IPS Working Papers

# DECODING THE COMMITTEE ON THE FUTURE ECONOMY (CFE) REPORT 2017: STRUCTURING PARTNERSHIPS, CHANGING MINDSETS AND NURTURING CREATIVITY

**TAN TAI LOONG ALEX**
**and**
**CHEW SI JUN PETRINA**

May 2017
IPS Working Papers No. 26

Institute of Policy Studies

## About Institute of Policy Studies (IPS)

**The Institute of Policy Studies** (IPS) was established in 1988 to promote a greater awareness of policy issues and good governance. Today, IPS is a think-tank within the Lee Kuan Yew School of Public Policy (LKYSPP) at the National University of Singapore. It seeks to cultivate clarity of thought, forward thinking and a big-picture perspective on issues of critical national interest through strategic deliberation and research. It adopts a multi-disciplinary approach in its analysis and takes the long-term view. It studies the attitudes and aspirations of Singaporeans which have an impact on policy development and the relevant areas of diplomacy and international affairs. The Institute bridges and engages the diverse stakeholders through its conferences and seminars, closed-door discussions, publications, and surveys on public perceptions of policy.

**IPS Working Papers No. 26**

# DECODING THE COMMITTEE ON THE FUTURE ECONOMY (CFE) REPORT 2017: STRUCTURING PARTNERSHIPS, CHANGING MINDSETS AND NURTURING CREATIVITY

**TAN TAI LOONG ALEX**
Senior Research Fellow
Institute of Policy Studies
tan.alex@nus.edu.sg

**CHEW SI JUN PETRINA**
Research Assistant
Institute of Policy Studies
petrina.chew@nus.edu.sg

May 2017

## CONTENTS

# DECODING THE COMMITTEE ON THE FUTURE ECONOMY (CFE) REPORT 2017: STRUCTURING PARTNERSHIPS, CHANGING MINDSETS AND NURTURING CREATIVITY

*Data-driven insights into what policymakers are thinking and identifying potential gaps.*

## EXECUTIVE SUMMARY

Singapore is witnessing structural shifts in the global economic environment, characterised by rapid technological change, subdued and uneven global growth, and a rise of anti-globalisation sentiments. To prepare the Singaporean workforce and to make our businesses resilient to a future that is increasingly volatile and uncertain, seven mutually reinforcing strategies were recommended by the Committee on the Future Economy (CFE). The purpose of this research is to elucidate and analyse the underlying thinking behind the CFE strategies in order to determine potential gaps that could arise as the strategies are implemented in policies and operationalised in various government initiatives.

To do this, we collected multiple sets of unstructured data related to the topic on the CFE, which form the empirical basis as well as literature review for our analysis. Data sources include the CFE report itself, discussions and feedback from a policy closed-door dialogue on future economy of Singapore, as well as a wide collection of topical private sector discussions and commentaries. We employed data mining techniques — frequency counts, word clustering and term correlations — to identify key ideas, derive meaning out of words used and understand the logic behind those ideas. To develop a more complete understanding and insights from the outside about the future economy of Singapore, we examined wide unstructured data drawn from discussions,

feedback and commentaries from various economics and business constituencies. Complementing our data mining, we also employed qualitative research methods — phenomenology and hermeneutics, to ensure thoroughness and accuracy in our data analysis and interpretation of the results.

Our examination of the CFE report found underlying concepts pertaining to enterprise innovation; skills development; government and private sector partnerships; sector (digital) capabilities; and industry transformation. These may indicate the key concerns weighing on policymakers' minds in building up Singapore's future economy, and concomitantly, the foci of policy objectives. Of fundamental interests are fostering business innovation through partnerships and developing deep skills among Singaporean workers. In turn, these mechanisms will propel the transformation of industries and support the development of sector-wide digital-enabled capabilities. Deeper analysis showed a number of potential gaps in the CFE's strategic recommendations. High-tech startups as a tool for future economic growth may be overemphasised and drawing away policy resources that could be better spent elsewhere. More jobs can be created out of growing many local existing companies instead. Further, transaction costs will arise due to resource dependency and absorptive capacity when SMEs are partnered with larger or more technologically advanced companies or government agencies to drive innovation. There is also misalignment in perceptions and motivations between business, the government, and the society at large (i.e., individuals) with respect to development of deep skills that can increase job resilience and support innovation, vis-à-vis acquisition of skills in order to adapt and play catch-up with current market needs.

This research provides a systematic way to organise the unstructured data and analyse and assess the CFE report. Our work contributes to an enhanced understanding of the policy direction and strategic plans to grow our future Singapore economy in two important ways. First, we identified the core themes and key elements across the CFE strategies, which suggestively reflect the underlying thinking of policymakers. Second, we highlighted latent issues that could emerge when implementing CFE recommendations, such as having our local enterprises achieve innovation through multi-faceted partnerships and our people to develop deep skills through a national SkillsFuture movement. Correspondingly, we proposed contingent ways to structure partnerships more efficiently through *market-determined*, *orchestrated-consortium* or *leader-follower* mechanisms, in order to better effectuate innovation and produce more and new innovative products and processes across heterogeneous businesses in Singapore. We also articulated the necessity of an institutional change in the way we think about learning, skills acquisition and continuous training in Singapore — so that the SkillsFuture movement can come to fruition. A reactive orientation towards skills acquisition is not sustainable, especially as there is increasing uncertainty and volatility in the external economic environment. There has to be a proactive stance and continuous skills training throughout one's career.

In conclusion, this working article broadly discusses why creating the space and time for individual creativity to flourish in Singapore is cornerstone to engendering innovation and deep skills — two primary objectives in the ambition to transform into a knowledge-based economy and Smart Nation. To become innovators, our schools

and education system must transform, to build the crucial link between creativity and innovation, which is completely missing in the CFE report.

## 1. INTRODUCTION

Built to change — this is the *raison d'être* of the Singapore economy. Since independence, a number of economic crises have pushed Singapore to restructure our economy repeatedly. High-level committees were convened to decide on direction, strategies and support, successfully weathering these crises and allowing us to continue along our growth trajectory. But is it different this time?

In the current milieu, the world continues to develop and change in unpredictable ways, driven by a combination of rapid technological change, rising multi-faceted competition and a new brand of geo-politics. The challenges that Singapore now face are characterised by prolonged uncertainty, volatility and complexity. Manufacturing output unexpectedly surged in December 2016, registering the fastest growth in the last five years (MAS, 2017). Conversely, unemployment rate grew to its highest levels since 2010 in the same time period (MOM, 2017). With such unpredictability, policymakers and observers alike suggest that Singapore's economy needs deeper fundamental changes, not just to adapt, but also to transform for the future.

A 30-member Committee on the Future Economy (CFE) was specially convened in January 2016 to provide strategic recommendations to help policymakers address these complex issues, and to chart a new growth direction for Singapore. The CFE comprised policymakers, and members from different industries that operate in both global and domestic markets, as well as from enterprises both large and small. Their collective vision is:

> *[To] be the pioneers of the next generation. In the future economy, our people should have deep skills and be inspired to learn throughout their lives; our businesses should be innovative and nimble; our city vibrant, connected to the world, and continually renewing itself; our Government coordinated, inclusive and responsive.*

In this exploratory study, we are motivated by what policymakers are thinking when charting the future direction of Singapore, and we attempt to decode this by applying data mining techniques to analyse the CFE report. We focused on: (a) identifying the key recurring issues across the different strategies; and (b) examining the relationships between these issues. Data mining in and of itself does not generate new facts. However, the process is most useful when the data it generates can be further analysed in tandem with additional contextual information and domain knowledge to develop a more complete picture. Further, data mining creates new relationships and hypotheses that we can explore further.

This research paper is organised into four sections. Following this introduction, in Section 2, we describe the multiple sources of data that provide additional contextual information and domain knowledge around the CFE report, and collectively, the empirical basis to triangulate our overall analysis. We also explain the data mining and interpretive methods we used. Then in Section 3, we discuss the findings and insights gained from our analysis and highlight potential gaps in the CFE recommendations — in particular, how to foster innovation in businesses and develop deep skills in the local workforce. We also suggest how to improve the efficacy of these strategies as they become implemented in various public policy spheres. Finally, in Section 4, we

conclude the paper with a broad discussion on some fundamental changes in our institutions and society-at-large that we view can support our worthy ambition to transform into a Smart Nation and economy of the future.

