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Embracing globalization to promote industrialization: Insights from the development of Singapore's petrochemicals industry

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ABSTRACT

Debates about industrial policy reveal disagreements on three salient issues. The first is whether government can overcome its own failures, namely knowledge constraints and rent-seeking, to correct market failures. The second is whether government should go beyond horizontal policies to adopt more activist interventions such as "winner-picking." The third is whether intervention should follow or defy the country's comparative advantage. Singapore's experience in developing a globally competitive petrochemicals industry, within only a few decades and through vigorous interventions, provides meaningful insights into these debates and offers valuable lessons for developing countries. The lessons drawn from this paper suggest three fundamental principles for designing a promotion strategy and a strategic action framework for implementation.

1. Introduction

Singapore has experienced transformational economic growth in the past five decades, progressing from a third-world country facing formidable economic and social challenges to a vibrant global economic hub with continuing growth potential. While Singapore's success is often described as an economic "miracle," its development process is no mystery and can serve as an example for other nations. As one of the major driving forces of the country's transformation, Singapore's petrochemicals cluster can serve as an instructive case.

How was it possible for Singapore, a tiny city-state with no natural resources, limited capital, and an undeveloped industrial structure, to achieve rapid success in developing a globally competitive position in petrochemicals, a resource- and capital-intensive industry? Underlying the cluster's success story is the effectiveness of Singapore's government in promoting this industry.

Insights from the case of Singapore's petrochemicals industry can shed light on debates concerning industrial policy, convincing policy makers that government failures can be overcome to fix market failures and enable both sectors work more effectively through deeper interdependence and synergy. The case is also evidence that a combination of horizontal and selective policies is more effective than relying only on the former. Furthermore, the case demonstrates that as globalization has become a major force transforming the world economy, a developing country can build a world-class industry within a short timespan by strategically embracing its comparative advantages, wisely positioning itself in the global economy, and continually upgrading its endowment structure.

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This case is structured as follows. Section 2 highlights salient issues from debates about industrial policy and outlines theoretical insights addressed by the study. Section 3 provides a comprehensive overview of Singapore's petrochemical cluster. Section 4 details the government's strategic approaches and policy coordination framework in promoting the development of the industry. Section 5 discusses related lessons and their transferability to developing countries. Section 6 offers concluding remarks.

2. Debates on industrial policy and insights from Singapore's experience

Robust debates on industrial policy have been occurring for decades but remain inconclusive. These debates cluster around three basic questions: 1) Is industrial policy justified? 2) To what extent should government intervene? 3) Which approaches characterize an effective industrial policy?

2.1. Is industrial policy justified? Market failure vs. government failure

The principal argument supporting the adoption of interventionist industrial policy is that market mechanisms do not always function efficiently, especially in developing countries. Therefore, government intervention is needed to correct market failures, particularly in two overlapping areas crucial to economic development: externalities and coordination.

Externalities are mainly associated with the mismatch between private gains and social benefits in entrepreneurial activities (Warwick, 2013). Economic activities having positive external effects and receiving close attention by government and scholarship include the acquisition of technology and industry information, R&D, exporting, foreign direct investment (FDI), structural change, entrepreneurial entry, and worker training (Rodrik, 2004; Lin, 2009, 2012; Naudé, 2010a; Harrison & Rodriguez-Clare, 2010). For developing countries, Hausmann and Rodrik (2003) specify "self-discovery," which is the process by which entrepreneurs explore markets and experiment with new product lines, as an externality-generating activity. The authors argue that although this process is essential to industrial development, entrepreneurs may refrain from investment due to the problem of appropriability – a situation in which the entrepreneur is unable to reap all investment benefits if a venture succeeds, but must bear full cost if it fails.

Coordination failure is another major obstacle to development (Rodrik, 2004, 2008; Lin, 2010, 2012). Coordination is related to the initiation of projects (e.g. upgrading factor conditions) that compel private firms to make simultaneous investments, benefitting invested parties through economies of scale and spill-over effects. Coordination is dependent on institutional arrangements that facilitate collaboration among government agencies and between the public and private sectors. In theory, this process enhances the quality of decision making and aligns the interests of all concerned parties. Coordination is vital in enabling companies to overcome constraints in finance, infrastructure, and logistics that hinder market entry and upgrading efforts. Coordination also helps firms achieve synergistic gains through deeper linkages within and between industries.

Given the potential benefits of managing market failures, governments in nearly every country have engaged in some degree of industrial policy intervention (Chang, 2009; Lin, 2012). However, success is rare and many countries have experienced disappointing results. There are several hindrances – often referred to as government failures – that stymie industrial policy (Aghion, Boulanger, & Cohen, 2011; Naudé, 2010b; Rodrik, 2008). The first is information constraints. Governments lack the information necessary to adequately substitute for market mechanisms in picking industrial "winners." The second hindrance is associated with rent-seeking and regulatory capture. In particular, if firms in target industries depend heavily on subsidies and import protection, they are likely to become the target of rent-seeking and political capture (Krueger, 1974; Lin, 2009). The third hindrance concerns capabilities. With weak capacity and limited institutional support, governments in developing countries often lack adequate capabilities in designing and implementing sound industrial policy.

2.2. To what extent should the government intervene? 'Soft' industrial policy versus 'hard' industrial policy

Concerning the potential benefits of industrial policy, there are differing views about how deep government intervention should be. Accounting for the risk of government failures, Harrison and Rodriguez-Clare (2010) propose an approach known as horizontal ('soft') industrial policy, which focuses on coordinating efforts to enhance productivity through deeper cooperation and consultation between government and industry. Activities related to this approach include programs and grants supporting particular clusters through worker upskilling, technology adoption, and regulatory and infrastructure upgrading. The authors argue that this approach has two advantages over selective ('hard') industrial policy, which relies on activist interventions in support of prioritized sectors and traditional measures such as tariffs and financial incentives. One advantage is its restriction of opportunities for rent-seeking, and the other is its compatibility with free trade agreements that many countries have embraced in recent decades (expected to increase with continuing globalization trends).

Presenting a counter argument to the 'soft' industrial policy approach, Aghion et al. (2011) find that state subsidies in particular sectors can be beneficial, especially in countries with a less mature capital market. According to the authors, governments in many countries continue to use subsidies and tax breaks as instruments to promote industrial development and attract foreign direct investment.

2.3. Which approach should be employed in pursuing industrial policy? Comparative advantage following (CAF) or comparative advantage defying (CAD)

Debates about which approach industrial policy should adopt provide further insights into underlying conceptual issues. Lin and Chang (2009), who advocate for government intervention in driving economic transformation, outline two opposite approaches: CAF and CAD. Advocating the CAF approach, Lin argues that "the government should facilitate the private sector's ability to exploit the country's areas of comparative advantage… the key is to make use of the country's current comparative advantage – not in the factors of production that it may have some day, but in the factors of production that it has now" (Lin & Chang, 2009: 484). In contrast, Chang, who supports the CAD approach, believes that "comparative advantage, while important, is no more than the base line, and that a country needs to defy its comparative advantage in order to upgrade its industry" (p. 489). Lin, however, sees risks "in deviating too far from a country's comparative advantage" (p. 492).

Although agreeing with Lin about the important role of government in addressing market failures, Rodrik (2011) questions whether the CAF approach can be used to coordinate investments and support new industry formation. Rodrik argues that these interventions induce firms to make choices that defy comparative advantage.

2.4. Debates about industrial policy and the case of Singapore

The debates about industrial policy explored above provide a helpful framework for investigating whether Singapore's interventions in promoting the petrochemicals industry have been justified. This framework can also be used to explore new insights that the Singapore case adds to these debates. Table 1 highlights these links, which are elaborated in Section 4.

3. Singapore's petrochemicals industry

This section provides an overview of the development of Singapore's petrochemicals industry and its contributions to the economy. With petrochemicals as a major driver of Singapore's economic growth and modernization, the evolution of the industry exhibits the salient and transformational effects of the government's industrial policy.

