real potential, among others.

Countries in Asia should co-operate and take advantage of each country's inherent strengths in ICT or digital landscape to effectively collaborate. The ideal way ahead should be to corroborate successful policies / frameworks of one country by other countries in the region. Below are identified (8+1) objectives and associated action steps which have been discussed in detail later in this research paper.

1. **Digital Infrastructure**: Countries in Asia Pacific must work towards providing 'high-speed internet for all' in today's digital era. For this, establishment of a strategic national broadband roadmap including defined targets with measurable goals is critical in achieving this goal.
2. **Human Resource Development:** APAC countries should facilitate cross-border ICT learning through graduate exchange programs by enabling graduates to work in other Asian countries. To facilitate digital learning among Asian countries, focus should be on developing collaborative projects between educational institutes and companies.
3. **Cyber Security:** The countries should formulate strategies to address the regional cyber security needs by establishing a nodal cyber security agency in each of the APAC economies. Co-operation in areas of cyber security and training corporates in deploying best practices in cyber security will also be helpful in achieving desired results.
4. **Start-Up Ecosystem:** A robust digital ecosystem for start-ups and SMEs is needed through a common platform to nurture talent and encourage regional digital innovation. Developing an APAC Start-up Map to identify different entities in the ecosystem will enable better coordination between accelerators, incubators, investors, corporations, universities and public administrations.
5. **Cross border investment and digital trade:** Expanding the present ASOCIO AEC E-Commerce Alliance to the digital Asia market through Asian economies participation will boost cross border trade. An APAC cross-border trade promotion initiative is also needed to frame standard regulations & policies. Similarly, an ICT Working Committee to discuss cross-border digital trade regulatory issues will be helpful.
6. **Smart city development:** Collaboration with successful economies is critical to identify and establish adequate standards necessary for smart city development. Also, country level standards and benchmarks need to be suggested for faster planning and implementation in other cities. A Smart City Alliance at regional level is needed to monitor the progress of implemented smart city initiatives and suggest best practices.
7. **New and emerging technologies:** For digital transformation, countries need to adopt and integrate new technologies into the existing ICT infrastructure. Fintech needs to be considered as one of the key national digital growth agendas to increase financial inclusion. IoT Alliance established at APAC level will support the creation of an industry-driven IoT ecosystem.
8. **ICT to enhance social welfare:** Countries should leverage digital technologies to solve social public issues and online delivery of government services. Similarly, to promote use of ICT in education, an online platform can be developed for disseminating educational e-resources. Agro industry can benefit from an APAC digital agriculture trading platform to bridge the gap between producer and direct buyer.

Lastly, it is imperative to establish a monitoring mechanism to overlook the implementation of various regional initiatives by standardising measurement metrics across all countries in the region. This will result in effective benchmarking, developing targeted policies and prioritising reforms. Regional Digital Transformation Index, maturity modeling, certification, etc. should be implemented as well to help track and measure the impact of major ICT initiatives in different economies at the APAC level. This initiative will also be useful to develop and maintain an annual progress report for digitisation at a regional level.

All the economies in the Asia Pacific region are making considerable efforts to overcome these challenges. However, the goal becoming a truly digital region can be realised for Asia Pacific region only if these efforts are focused and consistent for all the stakeholders at a regional level.

To read the full version of the report, please visit *https://www.asocio.org/wp-content/uploads/2017/09/ASOCIO%20Research%20Paper%20(for%20printing).pdf*


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Sharing Economy:
A LOOK AT ITS POTENTIAL TO SHAPE BUSINESSES AND CREATE OPPORTUNITIES

PIKOM

The sharing economy is an economic model which involves the sharing of assets and resources between individuals and/or businesses and governments while increasing asset and resource utilisation, all coordinated through community-based online services.

This model is most likely to be used when the price of a particular asset is high and the asset is not fully utilised all the time. It is also referred to as 'the gig economy', 'the platform economy', 'the access economy' and 'collaborative consumption', among others.

High-profile companies helping to shape and grow today's sharing economy include Uber, a global car-sharing transportation service; Airbnb, an online hospitality service that allows people to rent homes and other spaces for a short period of time; and TaskRabbit, a mobile marketplace that matches freelance labour with local demand, to name a few.

These shared services are often convenient, accessible and less expensive than existing market options.

Rapid Emergence

According to a study developed in 2010 by media research company Latitude in collaboration with Shareable Magazine (one of the most prominent publications on the sharing economy), there are four main driving forces behind the emergence of the sharing economy:

- **Technology:** Web and mobile technologies play a critical role in building large-scale communities. The development of new web and mobile technologies have spurred the rise of the sharing economy, enabling upscaling and enhancing economic impact. The world has witnessed a steep rise and penetration of the sharing economy facilitated by the growing digital platforms and willingness of consumers to try mobile apps that facilitate peer-to-peer business models.

- **Environmental concerns:** The sharing of resources and assets is a collaboration towards more sustainable ways of living. Most adopters of the sharing economy believe that their choices are made with the environment in mind.

- **Global recession:** Economic crisis occurs when people lose purchasing power, gain increasing awareness about purchasing decisions, stressing practicality over consumerism.

- **Community:** An effect of evolving technology and online connectivity is to facilitate offline sharing and social activities, allowing direct contact without interaction.

People have shown a robust appetite for all ranges of services provided by the sharing economy in hospitality and dining, automotive and transportation, labour, delivery, short-term loans, and retail and consumer goods. In the future, this crowd-based capitalism model is expected to penetrate many sectors.

Shaping Businesses in Malaysia

The sharing economy, exemplified by the rise of Uber and Airbnb, has been one of the most visible economic forces of the past five years in Malaysia. As of July 2017, Airbnb had about 18,000 active listings in Malaysia while there were about 16,000 Uber and Grab drivers registered in Malaysia.

Traditional patterns of ownership and consumer behaviour have changed and the majority of Malaysians, particularly in urban areas, have embraced it with open arms, leaving incumbents to ponder a fundamental threat to their businesses.

Disrupting Businesses

The sharing economy is a disruptive force in a slew of industries. It is not only the hospitality industry and taxis that are disrupted, but also travel, consumer goods, services, bicycles and car rental, finance, music and entertainment.

The disruption may be long-term if the new businesses permanently change consumers' attitudes towards ownership. The sharing economy has an air of inevitability about it and most, if not all industries, will be affected by one form of the sharing economy or another.

There are currently four different interpretations of the sharing economy in Malaysia:

1. **Rental economy:** An economy that comprises rental schemes run by companies specialising in goods, which are generally under-used when the users have exclusive private ownership (example: car sharing such as GoCar and Moovby).

2. **Peer-to-peer economy:** An economy that concerns goods that are also under-used but which are offered directly by their owners (platforms such as AirBnB).

3. **On-demand economy:** An economy characterised by the use platforms that broker personal services provided by professionals and non-professionals (platforms such as Uber or TaskRabbit).

4. **Social lending and crowdfunding:** It is about the application of finance to a sharing economy including direct loans between people and platforms that help raise the capital necessary for the development of a new idea among those potentially interested in it (platforms such as Kick Starter).

The sharing economy is powered by declining transaction costs. Smartphones, internet connectivity, and the cloud allow businesses and consumers to efficiently search for and sell their desired goods and services, understand the terms, ensure timely logistics, and enforce the agreed-upon contract.

Creating New Opportunities

Businesses in Malaysia need to understand the opportunities that this economic model can bring.

The sharing economy and the platforms that are developed to benefit from this economic model will ease the efficiency of businesses by taking advantage of emerging trends in technology; using data to match consumers to suitable products and services, organising logistics; getting products and services across as well as providing enforcement that regulates payment and manages pesky terms and conditions better with the use of innovations like Blockchain.

These opportunities include, but are not limited, to recognising emerging trends and the fact that consumers are more confident in and more willing to place digital trust, a leading currency of sorts in society today, in sharing platforms.

Trust remains a critical enabler of the sharing economy. As it grows, distributed trust networks and mechanisms will need to emerge, whereby consumers will have access to and more control of their own data, as well as the ability to share this data with multiple parties.

Platform players in the sharing economy will look to newer, better ways of showing consumers that they provide the best quality product, service and communications.

A plethora of opportunities are available in enhancing consumer or user experience. As the sharing economy expands, businesses will need to create and maintain legitimacy. Platforms will be listening to the crowd, transferring more control of personal data to consumers, provide seamless transactions, design beautiful front end experiences, all of which have to be backed by huge computing power, storage and data analysis and not forgetting a team of social interaction experts.

The field of marketing and advertising has also been affected by the rise of the sharing economy. Consumers are looking to peer reviews on not only products and services, but also the communication afforded to them by a particular business. Social media is a double edged sword and companies currently in or are looking to pivot into the sharing economy space will be looking to attract and retain customers with appropriate communication, tailored to each customers' personal experience.

Finally, local businesses need to embrace the concept of 'everything as a service'. As the race to be the next powerhouse in the sharing economy heats up - the race to be mentioned in the same breath as Airbnb, Grab and Uber - businesses need to look beyond traditional products and services and realise that anything and everything can be shared. Countries such as the US and the UK are going as far left field as 'mourners as a service' and 'bridesmaids as a service' to demonstrate the astounding breadth of possibilities tied to the sharing economy.

Fast Forward:
RETHINKING ENTERPRISES, ECOSYSTEMS AND ECONOMIES WITH BLOCKCHAINS

IBM Institute for Business Value

Executive Report

Blockchain

How IBM can help

As one of the world's leading research organizations, and one of the world's top contributors to open source projects, IBM is committed to fostering the collaborative effort required to transform how people, governments and businesses transact and interact. IBM provides clients the consulting and systems integration capabilities to design and rapidly adopt distributed ledgers, digital identity and blockchain solutions. IBM helps clients leverage the global scale, business domain expertise, and deep cloud integration experience required for the application of these technologies. Learn more at ibm.com/blockchain

Executive Summary

The long history of human progress has been a steady march against friction. From the introduction of money to replace barter and the gradual replacement of wax seals by digital signatures, we have seen steady progress facilitated by digital innovations.

The internet primed friction for a free-fall. Since then, some frictions fell while others rose. The friction of imperfect information, for example, took on added importance in an era that promotes transparency by business partners and consumers alike. New frictions like cybercrime threaten to cripple even the most successful organizations.

Today, three types of frictions predominate: information, interaction and innovation. In varying degrees to different industries, they're a drag on efficiency. A distributed ledger for business networks based on blockchain technology has the potential to eliminate these frictions.

The first system of record for business was a ledger captured on a clay tablet. Centuries later, the double-entry ledger helped promote modern finance. Since then, ledgers have been digitized but otherwise changed little, capturing only a snapshot of a transaction at a moment in time. They reflect only the information held by a single organization. Once a transaction has taken place, an asset is off one ledger and on to somebody else's.

Distributed ledgers like blockchains are shared and write business transactions to an unbreakable chain that is a permanent record, viewable by the parties in a transaction. Blockchains shift the lens from information held by an individual owner to the cross-entity history of an asset or transaction. Our research shows that once that happens, five attributes that are fundamental to blockchains have the potential to vaporize the frictions that hold us back today.

Our analysis of the impact of blockchains across the enterprise, ecosystems and economies shows that frictions can be greatly reduced or even eliminated. The result, we believe, will be a new economic equation for organizations, trust and value exchange.

The enterprise, once constrained by complexity, can scale with impunity. It can integrate vertically or laterally across a network or ecosystem, or both. It can be small and transact with super efficiency. It can be a coalition of individuals that come together briefly. Moreover, it can operate autonomously and as part of a self-governing, cognitive network.

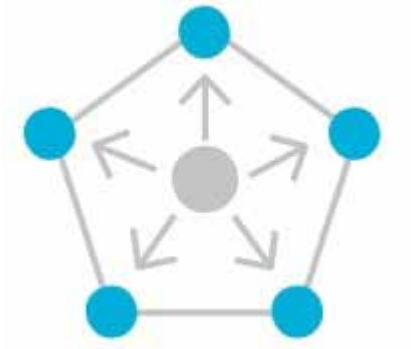
Distributed ledgers can become the foundation of a robust system of trust, a decentralized platform for massive collaboration. With that, intermediaries will be shuttered. Assets that were once dormant can be exploited. Profit pools can shift and be

Propelling business with blockchains

For centuries, global trade has been the single greatest creator of wealth in human history and market friction the greatest obstacle to wealth. Over the years, businesses have overcome multiple sources of friction. Institutions and instruments of trust emerged to reduce risk in business transactions. Technology innovations helped overcome inefficiencies. Still, many business transactions remain inefficient, expensive and vulnerable.

Blockchain technology – which creates a permanent and transparent record of transactions – has the potential to obviate intractable inhibitors across industries. As frictions fall, a new science of organization emerges, and the way we structure industries and enterprises will take novel shape. With transparency the norm, a robust foundation for trust can become the springboard for further ecosystem evolution. Participants and assets once shut out of markets can join in, unleashing an accelerated flow of capital and unprecedented opportunities to create wealth.

Today, three types of frictions – information, interaction and innovation – are a drag on efficiency.



Five attributes that are fundamental to blockchains have the potential to vaporize the frictions that hold us back today.

Monumental business model changes enabled by blockchains could transform: the science of organizational management, the tightening of trust and the economics of wealth creation.

redistributed. New services delivered on blockchain networks can accelerate access and liberate those that were once locked out of efficient value creation to fully participate in an all-in economy.

Beyond Friction: Tackling the Challenges of Our Times

In every century, new technologies have chipped away at the sources of friction – the inefficiencies that held back progress. The Silk Road connected East to West. The first letters of credit established a new basis for trust in the 14th century. In the 19th century, the telephone connected us in real-time. The internet threw into hyper-drive what was once a slow march to dissipate friction. Technologists and economists alike began to anticipate a world that was friction-free. Friction, in theory, could be "digitized away."

The internet did flatten some frictions, like transaction costs. And while it has ameliorated some forms of imperfect information, it has not solved for it completely. The frictions that remain, however, are consequential.[1] Indeed, they have become the basis for competition as start-ups race to capitalize on their destruction.

At the same time, other frictions have grown. Conflicting cross-border regulations throttle globalization. New threats like cyber-attacks are costly to prevent and even more expensive to recover from. Ecosystems are choked by intermediaries ready to take their cuts.

Friction Defined

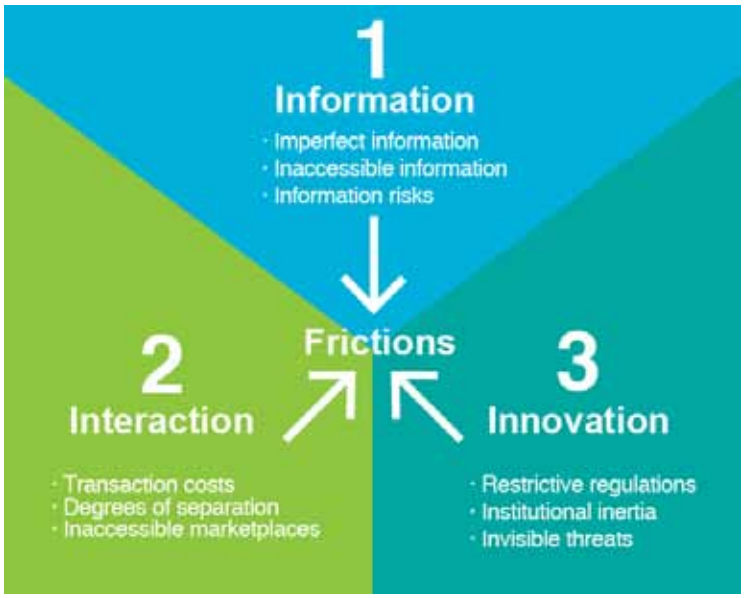
Today, a number of frictions – of varying degrees of importance to different industries – add costs and remain a drag on global business and trade (see Figure 1). They have the power to slow us down and sometimes to stop us cold.

Information Frictions

Imperfect information. Participants in a transaction don't have access to the same information. In the age of big data, that can put them at a disadvantage, potentially diminishing the value for their full ecosystem. Too often, information may also be incorrect or inconsistent, leading to bad decisions or delays while reconciling it.