## 2. DATA AND METHODS

### 2.1. Semantic Analysis Using Machine-Learning Algorithms

Text mining is the automated process using machine-learning computer algorithms to examine unstructured, natural-language text in order to analyse and pinpoint new information about the text. Here, we programmed in *R* — an open source language and environment for statistical computing and graphics. There are four steps involved in the text mining process: First, we divided the CFE report into separate documents based on the seven strategies to form our text data corpus, or body of documents, for information retrieval:

i. Deepen and diversify our international connections
ii. Acquire and utilise deep skills
iii. Strengthen enterprise capabilities to innovate and scale up
iv. Build strong digital capabilities
v. Develop a vibrant and connected city of opportunity
vi. Develop and implement Industry Transformation Maps (ITMs)
vii. Partner each other to enable innovation and growth

Next, we applied natural language processing (NLP) to analyse the text, meaning that the computer uses the grammatical structure of human speech to “read” the text, to perform a grammatical analysis of the sentences. After that, the NLP system structured the data into a frame so that information extraction can be performed. Finally, after pre-processing and staging the data, we mined the data by using a variety

of text mining tools, to look for interesting information and useful patterns that may not be easily observed in plain sight, and to draw potential insights.

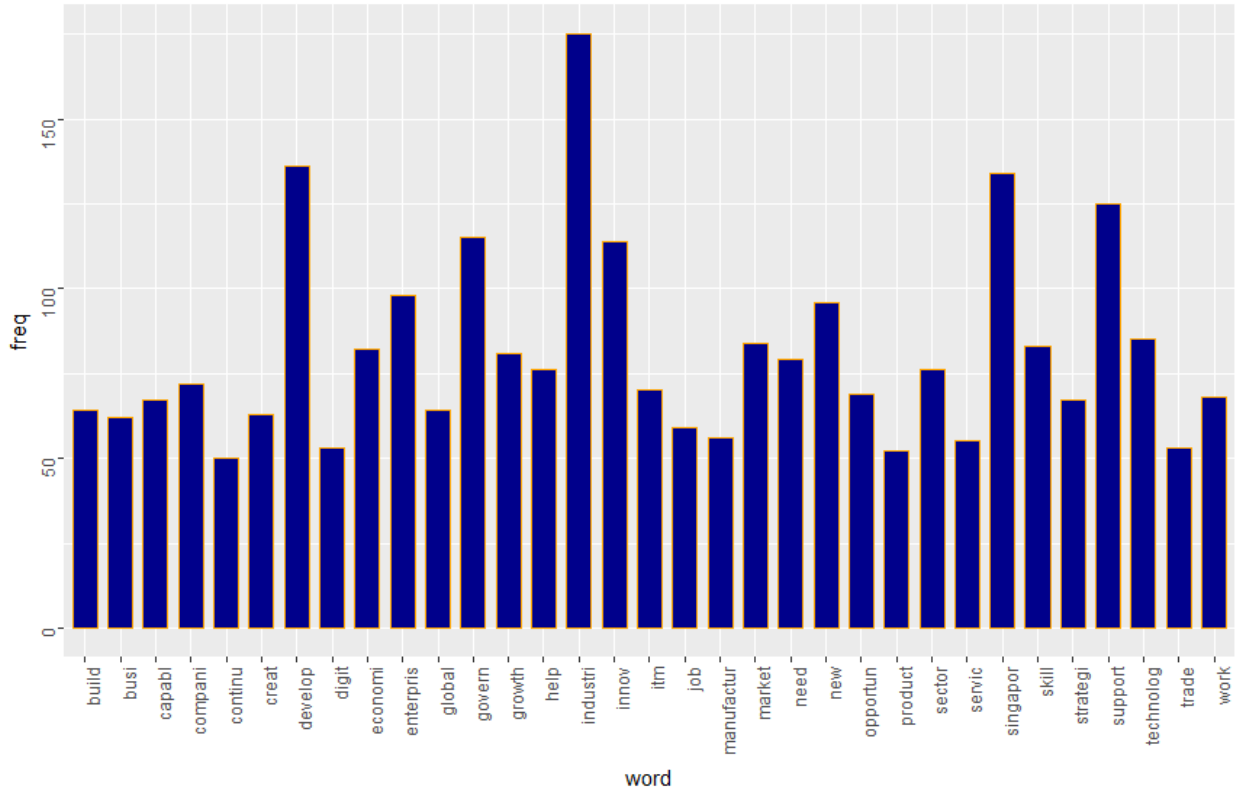
### 2.1.1. K-Means Clustering

To explore latent recurring topics that are not easily observed in the CFE report, we employed *k*-means clustering — a vector quantisation method that partitions the text into *k* non-overlapping clusters or topics. Here, we experimented and divided the body of text into 10 clusters for interpretability and statistical certainty (92% of variance explained). We chose *k*-means over alternative algorithms because of its simplicity and efficiency in estimating clustering based on iteratively calculating the Euclidean distances between vector words and means. This is similar to the Latent Dirichlet Allocation (LDA) process, which is to generate topics based on certain probabilities of words. *K*-means works to minimise the distance between data points — frequently used words in this case — and the centroid of a cluster. Close data points show that these words were used in a similar context, or the latent topic. Visually, the size and shape of each cluster indicate the average variance between words.

### 2.1.2. Word Association (Term Correlation)

To help us identify terms that are particularly meaningful in the narrative of the report, we created a graph of frequently used words. With each word or term that we were particularly interested in, we identified other words that were most highly correlated with it. The correlation value between the term of interest and another term ranges from 0 to 1. The closer the value is to 1, the greater the similarity in the semantics or the association between the two words.

**Figure 1: Frequently Used Words (More Than 50 Times) in the CFE Report**




## 2.2. A Closed-Door Discussion With Corporate Leaders and CFE Members

Following the public release of the CFE report, IPS hosted a dialogue with its corporate associates, consisting of 40 business leaders, management consultants and economists from different industries, including some members of the CFE to discuss the report.[1] The discussion focused on the "hows" around these three issues:

- Rationale behind the seven mutually reinforcing strategies described in the report and their shared goal towards building an inclusive Singapore society.

[1] The summary report on the IPS Corporate Associates Lunch Dialogue: The Committee on the Future Economy can be found at https://lkyspp.nus.edu.sg/ips/wp-content/uploads/sites/2/2017/03/ENews_CA-CFE-Dialogue_150317.pdf

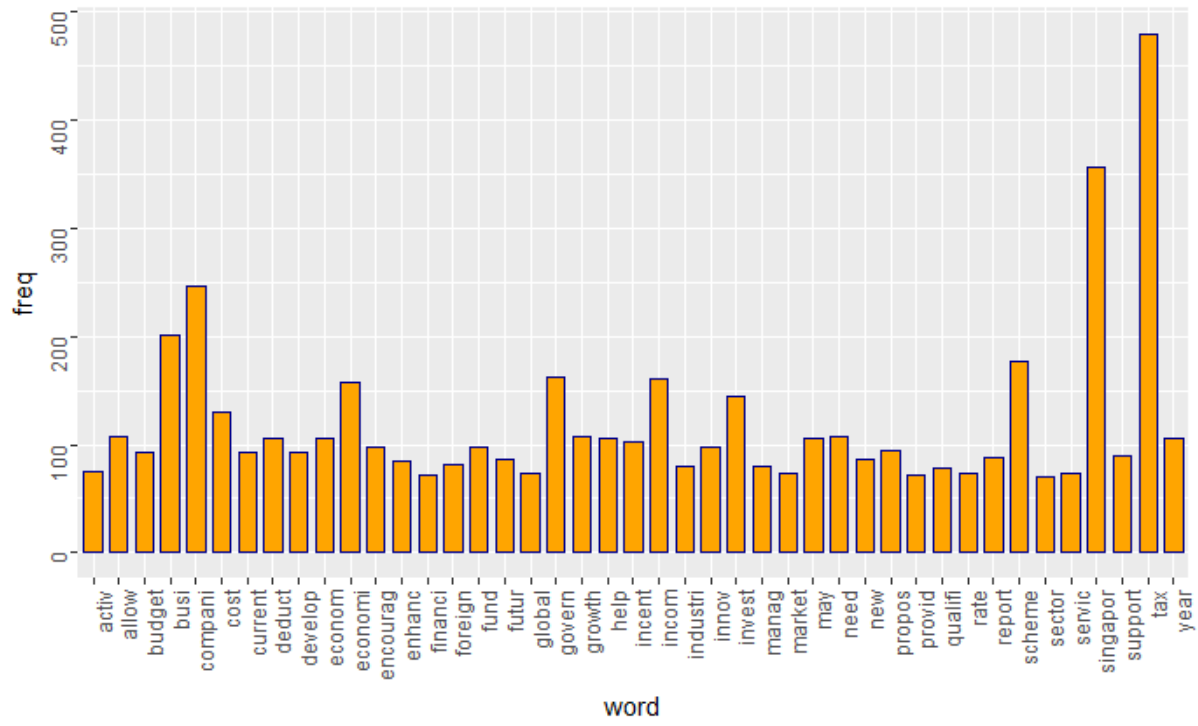
- Effectiveness of the strategies to address structural shifts in the global economy (e.g., growing momentum in anti-globalisation sentiments) and capture opportunities in future growth markets in Asia.
- Relationship between the Industry Transformation Maps, SkillsFuture programmes, and foreign and "local-first" labour policies amid a mature economy and ageing workforce.

