Evaluation of technopreneurship policy in Singapore

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**EVALUATION OF TECHNOPRENEURSHIP POLICIES
IN SINGAPORE**

**WONG TECK YENN
SCHOOL OF HUMANITIES AND SOCIAL SCIENCE
2013**

**EVALUATION OF TECHNOPRENEURSHIP POLICY
IN SINGAPORE**

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Contents

Acknowledgements	3
Figures.....	8
Tables	9
Appendix	10
List of Terms	11
Summary	12

Essay 1: Government policies to enhance high technology activities:

Singapore case study	14
Introduction and overview of this chapter	14
Objective of this essay	15
Significance of this essay	16
Summary of findings	18
Organization of this essay	18
Overview of other economies' entrepreneurship policies	19
Literature review: Conceptual framework.....	29
Government support for technopreneurship	30
Key supports needed from the government for the furtherance of such activities	35
Summary of framework	43
Methodology	43
Description of entrepreneurship policies in Singapore	44
Historical perspective.....	45
Current policies.....	49

Discussion of Singapore's policies to enhance high technology activities matched against conceptual framework	58
Institutionalisation for high technology business activities.....	58
Tax support.....	63
Grants or funding.....	65
Facilities support.....	68
Conclusion	69
Discussion of technology activities trend in Singapore	69
Conclusions.....	77
Limitations of this essay	78
 Essay 2: Evaluating incubator programmes in Singapore	80
Introduction.....	80
Significance of this topic	82
Breakdown of this essay	83
Overview of incubator programmes in Singapore	83
Literature review: Assessment framework for incubators	85
Applications of the framework.....	95
Data collection	95
Sample population selection	96
Results.....	97
Discussion of results	104
Conclusion	110
Limitations of this study	113
 Essay 3: Support Programmes and Entrepreneurship in Singapore	126

Introduction.....	126
Objective of this essay	127
Significance of this essay.....	127
Summary of findings	128
Organization of the essay.....	129
Conceptual framework	129
Research methodology	140
Respondents	140
Sample size	140
Data collection	141
Questionnaire	141
Results.....	142
Discussion of theoretical and policy inferences of results	152
Limitations and potential future studies.....	159
Conclusions.....	159
References.....	163

Figures

Figure 1-1: SPRING Singapore entrepreneurship institutional chart	61
Figure 1-2: Government assistance schemes	63
Figure 1-3: Total R&D expenditure in Singapore (S\$ mil)	70
Figure 1-4: Private R&D expenditure in Singapore (S\$ mil)	71
Figure 1-5: Total number of Research Scientists & Engineers (RSEs)	73
Figure 1-6: Number of RSEs per 10k labor force	73
Figure 1-7: Number of patent applications	74
Figure 1-8: Number of patents awarded	75
Figure 1-9 Number of PST start-ups	77
Figure 1-10: Summary of patterns of Singapore government's entrepreneurship policies	78
Figure 2-1: R&D intensity across countries in 2009	81
Figure 2-2: Nascent technopreneurship process & incubator deemed features	110

Tables

Table 1-1: Summary of framework to compare government support in Singapore	43
Table 1-2: Support provided by Spring Singapore for startups in 2010 (Tan 2011)	67
Table 1-3: Summary of extent of success of IDP by 2010 (Tan 2011)	68
Table 2-1: Summary of extent of success of IDP by 2010 (Tan 2011)	84
Table 2-2: Summary of key measures to be evaluated	95
Table 2-3: Summary of survey results for all respondents	102
Table 2-4: Summary of survey results for incubates	103
Table 2-5: Summary of survey results for non-incubates	103
Table 3-1: Conceptual framework of Singapore government support programmes to enhance entrepreneurship	139
Table 3-2: Results of survey for all respondents	147
Table 3-3: Results of survey for Group A	151
Table 3-4: Results of survey for Group B	152

Appendix

Appendix 1: Survey questionnaire on deemed effectiveness of Singapore incubators in the stated areas115

Appendix 2: Summary of incubators in Singapore116

Appendix 3: Survey questionnaire161

List of Terms

A*STAR	Agency for Science Technology and Research
EDB	Economic Development Board
FDI	Foreign direct investment
GDP	Gross domestic product
GLC	Government linked companies
IDP	Incubator Development Programme
IP	Intellectual property
IRAS	Inland Revenue Authority of Singapore
JTC	Jurong Town Council
MNC	Multi National Corporations
NRF	National Research Foundation
PE	Private equity
POC	Proof of concept
POV	Proof of value
R&D	Research and development
SME	Small medium enterprises
SP	Science park
VC	Venture capital

Summary

This dissertation comprises three self-contained essays with the common theme of public policy and high technology entrepreneurship (technopreneurship) in the Singapore context.

Essay 1 discusses the sufficiency of the Singapore government's efforts in enhancing high technology business activities. The conceptual framework on how this would be discussed would be elaborated in the literature review. Thereafter, this paper will go further to determine whether sufficient efforts by the government will indeed result in a corresponding growth in actual high technology business activities and hence start-ups. It is found that the government fulfilled sufficiently the efforts to contribute to enhancing high technology business activities. At the same time, the corresponding impact on high technology business activities level and start-ups is overall positive.

Essay 2 evaluates incubator programmes in Singapore using empirical survey. Technopreneurship is treated with high importance in Singapore, judging from the patterns of government support for entrepreneurship. The finding from this essay revealed the effectiveness of the supports from the government in boosting technopreneurship, and also the effectiveness of helping technopreneurs commercialize and globalize their results. From the survey results, it is found that costing benefit is the most important factor technopreneurs see in being part of an incubator programme. Other factors such as grouping resources for advisory services also play important roles in the perception of technopreneurs on the efficacy of incubator programmes.

Essay 3 focuses on the impacts of government support programmes on entrepreneurship in Singapore using survey data with entrepreneurs as survey respondents. This permits a direct analysis of the efficacy of the various elements of identified support programmes on entrepreneurship from

programme-users' point of view. Based on the framework of this essay, it is found that respondents deem current support programs aimed to influence individuals towards entrepreneurship as only slightly influential in importance. In comparison, the effectiveness of these support programmes reaching out to and benefited by individuals was neutral. While the matching intensity of effectiveness over importance is high (both are mediocre), rooms for improvements are suggested to generate a more robust level of entrepreneurship.

Essay 1: Government policies to enhance high technology activities: Singapore case study

Introduction and overview of this chapter

Entrepreneurship has a strong impact on a nation's economic growth. It is associated with job creation, a central feature of the development of new industries, a major contribution to productivity gains, as well as an option pursued by up to half of the work force during their careers (Potter 2005; Dana 1995). In particular, high technology entrepreneurship, otherwise known as technopreneurship, has become the focus of economic growth of countries (Choi and Phan 2006; Monck et al. 1988). The Singapore government is actively working towards growing high technology business activities in Singapore (Feng 2011; Lim and Lim 2009; NRF 2008a).

This essay aims to discuss the sufficiency of the Singapore government's efforts in enhancing high technology business activities, and as a result, the corresponding effect on technopreneurship start-ups. The conceptual framework on how this would be discussed would be elaborated in the literature review. As technopreneurship is an important part of high technology business activities, many discussions on high technology business activities will evolve around technopreneurship interchangeably. Thereafter, this paper will go further to determine whether sufficient efforts by the government will indeed result in a corresponding growth in actual high technology business activities, and as a result, on technopreneurship start-ups.

This essay is designed to be descriptive and critical in nature to explore the Singapore government's policies and their characteristics. Some scholars have adopted similar approaches in their study of the trends, roles or characteristics of the systems in different countries (See for example Farmer and Barrell 1981; Audretsch 2003; Siegel et al. 2003; Holtz-Eakin 2000; Chew and Chew 2001). For example, Audretsch (2003) described the Small Business Innovation

Research (SBIR) and elucidate why “it has emerged as an important policy instrument” and further conclude that the “SBIR has generally accomplished its mission by contributing to the creation of high-technology small firms and enhancing U.S. competitiveness” (Audretsch 2003). Siegel et al (2003) also explored “background information on U.S. and U.K. policies promoting innovation in small firms” and to conclude that “program evaluation is much more prevalent in the U.S. than in the U.K” and “the U.S. Advanced Technology Program (ATP) and Small Business Innovation Research (SBIR) program have been successful” (Siegel et al. 2003). Chew and Chew (2001) examined “how various public policies that have evolved may have both hindered and encouraged entrepreneurship in Singapore”. Similarly, this current essay seeks to achieve the objective of discussing and examining the policies in Singapore to enhance high technology business activities to provide a holistic reference for future related researches.

Objective of this essay

The objective of this essay is to critically discuss the theory that government support for technopreneurship could solve market imperfections that limit the activities of technology-based firms (Colombo and Grilli 2006). As will be defined later in the research methodology, and for the purpose of clarity right from the beginning of this essay, such activities will be defined by the amount of R&D spending. While there are different schools of thoughts that are either for or against this theory, the purpose of this essay is to examine its applicability in the context of Singapore.

At the same time, this essay aims to go further to discuss the sufficiency of the Singapore government’s efforts in enhancing high technology business activities, and as a result, the corresponding effect on technopreneurship start-ups. The conceptual framework on how this would be discussed would be elaborated in the literature review. As technopreneurship is an important part of high technology business activities, many discussions on high technology business activities will evolve around technopreneurship

interchangeably. Thereafter, this paper will go further to determine whether sufficient efforts by the government will indeed result in a corresponding growth in actual high technology business activities, and as a result, on technopreneurship start-ups.

Significance of this essay

Most previous studies on the impacts of policies on high technology business activities are based on the context of larger nations like UK or US (See for example Blanchflower and Shadforth 2007; Blau 1987; Bruce 2000; Capital 2005; Hansson 2010). For example, Blau (1987) found that “changes in technology, industrial structure, tax rates, and social-security retirement benefits have contributed to the reversal of the previous downward trend” of self-employment in the US. Bruce (2000) found that “differential tax treatment of the self-employed has significant effects on the probability of entry into self-employment”. He found that the higher the personal income tax rate, the higher the probability of individuals becoming self-employed. At the same time, when corporate tax rate is increased, he found significant reduction in self-employment.

There are, however, very few studies conducted based on the context of smaller countries like Singapore (Some of the few studies include Abeysinghe and Choy 2007; Chew and Chew 2008; Tan, Tan, and Young 2000; Chew and Chew 2001). Studies have shown that there are regional differences in the effect of new business formation (Fritsch and Schroeter 2011). For example, it has been found that the “main variables that shape the employment effects of new businesses in a region are population density, the share of medium-skilled workers, the amount of innovation activities as measured by the proportion of R&D employees, and an entrepreneurial character of the regional technological regime”. This suggests that different economies or countries, which certainly have different levels of the above variables, will result in different rates of new business formation, which will create different degrees of high technology business activities. The focus of this paper is on the effect

on high technology business activities and start-up growth. As such, the international economic development community has learned that a one-size-fits-all approach simply does not work (Easterly 2001). It is also recognized that there are considerable differences across countries in the orientation of entrepreneurial activities (Autio 2007).

This essay will contribute to the body of academic knowledge in the following ways:

Firstly, this essay will critically discuss the theory that government support for technopreneurship could solve market imperfections that limit the activity of technology-based firms (Colombo and Grilli 2006) in the context of Singapore. The extent of applicability of this theory in the particular context of Singapore will be meaningful to researchers keen to further the study of this theory in other contexts.

Secondly, there are very few studies on support policies for activities for technology-based firms dedicated to the Singapore context. This essay will contribute to the pool of reference for future studies and researches in various aspects of entrepreneurship policies related to Singapore.

Thirdly, this essay will discuss the Singapore government's policies based on current administrations. This will enable future researchers to have a holistic view of the entrepreneurship policies the Singapore government has adopted and implemented.

Last but not least, this essay will attempt to observe and describe the type of specific policies the Singapore government uses to encourage technology activities. These observations and descriptions will serve as basis for the derivation of hypothesis and theories in future for context-specific or culture-specific researches on entrepreneurship policies. It will go further to break down this theory to the different aspects of such government support to enhance formation of new technology-based firms, making full use of literature review for this purpose, and matched against the current

programmes the Singapore government has in place comprehensively. This will provide a clear picture of the extent of programme matching based on the constructed framework.

Summary of findings

The overview of the findings of this essay is as follow. Firstly, the Singapore government views high technology entrepreneurship with great importance. Secondly, they fulfilled sufficiently the efforts to contribute to enhancing high technology business activities as according to the conceptual framework built in this paper. Thirdly, the corresponding impact on high technology business activities level, as defined particularly in this paper, is overall positive, with some exception, which will be rationalized. Fourthly, with better forecasting and planning, the Singapore government would be able to ensure a sustained yearly growth in high technology business activities.

Organization of this essay

The main aim of this essay is to determine the actuality, and henceforth the effectiveness, of the Singapore government's support to encourage activities in technology-based firms, and thereafter, technopreneurship start-ups. As such, the next section will provide an overview of entrepreneurship policies in other comparable economies followed by establishing a framework based on literature review to the fundamental theory of this essay, which is that government support will enhance activities for technology-based firms in the context of Singapore, eventually leading to technopreneurship.

A rigorous literature review will then be conducted to provide a framework for discussion of government supports for high technology businesses based on the core theory for this paper by Colombo and Grilli (2006).

The following section will describe the methodology that adopted for this paper.

Thereafter, the various aspects of entrepreneurship policies in Singapore will be examined in detail. Specifically, a historical perspective will be adopted to study the government's entrepreneurship policies since the 1980s before discussing the current entrepreneurial policies, relating to start-ups, in detail. At the same time, the objectives, conception dates, and social environment at the time of introducing the policies will be observed.

The next section will discuss the results based on the matching of these supports against the framework. In the following section, the level of innovative activities in Singapore to determine whether it is in line with the results obtained earlier in the same section will be qualitatively analyzed followed by a conclusion and summary of this paper.

Overview of other economies' entrepreneurship policies

For the purpose of reference to other economies in the area of entrepreneurship policies, Hong Kong, Taiwan and South Korea are chosen because these three economies, coupled with Singapore, were recognized as the Four Asian Tigers. These four economies were compared in terms of economic development and gauged to be an Asian miracle collectively (Page and Fischer 1994). Many other studies of other developing economies were then compared against the Four Asian Tigers (Lee, LaPlaca, and Rassekh 2008). As such, it would be relevant to first have an overview of the entrepreneurship policies in these three other tigers before discussing in detail the fourth tiger – Singapore.

Hong Kong

In 2000, the Hong Kong government set up the Innovation and Technology Commission and the Applied Science and Technology Research Institute (ASTRI). This demonstrated their objective to promote high technology entrepreneurship. In the subsequent year, the Hong Kong Science and Technology Parks Corporation (HKSTP) was set up and became the physical focus of the implementation of the ASTRI initiatives (Thomas 2011).

The Hong Kong government has also identified six industries (accounting for six to eight percent of GDP) as important to the growth of Hong Kong – education, medical, testing and certification, environmental industries, innovation and technology and cultural and creative industries (Tsang 2009). As such, the Hong Kong government provides the following assistance schemes to encourage entrepreneurship in Hong Kong:

1. DesignSmart Initiative (Initiative 2013)

The programme provides funding support for the Design-Business Collaboration Scheme to encourage SMEs in using design services, and for the Design Incubation Programme at the InnoCentre to nurture design start-ups. This initiative was set up in 2004 and has a total allocated resource of HK\$250 million (approximately S\$40 million).

2. CreateSmart Initiative (CSI) (CSI 2012)

The CSI provides financial support to initiatives conducive to the development and promotion of the creative industries. This initiative was set up in 2009 with a total allocated resource of HK\$300 million (approximately S\$48 million).

3. Innovation and Technology Fund (ITF 2013)

This fund seeks to boost and assist Hong Kong companies to upgrade their technological level and introduce innovative ideas to their businesses. There are four different initiatives under the fund. They are: (1) Innovation and Technology Support Programme (ITSP 2013), which supports midstream and downstream R&D projects undertaken predominantly by universities, R&D centres, industry support organisations, professional bodies, trade and industry associations; (2) General Support Programme (GSP 2012), which is catered for non-R&D projects that contribute to the upgrading and development of industries as well as encouraging an innovation and technology culture

in Hong Kong; (3) University-Industry Collaboration Programme (UICP 2012), which seeks to stimulate private sector interest in R&D through leveraging the knowledge and resources of universities with close collaboration between private companies and universities in Hong Kong; (4) Small Entrepreneur Research Assistance Programme (SERAP 2013), which provides financing on a dollar-for-dollar matching basis of up to HK\$6 million (approximately S\$0.9 million) to support technology entrepreneurs and small enterprises to carry out R&D on innovation and technology where project periods are within two years span.

4. New Technology Training Scheme (NTTS 2013)

This scheme provides assistance to companies that wish to have their staff trained in new technologies that would benefit their companies. New technologies include those which are not widely applied in Hong Kong and the absorption and application of which will significantly benefit Hong Kong.

5. Patent Application Grant (PAG 2012)

Hong Kong incorporated companies and individuals can seek funding to apply for patents for their own inventions. The grant is administered by the Innovation and Technology Commission with Hong Kong Productivity Council (HKPC) as the implementation agent. The grant aims to encourage local companies and inventors to capitalise their intellectual work through patent registration.

6. SME Funding Schemes (SME 2012)

These schemes assist SMEs in Hong Kong to secure financing for acquiring business installations and equipment, and meeting working capital needs. It also helps SMEs to expand overseas markets, and enhance overall competitiveness.

7. Professional Services Development Assistance Scheme (PSDAS 2012)

The PSDAS provides financial support for projects that aim to strengthen the standard and external competitiveness of Hong Kong's professional service sector with a total allocated resource of HK\$100 million (approximately S\$16 million). At the same time, the PSDAS also targets to enhance the standard of professional services in Hong Kong.

8. Technology Business Incubation Programme (Incu-Tech/Incu-Bio Programme) (IP 2011)

Hong Kong Science and Technology Parks Corporation's Incu-Tech/Incu-Bio Programme aims to provide assistance for technology start-ups. Eligible companies of three-year and four-year incubation programmes are granted financial aid of HK\$639,000 (approximately S\$103,000) and HK\$851,000 (approximately S\$137,000) respectively. The programme will also provide ready-to-use offices or laboratory premises up to twelve months rent-free.

Taiwan

Taiwan's government has always provided a conducive environment for entrepreneurship and SMEs (Choo 2000). Since 1966, the government began to help SMEs finance and set up their own businesses. In 1981, the Small and Medium Enterprise Administration (SMEA) established an office under the Ministry of Economic Affairs. The SMEA takes charge of helping SMEs. In July 1997, a clause of protection of SMEs was amended into Taiwan's Constitution. As a result, the growth and development of entrepreneurship is further enhanced (Yu 2012). The following are some of the schemes to encourage entrepreneurship in Taiwan.

1. Biotechnology and New Pharmaceutical Industry (Biotechnology and New Pharmaceutical Industry 2011)

To boost Taiwan to become a knowledge-intensive economic model, the Biotech and New Pharmaceutical Development Act was introduced in 2007 to promote the development of knowledge-intensive industries such as new drugs and high-risk medical devices, and to drive the transformation of Taiwan's economy. Biotech and new pharmaceutical companies are entitled to a deduction from their profit-seeking-enterprise income tax liability when undertaking R&D on new drugs and high-risk medical devices, as well as the training of personnel. The deduction is limited to 35 percent of the total amount invested in R&D and personnel training and may be credited against the profit-seeking-enterprise income tax within five years from the year the tax liability is incurred.

2. Loans to encourage SMEs (Loans 2011)

The National Development Fund (NDF) will be used to provide financing facilities or loans to private companies to upgrade and improve the industrial structure.

3. Science Parks (SP 2011)

- a. Tax Incentives

Science parks incubates enjoy tax free status for various capital expenditure investments and also product exports.

- b. Government Participation in Investment

Entrepreneurs can apply for the government to co-invest in their business for up to 49 percent of the principal amount. Such government agencies will include the Science and Technology Development Fund and other development funds.

- c. Capital Raising

The entrepreneur can also raise funds by applying to the Taiwan Venture Capital Association. The Association comprises more than 180 venture companies in Taiwan and holds regular seminars and meetings, offering useful information for mutual interaction.

d. Incentives for R&D

The Science Park Administration provides park tenants innovative technology industry-academia cooperation project grants, with a maximum grant of ten million NTD. The grant, however, could not exceed 50 percent of project budget. R&D expenses can be deducted from corporate income tax up to 15 percent but the total deducted expenses cannot exceed 30 percent of the total corporate income tax. R&D equipments can be exempted from import duties.

e. Incentives Regarding the Act Governing Biotech and New Medicine Industry Development

The Taiwan government also introduced policies to encourage companies to invest in biotech or medical start-ups. Listed shareholders investing in biotech or new medicine corporations more than three years can be exempted from corporate income tax within a period of five years up to a total of 20 percent of the price of stock shares gained. For entities of venture capitalists, corporate income tax can be exempted from the fourth year of stock shares gained, with the same period of five years. When the start-ups spend on R&D and talent cultivation, the investor can enjoy 35 percent of R&D expenditure to be deducted from corporate income tax within a period of five years from the moment of a real corporate profit gain. At the same time, for the amount of R&D expenditure exceeding the average amount of the previous two years, the exceeded portion of R&D expenditure enjoys a deduction rate of 50 percent from corporate income tax.

4. Small Business Innovation Research Program (SBIR 2011)

To enhance Taiwan's SMEs to step up their development of innovative new technologies and new products, thereby strengthening the competitiveness of the SME sector, the Taiwan government formulated the Small Business Innovation Research (SBIR) program in accordance with the provisions of the government's Incentive Scheme for Enterprises to Develop Industrial Technologies. Taking into consideration the fact that SMEs constitute the backbone of Taiwanese industry, it was anticipated that the SBIR program would help to reduce the cost and risk of innovation and R&D for SMEs, thereby helping to boost these activities in the SME sector. Under Taiwan's SBIR plan, SMEs can apply for subsidies covering up to 50 percent of the total cost of R&D. This government funding support helps to reduce the costs and the level of risks that SMEs must bear when engaging in R&D initiatives. By encouraging SMEs to undertake the development of new industrial technologies and products, the SBIR plan aims to boost overall private-sector R&D spending, speed up industrial upgrading and strengthen Taiwan's international competitiveness.

Types of Research encouraged by the program include:

- Developing a brand new idea, concept or new technology.
- Applying an existing technology to a new application.
- Applying a new technology or business model to an existing application.
- Improving an existing technology or product upon various aspects.

The SBIR applications are segregated into three phases:

- Phase I: NT\$1 million total governmental subsidy for six months.
A small-scale experiment or statistical analysis of the creative concept that can potentially benefit industries so as to validate that concept as being viable. Applicants must describe the key problems addressed, the creative concept they intend to use, anticipated benefits to industries, as well as relative R&D track records and implementation plans.

- Phase II: NT\$10 million total governmental subsidy for two years.
R&D of a product, production method or service mechanism based on a tangible and feasible creative concept expected to benefit industries. The R&D of a production method can extend to the trial production or ramp-up stage. Applicants must describe the key problems addressed, the creative concept they intend to use, anticipated benefits to industries, as well as relative R&D track records and implementation plans.
- Phase II+: NT\$5 million total governmental subsidy for one year.
This involves the implementation and wide application of R&D results in Phase II so as to meet market and customer demand. The focus of R&D extends from the emphasis on the design of technical innovations to the production of the technical application. They may include engineering techniques, moulding development techniques, product design, trial production and ramp-up techniques, or primary market surveys. Applicants must describe the application of the developed technique, feasible implementation, commercialization target and expected benefits.

5. Government Participation in Investment (SME 2011)

To strengthen the investment in SMEs and promote the development of the industry, the National Development Fund has allocated NT\$1 billion (approximately S\$41 million) for the funding of SMEs.

The participation of government in equity investment should not exceed 49 percent of the total equity of the invested enterprise. The joint investment ratio for government and professional venture capital firms must be limited to 1:1.

South Korea

Since late 1990s, South Korea has welcomed a strong growth in the establishment of small start-ups (Jung 2002). The Small and Medium Business Administration (SMBA) set up in February 1998, coupled with the credit guarantee system, in which companies with little or even no capital can obtain credit guarantees from government-owned financial institutions in order to obtain bank loans, were useful to encourage and nurture new business start-ups in Korea (Moskovitch and Kim 2008).

Improvement in access to funding, high level of SME loan value as a percentage of GDP, and an efficient coordination and collaboration between government are the key reasons attributed to the growth in entrepreneurship (Jeong and Kim 2011). For example, the Korean Government established the Korea Fund of Funds in 2005 “for the purpose of providing a stable capital source for venture investment” and entrepreneurship (*Korea Fund of Funds* 2012). To mitigate the consequence of the economic downturn, the Government injected KRW\$1,980 billion (approximately S\$2.2 billion) to the fund in 2009. As of December 2010, the fund had invested in 1,300 companies through 165 partnership funds (Jeong and Kim 2011). The government has also raised “loans and grants for small and midsize businesses to as much as KRW\$16.7 billion (approximately S\$18.6 million)” in 2011, “helping fuel a boom in startups” (Yang and Yoon 2012).

Some of the current key programmes implemented by the Korean government include (SME 2012):

1. **Business Incubation (BI) Support:** partially supports the cost of new construction or expansion of Startup Incubation Centers and the cost of their operation, including personnel expenses (BI 2000). SMBA gave this programme a target to “incubate over 1,000 promising start-up companies and create over 4,000 technology-based jobs annually” (BI reorganized and advanced to a 3rd generation platform 2011).