Inaccessible information. The potential value of abundant data and information is greatly constrained by the technical challenges of storing, processing, sharing and analyzing it. As a result, much information is not collected or remains inaccessible.

Information risks. Technological risks to information, from hacking to cybercrime and privacy concerns to identity theft are on the rise. These incur growing costs, as well as damage to brand reputations.



The cost of organizational complexity

Economist Ronald Coase introduced the theory that transaction costs are lower for institutions than individuals. However, in recent years as enterprises have scaled, the added complexity of operations has grown exponentially while revenue growth has remained linear. The result? At a certain point, organizations are faced with diminishing returns. Blockchains have the potential to eradicate the cost of complexity and ultimately redefine the traditional boundaries of an organization.

Figure 1: Frictions framework: Information, interaction and innovation frictions challenge business efficiency

Source: IBM Institute for Business Value analysis.

Interaction Frictions

Transaction costs. The cost of conducting business is a function of its complexity and grows with scale, its size and the resources that need to be managed, including intermediaries. In almost every case, the cost of complexity yields diminishing returns.

Degrees of separation. As the world flattens and digital platforms connect disparate parties, distance has shrunk, but delays remain due to arcane business processes. Business transactions that take days and are costly to manage via intermediaries are prime for disruption by nimbler competitors.

Inaccessible marketplaces. Many local economies lack access to an efficient or trusted marketplace, unable to exploit their assets. Even large enterprises are confronted with barriers, and have assets that remain dormant and don't contribute to revenue growth or the creation of wealth.

Innovation Frictions

Institutional inertia. With success, organizations calcify; legacy systems and bureaucratic processes slow down their responsiveness and ability to change. This sclerosis renders them particularly vulnerable to digital disruption, and impedes their ability to innovate and adapt.

Restrictive regulations. Highly regulated industries are stifled by delays; cross-border operations are curbed by conflicting regulations. Of course, some frictions are by design and are intentionally built into the system. While automation can lower costs and speed up regulatory processes, it cannot entirely eliminate governance through regulation.

Invisible threats. New competitive business models made possible by new technologies are threats for which organizations can't plan. For many, this growing uncertainty will disrupt continued business success. Both small organizations and nimble larger ones will try new approaches. And although many will fail, some will redefine entire industries.

As these frictions fall, near-term achievable benefits include reducing time, cost and risk. Over time, and as both industries and societies grow their use of blockchain networks, we anticipate structural changes to business models across industries – and as a result, even to economies as a whole.

Why Fight Friction?

Consider a universally common asset, such as land. Bound by arcane processes that define the transfer of property, laws in both the developed and developing world are ambiguous.

A landowner in Honduras may have no record of his property and even have it possessed by another party. It's estimated that nearly 60 percent of the land in Honduras is undocumented.[2] These owners aren't just precluded from selling their land; they can't raise capital or credit from it, and are effectively locked out of the economy.

In countries like the U.S., the housing market faces a different problem: lack of transparency on who owns – and thus carries the risk associated with – a mortgage. Ownership is muddied in large part by complex financial instruments, such as collateralized debt obligations (CDOs). The chain of transactions grows increasingly disputable, depletes trust, accrues added costs and can have grave consequences, as we saw in the 2008 financial crisis.

The work of Peruvian economist Hernando de Soto on the importance of property rights to economic development inspired the First Annual Block Chain Summit in May of 2015.[3] De Soto calculates that some 5 billion persons and USD 20 trillion have been shut out of the economy due to disputed assets.[4] Participants at the conference asked: If blockchain technology could unleash wealth like this, what else might it do?

The network of participants required to securely document an asset like a property record illustrates how complexity takes its toll (see Figure 2). In this example, participants manage their own ledgers to record transactions and have access to different information, which is also vulnerable to tampering.

By contrast, assets from cars to warranties, art to corporate bonds – even assets that are aspects of our identity, like health or tax records – can be shared, exchanged or transferred on a blockchain platform with far greater efficiency and far less risk. With friction at our backs, we can move with new speed to remake our future.

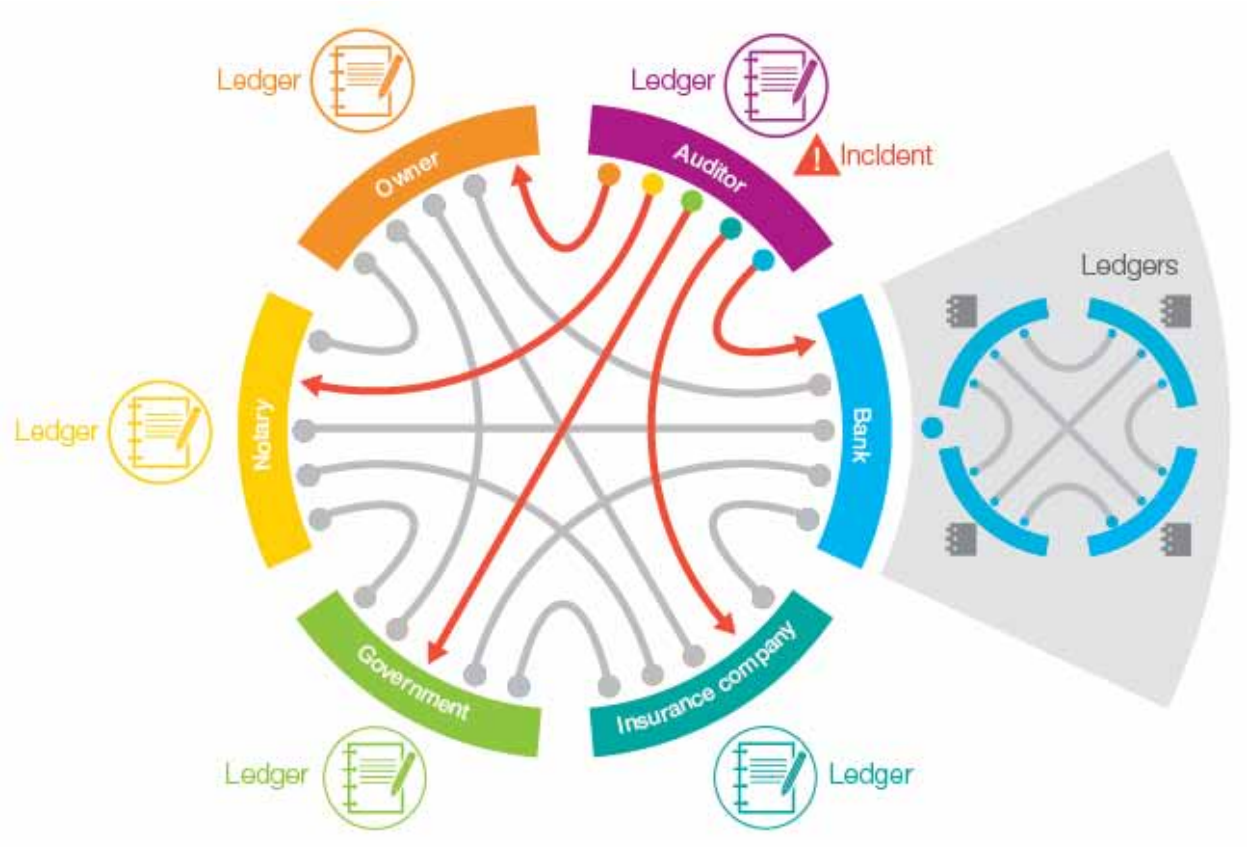


Figure 2: Current view: Individual ledgers and organizational siloes complicate how information and incidents are managed in the network

Source: IBM Institute for Business Value analysis.

Engineered for Motion: How Blockchains Propel Us Forward

Today, transactions are recorded in multiple ledgers. Each one captures at best a moment in time and reflects the information held by a single party: Bank X purchased or sold a mortgage, for example. They don't record what happens next, what came before, or the role of others

– partners, suppliers, consumers – in the transaction. Moreover, they're prone to human error and vulnerable to tampering.

By contrast, distributed ledgers can be shared and updated in near real-time across a group of participants (see Figure 3). Every transaction becomes part of the permanent record and can be scrutinized by those that have permission – and relevant information can be shared with others based on their roles and access privileges.

Today, cross-border payment transactions occur over secure and reliable messaging infrastructure like SWIFT. Banks send messages back and forth on SWIFT to accomplish various tasks, with each bank maintaining its state of the task locally. One can imagine a blockchain-based approach where banks send messages on the blockchain that represent the shared state of the task, with each message moving the task to the next state in its lifecycle.

Figure 3: Future view: A shared ledger built on blockchain offers visibility, trust and permanence

Source: IBM Institute for Business Value analysis.

Blockchains shift the paradigm from information held by a single owner to a shared lifetime history of an asset or transaction. Instead of messaging-based communications, the new paradigm is state-based. Information that was once obscure now becomes visible.

Friction in Free-fall

Blockchains can be "permissioned" or "permissionless." Unlike their permissionless counterparts, permissioned blockchains enforce identity-based policies that can constrain both access to data and network participation. This enables participating organizations to comply with data protection regulations. Permissioned blockchains are also more effective at controlling the consistency of the data that gets appended to the blockchain, allowing for more granular decision processes to be built on top of them.

But common to both is a set of attributes (see Figure 4). Our research suggests that five blockchain attributes are instrumental in stripping out frictions.

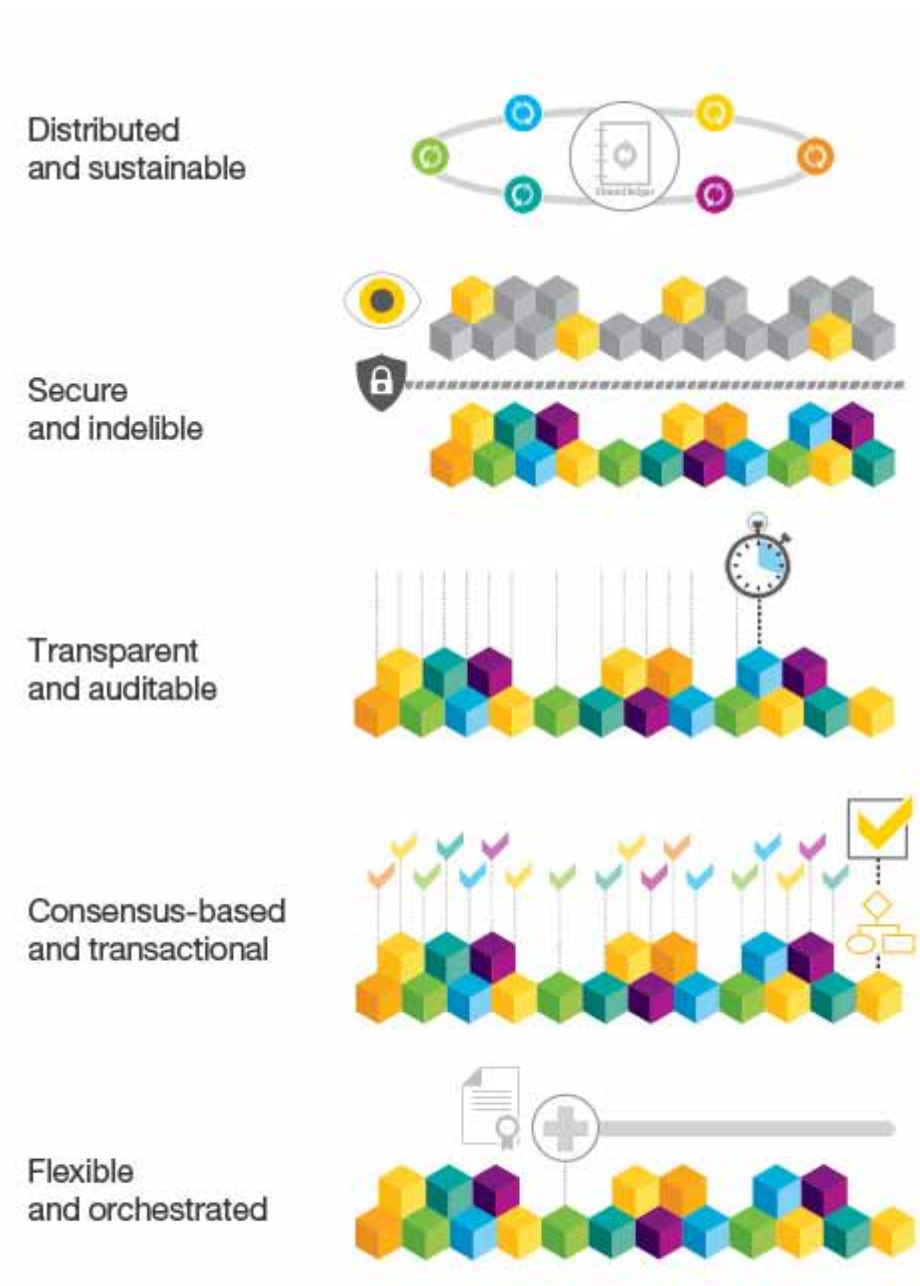


Figure 4: Blockchain attributes framework: Five are key to reducing frictions

Source: IBM Institute for Business Value analysis.

It takes a community: Hyperledger collaboration

The full potential of the blockchain is unleashed when it operates across ecosystems. The Hyperledger Project at the Linux Foundation is a shared and open source development project to identify and advance the features of blockchain across industries.[5]

It brings together partners in the finance, technology and other related industries. Accenture, ANZ Bank, Cisco, CLS, Credits, Deutsche Börse, Digital Asset, DTCC, Fujitsu, IC3, IBM, Intel, London Stock Exchange, R3, State Street, SWIFT and Wells Fargo were its founding members. Since then, many more members have joined.[6]

Distributed and sustainable. The ledger is shared, updated with every transaction and selectively replicated among participants in near real-time. Privacy is maintained via cryptographic techniques and/or data partitioning techniques to give participants selective visibility into the ledger; both transactions and the identity of transacting parties can be masked. Because it is not owned or controlled by any single organization, the blockchain platform's continued existence isn't dependent on any individual entity.

Secure and indelible. Cryptography authenticates and verifies transactions and allows participants to see only the parts of the ledger that are relevant to them. Once conditions are agreed to, participants can't tamper with a record of the transaction. Errors can only be reversed with new transactions.

Transparent and auditable. Because participants in a transaction have access to the same records, they can validate transactions, and verify identities or ownership without the need for third-party intermediaries. Transactions are time-stamped and can be verified in near real-time.

Consensus-based and transactional. All relevant network participants must agree that a transaction is valid. This is achieved by using consensus algorithms. Blockchains establish the conditions under which a transaction or asset exchange can occur.

Orchestrated and flexible. Because business rules and smart contracts that execute based on one or more conditions can be built into the platform, blockchain business networks can evolve as they mature to support end-to-end business processes and a wide range of activities.

Blockchains transforming ecosystems

Supply chains are prime examples of blockchain's potential for transformation that spans industries. Initial blockchain efforts could have quick impact by transforming even a small portion of the supply chain, such as the information used during importing. If import terminals received data from bills of lading earlier in the process, terminals could plan and execute more efficiently and without privacy concerns. Blockchain technology could make appropriate data visible in near real-time – for example, the departure time and weight of containers – while making inaccessible the information about the owners and value of the cargo. Costly delays and losses due to missing paperwork would be avoided.

Blockchains could also enable a robust and secure exchange for shared logistics, coordinating a vast array of activities from sharing spare space in a warehouse to optimizing truck fleets and shipping containers. Retailers and manufacturers could greatly improve demand forecasting and stock replenishment. Financial institutions, armed with a detailed track record of a supplier's reliability, could extend much needed credit to fuel the trading industry. Regulators could trace the origin of goods from raw materials, making it easier to identify counterfeit items, as well as sources of tainted materials.

The value derived from something as fundamental as a blockchain-enabled bill of lading ripples out beyond the port of entry to span many industries (see Figure 5). For blockchains, true transformation and network effects kick in not just with the number of users that join a blockchain network, but the variety of industries and activities that come together.

Figure 5: Improving interactions: A blockchain-enabled bill of lading spans many industries

Source: IBM Institute for Business Value analysis.

Toward Perpetual Motion: New Business Model Possibilities

As blockchains vaporize friction, the economic equation will change. Our analysis of frictions across the business network is indicative of how far friction can fall when blockchains are put in place. We studied how frictions across a lender, the mortgage lending ecosystem and the housing economy, normalized on a scale of 100, respond to attributes of the blockchain (see Figure 6).

