MINISTRY OF
COMMUNICATIONS

NATIONAL DIGITAL STRATEGY **2016-2020**

NATIONAL ICT WHITE PAPER

FOR **BRUNEI DARUSSALAM**

AITI | Authority for
Info-communications
Technology
Industry of Brunei Darussalam

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Background

Brunei Darussalam today is a young nation that has a stable political climate, good international relations, and a government that is pro-business and visionary.

Socially, its people enjoy a high quality of life, are highly literate with a strong belief that they are creative and innovative

Economically, clear directions have been set and measures are underway to diversify from its presently heavy dependency on the energy sector.

Impetus for a National ICT White Paper

Technologically, Brunei sees the intrinsic potential high value that ICT can bring for the economic and social development of the nation. The journey it has taken included several strategic ICT infrastructure projects, a fair amount of governance reviews, commendable effort to consolidate ICT within the government and attempts to deliver an increased number of citizen eServices.

However, it is facing the following challenges:

1 Effort to diversify through ICT for contribution to GDP

2 ICT industry requirement for a well established and developed;

3 eGovernment initiatives require re-calibration, greater acceptance and participation;

4 Need for improved change management and robust programme management.

Even as it forges ahead with the current I CT initiatives, it is good that Brunei Darussalam is cognizant to take stock and re-strategise. This would allow it to address the mentioned current hurdles so as to springboard ahead in the ever competitive global arena.

As such, this National ICT White Paper has been commissioned by Ministry of Communications and the Authority for Info-communications Technology Industry of Brunei Darussalam (AITI), to set the strategic direction for ICT in Brunei Darussalam for the period of 2016 – 2020.
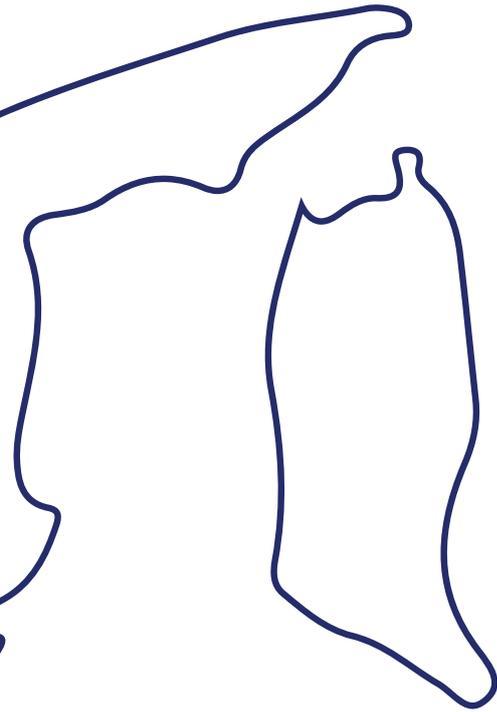
Considerations Incorporated

This White Paper advocates a National Digital Strategy with ICT playing the role as Brunei's future engine of economic growth.

It is written with pragmatic recommendations to assist Brunei Darussalam to leverage on ICT to diversify its economy, boost the GDP, improve the quality of life for its citizens and assist to achieve its goal of a Smart Society.

To achieve that, it sets out by focusing on delivering broad-based improvements through "horizontal" initiatives, whilst attending to the needs of six key sectors. See Figure 1.

WAWASAN 2035

Educated, Highly skilled people

High quality of life

Dynamic & sustainable growth

Towards a Smart Society

RECOMMENDATIONS FROM ICT MANPOWER MASTER PLAN	Energy
NETWORK INFRASTRUCTURE	Health
COMMON SERVICES	Transport
SECURITY	Services
GOVERNANCE	Education
	E-Government

Focus Of The National ICT White Paper
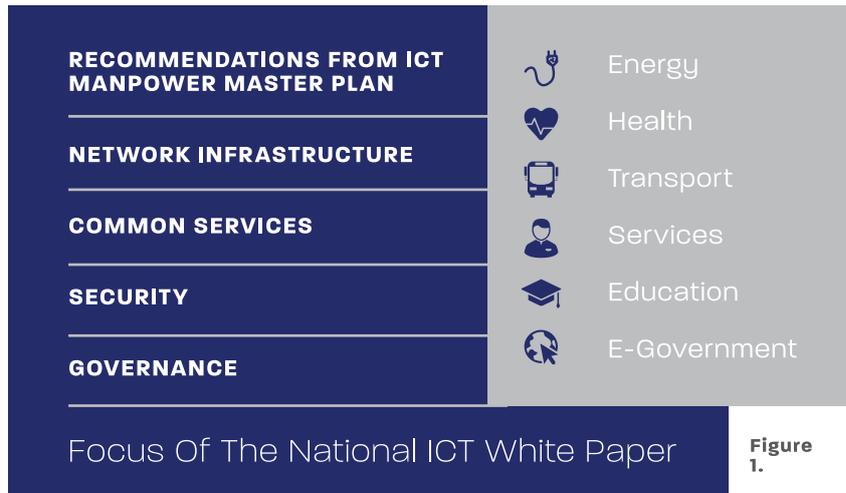
Figure 1.

Embedded in the White Paper are also considerations taken from international ICT benchmarking findings on Brunei and the inevitable strong influences coming from worldwide ICT trends such as Mobility, Internet of Things and Analytics.

Locally, the White Paper study has also gathered inputs from a representative sample of stakeholders and done a current state analysis.

The key concerns raised included the following and they are also factored into the **recommendations** so as **to address them**:

1 Minimal successes from ICT industry development for economic diversification;

2 Lack of ICT manpower resources and possible mismatch;

3 Lack of consolidation and sharing of reliable and key data;

4 Silos and lack of integration across agencies;

5 Bottlenecks in ICT infrastructure and common platforms;

National ICT White Paper

Keeping in mind to align to Wawasan 2035 and Outline of Strategies and Policies for Development 2007-2017 (OSPD), the following three strategic outcomes were identified to be realised:

1 A Vibrant Economy powered by ICT;

2 ICT-Smart Citizens;

3 A Connected and Efficient Nation.

To realise the outcomes, **four strategic thrusts** have been developed. They are

1 Create a Thriving ICT Industry;

2 Achieve a Productive and Diversified Economy Based on Knowledge and Innovation;

3 Inform, Engage and Empower the People;

4 Build a Next Generation Government.

In total, 21 programmes have been proposed to drive the thrusts forward. Supporting these programmes are recommendations for the essential ICT enablers that prop up the entire ecosystem. In summary, the outcome, thrusts and programmes and enablers are shown below:

The recommendations of this paper also stand guided by sound principles, namely top-down design, effective centralisation, citizen-centricity, demonstrable success, mobility first and context-aware. When guided and executed well, it aspires to achieve **8 key targets by 2020**:

1 6% contribution by ICT sector to GDP;

2 6000 skilled ICT professionals;

3 5 local SMEs with regional business;

4 30 places improvement in key rankings;

5 80% customer satisfied;

6 Cost of broadband to be 1.5% average monthly income;

7 50,000 online B2C marketplace transactions;

8 18,000 citizens trained in ICT literacy;

A VIBRANT ECONOMY POWERED BY ICT

——

Create a thriving ICT Industry

1 Increase ICT Enterprise Development

2 Increase ICT Demand Generation

3 Re-Model Grants and Incentives for iCT Industry

4 Develop a Technopreunership Culture

5 Address ICT Manpower Development

6 Drive up Infrastructure Investments and Policies

Achieve a productive and Diversified Economy Based on Knowledge & Innovation

1 Develop ICT-based halal certification for local and global

2 Develop a supporting Energy ICT Ecosystem with solutions that are marketable globally

3 Deliver the connected Brunei Travel Experience

4 Co-create new solutions using shared Public, Government and Private Sector Data

ICT SMART CITIZENS

——

Inform, Engage and Empower the people

1 Accelerate Key Education ICT programmes

2 Build upon health ICT Platform

3 Develop Islamic services for Individuals and Community

4 Promote lifelong ICT learning

5 Increase Community Awareness and Outreach

6 Achieve Universal Communications Service

A CONNECTED AND EFFICIENT NATION

——

Build a Next Generation Government

1 Create an Integrated View of Citizens and Businesses

2 Improve the delivery of e-darussalam

3 Develop e-Payment strategy & Payment Card standards

4 Set up a Nation-Wide Integrated Sensor network

5 Deliver efficient Transportation through an Intelligent Transport System

Enablers

1 Address e-legislations and policies

2 Build people, Business & Geospatial data hubs

3 Increase attention and efforts to manage ICT security risks

4 Address manpower Development for resource management

5 Drive towards a high performing and ready infrastructure

National Digital Strategy

A Vibrant ICT Industry & Diversified Economy,
ICT-Smart Citizens and Connected Nation

ICT Contribution to GDP	Increased ICT Skilled Professionals	Increased local ICT SMEs with regional businesses	Improved Key Ranking
High Customer Satisfaction	Lower Cost of Broadband	Increased online Business to Consumers marketplace transactions	Increased ICT Literacy By All

Innovation & Knowledge-based Diversitified Economy	Thriving ICT Industry

Informed, Engaged & Empowered Citizens	High Performing & Ready ICT Infrastructure	Necessary ICT Legislations & Policies	Open & Shared Data with Analytics	Enchanced Cyber Security	Next- Gen Government

High Performing & Ready ICT Infrastructure

Top-Down Design, Effective Centralisation, Citizen-Centric,
Demonstrable Success, Mobility First, Content Aware

Figure 2 National Digital Strategy

1

Introduction

1.1

Background

The Sultanate of Brunei Darussalam has come a long way since the start of its information and communications technology (ICT) journey in the early seventies[1]. Through strategic investments, hard work and tenacity, effort has been ongoing in developing an ICT industry, a young population that is educated and comfortable with the use of modern technology, and a stable and effective government that leverages on ICT technology to deliver services efficiently to the citizens and businesses.

Going into the twenty first century, the Sultanate of Brunei Darussalam recognised that its "Government is not only responsible for the people today. It must also help them fulfil their hopes for the next generation. To do this, it must listen to them and offer clear-sighted, realistic plans for the future that can be implemented with skill and professionalism.[2]" This paved the way for the National Vision known as Wawasan Brunei 2035, which aims to make Brunei Darussalam a nation widely recognised for the accomplishment of its educated and highly skilled people, as measured by the highest international standards; quality of life that is among the top 10 nations in the world; and a dynamic and sustainable economy with income per capita within the top 10 countries in the world.

In painting the background to developing the National Vision, it was noted that Brunei Darussalam's high standards of living in Asia, with one of the highest per capita income in Asia, having achieved almost all the target of the Millennium Development Goals, and with one of the highest standards of education and health in the developing world, were largely the result of political stability created by His Majesty's government's investment of oil and gas revenues in infrastructure and in the developing of far-reaching programmes of social welfare. However, these cannot be taken for granted and planning must take into account a number of emerging social and economic facts:

1 Economic growth has not kept pace with population growth;
2 Public sector can no longer adequately absorb the growing numbers of young people wishing to enter the work force each year;
3 Widening gap between expectations and capabilities of the nation's youth and the employment opportunities current being created;
4 Oil and gas sector's contribution to economy and export earnings was not proportionate to the sector's employment of the work force;
5 Local business community continues to be weak and is unable to create the employment opportunities required.

With the above in mind, the **National ICT White Paper for Brunei Darussalam: National Digital Strategy 2016-2020** (henceforth known as "National Digital Strategy" or "White Paper") was formulated to support and contribute towards this National Vision. It seeks to guide the ICT investment of the public sector over the period from 2016 to 2020, capitalising on the foundation laid by the past hard work and effort by the Government and other stakeholders, and to recommend new strategies to adapt to the needs of the new environment.

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[1] National Information Technology Development and E-Business Initiatives in Brunei Darussalam. Yap, Lye Tin. 2002. URL: http://citeseerx.ist.psu.edu/viewdoc/

[2] From the section titled "Message from His Majesty": Brunei Darussalam Long-Term Development Plan, by Prime Minister's Office, Brunei Darussalam, (2007).
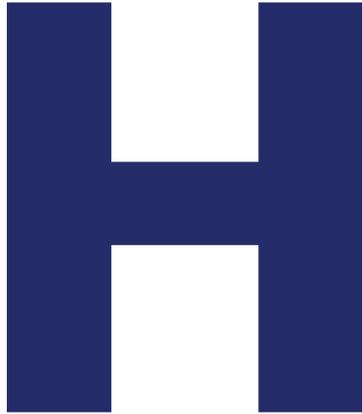
High level macro environment

In 2014, the crude oil and natural gas production accounted for more than 60% of the GDP and 90% of exports

The Sultanate has a stable political climate. It has a dual judiciary system that is based on English Common Law and the Islamic Syariah Law.