### 2.3. Private Sector Reports and Expert Opinions on the CFE

We also drew upon expert opinions, reports and white papers from private sector economists, trade association and chambers, and strategy consultants (see Figure 2). We compiled data collected from over 20 documents that either focused on or were pertinent to the CFE, including these Singapore Budget 2017 reports:

- Deloitte's *Singapore Budget 2017 Feedback: Creating Opportunities for Our Future*
- EY's *Wish List for Singapore Budget 2017*
- KPMG's *Pre-Budget 2017 Report: Building Enterprises of the Future*
- PwC's *Proposals to Enhance Singapore's Economy: Local Today, Global Tomorrow*
- SCCCI's *SME Survey 2016 and Pre-Budget 2017 Wish-List*
- SBF's *National Business Survey 2016/2017*
- OCBC's *Singapore Pre-Budget 2017 Thoughts*
- UOB's *Singapore 2017 Budget Preview*
- DBS's *Budget: Building the Future Economy*

**Figure 2: Histogram Summarising Text Data Collected From Private Sector Reports and Expert Opinions on the CFE**




## 2.4. Interpretive Phenomenological Analysis

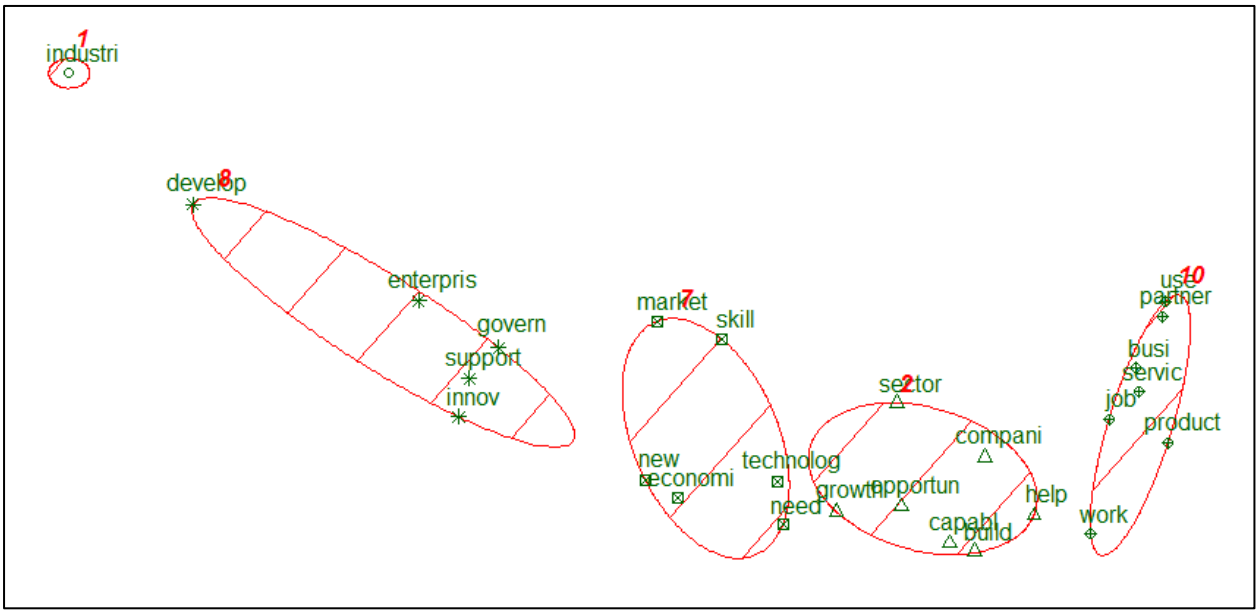
To make sense of what policymakers (as well as other stakeholders) were thinking in terms of how the future economy of Singapore could take shape across multiple issues, we drew upon the fundamental qualitative research principles of phenomenology and hermeneutics. Phenomenology aims to identify the essential but unique components of the issue discussed. Hermeneutics attempts to decode meaning from the participant's perspective of an event. Combined, this interpretive phenomenological analysis (IPA) technique enables the researcher to make sense of the data, and therefore complements the text-mining techniques we use. To improve veracity, we adopted a paired researcher approach wherein we first separately went

through the IPA process, and then combined our interpretations to ensure consistency in our analysis.

## 3. ANALYSIS OF THE CFE REPORT

We constructed an analytical lens on the empirical basis of applying text-mining techniques and phenomenology and hermeneutic processes, as described above. We interpreted the *k*-means clusters as the crux of the issues underlying the CFE strategies that policymakers deliberated upon. In the interest of providing actionable insights, we first briefly describe these five issues illustrated below in Figure 3: enterprise innovation; skills development; government and private sector partnerships; sector capabilities; and industry transformation. From there, we dive down to focus on what we see as the two primary drivers of the future economy of Singapore, placing particular emphasis on potential critical gaps in the strategy recommendations for innovation and skills.

**Figure 3: Key Issues Drawn From a Cluster Plot of Topics Discussed in the CFE Report**



### 3.1. Enterprise Innovation

In Figure 3, Cluster 8 comprises the root terms “develop”, “enterpris”, “innov”, “govern” and “support”, which indicate that these words are similarly used or often used in the same context in the report. As shown in Table 1, the term “innov” is highly correlated with terms such as, “small”, “partnership”, “risktak”, “rapid” and “simpli”. Taken together, they suggest three things. First, policymakers believe that innovation is key in solving many of the complex problems confronting Singapore and building an inclusive future economy for Singaporeans. Second, they believe that local micro, small and medium enterprises (SMEs) must take risks and engage in innovation through partnerships on different levels, in order to seize opportunities in the rapidly developing markets in the region. Remarkably, the root word “europ” is highly correlated with innovation, indicating that Europe (not the United States or China) is viewed as a key partner in helping Singapore upgrade its innovation capabilities, likely through the Enterprise Europe Network (EEN) Singapore Centre. Third, on its part, the government will increase targeted support for investments in innovation, and simplify the process for businesses to tap into these resources.

**Table 1: Term Correlations for the Root Term "Innov"**

| innov | | | | | | | |
|---|---|---|---|---|---|---|---|
| year | chang | economi | anoth | europ | futur | next | now |
| 0.96 | 0.95 | 0.95 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| small | among | capabl | focus | group | inclus | partnership | peopl |
| 0.94 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| seiz | grew | gross | rapid | risktak | simplifi | | |
| 0.93 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | | |

### 3.2. Skills Development

Cluster 7 is characterised by the root terms "need", "skill", "market", "new", "economi" and "technolog". With rapid technological change and, consequently, greater frequency of disruptions, workers in our economy need to deepen and refresh their skills to ensure that they can stay current with the needs of the job markets. On the other hand, employers need to understand how to promptly utilise the skills that employees acquire (Table 2), which implies that skills training needs to be closely linked to job needs. Budget 2017 pushed harder for the SkillsFuture movement to increase the accessibility of short-term, tech-focused and modularised training programmes through institutes of higher learning. E-learning will be expanded and the NTUC-Education and Training Fund will support union members in developing new skills quickly.