"Blockchain provides a revolutionary approach that enables businesses across industries all around the world to completely change their logistics business and operations. We're excited about the potential for blockchain to transform logistics value chains into a more seamless process that provides a trusted view of every piece of cargo."

Mika Lammi, Head of IoT business development at Kouvola Innovation, Finland

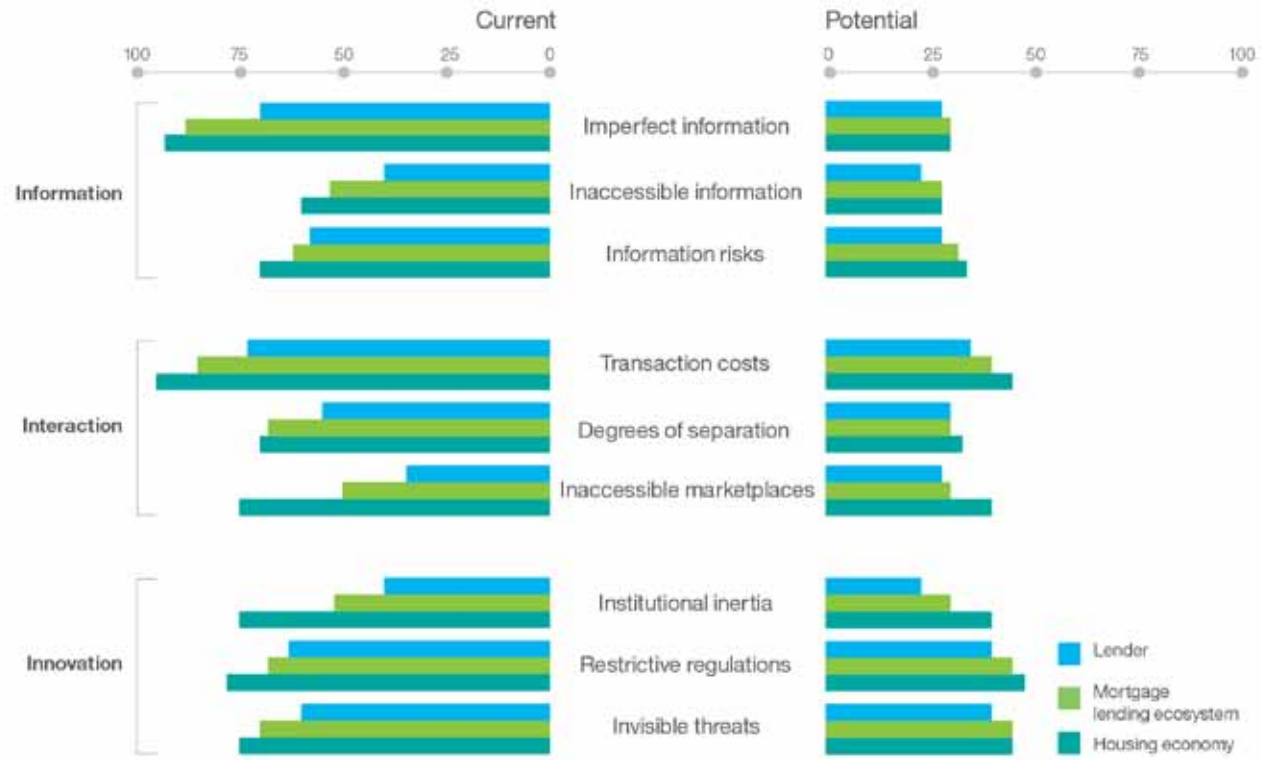


Figure 6: Better business: This is an illustrative example of the relative degree of increased efficiency blockchains make possible for each type of friction

Source: IBM Institute for Business Value analysis.

The leveling effects across frictions at various level of the economy are startling. They suggest that transaction costs and enterprise friction could be so greatly reduced that organizations will be transformed in ways not yet imagined. Ecosystems can operate with much more robust trust. Blockchain networks, by propelling the movement of capital and exchange of value, can change how markets function and expand economic opportunity.

A change as monumental as this would reset the clock on the science of organizational management, the tightening of trust and the economics of wealth creation (see Figure 7). What happens next can't be forecast with certainty. But as blockchains eradicate friction, they will recast our institutions and economy in new form.

Figure 7: Transformation triad: Three ways that enterprises, ecosystems and economies can benefit from blockchains

Source: IBM Institute for Business Value analysis

We know – thanks to Hayek – that information is best used when it is not centralized, and when it is not being monopolized by some central institution. We know that flat and non-hierarchical systems use info best… New innovations like the blockchain make this possible."

Patrick Byrne, CEO, Overstock[8]

A New Science of Organizations

The modern enterprise was built on friction – or rather, it assumed the structure it has today to harness friction to one's advantage. Once friction topples, radically new kinds of organizations could emerge. The cost advantage of Coase's theory, which has been challenged by the added costs of complexity, will become true again: the enterprise can scale more easily than before. It can also stay small and still compete. The size of the organization won't matter – how it's governed will.

Institutions once vertically integrated can scale laterally through partners. Activities guided by smart contracts can be executed at high speed and efficiency. Stripped of some hierarchy and bureaucratic controls, organizations won't just change the way they work, but what they choose to do. Pricing, profitability and ownership will need to be reconsidered.

Because of their distributed nature, blockchains will evolve over time and are potentially self- sustaining. Businesses that are born on a blockchain will surely assume new forms. The most novel may be the capacity for an organization to act autonomously.[7]

As blockchain-based transactions become more sophisticated, the business network as a whole will achieve greater levels of autonomy, reducing the need for human governance and ultimately evolving into self-governing, cognitive business networks. These autonomous organizations will stretch our definition of what it means to be a dynamic enterprise.

The Tightening of Trust

In business, trust is incredibly hard to engineer and impossible to guarantee. Until now, we've relied on instruments and institutions to be surrogates for our trust. With blockchains, trust can be embodied in the transaction itself. A far greater assurance of trust is now possible.

As this heightened sense of trust pervades the ecosystem, third parties that were once necessary to broker trust will be disintermediated. Smart contracts, certifications and digital compliance on blockchain networks will codify trust at the level of the individual transaction. This codification of trust can optimize transactional relationships, making business interactions across ecosystems far more efficient.

Trust will become a dynamic state: Depending on the role of the participant and the particular transaction, individuals and institutions can be deemed as trusted, semi-trusted or untrusted. A financial institution could trust an overseas partner to do X but not Y, for example.

Today, online rankings and ratings are proxies for trust. In the future, reputation systems built on blockchains will serve as a permanent record of an organization's or individual's behavior. Ledgers, once the system of record for business, become a robust record of trust – for business and government alike.

A New Nexus for Value Exchange

Blockchain networks can give commerce the attributes of assurance and provenance; and with that, new markets can be created to foster value exchange across the whole of the digitized world. Industries once shut out of digital commerce, from agriculture to construction, will find new access to ultra-efficient, trusted marketplaces. And as with the example of land in developing nations, blockchain asset registries can empower once-dormant assets to join the global economy.

An all-in economy unleashes a torrent of value creation – and also new competitors. Across industries, profit pools will shift and be redistributed among industry competitors, incumbent organizations from other industries, new players and even consumers. Governments that curtail fraud and bureaucracy can create a better social contract with their citizens. The field of science, which has always stood on the shoulders of giants, now has a secure platform for collaboration on everything from medical research to renewable energy.

But all of this will require more than a blockchain platform. Like mobile apps before them, a new generation of decentralized apps will make blockchain technology accessible to the shopkeeper in Nairobi, the individual who generates solar power in Tucson and the inventor with a 3D printer in Bangalore.

As blockchains speed up the flow of capital and the creation of wealth, our economy and interactions will be less subject to the fits and starts of friction, and instead head toward something more like perpetual motion.

"In cyberspace, trust is based on two key requirements: prove to me that you are who you say you are (authentication); and prove to me that you have the permissions necessary to do what you ask (authorisation). In return, I will prove to you that I am trustworthy by delivering services or products to you in a secure, efficient and reliable fashion."

"**Distributed Ledger Technology**: beyond block chain, A Report by the UK Government Chief Scientific Officer" [9]

"We believe this technology has the potential to drive change across the industry, but will need to be developed in partnership with customers and industry participants under an open source approach."

Moiz Kohari, EVP, Group head of technology innovation, London Stock Exchange Group

Blockchains in Practice

Blockchains first gained attention as a platform for cryptocurrency. Since then, non-currency assets on the blockchain have grown 1,600 percent to reach USD 1.6 billion between 2013 and 2016.[10] Now, 45 banks have formed the R3 consortium to address what's next.11 BNY Mellon in New York is working on applying the blockchain to transfer assets in securities lending.[12] The Japan Exchange Group is testing blockchain technology for trading in low liquidity markets.13

Blockchain technology is nascent, but other pioneers are already demonstrating its power to overcome friction.

Speedy access to capital. The retailer Overstock won government approval to use blockchain technology for the global issuance, settlement and trading of corporate bonds. The private bonds Overstock issued offered same-day settlement instead of the 2 or 3 days it typically takes now. That doesn't just speed access to financing; it can reduce the risk of naked short selling – selling securities without owning them first.[14]

The "e-Citizen." In Estonia, citizens can verify the integrity of the records held on them in government databases and are assured they are tamper-proof. That sense of security has made possible new digital services like e-tax and e-Business Register. Together with NASDAQ, Estonia is now offering a blockchain-based e-voting service that allows shareholders of companies listed on Estonia's NASDAQ exchange to vote in shareholder meetings.[15]

In the driver's seat. Visa and Docusign came together for a proof-of-concept that meets the demands of impatient consumers. The pilot registered cars on a blockchain and asked potential owners to step into the driver's seat to configure lease options on the dashboard, receive a contract immediately and click to sign. New owners could then choose among insurance options and pay the first installment directly. Future in-car payments, from downloaded music to parking to driver's registration fees are also expedited from the dashboard – all before the new owner drives off the lot.[16]

Faster dispute resolution. The IBM Global Financing Unit, which facilitates credit among 4000-plus suppliers and partners worldwide and handles 2.9M invoices a year, is using blockchain technology to reduce dispute times from over 40 days to under 10 days and free up about USD 100 million in capital that is otherwise tied up at any time.[17]

Disrupting the disruptors. New blockchain-based start-ups are attacking business models like Uber that were themselves only born yesterday. La'Zooz, a pilot in Israel cuts out the middlemen – in this case, professional drivers – and establishes a trusted system that allows car owners to share rides with each other.[18] Arcade City allows riders to directly negotiate rates with drivers.[19]

Putting Blockchains to Work for You

While blockchains can be extremely powerful in their ability to overcome friction and improve efficiency, trust and value, businesses must carefully evaluate where blockchains can provide the greatest gains and where they do not. They are not simply a modern database replacement; they bring the most value as a shared system of record. Blockchain-based business networks also require checks and controls across the system at the same speed to achieve the full advantage of instantaneous sharing.

To best extract value from blockchains, we recommend businesses answer three questions.

1. How Fast Should I Move?

First movers and early adopters can position themselves for quicker returns and sharper competitiveness by leveraging blockchain efficiencies.

Identify the most compelling use cases by considering which frictions are holding back your enterprise. Our frictions framework can help evaluate the current inefficiencies in your business.

Experiment in discrete areas where the attributes of blockchains drive rapid impact. Our attributes framework can help evaluate which features of the blockchain can provide the greatest benefit.

Consider agile proofs of concept and incrementally expand scope for major business results. Use insights from earlier, more limited projects to re-engineer and implement larger efforts, for example see Figure 8.

Blockchain considerations

- Value is limited within the boundaries of one organization
- Ecosystem participants have to agree on a standard
- Risk of overregulation exists without coordinated control
- Efforts may require large scale re-engineering.

Figure 8: Example of adoption patterns: From simple compliance ledgers to high-value markets

Source: IBM Institute for Business Value analysis.

Get more of our blockchain research

This cross-industry report is the first in a blockchain series we'll develop over the coming months. We plan to interview over a thousand executives on their experiences, intentions and expectations about the technology's impact on their businesses.

Future reports will offer industry-specific perspectives. As each becomes available, it will be posted on ibm.com/business/value/blockchain

Projects that expose blockchains to consumers can't rest exclusively in the hands of technologists; use design thinking to simplify the user experience for employees and consumers to drive rapid adoption.

2. Can We Achieve Network-wide Accepted Standards?

Success in blockchain adoption will depend not on who has the best technology or app, but who can build the strongest network.

Recognize the need for global standards: Blockchain innovation may accelerate faster and scale further than the internet did – requiring standards even sooner. Place your bets and invest your time now.

Explore the role of alliances and consortia in making blockchains scalable, open and interoperable. Blockchains will benefit from open-standard governance. Consider how your ecosystem could best benefit from network effects, and how profit pools might be redistributed in your industry or ecosystem. Then evaluate your role in this disruption.

Play for the long term – consider the blockchain as the new business environment and collaboration the optimal way of working. Consider with whom you should partner to create the optimal business network.

3. How Can I Scale With New Revenue Models?

Although implementing new technologies may be daunting, understand how they can help your business profit and scale quickly.

As business models are disrupted by blockchains, think through how you can make money in new ways. Consider business models and markets that will benefit most from consumption- based pricing, licensing and micro-payments.

Understand how blockchains will extract further value from other technologies, such as big data analytics, the Internet of Things and cognitive computing.

Explore how new blockchain-based services and apps can complement and scale existing revenue models.

In cases where revenue is not the objective, such as in government, evaluate how blockchains can free up capital or help secure privacy.

Study Team

The IBM Institute for Business Value brought together a core team of blockchain experts and business thinkers to envision the future of distributed ledgers:

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For More Information

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"The Economy of Things: Extracting new value from the Internet of Things." Veena Pureswaran and Dr. Robin Lougee. IBM Institute for Business Value. June 2015. ibm.biz/economyofthings

"Empowering the edge: Practical insights on a decentralized Internet of Things." Veena Pureswaran, Sanjay Panikkar and Sumabala Nair. IBM Institute for Business Value. March 2015. ibm.biz/empoweringedge

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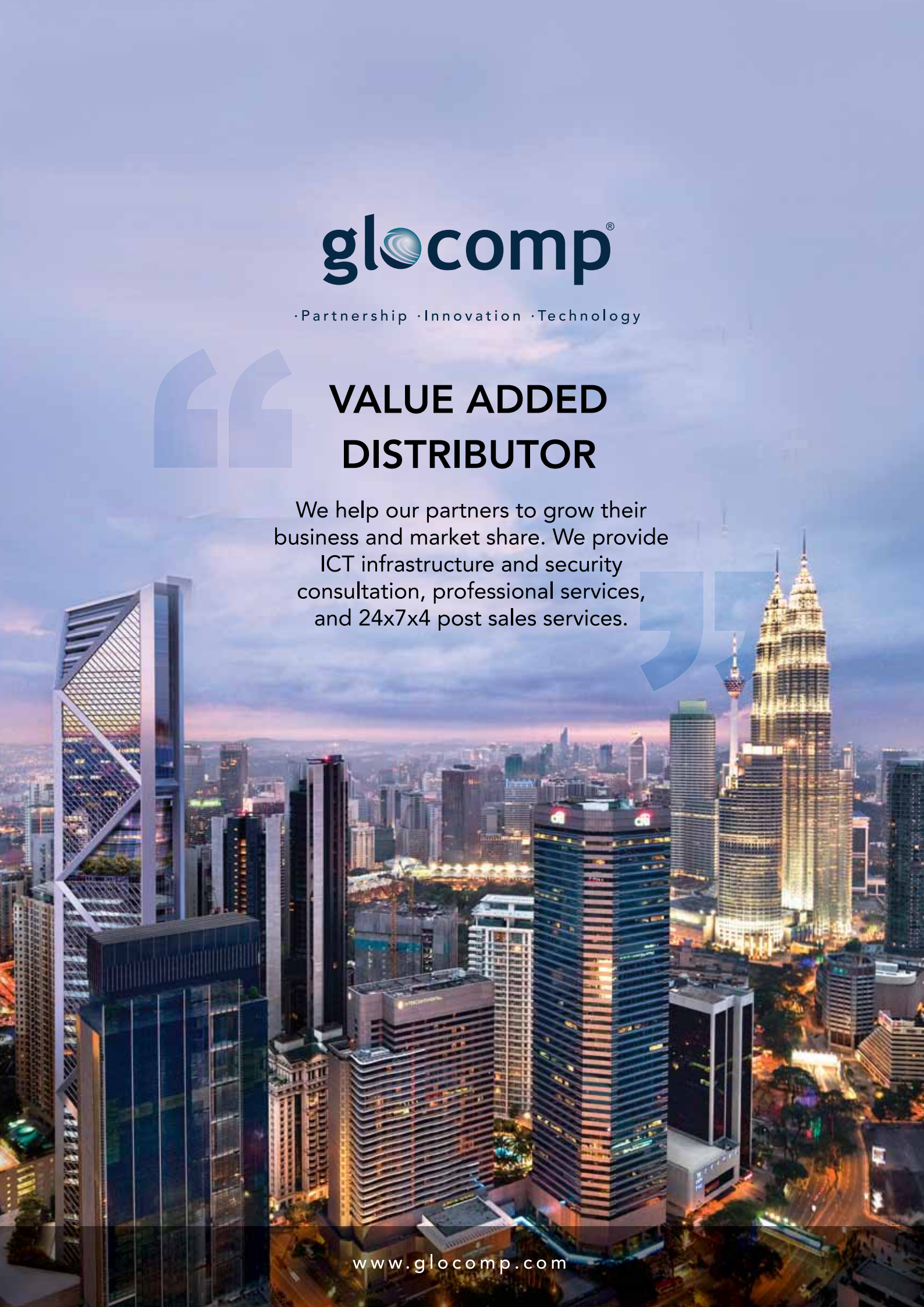

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Isn't Blockchain and Bitcoin the same thing?