The Government is perceived to be pro-business and has put in place a low tariff regime. Investors enjoy a wide range of incentives and are welcomed into the country.

For the past 80 years, Brunei Darussalam's economy has been largely dependent on the oil and gas industry. In 2014, the crude oil and natural gas production accounted for more than 60% of the GDP and 90% of exports[3]. The Government has always been concerned with this heavy dependence on the hydrocarbons sector

and has been advocating the diversification of the economy. With recent oil prices dropping below US$50 per barrel, it has provided even greater impetus to push for the transformation of the economy. Not only so, recent figures released by Jabatan Perancangan Dan Kemajuan Ekonomi (JPKE – Department of Economic Planning and Development, Prime Minister's Office) puts the official unemployment rate at 14,267 in November 2014. This was a cause for concern and the Energy Sector has stepped up to try to alleviate the issue. Though the country enjoys a healthy fiscal balance as of 2012, the negative GDP growth in 2013 could possibly change the fiscal balance scenario in the near future.

[3] Index Mundi – Brunei Economy Profile 2014. URL: http://www.indexmundi.com/brunei/economy_profile.html

1.2

On the social front, Bruneians enjoy a high quality of life, as evidenced by the Human Development Index 2014, placing 30 out of 187 (very high human development category)[4]. Besides the high adult literacy and comprehensive healthcare system, the country has a young population (54% are in the 20-54 working age group)[5] that are receptive to new ideas and comfortable with the use of modern technology. English is also widely spoken within the country and is the principal business language.

Technologically, the country has also been busy putting in major ICT infrastructure. According to the National Broadband Policy[6], by end of the phase two rollout, FTTH would reach 80% of the households. Other ICT infrastructure initiatives include the development of a National Data Centre by Brunei Economic Development Board (BEDB), as well as the connection of a new submarine cable to the country by Brunei International Gateway (BIG). On the Government front, the country has been highly focused on e-Government initiatives. It was given a bigger push in 2008 when the E-Government National Centre (EGNC) was formed. Since then, several major e-Government projects have been implemented, such as the Government Data Centre (GDC) [7], the e-Darussalam Government Portal[8], the One Government Network (OGN) and One Government Private Cloud (OGPC).

The past effort by the Government and other stakeholders in nation-building over the years must be recognised as these have laid a strong foundation for the country. However, with the existing low oil and gas prices and the unemployment situation, the country is now even more determined to push for the diversification of its economy. On the political, social and technology fronts, Brunei Darussalam is well-poised to position ICT as the engine of economic growth. This could well be the opportunity for the country to leapfrog other economies and carve out new niches of economic pillars by taking the non-traditional routes, but ones which are firmly supported by the strong foundation laid over the years.

Political Factors	Economic Factors	Social Factors	Technological Factors
Stable Political Climate	Dependence on Energy Sector	High Quality of Life	Broadband Infrastructure Avaliable
Government Pro-Business	Falling Global Oil Prices	High Adult Literacy	Transitioning to eGovernment
Instituted Islamic Sharia law in 2014	Unemployment Rate	Young Populations	Opportunities for Technology to Play Bigger Role in Accessing International Markets
	Negative GDP Growth in 2013	Receptive to New Ideas	
	Healthy Fiscal Balance as of 2012	Comprehensive Healthcare System	
	Low Tariff Regime	English Widely Spoken	

Figure 3 High Level Macro Environment

[4] UNDP Human Development Report 2014 for Brunei Darussalam. URL: http://hdr. undp.org/sites/all/themes/hdr_theme/country-notes/BRN.pdf

[5] Brunei Economic Development Board – Why Brunei. 2014. URL: http://www.bedb.com.bn/why_intro.html

[6] AITI Website. 2014. URL: http://www.aiti.gov.bn/nationalbroadband/NBP/Documents/National%20Broadband%20Policy.pdf

[7] The existing GDC is managed by E-Government National Centre, under the Prime Minister's Office. A future data centre will be built by Brunei Economic

Development Board (BEDB) and the GDC will be one of the anchor tenants in the new data centre.

[8] It is the Government of Brunei's official web portal which aims to facilitate government transactions and delivery of services.

2

Methodology

M
ethodology

When developing the National Digital Strategy, four factors were taken into consideration:

1
Alignment with National Development Objectives;

2
Current State Analysis;

3
International ICT Benchmarking;

4
Influences from Worldwide ICT Trends.

2.1

Alignment with National Development Objectives

Brunei Darussalam's National Vision or Wawasan Brunei 2035, was launched in January 2008. It aims to make Brunei Darussalam, by 2035, a nation which will be widely recognised for the accomplishment of its educated and highly skilled people as measured by the highest international standards; quality of life that is among the top 10 nations in the world; and a dynamic and sustainable economy with income per capita within the top 10 countries in the world.

To ensure the accomplishment of the above three main goals, eight strategies have been identified to ensure all aspects of the development are implemented systematically and effectively. **The eight main strategies** are:

1 Education Strategy;
2 Economic Strategy;
3 Security Strategy;

4 Institutional Development Strategy;
5 Local Business Development Strategy;
6 Infrastructure Development Strategy;
7 Social Security Strategy;
8 Environmental Strategy.

To support the eight strategies, the first **Outline of Strategies and Policies for Development (OSPD) 2007-2017** was developed. Under the OSPD, it lists 50 policy directions for the government to follow over the next 10 years. These directions are designed to help the Bruneian people meet modern challenges with confidence.

Arising from the OSPD, **National Development Plan (RKN) 2007-2012** was the first RKN to be formulated based on the objectives of **Wawasan Brunei 2035**. Under **RKN 9**, all programmes and projects were designed along four development objectives, with focus on providing the Bruneian people with the practical

opportunities and skills that strengthen their confidence in the future:

1 Widening the economic base and strengthening the foundation for a knowledge-based economy (KBE);
2 Accelerating social progress and maintaining political stability;
3 Enlarging the pool of highly skilled labour force;
4 Strengthening the institutional capacity.

For **The Tenth National Development Plan 2012-2017 (RKN 10)**, six strategic development thrusts were outlined and identified:

1 Educated and highly skilled population;
2 High quality of life;
3 Conducive business environment;
4 Productive and progressive economy based on knowledge and innovation;
5 Good governance and government modernisation;
6 High quality and sustainable development infrastructure.

2.1

Given the above, three key focuses stood out:

1 Economy development

In the **Long-Term Development Plan**, it recognised that on the economic front, progress has been inconsistent. Brunei Darussalam has experienced period of growths in the 1990s, but the economy has also shown signs of weakness in the aftermath of the Asian financial crisis. Gross Domestic Product (GDP) growth in real terms (constant prices) averaged at only 2.1 per cent per annum during the RKN 8 period. This growth was slower than the targeted annual growth rate of between 5-6 per cent. In RKN 9, it recorded an average growth of 0.3 per cent per annum, before improving to 2.6 per cent in 2010 and 2.3 per cent in 2011. However, in 2013, real GDP contracted 1.8 per cent as the energy sector declined due to longer-than-expected maintenance of hydrocarbon facilities[9]. These do not compare favourably with the World's or ASEAN 5's growth rates (see Figure 4). It was also projected by The Economist Intelligence Unit that with the falling global oil prices, this will reduce Brunei Darussalam's trade and fiscal surpluses, with the latter potentially falling to zero in 2016[10].

In the **Tenth National Development Plan (2012-2017) Brunei Darussalam**, the conclusion was on the need to continue efforts towards diversifying the economy through the non-oil and gas sector. Emphasis would be placed on enhancing productivity so as to generate a targeted average annual 6.0 per cent economic growth. However, for this happen, a "significant structural change in the economy is vital and Brunei has to chart out new frontiers in development that transform it into a fast growing economy[11]". As of 2013, ICT contribution to GDP stood at 1.8% (or about BND 360M).

Figure 4 Annual GDP Growth Rate of Brunei Darussalam

[9] IMF Executive Board Concludes 2014 Article IV Consultation with Brunei Darussalam. 2014. URL: https://www.imf.org/external/np/sec/pr/2014/pr14335.htm

[10] The Economist Intelligence Unit – Brunei. 2014. URL: http://country.eiu.com/brunei

[11] From section 4's "Tenth National Development Theme": Tenth National Development Plan (2012-2017) Brunei Darussalam, by Prime Minister's Office, Brunei Darussalam, (2012).

2 People development

Starting from RKN 9, Brunei Darussalam saw the need to pursue development of a knowledge-based economy (KBE). This was necessary given the small natural resources endowment of the nation, its geographical and population size. Under a KBE, knowledge, creativity and innovation play key roles in generating and sustaining growth. This is key in supporting the economic diversification agenda mentioned early.

Hence, under Human Resource Development (HRD), the focus was on improving the quality and accessibility of education and on the promotion of life-long learning culture. It was also recognised on the need to strengthen the competency in ICT for students, teachers and educational administrators including the integration of ICT in school curriculum. Technology should also be leveraged so as to adopt cost-effective methods of educating the people.

3 An effective government that provides a better life for the citizens

The third focus was the recognition of the need to enhance the national capacity to carry out development initiatives, especially moving from RKN 9 onwards. Hence, a competent civil service and seamless bureaucratic procedures would be crucial to the successful implementation of the programmes and projects.

This theme was continued in RKN 10 under the fifth thrust of "Good Governance and Government Modernisation". The thrust concentrated on efforts that would enhance the quality and productivity of the public sector.

Hence, it is imperative that during the formulation of the National Digital Strategy, it must be aligned to the National Development Objectives, especially on the three main focuses discussed above.

