

Education Change and Economic Development: The Case of Singapore

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Introduction

On 9 August 1965 Singapore was added to the world's list of sovereign and independent nations. Singapore's then nominal GDP per capita was around US\$500. It had no natural resources, no hinterland, no industry and depended on the outside world not just for trade, food and energy, but even for water. At that point of time, the question in the minds of many international observers was "Can Singapore survive?" Fifty years later, in 2016, Singapore's GDP per capita was about US\$56,000, close with that of Germany and the United States. This time, the question in the minds of many international observers is "How did the small island state do it?" One can attribute it to the government leaders and bureaucrats, particularly the economic planners and strategists, who brainstormed to produce the growth developmental blueprints, and that quality human resources are needed to translate these plans effectively. But quality human resources are developed through quality education. Hence, the critical role of education in the economic transformation of Singapore.

This short paper adopts a chorological approach towards narrating how Singapore's school education system is being transformed as the nation goes through its phases of economic development. In this way, readers will be able

to appreciate why and how education change serves to support the country's economic growth. It is divided into three main parts. The first summarizes Singapore's education change in response to the changing economic landscape from the 1960s to 1980s. The second part covers the period since the start of the 1990s when Singapore's education went through an exciting phase of change. The final part focuses on the new millennium – how Singapore planners mapped out the education strategies to develop the knowledge and skills of the people to face the challenges of the future. Singapore's economic success since independence in 1965 owes much to its leaders' ability to establish, through the education system, a close link between policies for skills formation and the demand for skills at each stage of economic development.

Economic Survival and Take-off, 1960s-1980s

A voluminous literature had been produced on the rise of Japan and the so-called Asian dragons – South Korea, Hong Kong, Taiwan and Singapore – in the 1970s and 1980s and how the “dragons” learned from Japan's economic transformation in a “flying geese” formation, with Japan at the front of the flying pack.¹ Writing in 1991, Ezra Vogel attributed their rise to the fortuitous

¹ The phase “flying geese pattern of development” was coined originally by Kaname Akamatsu in 1930s articles in Japanese. The late Saburo Okita (1914-1993), well-known Japanese economist and a foreign minister in the 1980s, greatly contributed to introducing the “Flying Geese” (FG) pattern of development to the wider audiences including the political and business world. Thus, the regional transmission of FG industrialization, driven by the catching-up process through diversification/rationalization of industries, has become famous as an engine of Asian economic growth

“situational factors”, which he described as U.S. aid, the destruction of the old order, a sense of political and economic urgency, an eager and plentiful labour force, and familiarity with the Japan model, and the Neo Confucianism-based social institutions that accompany their industrialization, including the reverence for education.² For Singapore, despite the war-time atrocities committed by the Japanese Imperial Army, the late Lee Kuan Yew, Singapore’s first Prime Minister, had deep admiration at the way the Japanese created their industrialised society through adoption and creative adaptation of Western technology. From 1970s to the 1980s, much of the Japanese investments went into the electronics and petrochemical industry cluster. Several industrial training centres were built and supported by Japan (and Germany) during the 1970s.

The crucial question facing Singapore’s survival in August 1965 was - How to produce a viable and expanding industrialisation programme in the shortest possible time? Singapore had inherited a colonial economy geared to an imperial system and dependent on entrepot trade, with little industry, some banking and commerce. Its political leaders of the People’s Action Party (PAP) and led by Lee Kuan Yew as the Prime Minister, reckoned that only government-led industrialisation based on export-orientation could ensure future economic development. Such a development strategy was made all the more necessary with the announcement by the British Government in 1967 of the intended military pull-out of British forces stationed in Singapore. Essentially, Singapore’s export-orientation industrialization (EOI) programme in the late 1960s and the 1970s had the primary objective of providing jobs for the people

² Ezra Vogel, *The Four Little Dragons: The Spread of Industrialisation in East Asia* (Cambridge, Massachusetts: Harvard University Press, 1992), Chapter 5.

and capitalised on the country's comparatively low-cost and disciplined labour force.

Lee and his chief economic wizard, Goh Keng Swee, then Deputy Prime Minister had the foresight of attracting foreign multinationals (MNCs) to set up shops in Singapore. The MNCs were seen as critical channels through which Singapore could acquire the latest in managerial and technological knowledge. Foreign technology became an effective means to overcome domestic limitations, such as the lack of an indigenous technological base. Due to the country's extremely positive attitude towards foreign investment and the wide range of attractive incentives to MNCs, Singapore became a favourite site, particularly for U.S. investors. In 1966, foreign direct investment (FDI) in Singapore's manufacturing sector amounted to \$239 million. As a result of aggressive promotion on the part of the Government through a range of tax and investment incentives, the figure increased to \$1,575 million in 1971 and \$6,349 million in 1979 respectively.³ By the early 1990s, the East Asian Newly-Industrialising Economies (NIEs) - South Korea, Taiwan, Hong Kong and Singapore - had graduated into major exporters of more mature consumer products in microelectronics, computers and telecommunication equipment.

The success of Singapore's EOI strategy in the late 1960s and 1970s was dependent to a large extent on adopting modern science and technology to catch up with the more advanced countries. But the task of closing the technological gap was easier said than done. British colonial rule had not produced the desired development in technical and vocational education.⁴ There was a severe

³ Economic Development Board, *Annual Report, 1972 and 1980*.

⁴ Goh Chor Boon, *Technology and Entrepot Colonialism in Singapore, 1819 – 1940* (Singapore: Institute of Southeast Asian Studies, 2013), Chapter 8.

shortage of local expertise in the field of science and technology. In 1970, it was estimated that Singapore would remain short of about 450 to 500 engineers each year over the period 1970 to 1975 - despite the government's effort to increase the annual output of engineers from the then University of Singapore from 80 to 210 by 1974.⁵ The shortage of management personnel and technicians was equally worrisome, the former by about 200 a year over the next three years and the latter by as many as 1,500 to 2,000 each year over the next two years.⁶

In the late 1970s, it became clear that as countries in Southeast Asia began to compete effectively for foreign investments in low-skilled, labour-intensive industries, Singapore's previous comparative advantage in labour-intensive manufactured products was gradually being eroded. The economic planners now launched an economic restructuring strategy to shift from low-skilled, labour-intensive to technology-led, capital-intensive industrialization. The government had assumed a crucial role in raising the Singapore worker's knowledge and skills to accelerate industrial restructuring. A new education system was needed.

During the "survival-driven" phase of education change in the 1960s and 1970s, the priority was to create jobs, so that the people and the country could survive. The strategy was to expand quickly the accessibility to primary education for all Singaporeans. This would at least create a young labor force with basic education to support the labor-intensive factories provided for by largely foreign companies. Besides, rapid construction of schools and recruitment of teachers would also provide employment opportunities. However, up to the 1970s, while the rapid construction of schools and training cohorts of

⁵ Goh Keng Swee, *The Economics of Modernization* (Singapore: Asia Pacific Press, 1972), p. 273.

⁶ *Ibid.*, p. 274.

teachers resulted in universal primary education, high enrolment in secondary education and an emphasis on science and mathematics, the Singapore education system lacked quality, including a poor perception of teaching as a profession. There was high education wastage.

In 1978, a team of system engineers was tasked to conduct a systemic review of the education system and to recommend a series of changes. It marked the start of the “efficiency-driven” phase of education change in Singapore. The primary objective was to reduce education wastage and to increase the efficiency in the education system. In June 1979, Lee himself led a high-level Singapore mission to Britain to look into ways of tapping British expertise to beef up Singapore’s education system. High on the agenda was the recruitment of English language teachers. Lee believed that a large pool of English language teachers and curriculum development specialists would lead to improvement in teaching standards. At the societal level, the use of the English language as a working language also bridges generation gaps and enhances national survival. Lee explained: “One of the things we did which we knew would call for a big price was to switch from our own languages into English. We have Chinese, Malay, Indian schools – separate language medium schools. The British ran a small English school sector to produce clerks, storekeepers, teachers for the British. Had we chosen Chinese, which was our majority language, we would have perished, economically and politically”.⁷

In January 1979, a New Education System (NES) was introduced in alignment with the government’s strategy for economic restructuring and sustainable growth. Under the NES, the education system was revamped to make it more efficient. The government maintained a bilingual language

⁷ Interview with the *New York Times*, 24 August 2007 in Singapore

policy in schools and provided three streams of instruction at both primary and secondary levels. Instructional and curriculum standards were raised through the centralization of writing of instructional materials and textbooks. The Curriculum Institute of Singapore (CDIS) was set up in June 1980 to produce teaching materials of high quality which included textbooks and multi-media teaching materials. In short, the underlying philosophy of the education system was to let pupils progress at a pace suited to their individual abilities. Its aim was to enable each child to go as far as possible in his or her schooling career, thereby giving everyone the best possible educational foundation for subsequent training and employment. By reducing dropouts, the NES achieved its objective of cutting educational wastage in the education system.