3.1. History and evolution[2]

Singapore's now-successful chemicals cluster is the product of long-term economic planning. The country's original economic plan, drafted in 1960 by UN economic advisor Dr. Albert Winsemius, targeted four industries, of which chemicals were one.[3] A strategic location made Singapore attractive to these four industries. The city had long served as an entrepôt for trade between Asia and other parts of the world, and ultimately assumed a new role as a bunkering facility for oil storage. Singapore then became a trading post for petroleum products, selling to passing ships and justifying the development and expansion of refining capacity.

The early stage of Singapore's modern industrialization saw a focus in the chemicals cluster on the lower end of the value chain. This included refining activity, with gasoline and naphtha the main products. In accordance with the government's strategy, multinational corporations (MNCs) have played a major role in the development of Singapore's petrochemicals cluster. Royal Dutch Shell was a pioneer with its investment in Singapore's first refinery, which opened in 1961. Most other refineries were built by MNCs in the 1960s and early 1970s: British Petroleum (1964), Mobil (1966), and Esso (1971). Singapore Refinery Corporation (1973) was a joint venture between British Petroleum (BP) and Caltex.

By the late 1970s, Singapore had become one of the largest refining centers in the world, with a capacity of more than 1.2 million barrels per day (Carpenter & Ng, 2013). Singapore soon gained a comparative advantage for producing higher value-added products from refined products such as downstream petrochemicals and specialty chemicals. The industry began to move up the value chain in the 1980s by investing in production of petrochemicals downstream products such as ethylene and propylene. Marking this turning point was the opening of the S$2 billion petrochemicals complex (PCS I) in 1984 on Ayer Merbau, one of the seven islets later amalgamated to form Jurong Island, the cornerstone of Singapore's petrochemicals industry (Appendix 1). PCS I provided processing capacities for converting naphtha, a major product of Singapore's refineries, into basic building blocks such as ethylene, propylene, and aromatics; these are inputs for a variety of higher-value finished products such as plastics, polymer, and additives. As a result of this transition, since the mid-1980s the chemicals cluster has replaced petroleum as the principal contributor to the petrochemicals industry's growth in value-added (Fig. 1) and employment (Fig. 2). The petroleum sector, which produces input products with lower value-added, has been comparatively steady on both measures since 1980. The success of PCS I spurred not only a new wave of investment into downstream products but also further expansion of the industry. In 1994, the partners of PCS I announced an investment of $3.4 billion to build PCS II, which opened in 1997.

To serve the rapid growth of the petrochemicals industry and enhance its global competitiveness, in 1995 Singapore embarked on an ambitious land reclamation project to build Jurong Island. This plan involved the amalgamation of seven offshore islets,

[2] Singapore was colonized by Britain from 1819 to 1959. It obtained internal self-rule in 1959 and joined Malaysia Federation from 1963 to 1965. The country became independent in August 1965.

[3] Other target industries were ship breaking and repair, metal engineering, and electrical equipment and appliances (Lee, 2000).

Table 1
Industrial policy debates and the case of Singapore.

Debate	Insights into the Singapore case	Insights the Singapore case adds to existing debates
Is industrial policy justified? Market failure vs. government failure	This debate implies that Singapore must overcome the main problems related to government failure (e.g. information constraints, rent-seeking, and capability limitations) in order to effectively implement market interventions.	Governments should commit to promoting economic development, adopting effective strategies, ensuring thorough implementation, and establishing feedback systems to capture learning opportunities.
To what extent should the government intervene? 'Soft' industrial policy vs. 'hard' industrial policy	The debate suggests that pursuing only a soft approach may reduce the risk of failure, but embracing both approaches can enhance the effectiveness of interventions.	Governments can enhance the effectiveness of the soft approach and at the same time reduce the risks related to the hard approach by: (i) working closely with industry to collect robust market intelligence and learning from leading companies and industry experts; (ii) promoting strategic investment projects through well-designed incentives and excellence--enabling conditions, rather than through the allocation of capital alone; (iii) closely monitoring industries' performance to enhance the quality of decision-making.
Which approach should be employed in pursuing industrial policy? CAF vs. CAD	The CAF is necessary for an open country to promote industrial policy by embracing global integration.	Singapore's experience shows that (i) comparative advantage should be defined in a broader view; (ii) the CAF approach works for best for an open economy; (iii) the CAF should be adopted.

some of which already housed refineries and petrochemicals plants (Appendix 2). Officially opened in 2000, Jurong Island rapidly became a magnet for investment in higher value-added products.

3.2. Contributions to the economy

The significant contribution of the petrochemicals industry to Singapore's economy is evident in most measures, particularly value-added, employment, investment, exports, and productivity growth. Additionally, the industry is among industries with the highest worker pay, which underscores its important role in driving Singapore's standard of living and prosperity. Furthermore, the global market leadership enjoyed by Singapore's petrochemicals industry has enabled the country to excel in related industries such as offshore oil rig engineering.

3.2.1. A key pillar of the manufacturing sector

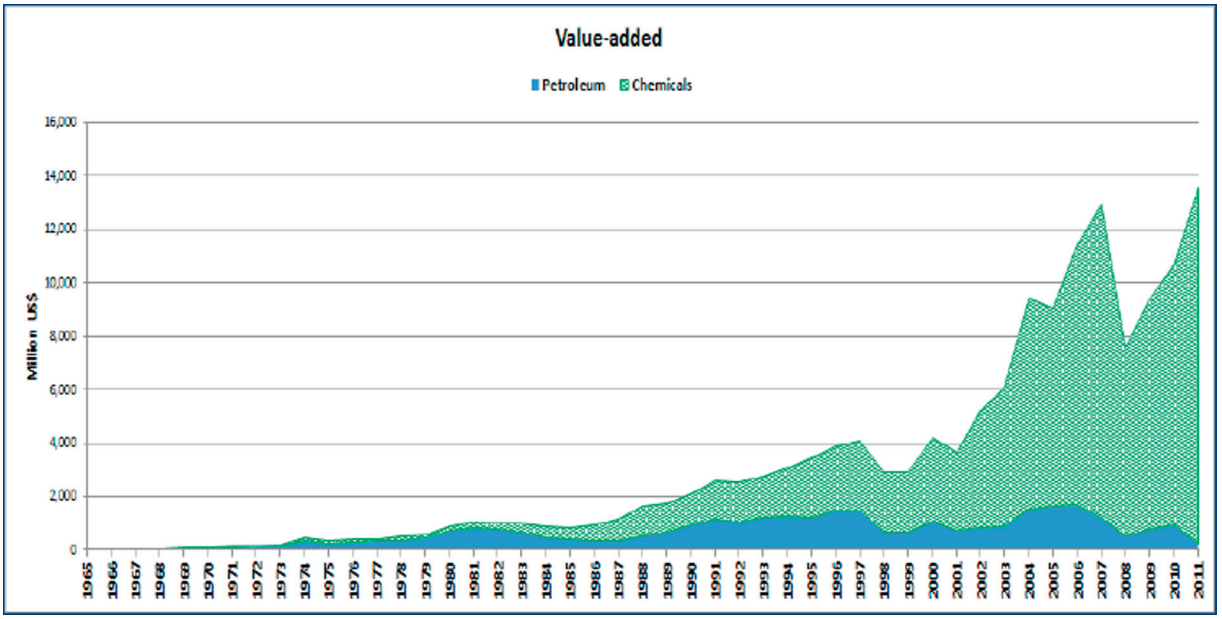
The manufacturing sector has been a major force driving Singapore's economic transformation and development, contributing 20–25% to the country's GDP. The petrochemicals industry is one of the main pillars of the manufacturing sector.[4] The share of the petrochemicals industry in manufacturing value-added exceeded 15% per year in recent decades[5] (Fig. 3). Moreover, this share expanded rapidly in the 2000s and the industry now accounts for more than a quarter of manufacturing value-added. Underlying the sustained contribution of the industry is its decisive shift towards higher value-added chemical products, starting in the 1980s and accelerating in the 2000s. The rapid growth of the chemicals sub-industry enabled the industry to reverse the decline of its share in overall value-added, despite the relative decline of the petroleum sub-industry (Fig. 4).