2.2

Current State Analysis
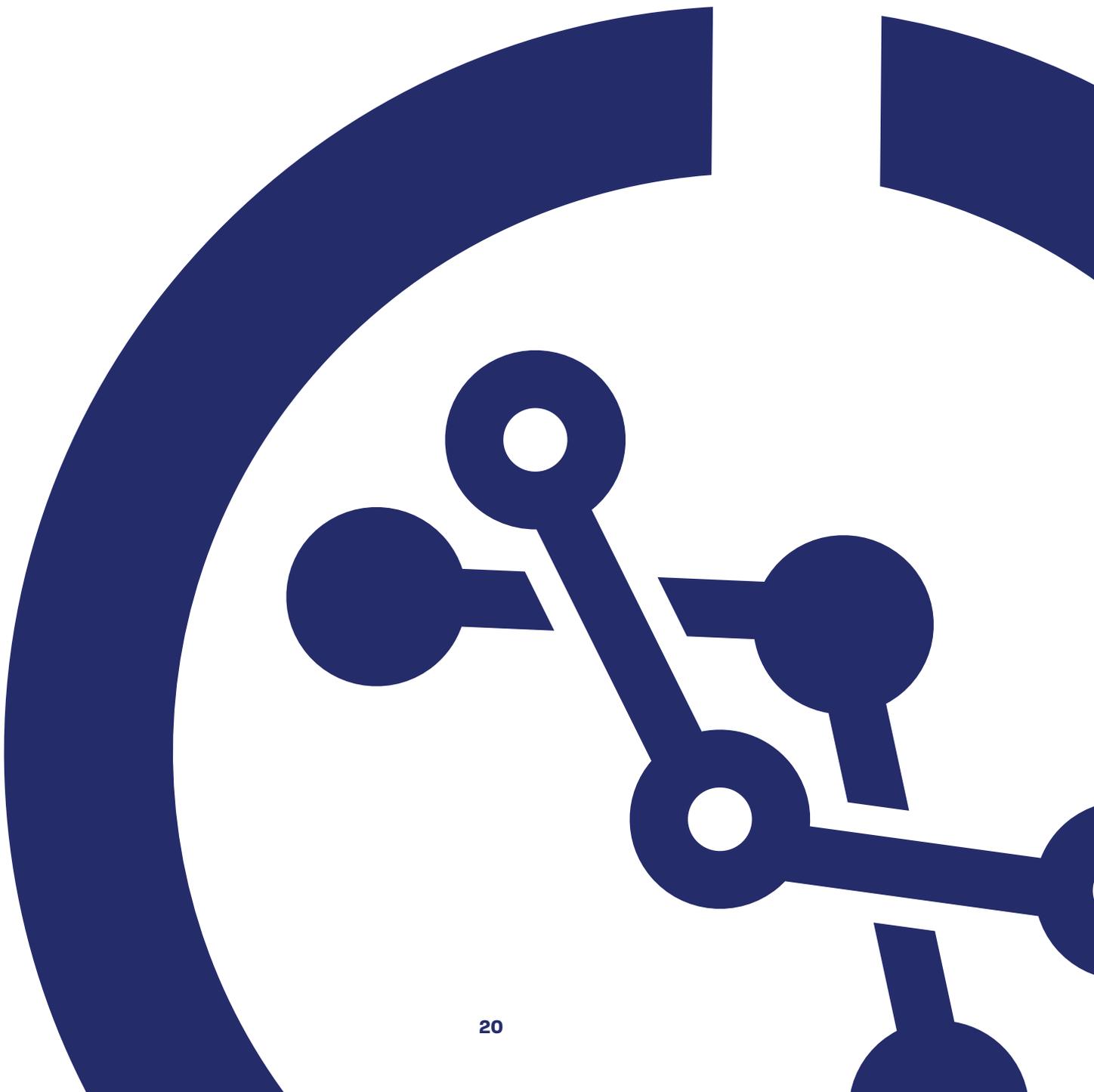
2.2.1

ICT Journey

The ICT journey for the Government of Brunei Darussalam started in the early seventies, where the early pioneers were the financial and telecommunications institutions who used ICT in data processing to support their business functions and operations. In 2000, to provide full commitment and support in ICT development, the National Information Technology Council (BIT Council) was formed to lead and facilitate the strategic development and diffusion of the state-of-the-art IT for the entire nation. This marked the start of Brunei Darussalam's concerted effort to leverage on ICT to deliver on its outcomes. Several key milestones were met along the way, namely:

2003 The formation of Authority for Info-communications Technology Industry of Brunei Darussalam (AITI);
2004 Ministry of Communications (MOC) was named the lead agency for the EG Bandwidth Service project[12];
2006 E-Government Implementation Review handed over to BIT Council;
2007 Prime Minister's Office appointed as Executive Owner for E-Government;
2008 The formation of E-Government National Centre (EGNC), as well as the Broadcasting Act transferred to MOC;
2010 EGNC took over the function as Government CIO, with internal support from EGTAB;
2011 Merger of EGTAB with EGNC;
2012 Proposed transfer of Broadcasting Regulatory function to AITI.

A summary of Brunei Darussalam's ICT Journey from 2000 to 2014 can be seen in Figure 5. Clearly, a lot of work and effort had taken place, laying the foundation for the next step-change for the nation.

2000	IT 2000 and Beyond Electronic Transaction Order 2000 Bit Council Formed.		Review handed over to BIT Council.		Consent for EGNC function as GCIO (support by EGTAB) Consent ESLF.
2001	AITI Order 2001 enacted.	**2007**	Consent for formation of EGLF, EGTAB (under AITI), ITPSS. PMO as Executive Owner for e-Govt.	**2011**	AITI Concergence Review Project kicked off. AITI Strategic Plan launched. E-Darussalam portal launched. EGTAB merged with EGNC.
2002	Telekom Brunei Bhd shell company formed. MOC as lead agency for EG Bandwidth.	**2008**	ETO revised. EGNC formed. MOC Strategic Plan 2008-2017 launched. Broadcasting Act transferred to MOC.		
2003	AITI Formed.	**2009**	Brunei International Gateway formed. BIT Council endorsed National e-Strategy Paper. E-Govt Strategic Plan 2009-2014 launched. Consent for formation of EBLF.	**2012**	Proposed new TVRO Policy . Proposed transfer Broadcasting. Regulatory function to AITI . Consent on Phase 2 NRI Study. FTTH and Industry Restructing Policy in progress. AITI Convergence Review Project Completion.
2004	MOC as lead agency for EG Bandwidth.				
2005	Bmobile Comm Sdn Bhd, 2nd Mobile service Licensee. Minister of Finance II as Dept. Co-Chair of BIT Council with Dep. Min. Of Comms.				
2006	AITI Order 2001 & Telecom Successor. Co. Order 2001 Enforced Telbru Bhd. in Operation E-Govt Implementation	**2010**	Interim payment gateway by Baiduri Bank. AIM2015 & NRI launched . Consent for BIT ICT Policy Direction.	**2014**	Launch of National Broadband Policy. Launch of ePayment Gateway System.

Figure 5 ICT Journey in Brunei Darussalam

Some of the significant achievements and learning points arising from the past effort included:
1. The formation of key entities (i.e. BIT Council, AITI, EGNC) to drive the development of ICT within the nation;
2. The strong focus on E-Government;
3. The far-sighted planning for convergence of broadcasting and telecommunications;
4. The development of various strategic plans to guide the development of ICT usage at the National and Government level.

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[12] This is an e-Government initiative aimed to connect all ministries and their departments in a comprehensive network, leading to speedier government processes. The network has since been replaced by "One Government Network" (OGN).

2.2.2

Taking Stock

As part of the stakeholders' engagement to develop the White Paper, more than 40 public and private organisations were involved and over 200 man-hours of onsite-interviews, email surveys and workshops were conducted. Some of the findings and comments[13] that surfaced regularly were:

1 Minimal Successes from ICT Industry Development for Economic Diversification. It was in the 8th National Development Plan 2001-2005 (RKN8) that ICT was recognised as a driver for the new economy. Hence, a scheme value of BND 1B was allocated for the implementation of ICT related projects. These projects included the expansion and upgrading of the national network, corporate infrastructure, e-Government, amongst other ICT initiatives. Not only so, it was also the first time that ICT was included in a chapter in RKN8[14]. Effort was made to develop e-Business[15], but it was noted in RKN9 that the progress to develop non-oil industry was low. Though ICT contribution to GDP is currently at 1.8%, it is still a distance away from the envisioned 6% contribution to be achieved by this year 2015[16].

2 Lack of ICT Manpower and Resources. The findings from the National ICT Manpower Masterplan highlighted a skills gap and mismatch in the ICT talent pool. Although Bruneians are supported by a well-rounded education system, misalignment in skills and competencies are prevalent, resulting in difficulty in hiring the relevant resources.

3 Lack of Consolidation and Sharing for Reliable & Key Data. Some of the government agencies expressed the need for data hubs, especially in areas such as people information and business information. As of now, every agency is maintaining its own data and sharing of data is near non-existent. This resulted in duplicated effort by the agencies to maintain the data, as well as pose inconveniences to the citizens, when they have to provide the same type of information several times to different agencies. Hence, a government data hub of critical information will be useful to the government agencies.

4 Silos and Lack of Integration across Agencies. The Brunei Government has done well with the implementation of the Business Licensing System (BLS). Jointly developed by the Ministry of Industry and Primary Resources (MIPR) and the Ministry of Home Affairs (MOHA), BLS aims to provide an easier and more efficient process of starting a business in Brunei. Stakeholders' have shared the need for more of such integrated systems across the agencies. Such integrated systems provide multiple benefits to the citizen or business users, as well as potentially cutting down on manual effort, resulting in efficiency and efficacy.

[13] As the stakeholders' engagements were conducted in a qualitative manner, the comments were supported mainly by anecdotal evidences, rather than empirical data.

[14] National Information Technology Development and E-Business Initiatives in Brunei Darussalam. Yap, Lye Tin. 2002. URL: http://citeseerx.ist.psu.edu/viewdoc/

[15] Some of the initiatives included: developing and communicating the legal and regulatory framework to build confidence in e-Business activities; increasing the local demand for e-Business based services; increasing the use of e-Business by local businesses; providing ICT literacy education for the local labour force so as to participate in the information economy; ensuring availability and affordability of ICT infrastructure; as well as the broadening of the local economic base through ICT industries.

[16] Brunei Darussalam increases ICT push. Oxford Report. 2014. URL: http://www.oxfordbusinessgroup.com/news/brunei-darussalam-increases-ict-push

5 Bottlenecks in ICT Infrastructure and Common Platforms. Access to Internet seemed to be hampered due to existing bottlenecks in the design of the ICT infrastructure, as well as cost. This issue is especially prominent with the Ministry of Education (MOE), given that the broadband bandwidth available was limited and had to be shared with more than 100,000 students and 9,000 teachers in Core Education, excluding the tertiary students and teaching staff. Existing plans are in place to upgrade the bandwidth, as well as leverage on the fibre-optics networks currently being rolled out[17] to improve the interconnectivity between schools and MOE. Similarly, other stakeholders have shared the constraint on cost and speed of Internet access and the Government is moving in the right direction to alleviate the issue[18].

A lot of good work has been done by the Government of Brunei in implementing common platforms for her agencies. Some of the platforms included the Government Employee Management System (GEMS[19]) and e-Darussalam. Anecdotal feedbacks from some of the agencies have highlighted potential bottlenecks with some of these platforms. Such bottlenecks are a major concern, especially when it affects user experiences and slows the take-up of the service. Given the need to push for more eServices to be online and more online transactions by the public, such bottlenecks, if any, have to be eliminated.

Moving forward, it will be important for the White Paper to address these concerns.

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[17] MOE will be tapping on the National Education Network (NEN), a fibre-optics network to connect the schools.

[18] TelBru broadband prices to be reduced 1st March. 2015. URL: https://www.telbru.com.bn/page.php?c=237

[19] The Government Employee Management System (GEMS) is an interactive, web-based Human Resource Management System spearheaded by the Public Service Department of the Prime Minister's Office to effectively manage HR functions and operations of the entire Brunei Civil Service. URL: http://www.bagnetworks.com.bn/index.php/our-solutions/track-record/gems

[20] This is MOE's disciplined effort designed to harness the Ministry's and national resources of the effective use of ICT in education. For more info, see http://ehijrah.info/

[21] This is MOH's ICT initiative where the management of all patients' data in Government Hospitals, Out Patient Departments, Treatment Centres and Clinics in Brunei Darussalam are done electronically through an Electronic Patient Record System. The project not only replaces the old computerised system but would also include extra functions which will thus integrating the management of patients' information across the Medical and Health Services. For more information, see http://www.moh.gov.bn/bruhims/

2.3

International ICT Benchmarking

Brunei Darussalam

High-Income
Group Average

1 Political and regulatory environment
2 Business and innovation environment
3 Infrastructure and digital content
4 Affordability

5 Skills
6 Individual usage
7 Business usage
8 Government usage
9 Economic Impacts
10 social Impacts
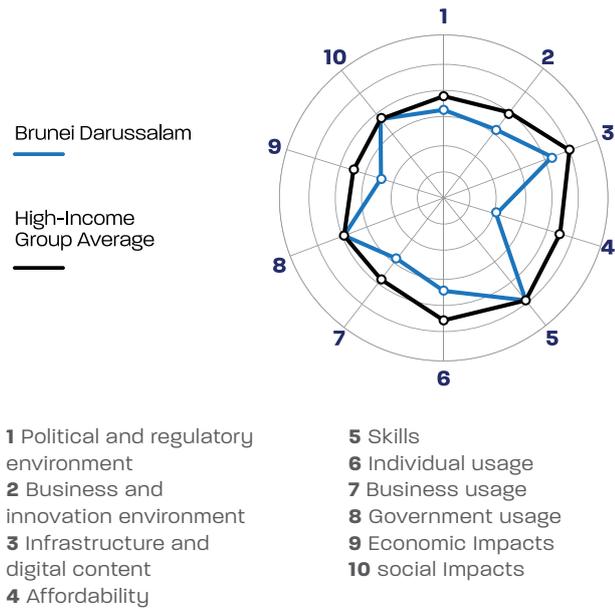
The e-Readiness of a country is indicative of its economy competitiveness relative to that of other countries in this digital age. It provides an overview and snapshot of the current state of ICT:

The extent of ICT availability and usage by the three major stakeholder groups, namely individuals, businesses and government;

The availability of an enabling environment for ICT, i.e. ICT companies and manpower capabilities, and policies and legislation that supports further ICT development.