**Table 2: Term Correlations for the Root Term "Skill"**

| skill | | | | | | | |
|---|---|---|---|---|---|---|---|
| classif | enter | nexus | adapt | profession | worker | job | meaning |
| 0.96 | 0.96 | 0.96 | 0.93 | 0.91 | 0.9 | 0.89 | 0.89 |
| improv | educ | skillsfutur | time | acquir | career | utilis | relev |
| 0.88 | 0.87 | 0.87 | 0.87 | 0.86 | 0.86 | 0.86 | 0.85 |
| catch | employe | evalu | graduat | law | modularis | necessari | older |
| 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 |
| placeandtrain | scalabl | skillsbas | technologyen | techskil | train | away | disrupt |
| 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.82 | 0.82 |

### 3.3. Government and Private Sector Partnerships

Cluster 10 contains the root words "partner", "busi", "use", "product", "service", "job" and "work". Partnerships between the government and the private sector are encouraged as a way to help Singapore-based enterprises develop exportable products and services, such as in areas of strong competency, like urban solutions. Partnerships could take a lead demand approach, in which newer SMEs in promising industries with shorter track records can use the government as a customer reference to support their growth and development. Another way is for the government to work together with commercial entities that have the technical expertise, business networks and instincts — to better commercialise research findings and intellectual property (IP) of research institutions. Meanwhile, Budget 2017 highlights that A*STAR will continue partnering companies in identifying suitable technologies for innovation through the

A*STAR Operation and Technology Road-Mapping, where SME partners that co-develop intellectual property enjoy exclusive licenses and royalty-free periods. The *Tech Access Initiative* also creates greater access for businesses to use specialised equipment such as advanced prototyping and testing tools.

**Table 3: Term Correlations for the Root Term "Use"**

| use | | | | | | | |
|---|---|---|---|---|---|---|---|
| cybersecur | asset | digit | potenti | ambit | bestinclass | flagship | format |
| 0.93 | 0.89 | 0.89 | 0.89 | 0.84 | 0.84 | 0.84 | 0.84 |
| influenc | infocomm | report | solv | adopt | test | media | ahead |
| 0.84 | 0.84 | 0.84 | 0.84 | 0.82 | 0.82 | 0.81 | 0.8 |
| border | certain | pervas | popul | solut | busi | distinct | urbanis |
| 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.78 | 0.78 | 0.78 |
| collect | done | gain | seiz | smart | analyt | problem | |
| 0.77 | 0.77 | 0.77 | 0.77 | 0.77 | 0.76 | 0.76 | |

### 3.4. Sector Capabilities and Industry Transformation

In Clusters 1 and 2, the root words are "growth", "opportun", "build", "capabi", "sector" and "industr". Recognising the tremendous economic growth opportunities offered by the digital economy, the CFE emphasises the importance for Singapore to be the best-in-class platform for all things digital — computer technology, digital connectivity, communications infrastructure and data flows, and integrating them into business activity (Table 4). To this effect, the government aims to build strong digital capabilities across all sectors in the economy by promoting the adoption of digital technologies among SMEs through national initiatives like the National Trade Platform and a

National Payments Council. It envisions digitalisation transforming industries and creating new jobs, especially in fields like data analytics, cybersecurity, and digital marketing. On its part, the government will provide support to defray initial investment costs in new digital solutions to be piloted by SMEs, and help deploy tested solutions to the wider SME community. This will be done industry by industry through the ITMs. It is interesting however to note that *Cluster 1* is standalone; it is significantly distant from the other clusters in Figure 3. There is little or no correlation between the root term "industry" and other member words in those clusters.

**Table 4: Term Correlations for "Digit"**

| **digit** | | | | | | | |
|---|---|---|---|---|---|---|---|
| border | pervas | analyt | asset | data | platform | ambit | announc |
| 0.99 | 0.99 | 0.97 | 0.97 | 0.96 | 0.94 | 0.93 | 0.93 |
| bestinclass | digitalis | flagship | format | influenc | infocomm | solv | cybersecur |
| 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.92 |

### 3.5. Potential Issues in the CFE's Recommendations for Driving Innovation

Our analysis thus far suggests the broad thinking behind the CFE report. Clearly, policymakers view technological innovation as central to driving transformation of our economy and growing jobs. The CFE proposes that partnerships in all directions will have a multiplier effect on creating innovative enterprises in Singapore, and emphasises high-technology and associated startups as an archetypal model. We

highlight potential issues arising from transaction costs and selection bias in these recommendations.

1. Many SMEs in Singapore possess few resources and lack technological capabilities. Consequently, there can be substantial transaction costs in fostering innovation through partnerships between SMEs and other companies, institutes of higher learning (IHLs), government agencies and overseas stakeholders, which disincentivises innovation-based partnerships.
    - SMEs are resource-dependent on larger or more advanced partners, leading SME owners to avoid innovation-based partnership in favour of retaining control of their businesses.
    - Vice versa, low absorptive capacity among SMEs decreases the incentive for potential partners to collaborate for innovation activities because of high transaction-specific costs in technology transfer.
2. There may be an overemphasis on a select group of high-technology startups in Singapore to drive enterprise innovation.
    - Inordinate focus on supporting and incubating “high-tech” startups to drive innovation draws resources away from the much larger proportion of “low-tech” companies, which may also have innovative ideas.

### 3.5.1. Transaction costs in innovation-based partnerships

An imbalance of power can be an obstacle to partnership formation (Casciaro & Piskorski, 2005). Power is tipped in the hands of the partner who possesses more resources and assets. Typically, SMEs in Singapore have relatively few resources and

little complementary assets to offer in a partnership with a large technology leading firm or public research institute like A*STAR, such that high transaction costs would be borne by the latter in terms of the risks associated with technology transfer as well as the provision of financial and other resources. This places SMEs in a resource-dependent position because they would have to rely (quite heavily) on the partner's resources (Pfeffer & Salancik, 1978). Consequently, wielding less power and a diminished ability to represent their own interests (i.e., loss of control), the expectation among SME owners is that they would be subject to their potential partners' beck and call, even though collaboration can be beneficial for engaging in innovation (Teo, 2017). In fact, small resource-dependent companies are often exploited and vulnerable to temperamental behaviour of their large or technologically advanced counterparts (Song, 2013).

These hidden pitfalls are likely to disincentivise many SMEs from partnering, especially for research and development (R&D) activities, in which they are inherently weaker (Knott, Posen & Wu, 2009). On the other hand, large businesses — multinational companies (MNCs) and large local enterprises (LLEs) may also be reluctant to partner with SMEs because of the potentiality of incurring high transaction costs. Wong (2016) found that MNCs often do not show a preference to collaborate with local SMEs in Singapore, because on average, they do not have the requisite absorptive capacity[2] to co-innovate or match the needs of these larger, more

[2] "Absorptive capacity" refers to a firm's ability to continually understand its own competencies or lack of, before reconfiguring its organisational processes towards adapting to and evolving in the face of uncertain market conditions (Cohen & Levinthal, 1990; Zahra & George, 2002; Zott, 2003). A firm must be able to recognise the value of new information, assimilate it and ultimately, apply it to achieve business objectives.

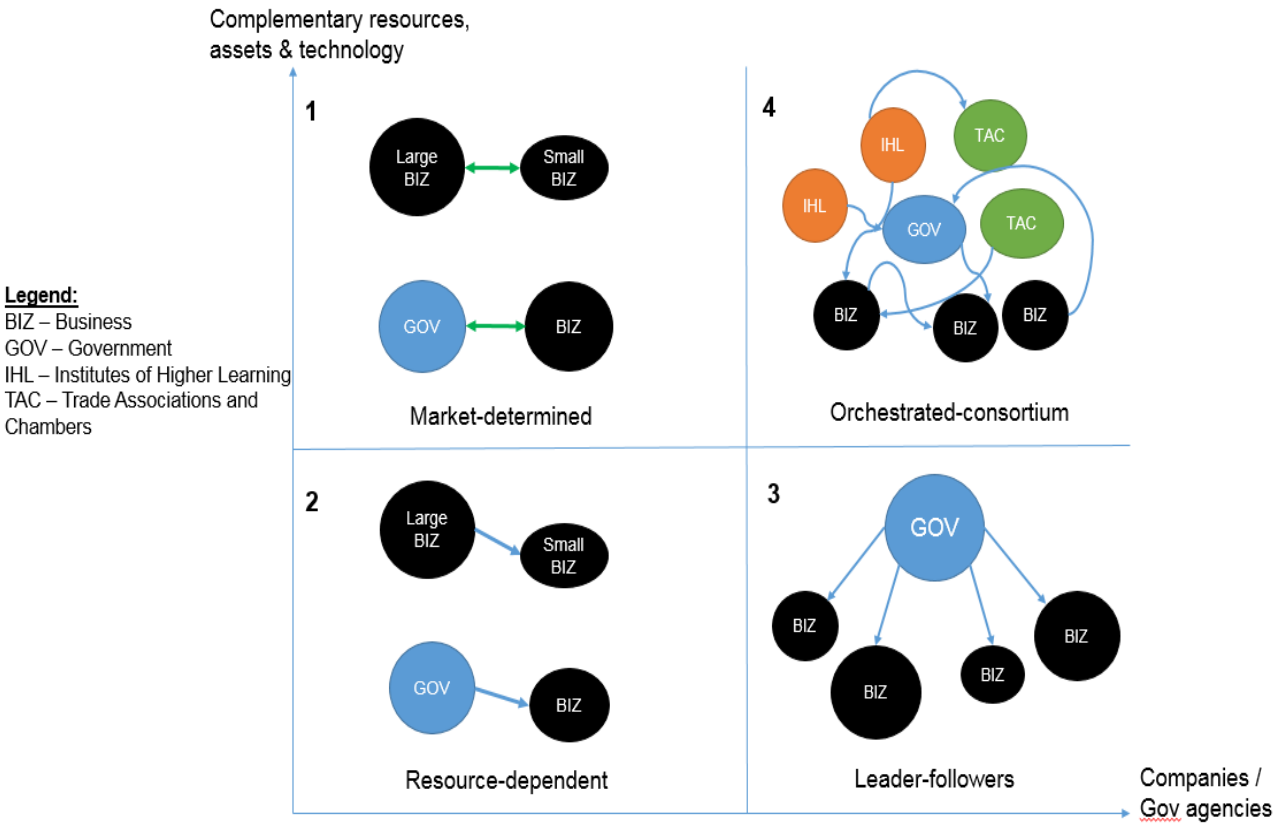
sophisticated organisations. Even technology imitation requires a certain level of technical knowledge base. Indeed, both large and small local businesses are reluctant to partner one another. Only 11 per cent of the surveyed businesses in the SBF National Business Survey 2016/2017 demonstrated their intentions to pursue business partnerships over the next 12 months.