Economic Development in the 1990s and the “Thinking Schools, Learning Nation” Vision

Increasing regional and international competition motivated Singapore’s leaders in the 1990s to initiate “The Next Lap” – a vision for economic development that would propel the city-state to be in the league of the industrial economies and to attain the same standard of living as the Swiss by 2020.⁸ To achieve this objective, the economic policy of the Economic Development Board (EDB) continued to be pro-MNCs but attracting only those that were able to invest in industrial clusters that were deemed to provide the next wave of economic expansion. Local companies were encouraged to move out into the Asia-Pacific to tap on cheaper production resources and to place Singapore in

⁸ Government of Singapore, *Singapore: The Next Lap* (Singapore: Times Editions, 1991).

the centre of the region's drive for economic growth. Clearly, the shift was from "Singapore Incorporated" to "Singapore International Incorporated".

In order to achieve the ambitious nation-building goals of the new millennium, Singapore's education system was comprehensively reviewed and revamped. In 1997, the foundation of Singapore's high-performing education system was laid with the implementation of the milestone initiative – the "Thinking Schools, Learning Nation" (TSLN) vision. It encapsulated an ability-driven approach with a focus on innovation, creativity and entrepreneurship, technological literacy and 21st century competencies. Hitherto, the education system had produced a stereotyped Singapore student, commonly seen as one who lacks several important qualities essential for scientific and technological innovativeness. These include a broad based knowledge of the world, an eagerness and inquisitiveness to search for new or different methods or perspectives on problems and issues, the patience, persistence and endurance to complete challenging tasks, a positive orientation towards planning for the future, and the general desire to create or "tinker with the fingers".

The 1990s also witnessed the transformation of technical and vocational training, from a generally unpopular post-secondary experience to a much sought after route for the more technically inclined youths.. As the young continued to show an aversion towards blue-collar jobs, the danger of the country not possessing a sufficient pool of technically-skilled local workers became obvious. This scenario prompted a serious warning by Lee Yock Suan, then Minister of Education in June 1994: "Singapore will be poorer if everyone aspires to and gets only academic qualifications but nobody knows how to fix a TV set, a machine tool or a process plant. We need a world-class workforce with a wide variety of knowledge of skills to achieve a world-class standard of

living”.⁹ Unlike in South Korea and Germany where vocational and technical training is held in high esteem, the Singapore’s system, prior to the 1990s, failed to project the same image. Vocational institutes became “dumping grounds” or “catch-nets” for those who failed to meet up with academic rigour. The development and transformation of the Institute of Technical Education (formed in 1992) and the polytechnics in the provision of technical and professional education is one of the most successful features of the Singapore’s education system and attracts the attention of many of the policy makers from developing countries in the area of vocational and technical education or VTEC.¹⁰

Future-Ready Education for the Future Economy

As the world races towards the mid-21st century and beyond, the application of the Internet, robotics and the power of artificial intelligence (AI) is revolutionizing the way people work, play and communicate. Technological progress is now at the center of the growth process. The digital economy also presents opportunities to transform industries, while new technologies can help to raise productivity in sectors like advanced manufacturing, popularly termed as Industry 4.0.

Beginning from the new millennium, Singapore has made the successful

⁹ *Straits Times*, 14 June 1994.

¹⁰ For an understanding of the evolution of technical and vocational education in Singapore, see Law Song Seng, “Vocational Technical Education and Economic Development: The Singapore Experience” in Lee Sing Kong, Goh Chor Boon, Birger Fredriksen and Tan Jee Peng (eds.) *Toward a Better Future: Education and Training for Economic Development in Singapore since 1965* (Washington, D. C.: The World Bank, 2008), Chapter 5.

transition, in the words of Lee Kuan Yew, “from Third World to First”.¹¹ In the new millennium, the Singapore economy shifted towards an innovation-driven economy - a more broad-based, dynamic technological strategy that does not depend solely on the importation and assimilation of Western technologies. Economic growth hinges strongly on two key components: (a) innovations through Research and Development (R&D) and (b) the creation of digitized infrastructure. The Government introduced initiatives to promote innovations and entrepreneurship. Small and medium enterprises (SMEs) were challenged to develop indigenous capabilities for creative innovations of products and processes, to develop new ideas and business models, tap new export markets and broaden their economic base.¹² The drive towards innovation was supported by an advanced technological infrastructure and generous funding for R&D – that is, towards the creation of a “national innovation system”. The Agency for Science, Technology and Research (A*STAR) was formed in January 2002 with the primary mission to advance the economy and improve lives by growing the knowledge-intensive biomedical, research, scientific and engineering fields. The agency supports R&D that is aligned to areas of competitive advantage and national needs for Singapore. These span the four technology domains of Advanced Manufacturing and Engineering (AME), Health and Biomedical Sciences (HBMS), Urban Solutions and Sustainability (USS), and Services and Digital Economy (SDE).¹³

¹¹ Lee Kuan Yew, *From Third World to First: The Singapore Story: 1965 – 2000* (Singapore: Times Edition, 2002).

¹² <http://www.mti.gov.sg/MTIInsights/Pages/1998-2009.aspx>

¹³ Public investment in research and innovation has grown over the last 25 years. In 1995, the budget allocated for R&D was S\$2 billion. Today, under the Research, Innovation and Enterprise (RIE) 2020 Plan, S\$19 billion was committed to drive

The Singapore Government put in place institutional measures aimed at creating an innovative industrial policy and work environment. It champions innovation-friendly rules, regulations and legislations to providing better protection on inventions and guarantees to ownership issues. It rolls out initiatives to attract professional talents from all over the world. It develops a world-class information and communication infrastructure for individuals and companies to stay connected to the world. Singapore's scientists and research engineers were kept busy as the Government poured billions into R&D projects, particularly in the biotechnology and pharmaceutical sector. Figure below illustrates the key players in the national innovation system.¹⁴

Singapore's Future Economy is encapsulated in its "Smart Nation" vision, characterized by the development of a digital infrastructure to harness information flows. In a 2016 report, McKinsey Global Institute has redefined globalization as "transmitting information, ideas, and innovation around the world and broadening participation in the world economy".¹⁵ The report ranks

the country's innovation-led economic blueprint. Quality of research has also risen substantially over the years. Singapore's universities have steadily risen up in global rankings and improved their research influence internationally. In 2018, the annual World University Rankings placed the National University of Singapore (NUS) and the Nanyang Technological University (NTU) in the 11th and 12th positions respectively. See <https://www.topuniversities.com/university-rankings/world-university-rankings/2019>

¹⁴ For a more in-depth understanding of the role of science and technology in Singapore's development, see Goh Chor Boon, *From Traders to Innovators: Science and Technology in Singapore since 1965* (Singapore: Institute of Southeast Asian Studies, 2016).

¹⁵ Quoted in Thomas Friedman, *Thank you for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations* (United Kingdom: Penguin Books 2016), p.

different countries on how much they are participating in all the different kinds of global flows which indicate the generation of wealth. Singapore topped the list as the country invested in both the infrastructure to tap on global digital flows of information as well as education of its workforce to take advantage of the flows. Singapore's 4G connection speed is one of the fastest in the world.¹⁶

The digitized economy has opened up new possibilities to enhance the way we live, work, play, and interact. “Smartness” is not a measure of how advanced or complex the technology is being harnessed, but how well a society uses technology to solve its problems and address existential challenges. At the heart of Singapore's Smart Nation vision is lifelong learning. Singapore's leaders understand that the job market is changing quickly. For most workers, the prospect of lifelong employment in a single role with a single company is long gone. The global economy now demands workers to be nimbler than ever. It requires the constant acquisition of new knowledge and skills, and the flexibility to thrive in an array of shifting environments. This means having both the mindset and the resources to learn continuously at every stage of life. The Government took the lead by launching the SkillsFuture initiative in 2016 - a national movement to provide Singaporeans with the opportunities to develop their fullest potential throughout life, regardless of their starting points.¹⁷

The strife towards the “Smart Nation” vision requires the creation of a creative society to support better living, stronger communities, and create more opportunities, for all. The basic premise is that, in the 21st century, creative people are required to sustain the wealth of nations. They are ones who unleash

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¹⁶ *Economic Survey of Singapore Third Quarter 2017*, p. 18.