2. **Global Startup Project for Young People:** local startup education and incubation programs are provided in the US, China, and other countries for domestic startup companies to enter overseas markets and also to increase successful business startup at the global level, with a total funding resource of KRW\$1.4 billion (approximately S\$1.6 million) (Startups by young people, expanded support and reduced burden 2012).
3. **Startup-Leading University Project:** provides startup-leading universities with comprehensive support through a package of policy measures for each stage of startup to form 'startup clusters' around such universities. There are currently 18 member universities in this program now (SMBA to add three more universities to 'Startup-Leading Universities' 2012).
4. **Venture Corporation Verification System:** identifies companies that satisfy certain conditions to foster venture corporations as venture companies, and provides them with support for human and material resources during the early stages when they have difficulty entering the market (First SME & Venture Corporation M&A Conference 2012).
5. **New-Technology-Based Startup Cluster:** to promote the creation of 'New-Technology-Based Startup Clusters' by universities and research institutes, it provides for part of the cost for infrastructure and production equipment to be shared. By early 2013, a total of ten start-ups were nurtured under this programme with 108 jobs and KRW\$5.2 billion (approximately S\$5.8 million) sales revenue created (10 technology-based startups, 108 jobs, and 5.2 billion won in sales 2013).
6. **FOF Investment Management:** a management system of investments from FOF that is created to raise capital for venture investment. It was announced in 2012 that several new funds will be created within the

FOF to stimulate “business creation by young people” (2012 plan for FOF investment 2012).

Conclusion

From the brief overview of the current key entrepreneurship policies by the three Asian Tigers, it can be seen that there is a lot of focus on high technology business start-ups. This leads to the discussion of Singapore’s policies with respect to high technology business activities and start-ups, commencing with a conceptual framework.

Literature review: Conceptual framework

Innovative startups represent a very key factor for growth for an economy (Baumol 2002).

A very important part of entrepreneurship policy is to create a conducive environment to encourage the formation of more new startups (Smallbone, Baldock, and Burgess 2002).

Entrepreneurship has been discussed very widely and defined by many scholars. Drucker defines it as the capabilities of an individual to combine limited resources in new ways to respond to opportunities or offer solutions to current needs (Drucker 1985). Entrepreneurs are typically seen to be risk takers and innovators. In Schumpeter’s words, entrepreneur forces allow one to “act with confidence beyond the range of familiar beacons and to overcome that social resistance requires aptitudes that are present in only a small fraction of the population” (Schumpeter 1942). Other definitions include self-employment with an uncertain return (Sharma and Chrisman 1999) and “the process of building and creating a vision from practically nothing” (Timmons and Spinelli 2004).

Technopreneurship is a part of entrepreneurship, with focus on “delivering an innovative hi[gh]-tech[nology] product” or making use of “hi[gh]-tech[nology] in an innovative way to deliver its product to the consumer” or both (Maglana

2006). The term “technopreneur” was created from within Singapore culture to define entrepreneurs who combine entrepreneurial skills with technology (Foo and Foo 2000). As such, throughout this dissertation, the terms “technopreneurship” and “high technology entrepreneurship” may be used interchangeably but will effectively bear the same meaning.

Throughout this dissertation, “entrepreneurship” will generally refer to the organizing process of creation of a new venture or organization, commonly referred to as startup (Van de Ven, Hudson, and Schroeder 1984). Starting of new businesses is regarded as a very crucial part of a country’s economy (Reynolds 1994). Approximately only 50 percent of individuals who attempt to start a business eventually managed to start one (Aldrich 1999). Of the businesses that were eventually established, less than ten percent were able to grow (Duncan and Handler 1994). In fact, many businesses fail in their initial years of conception because they did not receive sufficient support to overcome the inertial of commencing a business (Mokry 1988, P. 1). More specifically, many startups fail to get their businesses funded before receiving income from the operational activities of their business, and that is causing such startups to fail at very early stages of formation (Storey and Tether 1998). As such, policies to support new startups are extremely important. Also, the Singapore government is actively working towards growing high technology business activities in Singapore (Feng 2011; Lim and Lim 2009; NRF 2008a). As such, focusing on small business high technology innovation start-ups is very important to Singapore’s knowledge-based economy (Wong 2011).

Government support for technopreneurship

Technopreneurship startups are deemed to be important elements in the development of societal growth and worth. Hence, in recent years, vast resources have been injected into government entrepreneurship policy programmes (Heydebreck, Klofsten, and Maier 2000). Governments are fast recognising the importance of helping entrepreneurs and creating a conducive environment for high-tech start-ups (Plosila 2004).

Due to minimal internal red tapes and the typical grouping of like-minded dynamic individuals (Sivadas and Dwyer 2000), technopreneurship start-ups are believed to be efficient innovators (Rothwell and Dodgson 1994; Schumpeter 1934). The very fact that the business was started was because these technopreneurs had certain ideas and the accompanying skills in mind, and hence are able to commence on the development of the idea. This is in contrast to large firms that have to clear various levels of approvals within the organization before they could secure budgets for the R&D of their ideas. While bigger companies may have access to much knowledge, resources and technology, they are not necessary the optimal platform to discover and fully exploit such opportunities for new product developments (Park 2005). In contrast, the role of technopreneurship start-ups in the exploitation of new technology is widely acknowledged and that small firms would be the first to take up emerging new technologies to cause a disequilibrium to markets (Schumpeter 1934).

The socially desirable level of R&D spending tends to be higher than the actual amount of spending as a result of R&D externalities. Businesses choose to spend less on R&D as they feel that such spending will not generate justifiable and timely returns from the eventual commercialization, which might take many years to effect (Teece 1986). Capital limitation is also another serious factor that prohibits more R&D activities (Evans and Jovanovic 1989; Evans and Leighton 1989; Holtz-Eakin, Joulfaian, and Rosen 1994).

As a result, in order to enhance the extent of technological activities, Colombo and Grilli (2006) theorize that government support will solve market imperfections that limit the activity of technology-based firms (Colombo and Grilli 2006). This forms the core theory of this paper. The following literature review is to discuss this theory and then form a conceptual framework to apply to the context of Singapore.

Importance of innovation in a country

According to Abramowitz (1956), the ultimate two ways of growing a nation's output are increasing resources for the purpose of production, and "developing new ways to get more output from the same inputs." Economists have documented the strong connection between technological progress and economic prosperity, both across nations and over time (Abramowitz 1956). It has been recognized that high-tech industries are important to the continued development of an economy. This explains the rampant existence of incubators like Silicon Valley in the US and the Lee Valley in UK. Government support "is often advocated in high-tech sectors in order to solve market imperfections that limit the activity of new technology-based firms" (Colombo and Grilli 2006). This is because high technology entrepreneurship typically involves a prolonged period of R&D which is a cost-only period with no income in return. Incomes will only be obtained after the completion of R&D and commercialization of the initiative. Hence, private equities and venture capitalists do not like to fund such initiatives, explaining why government support is important to encourage such initiatives.

Schumpeter focuses very much on the concept of innovation. The core basis of his theory of innovation is in the economic model of the circular flow (Schumpeter 1934). This means that every factor in the economic system flows in a very stationary manner resulting in a perfect state of equilibrium. This also means that all things are in perfect balance. Profit equals loss. Assets equal liability. Costs equal income. This implies that profits always remain zero. This view is misunderstood by some scholars who interpreted Schumpeter's thoughts as a capitalist society that is always in motion and never reach an equilibrium state (Stolper 1994). Schumpeter's idea of equilibrium applies in the general sense to reflect the economic development after the entrepreneur within the company has introduced innovation to existing routines. This suggests that after the entrepreneur effected certain changes or improvements to the existing condition of the company, the company will normalize such changes which will form a state of equilibrium to the economy,

in the macro sense. This happens each time a change is introduced (Schumpeter 1939). It is not a reflection of economic reality as if there will be no further innovation to the economy as some scholars seem to interpret (Stolper 1981). In fact, it is precisely the many repetitions of this cycle of equilibrium, innovation, disequilibrium, normalization which then leads to equilibrium. From a macro point of view, this will eventually form a non-linear and dynamic theory of economic growth model (Stolper 1994).

Economists have come to recognize the input-completing and gap-filling capacities of entrepreneurial activity in innovation and growth, and the significant contribution of innovation and growth to prosperity and economic welfare (Acs and Armington 2006; Schramm 2006; Audretsch 2007). There are many positive externalities and spill-over effects for innovative business activities. For example, the development of iPhone by Apple has resulted in many applications which have not only many benefits to users of the applications, but also generated great streams of income from these applications. It is not only beneficial to the economy of US, but has also created positive externalities around the world (Mandel 2012; Myslewski 2012).

Being a small nation with limited resources, a pragmatic mode that Singapore can compete with the rest of the world would be in areas of high value products and services which will not be directly dependant on the amount of natural resources a nation has. This would typically be in the areas of better technology or know-hows, intellectual property (IP), R&D etc (Ho 2012). For example, the Singapore government was very supportive of Hyflux which developed better technology to treat water (Toh 2011; Teh 2010). They not only provided subsidies and grants of various sorts to encourage continued R&D efforts of Hyflux, but even allocated land at subsidized rate through the Jurong Town Council (JTC) and Economic Development Board (EDB) for Hyflux to build a state-of-the-art desalination plant under the Singapore government's Direct Allocation (DA) scheme. This reputation for strong infrastructural support for technology, solutions and IP is important to make

Singapore attractive to Multi National Corporations (**MNCs**) around the world to strongly consider making Singapore their regional hub of operation (Ng 2009; Lim 2012).

Problems limiting such activities

Recognising the importance of innovative activities in a country, Noll (1989) provided three justifications for government intervention in the market. First: the existence of high barriers of entry to prevent competitors from entering the market. For instance, industries like power and telecommunications have a high tendency for monopoly. Monopolies are known to result in lack of economic competition to produce competitive goods and services and insufficient substitute goods (Blinder, Baumol, and Gale 2001). As such, in order to prevent the few players from controlling the industry and hence prices, the government needs to step in to create an environment permitting smaller players' entry.

Second: the existence of imperfect information which causes some players to have more knowledge than other players hence resulting in unfair play. For example, a mobile phone manufacturer might be in possession of some information that could make a much better phone and that other suppliers do not have knowledge of. Hence, this could potentially result in exploitation of the market (Michael and Pearce 2009).

Third: the need to provide for public goods (Noll 1989). On its own, private enterprises will not engage in sufficient spending in R&D. This will in turn result in lesser amount of innovation in a society (Cohen and Levin 1989). The rationale is that innovative activities will result in the creation of expertise and skill sets to produce better products. This expertise and skill set will be easily made known to competitors who could either reverse engineer or use other means, like employing the engineer from the innovating company, to capitalize conveniently such expertise and skill sets (Cohen and Levin 1989). As it has been found that smaller firms have a higher propensity to create innovative solutions as compared to larger firms (Acs and Audretsch 1990; Cohen and

Levin 1989), it is imperative to provide solid support before such small firms are willing to bear all opportunity costs to engage in innovative R&D.

Conclusion

As seen from the above discussion, in order to ensure sufficient technological activities within an economy, which will boost the economy, government intervention in the form of support is important. It is therefore useful to discuss some of the key supports needed based on literature review to form a conceptual framework for discussion purpose.

Key supports needed from the government for the furtherance of such activities

In order for economies to move into the innovation-driven stage, it is necessary for them to develop environmental conditions conducive to entrepreneurship. Several countries have achieved this in the past decade, including Korea, Ireland, Israel and Taiwan to name few (Acs and Szerb 2007). Some of the key elements of such positive environments include ease to start business (which will be described as part of institutionalisation), low or no corporate tax rate for the initial years, grants or facilities support (Dana 1993).

Based on such key elements suggested by Dana (1993), I will proceed to discuss more on these elements based on literature review.

Ease to start business (institutionalisation)

Be it administration of tax incentives or funding, or in the administration of starting a new business, a proper mechanism has to be implemented to ensure an effective and fair administering of the programmes and to create an environment suitable for entrepreneurship (Dana 1993). A capitalist economy is greater in magnitude than individuals and the exchanges amongst individuals (Hodgson 1999). Market capitalism is, for instance, to a large extent subjugated by non-market institutions and their internal mechanisms (Simon 1991). Similarly, it appears as if collective organisation is rising in significance

for flourishing capitalist development (Lazonick 1991). Additionally, capitalist success cannot only be credited to uncontrolled free markets but also to institutions bringing together competition with cooperation (Kenworthy 1995). It has similarly been highlighted that substantially flexible economies are both flexible and institutionally wealthy (Streeck 1989).

Institutionalism is like a two-edged sword. Entrepreneurs are both inhibited and facilitated by the institutions in their environment of operations (Bruton and Ahlstrom 2003; Scott 2007). The key reasons are that for new businesses, the institutional environment marks out and restraints entrepreneurial opportunities. This will hence impact the pace and magnitude of new venture creation (Aldrich 1990; Gnyawali and Fogel 1994; Hwang and Powell 2005). The benefits of institutionalisation for entrepreneurship also include advantageous market enticements and the accessibility of funds (Foster 1986). Insufficient institutional growth can make difficult new business development (Baumol, Litan, and Schramm 2009) whereas a more developed institutional setting with excessively provisional directives can impede new company's setting up (Soto 2000).

The institutional features influencing entrepreneurial efforts comprise the direct administrations of governments in creating and preserving an environment encouraging of entrepreneurship on top of societal customs toward entrepreneurship (Hwang and Powell 2005). Particularly, the intensity of entrepreneurship that forms in a society is correspondingly associated to the society's rules and guiding principles leading the distribution of rewards (Baumol, Litan, and Schramm 2009). Governments can make sure markets operate economically by eliminating circumstances that generate entry barriers, market imperfections, and needless-oppressive rules. For instance, an adverse exterior environment may hinder the degree of capital investment, create fiscal and rigid barriers, and discourage the growth of the entrepreneurial spirit that is distinctive of some cultures (Broadman et al. 2004). It is discovered that economic expansion in the up-and-coming economies of Eastern Europe was held back by the lack of efficient market-

based institutions to guard property rights and to guarantee fair competition. Disturbed by the unproductive legal administration of agreements and property rights, entrepreneurs in such settings rely intensely on informal rules for security (Ahlstrom, Bruton, and Lui 2000) and keenly try to conceive unorthodox governance constructs and contractual pacts (Peng 2006). Informal connections and relational governance make up the “institutional voids” consequential from an inadequate official institutional infrastructure (Khanna and Palepu 1997). While such informal institutions such as establishing relations with core government officials and other administrative links (Peng and Luo 2000) can be very beneficial, these can also be expensive to firms and may deter new business growth (Huang 2008; Rajan and Zingales 1998).

Entrepreneurs are disheartened from commencing new businesses if a country or city has no proper institutional constructs (or alternative informal ones). They would also likely be disheartened if they are compelled to meet too many terms and bureaucratic demands, are anticipated to account to a group of institutions, and are made to expend significant time and costs in meeting administrative requirements (Soto 2000). As an illustration, to commence a new company in Russia takes 97 days and high expenses, and even more so in some sub-Saharan African countries (Soto 2000). A more conducive setting for starting a company will, on the other hand, reduce such obstacles and promote entrepreneurial prospective (Baumol, Litan, and Schramm 2009). This is the case in countries like US, Hong Kong (Timmons and Spinelli 2004) and Singapore (Wroughton 2009; Schwab 2010). Hence, the institutional setting puts forth a vigorous impact not only on entrepreneurial start-ups, but also on the consequential paths of entrepreneurial schemes. The compelling influence of the institutional setting for releasing entrepreneurship suggests that not only the mission setting was crucial but also the institutional setting which could either impel or inhibit entrepreneurship in a city (Aldrich and Waldinger 1990). At the same time, institutional setting could propagate futile activities

in the manner of disadvantageous institutional entrepreneurship (Ahlstrom, Young, and Nair 2003; Rajan and Zingales 1998).

Tax support

Another type of resource support comes in the form of tax incentives. In order to encourage more private equities to invest in start-ups, governments have introduced tax-based initiatives to encourage private individuals or VCs to invest in the start-ups (See for example Harrison and Mason 1989). These could come in the forms of tax rebates or tax deductions for the amount of investments put in.

Some academic research have discussed the consequences of taxes on the availability of capital and the entrepreneur's career options even though they do not unequivocally take into account the VC's productive function in supporting and advising nascent firms (Gordon 1998; Poterba 1989a, 1989b). Poterba stressed that a reduction in the capital gains tax essentially gives confidence to entrepreneurs to form a company and, in that way, raises the demand for funds, while it will only expectedly bear an insignificant impact on the supply of funds. The works of Gompers and Lerner are predominantly in a similar direction (Gompers and Lerner 1998).

While it has been shown that there is a relationship between career choice, risk and taxes (Broadway, Marchand, and Pestiau 1991), it has also been determined that the formation of new businesses is very much influenced by the personal-corporate tax differential (Gordon 1998). Differential corporate and personal taxes may be required to overcome "unhealthy" choices of new companies between that of taking a loan or using equity as financing (Fuest, Huber, and Nielsen 2003). Cullen and Gordon (2007) further showed that tax policies have "clear effects on individual behaviour, and together have had large effects on the amount of entrepreneurial risk taking" (Cullen and Gordon 2007). There are also sufficient data to prove that once commenced, the decisions made by the new companies with regards to employment, capital expenditure and manufacturing are largely affected by taxes (Rosen 2003).

Grants or funding

It has been shown that SMEs in Singapore are passive in terms of price control (Cai 2012). Hence, when “there is substantial increase in costs, SMEs will be in trouble as they cannot pass the increased costs to the buyers of their products and services.” As such, the Singapore government is needed to introduce initiatives to help SMEs (Chew and Chew 2008). Governments have developed public sector venture capital funds, and support for the operational expenses of private sector venture capital funds, especially those targeted at start-ups (For example Murray 1994). Nevertheless, each of these initiatives received their shares of criticism for limited impact (Mason and Harrison 1995).

In starting a business, very often capital is required. Capital requirements dissuade new business entry in a few ways. Firstly, some complex production processes require huge cash that not many entrepreneurs can easily acquire (Bain 1956; Koch 1974). Secondly, capital requirements discourage entry of new business that have inadequate access to funding (Van Auken 1999).

In the study of entrepreneurship, the significance of funding to new businesses is well recognized. The likelihood of someone becoming an entrepreneur is discovered to rise with their wealth and the amount of assets they have within their means (Evans and Leighton 1989). As a causal factor for firm establishment, capital is crucial as it impacts not only the capability of firms to penetrate into markets, but also their execution after the penetration into the market. Empirical researches on new start-ups have confirmed that adequacy and magnitude of preliminary capital resources enhance the ability of new businesses to continue to exist (Kauermann, Tutz, and Bruderl 2005) and expand (Bamford, Dean, and Douglas 2004).

Reviews of individuals have discovered that liquidity limitations reduce the entrepreneurial choice behaviour of individuals who may desire to move on to start a business (Bates 1995). In an investigation on individuals who have come up with business concepts but eventually did not start the new business, it is found that liquidity limitations were the most considerable impediment to

actually launching the business (Van Auken 1999). The resources necessary to start a new business are conventionally beyond the ability of individual entrepreneurs (Bhave 1994) and shortage of capital might be a core factor for emerging entrepreneurs to give up the entrepreneur process (Holtz-Eakin, Joulfaian, and Rosen 1994). As a consequence, current researches have determined that lower capital requirements and improved reach to capital increases the possibility of firm establishments (Van Gelderen, Thurik, and Bosma 2005).

In the circumstance of new businesses, entrepreneurs may be compelled to source for substitutes to financial institutions as the characteristics of new businesses cause challenges for entrepreneurs to acquire financing from conventional banks and debt financing. Since new businesses are short in physical assets that may be used as collaterals, bank loans might not be accessible to them (Berger and Udell 1998). Entrepreneurs may also be short of track record and the ability to demonstrate their present and future capabilities to potential investors.

The comparative small number of Venture Capital (**VC**)-invested new businesses is due to the fact that VC funds characteristically sustain high transaction expenses. This limits the number of portfolio firms that VCs can most favourably assess, invest in and supervise (Gifford 1997). The minimum invested amount is respectively high and beyond the reach of many smaller start-ups and hence the number of companies that can be funded by VCs is constraint.

Business angel networks (**BAN**) frequently contribute small scale investments in startups, bring a significant value added contribution to the companies in which they invest, are geographically scattered, and frequently invest locally (in that way disseminating wealth within the regions) (Mason and Harrison 1994).

BAN, and the wider category of informal investments, have received noteworthy interest in the academic field since Wetzel's (1983) pioneering essay on business angels in the US (Wetzel 1983). From then on, the significance of angel investment as a supply of funding for entrepreneurship has become well-recognized in the entrepreneurship academic field (Mason and Harrison 2000). BAN will be able to fulfil entrepreneurship needs for entrepreneurs who cannot get fund access from family and friends and are not yet eligible for VC funding. Some business angels also come with relevant business background to value add strategically to the firms they invest in (Freear, Sohl, and Wetzel 1995).

Facilities support

Dana (1993) suggests facilities support to be that of infrastructure support. For instance, in order to support tourism entrepreneurship for islands with no adequate roads and electricity supply, the government would supply incentives to encourage the construction of such infrastructure facilities.

One of the most obvious infrastructural supports for high technology entrepreneurial activities would be incubators and science parks (Rothaermel and Thursby 2005). In order to increase the chances of generating a profitable business, the technopreneur has to undertake a concerted evaluation that the endeavour can be enhanced or improved upon and that either the product of the business itself can be liquidated with profitability in a foreseeable and intended future (Bell, Crick, and Young 2004). As such, it is imperative that the technopreneur has access to suitable and effective facilities support for the purpose of their business development requirement.

The key function of incubator is to support entrepreneurs with business establishments and growth, and with probable participation of the public, private and non-profit sectors (OECD 1999). Specifically, the majority of incubators offer value-added services and assistances for just starting out technology-based firms, instead of conventional business start-ups (Mian 1996).

Business incubator can also offer a fostering environment for nascent firms and, as a result, resulting in later furtherance of development-centric businesses (Cooper 1985; Dana 1993).

Mian (1997) initiated a holistic structure to study the performance of incubators. He used three sets of variables, one of which is services and their value-added (Mian 1997). A relative assessment approach is then adopted to use this model to compare the various incubator programs in US. In gist, the conceptual structure was deemed as effective based on four case studies.

Infrastructure and supporting services, and hence synergy amongst high technology companies can be bred (Phillimore 1999; Ratinho and Henriques 2010). Incubators could also result in the development of “informal and personal linkages” which Phillimore (1999) feels are “important in promoting innovation and the development of synergies as the establishment of more formal research relationships.”

On the other hand, there are studies that criticize the effectiveness of incubators and science parks to generate activities through synergies. Massey et al. (1992), commented very harshly that science parks as ‘high tech fantasies’ (Massey, Quintas, and Wield 1992). They question the actual effectiveness of science parks to generate technology activities. Castells and Hall sang the same tune by commenting that significant activities will only take place in highly populated science parks, not those in less populated science parks (Castells and Hall 1994).

Conventional incubator assistances include common office services, business help, rental subsidies, business networking, links to funding, legal and accounting support, and guidance on management practices (Mian 1997; Harwit 2002). At the same time, technology-related structural provision includes the following services: laboratory and workshop facilities (Brown 1985; Mian 1997), processor computers, R&D activities (Jérôme 1987), technology transfer services and advice on IP (OECD 1999). These services are

considered meaningful as small start-ups would not have the resources to build such facilities and infrastructures just to conduct R&D on their ideas. By having these technology-related structural provision, technopreneurs start-ups would be able to leverage on these supports to focus on their core objective, which is to develop the product or service suitable for commercialization in the near future (Dana 2001).

Summary of framework

The above literature review provides a conceptual framework to critically discuss the Singapore government's support for high technology business activities.

Table 1-1 below is summary to form the framework of the various elements that the government could provide support to enhance technopreneurship activities and the indicators that will define the existence of such supports. This will form the framework that this essay will use to compare the conditions in the context of Singapore against.

	Key elements of government support	Indicators
1	Institutionalisation	Clearly defined government departments to administer technopreneurship
2	Tax support	Programs that offer tax incentives
3	Grants or funding	Programs that offer grants of funds to support technopreneurship
4	Facilities support	Programs that offer support for facility needs for the purpose of technopreneurship

Table 1-1: Summary of framework to compare government support in Singapore

Methodology

There will be two parts in addressing this research paper.

Firstly, I will attempt to determine whether the Singapore government is indeed undertaking initiatives to enhance high technology activities. This will be done using the principle of pattern matching (Campbell 1988; Yin 1992) where I will describe the relevant governmental policies to boost high technology activities and then match to the framework. According to Campbell (1988), if the pattern does not match predominantly, then it demonstrates that the Singapore government has not embarked on adequate initiatives to create a business environment conducive for high technology activities. If, on the other hand, the pattern matches predominantly, then it shows that government is indeed in the right direction to provide support for high technology activities.

If so, I will proceed to the second part: with the pattern matched, are there indeed increasing high technology activities in Singapore. According to Colombo and Grilli (2006), R&D investment is one of the key, and also more obvious, indicators of high technology activities. As such, I will analyze the R&D spending in Singapore based on the consolidated public data to search for an increasing trend in R&D spending. The existence of such a trend would suggest that the theory of more government support would lead to more high technology activities is indeed applicable in the context of Singapore.

Description of entrepreneurship policies in Singapore

Gaining independence only in 1965, Singapore has a short history for its policies in entrepreneurship. However, it is interesting to note that despite being small and lack of natural resources, Singapore was rated highly by the World Economic Forum in the years 2010 to 2011 for its competitiveness and good business environment. Other than being ranked first for having the most open economy for international trade and investment, world's easiest place to do business, best business environment in Asia Pacific and worldwide, and Asia's most "network ready" country, it is also amongst the top three most competitive countries in the world (Schwab 2010). Hence it is worthwhile to examine Singapore's entrepreneurship policies from both a historical

perspective and current perspective. By doing so, it would be possible to identify the manner in which the Singapore government plans its entrepreneurship policies.

Historical perspective

The Singapore government launched its first entrepreneurship policies in the late 1980s. I will first study the SME Master Plan, which eventually led to the policies to aid entrepreneurship in Singapore and the establishment of the entrepreneurship structure.

SME Master Plan

Singapore first launched the entrepreneurial structural initiatives in 1989, known as the SME Master Plan (Chew and Chew 2008).

This plan was initiated by the EDB to facilitate the coordination between the government agencies and the entrepreneurs in order to have a well defined SME developmental structure on a national level (SME Master Plan 1989). This plan includes the blueprint for the Singapore entrepreneurship development path and action strategies. It is the first most well defined policy introduced for the benefit of Singapore entrepreneurs. More than three hundred representatives from the private sector, academic world and government participated in the conceptualizing and launching of this plan.