We suggest two ways forward, which can be undertaken simultaneously to reduce the gap in knowledge asymmetry between SMEs and other SMEs, LLEs, MNCs, IHLs, government agencies and overseas stakeholders. First, in each industry across the 23 ITMs, systematically identify Singapore SMEs that demonstrate sufficient absorptive capacity, so that they can be better supported to establish partnerships. For example, supported by SPRING, co-innovation between Hewlett Packard (HP) Singapore and two local SMEs enabled them to jointly develop an environmentally-friendly packaging for ink cartridges, improving HP's manufacturing process and at the same time upgrading the technological capabilities of the SMEs (SPRING Singapore, 2014). Second, understand how to structure partnerships to minimise some of the transactional issues that are inherent in open and collaborative innovation. We illustrate this in Figure 4 with a typology of partnership structures based on complementary assets each partner contributes (Y-axis) and the number of organisations involved (X-axis). In a *market-determined* partnership (Figure 4, *Cell 1*), one firm's needs can be met by another firm's complementary resources. For example, Marina Bay Sands (MBS) has worked with the urban farming SME, Edible Garden City, to develop a fresher and more sustainable source of culinary herbs for MBS restaurants (Today Online, 2016). Through such partnerships, larger partners can tap

into newer technologies and at the same time, smaller partners can gain credibility for their services.

As the market may not always reach an equilibrium, it is more likely to encounter the *resource-dependent* situation (Figure 4, *Cell 2*). A low complementarity of resources and technology between the partners due to a difference in absorptive capacities could reduce the incentive for firms to collaborate on co-innovative activities. One reason why this type of partnership is inefficient is because larger partners may need to expend more resources in overcoming the lack of absorptive capacity of their smaller partners, drawing away resources that could have been employed in co-innovating new products and solutions.

**Figure 4: Typology of Partnerships for Innovation in Singapore**



To increase the efficiency of business partnerships, structuring them in the *leader-followers* style (Figure 4, *Cell 3*) can be beneficial. In some instances, the government can take the lead if the scale of the project is large and if there is consistency in the needs of the different firms in the industry. One example is the National Trade Platform (NTP), where the government is building a national-level digital platform and infrastructure to assist the digital adoption of businesses in the logistics and trade finance sectors. As creating the technology for the NTP is on a much larger scale, businesses in these sectors may not have the capacity and the ability to do it individually. Hence if the government is able to lead the way in these large-scale projects involving different firms in the same industry, it can benefit both the businesses and the economy.

However, there are some drawbacks to *leader-followers* partnerships. When the government takes the lead, it might create a “command planning” pattern among the business community. Firms may become accustomed to having the government chart and plan the way forward for them. A “crutch mentality” can develop where they have little incentive to develop innovation on their own, to improve their processes, or to adopt risk-taking attitudes to sustain and expand their businesses.

Thus, it may serve our economy and businesses better if an *orchestrated-consortium* (Figure 4, *Cell 4*) type of partnership emerges, where the government takes on a much more flexible and behind-the-scenes role in facilitating loose and weak ties to be built among the businesses. If the business receives a little help from the government but also has greater ownership in the process of seeking out connections and opportunities as with the market-determined situation, this can increase the

businesses' incentive to invest in innovation or productivity measures. Partnerships can be formed more organically and collaborative innovation can occur.

### 3.5.2. Overemphasis on high-technology startups

Singapore has developed quickly into an entrepreneurial hub due to its hospitable environment for startups, serious government support to catalyse entrepreneurship, and consistent positive messaging about entrepreneurialism (Anthony, 2015). PricewaterhouseCoopers analysts projected that tech-enabled startups would contribute 2 per cent to Singapore's GDP by 2035 (PwC, 2015). This is promising, yet there may be an overemphasis on the development of high-technology startups in our attempt to drive innovation-led economic growth. According to Daniel Isenberg, a professor at Babson College (a world-renowned entrepreneurship school in the United States), as well as an entrepreneur and venture capitalist, there is very little systematic evidence that programmes that encourage venture capitalist-backed startups actually produce jobs. He argues that the equity-driven model of entrepreneurship in the form of high-tech startups is overhyped and has limited use for economic growth (MacBride, 2017). In Singapore, the startup ecosystem is still in a fragile, development stage; it lacks strong leadership by entrepreneurs with long-term commitment and sufficient robustness even compared to Israel, let alone Silicon Valley (Yeoh, 2016). Only 10 per cent of an estimated total of 48,000 startups in Singapore are classified as "high-tech" startups[3] (Singstat, 2017). This implies that the bulk of our startups, and for that matter, most SMEs are found in "low-tech" or "medium-tech" industries. Certain

[3] SPRING Singapore defines "high-tech sectors" as those that engage in pharmaceuticals, biomedical manufacturing and hardware manufacturing.

sectors, such as food and beverage (F&B) services are traditionally considered low-tech but they continue to attract many home-grown entrepreneurs. F&B plays a vital role in our economy, supporting Singapore's reputation as one of Asia Pacific's eating capitals. If the perception is that only firms in high-tech sectors can be innovative, public funding may be misallocated and less support is allocated to other sectors (Peneder, 2010). Innovative firms in low- or medium-tech sectors may experience greater difficulty in accessing funding support compared to less innovative firms in high-tech industries.

Furthermore, anecdotal evidence suggests that accumulating a large pool of high-tech startups in Singapore does not necessarily translate into innovation and economic growth. Going by measures for the Bloomberg 2017 Innovation Index, Singapore ranks very high in terms of concentration of researchers engaged in R&D, but compares relatively weak against other countries in terms of patent activity (Jamsrisko & Lu, 2017). There is a large base of enterprises in Singapore — startups as well as SMEs that pursue opportunities other than from high-technology innovation in the form of pure market coordination and exploiting new resources, markets, or industrial organisation in the sense of Schumpeter's (1942) general definition of innovation. Therefore, it may be useful to also identify businesses other than high-tech startups that exhibit entrepreneurial quality and innovative potential. Research has found that a twofold increase in entrepreneurial quality, not quantity, in startups can possibly increase GDP by 6.8 per cent 11 years into the future (Guzman & Stern, 2015).

To better evaluate innovation potential for firms across different industries, innovation can be regarded as the complementary efforts of both product innovation and process

innovation. Low-tech businesses tend to engage less in product innovation or R&D as "high-tech" industries typically would, but could perform equally or even better at process innovation (Kirner, Kinkel, & Jaeger, 2009). Thus, other than using R&D intensity as a measure of innovation potential, firms can also be evaluated on the design of their business models, marketing strategies, labour productivity levels and other strategic approaches. With a better understanding of innovation potential, future policies and the ITMs can be updated each year to be better tailored to the unique needs of businesses.