That is a common question on many people's minds. When it comes to greenfield technologies like Blockhain, it is imperative to define and then redefine the technology in its most current context to quell or correct any misconception.

Definition of Blockchain from blockgeeks.com

The blockchain is an undeniably ingenious invention – the brainchild of a person or group of people known by the pseudonym, Satoshi Nakamoto. By allowing digital information to be distributed but not copied, blockchain technology created the backbone of a new type of internet. Originally devised for the digital currency Bitcoin, the tech community is now finding other potential uses for the technology.

The following section explains key terms from the definition commonly associated with Blockchain and could unlock the mystique that surrounds this technology.

Satoshi Nakamoto: The mysterious and unknown inventor(s) of the Bitcoin set out with the intent to create a truly borderless currency. They not only created a digital cryptocurrency, but they also extended the logic and created a truly borderless operating mechanism (a ledger) that could not be owned, operated or controlled by a large corporation or sovereign state. Hence, the emergence of Blockchain!

Distributed: The Blockchain is designed to be a distributed ledger and as has been pointed out by many experts, this concept is not new. A distributed ledger is not one core database with multiple copies but is comprised of a network of multiple hosts. Only when new data is safely replicated in over 50% (or any such pre-defined %) of the hosts, does that data become part of the ledger network.

With Blockchain, the concept of 'hyper distribution' has come into play - distribution of data in hosts or nodes across borders sometimes running into the thousands and making it truly distributed.

Tech Tip: Hosts in the Blockchain context are called 'nodes'. The common rules that all nodes follow to establish validity of incoming data are called 'consensus'. The process of validating incoming data using consensus rules is called 'mining'.

Immutable & Verifiable: While these two words are not part of the definition mentioned earlier, these are key outcomes of a truly distributed database or ledger like the Blockchain. Once information is put in the Blockchain and gets validated and distributed, it becomes immutable - It cannot be modified or deleted. Further, its verification becomes easy because the information source can be tracked thus creating trust - in essence, we know that the data has not been tampered with and we know where it came from.

New type of internet: This is where it gets interesting! The Blockchain is a distributed database or ledger that anyone can connect to either publicly or by being a part of a consortium (which will be explained in 'Types of Blockchain' section below). It rides the internet backbone and is like the internet itself - an information super highway except that you can rely on the information, can transact with it securely, and exchange value or data with parties who you do not know but whom both parties can trust - establishing 'inter-party trust' that is difficult to achieve with the open internet. Hence, this new type of internet emerges.

Other potential use cases: The Blockchain is being used by banks for cross border remittances (e.g: Emirates Bank, UAE) or for conducting KYC (e.g: Santander, UK), by governments to establish citizens' identity (e.g: Estonia), by logistics companies to validate supply chain milestones as goods are transported (e.g: BiTA), by the education world to validate student credentials (e.g: MIT), by land registries to establish provenance (e.g: Sweden), by asset registries to track ownership (e.g: Sotheby's) and many more innovative and fascinating ideas that are at varied stages of development. Blockchain is also likely to cause the explosive growth that has eluded the IoT space as it solves the key problems - the identity, ownership and privacy of connected devices.

Given the definition above, is Blockchain the solution to everything lacking in the internet - trust, data security, privacy? Is it the real Internet 3.0? How can data be

private if it is publicly distributed? If it is a database, how come large amounts of data cannot be stored on the Blockchain?

As with most new technologies, the Blockchain has morphed itself with increasing business complexity. Let us address each question one by one.

Blockchain Variations – There Is No 'One Size Fits All' Approach

The Bitcoin Blockchain is a 'public' or 'permission-less' blockchain. All information on it is open for access to the public. It is much like the bus or urban rail. Anyone can use it. So, this version of the Blockchain is best suited for use cases like attributing ownership of public information.

Example: A song played via the internet could be validated using the blockchain as being owned by a band every time it was played so only that band gets credit/paid for it and no one else anywhere in the world can fraudulently claim it as their creation.

The above logic, of course, will not work well in situations like bank accounts or other personal information like medical records, educational credentials or business information. In order to effectively handle such use cases, versions of the Blockchain have been created.

These are versions that continue to have all benefits of the Blockchain, but come with enhanced controls or permissions - permissions for who can insert what data and permissions for who can view and consume that data.

Continuing with the comparison above, this version is like Uber. It is also public transport but the app controls who uses it and who the drivers are. Such Blockchains, are called 'permissioned' or 'consortium' Blockchains.

Use cases like banking networks or identity validation networks within a particular jurisdiction (one country, one industry) are using Permissioned Blockchain instances. However, for data to be reliable and trustworthy, such a consortium must still adhere to core Blockchain principles - nodes must be distributed to multiple parties who cannot and will not act in collusion while consensus rules for data validity must be followed.

Lastly, there are always use cases that utilise new technology in a very controlled setting. Such needs gave rise to 'private' Blockchains. In line with our transport comparison, this would be like a privately-owned car. Only the owner can drive it, when they want to, and where they want to.

One might argue that such a setting defeats the very purpose of the Blockchain. While that is a valid argument, consider use cases where competing businesses which do not trust one another need to find common ground.

Take for example four music label companies which all claim ownership of a song because the band which created it fraudulently sold exclusive rights to all 4 four of them exposing them to legal claims.

These four labels might agree to create a private Blockchain where the bands would have to create a verifiable claim of their songs before giving exclusive rights to one music label. If any band tried selling the same rights to another label, they would be caught because the labels can now verify if the band's claim is valid and free of encumbrances.

On the other hand, till such time the band does not give the label company details of their claim, data on the private Blockchain would be stored in a manner that no label company can automatically identify which band owns a claim and which label has the rights to it!

Why Can't The Blockchain Store Large Amounts of Data?

It is a straight forward answer - because it would then be difficult to distribute. For example, if a user tried to add a 1GB movie file to the Blockchain, it will have to be distributed instantly across multiple nodes, validated and added to that Blockchain. It would take a long time and the people or businesses operating the nodes would be required to have large computing and storage capabilities. Alternately, the Blockchain only stores small bits of information about that 1GB file. Anyone with permission can access that information from the Blockchain to

verify if the file in their possession matches the original. This method makes the entire network very efficient and the underlying data is still rendered immutable. These 'bits of information' being mentioned here are like 'digital fingerprints' of original data which will not match with original fingerprints in case the data was altered in any way.

Tech Tip: The digital Fingerprint creation process is called 'data hashing' in the encryption world. Information about hashing is easy to find and understand.

What Is the Future?

"It is not in the stars to hold our destiny but in ourselves."
William Shakespeare

Little did Shakespeare know that what he said will ring so true when the Blockchain is discussed in 2017! As clichéd as it sounds, the future of anything is defined by our imagination, our needs and the solutions we seek. But if one must risk a guess, the following areas will certainly be transformed:

Fintech: The full convergence of financial technology with operational use cases will be made truly possible with the Blockchain. Simple implementation cases are now starting to emerge. An eCommerce company is now able to be a KYC provider to banks and banks are now able to issue working capital loans instantly by relying on trustable business data. These are just seeds of a revolution. Every individual or business will potentially be a bank themselves, being secure custodians of their own value. Banks as we know them today will be efficient market place service providers enabling deployment of that value where it is most needed to match the desired risk-return appetite for their customers.

Inter-party trust - The most profound change in the immediate term will be in business and P2P transactions. Establishing trust will now be easy and instantaneous. A student can directly send her credentials to her next university for admission and

not have to rely on her college because her data is verifiable. Businesses no longer need to wait at a bank to get a 'Letter of Good Standing' or call their auditors for a 'Letter of Support' to validate their financial report because they are empowered with verifiable claims. Transactions will be faster, cheaper and trusted. There will no longer be a need to rely on paper and first or third party verification as these will be instantaneous - locally or globally.

Public Services - Another area of profound change will be in public and government services. Transparency, reliability and simplification will be key outcomes. Governments will have to become 100% transparent, be it in how they distribute resources, deliver services and conduct elections. The function of trust will be distributed and no longer owned by the governments. This isn't a far-fetched prophecy. A live example would be the Estonian elections, which are now fully online. Over US$10 billion in public distribution leakage has been plugged in India by digitising citizen identities. And Blockchains has still not been deployed in these examples.

In conclusion, Blockchain, as a concept, has unleashed a wave of irreversible changes. Blockchain technology itself and its surrounding ecosystem must adapt and keep pace with this change. The benefits are far too vast and too pervasive to ignore.

"The best way to predict the future is to create it."
Peter Drucker

Parag Jain *is the Co-Founder and CEO of ThynkBlynk, creators of www.CHAINtrail.com.*

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"There is no escaping the digital age as business leaders identify both risk and opportunities in an age of data, disruption and new technology."

BDO Global Risk Landscape 2017 publication

Today, the total global Fintech funding remains strong, with US$8.2 billion invested in Q3 of 2017 according to the recent KPMG 'Pulse of Fintech' report despite the fact that the number of deals has declined. The US continues to lead global Fintech investment with US$5 billion across 142 deals with Europe and Asia lagging considerably by only accounting for US$1.66 billion in investment via 73 deals, and US$1.21 billion via 41 deals respectively.

There is no doubt that Fintech has proven to be a big disruptor to the FSI today. While technology and innovation can potentially compete with traditional financial methods in the delivery of financial services, there are still challenges such as regulatory compliance, risk management and data security to be overcome. However, it is not only the FSI that is disrupted per se, but this suite of innovations has also changed consumer behaviour and opened up new opportunities for businesses to offer services which were not possible before and at a lower cost. Regulators, especially in the FSI, are equally disrupted by Fintech.

As such, it is important to realise that there are a number of key players in the Fintech ecosystem. On one hand, you have Fintech technology solution providers endeavouring to infiltrate the market with their innovations, and on the other side of the spectrum, you also have regulators trying to stay ahead of the game. In the middle of this value chain, you also have the traditional brick and mortar financial institutions attempting to emulate and offer Fintech-type services and products but are hampered by regulatory controls and constraints. Each of these parties faces challenges of different nature and complexities.

What Are The Common Fintech Disruptions Today?

The use of smartphones for mobile banking and investing services is so pervasive today that they have literally replaced the need to visit physical branches to access most financial services. Other technology innovations and devices including mobile banking, mobile trading on commodities exchanges, digital wallets and mobile wallet systems are just some of these innovations that make financial services more accessible to the general public.

New technologies, like machine learning, predictive behavioural analytics, artificial intelligence (AI), data-driven marketing and learning apps will certainly have an impact and a key role in revamping the traditional processes and resulting in more effective decision-making outcomes while also minimising human errors and reducing fraud. It can potentially open up a whole world of opportunities for the industry.

While the FSI has been protected by regulations even from economic upheavals; this new wave of technologies and start-ups is increasingly changing the landscape of the financial industry. The biggest value proposition of Fintech is not only on its impact of cost, but also the increased speed of transactional activities.

Fintech has certainly changed the way business is conducted today. For example, approval of a loan can be secured within hours if not minutes and at a fraction of the cost as opposed to the traditional model of visiting your favourite banker. Crowdsourcing for funds is another example of a platform for innovative ideas to

be funded from anywhere in the world and at a speed that traditional fund raising models just cannot emulate, let alone compete against. Mobile payments will also provide ease of transfer of funds domestically and internationally, and at a cheaper and faster rate.

There are also regulation-related technology (known as RegTech) with algorithms that can process data including unstructured data to effectively automate risk management. RegTech provides alerts and dashboard reporting, detects potential fraud and supports both tactical and strategic decision making. This can potentially lower the cost of compliance while mitigating the risk of non-compliance. At the same time, it minimises the need (and cost) for human intervention. Such Fintech solutions are found in the Swiss FSI.

Another disruptive technology that has appeared in the Fintech scene is "Robo-advisory". As the term suggests, it is a form of automated advisory on financial matters and other wealth management services which requires little or no human intervention. While it will not totally replace the need for human advice, these automated services can often be the first level of advice offered before the traditional 'one-on-one' and more personalised services. These are again based on algorithms, which attempt to automatically seek the best allocation to manage and optimise investors' assets depending on their risk appetite and other requirements. Such solutions can potentially be extended to a larger investor base and at greater speed.

Blockchain technology, in particular cryptocurrencies, is perhaps one of the most debated topics in recent months. Most central banks have chosen to treat this with caution and remain on the fence, while some e.g. China has outright disallowed them in their market. The biggest fear (by the regulators) is that they are not in any printed form or controlled by the central bank; and any transactions undertaken are outside the regime of the traditional financial system. In essence, in a cryptocurrency blockchain, it allows individuals to store and transfer their assets peer-to-peer using digital cryptocurrencies. More often, the value of the transaction is on the basis of willing 'buyer-seller' prices. It is certainly a ready-made platform for illegal activities and transactions, which is the biggest concern of the regulators.

Another common barrier against cryptocurrency's use is the difficulty of exchanging digital tokens for real goods and services, particularly in face-to-face transactions. Now there is an emerging solution to this problem known as the crypto debit cards. As the name suggests, it is like the traditional debit card but loaded with cryptocurrency. Whether this will be accepted like the traditional debit card remains to be seen.

Contrary to some perception, Financial Technology (Fintech) is not a recent buzzword related to the Financial Sector Industry (FSI). As early as 2015, an Accenture report had already noted that global investment in Fintech leapt from US$930 million in 2008 to over US$12 billion by the beginning of 2015.

Accenture News release, 26 March 2015

What Are The Major Challenges?

Data is at the core of the business models regardless whether they are corporate or retail consumers. Whoever can derive business insights from the data has the potential to not only maximise opportunities, but to also exploit them. Hence, it is important to realise that data security and transparency are fundamental elements in the Fintech sector, not only to meet compliance objectives but also to safeguard reputations. Data security is consistently a major concern for all regulators as the risks of data security breaches are high in such an environment where financial

transactions are involved. As a result, priority must always be focused on protecting consumer and corporate financial data. Most Fintech companies are proactively turning to cloud technology to meet increasingly stringent compliance regulations.

Being a vital requirement for Fintech companies, a licence to operate remains the main challenge. As more and more regulators are clamping down on money-related activities, many Fintech companies are finding themselves in a precarious position as they have the solutions, but don't have the necessary licence to operate.