In the World Economic Forum Global Information Technology Report 2014, under the Network Readiness Index, Brunei Darussalam received a ranking of 45, up from the previous year's ranking of 57. See Figure 6 below for details of the sub-indices ranking.

Network Readiness Index 2014 (Ranked 45; Previously 57)

The World Economic Forum (WEF) assesses and ranks economies in terms of the state of their environments, stakeholder readiness, usage of ICT and impact. In the WEF-Global Information Technology Report (GITR) 2014, Brunei Darussalam was benchmarked against 148 economies and the country's rankings were as such:

Environment Component 54	Political & Regulartory 46 | Business and Innovation 69
Readiness Component 78	Infra & Digital Content 37 | Afforadability 129 | Skills 30
Usage Component 41	Individual 50 | Business 56 | Government 30
Impact Component 38	Economic 51 | Social 32

Figure 6 Sub Indices Ranking

Within the report, it also depicted a radar chart highlighting the scorings for Brunei under the 10 pillars. Notably, three pillars' scores stood out. For the 4th pillar "Affordability", it scored a value of 3.1. As this pillar assesses the cost of accessing ICTs, either via mobile telephony or fixed broadband Internet, as well as the level of competition in the Internet and telephone sectors, there is a need for the cost to come down further in Brunei Darussalam. For the 7th pillar "Business usage", this captures the extent of business Internet use as well as the efforts of the firms in an economy to integrate ICTs into an internal, technology-savvy, innovation-conducive environment that generates productivity gain, amongst other criteria. With a score of 3.7, there is room for improvement, especially on the capacity for innovation, as well as the number of technology patents filed. For the 9th pillar "Economic impacts", it measures the effect of ICTs on competitiveness, as well as the overall shift of an economy toward more knowledge-intensive activities. Brunei scored 3.5.

Besides World Economic Forum's Network Readiness Index, other international benchmarks can also be useful indicators of how countries have progressed individually, as well as their relative performances against other countries in the development of policy related frameworks. More importantly, multi-national corporations often use international benchmarks to gauge the viability and ease of doing business before investing in a country, and hence countries benefit directly from improvements made in their international rankings.

As part of the analysis on the current ICT landscape in Brunei Darussalam, other authoritative benchmark reports were studied. These included the World Economic Forum (WEF) Network Readiness Index, the WEF Global Competitive Index, the UN e-Government Survey and the World Bank's Doing Business Report. Efforts are underway by other stakeholders to examine these benchmarks and to recommend interventions to improve the rankings. (Figure 7)

WEF Global Competitive Index 2013/2014	26 out of 148 economies
United Nations e-Government Survey 2014	86 out of 193 countries
World Bank's Doing Business 2015 Report	101 out of 189 economies

Figure 7 International Benchmarks

2.4

ICT Trends and Developments

Intentionally, only the ICT trends observed globally for 2013 are recommended in this White Paper for Brunei Darussalam to consider and adopt through the suggested programmes. This is because given time, these trends have been tested, matured and proven to deliver value and benefits, yet able to minimise the high risks of investment associated with hype trends and avoids the substantial high costs for R&D.

The top ten strategic technology trends for 2013 according to Gartner[22] include:

1 Mobile Devices Battle

2 Mobile Applications & HTML5

3 Personal Cloud

4 Internet of Things

5 Hybrid IT and Cloud Computing

6 Strategic Big Data

7 Actionable Analytics

8 Mainstream In-Memory Computing

9 Integrated Ecosystems

10 Enterprise App Stores

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[22] Gartner's Top 10 tech trends for 2013. URL: http://www.computerworld.com/article/2492807/mobile-wireless/gartner-s-top-10-tech-trends-for-2013.html

Of these, a few disruptive technologies are associated with the natural push in the direction for increased mobility - a significant trend that is getting ever stronger. These technologies include mobile computing, open standards, social media, analytics, Internet of Things and Cloud Computing.

Mobile Devices Battle

The battle as to which mobile device platform would dominate the market will continue to evolve.

Mobile Application

While all organisations big and small jump on the bandwagon to develop mobile applications, it is necessary to plan and develop a mobile strategy so as to direct and complement existing web assets and progressively transition them into mobile services.

With open standards (such as HTML5 for app development) developed, it is important to note that "40 percent of developers have started building native, only to switch to HTML5, and 31 percent have started building cross-platform, only to switch to native. Hence, the choice between native and hybrid approaches is not clear-cut but dependent on business needs, app requirements, developer skill, development timeline, and other factors.23."

Personal Cloud

Cloud is slowly becoming the centre for digital experiences to meet one's needs, be it in terms of downloading mobile apps, preferences or place to search for content and information.

In Brunei, it is only a matter of time before this wave catches on in a big way for the majority of citizens and businesses.

Hence as a start, a mobile strategy is necessary for the Brunei government as it forays into mobile app creation and delivery. Keeping the cloud as the target destination, this strategy would help define the transformation vision, building blocks, engagement, governance, investments and roadmap. It also helps to determine the stage that the Brunei government is at on the IDC mobility maturity curve – ad hoc, opportunistic, repeatable, managed or optimised.

Internet of Things

The Internet of Things (IoT) is set to explode and is driven largely by the consumer market for everyday products such as smartphones, wearables and any electronic equipment which contain IP-addressable sensors. The value for Brunei comes from what data can be collected, contextualised, analysed with insights created. One example is IoT being proven applicable in the area of healthcare and sports applications. As for opportunities, they will come from investments into marketable solutions and services that tap on this vast amount of raw data and turn it into valuable knowledge. For Brunei Darussalam, this could apply in the energy sector for monitoring its extensive network of equipment against cyber-attacks and smart asset management or for the transportation sector as it embarks on a more complex transport landscape.

2.4

Hybrid IT & Cloud Computing

For strategic big data applications, it is an obvious choice to adopt cloud as the chosen platform due to the volume and speed that it can handle. With systems, consumers and devices spanning different networks and platform, it is natural that cloud be a key part of the strategy, with its wide-spanning and ubiquitous reach. However, given that the options for commercial clouds in neighbouring countries are easily within reach, it is no wonder that local based enterprises find it attractive to engage their services. However, such distant cloud solutions could potentially pose speed and performance concerns.

Strategic Big Data

Whilst there could be potential hype, it is important for Brunei Darussalam to identify and understand its needs first. Examples include data sets created by aggregates of individuals' behaviour and sentiments (on social media sites such as Facebook, Twitter and Instagram), by transaction logs, and by automated information-sensing devices such as traffic lights or environmental sensors.

Actionable Analytics

Though data analytics can be costly, it is best justified if it comes about in the actionable form. It is encouraged that Brunei Darussalam promote this further not only amongst its local enterprises but also for its government ministries and agencies.

In-Memory Computing

The power of being able to analyse millions of transactions in mere milliseconds opens up possible new value where situational awareness is critical or where response to any change is paramount. This could be an avenue for start-ups to consider for their innovative solutions.

Integrated Ecosystems

In this White Paper, halal certification and the tourism sector are good places recommended to adopt this strategy. Another possibility is the supply and logistics business.

Enterprise App Stores

Public App Stores such as iTunes or Google Play is today reaching out and serving to a high degree most of the common consumer's needs, and this includes government mobile apps. Private or enterprise app stores would be something to consider, if the number of internal mobile apps for use within the government employees starts to grow and become prevalent.

3

The National
Digital Strategy

3

The formulation of the National Digital Strategy was done holistically. Based on the influences from the various inputs such as the National Development Objectives, Current State, Benchmarks, Worldwide ICT trends, certain key elements must be present in this paper.

A set of over-arching **Guiding Principles** provides a reference model whereby future ICT initiatives can be assessed for their alignment with the National Digital Strategy. By defining what is important for success, it paves the way for efficient and effective decision-making.

The ICT **Strategic Outcomes** are important short-term national goals that the National Digital Strategy aims to achieve by 2020. These

outcomes are fundamental in helping Brunei Darussalam achieve the Wawasan Brunei 2035 goals. To achieve the stated outcomes, a set of **Strategic Thrusts** is necessary to focus one's effort on the relevant areas. Under each of this strategic thrusts, a list of aligned **Programmes** will contribute to the overall stipulated strategic outcome at the higher level.

Lastly, enabling factors must be in place to facilitate the individual, collective and environmental changes necessary to support the achievement of the desired strategic outcomes. These **Enablers** are critical in the context of the National Digital Strategy and due attention must be given as they do impact the outcomes of the various programmes.

Guiding Principles
Enablers →
Programmes →
Strategic Outcomes →
Strategic Thrusts ←

National
Digital Strategy
2016-2020

Guiding Principles

There are six guiding principles, which can also be seen as good practice principles, which Brunei Darussalam should consider so as to make informed decisions on ICT designs and implementations. They are:

1 Top-Down Design
2 Effective Centralisation
3 Demonstrable Success
4 Citizen-Centricity
5 Mobility First
6 Context-Awareness

Due to the size of its population, Brunei Darussalam has limited human capacity resources. Hence, it has to extract the greatest value for every dollar it invests in ICT. This calls for greater efficiency and effectiveness in its ICT designs and implementations. A **Top-Down Design** approach will ensure that the "big picture" is considered before ICT investment decisions are made. Given this, high level commitment and oversight leading to good ICT governance will play a strong role in the implementation of the National Digital Strategy.

Similarly, centralisation of resources (through consolidation), if implemented properly, can bring about greater savings and efficiency. For the Brunei Government, it has already embarked on several consolidation initiatives such as creating shared infrastructure services such as a GDC facility for most of the government agencies to tap on, as well as in administrative services such as GEMS. However, in order not to stifle innovation and creativity in the smaller (and to a certain extent, more agile) government agencies, a certain level of autonomy can be allowed. Hence, **Effective Centralisation** should take place for programmes that required heavy up-front financial investments with clear cost-savings. All government agencies should be encouraged to participate, where possible. Through effective ICT governance and controls, centralised programmes should be mandated, but with government agencies given the option to "opt-out", when there are reasonable justifications to do so.

In the section titled "ICT Trends and Developments" above, the recommendation is for Brunei Darussalam to consider and adopt trends that have been tested, matured and proven to deliver value and benefits, yet able to minimise the high risks of investment associated with hype trends and avoid

3.1

the substantial high costs for R&D. Thus, when it comes to implementing ICT projects or programmes, one of the key considerations should be the ability to have **Demonstrable Successes**. This will give programmes / projects with better success rates higher priorities over ICT initiatives which might require technologies that are still in their infancy stage. Hence, for the time being the suggestion is for Brunei Darussalam to not adopt the "first-mover" position, especially where the ICT technologies involved have not been proven. However, this position and risk appetite can change in future once Brunei has laid an even stronger foundation for ICT.

Citizen-centricity has always been a strong focus for the Brunei Government, where the aim is to improve the lives of the Brunei citizens. Hence, this remains a strong guiding principle for future ICT initiatives.

The International Telecommunication Union (ITU) shared that for mobile-broadband subscriptions, it is targeted to reach 2.3 billion globally by end 2014 (accounting for 32 per cent of broadband subscriptions), of which Asia-Pacific will account for 23%. This is almost double the penetration rate from 2011, and four time as high from 2009[24]. (Figure 8)
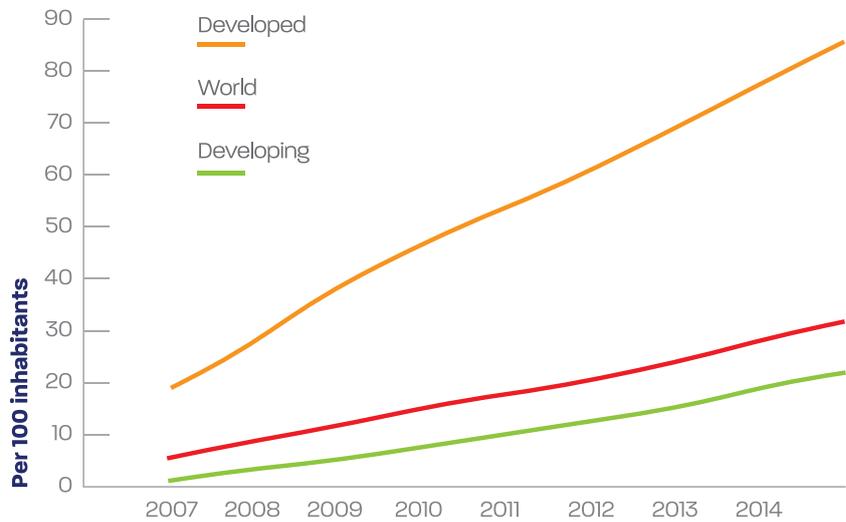

Figure 8 Mobile Broadband Subscriptions

Brunei Darussalam painted a similar picture in the National Broadband Policy where fixed broadband subscriptions per 100 inhabitants decreased by 16%[25] in 2012 over 2011, and active mobile broadband subscriptions per 100 inhabitants increased by 21%[26] over the same period. Given these, it will be important for the Brunei Government to adopt a **Mobility First** stance, where future (and if possible, current) ICT applications must be able to run on a smart mobile device such as smartphones, phablets and tablets.