Compared to its value-added, the petrochemicals industry's employment accounts for a smaller share in Singapore's manufacturing sector. However, this share (measured in 5-year moving average) has followed a strong increasing trend since the early 1990s after declining from nearly 5% in 1970 to 3.5–4% in the 1980s. In the past ten years, the share was stable at around 6%. Again, the chemicals sub-industry played a critical role in sustaining the industry's share in manufacturing employment.

In a cross-country comparison, Singapore's petrochemicals industry, and in particular its chemicals cluster, has a notably large share in the country's manufacturing value-added. At 25.2%, the share is well above the rate in other countries (Table 2). This difference is even more pronounced for the chemicals cluster. Moreover, the industry's labor productivity relative to that of the manufacturing sector is likewise higher for Singapore (4.1 times) than the range in other countries (from 1.2 times in South Korea to 2.6 times in Japan and the United States) (Table 2).

[4] Other main pillars are electronics, biomedical manufacturing, precision engineering, and transport engineering. Under Singapore's proactive industrial policy, these industries have also experienced rapid growth and played vibrant roles in transforming the economy.

[5] The share is measured in 5-year moving average to remove short-term fluctuations.



Data source: UNIDO. Note: the value is in current US$.

Fig. 1. Petrochemicals industry: value added (1965–2011).
Data source: UNIDO. Note: the value is in current US$.

3.2.2. Contributions to exports and success of related industries

Singapore's petrochemicals industry is a major source of its export growth, especially in the last decade. The industry's exports grew at an average annual rate of 14.5%, from US$21.3 billion in 2000 to US$123.6 billion in 2013.[6] This was much higher than the growth rate of 8.3% for the country's total merchandise exports.[7] As a result, the share of the industry in total merchandise trade nearly doubled, from 16.1% in 2000 to 32.8% in 2013.

The rapid transformation and growth of the petrochemicals cluster has also encouraged its related industries to enter into higher value-added activities and build global competitiveness. For example, Singapore's ship repair and building industry, through linkages with oil and gas companies, has undertaken major industrial upgrading and diversification to become of the leading players in the oil rigs and oilfield machinery industry.

4. The role of government in promoting the petrochemicals industry

Singapore's efforts in promoting the petrochemicals industry were guided by the country's overall development strategy, which is built on three fundamental principles and a related strategic action framework.

The three fundamental principles emphasize integration into the world economy: (i) interdependence between government and market; (ii) a focus on establishing linkages with industrialized countries and attracting investment from multinational companies (MNCs); and (iii) the importance of leveraging evolving comparative advantage through effective strategic positioning.

The strategic action framework consists of four pillars: capacity building (C), opportunity seizing (O), resources upgrading (R), and enduring success (E), which in combination can be referred to as the CORE framework.

This section describes Singapore's government interventions in promoting the petrochemicals industry, along the three fundamental principles and the CORE framework.

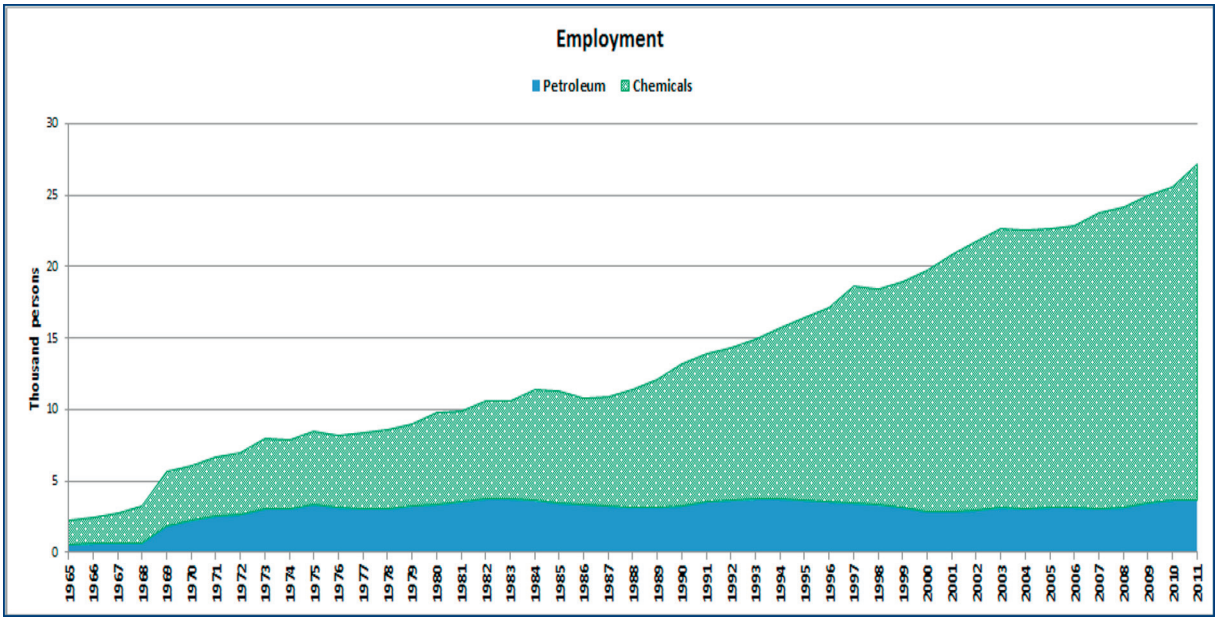
4.1. The three fundamental principles

Fundamental principle #1: Government and markets are critically interdependent. Government need markets to enhance its performance efficiency. Markets need government to enhance their functioning effectiveness. Government interventions should strengthen market forces but not substitute for them.

This principle was recognized from the outset of Singapore's development efforts and reinforced over time. As described by Thomas and Lim (2001), the Singapore government has faithfully relied on the market mechanism to enhance its effectiveness

[6] According to Singapore's I–O Tables 2010, the net foreign exchange earnings as a proportion of exports is much higher for petrochemicals (ranging from 23.8% to 51.1%, depending on types of product) compared to petroleum products (9.4%). This implies that the industry, by shifting to higher value-added products, has also increased its share as a major source of the country's hard currency earnings.

[7] Data come from the UNCOMTRADE dataset.



Data source: UNIDO

Fig. 2. Petrochemicals industry: employment (1965–2011).
Data source: UNIDO.

in achieving development goals. The authors also argue that the government's adoption of market mechanisms is robust though both demand and supply sides. From the demand aspect, the government will intervene if significant positive externalities exist by providing subsidies or tax incentives. The subsidies should take the form of co-investment or co-payment to get correct market signals for efficient allocation/distribution. The extent of government subsidies depends on the magnitude of expected benefits that the intervention can deliver. On the supply side, the government strictly uphold the key principle that provision of services should be left to the private sector if market solutions are available.