¹⁷ www.skillsfuture.sg/

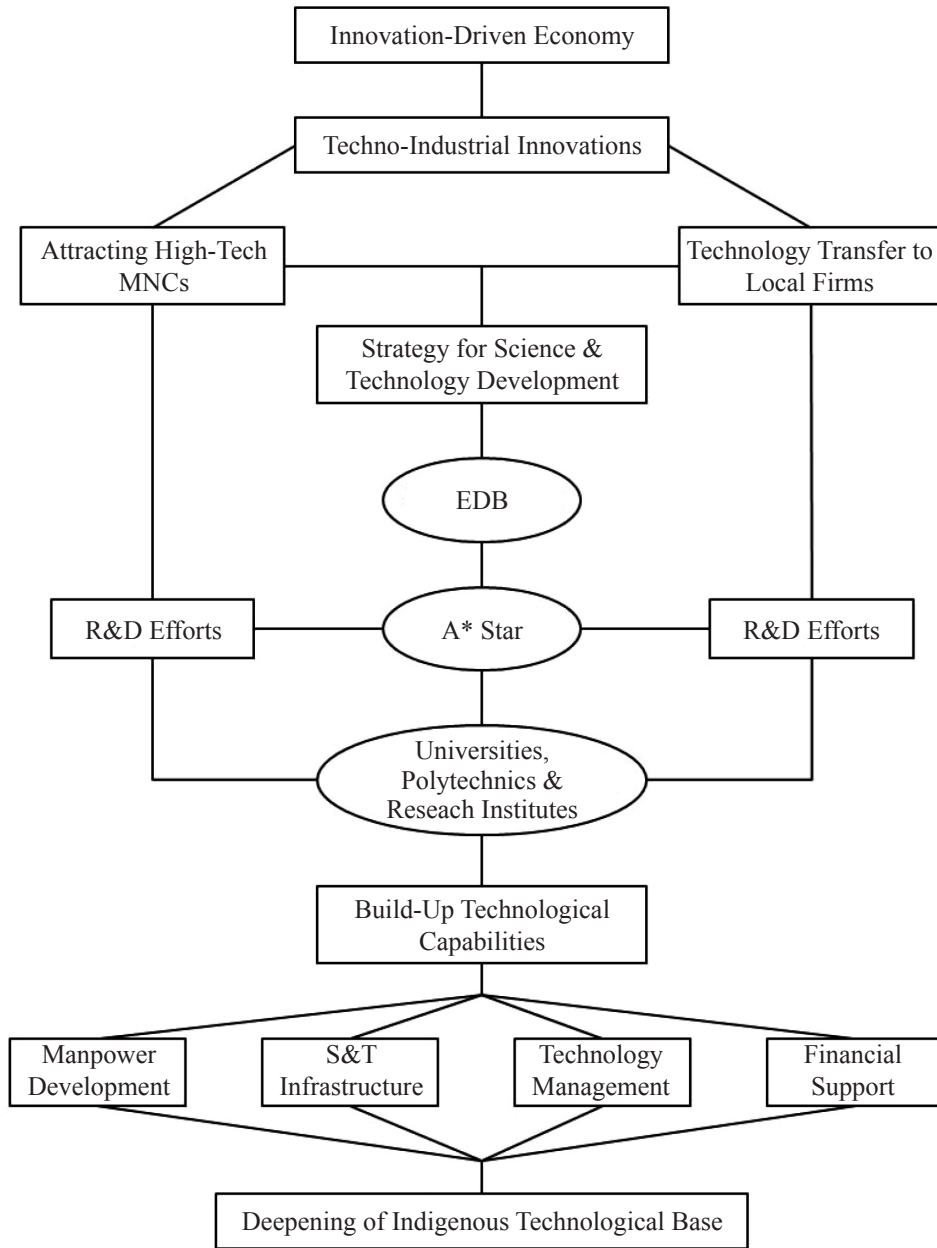


Figure 1: A Conceptual Model of Singapore’s Strategy in Technology Learning

innovations, create new jobs and increase productivity. How can Singapore nurture creative workers? First, there must be a strong conviction that every single human being is creative. Strategies would include making openness, diversity and inclusion as a core agenda for economic and social development and building an education system that spurs creativity and innovation.¹⁸

Singapore's innovation-led economic trajectory have increased the value of people with the right engineering, creative or design skills. These are the individuals with more human capital – knowledge and skills gained through education. They know how to maintain what Thomas Friedman terms as “dynamic stability” – the ability to self-motivate, learn skills for life and to re-invent oneself.¹⁹ What all this means is that there is the need to rethink and revisit the nature of education – and the role of schools - that will allow the young to face up with the demands of a technologically-driven and rapidly changing world. The concept of teaching and leading for teachers and principals respectively has changed in the new millennium. The old paradigm stressed on didactic teaching to impart subject knowledge and managing the administrative processes and functions in order for schools to function well. Today, in an ever-changing landscape, more emphasis is being given to the teacher as a facilitator of learning, imparting thinking and problem solving skills, and the education leader as an innovator in initiating change across a spectrum of areas – from school human resources, instructional leadership, facilitating and mentoring to the creation of an innovative school culture.

¹⁸ In many ways, Singapore's drive towards creating a creative “smart” city brings to mind Richard Florida's “3Ts” of economic development – Technology, Talent and Tolerance. See Richard Florida, *The Rise of the Creative Class Revisited* (New York: Basic Books, 2012), Chapter 12.

¹⁹ Friedman, *Thank you for Being Late*, p. 219.

To support an economy that thrives on innovation and digitisation, Singapore's education system did away with standardized, mass education. Critics of standardized, mass education have argued that such a system does not match to the needs of a twenty-first century, skills-based knowledge economy.²⁰ As Ken Robinson says in today's education system "schools need to cultivate the great diversity of young people's talents and interests; to dissolve the divisions between academic and vocational programs, giving weight to both areas of study; and to foster practical relationships with the world of work so that young people can experience different types of working environments firsthand".²¹ Singapore's school education customizes teaching and learning with the aim to help students to discover their own talents, to make the best of these talents and realize their full potential, to develop the skills, character and values, and to develop a passion for learning that lasts through life. Flexibility and diversity of learning opportunities to meet different interests and ways of learning are now features of a more broad-based education to ensure an all-round or holistic development, in and out of the classroom, for young Singaporeans. Being able to choose what and how they learn will encourage them to take greater ownership of their learning.

At the core of the Singapore education, its "thinking curriculum" continues to be emphasized.²² Young Singaporeans are encouraged to ask questions, look for answers, think in new ways, solve new problems and create new opportunities for the future. Besides the body of content knowledge of a

²⁰ See Ken Robinson, *Creative Schools: The Grassroots Revolution That's Transforming Education* (New York: Viking, 2015).

²¹ *Ibid.*, p. 47.

²² The results of the "thinking curriculum" is reflected positively in the performance of Singapore students in PISA. See <https://www.bbc.com/news/education-38212070>

discipline, in a thinking curriculum, students develop a deep understanding of core concepts and the processes. It provides in-depth learning and gives students the tools - the perspectives and methodologies and concepts - they need to carry out authentic tasks. In addition, a thinking curriculum is often interdisciplinary in approach, cutting across many school subjects and oriented towards problem solving, decision making, and critical and creative thinking. Teaching pedagogy now shifts strongly towards Inquiry-based teaching and learning - a form of active learning that starts by posing questions, problems or scenarios and orientates towards problem solving, decision making, and critical and creative thinking. The key task for the teacher is to get students to learn to think, to learn to learn, and to critically assess a situation. In short, teaching students how to learn on their own.