The last of the guiding principles will be the need to focus on collection of data that has **Context-Awareness**. As Brunei Darussalam embarks on its data analytics journey, it will need to start capturing and collecting data. Given the overwhelming volume of information that is available, some of the key data points to capture are context aware data, such as geo spatial, metadata and sensory information, as such data can provide deeper insights that are dependent on the context of location and time.

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[24] Mobile-Broadband Uptake Continues to Grow at Double-Digit Rates. 2014. URL: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf

[25] There were 5.7 fixed (wired) broadband subscriptions per 100 inhabitants in 2011, compared to 4.8 in 2012.

[26] There were 6.3 active mobile broadband subscriptions per 100 inhabitants in 2011, compared to 7.6 in 2012.

3.2

ICT White Paper Strategic Outcomes

Three strategic outcomes were distilled from the various drivers behind this White Paper. The outcomes collectively describe the end states envisaged for the nation, economy and people. In terms of the relative amount of attention necessary to achieve each of the outcomes over the coming six year period, it is ordered with the first needing the most attention:

1 A Vibrant Economy powered by ICT;
2 ICT-Smart Citizens;
3 A Connected and Efficient Nation.

3.2.1

Strategic Outcome 1
A Vibrant Economy Powered by ICT

This outcome paints the landscape with ICT industry being another engine of growth and, at the same time, having the other economic sectors assisted by ICT to power themselves ahead.

3.2.2

Strategic Outcome 2
ICT-Smart Citizens

As each nation recognises the need to strive towards a sustainable Smart City or Smart Society, it is important that the people be prepared to support it. Hence, ICT-Smart Citizens as an outcome differentiates itself with not just the ICT-savviness aspects, but also the preparedness by Brunei's citizens to embrace all the initiatives started under the push for Smart Society.

3.2.3

Strategic Outcome 3
A Connected and Efficient Nation

This is a necessary outcome, be it for a developing or developed nation, in order to stay competitive. It is a long process but each successful connection bridged brings forth significant value and benefits. The "Efficient" component encapsulates the need to be ever resource-conscious in this world of scarce resources.

3.3

Four Strategic Thrusts and Programme Highlights to Realise The ICT Strategic Outcomes

The four recommended strategic thrusts are designed to target the main owners, key stakeholders and recipients of the intended benefits. Owners may be key drivers of the ICT industry or economic sector, stakeholders could be the ICT entrepreneurs and beneficiaries could be the individual citizen.

Below is a list of key stakeholders of the National ICT White Paper of which the strategic thrusts are designed to serve:

STAKEHOLDER	DESCRIPTION	ROLE
Key Drivers of ICT Industry	Consist of agencies such as AITI, MOC, BEDB, JPKE, iCentre and BIT Council	Promotes Industry & Manpower Development
Key Driver of eGovernment	Comprises EGNC, PMO, EGLF	Drives eGovernment Policies and Programmes
ICT industry	Established ICT companies, start-ups, strategic alliances, suppliers, ICT professionals.	Industry player, Beneficiary
Stakeholders of Other Economic Sectors	Ministries, Statutory Boards, Departments, Commercial Service providers, end consumers	Driver of sectoral programmes & Beneficiary
Brunei Government	Ministries, statutory boards and departments to support the goal of next generation government.	Drivers and owners of specific national level offices, programmes and systems & Beneficiary

Specific strategic thrusts are defined respectively for each of the three strategic outcomes, taking into account the needs expressed by the stakeholders interviewed and supported by the corresponding programmes and initiatives recommended.

The four strategic thrusts have specific programmes recommended in order to realise them. These programmes are shown in the diagram below. In total, 21 programmes are linked to the delivering of the four thrusts. Separately, five programmes are recommended to support the ICT enablers and these are described in greater details under the section on Enablers.

3.3.1

Strategic Thrust 1 Create a Thriving ICT Industry

STRATEGY	DESCRIPTION	ACHIEVES
Create a Thriving ICT Industry	This strategy focuses on developing the ICT industry, be it through creating new businesses via strategic alliances, supporting via new grants and subsidies, manpower development efforts, or generating increased demand for ICT. The objective is to achieve an ICT industry that contributes to the national economy and at the same time create a conducive business environment for local start-ups and foreign investments. It addresses the problem of the ICT job mismatch, sufficient ICT demand to sustain ICT businesses.	Higher contribution to GDP Increased no. of ICT professionals Increase in number of sustainable local companies and ones that can achieve business regionally Conducive and attractive environment to do business, especially

The programmes under the **first strategic thrust include:**

PROGRAMME	DESCRIPTION
Increase ICT Enterprise Development	Selecting high value technology areas to set up strategic alliances between foreign proven technology leaders, local ICT enterprises, demand owner and government.
Increase ICT Demand Generation	Driving the demand for ICT products and services by the general populace, sectors and government by indrectly pushing for greater productivity and competitiveness.
Re-model Grants and Incentives for ICT Industry	Grants and incentives mechanisms to spur specialised ICT training, development of innovative projects in high value technology areas with co-funding by strategic alliances.
Develop a Technopreneurship Culture	Providing opportunities to aspiring technopreneurs and start-up founders to develop the necessary skill-sets to run a start-up, with mentoring by investors and angels who can help these aspirants realise their dreams.
Address ICT Manpower Development	Initiatives to meet the demand from the ICT industry for skilled and relevant ICT manpower professionals.
Drive up Infrastructure Investment	Creating demand and opportunities for new ICT infrastructure-related enterprises; The results of good ICT availability and accessibility attracts new foreign investments & set ups

3.3.2

Strategic Thrust 2 Achieve a Productive and Diversified Economy based on Knowledge and Innovation

STRATEGY	DESCRIPTION	ACHIEVES
Achieve a Productive and Diversified Economy based on Knowledge and Innovation	This strategy advocates the harnessing of knowledge and creation of innovative solutions. It helps to achieve economic sectors that are more productive, which in turn contribute more to the economy and achieve diversification. The objective is to: 1. Identify key processes and ecosystems that would benefit from consolidation, integration and business process re-engineering to become productive. 2. Find breakthroughs and succeed by piloting in new niche markets. 3. Develop solutions for complex supporting functions that can be marketed regionally or globally in the same sector.	Diversification Increased contribution to economy Improved eRanking Penetration to regional and global market by local SMEs Unique and innovative products and solutions

For the **second strategic thrust**, the **proposed programmes** are as follows:

PROGRAMME	DESCRIPTION
Develop ICT-based Halal Certification for Local and Global	Develop an integrated and streamlined ecosystem for local halal certification; Leverage on the global recognition of Brunei Darussalam's strict standards in halal management and develop a controlled system that maintains the halal integrity for products from start of material source to production to finally reaching the end customer.
Develop a supporting Energy ICT Ecosystem with solutions that are marketable globally	Adopt useful ICT technology such as Internet of Things and develop complex supporting ecosystems in the local Energy Sector. Derive solutions that are proven through its own local implementation and market them as it is or as consultancy service to other energy-heavy nations.
Deliver the Connected Brunei Travel Experience	Through the use of ICT and the belief to serve well, create an interactive and common platform that integrates all the players and consumers within the tourism ecosystem. The desired outcome is to create an engaging, memorable and connected travel experience that is revelled by all other travel industries in the world.
Co-Create using shared Public, Government & Private Sector Data	Further the value from the Open Data programme by creating new solutions from not only government data sources but also from the public and private sector. The possibilities from the myriad of combinations will lead to greater innovation and discovery of new services, previously hampered by lack of data.

3.3.3

Strategic Thrust 3 Inform, Engage and Empower the People

STRATEGY	DESCRIPTION	ACHIEVES
Inform, Engage and Empower the People	This strategy recognises the importance for lifelong ICT learning, outreach, awareness and need for services and programmes that caters to the entire Muslim community, the masses and also to the smaller population of underprivileged and disadvantaged. The objective is to build upon and leverage on existing successful major programmes in major sectors such as education and healthcare and to tap on their current big user base. Their services and those for meeting daily Islamic services translates to regular usage and familiarity with ICT, which directly helps to develop an individual's ICT-smartness.	Higher customer satisfaction Increased number of people trained in ICT literacy Increased usage of online B2C marketplace as trust and comfort level with online services goes up.

3.3.3

For the **third strategic thrust**, the **proposed programmes** are as follows:

PROGRAMME	DESCRIPTION
Accelerate key Education ICT programmes	Scale the e-Hijrah programme for effective student learning through ICT, delivered by ICT-trained teachers; Develop policy decisions and get support from education and school leaders in push for ICT-enabled learning.
Build upon Health ICT Platform	Take Bru-HIMS to the next level and extend to private general practitioners and pharmacies; Develop data exchange standards between public, private and overseas healthcare providers and data analytics for healthcare operations; Develop a portal for community-centred self-help online health information, awareness and promotion; Allow for health data points self-input by citizens and support telecare / telehealth / telemedicine.
Develop Islamic Services for Individuals and Community	Make available as many feasible Islamic services through a new mobile-based portal that is linked to e-Darussalam; Recognise and tap on the wealth of value that can be derived through capturing, understanding and management of data about Muslim new-borns' registrations, new Muslims (Mu'allaf) conversions, student religious educations, religious tithe (Zakat) obligations, Haj pilgrimage applications, real estate (Wakaf inheritance) and religious denunciations (Murtad).
Promote Lifelong ICT Learning	Create a framework with means for all ages to learn, be ICT-Smart and aware from young and continuously build upon it throughout their lives till they are in their silver years.
Increase Community Awareness and Outreach	Increase the outreach to the public and community on the government initiatives; Increase awareness of the public about ICT trends and threats so as pave the way for them to embrace ICT extensively and securely.
Achieve Universal Communications Service	Focuses on making ICT services ubiquitously available to all geographic locale and social groups of society. Its focus will be primarily on the broadband and broadcasting components of ICT services.

3.3.4

Strategic Thrust 4 **Build a Next Generation Government**

STRATEGY	DESCRIPTION	ACHIEVES
Build a Next Generation Government	This strategy sets forth a new benchmark for efficient and effective use of ICT by a government. It reinforces the good work achieved thus far by the Brunei Darussalam government. The objective is to: 4. Create holistic views of citizens and businesses so as to better understand their needs; 5. Address silos and lack of integration across agencies; 6. Tackle bottlenecks in ICT infrastructure and common platforms; 7. Achieve improved situational awareness as it pilots a national sensor network; 8. Deliver intelligent transportation system to demonstrate the value of ICT-aided systems.	Increased number of services online Increased number of online government transactions Improved eRanking Good Customer Satisfaction

For the **fourth strategic thrust**, the **proposed programmes** are as follows:

PROGRAMME	DESCRIPTION
Create an Integrated View of Citizens and Businesses	Understand the ICT needs and concerns of citizens and businesses holistically through customer segmentation, so as to deliver a coordinated portfolio of prioritised services and supporting infrastructure.
Improve the delivery of e-Darussalam and Introduce Mobile App for Public Feedback of Municipal Issues	Understand the service delivery issues faced by e-Darussalam and develop an action plan to address them; Convenient reporting of municipal issues by the public and efficient channelling to agencies to respond.
Develop e-Payment Strategy and Payment Card Standards \	Develop a common e-Payment Standard and System; Perform e-Payment Readiness Examination; Establish the operating framework for agencies to leverage and interface to the e-Payment system; Raise awareness and promote take-up rate of Government's e-Payment initiatives.
Set up a Nation-Wide Integrated Sensor Network	Achieve real-time sensing and situational awareness on a nation-wide level through creating an integrated network of sensors and interpreting the data collected
Deliver an Intelligent Transport System	Develop an advanced transport system with features such as "greenwave", incident broadcasting and providing parking advisories.