At the same time, government made every effort to enhance the functioning and legitimacy of markets.[8] According to Mr. Ravi Menon, Permanent sectary of the Ministry of Trade and Industry, the four tasks that guide government interventions are[9]:

- Enable markets by ensuring rule of law, property rights, public infrastructure, and coordination for industrial and capability development
- Regulate markets by supervising the financial sector, enforcing competition regulations, and taxing negative externalities
- Stabilize markets to ensure stable macroeconomic conditions
- Legitimize markets by facilitating adjustments, redistributing income (to help the poor through government transfer), and providing social safety nets

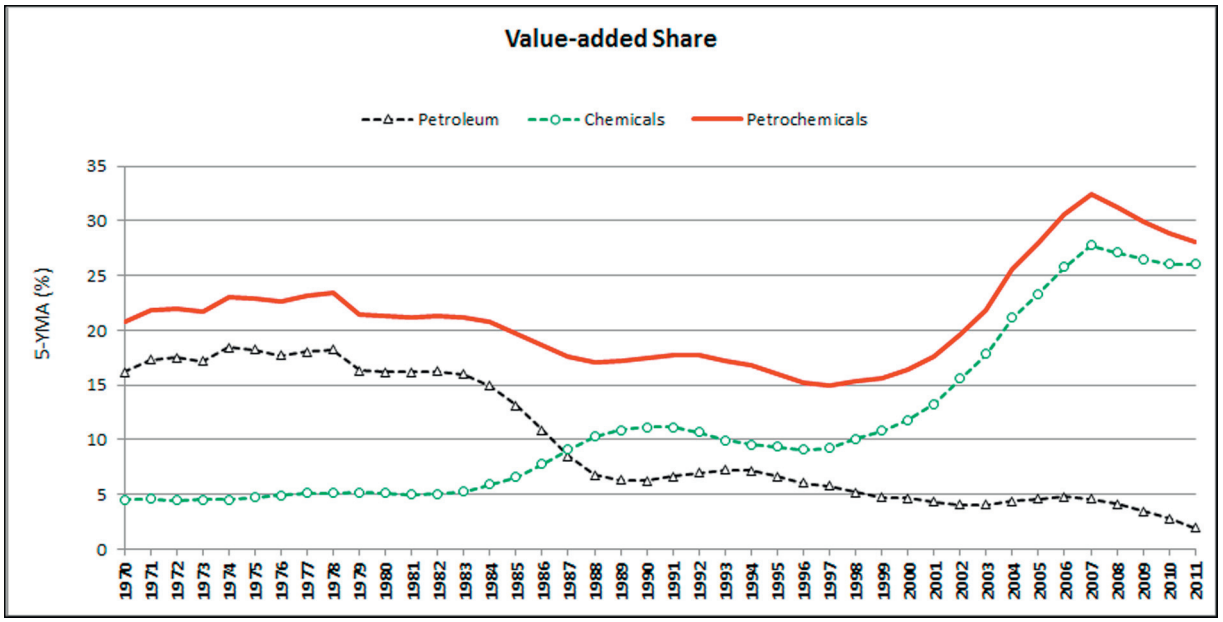
Singapore's commitment to the principle of government-market interdependence is evident in its promotion of the petrochemical industry; this is actualized through three approaches. First, the government creates a highly favourable business environment that attracts investors to Singapore. In this approach, policy measures to promote supported industries and business services include infrastructure upgrading, workforce development, government responsiveness, policy consistency, free-floating exchange rates, and the adoption of free trade agreements (FTAs).[10]Second, the government used financial incentives, especially tax holidays, to attract strategic projects. Third, the government took calculated risks to co-invest in projects deemed critical to the upgrading of the industry; the support was then withdrawn when the project became successful. For example, the government took a major stake in an international consortium[11] led by Sumitomo Chemical to build Singapore's first integrated petrochemical complex (PCS I). This project was essential for enabling Singapore to provide higher value-added downstream activities that

[8] In 2016, Singapore was ranked second on economic freedom by Heritage Foundation and the Wall Street Journal, third on ease of doing business by the World Bank (2016), and second on global competitiveness by World Economic Forum (2015).

[9] Drawn from Mr. Menon's speech, "Market and Government: Striking a Balance in Singapore" at the Singapore Economic Policy Forum held in Singapore on Friday 22, 2010.

[10] Singapore's FTA with Japan (concluded in 2002) was considered especially important to the chemicals industry. This reduced tariffs on 95% of Singapore's petrochemicals and chemical product exports to the Japanese market, and hence made Singapore more attractive as a production base for petrochemicals exports (source: Singapore Chemicals Report 2009, Business Monitor International Ltd, June 2009). Singapore currently has 21 FTAs with 31 trading partners, which include the US, Japan, China, S. Korea, India, and ASEAN.

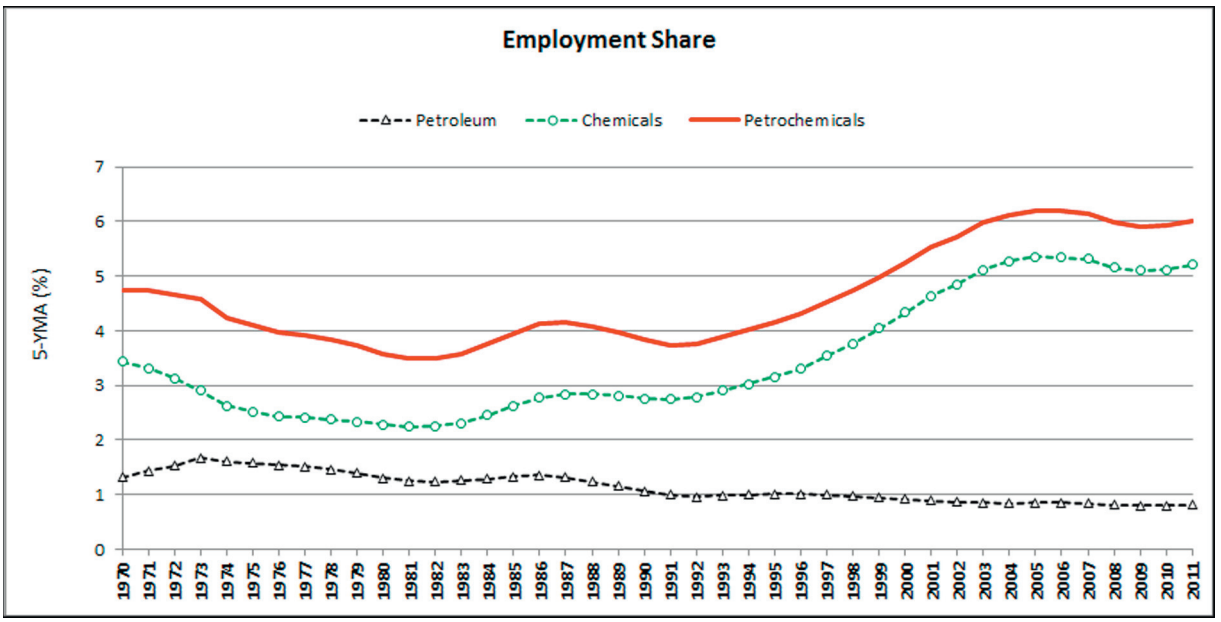
[11] Other partners in the consortium were Shell, Chevron Phillips and Celanese.



Data source: UNIDO

Fig. 3. Share of petrochemicals in Singapore manufacturing value-added.
Data source: UNIDO.

utilize the feedstock produced by its world-scale refineries. The opening of the complex in 1984 was considered the birth of a new era in Singapore's industrial development. Note that the government's equity participation in this project was market-driven. The government's co-investment was aimed to reduce the risk perceived by the MNCs, who were the leading investors. After the project had become a clear success, the government sold its share to Shell. This example illustrated the comment by Mr. Ravi that



Data source: UNIDO

Fig. 4. Share of petrochemicals in Singapore's manufacturing employments.
Data source: UNIDO.

Table 2
Share of the petrochemicals industry in manufacturing sector, 2010.Source: UNIDO.