The core objective of this plan is to leverage on the local chambers and merchant associations to promote and sell various government incentive and assistance programmes as stated in the Master Plan. In other words, these individual bodies take on the roles of one-stop shops for local entrepreneurs who wanted government assistance. They play very proactive role to introduce the relevant and suitable schemes to interested entrepreneurs, and to clarify the positions of the government in such initiatives. Small enterprises were hence better able to sum up their leverages that they have from the government to better decide and strategize how to build and develop their

businesses. This Master Plan demonstrated clearly the government's concern for local businesses, and also recognizes the entrepreneurs' contributions to the development of Singapore into a major centre in global business and a total business centre in the region (Tan, Tan, and Young 2000).

Another advantage of the Master Plan is to enhance cooperation between business, academic institutions and government bodies. Firstly, it encourages the commercialization of academic research output which will help to generate industrial entrepreneurs in the process. Secondly, technology transfer is guaranteed through the formation of small business innovation and incubator hubs. This allows entrepreneurs to leverage on the expertise, research findings, facilities and potentials that are available within the institutions (Chew and Chew 2008). The academic is seen as the catalytic agent to enhance the promotion of entrepreneurial development within Singapore, which will then complement the government and its related organization's efforts to play an effective role as facilitators and promoters of the process. Such an activity is already taking place in the form of the Enterprise Development Centre (ENDEC), and is currently operational in Singapore's academic institution. ENDEC was formed to help local entrepreneurs in their financial planning, and to also organize seminars, publish relevant research and offer counselling and advisory services in entrepreneurial establishments (Tan, Tan, and Young 2000).

Entrepreneurship Infrastructure

Due to its SME Master Plan, Singapore had a range of around 63 assistance schemes to help local companies. The first SME Master Plan resulted in the establishment of a multi-agency arrangement. Each of the agencies in the public sector circle is accountable for one particular facet of the SMEs' needs. International Enterprise Singapore (IE Singapore) is the statutory board accountable for bringing SMEs out of Singapore. It has a range of plans and tax incentives. SPRING offers a first-stop for all SMEs, which are then channelled to the appropriate agencies. Its fundamental span of accountability is over

local SMEs. The Agency for Science Technology and Research (A*STAR) advances scientific research and the utilization of technology through incubator units. The Jurong Town Corporation (JTC) supplies industrial space and has incubator areas too. The Infocomm Development Agency (IDA) advances, encourages and regulates the information technology and telecommunications industry. As part of its directive, it aims to enhance the implementation of online and e-commerce technology by SMEs. Its vision is to produce a digital future for Singapore where innovation, entrepreneurship and e-lifestyle become the standard of living. Other than the government agencies, there are private organizations, tertiary institutions and non-governmental organizations that are in the multi-agency network to which SMEs can use their assistance (Tan, Tan, and Young 2000).

Of the numerous plans, the Local Enterprise Technical Assistance Scheme (LETAS) particularly stands out. This is a standard scheme under which SMEs can acquire applicable technical help presented by management consultants. The SMEs may be refunded for up to 50 percent of their costs for appointing management or technical consultants on assignments permitted by applicable government agencies. SPRING, for example, keeps a list of approved consultants. SMEs that have projects that fulfill the agency's prerequisite may acquire reimbursement for up to 50 percent for aids obtained for the firm's ISO certification.

The government agencies concerned also recognized that there was a need to create better familiarity of their offerings. Tan, Tan and Young (2000) contend that for any entrepreneurship infrastructure to be meaningful there should be active involvement. They attempted to comprehend the decision-making process that an entrepreneur adopts before deciding to leverage on the entrepreneurship infrastructure. Other than consciousness of the rudiments of infrastructure, they discovered availability, convenience, exigency and assessments of accessibility to be issues that impose upon use. In the Singapore context, SMEs may not adopt the infrastructure if they do not deem it necessary. However, the enterprise owner may discover a need when he discovers the infrastructure offerings. The opinion of convenience also

influences the adoption of the infrastructure. Hence, if the opinion among the SMEs is that only particular industries or SMEs of selected sizes will be successful in their applications, such companies may not contemplate trying. One particular opinion derived from anecdotal evidence has been the amount of bureaucracy that an entrepreneur has to encounter in order to obtain benefits from the assistance schemes.

The existence of industry clusters in areas such as Route 128 near to Boston, Silicon Valley in California, and Cambridge and the “M4 Corridor” in England, has caused the duplication of their success by other countries. This has resulted in a range of investigation on the magnitude of “local” contemplations in innovation systems. The value of these clusters is the close distance of the innovators, with their suppliers, to the co-location of financial and legal service providers in the clusters. Even though Singapore is small, it recognizes the value that clusters provide for connections to technical information transfer. There are four major clusters formed under the Singapore Industry 21 Plan spearheaded by the Singapore Economic Development Board. These include (1) Singapore Science Park¹; (2) Agro-Bio Park²; (3) Tuas Pharma Zone³; and (4) Jurong Island⁴. Singapore’s dedicated industrial parks are premeditated to make easy the development of specific technological areas for the various industry clusters (Begley and Tan 2001).

Another event in conjunction with the clusters is the development of the Science Hub. Singapore has created its own Science Hub, where scientific ideas can be embraced, cultivated and developed into commercial vehicles. The Science Hub covers 176 hectares, thrice the size of the current two science

¹ Catered for local and multinational R&D organizations.

² Targeted at agro-biotechnology companies: involved in aquaculture, crop and livestock production, micro-propagation and tissue culture, genetic engineering, animal vaccines.

³ Meant for pharmaceutical, healthcare and biotechnology companies.

⁴ Currently utilized by petrochemical and chemical industries.

parks. A major part of the land in the Science Hub will be planned for industrial R&D and commercial intentions, while the remaining land will be for residential intentions. On top of the National University of Singapore, top institutions like INSEAD and Johns Hopkins University have set up their existence in the Science Hub. The co-existence of the research and business communities will generate better communication and synergies within the R&D community, which will hopefully create a bigger driving force to entrepreneurship (Koh and Mariano 2006).

Tertiary institutions have also created incubation labs. Originally, the institutions sought to be applicable to industry and set up these centers to encourage cooperation between university researchers and enterprises. Their functions have now extended to comprise incubators of new ventures on campus with participants potentially being students or faculty members.

Current policies

Having seen what the Singapore government has done since the commencement of their entrepreneurship policies, I will now look at the current policies that the Singapore government has in place to encourage entrepreneurial start-ups. This is the portion which I will adopt to pattern match against the framework.

The main categories of government assistance for businesses based in Singapore are loans, grants, tax incentives, equity financing, and non-financial assistance. However, only three of these categories have programs that are targeted specifically at high technology start-ups. They are namely grants, tax incentives and equity financing (EnterpriseOne 2011). The rest are meant for businesses which are already at certain stages of development, which is way passed the start-up phase.

Details of policies

Under each category, there are several different programs that cater to different business needs. For the purpose of this dissertation, I will only focus on the specific programs that influence entrepreneurial entry rates.

Grants

One of the greatest limitations young entrepreneurs face is the availability of funding (Beck and Demirguc-Kunt 2006). As such, the Singapore government has launched some grants targeted at these young nascent entrepreneurs hoping to help them overcome the initial problem of lack of funds.

In 2008, SPRING Singapore launched the Young Entrepreneurs Scheme for Startups (YES! Startups) programme targeted at Singapore Citizen or Permanent Resident applicants 26 years and below and are first time entrepreneurs. The objective of this programme was to encourage entrepreneurship among Singapore youths by providing seed money to co-fund their start-up costs to help develop the business. This programme encourages the applicants to utilize the grants for business development expenses including manpower, operation, Capital Expenditure (CAPEX), acquisition of IP rights, professional services like legal or consulting, and marketing activities. For every dollar raised through self-funding, schools or third-party sources, SPRING will match S\$4 up to a maximum of S\$50,000. This programme was launched to complement the Young Entrepreneurs Scheme for Schools (YES! Schools) which funds enterprising and innovative school projects. Both YES! Schools and YES! Startups tap on the S\$25 million Entrepreneurial Talent Development Fund (ETDF) which was launched in 2004 and managed by SPRING (SPRING 2013).

In the following year, the Nanyang Technological University (NTU) launched a programme known as ideas.inc supported by SPRING Singapore. Coincidentally, this programme was also targeted at first-time entrepreneurs aged between 18 to 26 years old who are keen to incorporate a private limited company with

their core business predominantly based in Singapore. The participating team is also required to have at least one member who is a Singapore Citizen or Permanent Resident. According to a study, university graduates with honours or higher degrees are less likely to be self-employed (Ghazali, Ghosh, and Tay 1995). Especially when Singapore is a regional hub for the headquarters of several MNCs, “good quality” students will find that there are high opportunity costs to start their own businesses rather than work for a good and reputable firm. Hence, the government hopes this program could generate more entrepreneurial spirit and to overcome the fear of high opportunity costs. The objectives of this program are to provide a platform for a pool of young and talented group with innovative ideas in businesses to materialize these ideas into actual businesses, and to promote young entrepreneurship spirit. Each team who made it to the final round of competition will have gotten up to S\$65,000 funding for putting their business ideas into perspective. The eventual winning team will win additional S \$15,000 cash (NTC 2011).

During the course of my research, I interviewed staffs working in the Nanyang Technopreneurship Center (NTC) in NTU. The NTC’s focus is to promote entrepreneurship not only for NTU students, but also for all tertiary students across Singapore. On top of just the competition, the NTC even invites successful entrepreneurs to conduct talks and seminars with the participating students so that participants would have a better idea of creating a business that is more likely to be successful. At the same time, the NTC will invite Venture Capitalists (VCs) to read the business plans of the students and do “cherry-picking” of businesses to invest in. After studying some of the plans, I realize that most of them are in the areas of high-technology solutions or products. It seems that the young nascent entrepreneurs are trained to acknowledge the importance of the elements of IP and scalability in their business proposals.

Coincidentally, the years of these two programs happen to be the period when Singapore was in a recession (Balakrishnan 2008). 2008 was the year the Lehman Brothers collapsed. 2009 was the year when manufacturing output

dropped to a new low since 2005. Total unemployment rate amongst residents also hit a new high of 4.5 percent since 2004 (Statistics 2010). Hence, these efforts by the government to boost entrepreneurship would likely be a measure to control unemployment rate from going even higher.

Tax Incentives

Cash flow and liquidity are crucial to new start-ups (See for example Keuschnigg and Nielsen 2003; Kitao 2008). As such, the Singapore government launched three different programmes in different years to either help nascent entrepreneurs preserve their cash flows through tax incentives, or to provide tax incentives for angel investors who invest in selected start-ups.

In 2008, the Singapore government increased focus on tax incentives in the areas of R&D. However, R&D activities typically imply an incubation period, which means there is no revenue generated during this period. Revenue can only be realized with the completion and commercialization of the R&D product. As such, policies are needed to encourage entrepreneurs to conduct R&D. Hence, the IRAS introduced the R&D Incentive for Startup Enterprises (RISE) Scheme. This programme provides a cash grant of up to S\$20,250 from the conversion of tax losses for the first three YA of incorporation for each YA. This is targeted at Singapore incorporated start-ups engaging in intensive R&D activities that incur losses, and hence tax losses, during the first three YAs of incorporation. Other than being a tax resident of Singapore, the company should also carry out R&D activities locally. The shareholding structure requirement is similar to the above-mentioned tax exemption programme. At the same time, the company's first three YAs must fall between YA 2009 – YA 2013 (inclusive of 2009 and 2013). To qualify for the cash grant, the company must have spent at least S\$150,000 qualifying R&D expenses in the period correlating to the YA in which they are making the claim (IRAS 2008).

Tax incentives are useful to encourage R&D-intensive start-up companies to carry out more R&D activities (Mansfield 1986). As mentioned, many of these

companies spend the first few years developing products and incur losses as a result. Tax allowances or reliefs are not helpful to these start-ups as they have no taxable income. Hence, this programme would be able to allow these start-ups to convert their tax losses to cash grants during the initial years. However, the requirement to first spend S\$150,000 on R&D expense before being eligible for up to S\$20,250 cash grant would not be attractive to many start-ups who don't have the initial capital. Hence, this scheme is only attractive to start-ups that have a minimum of S\$150,000 of capital initially. At the same time, it will encourage much creative accounting to qualify for as many expenses under R&D expense as possible in order to obtain maximum grants. This will defeat the purpose of the RISE grant to optimally boost R&D efforts in Singapore.

Hence, the bottom-line is still initial funds. As such, in 2010, SPRING Singapore introduced the Angel Investors Tax Deduction Scheme (**AITD**) which is a tax incentive aiming to stimulate business angel investments into Singapore-based start-ups and encouraging more angel investors to add value to these start-ups. Under the scheme, an approved angel investor who commits a minimum of \$100,000 of qualifying investment in a qualifying start-up within a given year shall enjoy a tax deduction at the end of a two-year holding period based on fifty percent of his investment costs, subject to a cap of \$500,000 of investments in each YA. The tax deduction will be offset against total taxable income. The AITD aims to encourage angel investors with entrepreneurial and business expertise to invest in start-up companies and to add value to the start-ups through the expertise and networks of angel investors (SPRING 2012b).

This scheme, while still based on tax incentive, is different from the above-mentioned scheme. The above-mentioned scheme aim to boost entrepreneurship by offering tax exemptions or cash grants for R&D efforts. However, they do not solve the fundamental issue of the lack of seed funding to start the business in the first place. This latter scheme solves the issue of lack of funding as angel investors will make the investment due to tax

deduction incentives the angel investors will enjoy. However, angel investors will only invest in the start-up if the business plans are solid, and if they have faith in the management personnel of this start-up (Douglas and Shepherd 2002). The fact that these start-ups need to seek seed funding in the first place suggest they are new in business and lack the experience and credentials to be trustworthy management personnel for the start-up. Fortunately, the current trend is to invest in technology-related businesses and start-ups as these could potentially develop into another Facebook or Google (Acohido and Krantz 2011). Management credentials (or the lack of it) for such technopreneurships could be justified by reference to the founders of Facebook, Google or Yahoo, who all had no credentials and experience too when they started the business.

Another tax incentive scheme offered by the Singapore government to boost high technology business activities is the Pioneer Status, administered by the Economic Development Board (EDB 2009). This allows companies, which fulfil the high technology criteria, with high technology business activities “100 percent exemption from tax for a period up to 15 years” (Lim and Lim 2009). Upon the completion of the initial Pioneer Status, the company would have to commit to service key performance indicator for growth in high technology activities in order to enjoy renewed Pioneer Status.

Equity Financing

As discussed thus far, start-ups require initial seed funding to commence the business. In 2001, in order to help start-ups obtain seed money, SPRING Singapore launched the SPRING Startup Enterprise Development Scheme (SPRING SEEDS) and the Business Angel Funds (BAF).

The SPRING SEEDS is an equity-based co-financing option for Singapore-based start-ups creating innovative products and/or processes, possessing intellectual content and strong growth potential across international markets. It co-invests into commercially viable local start-ups, with differentiated value proposition and matches dollar-for-dollar to third-party

investor(s), from S\$75,000 up to \$1 million, upon investment approval. Hitherto, the areas SPRING SEEDS has invested in include science and technology, information communications technology and business services space. This scheme targets private limited start-ups in Singapore involved in developing new or better products, processes and applications. The start-ups must be able to evidence its substantial innovative and intellectual content for its products and/or services and/or applications and that the business has high growth potential with clear scalability for the international market. The paid-up capital of this company should be between S\$50,000 to S\$1 million. SPRING SEEDS Capital will exit from the investment within a five-year investment horizon at the earliest of either (a) a sale, merger or acquisition (M&A) of the start-up; (b) if SPRING SEEDS Capital receives a third-party cash offer to buy its shares before the fifth anniversary or investment in the company; or (c) the Initial Public Offering (IPO) of the start-up (SPRING 2012c).

The BAF was launched in the same year. The mechanism on the BAF is rather similar to SPRING SEEDS where SPRING SEEDS Capital will also match investment by third party investors S\$1 for every S\$1. The differences are as follow: (1) The third party investor must be one of the three pre-approved Business Angel Funds, unlike SPRING SEEDS which allows third party investor to be any reasonably acceptable party; (2) The maximum investment SPRING SEEDS Capital will make in this BAF scheme is half a million dollars higher than in the SPRING SEEDS programme (SPRING 2012d). One noteworthy point is that start-ups who have received funding under SPRING SEEDS can still apply for BAF for follow-on investment up to a maximum of S\$1.5 million.

In April 2008, SPRING Singapore launched a S\$50 million programme – Technology Enterprise Commercialisation Scheme (TECS) – to help technopreneurs commercialize their R&D ideas. This programme was developed with the support of A*STAR, National University of Singapore (NUS), Nanyang Technological University (NTU) and National Research Foundation (NRF). The funding will be disbursed in two phases. The first phase is for Proof-

of-Concept (**POC**). Proposals will be assessed based on their commercial potential and technical feasibility. Successful applicants can receive 100% grant support of up to \$250,000. The second phase is for Proof-of-Value (**POV**). This is open to applicants who wish to carry out further R&D on the project, including the development of a working prototype. Successful applicants can receive grant support of 85 percent of up to \$500,000 to fund the development from proof-of-concept to turning the idea into product and to commercialise the product. Some of the more important criteria for the technopreneurs wanting to tap on this fund include: at least thirty percent of the shareholding are local; the company's group fixed assets are below S\$15 million; the company has no more than two hundred employees; has at least one in-house technology engineer or scientist. The TEC will fund projects in the areas of: electronics, photonics and device technologies; chemicals, materials science, nano technology; optical, wireless and hybrid communications systems; and biomedical sciences.

In July the same year, the NRF launched the Early Stage Venture Funding (ESVF) scheme, worth S\$350 million, to encourage innovation and entrepreneurship especially through the formation of start-up companies to commercialise technologies developed out of R&D. Under this scheme, NRF will invest S\$10 million in each of the selected VCs, who are required to raise a matching sum of at least S\$10 million from third-party investors to invest in locally-based start-ups. The fund managers will be given an option to buy out NRF's investment within 5 years at the price of 1.25 times NRF's original investment. Start-ups, in industries including infocomm technology, internet and digital media, electronics, biotechnology and nanotechnology can seek up to S\$3 million investment from the selected venture capital firms (NRF 2012b; EnterpriseOne 2011; NRF 2008b).

Two months later (September 2008), the NRF announced another S\$75 million POC grants under the National Framework for Innovation and Enterprise (NFIE), and in cooperation with SPRING Singapore, as a continuation of the TECS

programme announced in April the same year. The terms and conditions are the same as the TECS programme (NRF 2008c).

In February 2009, SPRING launched a S\$30 million Incubator Development Programme (IDP) to enable incubators and venture accelerators to enhance the services they provide to start-ups. The IDP provides up to 70 percent grant support to incubators and venture accelerators to enhance their programmes and services provided to innovative start-ups. The supportable cost items include: specific programmes introduced by the incubators and venture accelerators to help start-ups in product development, financing, and market access; operating costs, including manpower cost of employing incubator managers and other operating expenses incurred in running the incubator/venture accelerator; and costs of engaging mentors. The types of assistance to be provided to start-ups may range from access to local or international markets, platforms to raise funds, access to qualified management or mentors as well as infrastructure and shared services.

Incubator programmes generally “shape entrepreneurs' technical and commercial experience of markets, strongly influence their attitudes to risk and personal achievement, help develop an intricate network of social capital and resources and, finally, provide critical knowledge of the existence, availability and applicability of technology solutions in new and emerging markets” (Cooper and Park 2008). As such, the IDP programme is useful to speed up the development of start-ups, especially in their formative years. By having more resources available to the start-ups, these young companies would be able to receive more guidance and support in their technopreneurship process. With the IDP’s support for incubators, incubators would have the means to provide management guidance and mentorship to start-ups, and to also provide rental space with flexible leases, and shared business services and equipments to start-ups.

At the same time, the NRF launched the Technology Incubation Scheme (TIS) “under the umbrella of the National Framework for Innovation & Enterprise

(NFIE), which was formulated in 2008 with a \$360 million budget to advance R&D-based innovation in Singapore with a view to commercialization” (NRF 2008a). Through this scheme, the NRF has provided support to raise both incubators and technopreneurs through the support of such incubators.

The Singapore government also views the Medical Technology (Medtech) industry with importance. Hence SPRING SEEDS Capital has also announced their plan to launch a S\$40 million fund to encourage the formation and growth of medtech start-ups under their Research, Innovation and Enterprise 2015 plan. This is part of a new Biomedical Sciences Accelerator (BSA) programme. For this programme, SPRING SEEDS Capital has called for proposals to select up to two BSA Operators for the programme. The selected Operators will identify, evaluate, finance and manage high potential medtech start-ups. SPRING SEEDS Capital will co-invest in these start-ups on a 1:1 basis. The selected BSA Operators would provide facility access to areas such as investment capital, markets, infrastructure and facilities, world-class scientific and technical expertise and advisors, knowledge and familiarity of regulatory compliance, and also back-office support (SPRING 2011).

Discussion of Singapore’s policies to enhance high technology activities matched against conceptual framework

With the elucidation of the various policies implemented by the Singapore government relevant to high technology business activities, I will now attempt to discuss and match against the conceptual framework.

Institutionalisation for high technology business activities

This element of the framework comprises two portions: high technology activities and institutionalisation. As will be seen in the discussion below, the Singapore government has certainly engaged extensively in activities that encourage high technology business activities via the usage of institutionalisation.

High technology activities

Government support “is often advocated in high-tech sectors in order to solve market imperfections that limit the activity of new technology-based firms” (Colombo and Grilli 2006). This is because the socially desirable effects of R&D are typically higher than the privately desirable level due to spillover effects. New firms tend to face financial limitations in undertaking R&D works (Evans and Jovanovic 1989). Much costs are needed to embark on any R&D work, which includes paying of specialists and professionals to conduct review of current available works in the similar areas; identify existing patents so that the R&D won’t infringe on other patents; the machineries to build the protocol; purchasing of raw materials to build to protocol; utilizing of labs to conducts tests on white rats etc. It is certainly not something that any small firms could undertake without the relevant supports. Yet, the value of R&D projects on a country’s economy has already been described earlier.

In Singapore’s case, most, if not all, of the programmes introduced by the government to boost entrepreneurship highlight that one of the prerequisites is that the entrepreneurs’ initiative should be innovative. It could be the process, IP or some technologies that has potential to be duplicated and marketed internationally. Especially since 2008, several initiatives were launched to focus on R&D, with grants even being allocated for Proof-of-Concepts (POC) and Proof-of-Value (POV). Examples include the TECS, ESVF, a dedicated POC grant just to support conceptualization of business ideas, and the IDP to provide more incubator services for technopreneurs. For instance, an electronics company Printed Power Pte Ltd was awarded the POC grant under the TECS to demonstrate the technical feasibility of supplying power using printable nanoscale materials by developing printed active RFID tags with printed batteries. Another company in the infocomm industry – Niometrics – was awarded the POV grant which sought to develop a next-generation, two-way firewall that secures organizational networks from both internal and external threats (Yeo 2009).

In fact, SPRING Singapore set up the Technology Innovation Programme (TIP) to help SMEs develop technology innovation as a competitive strategy. Three forms of help are given. Firstly, the Centres of Innovation will offer one-stop technology consultancy and advice to help SMEs identify practical, downstream technology platforms that can be quickly adopted, and to help SMEs develop technology projects. There are currently five centers, including (1) Food Innovation & Resource Centre, Singapore Polytechnic; (2) Centre of Innovation for Marine and Offshore Technology, Ngee Ann Polytechnic; (3) Centre of Innovation for Environmental and Water Technology, Ngee Ann Polytechnic; (4) Centre of Innovation for Electronics, Nanyang Polytechnic and (5) Precision Engineering Centre of Innovation, SIMTech (A*STAR).

Secondly, Expert Help allows SMEs to engage local and overseas experts from polytechnics, universities, research institutions and the industry to help build up the in-house capabilities. They will be seconded to the SMEs and SPRING will cover up to seventy percent of the salary and other costs of these experts for up to two years. Thirdly, Project Development helps SMEs to defray the cost of undertaking projects which involve the application of technology to develop or improve products, processes or business models. SPRING will co-fund up to seventy percent of the qualifying costs for these projects (SPRING 2012e).

All these initiatives point clearly to the fact that the Singapore government places high emphasis on the business of technology entrepreneurship.

Institutionalisation

Institutional theory is playing a major role in helping to explain the forces that shape entrepreneurial success, apart from organizational (or entrepreneurial) resources (Ahlstrom and Bruton 2002; Peng 2006). From the above analysis, the Singapore government has set up many programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship. Most of the support programmes are initiated in connection to SPRING Singapore. Hence, SPRING is either the direct administrator of these programmes or is the

facilitator for other government agencies who will administer the grants and supports. It is the one-stop shop for start-ups to approach for various forms of assistance in their entrepreneurial endeavours, which will then work with the entrepreneurs to refer them to departments and task forces which are formed for the individual programmes. The Singapore government is very systematic and institutional in administering the various programmes.

For instance, Figure 1-1 demonstrates the institutional paths that an entrepreneur will go through when they start a business and requires government help. When they first approach SPRING Singapore, they will be referred to the Entrepreneurship Development department. Based on the needs of the entrepreneur or investor who wants to participate in programmes to help entrepreneurs and hence enjoy incentives, they will be referred to the respective relevant programmes.

Figure 1-1: SPRING Singapore entrepreneurship institutional chart

After the initial interaction with SPRING, depending on the followed up needs of the entrepreneur, SPRING will then tie up with various other departments dedicated to various needs. For instance, if the entrepreneur is desirous of venturing out of Singapore, SPRING will then rope in International Enterprise Singapore (IE Singapore), who have global presence in thirty over locations worldwide and will offer two types of help, namely Competency and Capital. Under Competency track, IE Singapore will provide various supports, including capability development programmes which will support enterprises to develop business capabilities in alliance formation, branding, design, export IP and manpower. Under the Capital track, IE Singapore will provide financial tools, grants and tax incentives to support entrepreneurs' efforts to internationalize. If the entrepreneur has objectives to conduct R&D for high technologies, A*STAR will be invited in to access and assist the entrepreneurs with various programmes. If the entrepreneur has needs to build their own factories or buildings, SPRING will then involve JTC to support such needs. As a side note, according to the interviews conducted with officers from SPRING and JTC, should entrepreneurs desire to acquire JTC land at direct allocated rate (which is highly subsidized), SPRING would need to first provide a report to JTC to support the direct allocation (DA) after which JTC would evaluate and be empowered to provide the land support.