Regulatory compliance is another area that can be a stumbling block to Fintech players. While many professed that their technology solutions can solve problems and enhance efficiencies, being compliant from a regulatory point of view is another major challenge. More often, these regulatory compliances are based on traditional brick and mortar models and stringent risk management principles are always embedded deeply into these regulations. It is not surprising that these regulations stem from adverse risk appetites on privacy issues, money laundering, terrorist funding, consumer (depositors) risks, fraudulent (cybersecurity), credit quality and capital adequacy. Ultimately, the impact of such risks has a bearing on the overall national sovereignty risk rating or ranking.

Protecting the IP of innovative products is another obstacle as some business models cannot be patented depending on their jurisdictions. Issues on copyright and trade secrets can surface when you think you are ready to launch. While an industry-wide adoption is to be encouraged, the market must also be ready for the products. Hence, timing of the registration of IP rights and launch of the products are equally crucial.

It is also very difficult and complex to assess whether the innovative new products fall within the ambit of regulatory regimes and their impact by the legal requirements. This problem is further compounded if the products are marketed across borders. These uncertainties can be stumbling blocks as well as result in cost escalation.

The other common issues include industry acceptance, marketing and funding. Most financial services-oriented startups tend to be underfunded. Their attempts to offer innovative complex financial services while facing inherent regulatory constraints and cost considerations can really be an uphill battle. Their competitors often have deep pockets and extensive resources; and who would not hesitate to defend their traditional turf.

As per the KPMG 'Pulse of Fintech' global report, although Fintech is seen as the biggest disruptor for financial institutions, there remains a lack of effective strategies for adoption. According to the survey in the report, only 46% of the institutions surveyed have a Fintech strategy in place. This is not surprising and depending on the market that you are in, it may be difficult to source for Fintech human capital and talent. A strategic partnering approach with start-ups could be an effective model to mitigate this issue.

While Blockchain cryptocurrencies trading was created with good intent to safeguard assets against inflation and to allow investors greater control over their assets, it has potentially created a huge 'disruption' to the traditional financial system over which regulators currently do not have any control or safeguards. Most speculate that it may also be a bubble waiting to burst.

How Is The Landscape of Fintech Development On The Home Front?

Many banking regulators worldwide have adopted a balanced approach in dealing with this kind of disruption in the FSI space. Instead of rejecting them, many have chosen to be part of this innovative supply-chain process. Like in other countries, Bank Negara Malaysia has used the 'sandbox' approach by providing the opportunity and a platform for Fintech start-ups to experiment with their innovations and at the same time guide them in terms of the rules and regulations governing the sector. More significantly, it is also an opportunity for regulators to learn from this process when drafting any potential changes to the existing regulations and future laws.

The Securities Commission Malaysia (SC) has also been very proactive on this, collaborating with several regulators in major financial centres with the objectives of spurring and regulating emerging enabling technologies for the financial sector. Referred to as 'Fintech' bridges, they can facilitate greater content sharing on trends, legal and regulatory requirements. The first agreement signed between the SC and the Australian Securities and Investments Commission (ASIC) was in June 2017. In addition, the SC was also the first jurisdiction in this region to introduce and regulate equity crowdfunding (ECF) in 2015, and subsequently via peer-to-peer (P2P) financing regulations in 2016.

Other recent innovative initiatives by the SC include the launching of the Digital Investment Management (DIM) framework this year for automated discretionary portfolio management services. They are expecting a licence to be offered in 2018. Another pilot project explores the usage of Digital Ledger Technology for the Over-The-Counter market space, which could lead to the creation of a secondary trading platform in crypto currency and digital assets.

MDEC also plays a role in creating this ecosystem by bringing the stakeholders together to spur industry development and foster partnerships. Their partnership with Supercharger Asia is a typical example of an inaugural platform to accelerate the developmental pace of Fintech. Over a period of 3 months, Supercharger will work with 10 selected Fintech companies and their unique and complimentary solutions to improve financial services in the areas of security, customer experience, new products and services. This can give rise to potential collaboration opportunities with other financial institutions within the country and the region.

"Business Leaders feel unprepared for the digital age, with 88% of CEOs believing that failure to innovate and embrace technological changes are the risks their business are most unprepared for"

BDO Global Risk Landscape 2017 publication

In Reality!

While the benefits of deploying Fintech are far reaching, in reality there are many hurdles to be overcomed before they can reside seamlessly and be aligned with traditional financial services. The integration issues are creating security vulnerabilities and generating new risks for consumers of digital financial services.

Fintech is an important game changer for the financial industry and while the challenges are numerous, an important reminder is the fact that there are still a lot of people around the world that do not have access to basic financial services and SMEs still cannot get decent credit. Micro-financing is already a fast growing instrument in providing financing to the lower income echelon especially in the ASEAN region. With Fintech, it can certainly help to streamline the processes and narrow it if not close this gap.

Perhaps a more collaborative approach among key players such as the regulators, traditional institutions in FSI and Fintech solution providers will be more conducive in minimising this disruption!

Woon Tai Hai *is the Executive Director of BDO Consulting.*

Behavioural Economics and the Risks of Technology Adoption in the Digital Age

In the convergence of physical and digital worlds, technology users are moving more into a realm requiring trust in tech that is not physically present on-site and therefore beyond traditional means of control. Understanding how people deal with and perceive risk in the digital age is crucial for understanding the adoption and management of technology going forward. To do this effectively, it is important to think about how we think about risk. This article will discuss the behavioural economics concept of risk perception and also present some findings from research conducted into this topic in Malaysia.

These days, it is rare that a week goes by without a major news story about technological innovations that are changing the business world. It is also rare that a week goes by without hearing a story about companies or governments suffering from massive breaches in cybersecurity. As advances in technologies such as artificial intelligence, big data, cloud computing, and many others continue to surge forward, Chief Information Officers (CIOs) and other business leaders are faced with balancing the potential benefits of adopting game-changing tech with the possible catastrophic risks that come with a hyper-connected and digital world. At the same time, technology vendors need to find ways to convince buyers that the risks involved with new technologies are outweighed by the rewards that these tools can bring.

No one can deny that cybersecurity is one of the biggest issues of this generation. During my time at IDC (International Data Corporation), many surveys showed that the biggest barrier to new technology adoption in Malaysia was worries over security risks. Malaysia is certainly not alone in its concerns. A recent global study by Dell found that while cloud adoption was positively correlated to business growth, security risk was the top concern regarding the technology for 52% of organisations. The same study showed similar fears of security risk as a major barrier for adoption of mobility and big data solutions.

So how do people make decisions on technology adoption in conditions of uncertain risk? While we would all like to believe that we make these decisions and risk assessments in a rational and logical way, the fact is that with new technologies, because there is a lack of existing data and evidence to use as a basis for quantitative risk assessment, much of the judgement of risk relies on perceptions – or even "gut feelings"- which are susceptible to bias. Today's fast-changing technology risk landscape is tricky to navigate and there is a need to look to other sources to provide a more comprehensive view of risk.

Behavioural Economics

This year's (2017) Nobel Prize in Economics went to Richard Thaler in recognition of his contributions in the field of behavioural economics. Behavioural economics combines learning from psychology, economics, neuroscience and other areas and has emerged over the past several decades as a challenge to the notion that human behaviour and decision-making is generally rational. Instead, what Thaler as well as other leading thinkers in this area have put forward is the notion that much of the way that we think and decide is often less than rational and that we use "heuristics" or rules of thumb – sometimes consciously but often unconsciously - to make decisions. Behavioural economists have also shown that much of human behaviour and thought is affected by cognitive bias and this has helped to reshape how we understand the world.

Much of the work in behavioural economics has been done with fields such as economics, financial investments, health choices, and public policy, but it is expanding out to other areas including technology adoption and management.

Risk Perception

One area of focus within behavioural economics is the study of risk perception and its effects on decision making. Risk is an interesting concept. It is often linked in our minds with danger, but it is also acknowledged as crucial to success in business and life. From a behavioural economics point of view, risk is about statistical probability but it is also about psychology – perception rather than reality. It has been found that factors such as familiarity, trust, and controllability have significant influence on risk perceptions and can outweigh rational and probabilistic analysis.

These influences can lead to distorted judgements – also known as "probability neglect" - in the assessment of actual danger and points to people's lack of innate abilities to analytically understand and correctly

predict risk. For example, "dread risks" - risks seen as particularly horrific or severe in magnitude - are often tied to probability neglect as people tend to overestimate the likelihood of a dread risk occurring while underestimating the probability of risks from more mundane activities. One example of this is that although people are many times more likely to die in a car accident (1.3 million per year globally with 20-50 million injured) than to be killed by terrorism (20,000-25,000 per year globally with most occurring in war zones), the dread fear of terrorism often causes people to vastly inflate estimates of its probability while most people underestimate their chances of having a car accident.

One of the most important findings to arise is that risk perception is not static, but rather malleable and subject to the influence of emotions, heuristics, and biases. Two of the biases that are frequently linked with risk perception are "**availability**" and "**affect**". The availability heuristic refers to the tendency to put greater weight on issues that readily come to mind so in the context of risk perception this means that a risk event that a person has been exposed to by the media or that has affected someone close may be perceived as a bigger risk than another issue that is less salient.

The **affect heuristic** refers to emotional rather than probabilistic views of risk that are influenced by positive or negative feelings – our instinctive and intuitive feelings – rather than rational analysis. In other words, if we feel that a certain technology is beneficial or if we like it, we are less likely to perceive that it is risky.

Given the importance of risk perception in influencing new technology adoption, there is a new and growing interest in applying some of these psychological and behavioural principles to get a better understanding of technology buyers and users.

Research in Malaysia

To get a view on how some of these behavioural economics theories might be in play in the Malaysia technology market, I conducted research with the hope of contributing to the nascent body of work on understanding behavioural risk perception in the adoption of technology. In late 2016 working with PIKOM and the London School of Economics and Political Science, I surveyed 100 business executives in Malaysia and built an exploratory model for measuring and analysing risk perceptions of eight emerging technologies (Table 1). The theoretical basis was developed from a model called the psychometric paradigm and customised to be relevant for the field of technology adoption. The psychometric paradigm is a well-established psychological tool that uses multivariate analysis of risk characteristics to understand underlying relationships among risk perceptions.

The sample was split between IT 'experts' (CIOs and others in technology management) and 'non-experts' (from other roles such as general management or sales). The sample was structured this way to reflect recent industry trends toward decentralisation of technology procurement; where previously almost all purchase decisions were made by

Technologies
Artificial intelligence
Big Data/Analytics
E-payments/online payments
Integrated, complex applications on the Cloud. Mission critical applications such as enterprise resource planning or supply chain management
Internet of things
Mobile devices (such as phones or tablets)
Public Cloud Storage (for documents or data)
Stand-alone applications on the cloud such as collaboration, productivity, or customer relationship management tools.

Table 1: Technologies researched

	Riskiness	Damage	Controllable	Known risk	Usefulness	Ease of use	Feeling	Trust
Artificial Intelligence	4.85	4.95	4.71	4.17	5.20	3.80	5.62	4.62
Big Data	4.71	5.02	**5.02**	4.46	**5.91**	4.53	5.92	**4.95**
Mobile Devices	**5.44**	5.23	**5.13**	**5.35**	**6.39**	**5.60**	**6.39**	4.88
Internet-of-Things	**5.32**	5.03	4.83	4.61	5.71	4.55	5.89	4.74
Stand-alone cloud apps	**5.46**	5.03	**5.26**	**4.98**	**5.84**	**4.95**	5.91	**5.15**
Integrated/complex cloud apps	4.94	**5.52**	**5.14**	**4.93**	5.63	4.54	5.81	**5.01**
Public cloud storage	**5.46**	**5.47**	4.75	**5.12**	5.79	**5.20**	5.91	4.88
E-payments	**5.28**	**5.76**	**5.08**	**5.42**	**5.92**	**5.18**	**6.37**	**5.15**
Mean of characteristic	*5.10*	*5.25*	*4.99*	*4.88*	*5.79*	*4.79*	*5.97*	*4.92*

Bold text = above average

Table 2: Risk characteristics for 8 technologies (mean score on 7-point scale)

technology specialists such as CIOs, the pervasiveness of technology applications has brought others into the equation. Marketing, finance, human resources, and others now have advanced technology solutions specifically geared to their areas of responsibility and are therefore increasingly involved in judging technology benefits and risks. Decisions on tech adoption are now made at many different levels of the organisation – even by individuals downloading and using apps on phones and other devices.

Research Results

In addition to mapping out the eight technologies' risk characteristic profiles (Table 2), the research uncovered many interesting findings. For the purpose of this article, I will focus on three areas: non-experts and availability bias, conflation of risk probability with severity of damage, and the affect heuristic.

Non-experts and Availability Bias

With regard to the overall ranking of perceived risks of new technologies, there were not huge differences between experts and non-experts (Table 3). However, where there does appear to be a difference is in how susceptible non-experts are to availability bias as compared with experts.

Within the study, I attempted to trigger the availability bias by priming a randomly selected set of respondents with a statement regarding the risk of adopting new technology and then assessing whether this would affect their risk judgements. While experts showed no significant differences whether or not they had been given the statement, non-experts showed significantly higher perceptions of riskiness when the idea of risk was "available" in their minds. This finding suggests that non-experts were more susceptible to the availability priming and agrees with other risk research that has found that non-expert risk perception is more prone to bias while experts tend to be more stable in their perceptions.

Why does this matter? Because it is becoming more normal for non-experts to be involved with or even responsible for technology purchase decisions. If their views on risk are more easily biased then this may hamper their ability to make the best and most rational decisions. It also points to a need for close cooperation between IT experts and other lines of business within organisations.

Riskiness	Non-expert	Expert
1	Public Cloud	Mobile Devices
2	Mobile Devices	E-payments
3	IoT	Public Cloud
4	E-payments	IoT
5	AI	Integrated Complex Cloud apps
6	Integrated Complex Cloud apps	Stand-alone cloud apps
7	Stand-alone cloud apps	Big Data/Analytics
8	Big Data/Analytics	AI

Table 3: Riskiness rankings, Non-expert vs. Expert

Conflation of Risk Probability With Severity of Damage

For seven out of the eight technologies measured and most clearly for mobile devices, big data, and artificial intelligence, if respondents felt that a technology has more potential for severe damage, then that technology was often also rated higher on the probability of an incident occurring. In reality, most major incidents that do major damage such as full-scale hacker attacks or massive losses of data occur only rarely while relatively low-damage incidents such as work delays from temporarily crashed systems would be much more likely to happen. This aggregation of probability and severity is in line with other psychometric paradigm research where dread risk perceptions (such as for terrorism or nuclear power) are often correlated with increased beliefs about the likelihood of a risk incident - suggesting probability neglect.

Why does this matter? Our ability to judge risk based on instinct is not as accurate as we think it is and may lead to mistakes in how the risks of new technology are assessed. In-company experts as well as ICT vendors need to help potential customers understand true probabilities of risk while recognising that innate biases will be difficult to overcome. There is a need to recognise that if solid information and data is not provided, then potential customers will make their own risk judgments and these may be subject to personal biases.

The Affect Heuristic

Looking at this study through the lens of the affect heuristic, I found mixed results. Behavioural economists have generally found that the more positive feelings and benefit associated with a technology, the lower the risk perception will be. In this research, some technologies followed this pattern. For example, higher ease-of-use perceptions for Big Data, Internet-of-Things and Stand-alone applications were correlated with lower scores on perceived Damage. Also, positive feelings about both Mobile Devices and Stand-alone applications on the cloud were correlated with lower perceptions of Riskiness. However, I also found a trend in five technologies where positive feelings (Feeling and Perceived Usefulness) were linked to higher perceptions of Riskiness or Damage. This could be explained by the nature of the respondents. As the research was done with a sample drawn from PIKOM, a technology industry group, it is not surprising that many members have strong positive feelings toward these technologies and perhaps also have the capacity to recognise that they bring high risks.

Although it did not come through clearly in this survey, the affect heuristic should not be ignored. Risk judgements can be clouded by positive or negative feelings that are not actually related to the true, probabilistic risks involved with a given technology. Separating feelings and emotions from risk judgements is very difficult and maybe even impossible to achieve, but efforts should be taken to be sure that the risks of new technologies are assessed as clearly and rationally as possible.

