

# Scenario Development for Job Futures Brunei Darussalam 2040\*

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## Abstract

This paper is based on a scenario development exercise to identify economic and job futures possibilities, in terms of employment and working patterns as well as future types of jobs and related manpower policy issues. Mindset and mentality change at all levels, 4IR/future ready skills and education, economic competitiveness and extreme 4IR acceleration are the critical issues which was identified and treated as key driving forces in shaping Brunei's job futures 2040.

Three research questions as follows were then addressed:

- a) What are the four most probable future economic scenarios for Brunei 2040?
- b) What types of jobs will there be in each of the four future economic scenarios for Brunei 2040?
- c) What are the main manpower planning implications of the probable future economic scenarios for Brunei 2040?

The paper then outlines the manpower implications of the preferred economic and job futures scenario for Brunei 2040, which is the scenario built upon rapid 4IR transformation and economic competitiveness.

**Keywords:** *job futures, strategic foresight, scenario planning, fourth industrial revolution, Brunei Vision 2035*

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\* This paper was written prior to the COVID-19 pandemic. However, as the pandemic has accelerated a number of aspects of the 4IR which is the focus of the paper, the points made are still relevant.

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## **1.0 Introduction**

Wawasan Brunei 2035 or Vision 2035<sup>2</sup> aims for the nation to be widely recognized for the:

- Accomplishment of its educated and highly skilled people as measured by the highest international standards;
- Quality of life among the top 10 in the world as measured by the United Nations Human Development Index;
- Dynamic and sustainable economy with income per capita within the top 10 in the world.

Brunei recognizes the need to achieve economic diversification away from oil and gas for sustainability and has pledged to transform itself from a primarily resource-based economy to a Fourth Industrial Revolution (4IR) economy. A number of initiatives have been undertaken to increase industrialization, capital deepening, private sector growth and to encourage Foreign Direct Investments (FDIs). Recently there has been an increase in FDI projects, such as the first production of the downstream oil and gas industry for an Oil and Petrochemical Plant Project and the construction of the Brunei Fertilizer Industries (BFI) plant<sup>3</sup>. However, the country's moves to diversify the economy away from a predominantly oil and gas economy has so far lacked the success levels that it aspires to and the 4IR has yet to be established within the country. In addition, increasing levels of unemployment and the worry that our current situation and job futures are quite bleak and highly uncertain is a serious policy concern, especially if Wawasan 2035 goals are to be achieved. Brunei's unemployment rate at 9.3% (Brunei Labour Force Survey, 2017) is higher than the ASEAN average of 3.3%. This concern is even more serious when we look at the youth (15-24 years old) unemployment rate where the figure is 31.7%. Basically, one in three Bruneian youth are unemployed.

What is the future of jobs for our youth over the next 20 years and beyond? How will Brunei be affected in terms of manpower implications given our goal of economic transformation towards the 4IR? There are a number of unknown opportunities and challenges (Cheong, 2019). Will Bruneians be faced with a jobless future? Lights out manufacturing? New types of jobs? Labour bifurcation? New job organization - portfolio careers, gig economy, new skills and knowledge and attitudes? For now, Brunei's economic future and, at least, the longer-term trends including how our employment and educational structures will be impacted in our quest towards 4IR are still uncertain in Brunei. This paper outlines the findings of a sub-project under a National Youth Unemployment and Job Futures project<sup>4</sup>, which attempts to answer some of the questions raised. Bruneian youth is the target population for our study as they (up to 35

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<sup>2</sup> See Brunei Darussalam Long Term Development Plan, 2007.

<sup>3</sup> Brunei's GDP growth has been low to negative for nearly 20 years and it is forecasted that its oil reserves are near depletion. However, in 2019, the IMF has projected the country's GDP growth at a promising 4.7 per cent for 2020, taking into account the new FDI projects. Source: Othman, 2020.

<sup>4</sup> See CSPA (2019). Study of Youth Unemployment in Brunei Darussalam: Towards a Sustainable Job Future, Final Report (publication pending).

years old) comprise approximately 60 per cent of our population and represent the future of the country.

The 4IR in this paper refers to what Schwab (2016) has described as a ‘profound change in economic and social structures’ in which the new technologies of automation - artificial intelligence (AI) and digitalization are predominant and this results in ‘a fundamental shift in how we produce, consume and relate to one another’

Our approach here is a combination of strategic foresight (or futures studies) with strategic forecasting. Strategic forecasting makes assumptions that an event will happen and usually with a defined probability which is extrapolated from the use of competitive intelligence analysis or environmental scanning of the trends and emerging issues of the event. The tendency in strategic forecasting is to assume that the future is a linear outcome of the progression or regression of identified current trends and emerging issues. On the other hand, strategic foresight is a broader term, encompassing forecasting but emphasizing the need to explore a number of alternative future possibilities, which are in addition to business as usual (BAU) expectations.

Futures studies - research - is concerned not only with forecasting the future, interpreting the future and critiquing the future, but also with creating not just the possibility but the reality of alternative worlds, alternative futures. Through structured methods, the emergence of new visions and strategies result (Inayatullah, 2015)<sup>5</sup>.

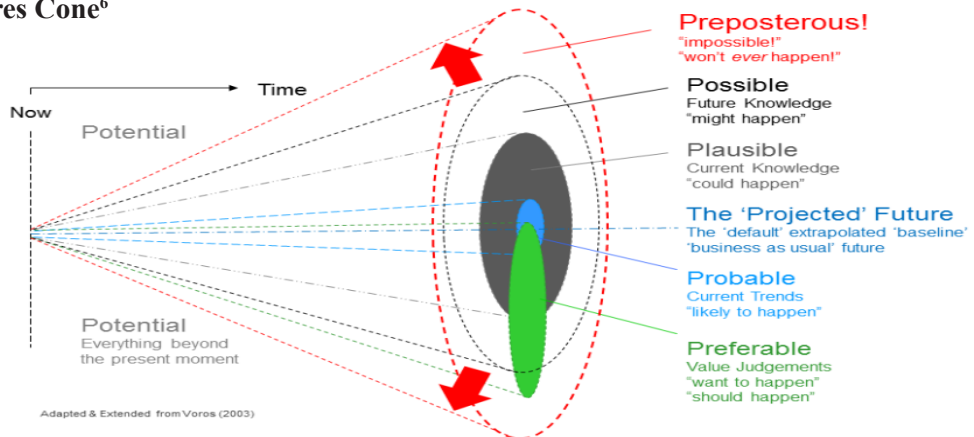
Strategic forecasting is useful for the short-term horizon, typically 1-5-year strategic plans, whereas strategic foresight is necessary for medium to longer term planning horizons of 10-30 years. Central to the distinction between the two approaches is the viewpoint that is held as to the certainty, control and impact that the environment holds upon the event in question. These critical issues – the driving forces that will affect our future – are usually further distinguished as to whether they are ‘predetermined’ forces or ‘critical uncertainties’. Critical uncertainties are issues that are high impact and high uncertainty to occur. ‘Predetermined elements’ are issues that are high impact and high certainty to occur.

Strategic forecasting is less likely to take into account variables that are outside the normal course of events, whereas strategic foresight acknowledges and, in fact, emphasizes the importance of driving forces that are critical uncertainties. Typically illustrated by the ‘Futures Cone’ in Figure 1, if we do simple forecasting based on our current trends and well-known driving forces, the tendency is to provide a linear ‘Projected Future’, perhaps with an allowance for a small deviation of 10% away from our expected outcome, as also shown in Figure 2.

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<sup>5</sup> See also Bell, 1997 and Dator, 2002.