Country	Share in Value-Added			Share in Employment			Relative Labor Productivity[a]		
	Petroleum	Chemicals	Petrochemicals	Petroleum	Chemicals	Petrochemicals	Petroleum	Chemicals	Petrochemicals
Singapore	2.2	23.1	25.3	0.9	5.3	6.2	2.4	4.4	4.1
Selected global major players									
China	3.1	10.8	13.9	1.1	8.2	9.3	2.8	1.3	1.5
Japan	1.3	11.7	13	0.3	4.6	4.9	4.3	2.5	2.7
S. Korea	*3.5*	*7.8*	*11.4*	0.3	8.9	9.2	11.7	0.9	1.2
France	1.5	12.7	14.2	0.5	7.8	8.3	3.0	1.6	1.7
Germany	1.3	11.4	12.7	0.3	6.5	6.8	4.3	1.8	1.9
Italy	0.9	8.7	9.6	0.5	5	5.5	1.8	1.7	1.7
UK	1.7	13.5	15.1	*0.8*	6.4	7.2	2.1	2.1	2.1
US	*3.8*	*16.2*	*19.9*	0.7	6.9	7.6	5.4	2.3	2.6

[a] Manufacturing labor productivity is standardized to 1.0.

"Government needs the capability to step in where they can make markets work better, the humanity to get out of the way when they are likely make matters worse, and most of all, the wisdom to know the difference."

Principle #2: Integrating into the world economy by focusing on deepening links with industrialized nations and attracting investments from MNCs is vital for Singapore's economic development.

This principle was adopted since the early days of independence, when Prime Minister Lee Kuan Yew envisioned a two-fold strategy for Singapore's development. The first was to "leapfrog" regional peers, bypassing the slow path of less developed nations to establish a direct and meaningful link with the developed world (Lee, 2000: 75). This emphasized attracting multinational companies from the United States, Europe, and Japan to produce for exports in Singapore. The second strategic thrust was to establish Singapore as a "first-world oasis" in a "third-world" region. This meant that Singapore would need to embrace the highest standards in all aspects of development, particularly in public services, infrastructure, and human capital (Lee, 2000: 76). This two-fold strategy has enabled Singapore to create virtuous cycles in achieving large gains from global openness; the deeper the integration, the better prepared the country.

Following this principle, Singapore has encouraged petrochemical MNCs to build their presence in Singapore to serve the Asian markets.[12] Beginning with the first refinery, built by Shell in 1960, Singapore rapidly developed its refining capacity in the 1960s and 1970s through large-scale investment from other leading petrochemical MNCs such as Esso, Mobil, and BP. As a result, since the late 1970s Singapore has become one of the world's largest refining centers (Carpenter & Ng, 2013). MNCs have been the central force transforming Singapore into a major global petrochemical and chemical hub, with an export value of US$124 billion in 2013. In this industry, Singapore outperforms much larger economies such as Japan, South Korea, India, France, and the UK.[13]

Fundamental principle #3: Effective strategic positioning is essential for Singapore to best exploit its comparative advantage in integrating into the world economy.

Strategic positioning involves efforts to turn a country's comparative advantage into its most recognizable and effective strengths for competing in strategically targeted industries. This process requires three things: a robust understanding of the external environment and the country's endowment structure, vigorous investment in upgrading the country's strategic resources, and proactive promotion of the country's unique strengths and strategic intentions.

Singapore's adoption of this principle in promoting the petrochemicals industry can be seen through three examples. First, at the outset of development in the 1960s, Singapore's only unique comparative advantage was its strategic location as a bridge between the supply of crude oil from Middle East and demand from growing Asian markets. Strategically positioning itself as a refining center, Singapore was successful in attracting major MNCs to build their refineries. Second, as Singapore became an established refining center in the 1980s, the abundance of one of its major refined products, naphtha (used as feedstock for higher value-added downstream products) provided a new comparative advantage for building the petrochemicals industry. Singapore made strategic efforts in strategically positioning itself as a major petrochemicals hub to attract investment in the industry. Third, since the late 1990s, the development of the Jurong Chemical Island as a highly integrated petrochemical cluster provided Singapore with a new comparative advantage. The companies operating in the cluster find it extremely efficient and convenient, given that they can buy and sell feedstock through pipelines and share utilities and services supplied by third-party providers. A high degree of efficiency and "plug-and-play" strategy became an additional feature in the Singapore's strategic positioning to attract investment in the production of high value-added petrochemical and specialty products.

[12] Wang and Yeung (2000) show that rising global competition and growing Asian market opportunities are two critical factors driving MNCs to invest in Asia.
[13] Data from UNCOMTRADE dataset.

4.2. The strategic policy framework for action

The strategic policy framework for action employed by the Singapore government to promote economic development can be observed along four dimensions: capacity building (C), opportunity seizing (O), resources upgrading (R), and enduring success (E), which in combination can be referred to as the CORE framework.

4.2.1. Capacity building (C)

Capacity building is a foundational step and has been a top priority since the People's Action Party (PAP) took power in 1959. The Economic Development Board (EDB), which was established in 1961 as a one-stop agency to provide support to investors, is an example of the government's strategic focus on capacity building in promoting economic development. Institutionally, the government established the EDB as a statutory board, giving it a full mandate to attract investment and promote economic growth. Organizationally, the government appointed the most qualified people to serve as the EDB's management[14] and provided strong support and incentives for meeting performance targets. Regarding human resources, the EDB made extraordinary efforts to recruit motivated and talented people, providing them with robust training and opportunities for making contributions to the agency's mission.

The EDB launched a number of strategic operation and management initiatives in carrying out its mission. These included opening overseas offices, applying performance-based management, and using survey tools to monitor the business climate; these efforts played an important role in enhancing the EDB's effectiveness in promoting the target industries, including petrochemicals.

Soon after Singapore became independent and adopted an export-led growth strategy, the EDB opened its first overseas offices in New York and Hong Kong in 1966 to attract foreign investment. The EDB's overseas offices network rapidly expanded to other major cities in the United States, Europe, and Japan. The officers based in these offices provide diligent analyses of target industries and solicit investment from major companies. Business intelligence and investment promotion contributed by the EDB's overseas offices was notable, especially during the period of the industry's major transformation (Chan, 2002).

4.2.2. Opportunities seizing (O)

The government's efforts to seize opportunities were carried out on three fronts: early identification of emerging opportunities, enhancing the country's competitiveness for seizing identified opportunities, and strengthening the government's effectiveness in turning these opportunities into achievements. To identify emerging opportunities, the government relied on robust business intelligence and in-depth understanding of global market dynamics through various channels, including close communications with MNCs and industry experts. To enhance the country's competitiveness, sharpening strategic positioning and upgrading comparative advantage were priorities for seizing these opportunities. To turn the identified opportunities into achievements, both “soft” and “hard” interventions, through decisive decisions as presented above, played a critical role.

4.2.3. Resources upgrading (R)

The government's resources upgrading aimed to make Singapore one of the best places to do business, positioning the city as a total business center rather than a production node. These efforts were focused particularly on continuously upgrading three critical factors: human capital, infrastructure, and innovation capacity. Singapore placed strategic emphasis on upgrading all such resources in order to attract not only large scale projects but also high-value added activities. The government sought solutions to satisfy the investors' immediate needs and help them enhance their own long-term competitive positions.

A distinctive feature of Singapore's resources upgrading strategy was its strong focus on turning the country's disadvantages into strengths. In particular, lack of natural resources prompted the overall determination to develop human capital; land scarcity inspired innovative solutions in urban planning, industrial clustering, and efficient use of land; and the small domestic market deepened the government's commitment to global integration and long-term relationships with MNCs. This approach has made Singapore's efforts to upgrade its endowment structure more effective, not only strengthening the country's comparative advantage but also reducing its vulnerabilities.

For the development of the petrochemical industry, the government proactively made strategic efforts to upgrade the resources critical to its success and upward transformation, with a special focus on workforce development, innovation capacity, and world-class infrastructure. In particular, the efforts on workforce development included a range of policy initiative and investment to ensure a robust supply of specialized skilled workers for the industry and minimize the need for its employers to conduct repetitive training.