Schools also take on an applied learning or authentic experience approach.²³ As part of Singapore’s innovation-led growth strategy, schools have introduced Applied Learning Programmes (ALP). Applied Learning refers to an approach that emphasises authentic and practice-oriented learning experiences, and is not necessarily restricted to vocational or technical education. It gives students additional opportunities to acquire skills and qualities based on the practical application of knowledge in real-world contexts, and strongly supports our focus on developing 21st century competencies and values in our students. Applied Learning provides hands-on or experiential learning for students to enact authentic scenarios and equips students with the skills to engage in the practical application of knowledge. It could also involve partnering the industry, community, institutions of higher learning. Under the ALP, schools offer to students a range of “Applied Subjects”, such as Coding and Computing,

²³ <http://www.moe.gov/education/secondary/applied-learning>

Electronics, Exercise and Sports Science, Drama, Robotics and Smart Electrical Technology, catering to students who have the interest in and aptitude for specific fields of applied study. Tapping on the tech-savviness of Singaporeans and the excellent digital infrastructure of the “wired” nation, schools are now developing programmes based on the Internet of Things (IOT) and use of data collected from several sensory sources relevant to the programme. In short, the ALP broaden students’ educational experience, particularly in areas of their choice which could be part of their subsequent career options.

To ensure an effective implementation of a thinking curriculum, schools today need to be creative and innovative, particularly in their adoption of teaching approaches. Entrepreneurs and educators alike have suggested the need to inculcate design thinking and ideation as critical capabilities required by workers who could not just value add, but also to value create. Design thinking is now used in many organisations and is gaining importance in Singapore schools where it is applied to areas like Project Work and Community Involvement Programmes. In Design Thinking, students learn to be human-centred problem solvers. They identify human needs and real-life problems, generating ideas based on the discovered insights, and finally, work in teams to prototype and test innovative solutions that meet those needs. In the process of solving these problems, students learn empathy, collaborative skills and the value of radical ideas.

Closely associated with the design thinking as an innovative approach in teaching is the creative process of generating new, useful ideas or ideation. There is the urgent need to motivate the Singapore kids to think creatively, to create and to innovate. The school becomes an important place for the nurturing of

creative youth. The school is where a culture of innovation could be nurtured.²⁴ Schools are tapping on STEM-related projects and creating “Makerspace” to spur students’ interest in designing and making things. Unlike the equipment of the typical Fab Lab, such as computers, 3-D printers, Arduino boards and laser cutters, STEM workshops in schools encouraged students to make objects and structures using ordinary materials, such as paper plates, cardboards, masking tapes, straws, rubber bands, etc. based on their theoretical understanding of scientific principles and their creative ideas. This eco-friendly approach teaches students that extraordinary things could be build using ordinary materials.

The rise of the Maker Education and the creation of Makerspace is also gaining strong support in Singapore schools. This is also in line with the government constant reminder to the people to think innovation and with the hope that some young can turn into budding manufacturing entrepreneurs. While Singapore is a very tech-savvy, forward-looking country, the education pedagogy is still quite rooted in heavily-supervised and -directed learning activities. There is very little room for free expression and limited space for maker-led activities, especially of the open-ended, interdisciplinary sort that are becoming more trendy in innovative educational systems. Through the makerspace, schools hope to create a conducive environment for the young to think, create and innovate or, as described by Dale Dougherty, the “process of makers might be informal, messy and organic”.²⁵

Finally, one critical component of Singapore’s education system is the

²⁴ See Tony Wagner *Creating Innovators: The Making of Young People who will change the World* (New York: Scribner), 2012.

²⁵ Dale Dougherty, *Free to Make: How the Maker Movement is changing our Schools, our Jobs and our Minds* (California: North Atlantic Books, 2016), p. 155.

emphasis on values. This is one feature which distinguishes Singapore's education from many others. As the Singapore economy moved into the technology-intensive phase of its economic development in the 1990s, there was an urgent need to create a mindset shift of Singaporeans towards developing values and attitudes that could sustain Singapore's trajectory into becoming a developed nation. Lee Kuan Yew himself acknowledged that changing mindset is not easy: "The difficult part was getting people to change their habits so that they behaved more like first world citizens, not like third world citizens spitting and littering all over the place".²⁶ Education is again seen as the crucial channel to achieve this outcome. The student-centric, values-driven education puts character development and values at the core of the education system. Schools' National Education (similar to Citizenship Education) programmes which aims to imbue students with the skills, values and attributes - innovative and enterprising, life-long learning habit and commitment to community and the state - for nation-building were actively infused into the formal and informal school curriculum. There is a shared belief across Singapore society that education is crucial in building up individual and collective capacity, and in strengthening the cohesiveness of the nation beyond knowledge and skills.

Conclusion

Growth theorists, economic historians and development economists consistently argue that the sustained growth of the East Asian economies stem from several inter-related key factors – substantial investment in infrastructure, an efficient absorption and adaptation of advanced technology, a stable social

²⁶ Interview in *New York Times*, 24 August 2007

and political environment, and an impressive commitment to human capital formation. One reason for Singapore's economic success is the ability of the state to successfully manage the education system and the demand for skills required by the changing economic landscape in tandem with each other. In the words of the late Lee Kuan Yew: "Our job was to plan the broad economic objectives and the target periods within which to achieve them. We review these plans regularly and adjusted them as new realities changed the outlook. Infrastructure and the training and education of workers to meet the needs of employers had to be planned years in advance".²⁷ This dynamic synergy continues to be a major source of Singapore's competitive advantage. The key strategy to having a workforce fit for the new economy is to ensure that education stays relevant and keeps pace with economic change.

For Singapore, the way in which education and training practices are being developed, is shaped by the over-arching nation-building agenda of the Singapore Government. Education promotes income growth, which in turn promotes further investment in education. Singapore's education and training strategies through the decades since 1965 consistently reflects the city-state's first generation of leaders' thinking that the nation's economic trajectory to sustainable growth has to be an integration of education policy with economic policy and manpower planning. The ability of the Singapore Government to successfully manage supply and demand of education and skills was and continues to be a major source of Singapore's competitive advantage. In coordinating the supply of trained personnel to meet the needs of the expanding economy, Singapore has one distinct advantage when compared with other countries. Its small geographical size and compactness (supported by an

²⁷ Lee, *From Third World to First*, p. 85.

excellent communication infrastructure) allows for efficient planning, cohesive decision-making, channeling of information and deployment of personnel within and between the government and private sectors.

With the dawn of the Fourth Industrial Revolution, we now need to rethink and revisit the nature of education – and the role of schools -that will allow the young to face up with the demands of a technologically-driven and rapidly changing world in the 21st century. The reality is that there is ever-widening skill gaps between what schools and universities are teaching and what the economy needs. Hence, we have countries where there is plenty of work opportunities but, despite the investment in education, too few people have the appropriate skills to do so. To nurture the development of the skill sets needed to meet the demands of the Fourth Industrial Revolution requires us to take a good look at how we can make our schools creative. Orthodox, unimaginative and regimental way of running schools will do no good to the education of the millennials or “Generation Y”.

One immediate challenge facing Singapore’s education is to change the attitudes of parents, teachers and students towards examinations and grades. The future economy requires students to develop soft skills and to apply what they know to solving problems and creating innovations. Indeed, employers today do not care how much one knows because knowledge is available everywhere and anytime. What employers want to know is how much one can do with the knowledge to add value, or even create value, to the organization. The time is ripe for leaders of schools and universities to put on their thinking caps and make teaching and learning innovative, relevant and exciting. In many countries, educational initiatives often consist primarily of short-term efforts to solve immediate problems or improve efficiency. However, Singapore’s educational policy makers prefer to plan for the long-term. A “futures thinking” modality

is adopted as preparing the youth of today to meet the challenges of tomorrow requires making strategic decisions, not merely to reform, but to transform and reinvent education. For countries striving for educational reform and change, this is perhaps one of the most significant challenges in the new millennium.