3.4

Key Enablers

Giving due attention to enablers is as important as setting the right outcomes, strategies and programmes. More often than not, the enablers form the foundation upon which programmes rely on heavily. Whilst there are many, the key enablers covered for this White Paper include:

1

Setting up of central data hubs to facilitate information access, sharing and analytics;

2

Creation of essential ICT policies to guide all development and management of IT;

3

Giving adequate attention to ICT security for risk management;

4

Addressing manpower development as a key aspect for resource management;

5

Ensuring well performing, available and accessible infrastructure support.

3.4.1

Data Hubs

Data is one of the most valuable asset for an organisation, and definitely that of a nation. It is often collected at source and stored at source. This approach results in isolated data which gives limited perspective and value.

Taking Singapore as an example, "Singapore had a headstart in setting up the Data Hubs (People, Establishment, Land) since 1994 to support e-services across government agencies. Despite the initial pains of unifying the People Data, Company/Business Data and Land Data, in terms of setting data standards and unique identifiers (IDs), formulating the data management governance and legal framework to capture, maintain and propagate the data, the appointed authorities bit the bullets and pushed through to see the Data Hubs properly set up and maintained. These Data Hubs have since been the bedrock for government e-services to thrive on at the "whole-of-government" level, enhancing productivity and integrity[27]". Thus, Brunei Darussalam can similarly follow suit and reap the same benefits with relative ease due to its smaller data volume.

Four principles of data use that are tested and proven is suggested here to guide Brunei Darussalam as it moves ahead in the data management space:

Data that is reliable and kept current creates trust;

Data, when consolidated, creates a wider and different perspective;

Data, when shared, creates informed public and it is valuable to the commercial sector for decision making (actionable intelligence) and creation of new services;

Data, when analysed, creates insights not known before.

Reliable Data — Single Source of Truth
Often enough, the same set of data such as home address is captured several times during the application of services. If a data collector (usually a government agency) backed by policy is able to provide a verified means to collect and receive validated updates, a set of reliable data is achieved.

[27] National Strategies to Harness Information Technology: Seeking Transformation in Singapore, Finland, the Philippines and South Africa by Nagy K. Hanna, Peter T. Knight.

3.4.1

Data Consolidation

Once several sets of such related data are established, a data hub is formed. Just by consolidating, a wider perspective is derived. This is especially so when they are presented graphically in a geospatial manner.

For Brunei, **the following data hubs are recommended** to begin with:

Peoples Hub (name, gender, home address, etc.);

Business Hub (company name, operating location, business registration number, board members, etc.);

Social Services Hub (providers, services, schemes, etc.);

Geospatial Hub (geolocations of non-sensitive structures, related-metadata, sensors location, commercial services, etc.).

Data Sharing

EGNC has recently launched its Open Data Initiative (www.data.gov.bn) on 1 Dec 2014 with over 300 data sets contributed by the Department of Economic Planning and Development (JPKE), the Ministry of Education (MoE), the Ministry of Health (MoH) and the Ministry of Industry and Primary Resources (MIPR)[28]. This effort by the government is commendable.

The next logical step is to crowdsource and allow controlled publishing of data by both the public and commercial sector. This move is logical as the two new group of contributors are firstly considerably large, contributing to the richness and usefulness, and secondly, they are also the source of real-time useful data, reflecting changing patterns and needs.

Data Analytics

Data analytics is a costly endeavour that is both people and resource intensive. It is a tool that has matured and made itself even more useful in the coming future due to the increasing huge volume, speed and variety of big data generated and collected by government agencies and private enterprises.

Supporting this is Figure 9, showing Gartner's 2014 Hype Cycle. On top of rudimentary data analytics which has been around for a while, we are now seeing in-memory systems for real time analytics and content analytics, both of which are advanced analytical technologies and these are projected to plateau and mature in the next two years.

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[28] The Brunei Times, Towards Online Future with New EGNC Website. 28 Nov 2014.
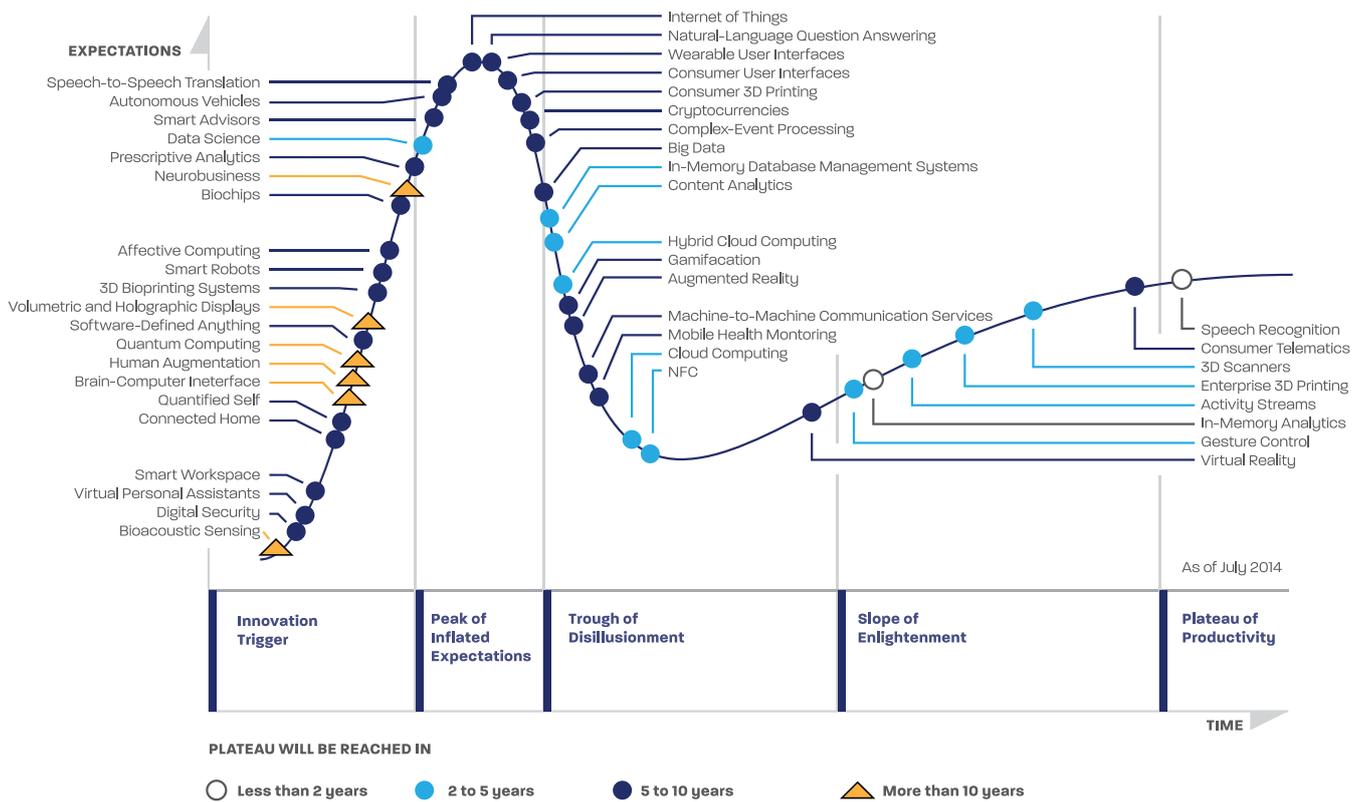
Figure 9 Gartner's 2014 Hype Cycle

For Brunei, whilst government agencies may not have invested into data analytics in a big way, there is an opportunity to create a centralised government data analytics platform. This approach allows the government to operate a shared facility and be cost effective.

On the same track, it is essential to promote the usefulness of data analytics to the private sector. However, it is necessary to establish affordable means and schemes for adoption. This could be achieved through partitioning part of the proposed common facility for the purpose, which is a viable and cost-reducing business model for the government.

In summary, the four data principles are described in Figure 10 below.

Open & Centralised Data with Analytics	**Shared**	**Analytics**	**Centralised Data**
Managed and driven by new National Data Offics	Expanding value from data.gv.bn to include data from private sector and people.	Common Analytics Platform & Tools for Govt agencies;	Managed Data.gov.bn (textual data);
Create single source of truth for reliable key data , insights, innovation opportunities and value for citizens, govt and businesses		Promote use and adoption of analytics.	Create and host One-stop access to People Hub, Land Hub, Social Services Hub;
Centralised and shared data, coupled with cost-effective data hosting, secutiy and analytics			Create and host New Brunei Geospatial Map, GIS Data & Services;
			Collect, Host & Manage Nationwide Sensor Data;
			Host National Digital Archives, E-Arkib.

Figure 10 Data Principles

3.4.2

ICT Policies

For overall guidance at the national level, a National ICT Policy is necessary to address the pertinent ICT issues and harmonise the various ICT standards, rules, procedures and regulations in operation.

Two examples[29] of a National ICT Policy are as follows:

1 The Tanzania National ICT policy states that among other things, an effective ICT policy should be progressive while promoting cost-effective intervention, inclusive, fostering a fair and comprehensive environment, taking into account the development of human capital, having mechanisms for regular review, setting out the necessary institutional arrangements for sustainable implementation, but should not be technology dependent. Therefore creating an appropriate environment is a prerequisite for the National ICT policy taking into account "best practice attributes".

2 The Government of Rwanda recognises that geographic data and information are essential to social and economic planning and development. It believes that they are much a part of the nation's information infrastructure as the other elements of the infrastructure and should be accorded the same level of support. In this context, ICT policies and strategies including National Information and Communication Infrastructure (NICI), will take into account the geo-information component.

Besides having a National ICT Policy, in order to support and enable the development of a robust ICT sector in Brunei Darussalam, the government will need to provide the legislative credibility of which ICT-based activities can be built on. This could be a comprehensive set of ICT policies which includes legislation, regulations, rules, procedures and appointed regulatory institutions. Once In place, they will facilitate, encourage and enforce a culture of transparency and accountability by ICT providers. It also creates the right environment and provide trust and confidence to both consumers and businesses of ICT, knowing that controls are in place.

29 The Need for National ICT Policy – Role of ICT in National Development Plan, by Marcel O Odhiambo, Tshwane University of Technology, South Africa.

National ICT Policy

The responsibility to develop and maintain a National ICT Policy and a comprehensive set of supporting policies and standards, will take considerable time and effort. Therefore, it is recommended that the relevant ICT policy agency to undertake the following key roles:

1 Study, develop and issue new essential ICT policies – To engage relevant agencies to study, develop and issue new ICT policies, ensuring also that they are complete, comprehensive and applicable to the ICT sector. It must also ensure that national ICT plans, policies and standards are aligned with national development thrusts, international commitments, and the overall national interest Examples of new policies could be the enactment of a Data Protection Act or the Electronic Evidence Act;

2 Clear and approve changes from periodic review of existing policies – In the ever-changing ICT sector, policies need to be periodically and regularly reviewed to ensure they remain relevant and effective. For example, existing policies that may have to be reviewed include National Broadband Policy, Electronic Transaction Act, and Computer Misuse Act. The need for review could be due to new broadband options, increase in online electronic transactions or cyber-based security wrongdoings;

3 Administer compliance through annual check – Any good policy is as good as the enforcement and compliance to it. One way is to conduct random annual checks and provide checklists for government agencies and affected parties to self-administer compliance. However, for greater support from the top, heads of agencies and organisations would have to endorse the self-declaration. This is currently practised in the Singapore Government;

4 Issue ICT-related General Orders (GO) – Besides, major ICT policies and legislated acts which may take time to develop and endorse, it is important to be able to quickly issue general orders or instructions to effect immediate actions to be taken. Such directives may be to promote collaborations and sharing within the public sector. For example, to issue directive for increased sharing of textual and geospatial data to data.gov.bn and the national GIS map. Another area would be to issue instructions to adopt ICT standards, best practices and guidelines.

3.4.3

ICT Security

With the progressive increase of ICT adoption within Brunei Darussalam, one of the main concern is to ensure that sufficient attention is given to ICT security. Increase in ICT usage increases the need to protect the data, computing devices, networks and services that they provide from the growing threats.