Resource upgrading strategies also focused on promoting the supporting services for the industry and enhancing its connectedness. The promotion of investment in specialized services such as the joint venture between SembCorp and Katoen Natie - a

[14] For example, the EDB's first managing director, E. J. Mayer, who was the director of the Industrial Planning Department at Israel's Ministry of Commerce before joining the EDB, was regarded as a highly competent person for the job (Schein, 1996). The EDB's first chairman, Hon Sui Sen, was considered by Lee Kuan Yew to be one of the most capable senior officials in the government (Lee, 2000).

world leader in logistics solutions for handling hazardous chemicals can serve as an example. To foster the collective efforts of petrochemicals companies, the Singapore Chemical Industry Council (SCIC was set up in 1979 and has played an important role in attracting investment to Singapore, promoting safety and sustainability practices in the industry, and facilitating linkages among the companies in the industry (Pillai, 2006).

4.2.4. Enduring success (E)

To ensure long-term success, strategic efforts were made on two fronts: sustainability and adaptability. Sustainability was focused on environmental protection, safety, and security. Adaptability emphasized the capability of firms and the industry to anticipate change, to understand the strategic implications of change, to seize related opportunities, and to enhance the industry's readiness for the future.

4.2.4.1. Sustainability. Singapore enjoys a strong reputation on development sustainability,[15] a notable achievement given the massive volume of petrochemicals its world-scale plants process each day. The main driver of this achievement is the government's commitment to and enforcement of high standards for environmental protection, safety, and security, in place since the early stage of development.[16]

4.2.4.2. Adaptability. Continually renewing economic strategy has been an effective way for Singapore to understand changes in external and internal economic circumstances, and has helped the government identify strategic measures to stimulate economic growth and adaptive transformation. Since 1960, Singapore's economy has been transformed through six main economic strategies (Appendix 1).[17]

Strategies played a critical role in not only engineering the development of Singapore's petrochemicals industry but also ensuring its success. In particular, the strategy to shift towards higher value-added production in the early 1980s ultimately led the industry to invest in major integrated petrochemical complexes, producing a richer portfolio of downstream products. This strategy was built on Singapore's new comparative advantage: sizable output from world-class refineries, yielding feedstock for downstream petrochemical products. Furthermore, the strategy of fostering efficiency through cluster development and integration adopted in the late 1908s, along with the development of Jurong Island in the 1990s, was essential for the industry to sustain its competitive advantage and growth amidst increasingly intense competition from rising economies in the region.

5. New insights to the industrial policy debates and the transferability of Singapore's lessons

5.1. New insights to the industrial policy

Singapore's success in promoting the petrochemical industry sheds valuable light on the policy debates presented in Section 2. The contributions of the Singapore case are evident in three issues: can government failures be overcome? Should the government focus on only soft approaches or both soft and hard approaches? And should the country adopt a CAF or CAD strategy?

5.1.1. Overcoming government failures: the importance of development strategy and capacity building

The Singapore case shows that a developing country can overcome government failures, namely information constraints and rent seeking, in its efforts to address market failures for accelerating industrialization. The case suggests that this success pushed the country to adopt an effective development strategy and maintain a deep commitment to building capacity. The effective development strategy and the highly qualified team in charge of its execution has enabled the country to surmount both the information constraint and rent seeking problems.

The Singapore case also suggests that investment in capacity building was well respected by the business sector, proving essential in the government's coordination efforts to overcome both market and government failures. The comments on the EDB below, which were drawn from interviews by Schein (1996) with the executives of major petrochemical MNCs, serve as illustrations:

[15] For example, Singapore was ranked fourth (after only Switzerland, Luxemburg, and Australia) on Environmental Performance Index (EPI) constructed for 178 countries and territories by Yale University in 2014 (Source: http://archive.epi.yale.edu/epi/country-rankings).

[16] For example, the Anti-Pollution Unit (APU) in the Prime Minister's Office (PMO) was set up in early 1970 and then Prime Minister Lee Kuan Yew personally led the *anti*-pollution drive, while a then Minister of State was named as anti-pollution chief. The Clean Air Act passed by parliament in 1971 required the occupiers of industrial and trade premises to meet regulated air quality standards and allowed authorized officials to inspect and fine those not conforming to the regulations. (Source: "The Clean Air Act of 1971" by Shaun Oon and Kartini Binte Saparudin, National Library Board, available at http://eresources.nlb.gov.sg/infopedia/articles/SIP_2014-04-07_110024.html).

[17] In a typical process of strategy formulation, the government appointed an economic review committee, which consisted of high-ranking government officials and leading representatives from businesses, academics, and labor movements. The strategy report was the product of vigorous discussions among the committee's members and its working groups and extensive consultations with all sectors. For example, the report "The Singapore Economy: New Directions," was prepared by a committee led by current PM Lee Hsien Loong, then Minister of State for Trade and Industry. The committee set up in April 1985, which consisted of 10 members (six of whom were business leaders), submitted its final report in February 1986. The committee held 28 meetings and received substantial inputs from its eight sub-committees and contributions from over 1000 individuals belonging to all sectors.

On recruitment and promotion:

> "They [EDB] always picked the best people and, through creating a fairly strong elitism, managed to get very good people to the top" (A. V. Liventals, Mobil's vice president for Middle East and marine transportation and the local manager in Singapore; p. 120)

On commitment, communication, innovation, and learning attitude:

> "What they said, they stuck to." (Edward Woolard, Chairman of DuPont, p. 125)"When they do things, they explain the logic so that everyone has a deeper understanding of why things are done the way they are. […] They are always very innovative in thinking of ways around constraints."" (Peter Chen, CEO of Shell Singapore, p. 144)"Very little is done without careful disciplined research and, in that process, they use outside resources and are willing to learn from whoever has relevant knowledge." (Liventals, Mobil, p. 120)

On long-term planning and strategic partnership building:

> "The strength of EDB is that they were very clear about their long-range goals and knew what they were trying to accomplish. At the same time, they were able to make shifts from labour-intensive to capital-intensive to high-tech to now more business architecture. They were good people to do business with, good partners, partly because they have high motivation, high skills, good education and, most important, the ability to constantly upgrade their mode of thinking and their goals." (Alan Murray, Mobil's CEO, p. 121)

5.1.2. Both "soft" and "hard" intervention are important

In promoting its petrochemicals industry, the government vigorously adopted both "soft" and "hard" interventions. For the "soft" approach, the government created a highly favourable business environment, built an excellent education system, and entered into FTAs with major trade partners to enlarge markets for businesses. It is notable that for this approach, the government's measures are more specific than generic. For example, the government invested in vocational schools and training centers that emphasize master skills specialized for the petrochemical sector, such as the operation of state-of-the art technology used in plants.

At the same time, the government was also proactive in "hard" interventions, which ranged from providing tax credits to pioneering investors to taking equity participation in investment projects for industrial upgrading. In particular, the government's equity participation in the PCS 1 (in 1985) project to build Singapore's first integrated petrochemical complex and its investment in Jurong Island were considered to vital for the sustainable development of the industry. With regard to the importance of financial incentives on investment decisions, Mobil's CEO Alan Murray explained the motivation behind the company's decision to build its first refinery in Singapore:

> "Though the general climate in Singapore was good for business, it was really the EDB that created the specific incentives, provided what was needed like pioneer status, investment tax credits, and so on that made us choose Singapore as a place to make these big investments rather than some of the other countries in the region." (Schein, 1996: 22).

5.1.3. For a highly open economy, pursing a CAF strategy is critical to success

As presented in Section 3, Singapore pursed the CAF strategy in building its petrochemical industry. It should be noted, however, that the country's comparative advantage was not only fully exploited but also continuously upgraded. In the 1960s, Singapore relied on its strategic location and position as the region's entrepôt to attract MNCs to build refineries for serving the growing Asian markets. In the 1980s, Singapore exploited its new comparative advantage in world-scale refining capacity, producing vast amounts of naphtha used as feedstock for higher-value downstream products. The government successfully seized this new opportunity to enable the industry to shift decisively to a higher value economic structure. In the 1990s and 2000s, the government enhanced the industry's comparative advantage by integrating the existing petrochemical plants through the development of the Jurong Island as a world-class petrochemical hub. This development paid the way for the industry to continue robust expansion along with sustainable development and upgrading.