教育變革與經濟發展： 以新加坡為例

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摘要

本文探究新加坡學校教育體系在各個經濟發展階段的變化，運用生物分佈學方法，以說明新加坡的經濟發展如何受惠於教育改革。本文分為三個部分，首先說明新加坡教育在1960-1980年間，經濟景觀產生變化的發展；其次，從1990年代初期，涵蓋了新加坡教育產生驚人變化的時期；最後，則以新世紀為主，敘述新加坡的規劃家們如何就教育策略提出詳盡的規劃，俾便人們發展足以因應未來挑戰的知識和技能。

關鍵詞：新加坡、學校教育、經濟發展、教育改革

壹、前言

1965年8月9日，新加坡躋身主權獨立國家之列，當時新加坡的人均名義GDP約為五百美元。新加坡沒有天然資源，沒有腹地，沒有工業，不僅貿易、食物、能源，甚至連用水都仰賴外界。當時許多國際觀察家心中都有個疑問：「新加坡活得下去嗎？」五十年後的2016年，新加坡的人均GDP約為56,000美元，與德國和美國相近。這次許多國際觀察家心中的疑問是：「小島國是怎麼做到的？」我們可以將之歸因於政府領導人和技術官僚，尤其是經濟規劃家和策略家，他們集思廣益而畫出成長發展藍圖。這些計劃要獲得有效實行，高素質人才必不可少，而高素質人才是高素質教育的產物。也就是說，新加坡之所以能在經濟上脫胎換骨，教育扮演了關鍵的角色。

本文採取生物分佈學方法，敘述新加坡學校教育體系在各個經濟發展階段的變化，以此說明新加坡的經濟發展如何受惠於教育改革。本文分為三大部分，第一部分說明經濟景觀產生變化的1960～1980年間新加坡教育的變化；第二部分始於1990年代初期，涵蓋了新加坡教育產生驚人變化的時期；最後一部份則以新世紀為主，敘述新加坡的規劃家們如何就教育策略提出詳盡的規劃，俾使人們發展足以因應未來挑戰的知識和技能。新加坡自1965年獨立以來在經濟發展上的成功，很大程度上要歸功於領導人的能力，他們在不同的經濟發展階段當中，透過教育體系而在技能養成政策和技能需求之間建立起緊密的連結。

貳、1960～1980年代，經濟倖存與經濟起飛

關於1970及1980年代日本和所謂亞洲四小龍（南韓、香港、台灣、新加坡）的興起，以及「小龍」如何在以日本為首的雁行（flying geese）模

式中自日本的經濟變革中獲益，已累積了大量的探討文獻。¹ 在1991年的書中，Ezra Vogel將這些國家的經濟興起歸因於一種幸運的「情境因素」（situational factors），諸如他所列舉的美國援助、舊秩序的摧毀、政治經濟上的迫促感、對大量勞動力的需求、對日本經驗的熟悉，以及伴隨著工業化過程以新儒學為基礎的社會習俗，其中也包括對教育的尊崇。² 新加坡在戰時雖然飽受日軍暴行，但日本接納西方科技並予以創意運用，從而創造出工業化的日本社會，卻受到已故新加坡首任總理李光耀極高的推崇。日本在1970和80年代大量投資於電子和石化工業群。1970年代有好幾個工業訓練中心都是由日本（和德國）建立維持。

1965年8月，新加坡在存亡關頭所面臨的關鍵問題是——怎樣才能在最短時間內創造出可行的擴展性工業化計劃？新加坡繼受效力於帝國體系的殖民經濟，仰賴轉口貿易，工業很少，銀行業和商業則有一些。當時人民行動黨（PAP）的政治領導人兼總理李光耀認為，由政府主導的出口導向工業化應可確保未來的經濟發展。這樣的發展策略在1967年英國政府宣布將自新加坡撤軍時變得更形重要。1960和70年代新加坡的出口導向工業化（export-orientation industrialization, EOI）計劃，首要目標是提供人民工作機會，並將新加坡相對低廉且規訓良好的勞動力予以資本化。

李光耀及其首席經濟規劃大師、時任新加坡副總理的吳慶瑞（Goh Keng Swee）都頗具遠見，有意吸引國外的跨國企業（multinationals, MNCs）到新加坡設立商店。跨國企業被視為重要的渠道，讓新加坡可藉

¹ 赤松要（Akamatsu Kaname）在1930年代的日文論文當中創造了「發展的雁行」一詞。曾於1980年代任日本外相的已故經濟學家大來佐武郎（Okita Saburo, 1914-1993）將「雁行」（FG）模型引進政治和商業領域而獲得更多人知曉。地區性的雁行工業化傳播是受工業多樣化和理性化的承接過程所驅動，是為亞洲經濟成長的推動引擎，這樣的看法於是變得十分出名。

² Ezra Vogel, *The Four Little Dragons: The Spread of Industrialisation in East Asia* (Cambridge, Massachusetts: Harvard University Press, 1992). Chapter 5.

此接觸到最新的管理與科技知識。國外科技成了克服國內限制（如缺乏本土的科技基地）的有效手段。新加坡對外資抱持極其正面的態度，並有多種吸引跨國企業的誘因，於是成為投資者的首選，其中又以美國企業為最。1966年新加坡製造部門的直接國外投資（foreign direct investment, FDI）便達到兩億三千九百萬美元。在政府以多種稅務及投資誘因強力推銷之下，這個數字在1971年成長到十五億七千五百萬美元，1979年更高達六十三億四千九百萬美元。³ 到了1990年代，東亞新興工業經濟體（East Asian Newly-Industrialising Economies, NIEs，即南韓、台灣、香港和新加坡）已經成為微電子、電腦及電信通訊設備領域成熟消費者產品的主要出口國了。

1960~70年代新加坡出口導向工業化策略的成功，在很大程度上仰賴於接納現代科技，以趕上更為先進的國家。但這個縮減科技差距的任務可謂知易行難。英國殖民統治並未能在科技與技職教育上獲致預期的發展，⁴ 科學和科技領域內都少有本土專業人才養成。1970年的估計指出，新加坡在1970~75年間每年短缺約450~500名的工程師，儘管政府已經努力將新加坡大學每年產出的工程師人數從1970年的每年80名提高到1974年的210名了。⁵ 經理人才和技術人員的短缺也同樣令人憂心，前者估計在未來三年內每年短缺200人，後者在未來兩年內每年短缺高達1,500~2,000人。⁶

1970年代晚期，東南亞國家開始有效的在低技能勞力密集產業爭取外資，新加坡之前在勞力密集製造業產品方面所具有的相對優勢逐漸受到侵

³ Economic Development Board, *Annual Report, 1972 and 1980*.

⁴ Goh Chor Boon, *Technology and Entrepot Colonialism in Singapore, 1819 – 1940* (Singapore: Institute of Southeast Asian Studies, 2013). Chapter 8.

⁵ Goh Keng Swee, *The Economics of Modernization* (Singapore: Asia Pacific Press), p273.

⁶ *Ibid.*, p. 274.

蝕。經濟規劃家於是展開新的經濟重整策略，讓新加坡從低技能勞力密集化身為科技導向資本密集的工業化國家。新加坡政府在這當中扮演著關鍵角色。為了提升新加坡勞工的知識與技能以加速工業重整，新加坡必須要有新的教育體系。

1960~70年代，新加坡的教育處在「求生」階段，首要目標在於創造工作機會，讓國家和人民能夠存活。當時的策略是要儘快讓所有新加坡人都接受初等教育，如此至少能夠創造出一批受過教育的年輕勞工，以支應外國大型公司投資設立的工廠所需的密集勞動力。此外，快速的興辦學校、招聘教師，也創造出新的工作機會。然而到了1970年代，當大量的新設學校與受訓師資導致初等教育普及、中等教育擁有大量註冊人數、科學和數學教育獲得重視，新加坡的教育體制卻素質不足，問題之一在於教學還不被視為一種專業。教育浪費的現象頗為嚴重。

1978年，一個系統工程師團隊受託就教育體系進行有系統的評估，並提出一系列的改革建議，新加坡的教育改革至此進入「效能導向」階段。1979年6月，李光耀親自帶領一群高階人員前往英國，向英國專家尋求強化新加坡教育體系的方法。招募英語教師在這項任務的待辦事項裡名列前茅。李光耀認為，擁有大量的英語教師和課程發展專家，將有助於提升教學水準。而在社會層面上，以英語作為工作語言能夠彌補代溝，也有助於國家的生存。對此李光耀說明道：「我們所做的必須付出高昂代價的事情之一，便是從我們自己的語言轉換到使用英語。我們有華人、馬來、印度學校，都是語言分立的中等學校。英國人的英文學校規模雖不大，卻為英國訓練出文職人員、倉管人員和教師。設若我們選擇了新加坡多數人所使用的華語，我們必然已在經濟和政治上都面臨消亡的命運。」⁷

1979年1月，隨著新加坡政府展開經濟重整和永續成長的新策略，新教育體系（New Education System, NES）也宣告上路，為提升效能而進行

⁷ 2007年8月24日與《紐約時報》（*New York Times*）在新加坡進行的訪談。

教育改革。政府維持著校內雙語教育的政策，並在初等及中等教育上都給予三組指示。教材和教科書的集中編纂提升了教學和課程水準。設立於1980年的新加坡課程中心（Curriculum Institute of Singapore, CDIS）致力於產出包括課本及多媒體教學素材在內的高水準教材。簡言之，教育體系的根本哲學是要讓學生以適合個人能力的速度發展，目的則是要讓學校教育中的每個學童都盡其所能的發展，從而使每個人獲得最佳的基礎教育，以利之後的訓練和就業。新教育體系使中輟人數減少，於焉達成降低體系內教育浪費的目標。