### 3.6. Potential Issues in the CFE's Recommendations for Developing Deep Skills

We also identified two potential issues in the CFE strategy to *acquire and utilise deep skills* in the economy with the aim to ensure Singapore's economic prosperity by creating jobs, placing and upgrading workers through a tripartite partnership between employers, unions and the government:

1. Misalignment between government push and business perception for skills development
    - Are employers willing to provide opportunities for skills development and training for their employees?
    - Should employees develop deep skills if jobs are changing throughout their lifetimes?
2. Red Queen effect — New skills as a "catch up" game
    - Reactive — promotion-focused training and acquisition of new skills to meet current market needs; or

- Proactive — performance-focused continuous training and development of deep skills?

### 3.6.1. Government push versus business perception for skills development

Retraining and reskilling workers are critical if businesses are to prepare for technological disruptions and to innovate. The government is spearheading the push to help workers acquire deep skills as well as facilitate the utilisation of these newly-acquired skills in companies to help them transform, develop new capabilities, and grow. Such programmes and initiatives include SkillsFuture, a national movement to enable workers to engage in lifelong learning, the Infocomm Media Development Authority's (iMDA) TechSkills Accelerator Programme (TeSA) and Workforce Singapore's (WSG) P-Max — a place-and-train programme for SMEs.

However, various polls conducted by private agencies consistently show that businesses are least concerned with upgrading the skills of workers, investing in productivity and innovation vis-à-vis their bottom line and the availability of government grants. For instance, in the SBF National Business Survey 2016/2017, only 20 per cent of SMEs believe it is important to upskill and train workers. These SMEs are most concerned about manpower-related policies, in particular, the availability of blue-collared workers, which has severely affected their businesses. Many businesses also continue to be much more interested (five times more) in attracting and retaining younger workers versus older workers. This entrenched view among SME owners poses a significant challenge to skills development movement because SMEs

represent 99 per cent of all enterprises in Singapore and employ 70 per cent of workers.

The government's ambitious push for deep skills development at the national level by providing a variety of individual and employee-sponsored training grants is highly commendable. In fact, in the current state of local businesses in Singapore, government-led skills initiatives are necessary. However, for this CFE strategy to be effective, businesses must first be engaged in a mindset change — away from a business orientation focused on short-term profit and towards a pursuit of innovation, productivity and growth. Companies themselves must understand the value of and be willing to invest in the training and skills development for their employees, even if it takes time. Without this strong buy-in from top management, the outcome would potentially be piecemeal. Hence, we proffer that the WSG In-House Training scheme is an excellent start, and greater emphasis should be placed in such programmes to further mobilise not just groups of individuals but also organisations in this movement to develop deep skills.

To encourage lifelong learning and wholly develop deep skills in an area, continuous learning and training is required and should be expected of all workers — professionals, managers, executives and technicians (PMETs) — in every aspect of the job. We suggest that skills development initiatives be internalised as a core organisational activity, best implemented in-house within the company. It would take the form of an informal teaching model, similar to an apprenticeship. For example, Simon (2017) notes that Germany still has many middle-class manufacturing jobs because of their unique German dual system of apprenticeship. Their *Mittelstand*

companies are highly resilient (the survival rate in the last 25 years is 90 per cent) and can innovate and grow because they invest heavily in vocational training, which combines practical and theoretical training in non-academic trades. The development of deep skills demands commitment not only from employees but also employers.

External training on a volunteer *ad hoc* basis such as the SkillsFuture programmes may introduce new skills, but is not sufficient to develop depth or specificity in knowledge. There are also inherent transaction and agency costs. Information search costs could be heavy on the part of the employee looking for the "right course" if there is limited shared understanding between the employee and employer with respect to individual aspiration for skills and career development versus current organisational needs. A vicious cycle may ensue; employers may not value the new skills acquired while employees could be looking for the next better-paying job once training is completed. According to a survey conducted by the Institute of Singapore Chartered Accountants on the SkillsFuture Credit scheme in 2016, almost half or 47 per cent of the respondents cite time as the key challenge for them in starting the journey of continuous learning. Another 30 per cent said that the lack of a support system, such as employer support is the biggest hurdle, while 20 per cent said that lack of individual motivation keeps them from embarking on SkillsFuture. Moreover, some of the most popular courses taken up by Singaporeans tend to be hobby-related, such as photography, Korean language and baking (Seow, 2017), and these skills may not be relevant or valued by their employers.

Albeit preliminary, such evidence could indicate that workers in Singapore believe that it is ultimately the responsibility of the company to provide work-related training. This

means that there must first be a change in business culture and employer mindset. Employers must believe in the importance of continuous training and improvement to develop organisational resilience for technological disruptions and new capabilities for innovation. They should also help employees understand the purpose and value of this training. In doing so, employees can feel proud and valued as an important part of the company since there company is continually investing in them. This encourages employees to reciprocate the company's efforts by being motivated to work harder and stay on longer. As renowned management thinker Peter Drucker (1971) once wrote:

> *[It] is the psychological conviction of job and income security that underlies … cheerful willingness on the part of the employees to accept continuing changes in technology and processes, and to regard increasing productivity as good for everybody."*

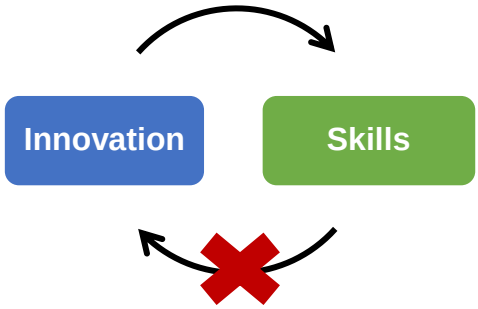
### 3.6.2. "Red Queen effect" — New skills as a "catch-up" game

On the other hand, the beliefs and attitudes of individual Singaporeans towards training and acquisition of skills has to change — from one that is reactive and focused on current job trends to one that is proactive and based on interests and aptitude. For instance, it is remarkable that the most popular major at Yale-NUS, a liberal arts college no less, is currently computer science (Tan, 2017). Lifetime training and development of deep skills are key ingredients for producing innovation. Even grand masters of their respective art (e.g., violinists, painters, scientists, calligraphers, mathematicians, architects, linguists) practise their craft daily. They go through the elementary exercises every day, engaging in continuous training so that their skills,

and above all, their *creativity* would not deteriorate. Paradoxically, students in Singapore religiously keep at their studies throughout formal school, constantly learning and revising new concepts taught in anticipation of the next test or examination, with the singular goal to perform well. Singaporean students even exhibit strong creativity by producing world-beating scores in the Programme for International Student Assessment (PISA) Test, which requires creative problem-solving skills. So at least within the Singapore education system itself, the values of performance-driven training inculcated in individual students is widely desired and exportable in the world. The problem is that this practice stops when school ends and career begins.

Our text-mining analysis of the CFE report showed that there was little connection drawn between skills and innovation. In Table 2, innovation is not highly correlated with skills in the report. The important implication is that the disposition may be to think of reskilling as a means to overcome acute job challenges brought about by technology-driven business disruptions. This contrasts against the vision of the CFE for Singaporeans to develop deep skills that can value-add — to become the disrupter, rather than be the disrupted. If we are to become a Smart Nation of innovation, skills must drive innovation (Figure 5). There remains a missing link insofar our workers need to first possess a set of deep skills. This can only come from a patient willingness to immerse in lifetime training that is focused on achieving better performances and an environment that supports this ongoing process.

**Figure 5: Relationship Between Innovation and Skills**




When our current system of training is promotion-focused, it naturally follows that our workers in Singapore would view skills acquisition narrowly, for the purpose of getting a job or switching jobs. Validated by the system, it is not uncommon that Singaporeans invest the time and effort to study for a higher qualification (typically a degree) with the expectation that they would be promoted within the company or alternatively offered a higher-paying job in a different company upon completion of the course. Conversely, redundant workers enrol in training courses only out of immediate necessity. In this manner, we inevitably become vulnerable to disruption by technological changes and new innovative business models. Such promotion-focused or necessity-based training fosters a reactive orientation towards technological disruption and innovation, and in turn, engenders what has been described as the "Red Queen effect" in Lewis Carroll's (1872) book, *Through the Looking Glass*.[4] Workers adapt, learn and train in order to stay relevant, but essentially go back to square one.