Going Forward

Technology investments are often costly and risky, but also have the potential to transform business strategies and results. It is certain that new and exciting technologies will continue to find their way to market. It is also certain that technology buyers will need to find a balance between sensible risk avoidance and the embrace of technology. Overall, understanding the psychology and dynamics of risk perception can help to cast some light on how people perceive the risks and benefits of new technologies and create awareness of biases that should not be ignored. A better path forward may be to rethink how risks are being assessed and fostering an environment of clear risk communication and education among expert and non-expert business leaders as well as the vendors of new technologies. There is no doubt that CIOs and other leaders will continue to face difficult choices when it comes to tech adoption and hopefully they will benefit from better understanding and using behavioural economics in informing the decisions they make.

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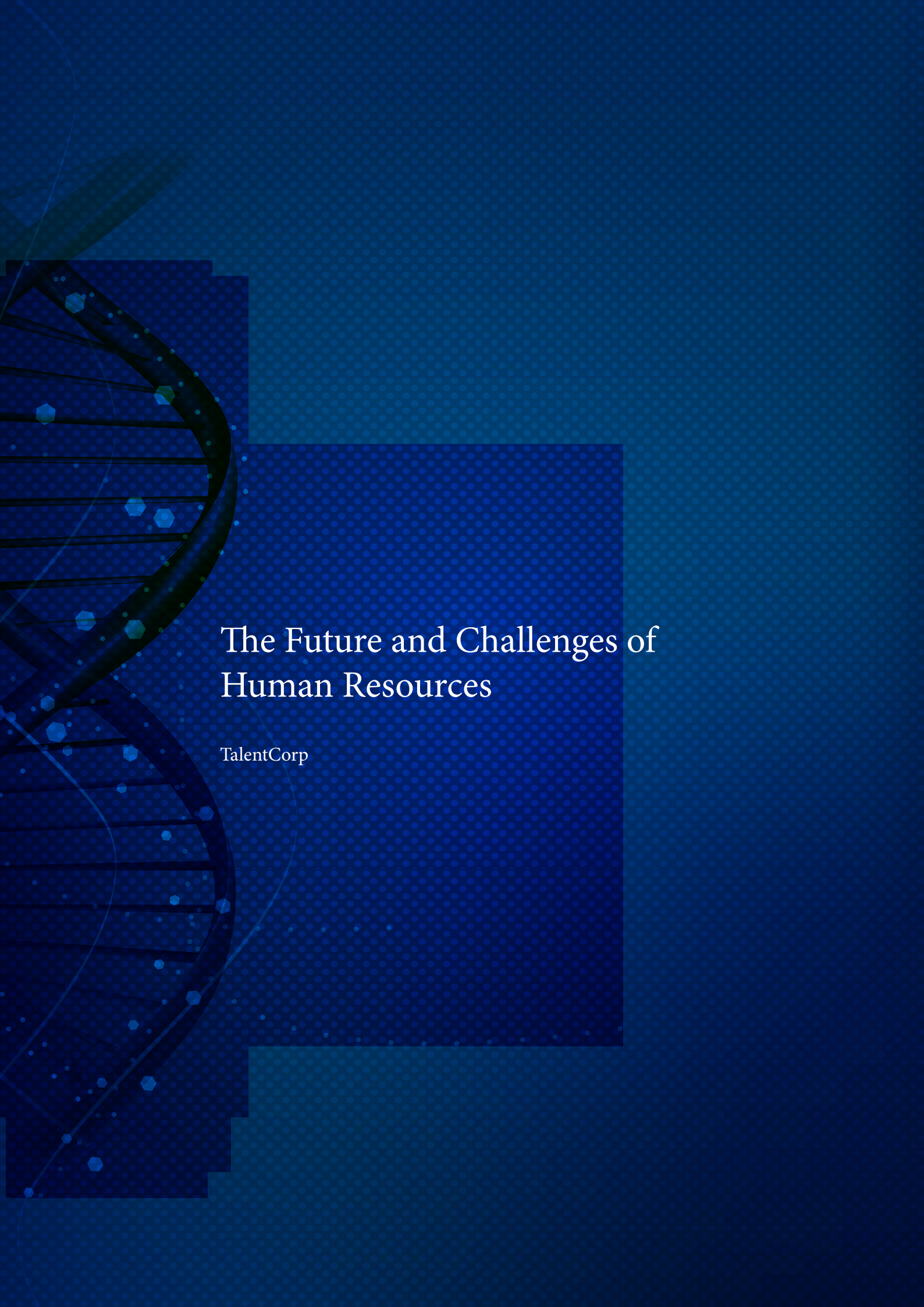


The Future and Challenges of Human Resources

TalentCorp

The nature of work and subsequently, the nurturing and retention of talent has evolved quickly in the space of merely a decade. Malaysia, seeking to nurture and retain job-ready workforces to add value and depth to local industries, faces critical challenges in its talent landscape.

Three Critical Challenges

The first challenge – the skills mismatch in talent – is not new to Malaysia. As the country rode the boom in the electrical and electronics and oil and gas sectors towards the end of the 20th century, the disparity between university output and industry needs, especially in the technical space, became more apparent.

As Industry 4.0 swings into full force globally, and Malaysian manufacturing facilities begin to embrace smart factories, machine-to-machine learning, artificial intelligence (AI), and Big Data – the gap has started to widen again as manufacturing roles change to evolve around the new technologies in place. Not only are skilled technical workers in short supply, those in the sector need to be upskilled to work with new technologies in place.

The second challenge lies in retaining female workers, who comprise half of Malaysia's talent pool, and yet many are seen exiting the workforce in their late 20s to early 30s – in the prime of their careers due to family commitments. Malaysian women do not typically return to the workforce in their later years, unlike peers in Japan and South Korea[1].

Many of these women have expertise vital to the organisations they support, as well as to the pipeline of future talents. Malaysia's female labour force participation rate stands at 54.3 per cent[2], putting the country on track towards its target of 59 per cent by 2020. The government also targets to have women account for 30 per cent of the boards of directors in the top 100 public-listed companies on Bursa Malaysia by 2020.

Another critical challenge facing Malaysia's talent landscape is tied to talent mismatch and the urgency in addressing skills gaps within key economic sectors. The evolution of roles in the Malaysian workforce has been largely impacted by the introduction of technology to increase productivity, reducing the need for semi-skilled roles. From 2013 to 2015, the ratio of workers in high-skilled and low-skilled occupations increased, while that of semi-skilled occupations declined[3].

Though semi-skilled roles such as office workers and machine operators continue to account for the bulk of the Malaysian workforce (60.7 per cent)[4], it will continue to compress, and both academia and employers will need to find a way to reskill or upskill people in these roles. By 2020, the government expects the services sector to account for 56.5 per cent of national GDP, employing 9.3 million workers, mostly in high-skilled jobs[5].

Talent Strategies

With these three challenges in mind, TalentCorp – tasked with attracting, nurturing and retaining the best and right talent, underlined in the Economic Transformation Programme – is taking various approaches in narrowing the gaps within the Malaysian labour force while nurturing it to be future-ready.

The first approach is built around key initiatives aimed at influencing the Malaysian employment market. The Critical Occupations List (COL) highlights skill gaps in the local talent landscape across 10 sectors: (i) Oil, Gas & Energy, (ii) Petrochemicals, (iii) E&E, (iv) Medical Devices, (v) Financial Services, (vi) Telecommunications and Multimedia, (vii) ICT and GBS, (viii) Professional Services (Accounting), (ix) Aerospace, and (x) Education.

This creates opportunities for the COL to influence policymaking across other facets of the Malaysian government such as immigration or education policies. Initiatives linked to the COL are TalentCorp's Returning Expert Programme (REP), Residence Pass-Talent (RP-T), the Immigration Department's Employment Pass,

1. Retaining Women in the Workplace (TalentCorp and ACCA, 2013)
2. Labour Force Survey Report (Department of Statistics Malaysia, 2016)
3. Labour Force Survey Report (Department of Statistics Malaysia, 2013-2015)
4. Labour Force Survey Report (Department of Statistics Malaysia, 2015)
5. Eleventh Malaysia Plan (2015).

government scholarships, up-skilling and re-skilling programmes, and courses offered by institutes of higher education, including TVET.

Another backbone initiative is the Nurturing Expert Talent (NEXT), the national talent data analytics platform. This proprietary assessment system profiles and maps current and future talent, in addition to identifying and forecasting talent and market needs. It also assesses talent's 21st century employability skills.

TalentCorp's efforts also include programmes targeted at Malaysians at different phases of their career paths, as well as high-skilled foreign talent.

TalentCorp works with industry players and tertiary institutions to provide young talent with greater career awareness and industry exposure, and to channel input on curriculum to upskill the nation's graduates in line with industry requirements. Through its Industry-Academia Collaboration (IAC), TalentCorp partners the Ministry of Higher Education (MoHE) to bring employers into universities with the aim of addressing skill gaps in the immediate term and subsequently, content and syllabus from such programmes will be embedded into the education system to address talent needs in the longer term. Together with MoHE, TalentCorp also facilitates the Structured Internship Programme, which aims to offer practical, industry-relevant work experiences that will enhance a graduate's employability, as well as provide tax incentives for employers who provide quality internships.

On the women side, encouraging employers to recruit and retain women on career breaks is a priority for TalentCorp. Its Career Comeback programme has been helping women find opportunities to return to work with over 100 employers. Another point to consider when bringing women back to the workforce is the availability of flexible work arrangements (FWAs). TalentCorp works closely with employers on offering FWAs as a key strategy to attract and retain women in the workforce.

Talent mobility enables the nation's economy to reap the benefits from the return or contribution of Malaysians who have studied or worked overseas as well as highly-skilled expatriate talent. Besides balancing the inflow of talent within the country, talent mobility encourages brain circulation and enables employers to tap on these talent to close the critical skills gaps within our key economic sectors. TalentCorp's initiatives to leverage on global talent include: (i) the Returning Expert Programme (REP), which facilitates the return of Malaysian professionals from abroad to overcome the shortage of professional and technical experts in the country; (ii) the Scholarship Talent Attraction & Retention initiative, where Government-funded graduate scholars are allowed to serve their bond of service by working in the private sector; and (iii) the Residence Pass-Talent (RP-T), a 10-year renewable pass for highly qualified expatriates to continue to reside and work in Malaysia.

With Malaysia's aspirations to emerge as a knowledge intensive and innovation-led economy, these talent will allow us to continue learning from global best practices and knowledge.

Future of Work

Industry 4.0 is changing the face of manufacturing with the increase in automation, robotics and AI. Furthermore, the services sector is not exempted from the impact that Industry 4.0 brings with it, as it dramatically alters work, the workplace and the workforce. The nature of work has also changed, with more independent contractors entering the workplace with the rise of the gig economy.

These trends will undoubtedly bode well for some, but it is highly likely that many others in the workforce will fall by the wayside – unless businesses, leaders, and policy makers work together to ensure that talent are equipped for the fast-evolving nature of job roles.

The nation needs talent that is both globally competitive and locally relevant to help us navigate through the challenges of this new reality. Talent strategies must be relooked and revolutionised, and keep up with the increased desire from talent, to determine how their workplaces will serve them.

Understanding that, TalentCorp is prepared to work hand-in-hand with the government, industry, learning, institutions and talent to expand Malaysia's talent pipeline, increase talent mobility and promote talent diversity to prepare the nation's workforce for the future of work.

PIKOM's new Cybersecurity Chapter was launched on 2nd October 2017.

The Chapter aims to create a heightened awareness of the growing threats to cybersecurity, seeking to play an advisory role to the government on policy formulation; engage with academicians and other stakeholders in addressing talent pool issues; and promote career prospects in the industry. The chapter will also collaborate with Chief Information Officers (CIO) across the industry to promote knowledge sharing and propagation of best practices.

PIKOM Councillor Alex Liew currently heads the chapter, which also includes appointed advisors from the private and government sectors, namely former PIKOM chairmen Woon Tai Hai (2011-2013) and Cheah Kok Hoong (2013-2015), and CyberSecurity Malaysia Chief Executive Officer Dato' Dr. Haji Amirudin Abdul Wahab as well as Malaysia Digital Economy Corporation's (MDEC) Chief of Information Security Victor Lo.

For the first time in conjunction with the launch of the PIKOM ICT Strategic Review 2017/2018 report, a special edition on cybersecurity has been incorporated into this annual publication. This special edition consists of a collection of valuable insights on the recent state and trends on cybersecurity, with the articles contributed by renowned internet security firms - Symantec, Trend Micro, LGMS, FireEye and Cisco.

Symantec:
Internet Security Threat Report

Trend Micro:
Enterprises still trip over old vulnerabilities

LGMS:
Hacking your own company; before the bad guys do it for you

M-TRENDS 2017:
A view from the frontlines

CISCO:
2017 Midyear Cybersecurity Report

Internet Security Threat Report
ISTR, Volume 22

Financial Threats Review 2017
https://www.symantec.com/connect/blogs/financial-malware-more-twice-prevalent-ransomware

Ransomware 2017
https://www.symantec.com/connect/blogs/businesses-most-risk-new-breed-ransomware

By Symantec

Symantec

FINANCIAL THREATS REVIEW 2017

Executive summary

Financial threats are still profitable for cyber criminals and therefore continue to be an enduring part of the threat landscape. From financial Trojans that attack online banking, to attacks against ATMs and fraudulent interbank transactions, there are many different attack vectors utilised by criminals.

As we had predicted in 2015, we saw an increase in attacks against corporations and financial institutions themselves during 2016. This was evidenced with a series of high-value heists targeting Society for Worldwide Interbank Financial Telecommunication (SWIFT) customers.

While there is no evidence of any such high value heists on SWIFT customers this year, the 2016 attacks saw several such institutions lose millions to cyber criminals and nation state supported attackers such as the Lazarus group.

On average, 38 percent of the financial threats we detected in 2016 were found in large business locations. Most of these infection attempts were not targeted attacks but were instead due to widespread email campaigns.

Although we have seen a 36 percent decrease in detection numbers for financial malware in 2016, this is mainly due to earlier detection in the attack chain and more focused attacks.

With more than 1.2 million annual detections, the financial threat space is still 2.5 times bigger than that of ransomware. For example, the number of Ramnit (W32.Ramnit) detections approximately equaled all ransomware detections combined.

The financial Trojan threat landscape is dominated by three malware families: Ramnit, Bebloh (Trojan.Bebloh), and Zeus (Trojan.Zbot). These three families were responsible for 86 percent of all financial Trojan attack activity in 2016. However, due to arrests, takedowns, and regrouping, we have seen a lot of fluctuations over the last year. For example, Bebloh has all but vanished in 2017 after the Avalanche takedown.

Many new variants of these families have appeared or re-appeared on the market, focusing on filling specific niches. The attackers mainly use scam email campaigns with little variation and simple attachments.

For example, one single Bebloh sample was responsible for 55,000 global detections in 2016.

Japan was the main focus of financial Trojans Bebloh and Snifula (Trojan.Snifula) in 2016, with more than 90 percent of their activity focusing on the country. It is unclear why these two threats shifted their attention but there are indications that they use a shared resource for attacking similar targets.

Globally, financial institutions in the U.S. were targeted the most by the samples analysed by Symantec, followed by Poland and Japan.

We have also seen trends in financial malware attempting to hide configuration files from researchers as well as the move to redirection attacks or even manually logging into the system to issue large transactions if interesting financial software is detected.

This paper is an update to last year's paper (Financial threats 2015). While Symantec and other researchers have published various research focusing on individual threat families, this report will discuss the overall changes we have noticed in the financial threat landscape in more detail.

Key findings

Cyber crime hit the big time in 2016, with high-profile victims and bigger than ever financial rewards. The Lazarus attacks that took place in 2016 were also the first time there was strong indications of state involvement in financial cyber crime.

Ramnit was the most active financial Trojan in 2016, responsible for 38 percent of activity, followed by Bebloh (25 percent) and Zeus (23 percent).

- Three threat families were responsible for 86 percent of all financial threat attacks.
- Japan was the country with the most infections, followed by China and India.
- Financial institutions in the U.S. were targeted the most by the samples analysed by Symantec, followed by Poland and Japan.
- The number of financial Trojan detections decreased by 36 percent in 2016 (73 percent in 2015).
- Malware authors are obfuscating the lists of attacked bank URLs, making it impossible to extract exact statistics for all threat families.