Key Milestones

On the ICT security front, the government of Brunei Darussalam have already made significant headway by undertaking the following key initiatives:

1 Putting into Effect the Computer Misuse Order, 2000 — In Jun 2000, An Order to make provision for securing computer material against unauthorised access or modification and for matters related thereto;

2 Establishment of Brunei National Computer Emergency Response Team (BruCERT) — In May 2004, the nation's first trusted one-stop referral agency was established to deal with computer-related and internet-related security incidents in Brunei Darussalam.

BruCERT also coordinates with local and international CSIRTs, network service providers, security vendors, government agencies, as well as other related organisation to facilitate the detection, analysis and prevention of security incidents on the Internet;

3 Cyber Security and Internet Etiquette Awareness Programme. Started in 2009, this programme has conducted of a series of seminars targeted for students and teachers of local educational institutions and parents;

4 Development of a National Cyber Security Framework — Since 2014, the e-Government National Centre (EGNC) under the Prime Minister's Office, has been developing the National Cyber Security Framework to provide the overarching framework on managing cyber security at the national level. These efforts are showcased below in Figure 11.

2000
June
Putting into Effect the Computer Misuse Order, 2000

2004
May
The establishment of the Brunei National Computer Emergency Response Team (BruCERT)

2009
Introduction of the Cyber Security and Internet Etiquette Awareness Programme

2014
Embarking on the implementation of the Brunei National Cyber Security Framework (In-Progress)

Figure 11 National Cyber Security Journey

Security threats are very real and are ever-present. Without adequate ICT security, Brunei Darussalam will be exposed and vulnerable to both domestic and foreign threats.

This White Paper recommends the following ICT security initiatives to boost the security activities that are ongoing:
1 Setup National Cyber Security Office (NCSO);
2 Setup National Authentication Framework (NAF);
3 Develop Policies, Legislations and Best Practices.

National Authentication Framework (NAF)

One of the key challenges in the cyber world is the difficulty to accurately establish the identity of a person on the internet. This is especially important when transacting with the government as there could be severe consequences, should such an impersonator apply for a passport.

Therefore, it is proposed that a National Authentication Framework (NAF) be set up whereby a single form (but may not be single factor) of authentication can be used to transact with all government agencies as well as commercial entities. Effectively, the NAF can:

1 Be the convenient single authentication device for consumers to access multiple online services that require strong authentication;

2 Enable businesses to enjoy cost savings through NAF instead of implementing their own strong authentication systems;

3 Boost online trust and confidence for Brunei to viewed as a trusted infocomm hub;

4 Enhance protection against online identity theft for online services for both consumers and online business owners.

Develop Policies, Legislation and Best Practices

As the world continue to evolve with new means and ways of delivery new services over the internet, policies, legislations and best practices too have to be constantly reviewed and updated to maintain relevance towards the ever-changing business environment.

The government should lead in this area but seek the participation and contribution from the industry experts and academia to ensure that policies, legislation and best practices developed are well-formulated, adequate in coverage and relevant to the industries and public.

Some of the more immediate activities are:

1 To study and formulate necessary national legislation – While there has been the Computer Misuse Order from 2000, relevant new ones such the Data Protection Act and Cyber Security Act should be developed;

2 To establish a set of IT Security Best Practices as guidance to both government and private organisations – The establishment of IT security best practices will serve as a useful reference tool for both government and private organisation, especially for smaller start-ups that might not have the resources to develop and maintain a set of in-house security policies.

3.4.4

ICT Manpower Development

In July 2014, a National ICT Manpower Masterplan was commissioned for development..

As part of the study, an analysis was carried out on the current state of ICT manpower. Coupled with feedback from the industry and education institutions, the following key issues were identified to be addressed:

1 Limited perception of an ICT career.

2 Lack of data on ICT manpower;

3 Skills gap and mismatch in the ICT talent pool;

4 Domestic demand for ICT services remains weak, with a high reliance on public sector ICT projects.

Against the backdrop of an **educated ICT workforce** which is **about 2%** of the total workforce, the following was also observed:

1 Only about 38% of bigger companies and 35% of SMEs responded that they had the sufficient ICT manpower to meet their demand;

2 Outside of government and financial sectors, 6 out of 10 hired ICT staff were Bruneians or PRs;

3 Top 3 areas in demand were ICT network, support and security.

In the report, the defined strategic target is to **grow the number of skilled ICT professionals** to 6,000 by creating 1,800 additional jobs in ICT by 2020.

Its three desired goals were:

1 Making ICT as an attractive career option for Bruneians;

2 Developing highly skilled ICT professionals with industry relevant competencies;

3 Creating a vibrant ICT industry in Brunei Darussalam as a source of employment.

To achieve the desired goals, four strategies were defined:

1 Attracting Bruneians to ICT careers: This strategy focuses on creating a better understanding and perception of the ICT profession, the type of jobs available in ICT amongst students and ICT professionals.

2 Developing "industry-ready" ICT graduates: This strategy aims to develop industry-ready ICT students who are capable of meeting the current and future needs of the economy.

3 Deepening the existing talent pool: This strategy seeks to enhance the existing capabilities of the domestic ICT talent pool as well as to improve the hiring of selected foreign ICT professionals.

4 Creating opportunities for employment: This strategy seeks to create more opportunities for ICT employment by expanding the scope and adoption of ICT usage in both the government and private sector.

To actualise the strategies and enablers, 21 programmes were designed and they are as shown in the table below. Full details would be available in the National ICT Manpower Masterplan when it is officially launched.

S1 | **ATTRACTING BRUNEIANS TO ICT CAREERS**

P1   **ICT Possibilities programme**
Create mindshare, increase visibility and generate interest in ICT careers, ICT professionals, ICT businesses and ICT ecosystem.

Deepen students and career counsellors' understanding of ICT careers and change their attitudes and perceptions towards the ICT profession, including ICT entrepreneurship through seminars

P2   **Youth ICT Network**
Provide students and unemployed youths in Brunei an opportunity to network and learn from each other in order to foster passion in ICT through forming ICT clubs.

P3   **Discover and Excite**
The objective of the Discover and Excite programme is to generate passion in ICT and inculcate computational thinking through short (0.5 ~ 1) day enrichment/experiential programmes.

P4   **National ICT Scholarships**
Attract, develop and retain bright Bruneian ICT students, young professionals, to take up the ICT profession or enhance their careers through the provision of scholarships where the bond period will be served through a combination of private and public sector appointments.

P5   **ICT Manpower Portal**
Build a one-stop ICT portal that can provide information relating to ICT career, jobs and development in Brunei. The ICT portal can also host a section targeted at expatriate professionals, which can be used to showcase the attractiveness of Brunei Darussalam as a living and working destination. The portal should also have a section dedicated to promoting ICT as a suitable career for disabled people.

S2 | **DEVELOPING "INDUSTRY-READY" ICT GRADUATES**

P6   **ICT Skills Round Table**
Platform where the three stakeholders involved in university education, namely the higher education institutions, employers (ICT and non-ICT organizations) and representatives from the government (AITI, MOE, EGNC) meet to exchange ideas and brainstorm ways to ensure that ICT students are well equipped to meet the ever changing demands of the ICT industry and labour market.

P7   **Structured Workplace Internship**
To increase the effectiveness of the internship process for both employers and interns through better planning

P8   **Enhanced ICT Youth Development Programme**
The objective of the Enhanced ICT Youth Development (eYDP) programme is to improve the ICT Youth Development experience by introducing new modules as well as soft-skills to improve the employability of the graduates.

P9   **Enhanced INSPIRE**
To provide more opportunities for high quality, overseas internship for students in the education institutions.

S3 | **DEEPENING THE EXISTING TALENT POOL**

P10   **ICT Industry Competency Framework**
Ensure Brunei's ICT professionals have the relevant skills to develop their careers by providing a national standard for ICT job roles, competencies and the type of training required.

P11   **Critical ICT Skills Upgrade Programme**
Ensure Brunei's ICT professionals have the relevant skills for the development of their careers by providing a national standard for ICT job roles and the competencies and training required for these job roles.

P12   **Overseas Talent Programme**
Attract the best ICT talents for top positions in the country, with a preference for existing Bruneian and former Bruneian citizens working overseas.

P13   **Review Labour Policies For Foreign ICT Professionals**
Ensure the right foreign ICT professionals are hired to fill gaps in critical Infocomm roles.

3.4.4

S4	**CREATING OPPORTUNITIES FOR EMPLOYMENT**
P14	**ICT for SME Programme** To enhance the productivity of companies through the adoption of infocomm solutions, thereby leading to new business opportunities for ICT companies.
P15	**ICT Savviness Programme for SME** In parallel with the ICT for SME programme, the ICT Savviness programme seeks to educate SMEs on the benefit of using ICT in their businesses to improve their productivity and reduce cost.
P16	**Employer Payroll Incentive Programme** To encourage companies, including SMEs to send staff for training by reducing their cost of operations.
P17	**Government ICT Project Forum** The objective for the Government Procurement Dialogue is to share with the private IT sector on the government procurement plan so as to make the market place attractive and transparent to supplier.
	ENABLERS
E1	**ICT Skills Round Table** Pilot niche MOOC programmes as part of tertiary curriculum Enhance existing tertiary curriculum with the most current ICT areas by leveraging on technology.
E2	**Growing Hobbyist Developers to supplement the ICT manpower talent pool** To support hobbyist ICT developers by providing venues and other resources.
E3	**National ICT Manpower Survey** To obtain regular data on the current state of the National ICT manpower in Brunei Darussalam and to identify key trends and requirements going forward.
E4	**Graduate Employment Data Collection Framework** To gather statistics on fresh local graduates thorough Graduate Employment Surveys. The statistics will help us to understand: - the types of employment these graduates go into, e.g. if it is ICT related or not; - the types of industry people are working in ICT in, e.g. Oil & Gas, Healthcare; - how many students stay on in Brunei and how many leave after graduation; - the jobs Bruneians take up.

To put things in perspective, the National ICT Manpower Masterplan strives to address the provision of the appropriate number of suitably trained ICT manpower (Supply), in anticipation of the demand. In a complementary role, the National ICT White Paper looks at developing a vibrant ICT industry, increasing ICT developments and demand by the various sectors and putting in place the necessary initiatives at the national level (Demand).

3.4.5

ICT Infrastructure

ICT Infrastructure for the nation revolves mainly around three major components, namely:

Cloud

Data Centre

Next generation broadband network.

Cloud
At present, a One-Government Private Cloud (OGPC) is in operation, hosting the e-Darussalam one-stop government services portal. Until such time where the ICT demand extends beyond that of government projects, it is unlikely that any commercial clouds would be set up in Brunei Darussalam. As a result, local ICT needs that are suitable for cloud services often seek commercial clouds sited in neighbouring countries.

National Data Centre
In 2012, BEDB called a tender to develop a National Data Centre which includes a hydrocarbon data centre. The tender is now in the final stages of evaluation. When the national data centre is ready, it will present many opportunities to consolidate smaller ones to reap the benefits from economies of scale. This includes the viability to be the disaster recovery site for Brunei Shell Petroleum and many of the data hubs proposed in this White Paper.

Next Generation Broadband Network
In 2012, a budget of BND $230 million was approved to implement a national broadband initiative. This was supported by the Telekom Brunei Berhad (TelBru)'s initiative to construct a fibre to the home (FTTH) broadband network. The target then was to connect to potentially 41,000 homes In Madang, Gadong and Bandar Seri Begawan. As of the beginning of 2014, 15,000 subscribers are connected to this network.