While the focus of this essay is on high technology business activities, it would be useful to look at the overall support environment for entrepreneurs who might be past the start-up phase. Figure 1-2 provides an overview of the various government assistance schemes available to help entrepreneurs who are SMEs and are part of the Small Manufacturer Association (SMA).

Figure 1-2: Government assistance schemes⁵

Tax support

Tax policies have been shown to have significant influences on entrepreneurship rates (Bruce and Mohsin 2006). It is found that reducing personal tax rate can substantially reduce entrepreneurial risk taking as it reduces the taxes saved from deducting business losses while profits frequently remain taxed at the corporate tax rate. At the same time, allowing business losses to be deductible under the payroll tax would increase sharply the amount of entrepreneurial risk taking, with forecasts ranging from a 50 percent increase to a doubling (Cullen and Gordon 2007).

The Singapore government has introduced various tax policies to encourage entrepreneurship, as discussed earlier. One of the interesting one is to encourage VCs to fund entrepreneurs, and the VCs in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested. This policy serves a few purposes. Firstly, it will encourage the entrance of more VCs, which will solve the issue of lack of seed funding in the market for

⁵ Abstracted from Enterprise Development Centre @ Small Manufacturer Association <<http://www.edc-sma.sg/doc/Navigate-thru-GAS.jpg>>

entrepreneurs. Secondly, it will encourage VCs to participate in the entrepreneur's new businesses to provide more guidance and support for the startup (Keuschnigg and Nielsen 2003). However, the impacts of such tax-incentivized VC supports are mixed on the quality of entrepreneurship. There are studies that discover that companies financed by such VCs who received tax incentives are "apparently of mediocre quality. After the financing, the firms' growth is weak and their operational performance is significantly inferior to that of companies of comparable size and sector" (Carpentier and Suret 2007).

SPRING also provides incentives to partners to support innovative start-ups. To encourage more investments in start-ups, SPRING launched the Angel Investors Tax Deduction Scheme in June 2010. The Scheme provides tax incentives to business angels whose investments, expertise and networks can accelerate the growth of start-ups. To date, four start-ups have raised about \$700,000 from angel investors approved under the Scheme. The support rendered by SPRING in 2010 is summarized in Table 1-2.

The other tax support given to companies involved in high value technology business activities is the Pioneer status. This is a very useful policy to encourage massive high technology activities within a country. Under this programme, companies have to commit to a pre-determined amount of investment in high valued technology activities like R&D to enjoy the Pioneer status. This also includes employing more highly-skilled professionals while cutting down on low-skilled labour intensive productions. The duration of the tax-free Pioneer status is based on the amount of committed investments. In other words, to enjoy a longer period of tax free status, the company would have to commit to a bigger amount of investments in high value technology activities like R&D. Upon the completion of the first period of Pioneer status, the company would have to commit to higher high technology investments in order to continue enjoying Pioneer status. Examples of companies in Singapore that have enjoyed Pioneer status and have engaged in increasing

high technology activities include Alteco Chemical⁶, Sigma Cable⁷, Manufacturing Integration Technology (MIT)⁸, and Biosensors International Group⁹.

Grants or funding

Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. This is a relatively new mode of public policy intervention in recognition of the equity gap between what entrepreneurs need and what investors are willing to fund (Capital 2005; Hayton et al. 2008). There are a few possible reasons. Firstly, industry players have better practical experience to provide more guidance to the start-ups. With funds invested in the start-ups, these industry players will have the incentives to help these start-ups succeed. Secondly, industry players have more experience to judge the quality of the start-ups and the entrepreneurs, in contrast to civil servants who have never been in business personally. Hence, involving industry players will serve as an insurance against making the wrong judgments of granting or rejecting a particular proposal. Thirdly, with the co-investment from the government, investors have greater

⁶ Alteco possesses comprehensive facilities, ranging from Research & Development work, in-house printing, adhesive manufacturing, aluminum collapsible tube manufacturing to finished products using advanced Japanese technology.

⁷ Sigma Cable was established in June 1964 under pioneer status. It has grown to be the leading power cable manufacturer in Singapore. The company manufactures full range of low tension cables which include PVC, PVC/PVC, XLPE, fire resistant armoured and non armoured power control cables for local and export.

⁸ Incorporated in 1992 and listed on the mainboard of the Singapore Exchange in 1999, MIT is a leading provider of integrated automation solutions to the semiconductor industry worldwide. The Company primarily designs, develops and distributes a wide range of automated equipment that caters to the front and back-end processes of IC assembly. Its flagship range of high-end semiconductor equipment includes wafer level die marking and sorting systems, vision inspection, laser markers and tape and reel systems

⁹ Biosensors develop, manufacture and market innovative medical devices for interventional cardiology and critical care procedures. The amount of tax savings due to its Pioneer status is more than S\$6 million a year.

confidence to inject funds into a new business that the investor would otherwise be put off due to the high risks and uncertainties involved.

According to a study on emerging Asian economy, with particular focus on the Philippines, business angel funds who “undertook in-depth due diligence, and played an active monitoring role after investing” tend to observe “positive returns on their investments” (Scheela and Isidro 2009). This could potentially be one of the key reasons the Singapore government wants to involve industry players so as to increase the chance of success of these entrepreneurial initiatives which will then be to the benefit of the country.

In the Financial Year spanning 2009 to 2010, Spring Singapore invested over S\$10 million in 15 start-ups. This increased the total number of firms that have received their funding support to 170. SPRING Singapore provided some \$20 million worth of assistance to start-ups through various programmes last year. The money was used to fund proof-of-concept projects, support young entrepreneurs, as well as to invest directly in innovative start-ups through the SPRING SEEDS. Of the \$10 million, two thirds were in nine new investments and the remaining one third were follow-on investments in six SPRING SEEDS companies. Since the launch of the co investment programme in 2001, more than \$63 million has been invested in 185 start-ups in various sectors. Of these, 30 companies have crossed the \$1 million revenue mark in the last two years. Besides funding, SPRING SEEDS Capital also helps start-ups to widen their business networks, strengthen their capabilities and access market opportunities. In fact, more than 30 of them have taken their business overseas to the Asian, Middle Eastern and North American markets.

To encourage youths to go into business, SPRING launched the Young Entrepreneurs Scheme for Startups (YES! Startups) in 2008. The Scheme provides youths below 26 years old with co-matching grants to start their first innovative business. In 2010, YES! Startups supported 31 start-ups with some \$1.5 million. Since its launch, the scheme has supported 72 start-ups with some \$3.5 million. Together, these start-ups employ about 160 people and 14

of them have gone on to secure another \$5 million worth of equity funds. One of the start-ups is 2359 Media Pte Ltd. The company developed a turnkey mobile publishing platform, MobDis, which enables users to create, publish and share rich media mobile sites on all mobile platforms. The company was set up in 2009 with funding from YES! Startups and was assisted by the NUS Enterprise Incubator. In January this year, it received a \$1 million investment at the seed stage from SingTel Innov8 and NUS Enterprise Incubator to expand into the United States (Regina 2011).

The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. In 2010, TECS supported 23 start-ups with more than \$8 million. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups. One start-up which has been assisted under TECS is Jitcomm Networks Pte Ltd, which developed the world's first chip-based high performance network acceleration solution. This new technology can potentially increase wide area network (WAN) capacity by up to five times and accelerate network applications, by up to 20 times without extra investments on physical bandwidth upgrading. It offers a cheap alternative for SMEs which have multiple remote office sites that experience network high latency issues and which have to rely on expensive leased lines. Another example is Biochip Devices Pte Ltd. Biochip decided to develop portable devices during the H1N1 crisis. As a result they received S\$750,000 grants for their innovation attempts. With the funds, they managed to cut the testing time and simplify the device to be easily operated by non-medical personnel (Chan 2010).

Scheme	No. of Start-ups	Supported Amount (million \$)
1. SPRING SEEDS	15	10.1
2. YES! Startups	31	1.55
3. TECS	23	8.4
TOTAL	69	20.05

Table 1-2: Support provided by Spring Singapore for startups in 2010 (Tan 2011)

Facilities support

One of the most commonly used method by the Singapore government to provide facilities support to enhance technopreneurship is the incubator service. The EDB, Spring Singapore, A*STAR and NRF are some of the key individual drivers to provide targeted and extensive incubator services in Singapore to boost technopreneurship. The Incubator Development Programme (IDP) was launched in 2009 to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment. Ten incubators and venture accelerators are supported under the IDP. Since its launch, about 250 start-ups have benefited from the services of these incubators and venture accelerators. More than 50 of them have secured business angel/venture capital investments worth over \$22 million. Ten of them have crossed the \$1 million mark. Collectively, they have generated close to \$40 million in revenue and created more than 400 jobs (Tan 2011). This is summarized in Table 1-3.

Total startups	About 250
No of startups with angel investments over S\$22 million	More than 50
Total revenue generated collectively	Close to S\$40 million
Total jobs created	More than 400

Table 1-3: Summary of extent of success of IDP by 2010 (Tan 2011)

The NRF has also taken massive actions to enhance incubator services in Singapore to encourage technopreneurship. In 2008, the Research, Innovation and Enterprise Council committed to investing S\$350 million for the National

Framework for Innovation and Enterprise (or NFIE)’s initiatives to boost technopreneurship and commercialization of their efforts (NRF 2008a). In the following year, the NRF budgeted S\$50 million from this S\$350 million to attract technology incubators to strengthen innovation and entrepreneurship in Singapore (NRF 2009). Seven incubators were selected from this scheme. In turn, these seven incubators “invested in 31 companies since August 2009” and provided the start-ups with “systematic management guidance and mentorship” (NRF 2011). In 2012, NRF selected eight more incubators to “mentor high tech start-ups in Singapore” (NRF 2012a).

Conclusion

As seen from the matching of the activities against the framework established in the literature review, the Singapore government has indeed undertaken significant activities to enhance high technology activities in Singapore, as according to Dana (1993)’s definition. As such, according to the methodology described in this paper, I will then proceed to observe the level of technology activities in Singapore and discuss the effect of such government support on the magnitude of high technology business activities.

Discussion of technology activities trend in Singapore

As discussed in the methodology section, R&D investment is one of the key indicators of high technology activities (Colombo and Grilli 2006). Teece (1986) further found that “profits from innovation may accrue to the owners of certain complementary assets, rather than to the developers of the IP”, which explains why private companies are reluctant to spend on R&D. The policies discussed above are precisely initiated by the Singapore government to overcome such reluctance. Hence, we will now observe the trend of R&D-related expenditures. These data are based on publicly available data from the various Singapore governments’ websites and are consolidated for discussion purpose.

Science parks and incubators play an important role in technopreneurship (See for example Cooper and Park 2008; Ratinho and Henriques 2010). By placing new technology start-ups at Science Parks, where these start-ups will have greater access to resources required for their industry in particular, the chances of success of these firms tend to be larger (Link and Scott 1998). Singapore also believes in investing in such R&D expenditure. Data compiled from the Singapore Statistics Department reveal that total R&D spending in Singapore has been rising consistently to reach S\$7.1 billion in 2008, as seen in Figure 1-3. The spending fell in 2009 as a result of “slowdown in Singapore’s economy, where GDP contracted by 3.1 percent” from the previous year (A*STAR 2010). Total R&D spending rose by 7.4 percent to S\$6.5 billion in the subsequent year in the same direction as GDP growth (A*STAR 2011). R&D spending by private sector has been growing strongly since 2000 and even accounted for 72 percent of total R&D spending in 2008 (A*STAR 2009). However, this percentage fell to 61.6 and 60.8 percent in 2009 and 2010 respectively. As an absolute value, private R&D spending fell by 27.3 percent year-on-year in 2009 to S\$3.7 billion. This recovered 6 percent year-on-year to S\$3.9 billion in the following year as seen in Figure 1-4.

Figure 1-3: Total R&D expenditure in Singapore (S\$ mil)¹⁰

¹⁰ Compiled from Yearbook of Statistics Singapore 2007 - 2011

Figure 1-4: Private R&D expenditure in Singapore (S\$ mil)¹¹

The above clearly demonstrates that private R&D expenditure plays a very important role in determining the total R&D expenditure in Singapore. While the Singapore government budgeted S\$350 million for R&D activities in 2008, only S\$50 million was subsequently allocated in 2009 to attract incubators to provide support for more technology businesses (NRF 2009). Only seven incubators were selected for this scheme and commencement of support for businesses by these incubators only commenced in August 2009. Considering the amount of time needed for the businesses to put in place a comprehensive business plan and to pitch to co-investors in order to enjoy funding from these incubators, the level of contribution from these new beneficiaries of the government's schemes to the corresponding years' R&D expenditure would be mediocre. Coupled with the financial crisis commencing 2008, existing technology companies would be reluctant to commit to increased R&D spending during these years. Hence, the total R&D expenditure dropped significantly in 2009. It can be further concluded that if the government is desirous of having continued sustained growth in R&D expenditure, then the ability to foresee the drop due to reasons like global issues should be

¹¹ Compiled from Yearbook of Statistics Singapore 2007 - 2011

improved and to hence introduce technology-enhancing policies at even more appropriate timing to allow the programmes to take effect (since any new initiatives would take some time to have effect).

At the same time, in 2000 the A*STAR was formed by restructuring the National Science and Technology Board. The Government has been setting aside considerable and growing amounts of finances for primary research and innovations, encouraging entrepreneurship and appealing to foreign talents. As of 2010, Singapore's R&D intensity (Gross R&D expenditure as a percentage of GDP) stood at 2.14 percent, which is a 0.16 percent drop from the previous year. This puts Singapore in the same league against research-intensive countries, according to A*STAR, like Switzerland (3.0%), United States (2.8%), Taiwan (2.9%), Denmark (3.0%), Austria (2.8%), Iceland (2.6%), Germany (2.8%), France (2.2%) and Belgium (2.0%). As a reference, the top 5 most research-intensive countries in the world were Israel (4.3%), Finland (3.8%), Sweden (3.6%), Korea (3.4%) and Japan (3.3%) (A*STAR 2011). In the 2007 Budget the Singapore Government dedicated to boost the R&D expenditure to 3 percent of GDP. In 2006 the Government set up a high-powered National Research Fund (Abeyasinghe and Choy 2007) which reports directly to the Prime Minister Office.

Given the long-term nature of these investments, it is not easy to evaluate their influence on the economy directly. However, indirect indicators reveal that Singapore is developing quickly on the R&D aspect. In terms of manpower, the total number of Research Scientists and Engineers (RSEs) has increased steadily from 4,329 in year 1990 to 28,296 in year 2010, as seen from Figure 1-5 below. This is an increase of more than 550 percent over the course of twenty years. Another indicator used by the Singapore government to measure the number of RSEs against the total labour force in the country is RSE versus every ten thousand labour force (Figure 1-6). This proportion was highest in year 2007 at 90.4, compared to 2010's 90.2. Comparing 2010 to 1990's proportion of 27.7, there is a significant increase of 226 percent for the number of RSEs versus labour force.

Figure 1-5: Total number of Research Scientists & Engineers (RSEs)¹²

Figure 1-6: Number of RSEs per 10k labor force¹³

In terms of patenting activities, the number of patent applications has been on the rise till 2006. A decrease was seen starting 2007. On a year to year basis, the number of patent applications decreased by 8 percent each in 2007 and 2008, and a further 0.8 percent decline in 2009 before recovering in the subsequent year. As a percentage of total applications, private sector

¹² Compiled from Yearbook of Statistics Singapore 2007 - 2011

¹³ Compiled from Yearbook of Statistics Singapore 2007 - 2011

accounted for 81 percent, 78 percent and 72 percent in 2007, 2008 and 2009 respectively. The R&D expenditure per patent application increased from S\$2.7 million per patent application to S\$3.6 million and S\$4.5 million in 2007 and 2008, while reversing to S\$3.9 million in the subsequent year (A*STAR 2008, 2009, 2010). This is summarized in Figure 1-7. Meanwhile, the number of patents awarded generally followed the direction of application, with a one year lead time (from application to the eventual award) as seen in Figure 1-8.

As such, these recent drops in patent activities can be understood as private R&D spending used to dominate total R&D spending, and that private patent application used to dominate total patent application. As such, with the decline in private R&D spending as discussed above in the same period, patent activities also fell correspondingly in absolute terms.

Figure 1-7: Number of patent applications¹⁴

¹⁴ Compiled from Yearbook of Statistics Singapore 2007 - 2011

Figure 1-8: Number of patents awarded¹⁵

Overall, it can be concluded that there is indeed an increasing trend in R&D activities over the past decade or more. This is despite that fact that there were drops in the level of spending in 2009 and 2010 from 2008, the reason with which was rationalized earlier. It can hence be also concluded that the increase in government support in the areas determined by the Dana (1993) framework is useful for an overall growth in enhancing the level of technology-related activities in Singapore.

One of the most obvious infrastructural supports for high technology innovative entrepreneurial activities would be incubators and science parks (Rothaermel and Thursby 2005).

It has been found that the level of innovation within a country, where patent application is one of the measuring variable, and the corresponding amount of R&D spending is positively related (Bilbao-Osorio and Rodríguez-Pose 2004). Carlsson et al. provided a comprehensive discussion on the relationship between such innovation and knowledge creation with that of the intensity of new business creations (Carlsson et al. 2009). As such, policies that result in

¹⁵ Compiled from Yearbook of Statistics Singapore 2007 - 2011

high technology activities (e.g. R&D spending, patent activities etc), are highly suggestive of having a positive relationship with that of the rate of new business creations.

The Singapore government provides data of the number of start-ups on a yearly basis classified by industries according to the Singapore Standard Industrial Classification. The Professional, Scientific & Technical (PST) industry is charted below from the year 1991 to 2011. The reason for starting with 1991, which is a year later than the year 1990 that we choose to commence observing the high technology activities is because the impacts on new start-ups of such activities is unlikely to be witnessed within the same year. A one year time lag observation method has been adopted in other studies (Choi and Phan 2006).

It can be seen that the number of new PST start-ups being formed has been growing steadily on a yearly basis. Even when R&D spending adjusted in 2009, PST start-ups continue to grow in the following year. Hence, as concluded in the earlier part of this essay that “there is indeed an increasing trend in R&D activities over the past decade or more”, a corresponding steady growth in the number of PST start-ups based on a one-year time lag has also been observed.

Figure 1-9 Number of PST start-ups¹⁶

Conclusions

On the basis of the “ingredients” suggested by Dana (1993), a vigorous literature review was conducted to put in place a conceptual framework for discussion. The Singapore government’s policies to enhance technology-related activities, both historical and current, were then described in depth. Adopting the pattern matching principle by Yin (1992), it was determined that the Singapore government has indeed undertaken significant and sufficient initiatives for the objective of enhancing technology-related business activities.

Based on the methodology described for this paper, further studies were conducted to determine whether, when the government has undertaken sufficient initiatives, there will indeed be a corresponding positive impact on the growth of technology-related business activities. It was found that the overall impact is positive, except for two particular years (2009 and 2010) when the R&D spending fell instead of increase. This exception was however rationalized by the “un-timeliness” of the launch of certain technology funding which was to have impact only at a later time, and also the environmental pressure due to the global financial crisis. It was concluded that better

¹⁶ Compiled from Yearbook of Statistics Singapore 2007 - 2012

planning and forecast ability by the government would be useful to result in sustained continued growth in R&D spending. However, in other technology-related areas like number of R&D personnel and patents applied, the overall growth was still positive and in line with the expected impacts from the fulfilment of the framework. As a result of the increase in high technology business activities, the number of new high technology start-ups has been growing steadily on a year to year basis.

Figure 1-10 presents a summary to the framework constructed representing the elements of government support given to enhance high technology business activities.

Figure 1-10: Summary of patterns of Singapore government's entrepreneurship policies

Limitations of this essay

This essay has identified the necessary ingredients the Singapore government has used to enhance the overall level of technology-related business activities within the context of Singapore. This is also largely done based on the framework by Dana (1993).

Future researches could consider the following:

1. Extend the boundary of the study to other countries also on a case study basis. As this field is relatively new and under-researched, it would be meaningful to conduct in-depth case studies of individual countries. When it has been found that such ingredients do result in the expected trends across several contexts, empirical tests could be conducted to suggest the adequacy of this trend towards being a theory.
2. The scope of ingredients could be increased to also include other elements like technopreneurship education (which some countries have already introduced in their tertiary institutions), impacts of Multi-National Corporation's setting up of technology base in the country (which will expectedly result in know-how spillover), enhanced social security and protection for technopreneurs (in the event that they fail and need financial support).

Essay 2: Evaluating incubator programmes in Singapore

Introduction

High technology entrepreneurship, or technopreneurship, is important, but often lacking, in a country. Government support “is often advocated in high-tech sectors in order to solve market imperfections that limit the activity of new technology-based firms” (Colombo and Grilli 2006). This is because the socially desirable effects of R&D are typically higher than the privately desirable level due to spillover effects. R&D typically implies an incubation period, which is also generally interpreted as a period of non-income generation. Also, private firms find it challenging to defend the intellectual property (**IP**) rights to their R&D results (Teece 1986). At the same time, new firms tend to face financial limitations in undertaking R&D works (Evans and Jovanovic 1989). Much costs are needed to embark on any R&D work, which includes paying of specialists and professionals to conduct review of current available works in the similar areas; identify existing patents so that the R&D won't infringe on other patents; the machineries to build the protocol; purchasing of raw materials to build to protocol; utilizing of labs to conduct tests on white rats etc. It is certainly not something that any small firms could undertake without the relevant supports.

The objective of this essay is to explore the efficacy of public sector support for technopreneurship in Singapore by conducting an empirical survey on incubator programmes in Singapore. Singapore emphasizes on high value entrepreneurship or technopreneurship. In year 2000, the Agency for Science and Technology (**A*STAR**) was formed by restructuring the National Science and Technology Board. The Government has been setting aside considerable and growing amounts of finances for primary research and innovations, encouraging entrepreneurship and appealing to foreign talents. As of 2009, the R&D intensity (gross R&D expenditure as a percentage of GDP) dropped from 2008's 2.7 percent to 2.3 percent. Compared to other economies,

Singapore is higher than France (1.0%), Ireland (1.4%), and Belgium (1.9%), but lags behind Japan (3.4 %), South Korea (3.4 %), and US (2.8 %), and even the small nations like Israel (4.9 %) and Taiwan (2.8 %) (Economic Survey of Singapore 2010 2011) as seen in Figure 2-1.

Figure 2-1: R&D intensity across countries in 2009

In the 2007 Budget, the Singapore Government dedicated to boost R&D expenditure to 3 percent of GDP. This was slated to increase to hit 3.5 percent by 2015 (Lee 2011). In 2006 the Government set up a high-powered National Research Fund to focus on all R&D initiatives in Singapore (Abeysinghe and Choy 2007).

In terms of manpower, the full-time equivalent (FTE) number of researchers in Singapore increased by 9.7 percent from 2008's 27,841 to 2009's 30,530, which is 28.3 percent higher than 23,789 in 2005. The number of researchers per 10,000 workers in 2009, which is 101, increased by 11.2 percent from 2005's 90 researchers per 10,000 workers and less than 30 in 1990. The number of patent applications decreased by 0.8 percent from 1,581 in 2008 to 1,569 in 2009. On the other hand, the number of patent awards of the R&D performers in Singapore increased by 2.3 percent from 730 in 2008 to 747 in 2009 (Economic Survey of Singapore 2010 2011). Clearly all these are

effectively input indicators of the R&D drive and the value added needs to be considered indirectly.

The A*STAR was set up to provide various supports for high technology ideas and initiatives. This includes various science park and incubator services like the Incubator Development Programme (IDP). This essay seeks to test whether such science park and incubator initiatives are effective in its objectives in Singapore, based on existing theories.

This topic is chosen because one of the identified patterns of the Singapore government's entrepreneurship support programs is to encourage technopreneurship through various means like science parks and incubators. It has been established that technopreneurship is important to the development of Singapore's economy. Hence, it is crucial that the end-users of these programmes (the technopreneurs) deem these programmes as effective. This is especially so in the areas of incubators, where the Singapore government has invested excessively to build places like Biopolis, One North, Biomedical Hub, Medtech Hub etc.

Significance of this topic

Technopreneurship is treated with high importance in Singapore, judging from the patterns of government support for entrepreneurship. However, most of the existing theoretical studies of technopreneurship supports are based on the European and US context. It is already acknowledged that people from these countries are more entrepreneurial by culture, whereas Singaporeans are known to be less adventurous in terms of entrepreneurship (Leong 2006). Hence, the finding from this essay will reveal the effectiveness of the supports from the government in boosting technopreneurship, and also the effectiveness of helping technopreneurs commercialize and globalize their results. By identifying the shortfalls, if any, of the current programs and how they could be improved upon for the purpose of being much more effective in nurturing successful R&D projects on a policy level, this could potentially contribute to the current body of scholarly knowledge on incubator programs

and even be developed further in future studies with more empirical evidence for generalization purpose.

Breakdown of this essay

The following section will entail an overview of incubator programs in Singapore. This will be followed by a literature review in Section 2.03 to determine how the study framework is built. In 0, I will elaborate the applications of the framework on how the target sample population is selected and how the survey is conducted. In 0, I will examine the results of the survey based on the questionnaire. In Section 2.06, I will explain and analyse the study results.

Overview of incubator programmes in Singapore

Currently, the key incubator programmes supported by the Singapore government are Technology Incubation Scheme (TIS), Incubator Development Programme (IDP) and I-JAM Reload (I-JAM).