- Redirection attacks to fake sites have increased again.
- The phishing rate dropped to 1 in 9,138 emails in March 2017.
- The use of free self-service valid SSL certificates on malicious sites increased.
- Mobile banking malware targeted at least 170 apps for credential stealing.
- APT groups are using financial malware to blend in with more common attacks.
- One Bebloh sample alone was responsible for 55,000 global detections in 2016.
- On average 62 percent of financial threat detections were on consumer computers.

RANSOMWARE 2017

Executive Summary

The ransomware landscape shifted dramatically this year with the appearance of two new self-propagating threats in the form of WannaCry and Petya. Both outbreaks caused global panic, catching many organisations off-guard, with infections spreading rapidly across corporate networks.

Prior to these outbreaks, the main threat posed by ransomware was from widescale malicious spam campaigns, capable of sending ransomware to millions of email addresses on a daily basis, in addition to a growing number of targeted attacks directed at organisations.

The arrival of WannaCry and Petya illustrates how malicious threats can suddenly and unexpectedly evolve and catch unprepared organisations by surprise.

The impact of these incidents will not go unnoticed on the cyber crime underground and it's likely that other groups may attempt similar tactics. Because of the nature of these attacks, organisations are particularly at risk (and were the main victims of both WannaCry and Petya). Businesses need to educate themselves about this new avenue of attack and ensure they have defences in place.

At the same time, traditional mass-mailing ransomware attacks remain an on-going threat; and while some spamming operations were disrupted this year, they nevertheless pose a significant risk.

Targeted ransomware attacks, involving the compromise of an organisation's network and infection of multiple computers continue to pose a threat. Although less prevalent than mass mailed threats, the damage caused by a targeted attack is potentially much higher.

Ransomware is now one of the key cyber threats facing organisations and can have a major impact on their bottom line, from financial losses, disruption, and reputational damage.

Attacks where dozens or even hundreds of computers are infected can leave businesses with enormous cumulative ransom demands.

However, ransom demands are not the only potential source of losses. Over the past year, a growing number of firms have gone on the record about the impact of ransomware on their businesses, with a range of major corporations citing ransomware attacks as materially affecting earnings.

Key findings

- The advent of worm-type ransomware is a new and highly disruptive avenue of attack.
- Businesses in particular are most at risk to worm-type threats, which can spread in minutes across poorly secured networks.
- During the first six months of 2017, organisations accounted for 42 percent of all ransomware infections, up from 30 percent in 2016 and 29 percent in 2015. This shift was mainly accounted for by WannaCry and Petya.
- Overall ransomware infection numbers are continuing to trend upwards, powered by the WannaCry and Petya outbreaks.
- The average ransom demand seen in new ransomware families appears to have stabilised at US$544 indicating attackers may have found their sweet spot.
- The U.S. is still the country most affected by ransomware, followed by Japan, Italy, India, Germany, Netherlands, UK, Australia, Russia, and Canada.
- After a dramatic increase in 2016, when the number of new ransomware families more than tripled, the number of new families appearing slowed in the first six months to 16.
- The drop-off in 2017 may indicate that the "gold rush" mentality among cyber criminals is beginning to abate somewhat, leaving the market to be dominated by professional ransomware gangs.

To download the full reports, please visit:

Financial Threats Review 2017
https://www.symantec.com/connect/blogs/financial-malware-more-twice-prevalent-ransomware

Ransomware 2017
https://www.symantec.com/connect/blogs/businesses-most-risk-new-breed-ransomware

Enterprises still trip over old vulnerabilities

Extract from 2017 Midyear Security Roundup: The Cost of Compromise

By Trend Micro

TREND MICRO

With the help of over 3,000 independent researchers who contribute to the Zero Day Initiative (ZDI) programme, we discovered and disclosed 382 new vulnerabilities in the first half of 2017.

Notably, there were drops in the vulnerability counts for the products of three of the largest software vendors in the world: Apple, Google, and Microsoft.

However, the number of zero-day vulnerabilities increased from eight in the second half of 2016 to 49 in the first half of 2017. The supervisory control and data acquisition (SCADA) software vulnerability count also went up from 34 in the second half of 2016 to 54 in the second half of 2017.

We were also made aware of a number of vulnerabilities in some of our products through ZDI, and we have since worked to address them. This patching is in line with our commitment to the continuous improvement of our products and resolution of issues in a timely manner.

Perhaps no vulnerability gained more notoriety in the first half of 2017 than CVE-2017-0144.

The two biggest cybersecurity stories of the period could be traced to this Microsoft vulnerability, which had been taken advantage of by the EternalBlue exploit.

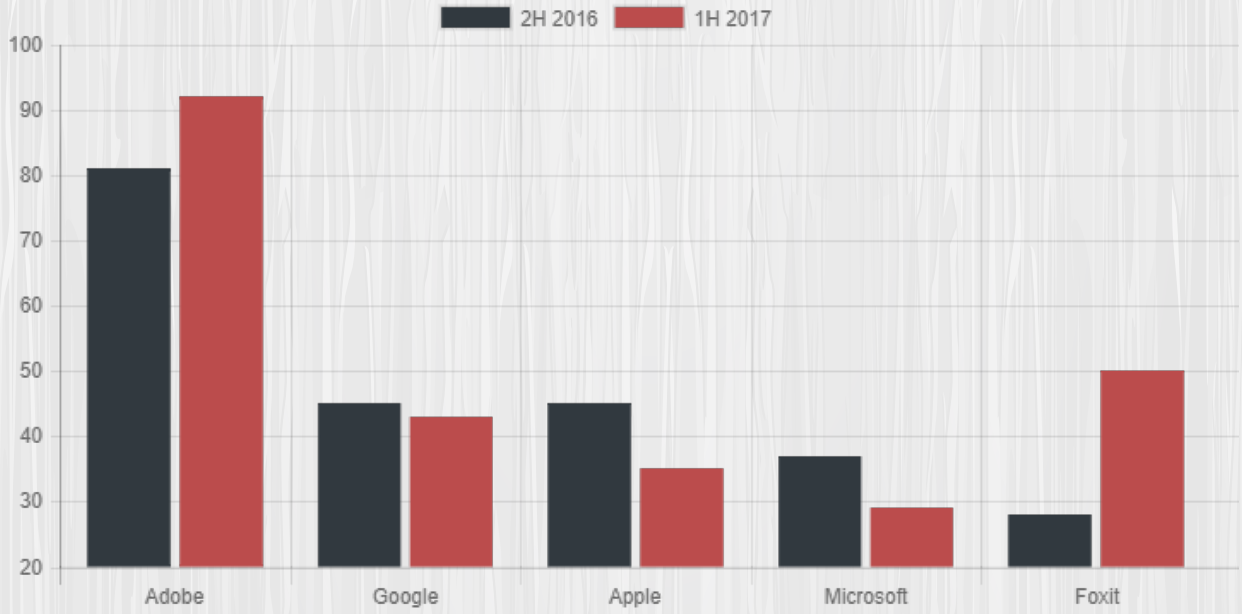
In May, a cyberattack that used EternalBlue - the WannaCry ransomware - caused significant disruptions around the world. This was followed in June by another massive ransomware infection that used the same exploit - Petya.

What is perhaps most lamentable about this double whammy is that even though the EternalBlue exploit was introduced in April 26, Microsoft had already patched the critical vulnerability with a security update released in March.27

To be fair, it can be difficult especially for enterprises to defend their systems from exploited vulnerabilities since patch management is no easy task. There is a great deal of logistics to be considered, not least of which is the manpower necessary to update thousands of units. Patching also often disrupts operations.

Furthermore, some cannot do away with legacy systems that are still in use even as they no longer receive patches. Nevertheless, securing systems from vulnerabilities is necessary. Solutions that provide vulnerability protection in the form of virtual patching can prevent the abuse of unpatched vulnerabilities and secure legacy systems. This effectively keeps networks protected until patches are deployed or even after support for systems has ended.

Cybercriminals take advantage of unpatched and otherwise vulnerable systems to drop their payloads. Leaving systems unprotected can result in network intrusions, opening the door to further attacks like data breaches and ransomware infections.



Comparison of vulnerabilities found in the second half of 2016 and the first half of 2017

Hacking your own company; before the bad guys do it for you

By CF Fong, CEO of LGMS

LGMS

For some of us who are familiar with the term 'hacker', we understand the general public's perception about what they'd imagine a hacker could do - usually in a more negative way. The mass media too, often portray hackers as the embodiment of all evil in cyberspace.

In the real world we live in, there are a group of individuals who havve good intentions in mind; carrying out the mission to 'hack' for a good reason and purpose. We call them the "White Hat Hackers".

Contrary to common beliefs, White Hat Hackers do carry out penetration testing or ethical hacking, just like what the malicious hackers do. However, White Hat Hackers do so with the sole objective of discovering vulnerabilities in the test target, before reporting vulnerabilities and providing recommendations and advice to the target owner.

PENETRATION TESTING IN MALAYSIA

White Hat Hacker services are nothing new in Malaysia. Major financial institutions and telecommunication operators in Malaysia have been engaging trusted security firms that are offering White Hat Hacking services for decades. The engagement frequency is usually based on the organisation's acceptance of risk. With the proactive discovery of loopholes and vulnerabilities, organisations can stay abreast of the latest cyber threats and be able to be vigilant in combating malicious hacking attempts.

A good example is the recent "Wannacry" ransomware attacks. Wannacry ransomware targets vulnerable and outdated Microsoft Windows systems to encrypt files and replicate itself on new targets. Proactive organisations which have been conducting regular penetration testing and vulnerability assessments would have had these outdated Windows systems identified during the testing and assessment exercises. Chances are that they may have already decommissioned these systems or patched them up prior to the Wannacry ransomware pandemic.

WHAT IS VULNERABILITY ASSESSMENT?

There are still much confusion between 'penetration testing' and 'vulnerability assessment'. To understand this further, let us walk through the example below:

Vulnerability assessment is conducted to understand and discover what are the 'vulnerabilities' or loopholes in an assessment target. An assessment target can range from a simple computer to a network of servers and networking equipment.

As the name implies, vulnerabilities assessment's (VA) main objective is to identify vulnerabilities. Security analysts can identify common vulnerabilities by analysing the assessment target from various angles: via the computer software the assessment target is using; the networking function; and sometimes the business functionality of the assessment target.

From a more technical perspective, some assessment targets may exhibit obvious vulnerabilities, for instance, if the assessment target is an old and outdated Microsoft Windows XP system, the analyst can conclude that the assessment target is vulnerable to various SMB protocol attacks, plus any attacks that exists after April 2014 in which Microsoft has stopped releasing patches for its Windows XP operating system.

During the VA, the security analyst may also cross check potential vulnerabilities in an assessment target by referring to a vulnerabilities database relevant to the assessment target. A database commonly used for reference is known as the national vulnerability database (NVD) that is currently maintained by the National Institute of Standards and Technology (NIST).

It is also interesting to note that VA activities mentioned above can sometimes be fully or semi-automated.

There are many software currently in the market that can be used to carry out such assessments. Nevertheless, the accuracy and relevancy of the assessment results are often relative to the tuning of an experienced security analyst.

WHAT IS PENETRATION TESTING?

In essence, penetration testing can be described as an extension of VA.

During the VA process, the analyst would gather vulnerabilities intelligence about the assessment target. Such intelligence can be further exploited by the tester to penetrate into assessment target.

Since vulnerabilities exploitation from penetration testing may potentially introduce different impact on the test target, normally penetration testers would have a structured testing and contingency plan while executing the penetration test. This is the clear differentiation point between a professional penetration tester and a malicious hacker.

Malicious hackers are necessarily concerned about the stability of the testing target whereas penetration testers have to always ensure their penetration test plan does not compromise the confidentiality, integrity and availability of the testing target.

WHAT SHOULD I CHOOSE: PENETRATION TESTING OR VULNERABILITY ASSESSMENT?

If your organisation has never before performed any security assessment, it's always easier to begin with a VA first. The assessment will have the least impact on your business operations and can be done in a shorter time period compared to a penetration test.

New vulnerabilities in systems and networks are discovered on almost a daily basis. We are only as good as we were secured yesterday. Hence, the VA should be conducted on a more regular basis, depending on the risk tolerance of an organisation.

Once your organisation's security controls become more matured in terms of security and vulnerabilities management, then you should consider penetration testing to gaug the effectiveness of the security controls of your organisation. The penetration testing exercise is a yardstick to test the effectiveness of your security controls and remedial process.

About LGMS

LGMS started as a specialised penetration testing and security assessment firm a decade ago. Today, LGMS is the single largest neutral-based cyber security firm, specialising not only in penetration testing and security assessment, but also computer crime investigation and digital forensics.

LGMS is also the first and only Malaysian cyber security consulting firm awarded with the CREST UK (Council of Registered Ethical Security Tester) certification, PCI QSA & PCI ASV accreditation. LGMS is also the first company in Malaysia to have obtained the ISO 9001 quality certification for professional services - in which penetration testing and VA are included.

A View from the Frontlines

Excerpt from M-Trends 2017

By Mandiant, a FireEye company

FireEye

Every year Mandiant, a FireEye company, responds to a large number of cyber attacks and last year was no exception. When it comes to attack trends, we are seeing a much higher degree of sophistication than ever before.

While nation-states continue to set a high bar for sophisticated cyber attacks, some financial threat actors have caught up to the point where we no longer see the line separating the two.

Financial attackers have improved their tactics, techniques and procedures (TTPs) to the point where they have become difficult to detect as well as challenging to investigate and remediate.

While financial threat actors have come a long way with the tools they use and how they use them, they have shown innovation in other areas as well. Perhaps the most unexpected trend we observed in 2016 is attackers calling targets on the telephone to help them enable macros in a phishing document or obtain the personal email address of an employee to circumvent controls protecting corporate email accounts.

To compound the issue, threat groups have also shown increased sophistication when it comes to escalating privileges and maintaining persistence.

Although our investigations show that inter-banking networks are particularly attractive to financial threat groups, we also saw plenty of activity in 2016 involving the use of malware to drain ATMs of cash.

While there has been a marked acceleration of both the aggressiveness and sophistication of cyber attacks, defensive capabilities have been slow to evolve and respond.

We have observed that a majority of both victim organisations and those working diligently on defensive improvements are still lacking fundamental security controls and capabilities to either prevent breaches or to minimise the damages and consequences of an inevitable compromise.

Based on our observations of trends from the past several years, organisations must adopt a posture of continuous cyber security, risk evaluation and defensive adaptation or they risk significant gaps in both fundamental security controls and - more critically - visibility and detection of targeted attacks.

Sophisticated intelligence integration, automation, and threat hunting should be the end-state goal for organisations facing significant business risks and exposure to cyber attacks.