參、1990年代的經濟發展及「思想學校，學習國家」的展望

1990年代地區及和國際性競爭的升高，促使新加坡領導人展開「下階段」計劃（The Next Lap）——這是一個經濟發展的遠景，意在使新加坡這個城市國家躋身工業化經濟體之列，並達到與2020年瑞士人同等的的生活水準。⁸ 為了達至目標，新加坡經濟發展局（Economic Development Board, EDB）維持著利於跨國企業的政策，而有些產業被認為將會帶來下一波的經濟擴張，故而新加坡所吸引的投資對象也就限於有能力對這些產業進行投資的企業。政府並且鼓勵本土公司轉向亞太地區，以獲取低廉的生產資源，並將新加坡置於於區域經濟發展的中心位置。很顯然的，這是「新加坡企業」轉型成為「新加坡國際企業」的過程。

為了完成新千禧年打造國家的雄心壯志，新加坡對其教育體制進行了全面的評估和更新。具有里程碑意義的「思想學校，學習國家」計劃（Thinking Schools, Learning Nation, TSLN）於1997年付諸實行，成為新加坡高效能教育體系的基石。這個計畫涵蓋了能力導向的方法，著眼於創

⁸ Singapore Government, *Singapore: The Next Lap* (Singapore: Times Editions, 1991).

新、創意與進取精神，以及科技能力和二十一世紀的各種能力。自那時起，教育體系創造出大家刻板印象中的新加坡學生，通常被認為欠缺科學和科技創新所需的幾種重要素質，這當中包括：對世界的廣泛基礎知識；一種熱切感與好奇心，會就問題和議題尋求不同的處理方式或觀點；完成挑戰性任務所需的耐心、恆心和毅力；規劃未來的積極態度；創造或「動手修補」的意願。

1990年代也是技術和技職訓練脫胎換骨的年代，從一個大體而言不受歡迎的中等以上教育訓練，轉變成備受歡迎、科技取向的青年教育。當年輕人持續對藍領工作感到嫌惡，國家欠缺技術熟練本土勞工的問題也就日趨明顯。時任教育部長的李玉全（Lee Yock Suan）在1994年6月就這個情況提出了嚴正警告：「如果新加坡人都致力於獲得學術資格，卻沒有人知道怎麼修理電視機、機械工具或加工廠，新加坡將會愈來愈窮困。我們需要具有廣泛技能知識的世界級勞動力，以達致世界級的生活水準。」⁹ 與南韓和德國等技職教育受到高度尊敬的國家不同，1990年代以前的教育體系並未能使技職教育在新加坡獲致同等的形象。技職教育機構成了接收未能達到學術標準者的「傾倒場」或「捕獲網」。成立於1992年的科技教育中心（Institute of Technical Education）的發展和變化，以及在科技和專業教育領域設立理工學院，都是新加坡教育體系最成功的特色，其技職與科技教育（VTCE）吸引到許多開發中國家政策制定者的注意。¹⁰

⁹ 《海峽時報》（*Straits Times*），1994年6月14日。

¹⁰ 要了解新加坡科技與技職教育的發展，參見：Law Song Seng, in Lee Sing Kong et al., *Toward a Better Future: Education and Training for Economic Development in Singapore since 1965* (Washington, D. C.: The World Bank, 2008). Chapter 5.

肆、為未來經濟就緒的未來教育

世界進入二十一世紀中葉，網際網路的運用、自動機器人的發展及人工智慧的力量，使人們工作、娛樂、溝通的方式都產生重大變革，如今科技的進展已經成為經濟成長的核心課題。數位經濟也帶來許多產業改革的機會，新科技可提高高階製造等部門的生產力，也就是現在所稱的「工業4.0」（Industry 4.0）。

新加坡在千禧年伊始便已化身成功，用李光耀的話來說，就是從「第三世界轉進第一世界」。¹¹ 新加坡在新的千禧年轉向一種受創新驅動的經濟型態——此種科技策略有著較廣也較為較動態的基礎，不單純只仰賴輸入並吸收西方科技。經濟成長基本上繫於兩大關鍵部分：（a）透過研發（R&D）而來的創新，以及（b）數位化基礎建設的創生。新加坡政府主動推廣創新和進取精神，中小型企業（SMEs）因而必須就產品和產製過程發展出本土的創造能力，也必須發展新構想和新商業模式，嘗試新的出口市場並擴大經濟基礎。¹² 高階科技基礎建設和投入研發的大量資金，都支持著企業向創新看齊，亦即要創造一種「國家創新體系」（national innovation system）。新加坡於2002年創立科技研究局（A*STAR），其首要任務便是提升知識密集的生化、研究、科學及工程領域的發展，以此促進經濟並改善生活。科技研究局支持投注研發於具有競爭優勢和國家需求的領域，這包括四大科技領域：高階製造與工程（AME）、健康與生化科學（HBMS）、都計與永續（USS）、服務與數位經濟（SDE）。¹³

¹¹ Lee Kuan Yew, *From the Third World to the First: The Singapore Story 1965-2000* (Singapore: Times Edition, 2002).

¹² <http://www.mti.gov.sg/MTIInsights/Pages/1998-2009.aspx>

¹³ 過去25年間，新加坡在研發與創新方面的公共投資頗有成長。1995年時，新加坡的R&D預算為20億美元，今日列於「2020研究、創新與企業（RIE）計畫」

為了創造創新產業政策和工作環境，新加坡政府做出制度性的設計，支持有利於創新的規範和立法，對發明提供更佳的保障，並在所有權議題上作出保證。新加坡也主動吸引世界各地的專業人才。一個世界級的資訊與通訊基礎設施於焉發展成形，讓個人和企業都能夠與世界接軌。新加坡的科學家和研究工程師們十分忙碌，因為政府傾注了大量的R&D計畫，其中又以生物科技和製藥部門為最多。圖1為新加坡國家創新體系內的主要參與者。¹⁴

新加坡的未來經濟（Future Economy）是其「精明國家」（Smart Nation）願景的縮影，其特色是以數位基礎建設的發展來駕馭資訊流。麥肯錫顧問公司（McKinsey Global Institute）在一份2016年的報告當中，將全球化重新定義為「在全球各地傳播資訊、創意與創新，並擴大世界經濟的參與」。¹⁵ 該份報告也評估各國在各種創造財富的全球流動當中的參與程度。新加坡投資於基礎建設，以便善用全球資訊的數位流動，也為求善用資訊而投資於勞動力的教育，在各國當中居於榜首。新加坡的4G連線速度也在全球名列前茅。¹⁶

數位化經濟開啟了新的可能性，強化了我們生活、工作、玩樂和互動

之下的預算，其中則有190億美元用於驅動新加坡的國家創新導向經濟藍圖。研究品質也有了長足進步。新加坡的大學在全球排名中穩定攀升，研究的國際影響力也提高了。2018年度的全球大學排名中，國立新加坡大學和南洋理工大學分列11和12名。參見：<https://www.topuniversities.com/university-rankings/world-university-rankings/2019>

¹⁴ 關於科學和科技在新加坡發展中所扮演的角色，更深入的探討請見：Goh Chor Boon, *From Traders to Innovators: Science and Technology in Singapore since 1965* (Singapore: Institute of Southeast Asian Studies, 2016).

¹⁵ 引自：Thomas Friedman, *Thank you for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations* (United Kingdom: Penguin Books 2016), p. 127.

¹⁶ *Economic Survey of Singapore Third Quarter 2017*, p. 18.