The TIS is part of the National Framework for Innovation & Enterprise (NFIE). NFIE was introduced in 2008 with a \$360 million budget to help further R&D-based innovation in Singapore with an intention to bring them to market (Loh 2012). The intention is to boost technopreneurship and commercialization of their efforts (NRF 2008a). In the following year, the NRF budgeted S\$50 million from this S\$360 million to attract technology incubators to strengthen innovation and entrepreneurship in Singapore (NRF 2009). Seven incubators were selected from this scheme. In turn, these seven incubators “invested in 31 companies since August 2009” and provided the start-ups with “systematic management guidance and mentorship” (NRF 2011). In 2012, NRF selected eight more incubators to “mentor high tech start-ups in Singapore” (NRF 2012a). This brings the total number of incubators under TIS to 15.

I-JAM is part of the inter-agency Interactive Digital Media Programme Office (IDMPO). The IDMPO was introduced in Aug 06 “as one of National Research

Foundation (NRF)’s programmes to support Singapore’s long-term vision of growing into a global IDM capital. The goal of the Programme is to help grow Singapore into a vibrant global media capital”. I-JAM aims to support start-ups and individuals with ideas that can potentially be developed into innovative products and services (I.JAM 2012). I-JAM currently has ten incubators under the programme.

The IDP, an initiative launched in 2009 under SPRING Singapore, has a \$30 million grant to support incubators and accelerators to “enhance capability development programmes for innovative startups”. Areas of support include programmes to nurture start-ups, mentoring start-ups and operating expenses (SPRING 2012a). These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment. Ten incubators and venture accelerators are supported under the IDP. Since its launch, about 250 start-ups have benefited from the services of these incubators and venture accelerators. More than 50 of them have secured business angel/venture capital investments worth over \$22 million. Ten of them have crossed the \$1 million mark. Collectively, they have generated close to \$40 million in revenue and created more than 400 jobs (Tan 2011). This is summarized in Table 2-1.

Total startups	About 250
No of startups with angel investments over S\$22 mil	More than 50
Total revenue generated collectively	Close to S\$40 mil
Total jobs created	More than 400

Table 2-1: Summary of extent of success of IDP by 2010 (Tan 2011)

As a summary, there are currently approximately 35 incubators in Singapore under the branch of three main government initiated programmes. The total

number of companies that have joined these incubators is approximately 380. The level of success of these companies has been discussed above.

Most of the incubators differ in terms of the way and style it is operated. The funding also differs from in-house funding to service to source for external co-funding. Other than university-linked incubators, most incubators do not encourage providing of office or incubator space for the incubates' business operations. In fact, some of these incubators do not subscribe to the idea of hand holding the incubates to guide them in the growth. These incubators reveal that entrepreneurs should have the ability to grow and survive on their own, and that they are only keen to invest in start-ups that have the motivation and resources to succeed. Some incubators, on the other hand, are more willing to provide comprehensive guidance to successful incubates, based on the published philosophy their websites.

Appendix 2 provides a summary of some of the key incubators in Singapore and a short description of their incubator key areas of interest.

Literature review: Assessment framework for incubators

Incubator programmes generally “shape entrepreneurs' technical and commercial experience of markets, strongly influence their attitudes to risk and personal achievement, help develop an intricate network of social capital and resources and, finally, provide critical knowledge of the existence, availability and applicability of technology solutions in new and emerging markets” (Cooper and Park 2008).

One of the most common incubator programs commonly adopted is the Science Park (**SP**) (Ratinho and Henriques 2010). In Singapore, the most renowned incubator program would be the S\$30 million Incubator Development Programme (IDP) launched by SPRING Singapore in 2009. It is useful to define the SP in this context to provide more focus on the discussions of the merits and weaknesses of the SP programmes in Singapore. In this study, I describe the SP as an area which permits a common grouping of

technological activities, resulting in positive spillover advantages to individual businesses situated within the SP (Westhead, Batstone, and Martin 2000). The SP phenomenon commenced in the US and Europe. It has now attracted governments across Eastern Europe, South America, and Africa to adopt the same concept to encourage technopreneurship. According to the criteria established by the UK Science Park Association (UKSPA), a science park is a property-based initiative which:

- has formal and operational links with a university or other higher education institution or major centre of research;
- is designed to encourage the formation and growth of knowledge-based businesses and other organisations normally resident on site;
- has a management function which is actively engaged in the transfer of technology and business skills to the organisations on site (Quintas, Wield, and Massey 1992).

Based on the above description, one of the key tasks of the SP is to promote and facilitate the progress of the establishment and development of knowledge-based businesses. This task is typically classified as ‘incubator’. The key function of incubator is, for that reason, to support entrepreneurs with business establishments and growth, and with probable participation of the public, private and non-profit sectors (OECD 1999). Specifically, the majority of incubators offer value-added services and assistances for just starting out technology-based firms, instead of conventional business start-ups (Mian 1996). Based on a national survey of six representative University Technology Business Incubator (UTBI) facilities, providing an insight into the value-added aspects as perceived by the technopreneurs, Mian (1996) found that “several UTBI services, specifically some of the university-related inputs such as university image, laboratories and equipment, and student employees add major values to the client firms”, making the UTBI a viable strategy for nurturing new technology-based firms.

One of the goals of forming incubators in many economies is to offer a physical framework of technical, logistic and administrative assistance that a nascent business requires in the bid to secure a position in a competitive industry (Guy 1996). It is especially crucial to those developed economies which encourage small nascent technopreneurship. Hence, many incubators would have capacity for incubator programs which will result in the advancement of technopreneurial businesses. Business incubator can also offer a fostering environment for nascent firms and, as a result, resulting in later furtherance of development-centric businesses (Cooper 1985; Dana 1993).

In a study on the comparison of four identified methods to incubators, including goal approach, system resource approach, stakeholder approach and internal process approach, Mian (1997) initiated a holistic structure to study the performance of the incubators. He used three sets of variables, referenced against existing literature for this framework, namely: (a) performance outcomes, (b) management policies and their effectiveness, and (c) services and their value-added (Mian 1997). A relative assessment approach is then adopted to use this model to compare the various incubator programs in US. In gist, the conceptual structure was deemed as effective based on four case studies. Nevertheless, since the model is developed to judge different incubator programs on a generic nature, it might not be entirely relevant to be adopted in the study of a specific incubation program. A structure with a regular set of measures for the respective firms in the incubators to be based on the evaluation process is considered more necessary. Additionally, it is also observed that the requirements of tenant incubators at various stages of growth are also different. Therefore, if the objective is to determine whether a specific incubator program is useful to technopreneurs in incubators at various stages of growth, the comparative assessment method should be edited so that the impacts on technology businesses during the business growth process could be identified. This essay is hence deliberated to describe how an alternative structure is built to examine the performance of a specific incubation program from the viewpoint of the technology companies. All

sample population used in this essay will be either existing or previous tenant incubates joining the incubation program under a SP programme related to the A*STAR and SPRING Singapore, or have experience or knowledge of incubator programmes.

For this essay, I will concentrate the study on the efficacy of technology incubation programmes in Singapore in the following areas based on opinions of incubates and firms who have experience or knowledge of Singapore incubators.

Training and marketing resources

Technopreneurs can obtain spillover benefits from the central consolidation of resources in the incubator, which will lead to lower overhead outlays and also better effectiveness. It will be more efficient and attractive to coordinate support activities for the firms in the incubator when resources are consolidated and the number of participants is more voluminous (Audretsch et al. 2002). Some instances include the organizing of staff training and development, central marketing activities, networking activities, social gathering, and media forums.

Infrastructural resources

The structural theory substantiates the claim that firms located within incubators can gain entrance to structural essentials made available by incubators. Some of the examples include infrastructure and supporting services, and hence synergy amongst high technology companies can be bred (Phillimore 1999; Ratinho and Henriques 2010).

Incubator assistances can be commonly separated into basic structural provision and technology-specific structural provision. Conventional illustrations of basic structural provision include common office services, business help, rental subsidies, business networking, links to funding, legal and accounting support, and guidance on management practices (Mian 1997;

Harwit 2002). At the same time, technology-related structural provision includes the following services: laboratory and workshop facilities (Brown 1985; Mian 1997), processor computers, R&D activities (Jérôme 1987), technology transfer services and advice on IP (OECD 1999). These services are considered meaningful as small start-ups would not have the resources to build such facilities and infrastructures just to conduct R&D on their ideas. By having these technology-related structural provision, technopreneurs start-ups would be able to leverage on these supports to focus on their core objective, which is to develop the product or service suitable for commercialization in the near future (Dana 2001).

Advisory service

One of the success factors that O'Neal (2005) pointed out for an incubator is the provision of outside experts and an advisory service (O'Neal 2005). These could be in the areas of legal, accounting, marketing, and market identification. Becker and Gasman (2006) are of the view that advisory boards with industry and public representatives are useful to enhance the performance of incubators in helping incubates to grow (Becker and Gassmann 2006). Tang, Basakan and Pancholi (2010) studied incubator programs in India and observed that the incubator is effective when they hire "consultants to provide specialist skills and expertise" in areas including "technical, legal, intellectual property, fund management" (Tang, Baskaran, and Pancholi 2010).

Public image

One of the objectives of incubators is that it provides positive image (Albert and Gaynor 2003). A new start up typically faces the challenge of credibility with interested parties, be it investors or vendors, due to the lack of track records. Recruitment of good employees would also be a problem due to the same issue of being new (Smilor 1997). By being part of an incubator, the new start up would have a better public image as incubates have to be pre-qualified before being admitted (McAdam and McAdam). This means that

these firms would be of certain quality and standard. As such, by being part of an incubator, the start up would be in a better position to reach out to the respective stakeholders with more credibility.

Business contacts

Incubators provide a conducive environment for fellow start ups to network with each other and to explore synergies of mutually beneficial opportunities (Smilor and Gill 1986). Partnerships are also encouraged internally and with academic institutions and other relevant bodies (Hansen et al. 2000). It will also provide a good platform for industrial networks (Albert and Gaynor 2003). This could then lead to a bigger base of customers and suppliers. Such cooperation and leveraging is extremely instrumental in helping small start ups get over the limitations of being new and small (Lender 2003).

Incubators could also result in the development of “informal and personal linkages” which Phillimore (1999) feels are “important in promoting innovation and the development of synergies as the establishment of more formal research relationships.”

Grouping effect of logistic support

The cluster theory furthers the line of reasoning that high tech firms of similar qualities and inside the value chain would be enticed to group together in incubators and hence progressively surface as a strong amalgamated group harmonizing to each other (Audretsch et al. 2002). The grouping effect causes the establishment of an innovative environment. Consequently, synergies are resulted both between the technopreneurs and the universities and also amongst the various firms themselves (Phillimore 1999).

By being in the same field, these firms could also share their knowledge about industry and technology, which is a very strong benefit to firms located in the incubator. Whenever a new knowledge is discovered, firms could also leverage on such new knowledge more efficiently to provide more innovative solutions

when they are located in incubators (McAdam and Marlow 2008). Following up on this same argument, technopreneurs will be able to play different parts in a value chain. With economies of scale, they will be able to play a better role at either upstream or downstream coalition as incubator programmes presents them with a positive pairing platform to cooperate (Feng, Qi, and Sun 2011). Hence, public policy can sustain business infrastructure with different facilities. Google and Netscape are two interesting examples of innovations originating from university campuses. Stimulating academic entrepreneurship and accelerating the commercialization of university-developed innovations can be one way to foster innovation in the economy (Foundation 2007). A Swedish study comparing 273 surveyed new technology-based firms further found a slight over-performance for firms situated in incubators as compared to off-incubators firms (Lindelöf and Löfsten 2003). Hence, firms located in incubators seem to have more benefits and advantages in operating their business as compared to individual firms that do not operate in incubators. In other words, by having an alliance or network formed, entrepreneurs are deemed to have a higher chance of succeeding in their endeavour (Dana, Etemad, and Wright 2001).

Geographic nearness

Geographic proximity will facilitate knowledge spillover and knowledge transfer. If public policy promotes networks through which knowledge can easily be transferred between businesses and organizations, entrepreneurship is facilitated as a result (Audretsch et al. 2002).

Another opinionated line of reasoning can be read from the network viewpoint. It is discovered that, other than being more effective in creating sales and jobs, businesses situated in incubators also have a higher tendency to have linkages with local universities (Colombo and Delmastro 2002; Löfsten and Lindelöf 2001) and create some types of organisational affiliation with each other due to geographical nearness (Jou and Chen 2001).

Start up cost advantages

One of the recurring operation expense related to start-ups are office and equipment rental. In fact, the smaller the firm, landlords would logically demand higher collaterals when inking the tenancy agreement as the firm would have a higher chance of defaulting payment of rent. This also applies to office equipments like photocopiers, computers and broadband routers. Very often, entrepreneurs might even need to sign a personal guarantee to ensure full payment in the event the start-up winds up. This is sometime that deters entrepreneurs from starting a business. Hence, one of the important functions of an incubator is to provide start-up assistance to new firms, in area such as subsidized office spaces (Albert and Gaynor 2003). Rent breaks and office equipments were considered a significant value add for incubators (Mian 1996). Very often, firms would “enter the incubator as tenants, spend a period of time within the facility, and then graduate when the business is viable and can be competitive in the market” (Markley and McNamara 1994). Other modes will include flexible rent (based on company performance), and below-market rental (Campbell and Allen 1987).

Capital resource

In order to grow beyond the incubation phase of burning cash, capital injection is important to a new start-up. Incubators have the ability to attract funding from business angels and venture capitalists (Albert and Gaynor 2003). In fact, one of the reasons for success of ‘California’s Silicon Valley and Boston-Route 128 area owe much to the significant amounts of venture capital available there” (Florida and Kenney 1988). One of the unique characteristic of incubators is the high frequency of meetings between the entrepreneurs and venture capitalists (Johannisson 1987). Incubators also sometimes play the role of helping entrepreneurs source for capital (Markley and McNamara

1994). As such, by joining an incubator, entrepreneurs would hope to have easier access to funds in the forms of venture capital and private equity.

Researches on how to determine the efficacy of incubator programmes are many but there is no one determining structure that is regarded as authoritative (Mian 1997). One way to assess such efficacy is to do a comparison between firms within incubators versus those out of incubators based on a set of pre-determined standards (Colombo and Delmastro 2002). For example, Colombo and Delmastro (2002) did a comparison based on a sample size of 45 firms on and off SPs. The firms off the SPs were used as control factors. They considered factors like “personal characteristics of founders” of these technopreneurial firms in the incubators, the “motivations of the self-employment choice, the growth and innovative performances of firms, propensity towards networking, and access to public subsidies” to obtain empirical findings confirming “the conventional wisdom that input and output measures of innovative activity are only marginally different between on- and off-incubator firms.” However, it was also demonstrated that SPs “managed to attract entrepreneurs with better human capital, as measured by educational attainments and prior working experience. In addition, on-incubator firms showed higher growth rates than their off-incubator counterparts. They also perform better in terms of adoption of advanced technologies, aptitude to participating in international R&D programs, and establishment of collaborative arrangements, especially with universities. Lastly, they find it easier to get access to public subsidies” (Colombo and Delmastro 2002).

To provide some balance to the above reviews, on the other hand, critics contended, quite the opposite, that incubators are improbable to create synergies of any important type (Macdonald 1987). It was highlighted that the communication amongst incubator firms, i.e. technology companies, with the local university and other companies within incubators was relatively inadequate (Bakouros, Mardas, and Varsakelis 2002). These companies were normally limited in commercial dealings and social interface. Quintas et al.

(1992) observed that geographical nearness between a university and an incubator only played a small role in advancing technology transfer (Quintas, Wield, and Massey 1992). Hence, nearness is not a driving influence for university-incubator (Conceição 1997). Based on the observations of Westhead and Storey (1995), the connection between universities and incubators was feeble (Westhead and Storey 1995) and that incubators are even thought to be 'high tech fantasies' (Massey, Quintas, and Wield 1992).

At the same time, it is tough to evaluate the efficacy of incubators as the goals of the different agents in incubators may vary significantly (Monck et al. 1988). A university may be concerned with obtaining targeted earnings from incubators by advancing business activities closely related to its own research interests. Private organisations, like the VCs, will be more focused on commercial goals towards investments in incubators or the participating firms within incubators. Monck et al. (1988) observed that notwithstanding the accomplishment and input of technopreneurs within incubators to the economy, the survey acknowledged several limitations on the ability of these technopreneurs in general to satisfy their economic potential. These included management ability, finance and vulnerability in sales and marketing. Monck et al. (1988) further commented that in order to comprehend the "value add" of an incubator location, there should be more in-depth research investigating the features and accomplishment of businesses situated in different incubators.

The above concise literature review provides no concluding directions on the significance of setting up incubators as a suitable medium to contribute to encouraging and easing the growth of technology companies within the incubation programmes. Opinions from both sides of the argument appear to point out that its value is conditional on the circumstance of the set up and the execution process of the incubator programmes. So as to weigh up its efficacy, I worked out the following framework including some criteria on the basis of the literature and then investigate its applicability by conducting a survey based on 203 firms of sample population who are either current or previous

registered firms with incubator programs or have experience or knowledge of incubator programmes in Singapore. Table 2-2 demonstrates the synopsis of the review structure.

Review measures	Examples of precise markers
Training & marketing resources	Arranging training and development courses for staffs, marketing efforts, symposiums, media events
Infrastructural resources	R&D laboratory infrastructure, office equipment, testing equipment, administrative support
Advisory services	Accounting, legal, marketing, market identification
Public image	Generic SP image projected to the public
Business contacts	Reach out to a bigger base of customers, suppliers, potential business partners and opportunities
Grouping effect of logistic support	Create a common group of skilled labour; spillovers from logistic organizations, spillovers from supporting network
Geographic nearness	Nearness to the market, R&D centres, R&D specialists etc.
Start-up cost advantages	Offsets and subsidies in rental, office equipments etc.
Capital resource	Greater reach out to VCs and angel funds

Table 2-2: Summary of key measures to be evaluated

Applications of the framework

Data collection

In order to assess how the above assessment framework is useful in the incubators for technopreneurs in Singapore, this essay adopted the survey method to interview 203 respondents based on a survey questionnaire (Appendix 1) designed from the above assessment framework. An ordinal scoring system of 1 to 5 is adopted for all the nine questions. The relevance and applicability of this survey method has been widely elucidated (Pervan and Klass 1992).

The respondents are briefed on the significance of the scores:

1 = ineffective (completely no effect at all)

2 = mildly effective (very little or almost negligible effect)

3 = somewhat effective (serving the purpose to some extent)

4 = very effective (serving the purpose largely)

5 = highly effective (fully and exceedingly serving the purpose)

Respondents are also briefed to answer the questions based on either their own personal experience or observation, or on their knowledge of the situations in the incubators. For instance, when they are asked how effective they deem Singapore incubators in providing training and development courses for staffs within incubates, marketing efforts, symposiums and also initiating media events, the respondents would grade it according to their own experience (if they are part of an incubator programme) or what they understand the situation to be from their knowledge of incubators in Singapore. The definition of “effectiveness” was also made known to refer to the capability of producing an intended, expected or desired result (Dictionary.com 2012).

Sample population selection

Over a period of one year, I participated in approximately twenty entrepreneurship seminars. Out of this convenient target group of participants, I randomly selected participants to be my survey respondent. When these randomly selected targets expressed that they are agreeable, they are then stratified and qualified with the following questions:

- (a) Are you a technology company currently or previously registered in any incubator programmes

- (b) If not, are you a technology start-up who has researched on incubator programmes in Singapore or have discussed extensively with counterparts who are currently or previously registered in any incubator programmes

If the target answers affirmatively to any of the two questions, they will be deemed qualified to have the minimal understanding or experience of incubator programmes in Singapore. It is also important to note, at this juncture, that different respondents would have different experiences with incubators, whether directly or indirectly. Hence, the opinion of effectiveness of the incubator programs would differ across respondents.

The seminars attended include technopreneurship seminars organized by the various government bodies and also seminars selling commercial courses to teach entrepreneurship courses. Participants of government-organized seminars are usually very relevant to technopreneurship. They are either industry players, investors, government officers, or the technopreneurs themselves. Many of them would either have participated in incubator programs or have at least come into contact with incubator programs but for some reasons did not become an incubate. Participants of commercial seminars will come from a wider range of backgrounds. Not everyone will be directly related to technopreneurship. In fact, many of them would attend hoping to learn of some get-rich-quick schemes without any intention of commencing any high technology business. It is through the participation of these various seminars, sometimes more than once that the interviews are conducted before and after the events.

Nevertheless, due to the filter questions adopted, the eventual respondents can be considered to be representative of high technology entrepreneurs.

Results

After keying in the data into the software Stata, the results of the survey are summarized in Table 2-3. Generally, all 203 respondents who agreed to be

interviewed gave complete answers to the nine questions. Out of these 203 respondents, 35.96 percent or 73 were registered or are still currently registered in incubator programs.

In terms of the deemed effectiveness of the Singapore incubators' efforts to provide training and development courses for staffs within the incubates, marketing efforts, symposiums and initiating media events, the mean score is 3.32 out of 5 (66.4 percent) with a standard deviation of 0.81. More than half of the respondents deemed the efforts as only somewhat effective.

The deemed effectiveness of provision of R&D infrastructural resources, office equipment, testing equipment and administrative support for incubates has a mean score of 3.37 (67.4 percent) and a standard deviation of 0.99. The percentages of respondents who deem it as somewhat effective and very effective were similar at 33.5 percent.

The mean score for the provision of advisory support in accounting, legal, marketing planning and market identification is 3.31 (66.1 percent) and a standard deviation of 1.02. Only 2.96 percent deemed this factor as ineffective while a significantly larger 11.82 percent deemed Singapore incubators' effects for this factor on the other end of the spectrum as highly effective. Out of the scale of 1 to 5, the most number of respondents (33 percent) indicated a score of 4 (very effective) followed closely by 32 percent who deemed the effects to be somewhat effective. Collectively, there were more respondents (ninety-one) who deem this effort as either very or highly effective versus forty-seven of them who deem this effort as either mildly effective or ineffective.

The mean score for the creation of a relatively better public image for incubates to be seen as part of the incubator is 3.32 (66.3 percent) with a standard deviation of 0.80. Slightly more than half of the respondents deem the efforts as only somewhat effective.

The effectiveness of incubators to provide a better reach to a bigger customer base and suppliers has a deemed mean score of only 2.23 (44.6 percent) and

standard deviation of 0.84. The median score is in the ineffective zone of 2. More than 63 percent of respondents deem it as either mildly effective or ineffective. Slightly more than 30 percent deem the effect to be only somewhat effective.

The ability of Singapore incubators to create a spillover effect of a common group of skilled labours for the same industry that the incubator is focused on that incubates can conveniently tap on for logistic and support needs is deemed to have the lowest effective mean score of 1.68 (33.6 percent) and a very low standard deviation of 0.64. In fact, 40.89 percent of respondents deem it as ineffective, while 50.74 percent deem it only mildly effective. The cumulative percentage for the low scores of 1 and 2 is 91.63 percent.

As to the provision of leverage for incubates to be near target markets, relevant R&D centres and specialists, Singapore incubators are deemed to be effective at a mean score of only 2.22 (44.4 percent) and standard deviation of 0.83. More than half of the respondents (64.53 percent) deem the effectiveness as only mildly effective or simply ineffective. Only slightly more than five percent deem it either very or highly effective.

One of the most important supports that startups require is capital support during startup phases. This would include offsets and subsidies for the benefits of startup costs including rental and office equipments. For this aspect, the deemed effectiveness has the highest mean score of 4.44 out of 5 (88.8 percent), and a relatively low standard deviation of 0.76. More than half of the respondents deem the efforts as highly effective.

After joining an incubator, incubates would typically hope to build the business to the stage where they could attract future funding and investments from VCs and angel funds. The deemed effectiveness of Singapore incubators in helping incubates gain better access to these funding has a mean score of 3.33 (66.6 percent) and standard deviation of 0.91. Of the score of 1 to 5, the highest percentage of nearly forty-one percent of respondents deemed the

effectiveness as only somewhat. Collectively, slightly more than forty-one percent of respondents deem it either very or highly effective while only slightly more than seventeen percent deem it either mildly effective or simply ineffective.

This essay goes further to explore the difference in score between respondents who are current incubates versus those who are not. The reason for this differentiation is because those who joined versus those who did not (or were not selected to join) could have a different view of incubators. The results are summarized in Tables 2-4 and 2-5 below.

For the incubates, in terms of the deemed effectiveness of the Singapore incubators' efforts to provide training and development courses for staffs within the incubates, marketing efforts, symposiums and initiating media events, the mean score is 3.74 out of 5 (74.8 percent). More than half of the respondents deemed the efforts as only very effective. On the other hand, for the non-incubates, the mean score is 3.08 (61.7 percent) with a median score of 3.

For the incubates, the deemed effectiveness of provision of R&D infrastructural resources, office equipment, testing equipment and administrative support for incubates has a mean score of 3.84 (76.7 percent). The percentages of respondents who deem it as somewhat effective and highly effective were similar at 30.1 percent. On the other hand, for the non-incubates, the mean score is 3.11 (62.2 percent).

For the incubates, the mean score for the provision of advisory support in accounting, legal, marketing planning and market identification is 3.63 (72.6 percent). Only 2.7 percent deemed this factor as ineffective while a significantly larger 21.8 percent deemed Singapore incubators' effects for this factor on the other end of the spectrum as highly effective. Out of the scale of 1 to 5, the most number of respondents (34.3 percent) indicated a score of 4 (very effective) followed closely by 31.5 percent who deemed the effects to be

somewhat effective. Collectively, there were more respondents who deem this effort as either very or highly effective versus those who deem this effort as either mildly effective or ineffective. On the other hand, for the non-incubates, the mean score is 3.12.

For the incubates, the mean score for the creation of a relatively better public image for incubates to be seen as part of the incubator is 3.64 (72.9 percent). The non-incubates gave it a slightly lower mean score of 3.13.

Incubates deem the effectiveness of incubators to provide a better reach to a bigger customer base and suppliers has a deemed mean score of only 2.68 (53.7 percent). The median score is in the somewhat effective zone of 3. Nearly 40 percent of respondents deem it as either mildly effective or ineffective. More than 43 percent deem the effect to be only somewhat effective. Non-incubates had a similar perception with a mean score of 1.98 and more than 50 percent deeming it as only mildly effective.