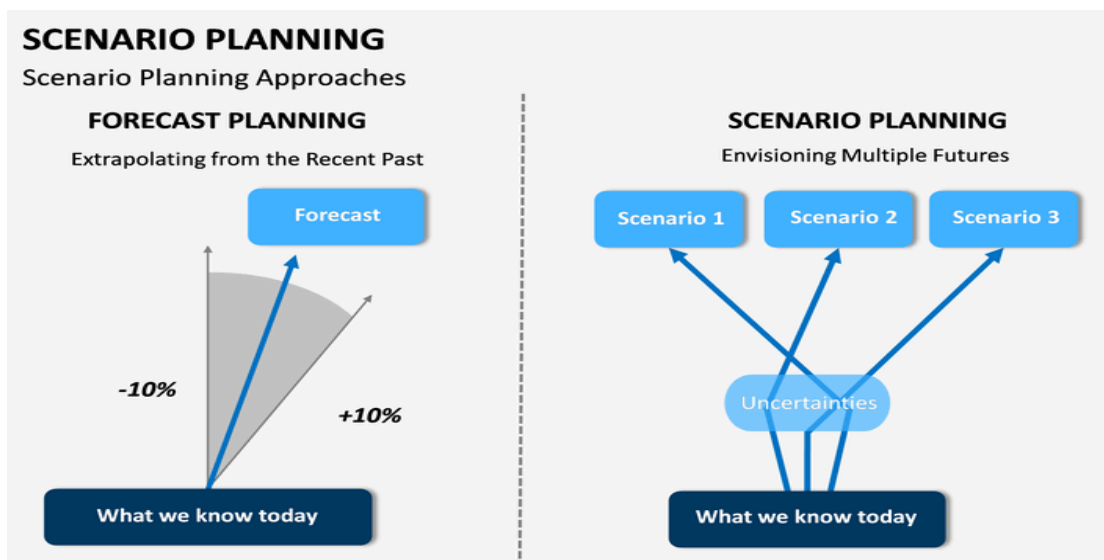
Figure 1:  
Futures Cone<sup>6</sup>



By taking into account plausible, probable, possible and even preposterous futures, strategic foresight at this stage undertakes 'scenario planning', in which multiple futures are considered, usually from 4 to 5 scenarios. The identification of which are the key driving forces helps in shaping each identified future scenario. This anticipatory approach is seen as the wiser way, since faced with a highly uncertain world, we must be prepared to address any of the main possible future scenarios.

Scenarios are the tool par excellence of futures studies. They open up the present, contour the range of uncertainty, reduce risk, offer alternatives, create more flexible organizational mindsets... (Inayatullah, 2015, Ibid)

Figure 2:  
A scenario approach to strategic planning



<sup>6</sup> Hancock & Bezold, 1994

With the above approaches in mind, the following questions are addressed specifically for the purposes of this paper:

## Research Methodology

### **What are the four most probable future economic scenarios for Brunei 2040?**

Carry out horizon scanning using STEEP (Social, Technological, Education, Economy, and Technology) to identify trends and emerging issues that will impact upon our future economic scenario 2040.

Prioritize these issues as key driving forces according to the impact and certainty to occur.

Develop probable alternative economic scenarios based on the identified driving forces



### **What types of jobs will there be in each of the four future economic scenarios for Brunei 2040?**

Map out the potential jobs based on the four probable future economic scenarios for Brunei 2040.

Three job categories were formulated: 1) Declining Jobs 2) Sustainable Jobs 3) Future Jobs. (CSPS Job Prism)



### **What are the main manpower planning implications of the probable future economic scenarios for Brunei 2040?**

To identify 1) the types of jobs, 2) employment structure and 3) educational requirements of each of the four probable future economic scenarios.

## **2.0 Research Question 1: What Are The Four Most Probable Future Economic Scenarios For Brunei 2040?**

A participatory action learning approach was undertaken in our scenario development process whereby we consulted with a wide range of key stakeholders. In total, approximately 150 stakeholders were consulted via multiple workshops. Key stakeholders included the Directors and relevant officers from the Prime Minister's Office, Ministry of Education, Ministry of Finance and Economy, Ministry of Energy, Ministry of Primary Resources and Tourism, Ministry of Home Affairs, Ministry of Transport and Infocommunications, Ministry of Culture, Youth and Sports, Ministry of Development, Ministry of Health, industry and business leaders, youths, career counselors, teachers, and thought leaders from both the private and public sectors.

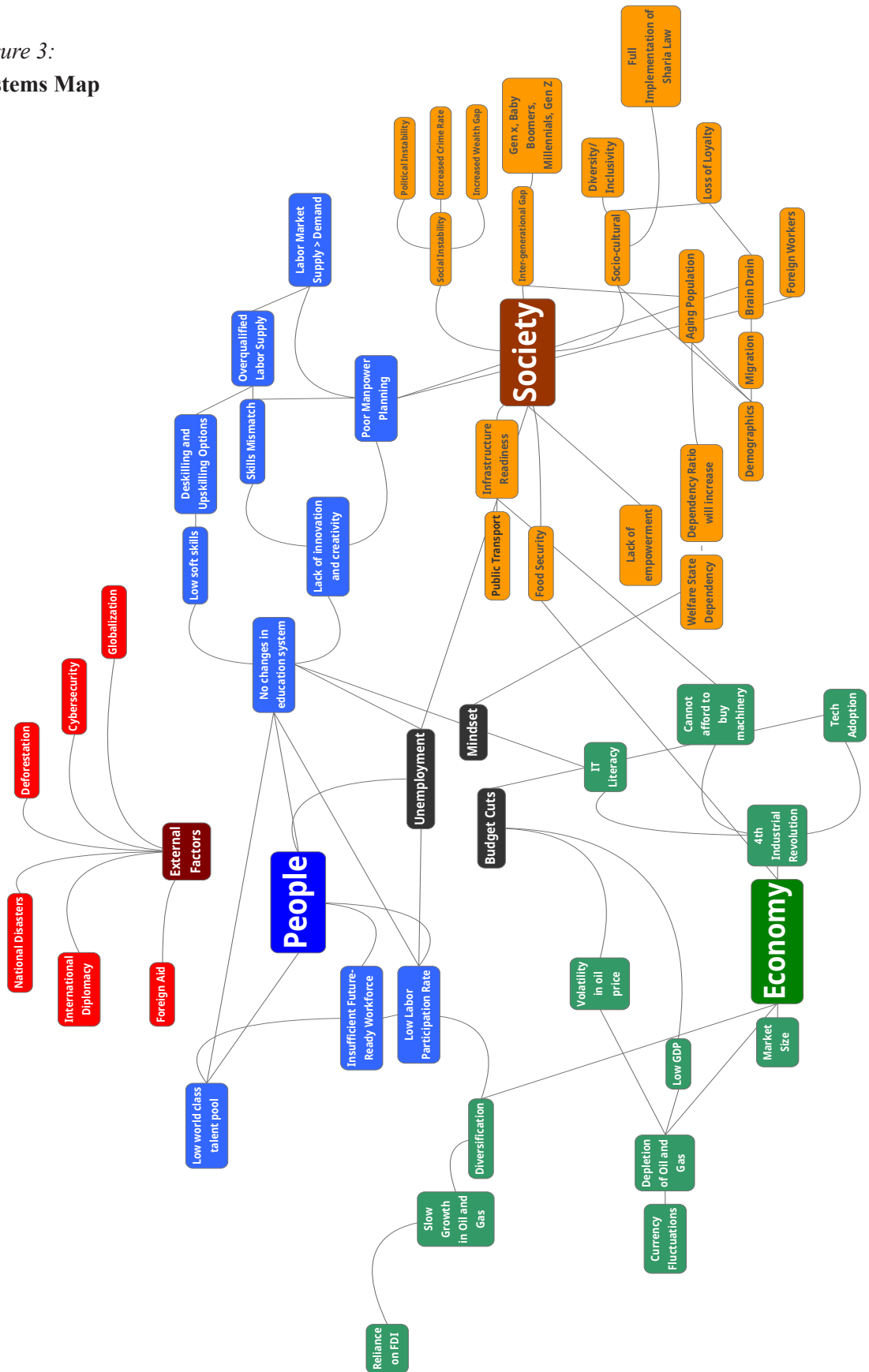
Aside from extensive data analysis (Brunei Official Statistics from the Department of Economic Planning and Statistics (DEPS) and a review of the relevant literature on the future of work and jobs (WEF, 2018, ILO, 2016, WEF, 2019, RSA Action and Research Centre, 2019), we also collected substantial primary data via the more qualitative parts of a National Youth Survey with a sample of 2,403 youth and a National Youth Unemployment Survey with a sample of 1,486 youth<sup>7</sup>. The surveys, which covered information such as the job preferences and aspirations of our youth, their employment status, and level of self-development in terms of skills and mindsets, provided useful qualitative background for our workshops to refer to in our discussions. This participatory approach is important to understand and to unpack the viewpoints and assumptions, the 'myths and metaphors' (Inayatullah, 2007) held by the various stakeholders when they think about the future and the potential future scenarios.