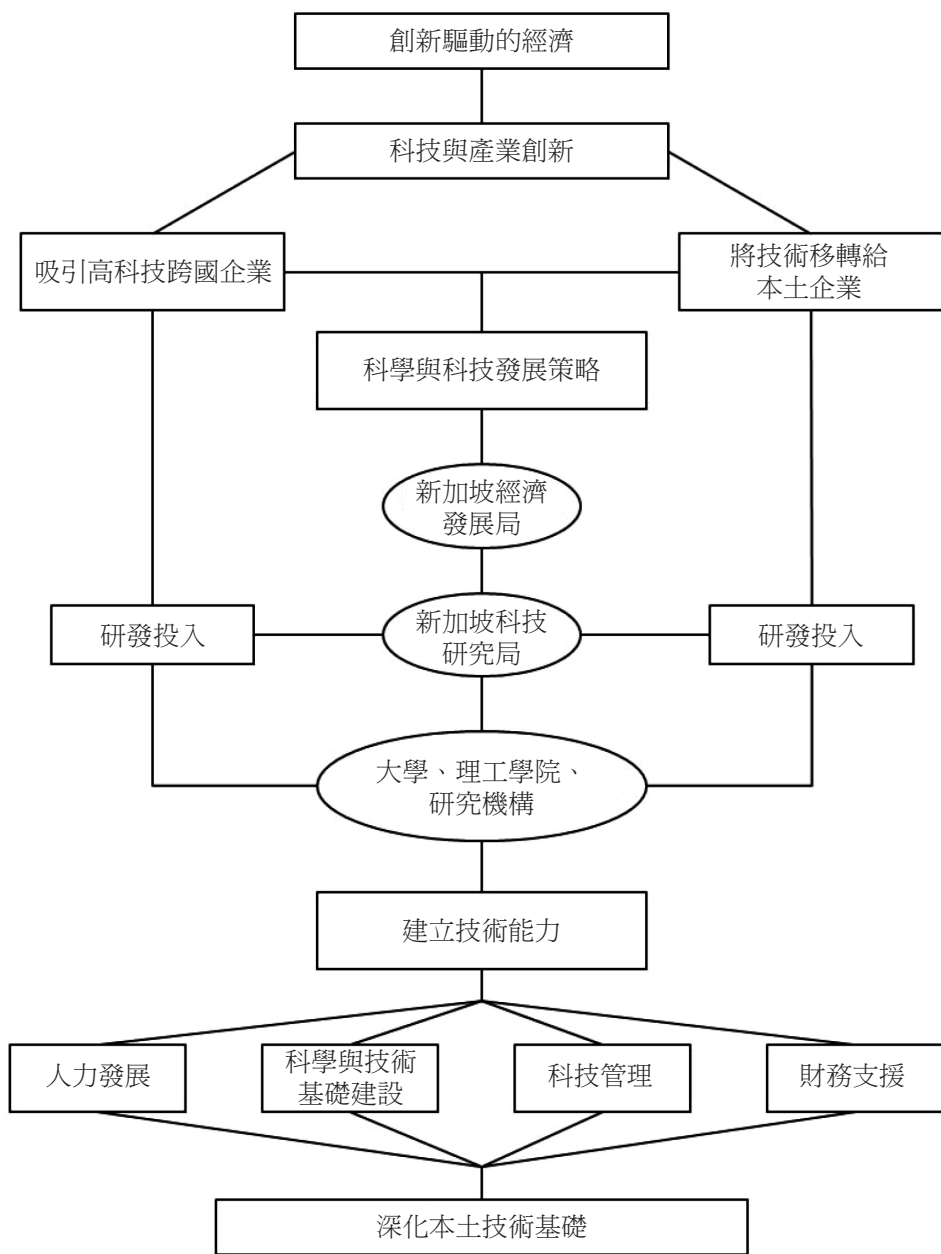


圖 1 新加坡科技學習策略的概念模型

的方式。如今「智慧」（smartness）不在於駕馭科技的方法多麼高明或複雜，而在於人們利用科技以解決問題、處理當前挑戰的能力。終身學習是新加坡精明國家願景的核心精神。新加坡的領導人都了解就業市場變化之快速。對多數勞工來說，一輩子只在一家公司擔任一個工作的終生聘僱時代已經過去，當今的全球經濟要的是比過去任何時候都更靈活機敏的勞工。為此勞工必須不斷獲取新知和技能，也必須有足夠的靈活度來適應不斷變遷的環境。這意味著在人生的每一個階段都必須抱持學習的意願、擁有學習的資源。新加坡政府在2016年帶頭展開「Skills Future」計畫，這是一個全國性的運動，讓新加坡人終生都能夠全力發展潛能，而不論起步點的早晚。¹⁷

要邁向「精明國家」的願景，必須要有一個富於創意的社會，才能使生活變得更好，社區變得更強健，也才能為所有人都創造出更多的機會。這當中有個基本的前提，亦即創意人肩負維持國家財富的任務。他們為創意鬆綁，創造出工作機會並提高生產力。新加坡如何孕育出富有創意的勞工？首先必須要抱有一種信念，相信每一個人都具有創意，策略則包括將公開、多元、包容納入經濟和社會發展的核心，並建立鼓勵創意和創新的教育體系。¹⁸

新加坡的創新導向經濟路線使人獲得適切的工程、創意或設計技能，從而提升了勞工的價值。這些人擁有較高的人力資本，亦即透過教育所習得的知識和技能。這樣的人懂得維持Thomas Friedman所稱的「動態穩定」（dynamic stability），那是一種主動自願去學習生活技能並自我再造

¹⁷ www.skillsfuture.sg/

¹⁸ 新加坡致力於成為創意「精明」城市，在很多方面令人聯想到Richard Florida所稱經濟發展的3T，亦即科技、天賦、寬容（Technology, Talent and Tolerance），見：Richard Florida, *The Rise of the Creative Class Revisited* (New York: Basic Books, 2012). Chapter 12.

的能力。¹⁹ 這一切意味著反省檢視教育的本質（以及學校所扮演的角色）有其必要，年輕一代才能在受科技驅動且瞬息萬變的世界裡從容應對。教學的概念及教師和校長的領導也都在新的千禧年產生變化。舊時典範著重於訓話式的教導，以傳授科目知識，管理行政程序和功能，俾便學校能夠良善運作。而在情況恆常變化的今天，教師作為學習促進者的角色受到更高的關注，教師所傳授的是思考和解決問題的技能，教育領導人則是帶頭從事變化的創新者，變化的領域橫跨學校人力資源、教育領導、促進創新性學校文化等。

要維持以創新和數位化為基礎的經濟，新加坡的教育體系放棄了標準化的集體教育方式。批評者指出，標準化集體教育已無法滿足二十一世紀以技能為基底的知識經濟。²⁰ Ken Robinson認為，在今日的教育體系裡，「學校應致力於培養年輕人的多元才華和興趣；應消解學術和技職課程之間的區隔，讓兩個學習領域具有同等的重要性；促進年輕人與工作世界之間的實踐關係，以便年輕人能夠親身體驗不同類型的工作環境。」²¹ 新加坡的學校教育將教學和學習予以客製化，目標在於協助學生發掘天賦，善用天賦，全面發揮潛力，發展技能、人格與價值，並發展能夠持續終生的學習熱忱。如今學習機會必須靈活而多元，才能契合不同的興趣和不同的學習方式，這已成為今日基礎深厚教育的特色，以此確保新加坡年輕人不論在教室內外都能獲得全面的發展。能夠選擇學習內容和學習方式，也提高學生的學習自主性。

作為新加坡教育核心的「思想課程」（thinking curriculum）一直備受重視。²² 新加坡年輕人勇於提問並尋求解答，懂得以新方式進行思考、解

¹⁹ Friedman, *Thank you for Being Late*, p. 219.

²⁰ Ken Robinson, *Creative Schools: The Grassroots Revolution That's Transforming Education* (New York: Viking, 2015).

²¹ *Ibid.*, p47.