Incubates deem the ability of Singapore incubators to create a spillover effect of a common group of skilled labours for the same industry that the incubator is focused on that incubates can conveniently tap on for logistic and support needs to have the lowest effective mean score of 1.73 (34.5 percent). In fact, 35.6 percent of respondents deem it as ineffective, while 56.2 percent deem it only mildly effective. The cumulative percentage for the low scores of 1 and 2 is 91.8 percent. Non-incubates gave it a mean score of 1.65 with 91.5 percent giving it a low score of 1 or 2.

As to the provision of leverage for incubates to be near target markets, relevant R&D centres and specialists, Singapore incubators are deemed to be effective at a mean score of only 2.51 (50.1 percent). Only slightly more than one percent deem it highly effective. The non-incubates gave it a low score of 2.10.

Incubates deemed the effectiveness of start-up cost advantage at the highest mean score of 4.45 out of 5 (89.0 percent). More than 60 percent of the

respondents deem the efforts as highly effective. Non-incubates gave it similarly high scores.

The deemed effectiveness of Singapore incubators in helping incubates gain better access to these funding has a mean score of 3.42 (68.5 percent) compared to 3.28 from non-incubates.

As such, it can be concluded that the perception of incubators by both incubates and non-incubates are relatively in the same direction, with non-incubates consistently giving the incubator a slightly lower score for all the variables. As such, the results are also relatively in line with the overall combined score direction from the two segments of respondents.

All Respondents	Med	Mean	Std Dev	1(%)	2(%)	3(%)	4(%)	5(%)
Training & marketing resources	3	3.320	0.809	0.0	12.8	51.2	27.1	8.97
Infrastructural resources	3	3.369	0.988	2.0	18.2	33.5	33.5	12.8
Advisory services	3	3.305	1.017	3.0	20.2	32.0	33.0	11.8
Public image	3	3.315	0.802	0.0	12.3	52.7	26.1	8.9
Business contacts	2	2.232	0.845	19.7	43.8	30.5	5.4	0.5
Grouping effect of logistic support	2	1.680	0.638	40.9	50.7	7.9	0.5	0.0
Geographic nearness	2	2.222	0.830	19.2	45.3	30.1	4.9	0.5
Startup cost advantages	5	4.438	0.758	0.0	0.5	14.8	25.1	59.6
Capital resource	3	3.330	0.909	1.0	16.8	40.9	31.0	10.3

Table 2-3: Summary of survey results for all respondents

All Respondents	Med	Mean	Std Dev	1(%)	2(%)	3(%)	4(%)	5(%)
Training & marketing resources	4	3.740	0.913	0.0	6.9	37.0	31.5	24.7
Infrastructural resources	4	3.836	0.958	0.0	8.2	30.1	31.5	30.1
Advisory services	4	3.630	1.021	2.7	9.6	31.5	34.3	21.9
Public image	4	3.644	0.918	0	9.6	37.0	32.9	20.6
Business contacts	3	2.685	0.896	9.6	30.1	43.8	15.1	1.4
Grouping effect of logistic support	2	1.726	0.607	35.6	56.2	8.2	0.0	0.0
Geographic nearness	2	2.507	0.945	13.7	38.4	32.9	13.7	1.4
Startup cost advantages	5	4.452	0.817	0.0	1.4	16.4	17.8	64.4
Capital resource	3	3.425	1.026	1.4	17.8	35.6	27.4	17.8

Table 2-4: Summary of survey results for incubates

All Respondents	Med	Mean	Std Dev	1(%)	2(%)	3(%)	4(%)	5(%)
Training & marketing resources	3	3.085	0.635	0.0	16.2	59.2	24.6	0.0
Infrastructural resources	3	3.108	0.909	3.1	23.9	35.4	34.6	3.1
Advisory services	3	3.123	0.973	3.1	26.2	32.3	32.3	6.2
Public image	3	3.131	0.663	0.0	13.9	61.5	22.3	2.3
Business contacts	2	1.977	0.698	25.4	51.5	23.1	0.0	0.0
Grouping effect of logistic support	2	1.654	0.655	43.9	47.7	7.7	0.8	0.0
Geographic nearness	2	2.062	0.713	22.3	49.2	28.5	0.0	0.0
Startup cost advantages	5	4.431	0.725	0.0	0.0	13.9	29.2	56.9
Capital resource	3	3.277	0.835	0.8	16.2	43.9	33.1	6.2

Table 2-5: Summary of survey results for non-incubates

Discussion of results

The survey results based on 203 respondents illustrated in the previous section offers an apparent picture of how technopreneurs progress through their growth phase and how they (a) extract applicable support from incubator; (b) relate to incubator; and (c) measure and remark on incubators. This section will discuss the results from the previous section.

According to the literature review and also the results from the survey in the previous section, it is by and large understood that cost concern is one of the most principal significance at the initiation of new businesses. Particularly, most founders of the technopreneur firms revealed that rental funding are the foremost benefits of being in incubation programmes. They deem this benefit as highly effective for Singapore incubators with 88.8 percent score. At the same time, this is also one of the chief appeals for these start-ups to consider participating in incubator programmes. As per anecdotal discussion with the interviewees, technology start-ups typically concentrate a large part of their energy and time on R&D during the beginning few years of the business. Correspondingly, lesser focus is channelled to sales and marketing. Hence it is virtually hopeless to produce earnings to sustain office expenses. For that reason, subsidized rental, as many incubation programmes would provide during the beginning few years, proves to be instrumental for these new businesses to continue to exist. There are some exceptions to this general observation though. For instance, some companies might have in point of fact progressed past the nascent phase when they participated in the incubator programme. If incubates already have ready-to-commercialize products when they joined the incubator, they would be able to commence sales and generate income. Subsidies for office rental would then not be too meaningful to them. There are also some feedbacks from interviews stating that incubators typically offer them office rental subsidy for the beginning two years. Thereafter, incubates are required to pay rental at the same or even higher rates than the market. One particular incubator, supported by the

National Research Foundation, specifically refuses to offer rental or office space support to nascent entrepreneurs. Instead, this incubator will only support the nascent entrepreneur by offering them cash injections, with which the entrepreneur has to make its own plans and preparations to take care of their office usage.

One of the chief factors that individuals participate in incubator programmes is due to the existence of grouping of resources. The survey results seem to affirm this conviction with a mean score of 3.32 out of 5, or 66.4 percent deemed effectiveness. Some of the respondents actually joined the incubator programmes as they recognize the pragmatic value behind the programmes. One of the most popular training is in business-related skill-sets. This is because many nascent entrepreneurs only have technology background without business knowledge. However, some of the respondents commented many of the events organized by the incubators using central resources like PR events and media conferences are not being appreciated at all. Some of the explanations for such non-appreciation is the lack of relevancy of these activities to incubates' business. There are feedbacks saying that they feel such PR events are meant more to satisfy the government, who needs the public to know about such incubator programs, and who will then fund these incubator programmes to help more individuals to become technopreneurs. Hence, these incubates feel that such resources are wasted. On the other hand, there are comments saying that the resources would be spent more meaningfully if expended on more promotional activities that could directly result in higher awareness of their business, rather than awareness for the incubator programmes.

During the building and growing of business, nascent technopreneurs typically require the usage of business facilities including office tools, conference venues, library, teleconference support etc. The survey results showed a mean score of 3.37 out of 5, or 67.4 percent effectiveness. The standard deviation is at 0.99 with a wide spread of scores 1 and 5 for minimum and maximum. This shows that while respondents generally agree on the degree of effectiveness

of Singapore incubators in their infrastructural support, there are those who benefited immensely from this while some practically do not enjoy any of such benefits at all.

Most nascent technopreneurs require technical support when conducting R&D activities. By being located within an incubator, they would theoretically be geographically nearer to their target market and also the relevant R&D centres and specialists to help them succeed. However, in terms of the effectiveness in the context of Singapore incubators, results from the respondents produced a low mean score of 2.22 out of 5, or 44.4 percent. The wide range of maximum and minimum score of 5 and 1 also suggests that there are parties who benefit greatly from such geographical nearness while there are others who totally do not benefit at all. The respondents' feedback is largely dependent on where incubates are located. If the incubator is within a tertiary compound that has a comprehensive suite of expert support, then incubates are likely to benefit much more from geographical nearness to such support. On the other hand, if the incubator itself is not equipped with such technology support or industry experts to provide guidance, or if the incubates do not have a good relationship with the resource owner, then the effectiveness for geographical nearness will be minimal. In Singapore, there are some incubators who choose to play the role of angel funds more than incubators in the conventional sense. Such incubators would rather provide funding rather than industry-specific guidance due to their own corporate philosophy. In fact, they do not even encourage their incubator participants to be situated within their compound, but to make use of the grants or funds given to source for their own office space. While such incubators do not play the role of a conventional incubator, they contend that the conventional theory of geographical nearness being an advantage for incubates is flawed.

The benefits of securing advisory services from incubator are typically regarded a significant portion of rational assistance for technopreneurs. In this survey, respondents gave Singapore incubators a mean score of 3.31 out of 5, or 66.1 percent. While 2.96 percent of respondents saw this aspect as

ineffective, 11.82 percent perceive Singapore incubators on the other end of the spectrum as highly effective in providing advisory services. During the interview, many technopreneurs indicate that they frequently rely on advisory support to plan their business operation and also set corporate objectives. They also need advisories in both technical and business-development areas. Twenty-six respondents revealed that most technopreneurs would have their own visions and directions on their core product, hence they would prefer consultants to guide them on business management skills rather than how to improve the technology-performance of the product. Specifically, they require guidance on how to ensure agreements with customers and vendors are crafted to their best advantages, and also how to keep up with the changing accounting standards to ensure both compliance with law and also better understand the financial health of the company.

Public image of incubators is frequently asserted to be the intangible benefit that would churn out marketing coupled with alliance advantages for these technopreneurs. The survey results showed that the deemed effectiveness of Singapore incubators' positive public image to the benefits of incubates has a mean score of 3.32 out of 5, or 66.3 percent. While important, 83.3 percent of respondents indicated that the effect of good public image is secondary to other supports in resources and start-up costs. During the initial start-up years, the nascent technopreneur would typically have many other considerations that will result in going concern. Many feel that a good public image due to being part of an incubator is a good-to-have but definitely not something crucial. There are feedbacks saying the public image factor is more to showcase how the government is contributing to supporting R&D, which will then rationalize the significance of the continued operations of incubators. Importance of public image aside, more than half of the respondents felt a neutral effect of Singapore incubators to provide value-add to portray a better image for incubates.

Meeting people, together with grouping, is adopted hypothetically that would cause the quick development and growth of technopreneurs in incubators. The

result from the survey is quite the contrary though. The mean score of both the grouping effect of logistic support and also the business contacts are among the lowest factors (the other factor being geographic nearness) at 1.68 and 2.23 respectively with respect to their effectiveness according to the performance of Singapore incubators. It is widely pointed out that the many social events, or commonly termed networking events, organized by incubators are not serving the “networking functions” for firms within the incubators. Technopreneur firms do not like to discuss about their work progress, be it R&D or even anything closely related to their business even though incubates appear to be friendly to each other in the most superficial manner. This could be due to several factors. Firstly, the ones who are progressing well are fearful that their ideas would be stolen by fellow incubates due to the close proximity. Secondly, the ones who are not progressing well might be afraid fellow incubates might disclose to the incubator resulting in their possible fate of being kicked out of the incubator program. The general consensus from the respondents is that there are minimal chances for partnership (despite much marketing talks from the incubators of potential partnerships within the incubators), minimal positive spill-over from the works of fellow incubates, and minimal sharing of information.

In the evaluation model for incubation programmes in Singapore, financial support is the final element in the list. The query that we raise is the likelihood that nascent technopreneurs participating in incubator programmes would have relative advantages to acquire funding backing and hence make easy their development and growth. The mean score of 3.33 out of 5 is 66.6 percent score. Around thirty percent of incubates have received financial support in the course of their R&D efforts. In Singapore, the Economic Development Board (EDB) has a scheme that undertakes the full cost of employing a postgraduate student to undertake R&D work for the technopreneur for up to a certain number of years. This is very useful help to technopreneurs especially during the nascent phase. There are also additional funding for capital

expenditure (CAPEX) on equipments and machineries to boost R&D. There are several other financial supports within the incubation program all of which are targeted to assist the technopreneur in the R&D and commercialization of high technology solutions. However, some respondents revealed that being part of an incubator only provides an initial edge over other non-incubate companies, but is not a given to have significant advantages over other companies to secure future investments. This is especially true as most nascent technopreneurs are small and developing and that their R&D directions are normally smaller products. If financial support is only given to the big ideas and high technology products, the smaller technopreneurs might not be eligible for the funding. Investors in the forms of Private Equity (PE), Venture Capital (VC), and Business Angels Network (BAN) will not be limited to proposals and sales pitches from the incubation programmes.

To recapitulate this evaluation by the growth point of view of respondents, we position the main development activities of the technology companies together with their related needs obtained from incubators and then verify what flaws are observed so that the operators of the incubators and the relevant policy makers can extract constructive indications for advancement. The figure below portrays the main parts (Figure 2-2).

Figure 2-2: Nascent technopreneurship process & incubator deemed features

Conclusion

Incubator hubs have been adopted by governments as a platform to aid the development of nascent technopreneurship. Proof of its efficacy is not absolute. Hence, the matter of constructing a suitable evaluative model and putting into operation the model in any specific incubator is of great interest for academics and policy makers. In this essay, I recapitulate the models and the means adopted previously and construct a substitute evaluation model with reference to the hypotheses supporting the underlying principle of technology incubator. This model is then applied to the Singapore context. Adopting the growth point of view of nascent technopreneurs that joined incubator programmes at dissimilar time periods and also technopreneurs who have either direct experience or have knowledge of incubation programmes, I gathered data of 203 respondents via survey and elucidate how these entrepreneurs grow, with specific reference to its interface with incubators. Analyses are then conducted on the principle of the measures developed in the evaluation model. In gist, this research discovered that:

1. Offsets and subsidies for the benefits of start-up costs including rental and office equipments are ascertained to be the highest scored advantage that is deemed of Singapore incubators. This is very useful for nascent technopreneurs who are still spending time to conduct R&D and are far away from commercialization.
2. The training and development course for staffs within incubates, marketing efforts, symposiums and initiating media events is deemed partially effective for nascent entrepreneurs. This is because, while there are cost and other benefits for organizing of such activities on a large scale due to economies of scale, different incubates will have different skill-set needs at various phases of their business growth.
3. The provision of R&D laboratory infrastructure, office equipment, testing equipment and administrative support for incubates are deemed to be generally effective.
4. However, in the incubators' efforts to create a spill-over effect of a common group of skilled labours for the same industry that the incubator is focused on that incubates can conveniently tap on for logistic and support needs, respondents deem such efforts as highly ineffective. It is only when the incubator is a theme-specific one will there likely be more synergies in generating a common pool of resources.
5. The effects of incubates being near to the target market, relevant R&D centres and specialists will only be positive if they are near to universities which have technology resources for the nascent technopreneurs' benefits. In Singapore's context, as there are some incubators which do not provide adequate support within the compound, respondents generally deem the local efforts as ineffective.
6. Advisory support in accounting, legal, marketing and market identification for incubates are deemed useful and effective to

respondents as these are areas different from their core strengths. They found pragmatic solutions in such advisory services especially in accounting and legal aspects for the furtherance of their business. However, respondents do not deem advisory services for technology-related areas as effective as they feel advisors might not be experts in incubates' specific fields. Incubates might also be concerned that the ideas will be copied if they reveal excessively to advisors who are outsiders.

7. It is also observed that Singapore incubators are not effective in helping incubates reach out to a bigger base of customers, suppliers, potential business partners and opportunities. Some schools of thoughts that suggest incubators can create synergies for firms within the incubator to have stronger development are not supported in this research. In fact, firms within the same incubators are more wary of each other than being willing to complement each other.
8. As to the saying that firms in incubator programmes are seen in better light with a better public image is true only to a certain extent. There are several firms who revealed that such public image has no effects at all on their business growth, while there are others who feel they could leverage on their status as part of an incubator programme to gain access to more business opportunities.
9. Respondents generally deem Singapore incubators' role to attract future funding as effective. Such funds could be from PE, VC, BAN, or the government.

In gist, as incubator programmes are widely adopted by governments but the efficacy of which is not certain, this essay is a concerted effort to construct an evaluative framework on the basis of related researches. Thereafter, from the growth point of view of nascent technopreneurs, this framework is applied to analyze the survey results of 203 respondents in the Singapore context. This

evaluative framework and its following application provide a substitute point of view in the examination of technology incubators. In addition, in the course of applying the framework, several matters regarding various features of incubators are discovered and illustrated in the final section. These are deserving of additional considerations when governments are desirous of planning and enhancing incubator programmes.

Limitations of this study

As a result of the exploratory method adopted in amassing data to merit the narrative and analysis of the growth process of nascent technopreneurs in incubators, the survey for this research was conducted with 203 interviewees who are either current or previous incubates, or are technopreneurs who have either experience or knowledge of incubators. These respondents could be generally termed the end-users.

As such, the findings are limited to only the opinions and experience of end-users and do not include the views of incubator operators, who could either be linked to the government or privately owned. Some incubators are ranked lowly for the lack of provision of certain features named in the conceptual framework, e.g. rental subsidies, training and marketing aids etc. This could be due to the philosophy and practise of the individual incubator and would be unfair to be used to penalize the incubator as such. As such, the aggregated results need to be interpreted with caution. Future researches could take into account of incubator operators' opinions of the constitutions of a good incubator programme and maybe challenge existing theories on the features of a "good" incubator.

Another limitation of this research is its background context of the incubator programmes, which is entirely based on Singapore. Despite the fact that incubator models in many economies adhere to more or less similar policies and practises in their structure, it is still crucial to qualify certain findings with reference to their distinctive traits. It is hence useful to further this research to study incubators in other countries and to search out more information on

their growth process so as to have a more holistic comprehension of how incubator programme can be evaluated from the development point of view.

Appendix 1: Survey questionnaire on deemed effectiveness of Singapore incubators in the stated areas

How effective do you deem incubators in Singapore's efforts are in the following areas?

1. Provide training and development courses for staffs within the incubates, marketing efforts, symposiums and initiating media events
2. Provide R&D laboratory infrastructure, office equipment, testing equipment and administrative support for the incubates
3. Provide support in accounting, legal, marketing and market identification for the incubates
4. Create a relatively better public image for the incubates to be seen as being part of the incubator
5. Help the incubates reach out to a bigger base of customers, suppliers, potential business partners and opportunities
6. Create a spill-over effect of a common group of skilled labours for the same industry that the incubator is focused on that the incubates can conveniently tap on for logistic and support needs
7. Provide leverage for the incubates to be near to the target market, relevant R&D centres and specialists
8. Provide offsets and subsidies for the benefits of start-up costs including rental and office equipments
9. Provide better access to VCs and angel funds for future funding needs

Scores & implication

1 = highly ineffective

2 = ineffective

3 = neutral

4 = moderately effective

5 = highly effective

Appendix 2: Summary of incubators in Singapore

NRF - Technology Incubator Scheme	Description	Source
Get2Volume	<p>Focuses on innovative semiconductor and microelectronics emerging growth companies. Successful semiconductor and microelectronics companies are global from day one. Get2Volume brings global capabilities, capital and connections to enable emerging growth company success.</p>	www.g2vaccelerator.com
Golden Gate Venture Investments	<p>Focus on companies building out consumer internet products and services for Southeast Asia. Frequently traveling between Singapore, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Prefer companies with a launched product (stealth is fine) or that have establish valuable distribution partnerships in the region.</p> <p>As a seed-level investment firm, look at a wide range of companies and always happy to co-invest with other investors that can help bring value to the table. Just like the valley VC model, they take a minority equity stake.</p>	www.goldengate.vc

Incuvest	<p>A group of successful Singapore serial and corporate entrepreneurs with experience starting, building, operating and creating valuable companies. Interest to mentor early stage and startup technology companies, invest and create value through their investment ecosystem supported by this experience and extensive network of global business contacts, angel and venture capital, and corporate backgrounds.</p> <p>Within the technology domain, IncuVest's primary focus areas include the Retail and Lifestyle, Healthcare and Education, and Financial Services verticals. In addition, they constantly look for "Blue Ocean" ideas and start-ups that have the potential to create new market spaces in previously uncontested areas. Potential investees are similar in their use of innovative new channels of the Internet, Mobile, Tablet and Digital Media to deliver value to consumers and businesses alike.</p>	www.incuvestasia.com
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Jungle Ventures	<p>Jungle Ventures is a Singapore native global venture capital firm that provides early stage investments and business building infrastructure to startups.</p> <p>The focus is on seed to early stage investments into Singapore, India, South East Asia and other regional hotbeds of innovation.</p> <p>The firm is invested in by an active network of Asian entrepreneurs, tech executives and institutional investors that further support the tactical and strategic growth of the investee companies in the region and world markets.</p>	www.jungle-ventures.com
Red Dot Ventures	<p>Established in 2011, Red Dot Ventures (RedDot) is a seed-stage venture capital firm focused on Singapore-based high-tech startups in areas including ICT, Interactive Digital Media (IDM), MedTech, Nanotech, CleanTech, and Engineering.</p>	www.reddotventures.com
The Biofactory	<p>Focus on Biomedical Science technology, including:</p> <ul style="list-style-type: none"> - Research tools and platforms - Clinical diagnostics kits and markers - Class I and II biomedical devices 	www.thebiofactory.com
The Network Fund (TNF)	<p>Besides investing into your company, we actively work with you and your team to propel your ideas and business into market leading businesses.</p>	www.tnfventures.com

	Specializes in: Telecommunications, Media, Medical and Eco- related ideas	
WaveMaker Labs	<p>Over 25 years of early stage investment experience in over 50 start-ups which have received more than \$500M in follow on funding.</p> <p>With the help of the Singapore government's National Research Foundation (NRF), they can provide each start-ups with up to S\$589,000 of seed capital</p>	debneel@wavemakerlabs.com
Clearbridge Accelerator	<p>Focuses on key emerging and disruptive technologies that will make a dramatic impact in tomorrow's world. Supported by the National Research Foundation's (NRF) Technology Incubation Scheme (TIS), CBA provides the necessary funding, mentorship, operational and execution discipline to deliver determined and accelerated results. CBA's initiatives and investment focus areas are in biomedical devices, advanced materials and computational algorithms.</p>	www.clearbridgeaccelerator.com
I2G Tech Accelerator	<p>Experience in technology, software, semiconductor, secure payment, information technology companies with success leading startups from concept through rapid growth and profitability.</p> <p>Work with companies across a range of industries and business situations</p>	mholt@get2volume.com

Neoteny Labs	Helps start-ups in IT and apps business and proliferation of technology and trends such as the Open Web and its standards, advanced software development methodologies (i.e. Agile), and the availability of cloud infrastructure	http://neotenylabs.com/
Plug and Play	Business accelerator that specializes in growing tech startups. Headquartered in Sunnyvale, CA, Plug and Play's global network includes 300+ tech startups, 180+ investors and a community of leading universities and corporate partners.	http://www.pluginandplaytechcenter.com/
Social Slingshot	<p>The Social Slingshot Fund is a S\$5 Million Singapore based incubator fund which represents the partnership between Singapore's National Research Foundation and Brad Greenspan, the successful internet media and technology investor and entrepreneur and the founder of MySpace.</p> <p>Brad saw the National Research Foundations call For Proposals as a unique opportunity to intensify his exploration of investment opportunities in Singapore and subsequently leverage his international internet and media properties to accelerate the growth of a select group of Singapore related start up companies</p>	

Small World Group	Focuses on 3 areas of technology innovation – clean tech, optical systems and advanced materials. Accepts unsolicited business plans. However, will start more companies by using the substantial IP and working technology from Singapore’s rich ecosystem in their Universities and Institutes.	http://www.smallworldgroup.com/?page_id=380
Stream Global	Focuses on emerging enterprise in the sectors of Infocomm Technology (ICT) and Interactive Media	liubill@stream.com.sg
i.JAM Reload		
NUS Enterprise	Offer a wide range of services to nurture start-ups by NUS professors, researchers, students and alumni. Among them is the NUS Enterprise Incubator (NEI), a place with physical facilities to give aspiring entrepreneurs the infrastructure they need to bring groundbreaking ideas to the next level. Incubatee companies enjoy access to NEC’s support services, which include training workshops, introductions to venture capitalists and angel investors, linkages to business networking contacts and other corporate shared services. Through the active mentoring programme, they also regularly meet with the centre’s team of experienced local and	http://www.nusentrepreneurshipcentre.sg/

	international mentors to benefit from their assistance with global marketing, fund raising, business advice and international expansion.	
Crystal Horse Investment	Funds various types of online internet business start-ups.	http://www.ch-investments.com.sg/
Expara IDM Ventures	Provides support in various high technology business with training, advisory, innovation challenges, incubation and funding	http://expara.com/
Ruvento Ventures	Up to US\$200,000 investment in areas such as: - Enabling technologies for web and mobile - Medical diagnostics and devices - Devices / Robotics - Cleantech	http://www.ruvento.com/en/company/
NTU Ventures	NTU Ventures Pte Ltd (NTUV) is the commercial arm and technology holding company of the Nanyang Technological University. NTUV supports the University's mission to promote innovation, cultivate entrepreneurship and facilitate the commercialization of research. Examples of support include Institute of Environmental Sciences and Engineering (IESE) and SystemED. IESE specializes in water treatment and purification with a focus on 'crossing the last mile' to the marketplace. SystemED helps identify areas of	www.ntuventures.com

	<p>unmet clinical needs, evaluate their commercial potential and match these to technologies and solutions developed by the University.</p>	
QuestAccelerator	<p>QuestVC is China's leading venture fund for technology companies that have scalability and replicability in large internet communities.</p>	<p>www.questvc.com</p>
Fatfish MediaLab	<p>Digital incubator and investor in Asia that is focused on a particular segment of the interactive digital media (IDM) space: mobile and social media apps.</p> <p>Fatfish is headquartered out of Block 71, Singapore, an emerging cluster and home to the IDM startups of Southeast Asia. Fatfish believes the effect of being near to like-minded IDM entrepreneurs and other stakeholders will stimulate creativity and collaboration among the startups in its eco-system.</p>	<p>www.fatfishlab.com</p>
FocusTech Ventures	<p>Focus on interactive digital media and web business.</p>	<p>http://www.focustechventures.com/</p>
Angels Gate Advisory	<p>Focus on interactive web-based business and mobile apps. Applicants would need to pitch their ideas on the media platforms that are in collaboration with the incubator.</p>	<p>http://angelsgate.com/</p>

Incubator development programme		
iAxil Venture Accelerator Centre	Provides support in all areas of high technology business start-ups.	http://www.iaxil.net/
JFDI Asia	Focus on interactive mobile apps and enterprise resource programmes	http://jfdi.asia/
Mercatus Capital Pte Ltd	<p>Help businesses across a diverse area of services including Venture and Angel Funding, Securing Grants, Public and Private Equity, Mergers and Acquisitions, Corporate Restructurings, Financial Advisory, Initial Public Offerings and Strategic Partnerships.</p> <p>Areas of interest includes education, advanced engineering, environmental science, media etc.</p>	http://mercatus-capital.com/
Microsoft Innovation Centre	Focus on internet and mobile solutions	http://www.microsoft.com/mic/default.aspx
NUS Enterprise Centre	Offer a wide range of services to nurture start-ups by NUS professors, researchers, students and alumni. Among them is the NUS Enterprise Incubator (NEI), a place with physical facilities to give aspiring entrepreneurs the infrastructure they need to bring groundbreaking ideas to the next level. Incubatee companies enjoy access to NEC's support services, which include training workshops, introductions to venture capitalists and angel investors, linkages to	http://www.nusentrepreneurshipcentre.sg/

	business networking contacts and other corporate shared services. Through the active mentoring programme, they also regularly meet with the centre's team of experienced local and international mentors to benefit from their assistance with global marketing, fund raising, business advice and international expansion.	
SMU Business Innovations Generator	Works closely with NRF to support high tech business start-ups	http://www2.smu.edu.sg/institutes/IIE/Incubation/Programmes.asp

Essay 3: Support Programmes and Entrepreneurship in Singapore

Introduction

It has been acknowledged that “government should support new entrepreneurial activity” and that “a significant proportion of jobs are created via new firm formation” (Deakins, Sullivan, and Whittam 2000). At the same time, it has also been widely acknowledged that a significant percentage of start-ups do not sustain (Stanworth and Gray 1991, p. 11). This is the reason for the increased “targeted support at potential new growth companies” (Deakins, Sullivan, and Whittam 2000). However, the effectiveness of support programmes is not certain. In a Swedish study, it was found that “public support programme has not generated measurable additionality and the programme has to some extent been able to select firms on a general level”, and that of the companies selected to receive support, the programmes have “not been able to identify potentially successful firms” (Norrman and Bager-Sjögren 2010).