For the first stage of scenario development, we held two workshops of around 50 stakeholders per event and a series of smaller focus group interviews. The main purpose of this Stage 1 workshops and interviews was to conduct a horizon scan focusing on the more general question of what are the critical issues that may impact Brunei's development future in 2040. After extensive brainstorming, we captured the main identified issues under three main headings of 'People', 'Economy' and 'Society' in a Systems Map, as shown in Figure 3.

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<sup>7</sup> The two National Surveys were conducted by the Centre for Strategic and Policy Studies (CSPS) and the Ministry of Culture (MCYS) in 2018 (CSPS/MCYS, 2018), See CSPS Final Report (2019), Ibid.

Figure 3:  
Systems Map





With so many issues at hand, we then further conducted three smaller group workshops of around 25 different stakeholders each to work on the necessary exercise of prioritizing the issues proposed. For these stage 2 workshops, our prioritization was conducted focusing more specifically upon the question of the critical issues impacting on Brunei's economy and job futures in 2040. Conducting this further horizon scan from our Systems Map we followed a STEEP analysis. Some issues were clustered for practicality or renamed for clarity or eliminated because of duplication. Prioritizing prevents over-complicating the workings of our future scenarios while ensuring the critical issues which have most impact are captured. After extensive discussion, a total of 33 issues were identified as follows:

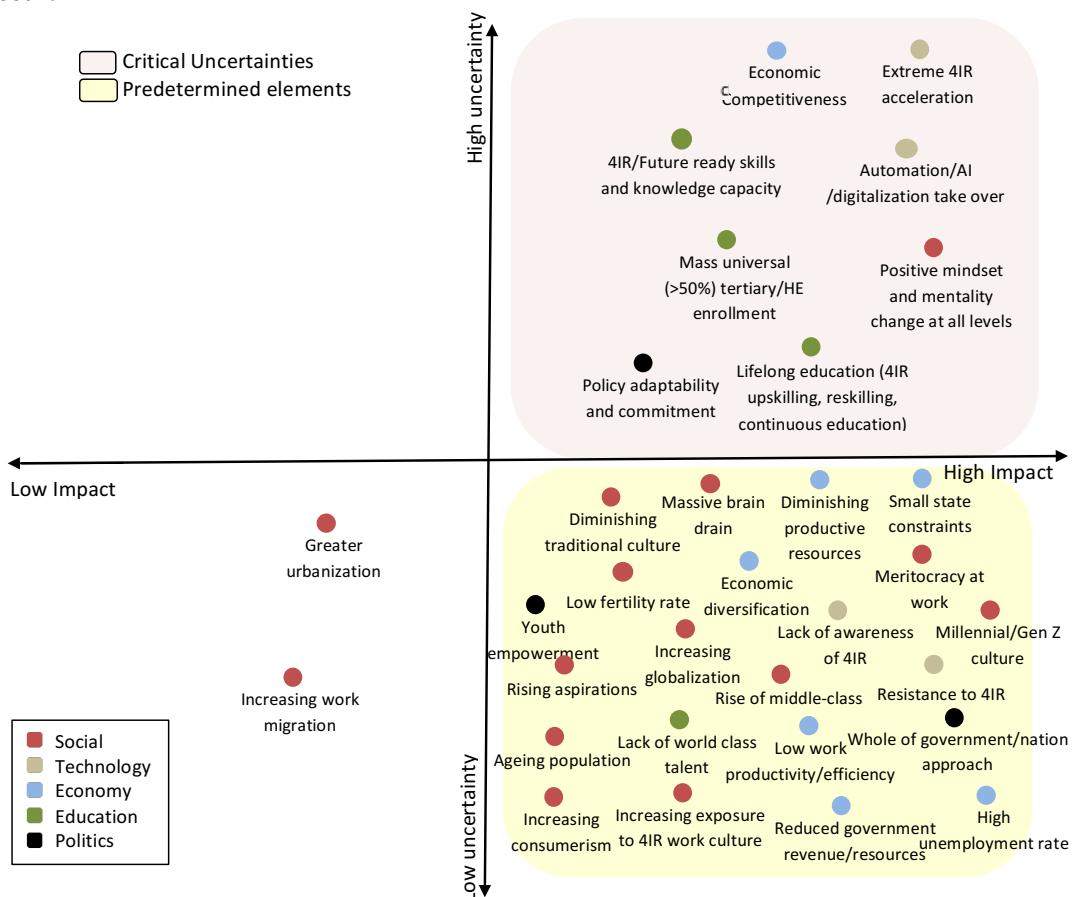
Critical issues on Brunei's Economy and Job Future 2040 using STEEP framework:

<b>Social</b>	<ol style="list-style-type: none"> <li>1. Ageing population</li> <li>2. Low fertility rate</li> <li>3. Negative mindset and mentality at all levels</li> <li>4. Rising aspirations</li> <li>5. Increasing consumerism</li> <li>6. Lack of meritocracy at work</li> <li>7. Increasing globalization</li> <li>8. Diminishing traditional culture</li> <li>9. Greater urbanization</li> <li>10. Rise of middle-class</li> <li>11. Increasing work migration</li> <li>12. Millennial/Gen Z culture</li> <li>13. Increasing exposure to 4IR work culture</li> <li>14. Massive brain drain</li> </ol>
<b>Technology</b>	<ol style="list-style-type: none"> <li>15. Automation/AI/digitalization take over</li> <li>16. Need for extreme 4IR acceleration</li> <li>17. Resistance to 4IR</li> <li>18. Lack of awareness of 4IR</li> </ol>
<b>Economy</b>	<ol style="list-style-type: none"> <li>19. Lack of economic competitiveness</li> <li>20. Lack of economic diversification</li> <li>21. Lack of viable economic blueprint</li> <li>22. Diminishing productive resources</li> <li>23. Small state constraints</li> <li>24. High unemployment rate</li> <li>25. Low work productivity/efficiency</li> <li>26. Reduced government revenue/resources</li> </ol>
<b>Education</b>	<ol style="list-style-type: none"> <li>27. Lack of 4IR/future-ready skills and knowledge capacity</li> <li>28. Lack of world class talent</li> <li>29. Lack of lifelong education (4IR upskilling, reskilling, continuous education)</li> <li>30. Need for mass universal (&gt;50%) tertiary/HE enrollment</li> </ol>
<b>Politics</b>	<ol style="list-style-type: none"> <li>31. Lack of whole of government/nation approach.</li> <li>32. Lack of policy adaptability and commitment</li> <li>33. Youth empowerment</li> </ol>

Next, a 2x2 Matrix as shown in Figure 4 was used in these Stage 2 workshops whereby stakeholders had to place the 33 issues according to their perceived impact on economic and job futures, and certainty to occur.

Figure 4:

**Prioritization of issues according to impact on economic and job futures, and certainty to occur.**



We ended up with eight critical uncertainties as represented in the top right-hand quadrant of Figure 4:

1. Extreme 4IR acceleration
2. Economic competitiveness
3. 4IR/future-ready skills and knowledge capacity
4. Positive mindset and mentality change at all levels
5. Policy adaptability and commitment
6. Mass universal (>50%) tertiary/HE enrollment

## 7. Automation/AI/digitalization take over

## 8. Lifelong education (4IR upskilling, reskilling, continuous education)

Focusing on these eight issues, we further narrowed down the list particularly in terms of their extent of overlap. Whilst acknowledging that all are not mutually exclusive, we prioritized only the issues that were considered most distinct in terms of having the least correlation with each other. These issues then represent the driving forces to envision our probable future economic scenarios. Four issues are identified for us to add detail to and these are seen as key driving forces which are most likely to pose institutional surprises, and are strategic, as the consequences they generate, are high impact and cut across multiple domains of policy making:

- Mindset and mentality change at all levels<sup>8</sup> - Stakeholders noted the often-cited lack of entrepreneurship and preference of our youth for white collar and public sector jobs despite the fact that this sector is already oversaturated<sup>9</sup>. However, it is also emphasized that a negative mindset amongst employers is also prevalent in that better HR and policy approaches suitable to 4IR transformation are required. Overall, a dependency culture appears to pervade in the country, and the mindset and mentality assumes a business as usual attitude is ok even though the country's primary resources are depleting, with a high number of jobless youths. A permanent 'golden umbrella' or always a rainbow over the near horizon are appropriate metaphors to describe assumptions of the future. Acquiring a (positive) mindset and mentality change at all levels within the country is therefore seen as a big challenge and a factor leading to uncertainty.
- 4IR/Future ready skills and education<sup>10</sup> – Stakeholders noted that the capacity to properly transform into 4IR is not yet available as the country lacks sufficient 4IR knowledge (e.g. Science, Technology, Engineering, Mathematics (STEM)) and required digital skills and future-ready skills (e.g. adaptability, creativity, curiosity). Lifelong education is still in its infancy, upskilling and reskilling programmes are limited and only provided via formal structures - tertiary colleges or IHLs - which may not be equipped or suitable for the purpose. Moreover, it is a common complaint that there is a need for future proofed manpower planning to identify what are the future-ready skills and knowledge that are required to avoid substantial mismatches in education and skills requirements in the long run<sup>11</sup>. Important too are the constraints posed for a

<sup>8</sup> For example, in the National Youth Survey (CSPS/MCYS, 2018. Ibid), 70% of youth stated that negative mindset and mentality is the second top policy concern. A large 32% of our youth sample prefer to work in the government sector and 30% even prefer a low paid/qualified job in the government sector compared to a better paid/qualified job in the private sector.

<sup>9</sup> See Cheong, D. & Lawrey, R. 2009 and Rizzo, G., Cheong, D. & Koh, W.C. 2016.

<sup>10</sup> The new proposed Brunei National Youth Policy and Strategy 2020-2035 (publication pending) identifies 4IR future ready skills as lacking and is a main goal for Brunei youth to achieve.

<sup>11</sup> Cheong, D. & Lawrey, R. (2009) & Rizzo, G., Cheong, D. & Koh, W.C. (2016). Ibid.

small state, whereby there is a lack of world class talents and a critical mass of highly educated workforce<sup>12</sup> to compete in a very sophisticated global economy made up of technological giants.

- Economic competitiveness – Stakeholders acknowledged that Brunei has to ramp up its economic diversification efforts. Ultimately, Brunei’s targeted industrial clusters needs to leverage on its comparative advantages and an acceleration of 4IR transformation. In the first instance, as a primarily resource-based economy with limited productivity and technological capacity<sup>13</sup>, Brunei will have to pursue accelerated and possibly extreme 4IR transformation. Facing global complexities and multinational and technological giants is indeed a tremendous challenge for a small state with limited resources, thereby explaining why economic competitiveness is identified as the top critical uncertainty for Brunei’s future.
- Extreme 4IR acceleration – This final issue encapsulates all the previous three issues and therefore is another top critical uncertainty for Brunei’s future. In order to achieve 4IR transformation, we are looking at a complete overhaul of our economic and social structures and capacity – mindset and mentality change, 4IR skills and education capacity and economic competitiveness. This will require the country to carry out extreme transformation.

We then conducted our Stage 3 workshop consisting of our own internal project team of 8 policy researchers to construct our future economic scenarios for Brunei 2040. Using Shell’s 2x2 method, we formulated the final two driving forces which we felt are most critical, ranked as such at Stage 2 workshops, and cutting across all of the previously stated 8 critical uncertainties (Figure 4). The two final driving forces are “4IR Transformation” and “Economic Competitiveness”.

**4IR Transformation:** This driving force is most akin to extreme 4IR acceleration and incorporates the related issues of 4IR future ready skills and education, policy certainty and commitment, and mindset and mentality change at all levels.

**Economic Competitiveness:** Together with 4IR Transformation, this driving force is the highest ranked in terms of uncertainty and impact.

We finally came up with four alternative economic scenarios for Brunei 2040 as follows:

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<sup>12</sup> Higher education enrolment rate in Brunei is low at 22% of student age cohort (2016) - a minimum of 50% is generally a recognised minimum threshold for developed countries (Trow, 2010). See also Cleary & Wong, 2016 for an explanation of Brunei’s economic constraints as a small state.

<sup>13</sup> See Cheong, D., 2013.

### Scenario 1: Learning to surf the waves

A continuity and growth scenario, this is Brunei's default future; the country manages to diversify its economy and growth ensues without relying on major transformation towards a 4IR economy.

### Scenario 2: River overrun

A continuity and collapse scenario, this is the future where business as usual does not work, Brunei is left as a previously successful oil and gas economy which is now backward and the economy has collapsed.

### Scenario 3: Lost at sea while surfing

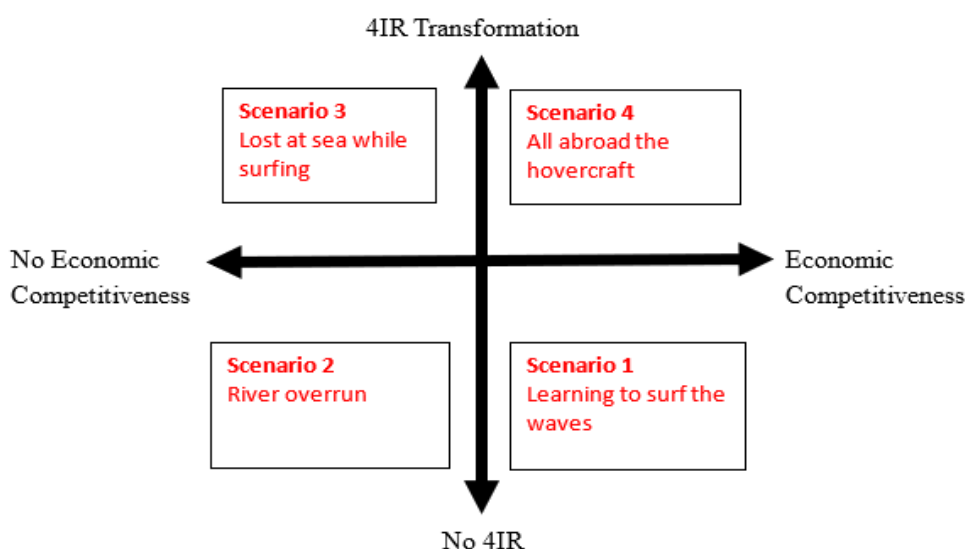
A transformation and failure scenario, this is an unfortunate future where Brunei goes all out for 4IR transformation to prosper but fails regardless.

### Scenario 4: All aboard the hovercraft

A transformation and growth scenario, this is a future where Brunei goes all out for 4IR transformation and manages to grow and prosper.

Figure 5:

2x2 Shell Scenario Matrix



### 3.0 Research Question 2: What Types Of Jobs Will There Be In Each Of The Four Future Economic Scenarios For Brunei 2040?

Our focus here is to map out potential jobs for the short to medium term (about 5 - 10 years) and the medium to long term (about 10 - 20 years) future, assuming Brunei is to transform itself into a 4IR economy. Extensive literature and desktop research was carried out and the main reports

1. The Future of Employment Study by Frey and Osbourne (2013)
2. Atlas of Emerging Jobs Report (2015)
3. 100 Jobs of the Future Report by Ford Australia, Deakin University and Griffith University (2019)
4. World Economic Forum's 'Future of Jobs' report (2018)

We then formulated three job categories; 'declining', 'sustainable' and 'future' job and referred to these as the '*CSPS Job Prism*', as shown in Figure 6.

The categorisation of declining and sustainable jobs is based on the likelihood and probability of automation (Frey and Osbourne, *ibid*). Jobs that are identified to have greater than 50 per cent probability of being automated within the short-term period are categorized as 'declining', whereas those with less than 50 per cent likelihood of being automated are categorized as 'sustainable' jobs. A total of 702 jobs are contained in the list and we meticulously conducted several rounds to filter the jobs according to whether these are 'declining' or 'sustainable'. Future jobs, on the other hand, are a compilation of around 250 jobs taken from the Atlas of Emerging Jobs Report (*ibid*) and 100 Jobs of the Future Report (*ibid*).