²² 新加坡學生在國際學生能力評估計畫（PISA）中表現顯示「思想課程」的正

決新問題，並為未來創造新的機會。除了學習一個學門的內容知識，學生也在思想課程當中發展對核心概念及過程的深度理解。這使得學習具有深度，也提供學生實踐真實任務所需的工具（觀點、方法、概念等）。此外，思想課程多半具有方法上的跨領域性質，橫切許多教學科目，以解決問題、做成決策、從事批判性及創造性思考為目標。教學方法也大幅轉向探詢式教學與學習，也就是一種主動學習方式，以提出問題、疑難、情境開始，以解決問題、做成決策、從事批判性和創造性思考為目標。教師的主要任務是讓學生學習如何思考、學習、以批判角度評價情況，簡言之，就是教導學生如何自行學習。

學校也採取應用學習法或真實經驗法。²³ 作為新加坡創新導向成長策略的一部份，新加坡的學校也引進了應用學習計畫（Applied Learning Programmes, ALP）。應用學習計畫著重於真實及實踐導向的學習經驗，且不必然只限於技職或技術教育。這讓學生獲得額外的機會，可以在真實世界的情境之內獲得以知識的實踐應用為基礎的技能和才能，而我們試圖在學生身上開發二十一世紀能力與價值的企圖，也受到應用學習計畫的強力支持。應用學習是一種實用學習或經驗式學習，學生因此能夠體驗真實的場景，也擁有足夠的技能來將知識付諸實踐應用。應用學習也與產業、社群和較高階的學習機構相結合。在應用學習計畫之下，學校提供給學生的是各種「應用科目」（Applied Subjects），如程式編寫與電腦演算、電子學、練習與運動科學、戲劇、機器人學與智慧型電子科技等，以滿足對各特定領域的應用學習有興趣的學生。著眼於新加坡人的科技理解力及這個「有線」國家卓越的數位基礎建設，如今各個學校著手發展各種計畫，其基礎在於物聯網（Internet of Things, IOT）及數據的使用（該等數據是從與計劃有關的數種知覺來源收集而來）。簡言之，應用學習能夠拓展學

面成果，見：<https://www.bbc.com/news/education-38212070>

²³ <http://www.moe.gov/education/secondary/applied-learning>

生的教育體驗，特別是在學生所選擇的領域內，這些領域也可能與學生們未來的職業生涯重疊。

要確保思想課程獲得有效實行，現在的學校必須富有創意、能夠創新，在選採教學方法上尤然。企業家和教育家都認為勞工的關鍵能力應當包括設計思考（design thinking）和觀念構成（ideation），勞工不僅須有能力提高價值，還要有能力創造價值。設計思考如今在許多組織裡都獲得採用，在新加坡的學校裡也益形重要，被應用於諸如工作與社區涉入計畫（Project Work and Community Involvement Programmes）等領域。學生在設計思考當中學習以人為核心來解決問題。他們辨別人的需求和生活問題，獲得洞見、產生構想，最後以團隊合作的方式設計並測試符合這些需求的創新性解決方法。在解決問題的過程當中，學生也學到同理心、合作技能以及激進想法的價值。

設計思考是一種創新教學方法，而產生有用新想法的創意過程與此密切相關。新加坡學童迫切需要接受刺激而展開創意思考、從事創造及創新活動。學校成為孕育創意青年的重要場所。學校是創新文化獲得培育滋養之處。²⁴ 學校展開STEM（科學、技術、工程、數學）教育計畫並創造「創客空間」（Makerspace），以刺激學生對設計和製作的興趣。不同於配置電腦、3D印表機、Arduino硬體、雷射切割機等設備的典型創客製造實驗室（Fab Lab），學校的創客空間鼓勵學生以普通材料（如紙餐盤、硬紙板、紙膠帶、吸管、橡皮筋等）來製作物件或結構，如此學生必須仰賴自己的創意和對科學原則的理論性理解。透過此種生態友善的方法，學生於是了解到使用普通素材也一樣能夠創發非凡產物。

創客教育的興起和創客空間的設立都獲得新加坡學校的強力支持，這與政府不斷提醒人們要有所創新，並期望年輕人成為新興製造業創業家的

²⁴ See Tony Wagner, *Creating Innovators: The Making of Young People who will change the World* (New York: Scribner), 2012.

態度有關。新加坡雖然是個具有科技理解力及前瞻性的國家，教條主義依舊深植於指導強度高的學習活動，因此自由表達的空間很少，創客活動也受到限制（尤其是創新教育體系愈來愈重視的開放性跨領域活動）。學校希望透過創客空間來創造有益於年輕人思考、創造、創新的環境，或如 Dale Dougherty 所形容的，「創客活動過程容或是非正式的、邇邇的、有機的。」²⁵

最後，新加坡教育體系當中另一個關鍵成分便是對價值的重視，這一特點使得新加坡的教育有別於其他許多地方。當新加坡經濟在1990年代進入科技密集階段，新加坡人便迫切感到心態也必須有所調整，必須開始發展能使新加坡躋身已開發國家之林的價值與態度。李光耀本人曾表示改變心態並非易事：「困難在於人們得改變習慣，行為舉止要更像第一世界的公民，而不是像第三世界公民那樣隨地吐痰或亂丟垃圾。」²⁶ 教育再度被視為達成這些目標的關鍵渠道。以學生為中心、價值導向的教育，以人格發展和價值作為教育體系的核心。學校裡的國民教育（類似於公民教育）課程，目標在於使學生熟習技能、價值與屬性（如創新進取、終生學習的習慣、對社區和國家的責任感等），因為打造國家與正式和非正式的學校教育課程密不可分。要建構個人和集體的能力，要在知識和技能之外強化國家團結，箇中關鍵在於教育，這也是新加坡社會所具有的共識。

伍、結論

經濟成長理論家、經濟史學家和發展經濟學家認為，東亞各經濟體的持續成長，乃是基於幾個彼此相關的關鍵因素，如大量投資於基礎建設、

²⁵ Dale Dougherty, *Free to Make: How the Maker Movement is changing our Schools, our Jobs and our Minds* (California: North Atlantic Books, 2016), p. 155.

²⁶ Interview in *New York Times*, 24 August 2007

長足的吸收並採用先進科技，穩定的社會與政治環境、投注高度心力於人力資本的形成等。新加坡經濟成功的原因之一，在於國家有能力成功的管理教育體系，對於改變經濟景觀所需的能力，國家也能夠成功管理其需求。以李光耀的話來說：「我們的工作在於規劃出廣泛的經濟目標，以及達成目標的時程。我們定期檢討這些計畫，當前景因現實情況而有所改變，我們也據此做出計畫調整。基礎建設和勞工為滿足僱主需求而需要的教育訓練，都必須提前許多年做出規劃。」²⁷ 此種動態的同步協力一直都是新加坡競爭優勢的主要來源。要讓勞動力適合於新經濟，關鍵策略在於確保教育內容與經濟發展相關，與經濟變化同步。

對新加坡來說，教育和訓練的發展，取決於新加坡政府打造國家的整體計畫。受教育能使收入增加，這又會反過來提高對教育的投資。1965年以來，新加坡的教育和訓練策略都反映著城市國家第一代領導人的思維，亦即一國邁向永續成長的經濟發展路線，必須與教育政策、經濟政策與人力規劃相統合。新加坡政府管理教育和技能供需的能力，在過去是新加坡競爭優勢的主要來源，在未來也依然如此。與其他國家相比，在協調供給熟練人力以滿足經濟體擴張的需求方面，新加坡具有一種特殊的優勢——新加坡地小人稠（且通訊基礎設施甚為傑出），因此能夠做出有效的規劃和高凝聚力的決策，資訊和人力部署也得以在政府和私部門之內與之間流通。

如今正當第四次工業革命的黎明，我們必須反省教育的本質及學校所扮演的角色，如此年輕一代才能夠因應二十一世紀快速變遷科技導向世界的需求。現實的情況是，學校和大學所教授的內容與經濟體的需求之間，存在著一個愈來愈大的技能鴻溝。有些國家有著充分的工作機會，但儘管投資於教育，擁有適當技能可投入工作的人才還是太少。要培養出能夠滿足第四次工業革命需求的技能，我們必須認真思考如何才能使學校成為富

²⁷ Lee, *From Third World to First*, p. 85.

於創造力的環境。欠缺想像力的正統軍事化教育並不能滿足千禧世代或「Y世代」的教育需求。

改變父母、師長和學生看待考試和成績的態度，是新加坡教育刻正面臨的挑戰。未來的經濟型態需要學生發展軟技能，並將所知運用於解決問題、獲致創新。確實，今日的雇主並不在乎員工有多少知識，因為如今隨時隨地均能取得知識。雇主所在意的，是員工運用知識以提升組織價值甚或為組織創造價值的能力。如今時機已然成熟，學校與大學的負責人應當審慎思考，以求在教學和學習上獲致振奮人心的重大創新。許多國家的教育創舉都著眼於在短期內解決當前問題或提升效能，新加坡的教育政策制定者則偏好長期規劃。新加坡採取「未來思考」模式（*futures thinking*），協助今日的年輕人為承擔未來的挑戰而做準備。這需要作出策略性的決定，不只是從事教育改革，更要讓教育改頭換面，獲得新生。對致力於教育改革的國家來說，這或許就是新千禧年最重大的挑戰之一。