The entrepreneurial role is crucial in the going concern for a capitalist society, because when the entrepreneur stops introducing innovation, the society will no longer improve. Instead, the economy will collapse (Schumpeter 1942). As such, entrepreneurship is crucial to the survival and development of a country (Dana 1995). In fact, a nation that does not proactively foster entrepreneurship is making an unacceptable policy decision (Entrepreneurship 1999) and that most states in the United States consider entrepreneurship an important part of their economic development strategy (Kayne 1999). This is especially true for a small country like Singapore (Dana 1988) due to the objective entrepreneurially-competitive circumstances of excessive influence from Foreign Direct Investment (**FDI**) (Huang et al. 2002) and Government

Linked Companies (GLCs)¹⁷. The result is that SMEs found it tough to survive and excel in such an environment especially with intensive competition from the GLCs, as proven by previous researches (Chew and Chew 2001).

It is also important to note, at this point, that in the attempts to grow a country's economy, many governments rely on the typical Keynesian concept of boosting overall spending (especially government spending which is the easiest for government to manoeuvre), while what is even more important is the creation of an environment for private investment and entrepreneurship growth (Europe's Growth Deficit 2011). Hence, this current essay will be meaningful to address the efficacy of the impact for entrepreneurship growth through governmental support programmes in the context of Singapore.

Objective of this essay

In line with the focus of this essay, I will attempt to create a conceptual framework of the impacts of government support programmes on entrepreneurship, focusing on the context of Singapore. Support programmes will include tax incentives, grants and funding, and also institutional support. It will seek to find out the importance and the corresponding effectiveness of these various areas on entrepreneurship from the view point of the end-users, namely entrepreneurs.

Significance of this essay

By focusing directly on the impacts of government support programmes on entrepreneurship using survey data in Singapore, this essay will be able to

¹⁷ In Singapore, the GLCs are involved in a wide genre of businesses, from ship building (example include Keppel Shipyard) to groceries (examples include NTUC, Cheers etc) an even video-arcade amusement centres (Koh 1998). The Singapore government took stakes in these businesses through the Temasek Holdings and the Government of Singapore Investment Corporation (GIC). With huge national reserves as their capital, the GLCs control around fifty corporations, which in turn control more than five hundred subsidiaries, which have further sub-companies under the structure. In total, there are more than a thousand GLCs in Singapore. This forms approximately 70 percent of all Singapore-established companies (See (Garry 2000), p 223 and (PSD 2007)).

directly analyze the efficacy of the various support programmes. This is important as the manner in which such support programmes are administered is expected to have different effects on whether an individual decides to become an entrepreneur. For example, one school of thought believes that public research institutes and higher education's higher spending on R&D will create a more conducive environment for entrepreneurs to want to leverage on their support for entrepreneurship (See for example Mian 1996; Colombo and Delmastro 2002; Lindelöf and Löfsten 2003). This is sometimes structured in the forms of science parks or incubators. However, there are also schools of thought saying that such incubator environments created by public research institutes and higher education institutions are not effective in creating genuine and effective entrepreneurs (For example Holtz-Eakin 2000; Amirahmadi and Saff 1993). Rather, it is the private sector's own efforts in investing in R&D that will generate more entrepreneurs. As an illustration, when Bill Gates founded Microsoft, he did not rely on any public programmes or incubator labs from tertiary institutions (Gates 1996, pg 18-19). Similarly, when Larry Page and Sergey Brin founded Google and Mark Zuckerberg founded Facebook, it was more of their own private efforts than spending from the schools or any particular research institutes (*Google History* 2011; Carlson 2010). As such, this essay would then be able to provide empirical evidence on the specific or most relevant driver for the boosting of entrepreneurship, if any, in the Singapore context.

While recognizing the possible limitation that the results obtained based on the Singapore context might not be fully applicable to other nations, the findings in this essay would be a useful reference for future researches to adopt as a basis to test its applicability and suitability in other areas of the world.

Summary of findings

Based on the framework of this essay, it is found that respondents deem current support programs aimed to influence individuals towards

entrepreneurship as only slightly influential in importance. In comparison, the effectiveness of these support programmes reaching out to and benefited by individuals was neutral. While the matching intensity of effectiveness over importance is high (both are mediocre), rooms for improvements are suggested to generate a more robust level of entrepreneurship.

Organization of the essay

This essay will commence by conducting a literature review to build a conceptual framework that is suitable to analyze the context of Singapore. Thereafter, the research methodology for this essay will be described. After an elucidation of the results, discussion will be made on the results and its implications.

Conceptual framework

It is already a widely acknowledged fact that government support is important to boosting the rate of entrepreneurship formation. This is the key reason why governments have been investing hugely in programmes to entice more individuals to become an entrepreneur (Heydebreck, Klofsten, and Maier 2000). Small high-technology firms are found to be very valuable to society for two reasons. Firstly, data imply that smaller organizations initiate a more than proportional share of commercially oriented innovations to the marketplace (Roberts 1980). Small firms view an invention as a significant opportunity because it allows them to enter the marketplace. On the other hand, big, recognized firms tend to see the small enterprises as a threat (Cooper and Schendel 1976). Hence, to defend their market position, big firms must take action to also innovate or to acquire the smaller firm. This implies that small firms contribute to making the marketplace more robust. Secondly, small high technology firms play an important role in creating innovative creations (Acs and Audretsch 1990). While large organizations bear the major financial duty for R&D, studies have revealed that small businesses and individual inventors have created a significant number of the key innovations in the United

Kingdom and the United States (Roberts 1980). It has been deliberated that the character and atmosphere of small firms is exceptionally proficient to encouraging major product innovations (Abernathy and Utterback 1979). There are many ways that the government could interfere to influence entrepreneurship formation rates. Dana (1993) classifies the key areas of support from the government as ease to start business (which will be described as part of institutionalisation), low or no corporate tax rate for the initial years, grants or facilities support (Dana 1993). This structure is found to be suitable in the description of the Singapore government's policies to enhance high technology entrepreneurship. I will expound briefly how the Singapore model fits this structure, which I will then use as the conceptual framework to conduct my survey for this paper. More in-depth discussion of the Singapore model against the framework has been made in the earlier paper of this dissertation (Wong 2013). The following discussion will provide the gist of such discussion and to also raise some additional views.

Institutionalisation

With a proper structure in place to start a business, and to receive supports, there will be less unknown factors of the "hows" and the "whys" on what is needed to take the business further. The routines and work process are in place and adhered to because of the accepted way of how things are done (Scott 2001). The institutional features affecting entrepreneurial efforts consist of the direct administrations of governments in forming and maintaining an environment conducive for entrepreneurship on top of societal customs toward entrepreneurship (Hwang and Powell 2005). Particularly, the intensity of entrepreneurship that forms in a society is correspondingly associated to the society's rules and guiding principles leading the distribution of rewards (Baumol, Litan, and Schramm 2009). It is found that economic expansion in the up-and-coming economies of Eastern Europe was constraint by insufficient efficient market-based institutions to guard property rights and to guarantee fair competition. Disturbed by the unproductive legal administration of agreements and property rights, entrepreneurs in such settings rely intensely

on informal rules for security (Ahlstrom, Bruton, and Lui 2000) and keenly try to conceive unorthodox governance constructs and contractual pacts (Peng 2006). Informal connections and relational governance make up the “institutional voids” as a result of inadequate official institutional infrastructure (Khanna and Palepu 1997). While such informal institutions such as establishing relations with core government officials and other administrative links (Peng and Luo 2000) can be very beneficial, these can also be costly to firms and may discourage new business growth (Huang 2008; Rajan and Zingales 1998).

Entrepreneurs require a balance of institutional restructure in place versus an overly bureaucratic environment which requires so much work and time to move to the next phase (Soto 2000). The compelling influence of the institutional setting for releasing entrepreneurship suggests that not only the mission setting was crucial but also the institutional setting which could either impel or inhibit entrepreneurship in a city (Aldrich and Waldinger 1990). At the same time, institutional setting could propagate futile activities in the manner of disadvantageous institutional entrepreneurship (Ahlstrom, Young, and Nair 2003; Rajan and Zingales 1998).

In Singapore’s case, most, if not all, of the programmes introduced by the government to boost entrepreneurship highlight that one of the prerequisites is that the entrepreneurs’ initiative should be innovative. It could be the process, IP or some technologies that has potential to be duplicated and marketed internationally. Especially since 2008, several initiatives were launched to focus on innovative business activities, with grants even being allocated for Proof-of-Concepts (POC) and Proof-of-Value (POV). In fact, SPRING Singapore set up the Technology Innovation Programme (TIP) to help SMEs develop technology innovation as a competitive strategy. All these initiatives point clearly to the fact that the Singapore government places high emphasis on the business of technology entrepreneurship.

The Singapore government has set up several programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship. Most of the support programmes are initiated in connection to SPRING Singapore. Hence, SPRING is either the direct administrator of these programmes or is the facilitator for other government agencies who will administer the grants and supports. It is the one-stop shop for start-ups to approach for various forms of assistance in their entrepreneurial endeavours, which will then work with the entrepreneurs to refer them to departments and task forces which are formed for the individual programmes. The Singapore government is very systematic and institutional in administering the various programmes.

After the initial interaction with SPRING, depending on the followed up needs of the entrepreneur, SPRING will then tie up with various other departments dedicated to various needs.

Tax support

Another type of resource support comes in the form of tax incentives.

In a research by Ernst and Young in 2012, it was found the United Kingdom was losing competitiveness as a ground for setting up business with one of the reasons where tax incentives are not adequate (Guardian 2012). In order to encourage more private equities to invest in start-ups, governments have introduced tax-based incentives to encourage private individuals or VCs to invest in the start-ups (See for example Harrison and Mason 1989).

There are some researches discussing the consequences of taxes on the availability of capital and the entrepreneur's career options (Gordon 1998; Poterba 1989a, 1989b). Poterba stressed that a reduction in the capital gains tax essentially gives confidence to entrepreneurs to form a company and, in that way, raises the demand for funds, while it will only expectedly bear an insignificant impact on the supply of funds. The works of Gompers and Lerner are predominantly in a similar direction (Gompers and Lerner 1998). Cullen and Gordon (2007) showed that tax policies have "clear effects on individual

behaviour, and together have had large effects on the amount of entrepreneurial risk taking” (Cullen and Gordon 2007).

The Singapore government has introduced various tax policies to encourage entrepreneurship. One of the interesting one is to encourage VCs to fund entrepreneurs, and the VCs in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested. This policy serves a few purposes. Firstly, it will encourage the entrance of more VCs, which will solve the issue of lack of seed funding in the market for entrepreneurs. Secondly, it will encourage VCs to participate in the entrepreneur’s new businesses to provide more guidance and support for the startup (Keuschnigg and Nielsen 2003).

SPRING also provides incentives to partners to support innovative start-ups. To encourage more investments in start-ups, SPRING launched the Angel Investors Tax Deduction Scheme June 2010. The Scheme provides tax incentives to business angels whose investments, expertise and networks can accelerate the growth of start-ups.

The other tax support given to companies involved in high value technology business activities is the Pioneer status. Under this programme, companies have to commit to a pre-determined amount of investment in high valued technology activities like R&D to enjoy the Pioneer status. This also includes employing more highly-skilled professionals while cutting down on low-skilled labour intensive productions. The duration of the tax-free Pioneer status is based on the amount of committed investments. In other words, to enjoy a longer period of tax free status, the company would have to commit to a bigger amount of investments in high value technology activities like R&D.

Grants or funding

It has been established that countries with high spending on high technologies, which includes the provision of grants and funding for high technology activities, are more conducive for attracting start-ups (Audretsch and Feldman

1996; Audretsch 1998). Governments have developed public sector venture capital funds, and support for operational expenses of private sector venture capital funds, especially those targeted at startups (For example Murray 1994). In starting a business, very often capital is required. Capital requirements dissuade new business entry in a few ways. Firstly, some complex production processes require huge cash that not many entrepreneurs can easily acquire (Bain 1956; Koch 1974). Secondly, capital requirements discourage entry of new business that have inadequate access to funding (Van Auken 1999).

In a study on individuals who have come up with business ideas but eventually did not start the new business, it is found that liquidity limitations were the most considerable impediment to actually launching the business (Van Auken 1999). The resources necessary to start a new business are conventionally beyond the ability of individual entrepreneurs (Bhave 1994) and shortage of capital might be a core factor for emerging entrepreneurs to give up the entrepreneur process (Holtz-Eakin, Joulfaian, and Rosen 1994). As a consequence, current researches have determined that lower capital requirements and improved reach to capital increases the possibility of firm establishments (Van Gelderen, Thurik, and Bosma 2005).

The comparative small number of Venture Capital (**VC**)-invested new businesses is due to the fact that VC funds characteristically sustain high transaction expenses. This limits the number of portfolio firms that VCs can most favourably assess, invest in and supervise (Gifford 1997). Business angel networks (**BAN**) frequently contribute small scale investments in startups, bring a significant value added contribution to the companies in which they invest, are geographically scattered, and frequently invest locally (in that way disseminating wealth within the regions) (Mason and Harrison 1994). Some business angels also come with relevant business background to value add strategically to the firms they invest in (Freear, Sohl, and Wetzel 1995).

In the Financial Year spanning 2009 to 2010, Spring Singapore invested over S\$10 million in 15 start-ups. This increased the total number of firms that have

received their funding support to 170. SPRING Singapore provided some \$20 million worth of assistance to start-ups through various programmes last year. The money was used to fund proof-of-concept projects, support young entrepreneurs, as well as to invest directly in innovative start-ups through the SPRING SEEDS. Since the launch of the co investment programme in 2001, more than \$63 million has been invested in 185 start-ups in various sectors. Besides funding, SPRING SEEDS Capital also helps start-ups to widen their business networks, strengthen their capabilities and access market opportunities.

To encourage youths to go into business, SPRING launched the Young Entrepreneurs Scheme for Startups (YES! Startups) in 2008. The Scheme provides youths below 26 years old with co-matching grants to start their first innovative business. Since its launch, the scheme has supported 72 start-ups with some \$3.5 million. Together, these start-ups employ about 160 people and 14 of them have gone on to secure another \$5 million worth of equity funds. The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups.

Facilities support

The national R&D spending in 2010 increased by half a billion dollars to S\$6.5 billion on a year-to-year basis in Singapore. The number of R&D researchers also increased by 6.4 percent to 28,296 for the same period. The Singapore government has set aside S\$16.1 billion between 2011 and 2015 to support R&D under its Research, Innovation and Enterprise 2015 plan. It has announced its “long-term goal of raising Singapore’s research-intensiveness by lifting R&D spending as a proportion of GDP” and to increase this ratio to “3.5 percent of GDP by 2015, placing it among the most research-countries in the world” (Ho 2011; A*STAR 2011; Lee 2011). One aspect of R&D spending would be in facilities support. Dana (1993) suggests facilities support to be that of infrastructure support. For instance, in order to support tourism

entrepreneurship for islands with no adequate roads and electricity supply, the government would supply incentives to encourage the construction of such infrastructure facilities.

It has also been shown that there is a positive correlation between entrepreneurship, innovative activity and university research especially when these business and innovative activities are within close proximities to the university (Jaffe 1989; Acs, Audretsch, and Feldman 1992). This means that the better support a higher learning institute provides for R&D administration, there is a positive relationship to more businesses being formed. Some of the reasons for this relationship are as follow (Massey, Quintas, and Wield 1992; Quintas, Wield, and Massey 1992; Westhead and Batstone 1998; Storey and Tether 1998). Firstly, closeness to research laboratories in universities and higher learning institutes will provide new ventures with more convenient reach to scientific expertise and research findings. This will help to make the process of commercialization of new venture's R&D findings more efficient.¹⁸ Secondly, by having a technology incubator in close proximity, academic researchers are better able to make use of knowledge-based business ideas, thereby lowering the barriers that hold back direct commercial application of the results of university research.¹⁹

One of the most obvious infrastructural supports for high technology entrepreneurial activities would be incubators and science parks (Rothaermel and Thursby 2005). In order to increase the chances of generating a profitable business, the technopreneur has to undertake a concerted evaluation that the endeavour can be enhanced or improved upon and that either the product of the business itself can be liquidated with profitability in a foreseeable and intended future (Bell, Crick, and Young 2004). As such, it is imperative that the

¹⁸ This is only true to parks that, in addition to university research laboratories, are able to attract other knowledge intensive organizations, such as the research laboratories of established firms not otherwise connected with the park.

¹⁹ Again, this argument will only be applicable for parks that develop a close concerted connection with an academic institution.

technopreneur has access to suitable and effective facilities support for the purpose of their business development requirement. Business incubator can also offer a fostering environment for nascent firms and, as a result, resulting in later furtherance of development-centric businesses (Cooper 1985; Dana 1993).

On top of this, public and corporate investments in R&D play a part to the complexity and level of technological ability in a country (Audretsch and Acs 1994). Coupled with knowledge externalities among the participants of R&D activities in universities and laboratories, such investments amplify the reserves of technology capital in an economy, generating new opportunities for new business creation.

In gist, the positive association between the supply of facilities and the number of technopreneur-based start-ups has been time after time established (Lockett and Wright 2005; O'Shea et al. 2005; Powers and McDougall 2005).

The EDB, Spring Singapore, A*STAR and NRF are some of the key individual drivers to provide targeted and extensive incubator services in Singapore to boost technopreneurship. The Incubator Development Programme (IDP) was launched in 2009 to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment. Ten incubators and venture accelerators are supported under the IDP. Since its launch, about 250 start-ups have benefited from the services of these incubators and venture accelerators (Tan 2011).

The NRF has also taken massive actions to enhance incubator services in Singapore to encourage technopreneurship. In 2008, the Research, Innovation and Enterprise Council committed to investing S\$350 million for the National Framework for Innovation and Enterprise (or NFIE)'s initiatives to boost

technopreneurship and commercialization of their efforts (NRF 2008a). In the following year, the NRF budgeted S\$50 million from this S\$350 million to attract technology incubators to strengthen innovation and entrepreneurship in Singapore (NRF 2009). By 2012, a total of fifteen incubators were selected by NRF to “mentor high tech start-ups in Singapore” (NRF 2012a).

Conceptual Framework

Based on the above brief literature review and concise description of Singapore’s support programs, the following conceptual framework is derived. The purpose is to find out firstly, how important these programs are in encouraging entrepreneurship; secondly, to what extent has it been benefited by entrepreneurs. The methodology will be explained below. These two questions will be asked for the following four types of support, namely (i) institutionalisation; (ii) tax incentives; (iii) grants or funds; (iv) facility support. Table 3-1 below forms the summary of the framework based on the type of support, accompanied by the description of some of the key supports from each type of support.

Type of support	Description
1 Institutionalisation	<p>The Singapore government encourages high technology activities by giving grants like Proof of Concept (POC) and Proof of Value (POV) and institutional settings like Technology Innovation Programme (TIP).</p> <p>The Singapore government has set up many programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship, mostly initiated via SPRING Singapore. When they first approach SPRING Singapore, they will be referred to the Entrepreneurship Development department. Based on the needs of the entrepreneur or investor who wants to participate in programmes to help entrepreneurs and hence enjoy incentives, they will</p>

	be referred to the respective relevant programmes, which might include other departments like IE Singapore, A*Star, JTC etc.
2 Tax	<p>Government has introduced various tax policies to encourage entrepreneurship, as discussed earlier. One of the interesting one is to encourage VCs and angel investors to fund entrepreneurs, and the VCs and angel investors in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested.</p> <p>Pioneer status allows high technology companies to enjoy tax-free status in Singapore for a determined period. This is useful to encourage formation of high tech startups.</p>
3 Grants or funds	<p>Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. Having investors who are industry players to co-fund startups with the government will not only solve funding issues but also provide industry experience to help startups have higher success rates.</p> <p>The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. In 2010, TECS supported 23 start-ups with more than \$8 million. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups.</p>
4 Facility support	<p>The Incubator Development Programme (IDP) and National Framework for Innovation and Enterprise (or NFIE) was launched to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment.</p>

Table 3-1: Conceptual framework of Singapore government support programmes to enhance entrepreneurship

Research methodology

This paper seeks to test the perceived importance of the various areas of government support on the basis of the conceptual framework built. This will be done using the survey method. The relevance and applicability of this survey method has been widely elucidated (Pervan and Klass 1992).

Respondents:

Survey target respondents are entirely business owners or representatives of business owners which have bases in Singapore selected from ASME 1000, Small Manufacturer Association, or companies who have joined incubator programmes in Singapore. The three main incubator support programmes by the government are Technology Incubator Scheme, I.Jam reload and the Incubator Development Programme (IDP). Within the website of each of these programmes, the incubators are listed together with their contact details. Within the website of each of these incubators, the incubates participating in the respective incubators are listed. Hence, most of the contact information of these start-ups incubates can be gathered online. The ASME 1000 is a list endorsed by the Singapore government on the most outstanding SMEs with Singapore presence.

Sample size:

I filtered the entire company listing to identify industries that have elements of science and technology in their business according to the definition of the Singapore government (A*STAR 2011).²⁰ Since the entire list has been pre-qualified to possess elements of science and technology in their business, from the overall list, I randomly selected 355 eligible companies from the target survey group. The number 355 was chosen with reference to other studies of

²⁰ This includes natural sciences, engineering and technology, biomedical and related sciences, agricultural and food sciences.

similar nature. For instance, Colombo and Delmastro (2002) started the survey by choosing 232 targets and to eventually be left with only 45 survey-completed respondents (Colombo and Delmastro 2002). Mian (1994) tested US university-sponsored incubators by surveying 150 samples (Mian 1994). Westhead et al (2000) surveyed 284 samples to study the efficacy of technology-based firms located in Science Park (Westhead, Batstone, and Martin 2000). I then searched for the emails and contact numbers for all these 355 companies online.²¹ 82 companies either did not have their own website, or did not have a published email. As such, my target respondent group is reduced to 273.

Data collection:

I keyed in my questions and sent an email to all 273 targets with a link to the survey followed by telephone calls to the targets. I explained that there are only eight questions, and that the process will take no more than ten minutes to complete. I also provided a one week deadline. Knowing the typical procrastination of recipients, I sent a follow-up email to all 273 targets after one day to seek their help to complete the survey followed by another call²². This eventually provided me with a 68 percent response rate (189 respondents) out of the 273 targets.

Out of the respondents, 73 (38.6 percent) had previously received some form(s) of assistance from government programs.

Questionnaire:

The survey is designed in a way to derive two messages. After the phenomenon is described, based on the above-constructed conceptual

²¹ I had no access to any databases that would conveniently provide me with the contact details of these target respondents. Furthermore, as mentioned in the above footnote, many of the contact details of these selected target companies could be found online as long as they have a website.

²² My objective was to fill up as much survey form as possible.

framework, respondents are first asked how strongly they agree or disagree, based on their experience or perception, with the phenomenon on its ability to encourage high technology entrepreneurship formation. Secondly, respondents are then asked, once again based on their experience or perception, how far they think entrepreneurs are getting such support.