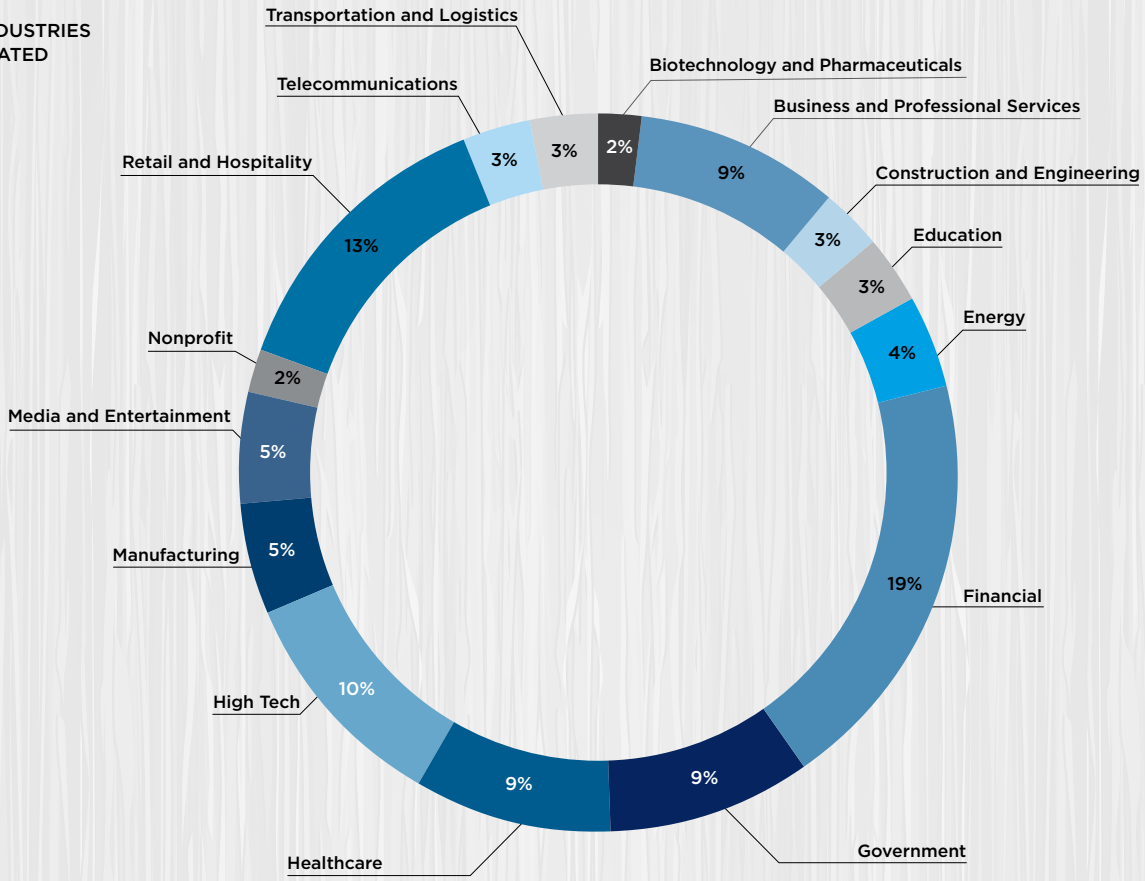
In 2016, we observed a rise in companies either exploring or implementing such capabilities, which were once limited to government and global financial services organisations.

The trend toward enabling these proactive security operations is one we encourage and endorse, but businesses must not lose focus of the foundational security functions that both reduce overall cyber risks and enable the defensive operations to operate effectively and efficiently.

With an increased willingness of both nation states and financial threat actors to operate increasingly blatant business disruption, extortion, and public disclosure attacks, fundamental protections such as data and key application segregation, network segmentation, and continuous visibility and monitoring of critical systems, have returned to prominence and should remain a primary focus for many IT and security teams.

BY THE NUMBERS

TOTAL INDUSTRIES INVESTIGATED



SPOTLIGHT ON APAC REGIONAL TRENDS

Continued focus on financial crime

FireEye observed a continued focus on financial services organisations in APAC. Headline breaches dominated the financial services industry for 2016, and Mandiant continues to respond to significant sophisticated compromises in these industries as well as many others driven by financial motivation.

ATM attacks

2016 brought a notable increase in attacks against ATMs and ATM networks using various types of malware. Similarities between ATM compromises with significant financial losses in Thailand and Taiwan strongly suggest these were linked to actors and activity in Eastern Europe.

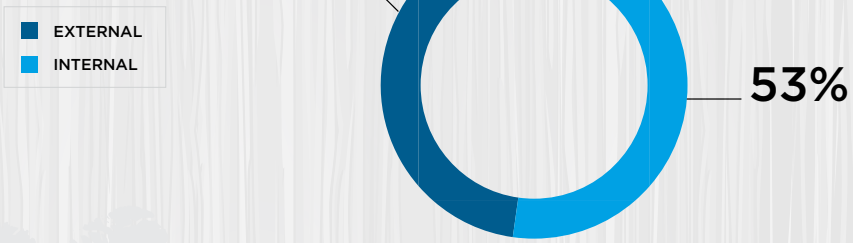
Nation States on the hunt for PII

Various regional nation state-sponsored APTs continued to harvest vulnerable commercial and government systems for PII for influence, intelligence and political gain.

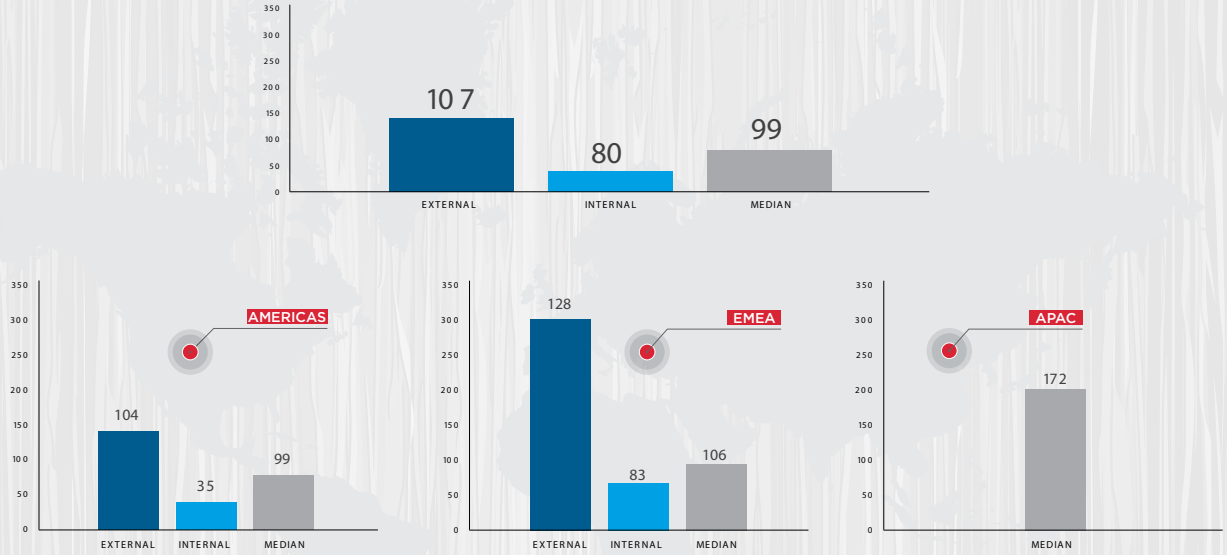
Espionage targets on China's periphery

Geopolitical events within APAC seemingly continued to drive nation state-sponsored espionage across the region with some telecommunication companies continually targeted.

NOTIFICATION SOURCES TOTAL



DWELL TIMES



This year, we have seen a marked decrease in the average dwell time in the EMEA and APAC regions. We deem that a number of factors have played a part in reducing this number.

While many organisations have been establishing better testing methodologies such as Red Teaming and Response Readiness Assessments to proactively understand their security posture, we suspect the changing nature of attacks has had a significant effect.

Victims in the regions are still experiencing lengthy breaches, but we believe a significant rise in attacks that are intended to be identified quickly, such as ransom and destructive wiper attacks, are impacting the statistics for EMEA and APAC.

Overall, APAC continues to have one of the highest dwell times for adversaries because of the basic lack of investment in security.

MAJOR INDUSTRIES IN THE APAC REGION SUSCEPTIBLE TO CYBER THREATS

INDUSTRY	MOTIVATION	TARGET
Construction and Engineering	With engineering powerhouses such as Japan, South Korea, Hong Kong and Singapore, the region is home to innovations that are highly coveted by nations with less advanced engineering capabilities. Designs, blueprints, formulas and equipment specifications are typically prized by threat groups that steal data in support of domestic industries.	• Advanced materials • Chemical engineering • Industrial equipment • Marine engineering • Oil, gas and nuclear engineering
Financial	The Asian financial services sector has been a top target for cyber criminals and nation-state actors from around the world. Recent incidents involving banking network fraud highlight the risks to the region's banks, which may lack the rigorous security measures of their Western counterparts in securing key systems such as transactions, internal banking documents and mobile banking apps. In addition, China-based cyber threat groups have been interested in regional economic development to ensure access for Chinese firms to lucrative contracts.	• Credentials • Payment cards • Personally identifiable information (PII) • Transactions
Governments	Regional governments and militaries are a continuous target of cyber espionage activity. Territorial disputes and evolving defense policies drive threat activity. We continue to observe China-based cyber threat groups targeting regional militaries — especially navies and coast guards — almost certainly because of Beijing's concerns about sovereignty in the region. We are seeing significant threat activity involving India, and we have seen ongoing targeting of the Indian government.	• Alliances • Diplomacy • Foreign policy • Territorial disputes
High Tech and Electronics	Japan is host to the world's largest electronics industry. Innovative countries such as Japan that are strong in advanced technologies make these countries' private sectors a priority target for threat actors seeking access to intellectual property and competitive intelligence. Threat actors use this information to advance the capabilities of domestic companies and enable national champions to better compete in the global market.	• Advanced electronics • Cloud and IT service providers • Computing and hardware Semiconductors • Software and gaming

To view the complete M-Trends report, visit www.fireeye.com/current-threats/annual-threat-report/mtrends.html

2017 Midyear Cybersecurity Report

By CISCO

AN EXECUTIVE SUMMARY

For nearly a decade, Cisco has published comprehensive cybersecurity reports that are designed to keep security teams and the businesses they support apprised of cyber threats and vulnerabilities - and informed about steps they can take to improve security and cyber-resiliency.

In these reports, we strive to alert defenders to the increasing sophistication of threats and the techniques that adversaries use to compromise users, steal information, and create disruption.

With this latest report, however, we find we must raise our warning flag even higher. Our security experts are becoming increasingly concerned about the accelerating pace of change - and yes, sophistication - in the global cyber threat landscape.

That is not to say defenders are not improving their ability to detect threats and prevent attacks, or to help users and organisations avoid or recover more quickly from them. But we see two dynamics undermining their hard-won successes, hindering further progress, and helping to usher in a new era of cyber risks and threats:

THE ESCALATING IMPACT OF SECURITY BREACHES

Revenue generation is still the top objective of most threat actors. However, some adversaries now have the ability - and often now, it seems, the inclination - to lock systems and destroy data as part of their attack process.

Our researchers see this more sinister activity as a precursor to a new and devastating type of attack that is likely to emerge in the near future: destruction of service (DeOS).

Within the past year, we have also observed adversaries employing Internet of Things (IoT) devices in DDOS attacks.

Botnet activity in the IoT space suggests some operators may be focused on laying the foundation for a wide-reaching, high-impact attack that could potentially disrupt the internet itself.

THE PACE AND SCALE OF TECHNOLOGY

Our threat researchers have been monitoring for years how mobility, cloud computing, and other technology advancements and trends are stretching and eroding the security perimeter that enterprises must defend.

What they can see even more clearly today, however, is how malicious actors are taking advantage of that ever-expanding attack surface. The breadth and depth of recent ransomware attacks alone demonstrate how adept adversaries are at exploiting security gaps and vulnerabilities across devices and networks for maximum impact.

Lack of visibility into dynamic IT environments, the risks presented by 'shadow IT', the constant barrage of security alerts, and the complexity of the IT security environment are just some reasons resource-strapped security teams struggle to stay on top of today's evasive and increasingly potent cyber threats.

WHAT WE COVER IN THIS REPORT

The *Cisco 2017 Midyear Cybersecurity Report* explores the above dynamics through the discussion of:

Adversary tactics

We examine select methods threat actors are using to compromise users and infiltrate systems. It is important for defenders to understand changes in adversaries' tactics so that they can, in turn, adapt their security practices and educate users.

Topics covered in this report include new developments in malware, trends in web attack methods and spam, the risks of potentially unwanted applications (PUAs) like spyware, business email compromise (BEC), the changing economics of malicious hacking, and medical device compromise. Our threat researchers also offer analysis of how - and how quickly - some adversaries are evolving their tools and techniques, and deliver an update on Cisco's efforts to reduce our Time to Detection (TTD) of threats.

Vulnerabilities

In this report, we also provide an overview of vulnerabilities and other exposures that can leave organisations and users susceptible to compromise or attack. Weak security practices, such as not moving swiftly to patch known vulnerabilities, not limiting privileged access to cloud systems, and leaving infrastructure and endpoints unmanaged, are discussed.

Also in focus: why the expanding IoT and the convergence of IT and operational technology (OT) create even more risk for organisations and their users, as well as for consumers, and what defenders should do now to address these risks before they are impossible to manage.

Opportunities for defenders

The *Cisco 2017 Midyear Cybersecurity Report* presents additional findings from Cisco's latest Security Capabilities Benchmark Study. We offer in-depth analysis of the key security concerns of eight industry verticals: service providers, public sector, retail, manufacturing, utilities, healthcare, transportation, and finance.

Industry experts from Cisco offer recommendations on how these businesses can improve their security posture, including using services to bridge knowledge and talent gaps, reducing complexity in their IT environment, and embracing automation.

The concluding section of the report includes a call to action for security leaders to seize the opportunity to engage senior executives and boards of directors in discussions about cybersecurity risks and budgets - and to offer suggestions on how to start that conversation.

Major findings:

- Business email compromise (BEC) has become a highly lucrative threat vector for attackers. According to the Internet Crime Complaint Center (IC3), US$5.3 billion was stolen due to BEC fraud between October 2013 and December 2016. In comparison, ransomware exploits took in US$1 billion in 2016.

- Spyware that masquerades as potentially unwanted applications (PUAs) is a form of malware - and a risk that many organisations underestimate or dismiss completely. However, spyware can steal user and company information, weaken the security posture of devices, and increase malware infections. Spyware infections are also rampant. Cisco threat researchers studied three select spyware families and found that they were present in 20% of the 300 companies in the sample.

- The IoT holds great promise for business collaboration and innovation. But as it grows, so too does security risks. Lack of visibility is one problem: defenders are simply not aware of what IoT devices are connected to their network. They need to move quickly to address this and other hurdles to IoT security. Threat actors are already exploiting security weaknesses in IoT devices. The devices serve as strongholds for adversaries, and allow them to move laterally across networks quietly and with relative ease.

US$5.3 billion was stolen due to BEC fraud between October 2013 and December 2016

- Cisco has been tracking our median time to detection (TTD) since November 2015. Since that time, the overall trend has been downward - from just over 39 hours at the start of our research to about 3.5 hours for the period from November 2016 to May 2017.

- Cisco has been observing an overall increase in spam volume since mid-2016, which seems to coincide with a significant decline in exploit kit activity during the same period. Adversaries who had relied heavily on exploit kits to deliver ransomware are turning to spam emails, including those containing macro-laden malicious documents that can defeat many sandboxing technologies because they require user interaction to infect systems and deliver payloads.

- Supply chain attacks offer adversaries a way to spread malware to many organisations through a single compromised site. In an attack studied by RSA, a Cisco partner, a software vendor's download webpage was compromised, allowing the infection to spread to any organisation that downloaded the software from this vendor.

- The dramatic increase in cyber attack frequency, complexity, and size over the past year suggests that the economics of hacking have turned a corner, according to Radware, a Cisco partner. Radware notes that the modern hacking community is benefitting from quick and easy access to a range of useful and low-cost resources.

- When it comes to enterprise security, cloud is the ignored dimension: open authorisation (OAuth) risk and poor management of single privileged user accounts create security gaps

‘Revenue generation is still the top objective of most threat actors. However, some adversaries now have the ability to lock systems and destroy data as part of their attack process.’

that adversaries can easily exploit. Malicious hackers have already moved to the cloud and are working relentlessly to breach corporate cloud environments, according to Cisco threat researchers.

- In the exploit kit landscape, activity has declined dramatically and innovation has stagnated since Angler and other leading players have disappeared or changed their business model. This situation is likely temporary, given previous patterns in this market. But other factors, such as the greater difficulty of exploiting vulnerabilities in files built with Adobe Flash technology, may be slowing the resurgence.

- DevOps services that have been deployed improperly or left open intentionally for convenient access by legitimate users pose a significant risk to organisations, according to research by Rapid7, a Cisco partner. In fact, many of these instances have already been ransomed.

- A ThreatConnect analysis of colocated domains used by adversaries connected to the Fancy Bear cyberespionage group showed the value of studying bad actors’ IP infrastructure tactics. By studying this infrastructure, defenders gain a larger list of domains, IP addresses, and email addresses to proactively block.

- In late 2016, Cisco threat researchers discovered and reported three remote code-execution vulnerabilities in Memcached servers. A scan of the internet a few months later revealed that 79% of the nearly 110,000 exposed Memcached servers previously identified were still vulnerable to the three vulnerabilities because they had not been patched.

Download the Cisco 2017 Midyear Cybersecurity Report at cisco.com/go/mcr2017.

Locking Out the Threats with Cybersecurity