Reskilling workers only to move them into new jobs in emerging industries cannot be a sustainable solution, especially given a rapidly ageing population. The CFE report charts a new beginning for Singapore, and therefore appropriately, we suggest moving

[4] See also L. Van Valen (1973).

away from this practice and embracing the concept of lifetime training that focuses on performance. The new system can promote a culture in which workers believe they must continuously train so that they can do their jobs better and better, no more and no less. This necessarily requires that workers are made to feel empowered, taught the foundational skills and given the edifice which they can build upon to teach oneself to improve one's own productivity through the process.

This concept of continuous training can also go a long way towards preventing extreme specialisation and departmentalisation plaguing Singapore's businesses — reducing job mismatch by allowing workers to develop a set of deep skills around their jobs (Malone, Laubacher, & Johns, 2011). For example, under the current promotion-based system, imagine a certified financial analyst (CFA) who has lost his or her job as an investment professional specialising in equity capital market deals. He or she would find it quite a challenge to move into other roles within the banking industry because those specific roles may no longer be available in Singapore. Alternatively, if lifetime training were accepted as a norm, the CFA would believe in training continuously in other related job functions (e.g., compliance, risk management) beyond the professional certification attained to become a well-rounded banker, and the job switch might have been much easier. If we can develop an institutional framework that celebrates continuous training focused on performance, we may be better able to create job resilience in the fast-changing world today. The national SkillsFuture movement presents a great platform to develop well-rounded skills, but employees and employers must come to an understanding with one another as well.

## 4. DISCUSSION

In this working research paper, we used a combination of data mining and qualitative research methods to analyse the strategies and recommendations laid out by the CFE, and how they resonated with businesses and other constituencies. From this dual perspective, we identified possible gaps that policymakers could re-examine or look further into as these strategies become operationalised.

We focused our analysis on the issues related to enterprise innovation and skills development, as these form the building blocks of how Singapore wants to transform for the future — its citizens, industries, sectors, and collectively as a Smart Nation. Even as the CFE rightly points to open collaboration (vis-à-vis proprietary knowledge) as a driver of technological innovation, we found potential issues arising from transaction costs in firm-to-firm and government-to-firm partnerships, specifically, asset complementarity and absorptive capacity. Further, we identified an overemphasis on "high-tech" startups to spearhead innovation in Singapore, neglecting "low-tech" companies and other businesses that may pursue opportunities in ways other than from technological innovation, and that may also be important to us. To these, we propose a model on how partnerships can be structured in a continuum — from *market determined* to *leader-followers* to *orchestrated consortium*, in order to better facilitate innovation among different segments of enterprises within the domestic eco-system as well as in international alliances.

With respect to developing deep skills within the local workforce, the results from our text mining and interpretive analyses suggest that there is a chasm between the government's push and businesses' perceptions for skills development. While

policymakers understandably place much emphasis on the need to deepen skills in our workforce in order to prepare ourselves to become more resilient to technological disruptions and heightened global competition, the mindset of business owners and managers in Singapore by-and-large is strongly oriented towards short-term profits as opposed to sustainable growth and development. On the other hand, the work culture and institution in Singapore is such that, isomorphically, individuals aspire for a managerial role, sometimes immediately at the start of one's career. Our reward system and individual attitudes and beliefs can be characterised as promotion-focused wherein skills development is viewed as a means to become a manager, rather than performance-focused in which emphasis is placed on lifelong learning and continuous training to improve one's craft. In fact, three out of four white-collar jobs (i.e., PMET jobs) require a patient mentality corresponding to the latter. To develop a Singaporean core with deep skills that can assist in our quest for an innovation-driven, export-oriented future economy, we propose a stylised model, not unlike the Japanese model of company-sponsored apprenticeship. In concert, with the support of the government, companies must value their employees and take the lead to invest and train them, and vice versa, employees should embrace the idea of continuous self-improvement to do their jobs better and better. There are elements of such practices in the Singapore civil service that can be referenced.

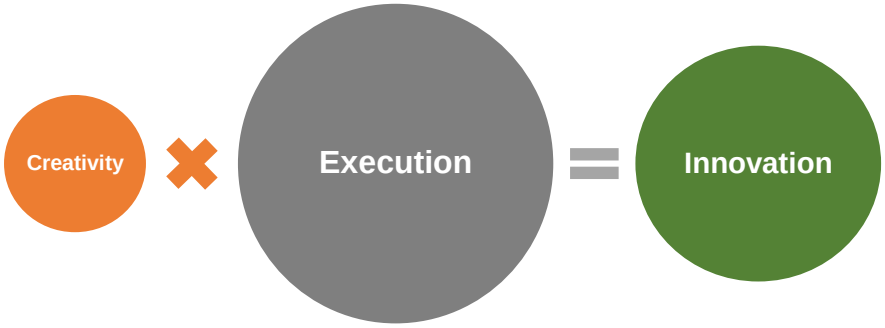
### 4.1. Space for Individual Creativity to Flourish

Interestingly, we discovered in our data analysis that the notion of creativity is significantly missing in discussions on the future economy of Singapore, by both the CFE itself as well as private sector. For example, the CFE used phrases such as

"being innovative", "innovative businesses", and "viable commercial products", while private sector stakeholders encouraged the government to develop more "tax-friendly regimes and incentives for businesses which engage in innovative activities". However in both cases, there was very little reference to the root term "creative", and expectedly, it was not correlated with "innov".

Creativity and execution are both equal and necessary inputs in order for innovation to happen (Govindarajan & Trimble, 2010). But our results indicate that in Singapore's context, there may be a disposition to focus lopsidedly on the execution component of innovation (Figure 6), and in a fashion that tends to be government-initiated and directed, driven by large macro-level enabling strategies towards a certain expected outcome. Companies, whether large enterprises or SMEs or startups, are after all social organisations made up of individuals, and it is at this level where we should begin to re-think about our approach to innovation. Commercialising ideas and inventiveness into innovative products and services should ultimately be our aim, and which economic-level success here is critical to Singapore's strategic positioning to be a global innovation hub. But crucially, individual creativity must first be allowed to flourish in an enabling environment. There must be sufficient luxury of space and time for individual ideas to materialise in their own ways and settings, for actions to be taken to experiment and create something as one would see fit the application, and for personal failures to occur and celebrated as good learning experiences. Without this ground-up momentum, despite tremendous government efforts from the top-down, however well intended to catalyse and bolster commercial execution, may not be wholly sufficient for innovation to occur.

**Figure 6: Adapted from Govindarajan & Trimble's Model: How We Currently Think About Inputs Required for Innovation in Singapore**




Good ideas, bad ideas — ideas are cheap, a dime in a dozen, yes. But at issue is the audacity and instinct (or lack thereof) to come up with one's own ideas to begin with, and then to pursue those ideas passionately. Creativity as the *active* use of one's imagination must be cultivated and come more in front. We should work towards building an institution or developing a social norm whereby creativity can even take precedence over pragmatism in Singapore. In the spirit of Singapore tripartism involving businesses, government and society, we have to explicitly communicate and arrive at a shared understanding of the fundamental importance of promoting individual creativity, if we want to achieve the sort of innovative Smart Nation envisioned. Individual creativity is needed no matter the type of approach to innovation, from science- and engineering-based to customer-focused and efficiency-driven innovation. Scientists need to be inventive in order to make breakthrough discoveries. Engineers need to use their imagination to design feasible technology solutions to meet myriad user requirements. Entrepreneurs need to creatively use various open resources, internal or external, in ways that create some specific

advantage (e.g., efficiently innovating by integrating and configuring boundary-crossing technologies to achieve high value-price ratio) or fulfil previously unmet customer needs. Although not everyone will become innovators, everyone should still be empowered to have the opportunities to contribute their ideas in the process of innovation.

### 4.2. Transforming Schools and Our Education System

To realise the CFE's vision for Singapore to eventually become a disruptor rather than continually be at the receiving end of disruption, it bores down to our education system (Thio, 2017). Singapore has one of the world's highest-performing education systems. We continually outperform counterparts globally on international tests for science, reading, and especially, mathematics. Yet, we can still learn from elements of alternative successful models of schooling and education that rely less on drill and intensity, and more on creative play and curiosity. For example, the Finnish education system made music, visual arts and crafts education compulsory for students up to age 16, as part of a national effort to promote creativity and problem-solving skills, and boost learning capabilities in other subject areas (Hargreaves & Shirley, 2012). More generally, the Finns place emphasis on foundational competencies and "higher thinking" which are much needed in the future, such as critical analysis, goal-setting, collaboration, creativity, and learning skills. Having such soft elements in their education system can virtuously transfer to the workplace. Finland has an industry structure very similar to Singapore — dominated by some 200,000 SMEs, but their companies are more technologically advanced and knowledge-intensive. In Finland, SMEs account for 70 per cent of gross value-added in the medium-high and high-

technology manufacturing industries and 60 per cent in the knowledge-intensive service businesses (Airaksinen et al., 2017). Currently, Finland is embarking on an ambitious new initiative called HundreED, to scale education innovation for the next 100 years. Here in Singapore, we currently have an excellent education infrastructure — clear moral purpose, strong public education, clear commitments to high-quality teachers and teaching, and robust system integration, to build upon. We too can have these achievements and help our people become more resilient — to acquire deep skills and be innovative, through transforming parts of our education system to provide time and space to pursue other interests and activities outside the “hard” subjects taught in school.