Next, we then compiled the jobs according to how they relate to the recent Ministry of Finance and Economy (MOFE) list of five targeted industrial clusters: ICT industry, tourism industry, food manufacturing industry, business services industry and downstream oil and gas industry<sup>14</sup>. We also added on a sixth category to the five industrial clusters, which is to cover all job futures that are not industry specific and are required by all industrial clusters and for the country as a whole such as civil servants, public services (e.g. teachers; doctors), construction workers and so on<sup>15</sup>.

Overall, we have found that the types of jobs that are more likely to be categorised as sustainable and jobs of the future are those that are: (i) Non-Routine (ii) Non-Repetitive (iii)

<sup>14</sup> See InvestBN, 2020

<sup>15</sup> See Annex 1 for the full list of jobs within the declining, sustainable and future job categories according to the recent MOFE list of 5 targeted industrial clusters. The sixth category covers jobs not are industry specific and are required by all industrial clusters i.e. a) Declining jobs consist of mostly administrative support jobs. b) Sustainable jobs consist of mostly managers and professionals. c) Future jobs are mostly related to automation and ICT.

Non-Predictable. As Ford (2015) has explained, there are three criteria for jobs that survive. The first is jobs that involve “genuine creativity, such as being an artist, being a scientist, developing a new business strategy”. The second area is occupations that involve building complex relationships with people: nurses, for example, or a business role that requires you to build close relationships with clients. The third area is jobs that are highly unpredictable – for example, if you’re a plumber who is called out to emergencies in different locations.

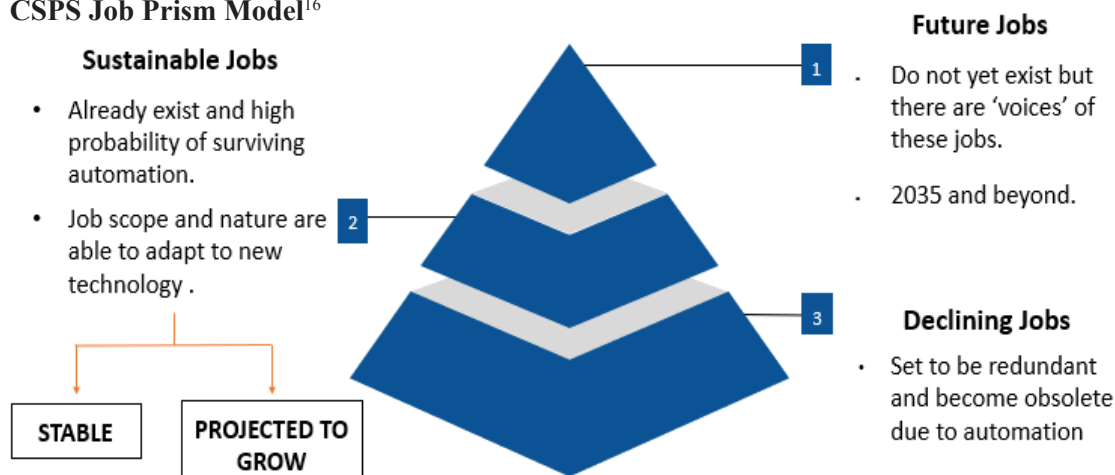
In summary, the job categories are:

- a) **Declining Jobs:** Declining jobs are defined as jobs that are set to decline or even become redundant and obsolete due to automation within the next short to medium term of 5-10 years or so. For example, under the downstream oil and gas industrial cluster, chemical plant and system operators or riggers are becoming redundant. These jobs can easily be automated as they are routine and predictable in nature. Another obvious example under the services industrial clusters are cashiers, as these are increasingly replaceable with cashless payment and self-checkout counters. Under the ICT industrial cluster, jobs like typists and meter readers are declining as these jobs are repetitive in nature. Although the likelihood is higher, declining jobs are not confined to non-professional jobs; accountants and auditors for example are also declining in demand as AI can now replace their core work.
- b) **Sustainable Jobs:** Sustainable jobs are jobs that already exist and have a high probability of surviving or adapting to automation into the medium and long term future of 10-20 years. We further subcategorise them into (i) stable and (ii) projected-to-grow jobs. ‘Stable jobs’ refers to jobs that will remain in demand. ‘Projected-to-grow’ jobs are expected to have a steady increase in demand over the upcoming years. Some examples of jobs under the downstream oil and gas industrial cluster such as chemical, civil and mechanical engineers are considered to be sustainable and stable. These jobs are STEM related, complex in nature, and, require creativity and adaptability that only humans can provide so far. Similarly, under the food industrial cluster, jobs such as chefs and head cooks, biomedical engineer, dietician and nutritionist require cognitive decision making and are therefore sustainable. Jobs that require people skills and human interaction such as first line supervisors, hotel and hospitality management, chief executives, HR managers and anthropologists are also sustainable.
- c) **Future Jobs:** Future jobs are jobs that are nearly or entirely new, dependent on the transformation to 4IR and expected to establish themselves in the longer-term future of 15 years and beyond. For example, under the services industrial cluster, foresighter, personal pension plan designer, environmental auditor, satellite network engineer, direct talent

investment fund manager and individual financial trajectory designer are considered as future jobs. They involve the use of key human skills such as critical thinking, creativity and complex problem solving. Importantly, these jobs also cater for the changing social structures and required skills of a 4IR culture, for example; virtual lawyer, robot attendant, new and advanced materials engineer and cyber detective. With the digitalization and proliferation of data, we will see a lot of jobs in the future that are related to ICT, such as AI educator, quantum computer programmer, forensic data analyst, cyber detective, data farmer, behaviour prediction analyst and so on.

Figure 6:

#### CSPS Job Prism Model<sup>16</sup>



### 4.0 Research Question 3: What Are The Main Manpower Planning Implications Of The Probable Future Economic Scenarios For Brunei 2040?

It is very important to emphasize that the four scenarios are not meant to make predictions about the future but to guide policy makers intending to plan for probable futures. We have elaborated that, faced with uncertain futures, we prefer to avoid traditional purely manpower forecasting approaches. To flesh out the narratives for each scenario, we referred to the identified four key driving forces of mindset and mentality change at all levels, 4IR/future-ready skills and education, economic competitiveness and extreme 4IR acceleration. Our discussions were centred on the following question:

If this scenario (Scenario 1, Scenario 2, Scenario 3, Scenario 4) were to occur, what would be the implications in terms of:

<sup>16</sup> We are grateful for the extensive desktop work that was conducted over several weeks by the CSPS project officers (Abdul Malik Omar, Adib Yusop & Anisah Zahraa Haji Isa) to filter out the types of jobs for the CSPS Job Prism.



1. Types of jobs
2. Employment structure
3. Educational requirements

#### 4.1 Scenario 1: Learning To Surf The Waves

This is Brunei's default future; the country manages to diversify its economy and growth ensues without relying on major transformation towards a 4IR economy. There is also not much need to transform the political machinery and social structures as continuity is successful and leads to further growth. The industrial clusters of ICT industry, tourism industry, food manufacturing industry, business services industry and downstream oil and gas industry develop and expands. Brunei succeeds in diversifying its economy and prospers, most likely sustained by continuing oil and gas reserves and the contributions of a number of increasing FDI investments from China and the region. Pursuing a targeted industrial policy, Brunei is fortunate enough to secure a sufficient number of responsible FDI ventures as it has started to do so with Hengyi Industries, Brunei Fertilizer Industries (BFI), and Golden Corporation<sup>17</sup>. These FDI's undertake to put local employment and training as a priority. Brunei's drive to expand the provision of higher education and vocational technical education over recent years<sup>18</sup> provides sufficiently qualified locals to drive the economy. Moreover, the employment generation and manpower development programmes also provided by the Government<sup>19</sup> also succeed in reducing local youth unemployment<sup>20</sup>. Jobs in traditional sectors of public services remain and there are growing job opportunities in new targeted industrial clusters from the 'declining' and 'sustainable' job categories in the CSPS Prism. While lacking in 4IR curriculum, existing educational and training institutions are adequate and able to provide functional skills and knowledge to its local youth, who are able to secure full employment in the growing economy.