Ministry of Communications, has under its National Broadband Policy set the goals to:

1 Ensure that all Bruneian homes and business can access a high-speed broadband service by 2017;

2 Ensure that competition delivers benefits to broadband users in the forms of lower prices, better quality, and greater choices;

3 Maximise the number of Bruneian's making use of broadband connections to the internet.

3.4.5

To meet that, it has set forth to achieve the following ITU targets by the year 2017:

A minimum of 10 Mbps (shared) broadband connectivity to each Kampong;

Basic broadband services offering headline downstream speed of at least 2 Mbps to be available to 95% of the population by December 2015;

High-speed broadband services offering headline downstream speed of at least 20 Mbps to be available to 75% of the population by 2017;

Additional 190 MHz (2 x 70 MHz FDD and 50 MHz TDD) in the 2.6 GHz spectrum band made available for assignment to broadband service providers;

Universal service definitions completed;

A new competition code

of practice for the telecommunications and broadcasting sectors introduced;

A new unified licensing regime is implemented December 2016;

Ex ante wholesale access requirements in relation to the FTTH network, international links, and key national backhaul network infrastructure are introduced;

Study into the potential establishment of a national internet exchange with local peering arrangements;

Study into the potential for internet peering with peers within ASEAN completed;

Retail price controls introduced in relation to broadband services supplied via the FTTH network introduced by June 2015; The retail price for a

residential high-speed broadband service with a headline downstream speed of at least 20 Mbps is less than 3% of average monthly earnings by 2017;

At least 80% of households with a broadband service by 2017;

At least 85% of the population using the internet regularly by 2016;

At least 4 ICT Rural Outreach Program Centres in Brunei Darussalam by December 2016;

Strategic plan for the development of greater local content completed;

Broadband quality of service regulations introduced.

These targets, if delivered, would propel Brunei ahead and support all the ongoing and new programmes by the government. One such recent achievement is Telekom Brunei Berhad's (TelBru) lowering of broadband rates by 40 per cent starting 1 Mar 2015, which aimed to reduce broadband entry costs and increase balanced data consumption among users. However, as these targets culminate in 2017, it is recommended that the Ministry of Communications and AITI takes steps to measure the meeting of the targets, take rectification actions, re-calibrate and prepare new targets. At that time, it should also consider the strategy of setting up a heterogeneous network to enable everyone and everything to be always connected via the best available network that can serve their connectivity needs with a very high speed, everywhere, at any time.

Complementing this network is the One Government Network (OGN) for all government ministries and agencies. This has helped to create the platform of which it can centrally manage the ICT traffic with the whole of government. It is recommended that the performance (quality of service) of this network be monitored with its bandwidth and speed to equal the demands placed on it.

4

Aspirations 2020

4

Aspirations
2020

The Government of Brunei Darussalam is accountable for the progress and success of the National ICT White Paper. The progress and success of the Plan must be based on performance measures that are finite and agreed upon by stakeholders. They must be clearly documented and published, so as to be accountable to the people of Brunei Darussalam.

At the White Paper level, clear outcomes have been identified with challenging but achievable targets. Subsequent to the launch of the White Paper, these targets must be assigned and owned by a specific government agency or department. Please see Figure 12 below for the White Paper's Recommended Aspirations 2020 targets.

These recommended targets, together with the programmes that will support and contribute towards achieving the outcomes.

Even though there were calls to extrapolate the targets to the year 2035, it was not pursued given the nature of the fast changing ICT environment and technologies involved (which can be highly disruptive). Additionally, for Brunei Darussalam to stay agile and relevant, a fresh set of strategic thrusts and programmes will have to be re-established possibly every 5-6 year period. Lastly, growth numbers are also likely to be non-linear and hence any projected figures for 2035 will not be accurate and meaningful.

At the master plan and action plan levels (to be developed downstream), KPIs and targets are recommended to be set at project level to track the progress of projects. These separate set of targets when monitored will help to track the success of the respective programmes and the overall Plan. As part of the monitoring process for the National ICT White Paper, it is recommended that the ICT white paper programmes to be reported on quarterly through annual basis.

Since the formulation of the Wawasan Brunei 2035 long term development plan and RKN 9, ICT has been viewed as an enabler to economic growth and development of ICT will continue to be given priority[30]. Hence, it is critical for the success of the National ICT White Paper to be recognised as direct contribution to the outcomes of the former. These measures should be incorporated into measurement framework of the Wawasan Brunei 2035, where possible.

ASPIRATIONS 2020	CURRENT BASELINE
3x contributions by ICT sector to GDP	1.8%
6,000 Skilled ICT professionals	4,200
5 Local ICT SMEs with regional business	2
30 Places improvement in key rankings	WEF GCI Tech-Readiness 71 UN eGOV 86
80% Customers satisfied	New
1.5% Cost of broadband to average monthly income	Over 3%
50,000 Online B2C marketplace transactions	New
18,000 Citizens trained in ICT literacy	Annually 1,000

Figure 12 Aspirations 2020

[30] From Chapter X titled "Info-Communications Technology": Brunei Darussalam Long-Term Development Plan, by Prime Minister's Office, Brunei Darussalam, (2007).

5

High Level Implementation Roadmap

The list of programmes described in Section 3.3 will be delivered over a period of five years beginning 2016 to 2020. The programmes are prioritised in accordance to the following guidelines:

1 Current On-Going Programmes
- Current programmes that are on-going shall be implemented in accordance to their existing schedules

2 Foundational Programmes
- Programmes that are considered foundational shall be scheduled to start earlier;
- Periodic reviews should also be built into these programmes over the six year timeline for tweaking purposes;
- Examples of such programmes would be "Infrastructure Investment and Policies", "Lifelong ICT Learning", "Universal Communications Service";

3 Programmes for Reviewing and Strengthening
- Programmes that focus on reviewing and strengthening existing initiatives shall be scheduled to start earlier;
- Periodic reviews should also be built into these programmes over the six year timeline for tweaking purposes;
- An example of such a programme is "e-Darussalam 2.0";

4 Long Term Programmes
- Programmes that are longer term in nature should be implemented in waves so as to learn and refine the implementation approach along the way;
- Examples of such programmes would be "ICT Enterprise Development", "Co-Creation Using Government Data".

2015	2020	2025	2030	2035

Start Key Initiatives

Strengthen Foundation

Transform

Globalise

1 "Enablers" Programmes

2 ICT Enterprise Development

3 ICT Manpower Development

4 Technopreneurship

5 Infrastructure Invesment and Policies

6 Co-Creation Using Government Data

7 Supporting Energy

8 ICT in Education

9 ICT in Health

10 ICT Lifelong learning

11 Universal Communications Service

12 e-Darussalam

13 ICT Demand Generation

14 Grants and Incentives for ICT industry

15 Halal Certification Local and Global

16 Community Awareness and Outreach

17 Integrated View of Citizens and Businesses

18 Nationwide Intergrated Sensor Network

19 Intelligent Transport System

20 Islamic Services for Individuals and Communities

21 The connected Brunei Travel Experience

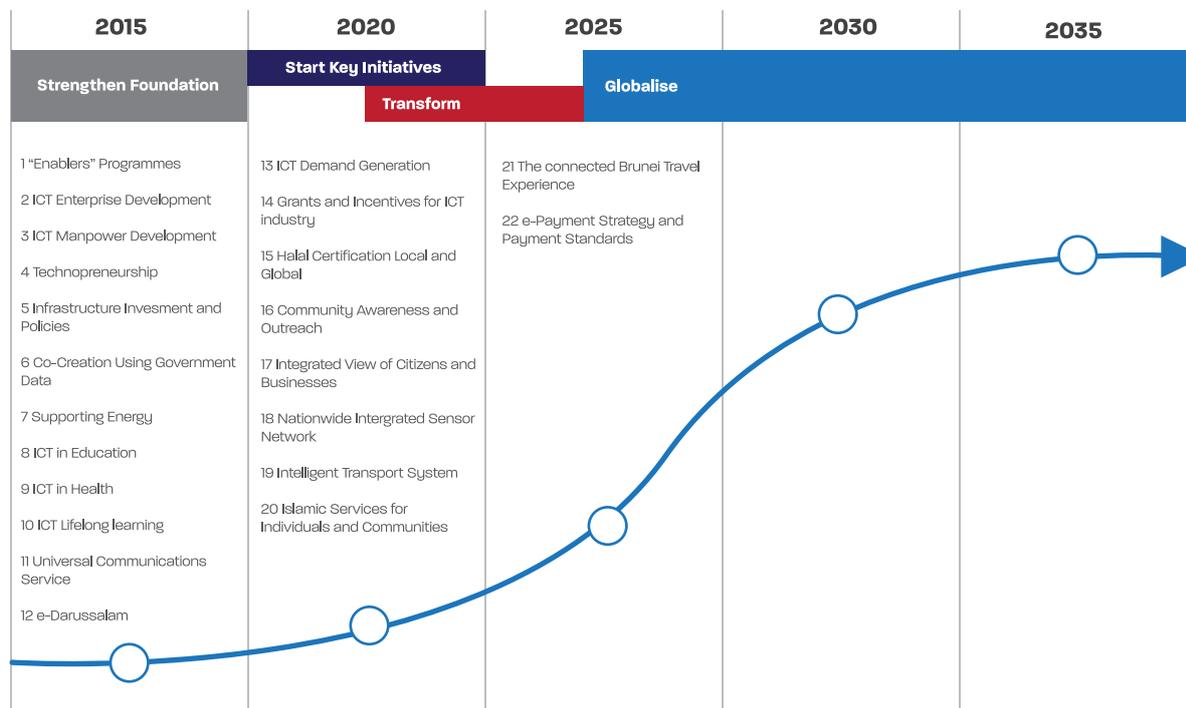22 e-Payment Strategy and Payment Standards

Figure 13 High Level Implementation Roadmap

In general, the approach taken by the White Paper is one where the foundation is strengthened first before starting the key initiatives to transform the country. The rationale is to ensure that the same foundational piece is ready and able to support any of the Smart Society initiatives that runs in parallel to the programmes of this White Paper. See Figure 13 above.

While the Ministry of Communications will take overall ownership of the National ICT White Paper, support from the other government agencies and the industry is critical to ensure the successful implementation of the White Paper.

6

Conclusion

The National ICT White Paper aims to provide both remedial and proactive interventions to jumpstart the effort in diversifying Brunei Darussalam's economy, creating opportunities for the people and enhancing the quality of their lives.

For successful implementation of the plan to meet the desired outcomes, a strong governance must be in place to ensure timely mitigation to manage changing priorities and needs of the country.

There is also the need for continued strategic investments in ICT. To make ICT the future engine of economic growth for Brunei, Government investments are still necessary to support the still fledgling local ICT industry, so as to create a tipping point in momentum where the private sector organisations can take over and continue the economy diversification effort.

More importantly, there is a need for a mind-set change to transition to a new knowledge-based economy and embrace ICT extensively. The people, businesses and the Government of Brunei Darussalam must be prepared to do things differently and adapt to new ways of learning, living, doing business, staying 'connected' and delivering public services.

Acknowledgements

The development of the National ICT White Paper tapped on the collective wisdom of a diverse group of individuals who represented the business community, the Telcos industry and public servants from different levels across the public sector. The White Paper benefitted from their contributions in terms of direction, support and feedback either in an advisory role or as a member of a work group or focus group.

See below the list of organisations, companies and agencies who had contributed their comments and feedback during the development of the National ICT White Paper (in no particular order).

Organisation/Company/Agency

Prime Minister's Office

Ministry of Communications

Ministry of Education

Ministry of Finance, Investment Division

Ministry of Health

Ministry of Primary Resources and Tourism

Autoriti Monetari Brunei Darussalam

Authority for Info-communications Technology Industry of Brunei Darussalam

Brunei Economic Development Board

Brunei Investment Agency

Brunei Technical Education

Brunei Tourism Board

Brunei Darussalam National Information Technology (BIT) Council

Department of Economic Planning and Development

Department of Technical Education

Department of Civil Aviation

E-Government National Centre

Land Transport Department

Public Works Department

Abdul Razak Holdings

Alif Technologies Sdn Bhd

Azure Technologies

BAG Networks Sdn Bhd

Baiduri Bank Group

Brunei Shell Petroleum Company Sdn Bhd

Darussalam Holdings Sdn Bhd

DST Sdn Bhd

e-Government Innovation Centre (eG.InC)

Ghanim International Corporation Sdn Bhd
H.A.D. Technologies

Infocomm Federation of Brunei Darussalam

Institut Teknologi Brunei

International School Brunei Ishajaya Technology Sdn Bhd

ITPSS Sdn Bhd

J.J. Tour Services Sdn Bhd

Jerudong International School

Kin-ethics Company

Radisson Hotel

PAR Food & Beverage Sdn Bhd

Laksamana College of Business

The Brunei Hotel

The Empire Hotel & Country Club

Telekom Brunei Berhad (TelBru)

AITI Authority Members

Infocomm Development Authority of Singapore - International

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