The Singapore case, therefore, demonstrates that pursuing a CAF strategy entails seizing comparative advantage not only for the industry's direct expansion but also in enhancing it for the industry's future growth.

5.2. Lessons for promoting industrialization in developing countries

The Singapore case offers helpful lessons for developing countries in their efforts to promote industrial policy. The lessons are associated with the three fundamental principles underlying a development strategy and the strategic policy framework for implementation (CORE).

5.2.1. The three fundamental principles

In pursuing industrial policy, a developing country should uphold three fundamental principles presented in Section 3: (i) adhere to market principles in order to enhance market effectiveness; (ii) embrace global integration with a focus on deepening

economic links with industrialized nations to accelerate industrialization; and (iii) use strategic positioning to enhance the effectiveness in exploiting and upgrading comparative advantage.

The first principle suggests that commitment to market principles and the ability to design policy interventions that enhance market effectiveness are prerequisites for a government in pursuing industrial policy.

The second principle requires a country to not only fully understand and appreciate the benefits of globalization but also to overcome domestic obstacles caused by protectionism and special interest groups. Absent either of these perquisites, the country may not be prepared to embrace globalization.

The third principle suggests that the government should pay special attention to establishing effective strategic positioning. This emphasis requires both analytical competence and an ability to make strategic investments. Analysis of cases from this perspective provides a deep understanding of a country's internal strengths and external opportunities, as strategic investments enhance the critical features of a country's comparative advantage.

5.2.2. The CORE framework

Capacity building is the starting point and most critical component for action. Establishing an agency dedicated to implementing development strategies, such as the EDB, is a foundational step. The EDB has a full mandate and complete support from relevant government agencies to execute its duties successfully. At the same time, such an agency should be led by highly effective leaders and staffed with the most competent employees. This agency and its employees should have the attributes essential for success, including analytical skills, incorruptibility, effective communication, a sense of mission, and a strong spirit of teamwork. The quality of the organization's execution is the most important factor determining the government's effectiveness in addressing market failures, including externalities, coordination, and moral hazard.

Opportunity seizing, among other factors, includes identifying a target industry and making policy efforts to facilitate its development. Identifying an industry should not be based on wishful thinking, but on thoughtful assessments of global opportunities, the country's comparative advantages, and early market signals. This process requires the government to work closely with the industry to leverage their insights, commitment, and recommendations for making the industry viable. It should be noted that opportunity seizing is a robust learning process and a country may make mistakes in its early stage of development. This also happened to Singapore. The EDB in the early 1960s chose several industries in which to enter joint ventures with foreign investors, but these efforts failed because Singapore had little comparative advantage in those industries.[18] Singapore's experience is consistent with the observation by Lin (2011: 210) that "even in successful cases, industrial policy is never a smooth process. It always involves trial and error from governments that put in place good mechanisms and channels to learn from mistakes, adjust economic strategies, and minimize the potential costs of bad decisions."

Resources upgrading should be both vigorous and strategic. In aiding the efforts in this dimension, establishing an effective strategic positioning is vital. It enables the country to be efficient, effective, and strategic in building and exploiting its comparative advantage over time.

Enduring success requires the country to pay strategic attention to enhancing the sustainability of development and the timely adaptability of the economy. In particular, environmental protection, safety, and security should never be overlooked.

5.3. The transferability of Singapore's lessons for China's promotion of the petrochemicals industry

China has made significant efforts to build petrochemicals clusters. As of 2015, the number of chemical industrial parks (CIPs) in China exceeds 500 (Yune, Tiana, Liu, Chena, & Descamps-Large, 2016). Lessons from Singapore's experience in developing a successful petrochemicals industry are relevant for China's efforts to promote the development of CIPs.

The successful application of Singapore's lessons has several prerequisites. First, the CIP must have a strategic location that allows it to participate competitively in global trade. In this regard, the presence of a deep seaport and basic logistics infrastructure are essential.

Second, the CIP's management must be committed to the three fundamental principles of development strategy presented in Section 4: government interventions are driven by market signals and deliberately designed to enhance market effectiveness; projects embrace global integration, with a focus on attracting investment from MNCs to become a global chemicals hub; and adopting prudent strategic positioning to build growth-enhancing competitiveness.

Third, CIP management should work closely with governments to adopt the CORE framework in its development actions. In the context of China, two components – capacity building and enduring success – may need a stronger emphasis. Due to institutional constraints and the legacy of a command economy, it may be more challenging for CIP management to recruit highly qualified people and apply modern performance-based management practices. At the same time, China's unproven record on environmental protection, safety, and security indicate that imposing high standards on such issues and enforcing them vigorously are critical for development success.

More nuanced views into the transferability of Singapore's lessons to China can be gained by examining the cases of the Shanghai Chemical Industry Park (SCIP) and the Ningbo Petrochemical Economic & Technological Development Zone (NPETD). As described in Table 3, both SCIP and NPETD are fairly comparable to Jurong Chemical Island (JCI) in terms of locational

[18] Source: Lee (2000). Examples include ceramics and recycled papers, which were polluting and required large water consumption. Due to its small size, high population density, and shortage of natural water, Singapore suffered from serious disadvantages in developing these industries.

Table 3
SCIP and NPETD vs. Singapore's Jurong Island: selected information.Sources: He (2013), Yune et al. (2016), and SCIP and NPETD websites for SCIP and NPETD; EDB and ExxonMobil's website for Jurong Island.

SCIP	NPETD	Singapore's Jurong Island
Geographical and logistics conditions		
+ Location: Proximity to downtown Shanghai, 50 km from Shanghai port; + Area: 29.4 km^2 area; + Logistics conditions: excellent with a jetty located within the cluster.	+ Location: near downtown Ningbo, proximity to Beilun, China's largest natural deep-water port; + Area: 56.2 km^2 + Logistics conditions: Efficient logistics conditions, with direct access to Zhenhai Liquid Chemical Dock, China's largest liquid chemical dock.	+ Location: Excellent position as a link between Middle-east crude oil supply and growing Asian markets. + Area: 30 km^2 + Logistics conditions: World- class infrastructure; high efficiency from integration and sharing.
Strategy		
+ Becoming a world-class chemical/-petrochemical cluster; + Providing investors with the best investment environment and high levels of operational efficiency and integration; + Priority given to large-scale projects.	+ Becoming a world-class petrochemical industrial base; + Extending into downstream higher value petrochemical products; + Open to small-scale projects.	+ Leveraging its position as a major global petrochemicals hub with unmatched strengths in efficiency, infrastructure, and government's strategic support. + Give top priority to attracting investment in high value-added specialty chemicals. + Promoting R&D activity
Number of manufacturing companies		
48 BP, BASF, Bayer, Degussa, Huntsman, SUEZ, Vopak, AIR LIQUIDE, Praxair.	69 LG, Akzo Nobel.	More than 100 + Most global major petrochemical and chemical companies, including Shell, ExxonMobil, BASF, Lanxess, Mitsui Chemicals, and Sumitomo Chemicals.
Salient facts		
+ Bayer's integrated chemical complex in SCIP is the largest and most important production site for Bayer Material Science in Asia. In 2016, its total investment exceeded 3 billion euros.	+ Home to Sinopec Zhenhai Refining & Chemical Company, China's largest petrochemical company.	+ Long-term commitment by major global players. The case of ExxonMobil: 2 world-scale refineries built before 1980. $2 billion investment in 2001 to build its world's largest integrated petrochemical complex; $6 billion investment in 2014 to expand and upgrade its production in Singapore, using its latest proprietary technologies and producing a range of high value products.

advantage and potential for growth, which implies the relevancy of the Singapore lessons. Note that SCIP and NPETD are not behind Singapore in terms of locational advantage. In fact, Singapore is increasingly reliant on China's market for exports of chemicals. China accounted for nearly one fifth of Singapore's export of this product and this share has been rapidly expanding.