#### 4.2 Scenario 2: River Overrun

This is the future in which 'business as usual' does not work, Brunei is left as a previously successful oil and gas economy which is now backward and the economy has collapsed. Without sufficient 4IR transformation, policy change and technological upgrading, Brunei's targeted industrial clusters fail to grow. Even though the country has managed to attract FDI's to invest in its targeted industrial clusters, global giants and technology behemoths and gains from these FDIs are offshored and concentrated in the hands of the FDIs and a handful of local business

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<sup>17</sup> See InvestBN, 2020. Ibid

<sup>18</sup> The existing Institute of Technology Brunei for example has been upgraded to university status to provide degree programmes in 2016, adding to Universiti Brunei Darussalam, which was the country's only university before. By 2016, Brunei boasted a total of 7 degree-granting institutions. Vocational Technical Education (VTE) expanded vastly to a total of 13 institutions.

<sup>19</sup> Examples of programmes to reduce unemployment under the Manpower Planning and Employment Council are establishment of Jobcentre Brunei, I-Ready Apprenticeship programme, i-Usahawan, 'Bruneisation Directive', etc.

<sup>20</sup> To an extent, the most recent reduction in Brunei's unemployment rate in 2018, from 9.3% to 8.3% (Department of Economic Planning and Statistics, Labour Force Survey 2018) may support this scenario.

elites<sup>21</sup>. Economic collapse is a realistic possibility in the face of further oil and gas revenue depletion, global competition, and the constraints of a small state, in particular the country's lack of comparative advantage, productivity and industrial efficiency in all industries except for the energy industrial cluster<sup>22</sup>. Without sustained and meaningful economic growth, labour demand perpetually lags behind labour supply and there is mass and permanent unemployment amongst locals and many have to gravitate towards low-skilled subsistence jobs to sustain themselves. Efforts to retrain are ineffective as there are simply not enough jobs to retrain for. This leaves a large fraction of the Bruneians permanently reliant on Government welfare with skills that are continuously depreciating the longer they are unemployed. Bruneian youth suffer not only from missing the first rung of skills development but there is hyper qualification inflation as people will try to be as qualified as possible to chase fewer and fewer jobs and employers will raise their qualification demands for the same jobs to filter an oversupply of qualified applicants. Education therefore no longer serves the requirements of the economy. The only jobs still available will be from the 'declining' and to an even smaller extent, the 'sustainable' job category, especially within the traditional and oversaturated sectors which are relied on by locals (i.e. Public Administration; Education; Wholesale & Retail Trade) but these historical employment avenues will also diminish even further over the medium to long term period (within 10 years and beyond).

### 4.3 Scenario 3: Lost At Sea While Surfing

This is an unfortunate future where Brunei goes all out for 4IR transformation but fails to prosper regardless. There is a big push for 4IR transformation, mindset and mentality drastically transforming together with policy practice. Brunei invests heavily into 4IR technology not just for transformation within the targeted industrial clusters, but the public sector is also digitally overhauled, spearheading broader digital takeover throughout the country. However, industrial development, within the targeted industrial clusters and overall, fails to take off properly. Similar to Scenario 2, even though the country has managed to attract FDI's to invest in its targeted industrial clusters, global giants and technology behemoths and gains from these FDIs are offshored and concentrated in the hands of the FDIs and a handful of local business elites. In order to maximize profits, the handful of industries emerging with FDI investments operate on a 'lights-out manufacturing' policy whereby the factories are fully automated with little human presence on site. Lacking in economic growth, the country is unable to continue 4IR transformation comprehensively. Although a minority of very highly trained locals with 4IR skills and knowledge will benefit with top jobs especially within the 'sustainable' and

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<sup>21</sup> As Cheong, 2019 (ibid) has argued, of the 16 recent FDIs that have invested in the country, only approximately 1,600 local employment can be created- insignificant in view that there were approximately 18,000 unemployed locals in 2017.

<sup>22</sup> As illustrated by Rizzo, 2020 (See Chapter 4: Economic Cluster Development and Employment Creation in Brunei Darussalam, CSPS Final Report on Study of Youth Unemployment - pending publication) only the energy industrial cluster has comparative advantage in Brunei and there are significant productivity and efficiency gaps in the industrial practices of other clusters as well as in public spending and regulations.

increasingly, ‘future’ job category, the country suffers with mass and permanent unemployment due to the extreme bifurcation of labour. As there is limited top job availability, competition is fierce and newly qualified graduates with 4IR skills and training find themselves unemployable unless they are willing to take up the remaining low wage, low skilled and non-automatable jobs. The country witnesses a massive brain drain and migration of its young locals. Others who cannot migrate but prefer meaningful work<sup>23</sup> become increasingly disenfranchised as standards of living drop drastically. The Government is pressured to provide extensive welfare, such as universal basic income for the majority population, but this becomes unsustainable due to the dwindling GDP. Education, even with a 4IR transformed curricula, no longer serves the requirements of the economy.

#### **4.4 Scenario 4: All Aboard The Hovercraft**

This is a future where Brunei goes all out for 4IR transformation and manages to grow and prosper. As with Scenario 3, there is a big push for 4IR transformation, mindset and mentality drastically transform together with policy practice. Brunei invests heavily into 4IR technology, not just for transformation within the targeted industrial clusters, but the public sector is also digitally overhauled, spearheading broader digital takeover throughout the country. Fortunately, the country is able to secure responsible technological giants and FDI collaboration whereby industries and factories operate with ‘Human-AI Co-existence’ and avoid lights out manufacturing. Work and productivity are radically redesigned to bring out the best in 4IR technology. Educational provision is drastically overhauled and lifelong education with full emphasis on 4IR skills and knowledge takes over formal and informal educational systems. With historically high levels of literacy, cosmopolitanism and political stability, Bruneians are easily trained to a world class standard in 4IR technologies and are seen as highly employable by technological giants. There is near or full employment, including meaningful employment as Bruneians find gainful work particularly in the ‘sustainable’ and increasingly ‘future’ job category, especially within the targeted industrial clusters for which they have been well trained for. The establishment of strong technological and digital infrastructure within the public and private sector prepares Brunei to successfully launch itself into the 4IR and the country takes off and prospers within the medium to long term period (10 years and beyond). Initial constraints of a small state become insignificant. Particularly as the 4IR economy requires a highly educated future-ready workforce and not a large workforce, and Brunei successfully looks outwards for an international market for its goods and services. Brunei no longer relies on oil and gas and it achieves Wawasan 2035 goals of being in the top 10 in standard of living and GDP per capital, and its citizens are viewed as highly educated and employable.

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<sup>23</sup> Notwithstanding our negative mindset and mentality finding on youth job preferences, we also find that this situation is changing and there is now increasing desire for meaningful work including a more entrepreneurial mindset and need to be empowered culture amongst local youth. For example, the National Youth Survey (CSPS/MCYS, 2018. Ibid) found that a substantial 68% stated that they prefer “to support young people to get a more decent job and meaningful employment” and 82% prefer “to enable youth to contribute fully to the economy and society and participate in decision making.”

Table 1:

**Summary of Manpower Planning Implications: 1) the types of jobs, 2) employment structure and 3) educational requirements**

	<b>Scenario 1 <i>Learning to surf the waves</i></b>	<b>Scenario 2 <i>River overrun</i></b>	<b>Scenario 3 <i>Lost at sea while surfing</i></b>	<b>Scenario 4 <i>All aboard hovercraft</i></b>
<b>Economic Scenario</b>	Economy diversifies and grows with new industrial policy of targeted industrial clusters even without 4IR transformation.	Economy collapses even with new industrial policy of targeted industrial clusters due to global competition, small state constraints and insufficient 4IR capacity.	Economy collapses as targeted industrial clusters fail to grow even with extreme 4IR transformation due to technological behemoth and lack of reciprocal technical giants.	Economy diversifies and targeted industrial clusters take off with 4IR transformation, integrates successfully in the world economy and secures responsible technological giants and FDIs.
<b>Type of Jobs</b>	Jobs in traditional sectors of public services remain and there is growing job opportunities in new targeted industrial clusters from 'declining' and 'sustainable' job category, CSPS Prism.	Only a handful of jobs remain within traditional sectors of public services and targeted industrial clusters from 'declining' and 'sustainable' job category, CSPS Prism.	Only a handful of very highly trained locals with 4IR skills and knowledge will benefit with top jobs within targeted industrial clusters from 'sustainable' and 'future' job category, CSPS Prism. Some others may take up low wage, low skilled and non-automatable jobs.	Plenty or sufficient gainful work for all Bruneians within targeted industrial clusters from 'sustainable' and increasingly 'future' job category, CSPS Prism.
<b>Employment Structure</b>	Full or nearly full employment levels.	Mass and permanent unemployment.	Lights out manufacturing and or extreme bifurcation of labour leading to mass and permanent unemployment.	As industries and factories operate successfully with 'Human-AI Co-existence' and avoids lights out manufacturing, there is near or full employment, including gainful and meaningful employment.
<b>Education Implications</b>	Existing educational and training institutions remain and expands. Education provides relevant skills and knowledge even without 4IR transformation.	Bruneian youth miss first rung of skills development. Hyper qualification inflation. Education no longer serves the requirements of the economy	Drastic overhaul of education towards lifelong and 4IR curriculum. However, education is not functional for the economy.	Drastic overhaul of education towards lifelong and 4IR curriculum. Education is highly functional for the economy.