The scores are also matched to compare the usefulness score to encourage entrepreneurship of a particular support against the actual or perceived intensity of the support by entrepreneurs. A perfect match is 100 percent. This implies that what the entrepreneur is receiving matches what is perceived to be useful to encourage entrepreneurship. This means that the resources and efforts put in by the government is optimal to attracting entrepreneurship. A score greatly exceeding 100 percent will mean too much resources or efforts put in to a programme that is not deemed correspondingly important to enhance entrepreneurship. A score greatly below 100 percent will mean too little resources or efforts put in to a programme that is deemed important to enhance entrepreneurship. In other words, not all programs need to be graded scores of 5 to be deemed good match. Some programs might not be deemed important at all to attract entrepreneurship. As such, the corresponding resources or efforts to provide such programs to entrepreneurs would not need to be too high a level.

Survey response is in the form of Likert Scale, which allows respondents to express their extent of agreement or disagreement of a particular statement (Burns and Burns 2008). A score of 1 is strongly disagree while on the other end of the spectrum, a score of 5 is strongly agree with the proposition. A score of 3 represents neutrality, i.e., respondent neither agrees nor disagree.

A sample of the survey is found in Appendix 2.

Results

In terms of the Singapore government trying to encourage high technology activities by providing grants like Proof of Concept (POC) and Proof of Value

(POV) and also through institutional settings like Technology Innovation Programme (TIP), respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 4 out of 5. A total of 145 respondents (76.72 percent) graded it 4 or higher. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave it a mean score of 3.02. The largest number of 86 respondents (45.50 percent) gave it a neutral score of 3. The percentage of respondents who were either on the agreeing side or disagreeing side were close at 26.98 percent and 27.52 percent respectively. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of this support, the score is 76 percent.

The Singapore government has set up an institutionalized system in a systematic manner to assist the efforts of start-ups and entrepreneurship, mostly initiated or administered via SPRING Singapore. Based on the needs of the entrepreneur or investor who wants to participate in programmes to help entrepreneurs and hence enjoy incentives, SPRING will refer them to the respective relevant programmes, which might include other departments like IE Singapore, A*Star, JTC etc. Respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 3.33. The number of respondents giving it s score of 3 and 4 were close at 66 (34.92 percent) and 68 (35.98 percent) respectively. The summation of the respondents who gave agreeable scores of 4 or 5 was higher than the disagreeable scores of 1 and 2 at 45.5 percent agreeable versus 19.58 percent. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave it a mean score of 2.48. The largest number of 75 respondents (39.68 percent) gave it a disagreeable score of 2. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of this support, the score is 75 percent.

Government has introduced various tax policies to encourage entrepreneurship, as discussed earlier. One of the interesting one is to

encourage VCs and angel investors to fund entrepreneurs, and the VCs and angel investors in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested. Respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 3.51. More than half of the respondents (50.8 percent) gave it an agreeable score of 4 or 5. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave it a mean score of 3.33. The largest number of 87 respondents (46.03 percent) gave it an agreeable score of 4. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of this support, the score is 95 percent.

Pioneer status allows high technology companies to enjoy tax-free status in Singapore for a determined period. This is useful to encourage formation of high tech start-ups. Respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 4.00. Nearly half of the respondents (49.74 percent) gave it a strongly-agree score of 5. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave it a mean score of 3.00. The largest number of 111 respondents (58.73 percent) gave it a neutral score of 3. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of this support, the score is 75 percent.

Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. Having investors who are industry players to co-fund startups with the government will not only solve funding issues but also provide industry experience to help startups have higher success rates. SPRING Singapore provided some \$20 million worth of assistance to start-ups through various programmes last year. Respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 3.17. More than half of the respondents (51.32 percent) gave it a neutral score. On the other hand, respondents who

deem entrepreneurs as actually receiving such support gave it a mean score of 3.00. The largest number of 130 respondents (68.78 percent) gave it a neutral score of 3. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of this support, the score is 95 percent.

The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. In 2010, TECS supported 23 start-ups with more than \$8 million. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups. Respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 3.83. More than half of the respondents (64.55 percent) gave it an agreeable score of 4 or 5. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave it a mean score of 3.67. The largest number of 107 respondents (56.61 percent) gave it a neutral score of 3. There were no respondents giving it a disagreeable score. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of this support, the score is 96 percent.

The Incubator Development Programme (IDP) and National Framework for Innovation and Enterprise (or NFIE) was launched to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment. Respondents who deem this as being able to positively influence individuals to start a company gave it a mean score of 3.83. More than half of the respondents (66.66 percent) gave it an agreeable score. There were no respondents with disagreeable scores. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave it a mean score of 3.67. Nearly half of respondents (47.62 percent) gave it an agreeable score of 4. In terms of matching of expectation between what entrepreneurs actually

received or were perceived to actually receive versus the importance of this support, the score is 87 percent.

On an overall basis, the mean score for all the questions put together for respondents who deem this as being able to positively influence individuals to start a company was 3.67. On the other hand, respondents who deem entrepreneurs as actually receiving such support gave a mean score of 3.12 on an overall basis. In terms of matching of expectation between what entrepreneurs actually received or were perceived to actually receive versus the importance of these supports, the score is a relative high of 85 percent.

	In your perception, if you are an individual who is interested to start a company, the existence of this particular support would be influential in convincing you to start the company (importance).			Based on your own experience or perception or what you understand, entrepreneurs actually receive support from this particular programme (receipt).			Receipt vs importance
	Mean (A)	Std Dev	Med	Mean (B)	Std Dev	Med	B/A (%)
The Singapore government encourages high technology activities by giving grants like POC and POV and institutional settings like TIP.	4.00	0.73	4.00	3.02	0.85	3.00	76%
The Singapore government has set up many programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship, mostly initiated via SPRING Singapore.	3.33	0.96	3.00	2.48	1.03	2.00	74%
Government has introduced various tax policies to encourage entrepreneurship. One of the interesting one is to encourage VCs to fund entrepreneurs, and the VCs in turn gets	3.51	0.89	4.00	3.33	0.69	3.00	95%

incentives by reducing their taxable income by the amount equivalent to what they invested.							
Pioneer status allows high technology companies to enjoy tax-free status in Singapore for a determined period.	4.00	1.15	4.00	3.00	0.91	3.00	75%
Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. Having investors who are industry players to co-fund startups will provide industry experience to help startups have higher success rates.	3.17	0.68	3.00	3.00	0.57	3.00	95%
The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups.	3.83	0.92	4.00	3.67	0.84	3.00	96%
The Incubator Development Programme (IDP) and National Framework for Innovation and Enterprise (or NFIE) was launched to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment.	3.83	0.69	4.00	3.33	0.71	3.00	87%
Average	3.67			3.12			85%

Table 3-2: Results of survey for all respondents

Out of these 189 respondents, 73 (or 38.62 percent) had been recipients of some forms of assistance from the government programmes.

This essay goes a step further to analyze the difference in response of the group that received some forms of government assistance (hereinafter conveniently referred to as “**Group A**” in this essay) versus those that did not (hereinafter conveniently referred to as “**Group B**” in this essay).

In terms of the perception that the existence of the particular supports would be influential in convincing them to start a company, Group A’s aggregate mean score was 3.77 versus Group B’s 3.60. Group A have a higher opinion of the usefulness of government supports to encourage start-ups versus Group B. The particular support that had the biggest difference in opinion of usefulness between the two groups is where VCs fund entrepreneurs while VCs in turn get tax deduction with a mean score of 3.97 versus 3.22 or a ratio of 1.24. On the other hand, the particular support that had the smallest difference in opinion of usefulness between the two groups is that of Pioneer Status where Group A gave an average score of 4.01 while Group B was 3.99. Interestingly, Group B had a better opinion of the usefulness of the institutional systematic support given by the government with a mean score of 3.38 versus Group A’s 3.25.

In terms of the experience or perception that entrepreneurs actually receive particular supports, Group A gave an aggregate mean score of 3.30 versus Group B’s 3.01. This means that both groups were relatively neutral to whether entrepreneurs actually receive supports. The particular support that had the biggest difference in opinion of entrepreneurs actually receiving support is the institutional systematic support given by the government with Group A giving a score of 3.07 and Group B 2.11. The two programmes that receive the most similar opinions were government grants in the likes of POC, POV and TIP and also incubator support. The former had a mean score of 3.01

from Group A and 3.03 from Group B. The latter had a mean score of 3.34 from Group A and 3.33 from Group B.

Next, the match between what entrepreneurs receive versus what they would have hoped to receive to become entrepreneurs is examined.

For Group A, for the various types of support, the Technology Enterprise Commercialisation Scheme (TECS) which helps start-ups commercialise new technologies received the highest score of 104 percent. The POC, POV and TIP grants, on the other hand, received the lowest score of 71 percent.

For Group B, the Government's tax incentives to VCs to fund ventures received the highest matching score of 98 percent. The institutional systematic assistance to start-ups received the lowest score of 63 percent.

The results will be discussed in the next section.

	In your perception, if you are an individual who is interested to start a company, the existence of this particular support would be influential in convincing you to start the company (importance).			Based on your own experience or perception or what you understand, entrepreneurs actually receive support from this particular programme (receipt).			Receipt vs importance
	Mean (A)	Std Dev	Med	Mean (B)	Std Dev	Med	B/A (%)
The Singapore government encourages high technology activities by giving grants like POC and POV and institutional settings like TIP.	4.23	0.66	4.00	3.01	0.77	3.00	71%
The Singapore government has set up many programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship, mostly initiated via SPRING Singapore.	3.25	1.00	3.00	3.07	1.06	3.00	95%

Government has introduced various tax policies to encourage entrepreneurship. One of the interesting one is to encourage VCs to fund entrepreneurs, and the VCs in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested.	3.97	0.67	4.00	3.60	0.55	4.00	91%
Pioneer status allows high technology companies to enjoy tax-free status in Singapore for a determined period.	4.01	1.16	5.00	2.93	0.99	3.00	73%
Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. Having investors who are industry players to co-fund startups will provide industry experience to help startups have higher success rates.	3.22	0.63	3.00	2.99	0.54	3.00	93%
The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups.	3.96	0.87	4.00	4.14	0.80	4.00	104%
The Incubator Development Programme (IDP) and National Framework for Innovation and Enterprise (or NFIE) was launched to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation,	3.78	0.65	4.00	3.34	0.71	3.00	88%

mentorship, technology advice, access to financing and markets, and shared business services and equipment.							
Average	3.77			3.30			88%

Table 3-3: Results of survey for Group A

	In your perception, if you are an individual who is interested to start a company, the existence of this particular support would be influential in convincing you to start the company (importance).			Based on your own experience or perception or what you understand, entrepreneurs actually receive support from this particular programme (receipt).			Receipt vs importance
	Mean (A)	Std Dev	Med	Mean (B)	Std Dev	Med	B/A (%)
The Singapore government encourages high technology activities by giving grants like POC and POV and institutional settings like TIP.	3.85	0.74	4.00	3.03	0.90	3.00	79%
The Singapore government has set up many programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship, mostly initiated via SPRING Singapore.	3.38	0.93	3.00	2.11	0.83	2.00	63%
Government has introduced various tax policies to encourage entrepreneurship. One of the interesting one is to encourage VCs to fund entrepreneurs, and the VCs in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested.	3.22	0.88	3.00	3.16	0.72	3.00	98%
Pioneer status allows high technology companies to enjoy tax-free status in Singapore for a determined period.	3.99	1.15	4.00	3.04	0.86	3.00	76%

Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. Having investors who are industry players to co-fund startups will provide industry experience to help startups have higher success rates.	3.14	0.71	3.00	3.01	0.60	3.00	96%
The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups.	3.75	0.95	4.00	3.38	0.72	3.00	90%
The Incubator Development Programme (IDP) and National Framework for Innovation and Enterprise (or NFIE) was launched to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment.	3.86	0.71	4.00	3.33	0.72	3.00	86%
Average	3.60			3.01			84%

Table 3-4: Results of survey for Group B

Discussion of theoretical and policy inferences of results

On an overall basis, the matching intensity between the deemed importance of policies versus the extent of such support received by entrepreneurs is fairly

high at 85 percent, based on the given framework. This means that, from entrepreneurs' perspectives, the support that the Singapore government is offering currently has close proximity between the deemed importance and the extent offered.

Of all the variables, the TECS support received the highest matching score of 96 percent. The deemed importance was 3.83 while the deemed effectiveness was 3.67. This shows that they feel that this support is only slightly positive in its ability to influence individuals into entrepreneurship. In comparison, the deemed effectiveness was also only marginally nearer to 'Agree' over 'Neutral'. As such, the spending of \$28 million hitherto on what is deemed as marginally important might seem too much. On the other hand, the TECS is not meant for the mass type of entrepreneurship. From the records, only 75 start-ups have received supports in one way or another from the TECS programme of \$28 million. This demonstrates that either not many entrepreneurs have applied for the TECS, or they do not meet the requirement. If it is the former reason, then more marketing has to be done to reach out to the target group. If it is the latter reason, then the amount of spending in TECS should be independent of the mass entrepreneurs' opinions and grading, since it will not be meant for the masses. It will be useful for the administration body of the TECS to articulate with more clarity the target beneficiaries of this programme in order to maximize the impact for this programme.

The two variables that are deemed most important (both with scores of 4) are government grants like POV and POC and also the Pioneer tax incentive. The former is the issuance of grants for the implementation of business concepts. The government does not take any stakes in the business. This is a very attractive support as there are "no strings attached" except that the business concept has to be first approved. While deemed important, the programme received a neutral score of 3.02 in its effectiveness in reaching out to entrepreneurs. This is considerably a positive observation. Some entrepreneurs I spoke to commented negatively about how such supports only reach a niche group, while the rest never gain approval. Hence, the matching

score of 76 percent, while not exceedingly high, demonstrates effective implementation of the programme. Similarly, the Pioneer tax incentive allows recipients to remain tax-free for a stipulated number of years as long as it fulfils certain expenditure criteria. For companies that have just turned profitable especially, this tax savings will be very attractive. In terms of effectiveness, the score is similarly at 3 with effectiveness of 75 percent. Since these two programmes are deemed with such high importance in influencing one's decision towards entrepreneurship, the Singapore government might want to consider using some resources from other deemed-less important programmes to enhance the offering from these two programmes. One example would be the co-funding programmes, which received only 3.17 in importance. While still positive, the level of importance is deemed much lower compared to other programmes. By channelling resources appropriately, this will allow a greater reach out to entrepreneurs, if the objective of the government is as such.

The item that received the lowest score of 2.48 was the perceived actual receipt of support by entrepreneurs from the institutional services. This means entrepreneurs do not feel they are getting sufficient support from such a channel of mechanism. One of the key reasons is that, with institutionalization, certain responsibilities of the agencies get mixed up. For example, one digital media firm feedback that when they tried to apply for approval to place advertising media platform on the outdoor railway tracks in Singapore, the operator (SMRT) directed them to seek clearance from Land Transport Authority (LTA) as LTA owns the jurisdiction to the train system. However, when the media company approached LTA, they were directed to first seek Urban Redevelopment Authority (URA) approval as it involves landscaping issue. URA refused to approve as they wanted to first see Building Construction Authority's approval (BCA) as the railway track was considered a structure that falls under the description of building. BCA directed them to Singapore Land Authority (SLA) as the "building" was located on top of a land. When they finally reached SLA, they were told that LTA has to give the first

approval before they are willing to do so. This one round process took more than three months to complete as each department took a while to respond. It repeated two more rounds before the media company gave up on this initiative.

When the respondents are broken down into two groups of those who received support versus those who did not received support, some interesting results were revealed.

In terms of the perception that the existence of the particular supports would be influential in convincing them to start a company, both groups were prone towards agreeing that supports are useful to encourage entrepreneurship. When it comes to the support where VCs funding entrepreneurs could get tax breaks, Group B's views differed the most to Group A compared to the other supports. One of the possible reasons is that Group B is sceptical that VCs will be willing to take the risk of losing money in start-ups, assuming the theory that start-ups have high failure rates is true, even though they get tax breaks in return. To Group B, this idea may be remote as they would probably seldom come into contact with VCs and are more self-dependant in building their own business. On the other hand, both groups are of the opinion that Pioneer Status is useful to encourage entrepreneurship. Even though both supports are related to tax breaks, the latter is a direct tax advantage to the entrepreneur while the former allows VCs to enjoy the tax breaks while helping start-ups. Hence, the former's concept may be too remote to be deemed meaningful.

In terms of the experience or perception that entrepreneurs actually receive particular supports, both groups were relatively neutral to whether entrepreneurs actually receive supports. This is likely due to human tendencies to always expect more support from the government. Hence, whatever support received might be acknowledged, but the sufficiency would always be questioned. The particular support that had the biggest difference in opinion of entrepreneurs actually receiving support is the institutional systematic support given by the government. While Group A is neutral to this notion,

Group B disagreed to the support to actually being given. This is an expected result since Group B is not a recipient of any government support, and that every entity would always like to receive grants and supports naturally. It is Group A's neutral stand that is a cause of concern as Group A is a beneficiary of some form of support, and the neutral stand indicates that whatever support they have received are still deemed insufficient. The two programmes that received the most similar opinions were government grants in the likes of POC, POV and TIP and also incubator support. In the former, both groups adopted a neutral position as to entrepreneurs actually receiving such grants. This is likely because such grants have to go through rounds of auditions and competition before finally emerging as one of the rare few to obtain the grants. Hence, both groups might not actually be or know these rare few, but are aware of the grant's existence from the government's media propaganda or networking events. As for the latter, both groups were also neutral leaning towards an agreeable score. Again, it would likely boil down to free-rider psychology where recipients of public benefits would always deem what they received to be insufficient (Elster 1985; Zywicki 2000; Marwell and Ames 1979).

When looking at the matching score, it should be noted that the closer to a score of 100 percent represents a better match.

For Group A, the best match goes to the TECS which helps start-ups commercialise new technologies. The usefulness score is 3.96 while the receipt score is 4.14. This means that while they agree this support is useful to encourage entrepreneurship, the actual receipt matches, and slightly even exceeded the usefulness. This demonstrates an over-usage of resources and efforts on the government's end in administering this support and that a slight reduction of administering this support is good. On the other hand, the POC, POV and TIP grants was deemed the worst match in this survey. The usefulness score is 4.23, but the actual receipt is only 3.01. As such, Group A agrees, and trends towards strongly agree, that this support is useful to encourage entrepreneurship. But the receipt level is at a neutral level. Hence, more could be done to allow more entrepreneurs to receive these grants.

For Group B, the best match goes to the Government's tax incentives to VCs to fund ventures received the highest matching score. The usefulness and receipt level are both near to neutral. Hence, even if the government is to enhance resources to offer more tax incentives to more VCs to fund entrepreneurship, it will unlikely have any significant effect on entrepreneurship level for Group B. The institutional systematic approach to help entrepreneurs receive help for their various needs was considered the worst match for Group B. The usefulness score is 3.38 while the receipt score is 2.11. This demonstrates that Group B deems government effort to use institutionalisation to encourage entrepreneurship is lacking and should be enhanced. One commonly heard feedback is that entrepreneurs find the amount of red tapes too tedious for them to eventually go through the whole process of support application.

The programs are implemented for the purpose of encouraging entrepreneurship, as expounded in the conceptual framework. However, not all programs will be deemed with similar effectiveness in encouraging entrepreneurship, from the view point of entrepreneurs. This is due to difference of needs, education, culture etc. For example, some programs might be implemented to encourage entrepreneurship from a third party angle, in the case of government offering tax breaks to VCs who fund entrepreneurship. Rightfully, this will attract more VCs to fund start-ups, and should encourage entrepreneurship. However, not all entrepreneurs will be enticed by this policy to start a business as they do not believe VCs will fund them and that they do not know where to find and how to convince such VCs. As the benefits of such programs are deemed too indirect, it did not receive high score in terms of usefulness to encourage entrepreneurship.

On the other hand, respondents tend to be more negative on the actual benefits received by entrepreneurs. It would likely boil down to free-rider psychology where recipients of public benefits would always deem what they received to be insufficient (Elster 1985; Zywicki 2000; Marwell and Ames 1979). This is especially so when both Groups A and B have the same negative tendencies on actual receipts. This goes to show that they believe whatever

they receive from the government will never be enough, which explains why this portion is more negative as compared to the perceived importance.

In my anecdotal interviews with individual entrepreneurs, the common feedback I received is that government is also not providing sufficient help in the most relevant area. For example, labour cost is something commonly brought up by entrepreneurs. Local employees are more expensive compared to foreign labours. However, the government's policies and rules to impose quota on foreign employment has created much inconvenience to entrepreneurs. Without the relevant manpower, entrepreneurs face challenges in operations.

There are also entrepreneurs who commented that the Singapore government's supports sound generous, but not matched by corresponding effectiveness in implementation. An example is the government's reimbursement of entrepreneurs' spending, which entrepreneurs feel is problematic as they are conscious of controlling costs. This makes them ineligible to enjoy maximum benefits from government supports (Lee 2012).

Also, some entrepreneurs have tried to apply for grants but failed. This is because they do not know how to fulfil requirements of such grants. There are professional companies providing services to apply for such grants. However, these companies typically charge entrepreneurs an upfront fee without guarantee for success in the grant application. As such, many small entrepreneurs would be put off by the idea.

These are some of the areas that are not covered within the framework as there are no such supports at this moment. The support system could, however, be improved to enhance the administration of support programs to increase entrepreneurship.

Limitations and potential future studies

Due to the limited data in this field in the Singapore context as a result of the short history of technopreneurship in Singapore, the finding may not be effectively generalized to apply to other countries. A plausible furtherance to this research would be to incorporate additional international information from such fast growth countries and regions based on certain framework. For example, this could include fastest growing countries in Asia; fastest growing countries in Southeast Asia; fastest growing countries in the world with population size similar to that of Singapore. By including data of countries based on certain frameworks, this would facilitate scholars to examine the further possibility to generalize this method and provide a better extent of liberty to extract practical policy suppositions.

It was recommended that the policy-centric method of national entrepreneurship can be additionally spelled out and examined at the regional level by reducing the extent of investigation to a clearly-defined geographic area or industry group in a huge economy like that of the US (Gilbert, Audretsch, and McDougall 2004). This will facilitate scholars to attain better quality data and therefore accomplish better measures of the different variables of the model. Better quality data would enhance the administration of the efforts to build the model and therefore bestow better background information authority to the variables.

Conclusions

This essay tested the perceived importance of support programmes implemented by the Singapore government to enhance entrepreneurship versus the perceived extent of actual benefit received by entrepreneurs. The results demonstrated that most of the programmes currently introduced by the Singapore government are deemed relatively more positive than neutral in its importance to persuading one to become an entrepreneur. On the other

hand, the deemed effectiveness of these programmes in being benefited by entrepreneurs is mediocre. As such, the matching intensity is high.

One way to interpret such high matching intensity is that the government is doing a good job in administering the programmes effectively. Another way to look at it is that the programmes introduced are not deemed important in the first place, which explains why it's easily matched. According to the observation from this current study, it will be a hybrid of both ways.

In order to improve the efficacy of support programmes, the government would need to establish more communications with entrepreneurs and individuals to find out the strategic needs to move them towards entrepreneurship. Coupled with the current strength of programme administration, government efforts to reach out to individuals to convert them to entrepreneurs would be more pervasive and effective.

This analysis of how policy can offer reasonable clarifications for the variance in new business establishments over time in Singapore is harmonious to the current theories of national entrepreneurship. This essay is a continuation of in-progress studies on entrepreneurship by presenting substantiation that entrepreneurial policy issues that adjust over time can considerably influence the discrepancies in entrepreneurial strength. It is supposed that this current method adopted in this essay is possibly worthwhile to the government on the search for a more optimal framework for having a more holistic knowledge on how to speed up entrepreneurship within a country via support programmes. As an illustration, the magnitude of this essay's discovery with respect to the associations between policy issues (in the various aspects of support programmes administration) and entrepreneurial strength positions the responsibility of government exactly in the heart of the entrepreneurship start-ups dynamic.

Appendix 3: Survey questionnaire

Please answer the following two questions based on the following seven scenarios.

1. In your perception, if you are an individual who is interested to start a company, the existence of this particular support would be influential in convincing you to start the company.	1	2	3	4	5
2. Based on your own experience or perception or what you understand, entrepreneurs actually receive support from this particular programme.	1	2	3	4	5

The scale is represented as follow:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Scenarios:

1. High technology institutionalisation
 - a. The Singapore government encourages high technology activities by giving grants like Proof of Concept (POC) and Proof of Value (POV) and institutional settings like Technology Innovation Programme (TIP).
 - b. The Singapore government has set up many programmes in a systematic manner to assist the efforts of start-ups and entrepreneurship, mostly initiated via SPRING Singapore. When they first approach SPRING Singapore, they will be referred to the Entrepreneurship Development department. Based on the needs of the entrepreneur or investor who wants to participate in programmes to help entrepreneurs and hence enjoy incentives, they will be referred to the respective relevant programmes, which might include other departments like IE Singapore, A*Star, JTC etc.
2. Tax incentives

- a. Government has introduced various tax policies to encourage entrepreneurship, as discussed earlier. One of the interesting one is to encourage VCs and angel investors to fund entrepreneurs, and the VCs and angel investors in turn gets incentives by reducing their taxable income by the amount equivalent to what they invested.
- b. Pioneer status allows high technology companies to enjoy tax-free status in Singapore for a determined period. This is useful to encourage formation of high tech startups.

3. Grants / funding

- a. Many of the entrepreneurial programs in Singapore seek to involve industry players to co-fund these entrepreneurs' start-up businesses. Having investors who are industry players to co-fund startups with the government will not only solve funding issues but also provide industry experience to help startups have higher success rates. SPRING Singapore provided some \$20 million worth of assistance to start-ups through various programmes last year.
- b. The Technology Enterprise Commercialisation Scheme (TECS) helps start-ups commercialise new technologies. In 2010, TECS supported 23 start-ups with more than \$8 million. Since its launch in 2008, TECS has provided \$28 million to support 75 start-ups.

4. Facilities support

- a. The Incubator Development Programme (IDP) and National Framework for Innovation and Enterprise (or NFIE) was launched to support full suite incubators and venture accelerators in nurturing innovative start-ups in their formative stages. These partners provide start-ups with critical resources and services, such as incubation, mentorship, technology advice, access to financing and markets, and shared business services and equipment.

5. Personal questions

- a. Are you currently a beneficiary of any of the above-mentioned programmes?

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