At the higher education level, liberal arts education, like with Yale-NUS college can be a model to look into. Liberal arts students are not only taught a broad-based and multidisciplinary curriculum, they also have a living community of learning and engagement, opportunities for experiential learning, overseas exposure and character development. But this is only one model, and not necessarily the best model. The changes in the higher education landscape are expected to create different pathways for different people to excel at different interests, and these changes are likely to continue evolving. It will be something to aspire to if all institutes of higher education and learning can take on some elements of the liberal arts education and teach all our people, not just a select few how to be creative, innovative and entrepreneurial.

**REFERENCES**

Airaksinen, A., Loumaranta, H., Alajaasko, P., & Roodhuijzen, A. (2017, March 21). Statistics on small and medium-sized enterprises: Statistics explained. Retrieved from: http://epp.eurostat.ec.europa.eu/statisticsexplained/

Anthony, S. (2015, February 25). How Singapore became an entrepreneurial hub. *Harvard Business Review*. Retrieved from: https://hbr.org/2015/02/how-singapore-became-an-entrepreneurial-hub

Carroll, L. (1872). *Through the Looking Glass and What Alice Found There*. London: Macmillan.

Casciaro, T., & Piskorski, M. J. (2005). Power imbalance, mutual dependence and constraint absorption: A closer look at resource dependence theory. *Administrative Science Quarterly, 50*(2), 167–199.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152.

Drucker, P.F. (1971). *Men, Ideas & Politics.* New York, Harper & Row.

Govindarajan, V., & Trimble, C. (2010). *The Other Side of Innovation: Solving the Execution Challenge*. Boston, Massachusetts, Harvard Business School.

Guzman, J., Stern, S. (2015). *Nowcasting and Placecasting Entrepreneurial Quality and Performance. NBER Working Paper No. 20954*. Cambridge, MA: National Bureau of Economic Research. Retrieved from: http://www.nber.org/papers/w20954.pdf

Hargreaves, A., & Shirley, D. (2012). *The Global Fourth Way: The Quest for Educational Excellence*. Thousand Oaks, California: Corwin.

Jamrisko, M., & Lu, W. (2017, January 17). These are the world's most innovative economies. *Bloomberg.* Retrieved from: https://www.bloomberg.com/news/articles/2017-01-17/sweden-gains-south-korea-reigns-as-world-s-most-innovative-economies

Kirner, E., Kinkel, S., & Jaeger, A. (2009). Innovation paths and the innovation performance of low-technology firms — An empirical analysis of German industry. *Research Policy, 38*, 447–458.

Knott, A. M., Posen, H. E., & Wu, B. (2009). Spillover asymmetry and why it matters. *Management Science*, *55*(3), 373–388.

MacBride, E. (2017, May 5). How a professor is trying to spark an entrepreneurial revolution across American. *CNBC.* Retrieved from: http://www.cnbc.com/2017/05/05/a-professor-is-sparking-an-entrepreneurial-revolution-across-america.html

Malone, T. W., Laubacher, R. J., & Johns, T. (2011). The age of hyperspecialization. *Harvard Business Review*, July-August, 56–65.

Ministry of Manpower (MOM). (2017, January 26). Labour market advance release 2016: Local employment grew while foreign employment contracted. Press release. Retrieved from: http://www.mom.gov.sg/newsroom/press-releases/2017/0126-labour-market-advance-release-2016

Monetary Authority of Singapore (MAS). (2017, March 8). *Recent Economic Developments in Singapore.* Retrieved from: http://www.mas.gov.sg/~/media/MAS/Monetary%20Policy%20and%20Economics/The%20Singapore%20Economy/RED/Economic%20Developments%20in%20Singapore%20Mar%2017.pdf

Peneder, M., (2010). Technological regimes and the variety of innovation behaviour: Creating integrated taxonomies of firms and sectors. *Research Policy, 39*, 323–334

Pfeffer, J., & Salancik, G. R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper & Row.

PricewaterhouseCoopers (PwC). (2015, April). Singapore's tech-enabled startup ecosystem. PwC Strategy. Study commissioned by Google Asia Pacific Pte Ltd. Retrieved from: http://techsg.io/upload/files/research/1453173164742.pdf

Schumpeter, J.A., 1942. *Capitalism, Socialism and Democracy.* New York: Harper.

Seow, J. (2017, April 4). Govt reviewing 4 areas for SkillsFuture credits. *The Straits Times*. Retrieved from: http://www.straitstimes.com

Simon, H. (2017, May 2). Why Germany still has so many middle-class manufacturing jobs. *Harvard Business Review*. Retrieved from: https://hbr.org/2017/05/why-germany-still-has-so-many-middle-class-manufacturing-jobs

Singstat (2017). Department of Statistics, Singapore. R. C. Chee, personal communication, April 11, 2017

SPRING, Singapore. (2014). Partnership is key to a successful business strategy. Retrieved from: https://www.spring.gov.sg/Inspiring-Success/Enterprise-Stories/Pages/Partnership-is-Key-to-a-Successful-Business-Strategy.aspx

Song, J. A. (2013, November 6). Small businesses battle to make mark alongside South Korean conglomerates. *The Financial Times.* Retrieved from: https://www.ft.com/content/7af74400-3b06-11e3-a7ec-00144feab7de

Tan, T. Y. (2017, April 26). Relevance of liberal arts education for Asian development. Lecture presented at The Head Foundation Public Event Series in Singapore.

Teo, S. S. (2017, March 16). Missing piece in the CFE recommendations. *The Business Times.* Retrieved from: http://www.businesstimes.com.sg/opinion/singapore-budget-2017/missing-piece-in-the-cfe-recommendations

Thio, S. Y., (2017, April 4). Singapore's state of disruption. *The Business Times.* Retrieved from: http://www.businesstimes.com.sg/opinion/singapore-budget-2017/singapores-state-of-disruption

Today Online. (2016, February 26). Better S'pore productivity "requires more collaboration between large, small firms". Retrieved from: http://www.todayonline.com/business/better-spore-productivity-requires-more-collaboration-between-large-small-firms

Van Valen, L. (1973). A new evolutionary law. *Evolution Theory*, 1, 1–30.

Wong, W. H. (2016, August 23). SMEs partner big firms overseas to do well. *The Straits Times.* Retrieved from: http://www.straitstimes.com/business/economy/smes-partner-big-firms-overseas-to-do-well

Yeoh, F. (2016, May 6). Singapore's startup ecosystem: Have we arrived? *Channel NewAsia.* Retrieved from: http://www16.mediacorp.sg/themediapreneur/img/20160506.pdf

Zahra, S. A., George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *The Academy of Management Review, 27*(2), 185–203.

Zott, C. (2003). Dynamic capabilities and the emergence of intra-industry differential firm performance: Insights from a simulation study. *Strategic Management Journal*, *24*(2), 97–125.

**About IPS Working Paper Series**

The IPS Working Papers Series is published in-house for early dissemination of works-in-progress. This may be research carried out by IPS researchers, work commissioned by the Institute or work submitted to the Institute for publication.

The views expressed in the Working Papers are strictly those of the author(s) alone and do not necessarily reflect the views of the IPS.

**Comments on the Working Papers are invited. Please direct your comments and queries to the author(s).**

IPS Working Papers are available from the IPS at $7.00 each (before GST). Postage and handling charges will be added for mail orders.

For more information, please visit www.lkyspp.nus.edu.sg/ips or
contact email: ips@nus.edu.sg or tel: 6516-8388 or fax: 6777-0700.

**Institute of Policy Studies**
Lee Kuan Yew School of Public Policy
National University of Singapore
1C Cluny Road House 5
Singapore 259599

Tel: (65) 6516 8388  Fax: (65) 6777 0700
Web: www.lkyspp.nus.edu.sg/ips
Registration Number: 200604346E