## **5.0 Conclusion**

Our workshop discussions were consensual in our views that Scenarios 1 and Scenario 2 should be avoided at all costs. The inevitability of globalization and our dependent linkage to the world economy necessitates that Brunei catches up with 4IR, by leapfrogging if possible, particularly if we aspire for the Wawasan 2035 goals. The preferred future as chosen by the majority of our stakeholders is Scenario 4, which is the scenario where our economy, employment and educational structure are focused upon rapid transformation towards 4IR technologies with specific emphasis upon the Government's targeted industrial clusters. However, it was agreed that it would be policy wise to also be prepared for Scenario 3 in the event that 4IR transformation does not work out and Brunei's economy fails to grow particularly in the face of global competition.

The broad strategic policies towards achieving a successful Scenario 4 as implicated from the scenario outlines include:

- i. Overhaul of dependency mindset and mentality towards a 4IR culture
- ii. Explicit policy commitment towards 4IR transformation especially on targeted industrial clusters
- iii. Investment in 4IR skills and education transformation
- iv. Digital transformation of all sectors
- v. Capacity to negotiate for responsible technological giants and FDI's
- vi. Social policy to manage social gaps in 4IR transformation (as shown likely in Scenario 3)

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Annex 1:

**Job categories according to 5 industrial clusters under Minister of Finance and Economy (MOFE)**

**Declining Jobs**

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
Industrial Truck and Tractor Operators	Farm Equipment Mechanics and Service Technicians	Museum Technician and Conservators	Architectural and Civil Drafters/ Assistants	Radio, Cellular, and Tower Equipment Installers and Repairs	Customer Service Representatives
Rotary Drill Operators	Agricultural Technicians (Agri-food)	Hotel, Motel, and Resort Desk Clerks	Advertising Sales Agents	Electrical and Electronics Engineering Technicians	Market Research Analysts and Marketing Specialists
Roustabouts, Oil and Gas	Food Science Technicians (Halal)	Porters and Bellhops	Aircraft Mechanics and Service Technicians	Medical Records and Health Info Technicians	Janitors and Cleaners, Except Maids and Housekeeping Cleaners
Geological and Petroleum Technicians	First-Line Supervisors of Food Preparation and Serving Workers	Bus Drivers, Transit and Intercity	Insurance Claims and Policy	Computer Support Specialists	Administrative Services Managers
Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	Food Cooking Machine Operators and Tenders	Taxi Drivers and Chauffeurs	Insurance Appraisers, Auto Damage	Audio and Video Equipment Technicians	Security Guards
Gas Compressor and Gas Pumping Station Operators	Packaging and Filling Machine Operators and Tender	Hosts and Hostess, Restaurant Lounge, and Coffee Shop	Legal Secretaries/ Paralegals and Legal Assistants	Electronic Home Entertainment Equipment Installers and Repairers	Executive Secretaries and Executive Administrative Assistants
Chemical Plant and System Operators	Pesticide Handlers, Sprayers, and Applicators, Vegetation	Ushers, Lobby Attendants, and Ticket Takers	Retail Salespersons and Cashiers	Switchboard Operators (Answering Service)	Correspondence Clerks
Moulders, Shapers, and Casters except Metal and Plastic	Cooks and Short Order (Fast Food)	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	Cost Estimators	Camera Operators, TV, Video and Motion Picture	Human Resources Assistants except Payroll and Timekeeping
Reinforcing Iron and Rebar Workers	Cooks and Short Order (Restaurant)	Motorboat Operators	Recreational Vehicle Service Technicians	Broadcast Technicians	Retail Salespersons
		Agricultural Inspectors	Insurance Underwriters	Computer Operators	Accountants and Auditors
			Tax Preparers	Meter Readers, Utilities	Receptionists and Information Clerks
			Credit and Budget Analysts	Plant and Systems Operators	Office Clerks, General Secretaries and Administrative Assistants except Legal, Medical, and Executive
				Semiconductor Processors/Integrated Circuit Technicians	File Clerks



## Declining Jobs (Cont)

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
Riggers / Derrick Operators, Oil and Gas	Agricultural and Food Science Technicians	Reservation and Transportation Ticket Agents	Aircraft Structure, Surface, Rigging and Systems	Traffic Technicians (Switchboard)	Payroll and Timekeeping Clerks
Surveying and Mapping Technicians	Farm Labour	Demonstrators and Product Promoters	Appraisers and Assessors of Real Estate	Electromechanical Equipment Assemblers	Bookkeeping, Accounting, and Auditing Clerks
Operating Engineers & Other Construction Equipment Operators	Animal Breeders	Janitors and Maids (Hotel)	Assemblers	Typists	Legal Secretaries
Welders, Cutters, Solderers, & Brazers	Food Batch Makers	Sales and Correspondents Clerks	Loan Officers	Pharmacy Technicians (Software)	Procurement Clerks
Industrial Machinery Mechanics	Health Technologists and Technicians (Agri-food) Contractors	Personal/ Freelance Tour Guides	Bill and Account Collectors	Proof-readers and Copy Markers	Order Clerks
Gas Plant Operators	Forest and Conservation Workers (Agri-food)	Tourism Receptionist (such as those in Airport)	Court Reports	Computer, Automated Teller, and Office Machine Repairers	Dental Assistants
Engine and other Machine Assemblers	Food Preparation Workers	Travel Information Clerks	Customer Service	Helpers - Electricians	Teacher Assistants
Derrick Operators	Meat, Poultry, and Fish Cutters and Trimmers	Amusement and Recreation Attendants	Personal Financial Advisors	Electrical and Electronics Engineering Assemblers	Healthcare Support Workers
Heavy & Tractor-Trailer Truck Drivers	Bakers	Transportation Attendants	Transportation, Storage, and Distribution Managers		Bus Drivers
Chemical Equipment Operators & Tenders	Meat Packers	Food Servers	Light Truck or Delivery Services Drivers		Postal Service Mail Carriers
Service Unit Operators, Oil, Gas, and Mining	Slaughterers and Meat Packers	Tour Guides and Escorts	Heavy and Tractor-Trailer Truck Drivers		Tile Installers
Chemical Technicians	Fishers and Related Fishing Workers	Retail	Labourers and Freight, Stock, and Material Movers		Floor Layers
	Buyers and Purchasing Agents, Farm Products	Laundry and Dry Cleaning Workers	Sales Representatives		Construction Labourers / Inspectors
			Transportation Inspectors		Painting, Coating, and Decorating Workers
					Tax Examiners and Collectors
					Library Assistants
					Library Technicians

## Declining Jobs (Cont)

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
Pipelayers Geoscientists Hoist and Winch Operators Boilermakers Petroleum Pump System Operators, Refinery Operators, and Gaugers Wellhead Pumpers Dredge Operators	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders Cooling and Freezing Butchers and Meat Cutters Waiters and Waitresses Dishwashers	First Line Supervisors of Housekeeping and Janitorial Workers	Insurance Sales Agent Shipping, Receiving, and Traffic Clerks Data Entry Keyers Cargo and Freight Agents Avionic Technicians		