The description in Table 3 also suggests that SCIP is more ready than NPETD in applying the Singapore's lessons. In fact, SCIP has applied key management practices underlying Singapore's success. The management of SCIP, which is under the authority of the SCIP Steering Committee, consists of two agencies: the Administrative Committee (SCIPAC), which is similar to the EDB; and the Development Companies (SCIPDC), which is comparable to the JTC. SCIPDC oversees infrastructure development and operates under the guidance of SCIPAC. SCIP's promotion strategy emphasizes an orientation towards foreign investment and technologies, a high degree of international linkages, and active promotion of R&D activities and human capital development (Zeng & Bathelt, 2011). Since 1999, SCIP has attracted more than 30 large foreign direct investment (FDI) projects, half from Fortune 500 corporations. Compared to China's other chemical industrial parks, SCIP exceled in ecological conditions under its “five-integration” approach (products integration, utilities and infrastructure integration, logistics integration, safety and environmental management integration, and public services integration).

On the other hand, NPETD seems less aggressive in attracting FDI. English language information about the CIP lacks the kind of detail that would capture foreign investors' attention. NPETD also lagged behind SCIP on internationalization, skilled labor employment, and innovation (He, 2013).

From the general lessons derived from the case of Singapore as presented in Subsection 5.2, NPETD and CIP can consider the following three recommendations to foster their development.

First, they should make sure that the three fundamental principles were robustly upheld. It should be noted that adhering to market principles, while being natural for Singapore because it cannot afford to overlook it, can be a challenge for China. The country's socialist legacy and growth model may persist a business system called “authoritarian capitalism”, in which market principles are important but may not applied faithfully (Witt & Redding, 2014b). For example, the authors point out that state-owned enterprises (SOEs) and well-connected firms in China tend to enjoy notably favourable access to long-term finance. On the other

hand, due to its sheer size market, China may over-depend on this advantage in attracting investment, while overlooking efforts to establish a highly effective strategic positioning for promoting the industry's growth and transformation.

Second, in application of the CORE model, both SCIP and NPETD should pay a more strategic attention to enhancing their effectiveness in seizing opportunities. For SCIP, using a more meaningful set of priority criteria for attracting FDI should be considered. Currently, SCIP (as shown on its website) provides a list of products prioritized for FDI. This approach may lead to inadvertent selections of winners without knowing their actual contribution. In the Singapore case, selection criteria are based on the expected contributions in term of value-added, skilled employment, and technology capability upgrading. For NPETD, being more outward-looking and proactive in attracting global leading petrochemical players should be given a high priority. In particular, strengthening web presence in English is essential.

Third, SCIP and NPETD could enter into a strategic partnership and jointly establish more effective strategic positioning for the region. This would generate substantial synergy between the two clusters and make the area more attractive as a major global petrochemical hub.

6. Conclusion

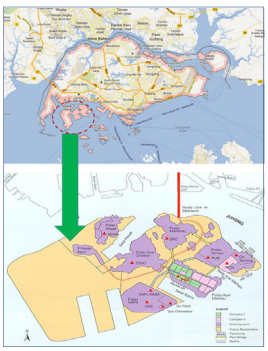
This paper has examined Singapore's experience in the successful promotion of the petrochemicals industry. The objective of the study has been two-fold: shedding additional light on recent industrial policy debates, and identifying lessons transferable to developing countries. Contributing additional insight about industrial policy debates, the case indicates that policymakers can overcome the typical problems of government failures, namely information constraints and rent-seeking, to not only effectively address market failures but also provide a strategic platform for industry to achieve high performance and global competitiveness. Furthermore, targeted policies and horizontal policies are both needed for successful implementation of industrial policy. In addition, following the country's comparative advantage with strategic investments to continuously upgrade is an effectual means to facilitate globalization-leveraged industrialization. It should be noted that a country's comparative advantage is not only present in visible endowments such as labor cost, location, and natural resources, but also in hidden and intangible resources such as leadership foresight and commitment, management capabilities; the quality of labor and business environment; and strategic partnership between the government and industry.

Lessons learned in this case include the three fundamental principles and the CORE framework for action, which provide a comprehensive platform for formulating an effective promotion strategy. The three fundamental principles concern government-market interdependence, embrace of global integration, and establishment of strategic position. The CORE framework for action consists of four components: capacity building, opportunities seizing, resources upgrading, and enduring success. Concurrent adoption of these principles and the related framework has proven to be an effective strategy for Singapore's development, and can generate a roadmap to success for developing countries.

The story of Singapore's petrochemicals industry is not finished. The government remains highly active in promoting the petrochemicals industry as a key driver of the economy's growth for the foreseeable future. As economic development is a process of continuous industrial upgrading and transformation in response to new challenges and opportunities (Lin, 2011), it is useful and instructive to observe how Singapore upholds its own lessons in strategizing and implementing efforts to promote the petrochemicals industry in the coming decades.

Appendix A

Appendix 1. Jurong Chemical Island.



Source: http://www.tripinasia.com/en/islands-in-the-sun/s

Appendix 2
Singapore's main milestones in development strategies since 1960.Source: Compiled from the Ministry of Trade and Industry (MTI) website.

Period	Economic situation	Key Developmental Strategies
1960–1964	• Small population (1.6 million in 1960) with no natural resources. • Highly dependent on entrepôt trade and the provision of services to British military bases here. • Insignificant manufacturing capability and little domestic capital	• Pursued import substitution strategy to create jobs, reducing dependence on entrepôt trade. • Established economic agencies to spearhead economic development: Economic Development Board (EDB) in 1961; Tourism Promotion Board (STPB) was formed in 1964.
1965–1978	• Separation from Malaysia and confrontation with Indonesia threatened Singapore's traditional role as a major trading post for the region. • Withdrawal of British military bases during 1968–1971; unemployment rate exceeded 10%.	• Pursued export-oriented strategy by attracting foreign investors to Singapore to develop the manufacturing and financial sectors. • Improved business environment, investing in key infrastructure and enacting new legislations that enhance employment standards and labor-management relations. • Promoted the shift from older industries such as rubber, wood, and metal products to more rapidly-developing industries like petroleum products, electronics, and industrial machinery.
1979–1985	• Tight labor market, rising wage pressures. • Emergence of lower cost competition from countries in contending for MNC investments. • Need to restructure the economy towards higher value added activities.	• Renewed emphasis on manpower development through education and training. • Encouraged automation, mechanization and computerization. • Shifted towards higher value-add and skills intensive investment promotion policy
1986–1997	• A more mature economy with slower growth. • Faster rising costs. • More intense competition, from both developed and developing countries. • Relatively low technology base on a global basis.	• Heavily invested in building technological capabilities. • Adopted the industrial cluster development approach in promoting key industries, including petrochemicals, fostering synergies at the firm and industry levels. • Promoting manufacturing and services as twin pillars of the economy. • Embraced regionalization, leveraging on the potential of the Asian markets to boost growth and strengthen the strategic positioning as the regional hub.
1998–2009	• The economy contracted by 2.2% in 1998 (caused by the 1997 Asian financial crisis) and 1.2% in 2001 due the global recession. • New challenges and opportunities emerged from the rise of China and India	• Expanding external ties - embracing globalization through WTO frameworks and FTAs. • Maintaining competitiveness and flexibility through policy measures affecting production costs such as wages and land rents. • Promoted entrepreneurship and domestic companies. • Fostering human capital development through both investing more in education/training and attracting global talent to augment the indigenous talent pool.
2010-Present	• The economy contracted by 0.8% in 2009 due to the global financial crisis erupted in 2008. • Labor productivity growth slowdown.	• Fostered growth through skills and innovation • Anchored Singapore as a global-Asia hub • Built a vibrant and diverse corporate ecosystem • Fostered innovation and commercialization of R&D • Promoted smart energy and land productivity

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