## Sustainable Jobs

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
Chemical Engineers Petroleum Engineers Civil Engineers for Renewable-Energy Materials Scientists and Engineers Environmental Engineers and Technicians	Dietitians and Nutritionists Biological Scientists Natural Sciences Managers Animal Control Workers Biomedical Engineers	Lodging (hotel) Manager Commercial Divers (and Operators) Tourism Operations Specialists Travel Agents/ Guides (for Groups) Public Relations Specialists	Architectural Managers Training and Development Specialists Surveyors Business Operations Specialists Business Continuity Planners (BCP)	Software Developers, Applications and Systems Software IT Security Analysts, Web Developers, and Computer Network Architects Computer and Information Research Scientists Health Technologist and Technicians Multimedia Artists and Animators	Human Resources Managers Training and Development Managers Sales Managers Marketing Managers First-Line Supervisors of Office and Administrative Support Workers

## Sustainable Jobs (Cont)

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
Industrial Production Managers and Engineers	Butchers and Meat Cutters (Halal)	Interpreters and Translators	Risk Management Specialists	Computer Hardware Engineers	Public Relations and Fundraising Managers
Emergency Management Directors	Food Scientists	First-Line Supervisors of Transportation and Vehicle	Securities, Commodities, and Financial Services Sales Agents	Data Warehousing Specialists	Chief Executives
First-Line Supervisors of Mechanics, Installers and Repairers	Food Service Managers	Airline Pilots, Co-pilots and Flight Engineers	Credit Counsellors	Agri-food and Smart Home Advisors	First-Line Supervisors of Production and Operating Workers
First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	Chefs and Head Cooks	Aircraft Cargo Handling Supervisors	Financial Managers and Examiners	Set and Exhibit Designer (Digital)	Network and Computer Systems Administrators
Solar Photovoltaic Installers	Agri-food Engineers	Flight Attendants	Management Analyst	Telecommunications Equipment Installers and Repairers, Except Line Installers	Database Administrators
Electrical Power- Line Installers and Repairers	Farm and Home Management Advisors	Air Traffic Controllers	Actuaries	Forensic Science Technicians	Lawyers
Electrical and Electronics Repairers, Commercial and Industrial Equipment	Foresters	Curators (Stories, Myth, Legends)	Financial Analysts and Specialist	Computer Systems Analysts	Computer and Information Systems Managers
Mechanical Engineers and Technicians	Hydrologists	Conservation Scientist	Statisticians	Mathematicians	Advertising and Promotions Managers
Captains, Mates, and Pilots of Water Vessels	Conservation Scientists	Recreation Workers	Advertising and Promotions Manager	Computer Programmers	Financial Managers
HSE Specialist and Technicians	Microbiologists	Anthropologist and Archaeologists	Operations Research Analyst	IT Database Administrators	General and Operations Managers
	Soil and Plant Scientists		Meeting, Convention, and Event Planners	Graphic Designers	Occupational Health and Safety Technicians
	Farmers, Ranchers, and Other Agri-food Managers		Logisticians	Gaming Supervisors	Managers
	HSE Specialists and Technicians (Farm and Food Safety Advisor)		Architects	Computer Numerically Controlled Machine Tool Programmers	Healthcare Social Workers
	Food Technologists		Survey Researchers		Physicians and Surgeons
	Environmental Engineers		Judicial Law Clerks		Psychologists
					Dentists

## Sustainable Jobs (Cont)

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
<p>First-Line Supervisors of Fire Fighting and Preventions Workers</p> <p>Structural Metal Fabricators and Fitters</p> <p>Mining and Geological Engineers, including Mining Safety Engineers</p> <p>Health and Safety Engineers</p> <p>Industrial-Organizational Psychologists</p> <p>Engineering Managers</p>					<p>Elementary / Secondary Special Education / Technical / Vocational / Career School teachers</p> <p>Medical and Health Services Managers</p> <p>Registered Nurses</p> <p>Pharmacists</p> <p>Fitness Trainers and Aerobics Instructors</p> <p>First-Line Supervisors of Construction Trades and Extraction Workers</p> <p>Ambulance Drivers and Attendants, Except Emergency Medical Technicians</p> <p>Judges, Magistrate Judges, and Magistrates</p> <p>Construction Managers</p>

## Future Jobs

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
Power generation system upgrade manager	Agroecological Farmer	Individual (bespoke) tour director	Integrated industrial Security Auditor	Online Lawyer	Remote Security coordinator
	Agricultural Ecologist	Space tourism manager	Corporate anthropologist	Quantum Computer Programmer	Business Continuity Manager
Energy and data systems installer	Environmental Counselor (Halal)	Space travel operator	Smart house infrastructure Designer	Digital Implant Designer	Big Data Model Designer
Weather expert in power industry (Solar and Wind Engineer)	Agricultural Informatics and Engineering Expert	Territory architect (Geography)	Zero energy house architect	Neural interface designer	Information systems architect
	City Farmer	Smart travel system designer	Specialist in old structure renovation/ reinforcement	Digital linguist	Information security supervisor
	Farm Safety Advisor (A.I.)	Tour navigator designer (Digital)		Interface designer	Power consumption system designer
Integrated Energy Systems Strategist	GMO farmer		Personal pension plan designer	Chief digital augmentation officer	Virtual reality architect
	Automated farming equipment operator	Virtual and augmented reality experience creator	Multicurrency translator	Data farmer	Virtual world designer
Local power supply system specialist (A.I.)				Child assistant bot programmer	Augmented reality area designer
Energy auditor	Automated farming equipment designer	Emotion designer	Direct talent investment fund manager	Forensic data analyst	Robot attendant
				Bioinformatician	Trend watcher/ foresighter
Electricity consumer rights expert	Cricket Farmer	Automated transportation system operator	Intellectual property appraiser	IT auditor	Automation anomaly analyst
	Unmanned exploration aircraft operator (Farming)	Space structure designer	Corporate venture fund portfolio manager	Unmanned exploration aircraft operator	Digital augmentation officer
System engineer for smart power grids				Telemetric data interpretation engineer	DigiTech troubleshooter
Energy storage device designer (Battery Packs for E-cars, etc.)	Bio- Ethicist/ Genetic Consultant	Human habitat designer	Individual financial trajectory designer	Wearable power device designer	Machine-learning developer
	Bio-Jacker (or Bio/DNA Modifier)	Local community coordinator	Sharing auditors	Crowd sourcing expert for social issues	Algorithm interpreter
Integrated ecology restoration worker	Spiritual Advisor (Halal Food)	Regional community growth coordinator	Crowd funding and crowd investing platform manager	Personal profile security advisor	Behaviour prediction analyst
				Cyber Detective	Data privacy strategist
					AI intellectual property negotiator

## Future Jobs (Cont)

Downstream Oil and Gas Industry	Food	Tourism	Service	Infocommunication Technology	Jobs that are not industry specific and required by all industrial clusters
New and advanced materials engineer	Additive Manufacturing Engineer	Net positive architect	Environment auditor	Virtual assistant personality designer	Chief ethics officer
Sustainable energy solutions engineer	Molecular nutrition expert	Collective Art Supervisor	Satellite network maintenance engineer	Predictive regulation analyst	Innovation manager
Smart dust wrangler	Farm Safety Advisor (For Halal)	Creative State Trainer	Small aircraft production engineer		Personalised marketer
Recycling Technologist	Automated food manufacturing systems operator	Smart environment Cyber Technician	Smart management system architect		Start up mentor
Nanomaterial Designer	Agricultural economist	Intermodal Hub Designer (Tourism Hub)			Virtual Lawyer
Distributed Mining Team Coordinator					Personalized Healthcare Expert
Ecorecycler in Metallurgy					Urban Ecologist
Power Grid Adjuster					Personal Security Designer
Multi-Purpose Robotic Systems Designer (Renewable Energy)					Construction Technology Upgrade Specialist
Mining system engineer					3D Printing Designer in Construction
Robotic system engineer					Multi-Purpose Robotic Systems Designer
Environmental analyst in mining industries					Educational Online Platform Coordinator
					Government Authority Communication Platform Moderator
					AI Educator
					Lifelong Education Advisor
					Data-Based Medical Diagnostician