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PORT AND THE CITY:
BALANCING GROWTH
AND LIVEABILITY



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URBAN SYSTEMS STUDIES

PORT AND THE CITY: BALANCING GROWTH AND LIVEABILITY

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Cover photo:
Tanjong Pagar Terminal, with the Central Business District in close proximity. Photo courtesy of Maritime Port Authority of Singapore.

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FOREWORD

During the 1960s, Singapore's port operated mainly as a Hub-and-Spoke transshipment port to serve the adjoining Southeast Asian hinterland. How did the country transform its port industry from riverine trade beginnings along the Singapore River to become one of the country's key economic engines today? The key lies in containerisation, the American invention pioneered by Malcolm McLean that revolutionised the transport of goods from break-bulk to containers. It had a profound impact on the way goods were transported via the hub at Singapore and eventually shaped the city's development.

Drawing upon past lessons and new interviews, *Singapore – Port and the City* illustrates how the country has risen above early beginnings of good geography, deep harbour waters and physical constraints to transform an entrepôt port into a world-class port. The book goes on to take a broad look at Singapore's port development in relation to the city by examining the intricacies of managing huge demands on land allocation for port terminal facilities and related infrastructure, especially for a small, land-scarce nation.

Against a backdrop of uncertainty, when the transport of goods via containers had not yet taken off in Asia and amidst doubt from international advisors on the readiness of Singapore's port infrastructure to handle container ships, the bold decision was taken to invest in the first container port. Tanjong Pagar Terminal was completed in 1972 and the country has not looked back since as we rode the wave of containerisation and developed our port in tandem with economic demands. Singapore quickly embarked on an industrialisation programme and capitalised on existing port infrastructure to serve the fledging economy. A system was established, buoyed by visionary leadership, pragmatic decisions and a strong workforce of port planners and workers, to develop Singapore as a global port city.

We hope you will find this account of Singapore's port journey refreshing and informative. As the journey continues, surrounded by challenges such as alternative shipping routes, competition and economic downturns, I also hope that this book will serve to guide future generations of thought leaders and city planners in developing our port as part of a global and liveable city.

Wong Hung Khim

Former Permanent Secretary,
Ministry of Community Development and
First Executive Director of the Port of Singapore Authority (PSA)

PREFACE

The Centre for Liveable Cities' (CLC) research in urban systems tries to unpack the systematic components that make up the city of Singapore, capturing knowledge not only within each of these systems, but also the threads that link these systems and how they make sense as a whole. The studies are scoped to venture deep into the key domain areas the CLC has identified under the CLC Liveability Framework, attempting to answer two key questions: how Singapore has transformed itself into a highly liveable city within the last five decades, and how Singapore can build on our urban development experience to create knowledge and urban solutions for current and future challenges relevant to Singapore and other cities through applied research. *Singapore – Port and the City* is the latest publication from the Urban Systems Studies (USS) series.

The research process involves close and rigorous engagement of the CLC with our stakeholder agencies, and oral history interviews with Singapore's urban pioneers and leaders to gain insights into development processes and distil tacit knowledge that have been gleaned from planning and implementation, as well as governance of Singapore. As a body of knowledge, the Urban System Studies, which cover aspects such as water, transport, housing, industrial infrastructure and sustainable environment, reveal not only the visible outcomes of Singapore's development, but the complex support structures of our urban achievements.

CLC would like to thank the Maritime Port Authority of Singapore and all those who have contributed their knowledge, expertise and time to make this publication possible. I wish you an enjoyable read.

Khoo Teng Chye

Executive Director
Centre for Liveable Cities

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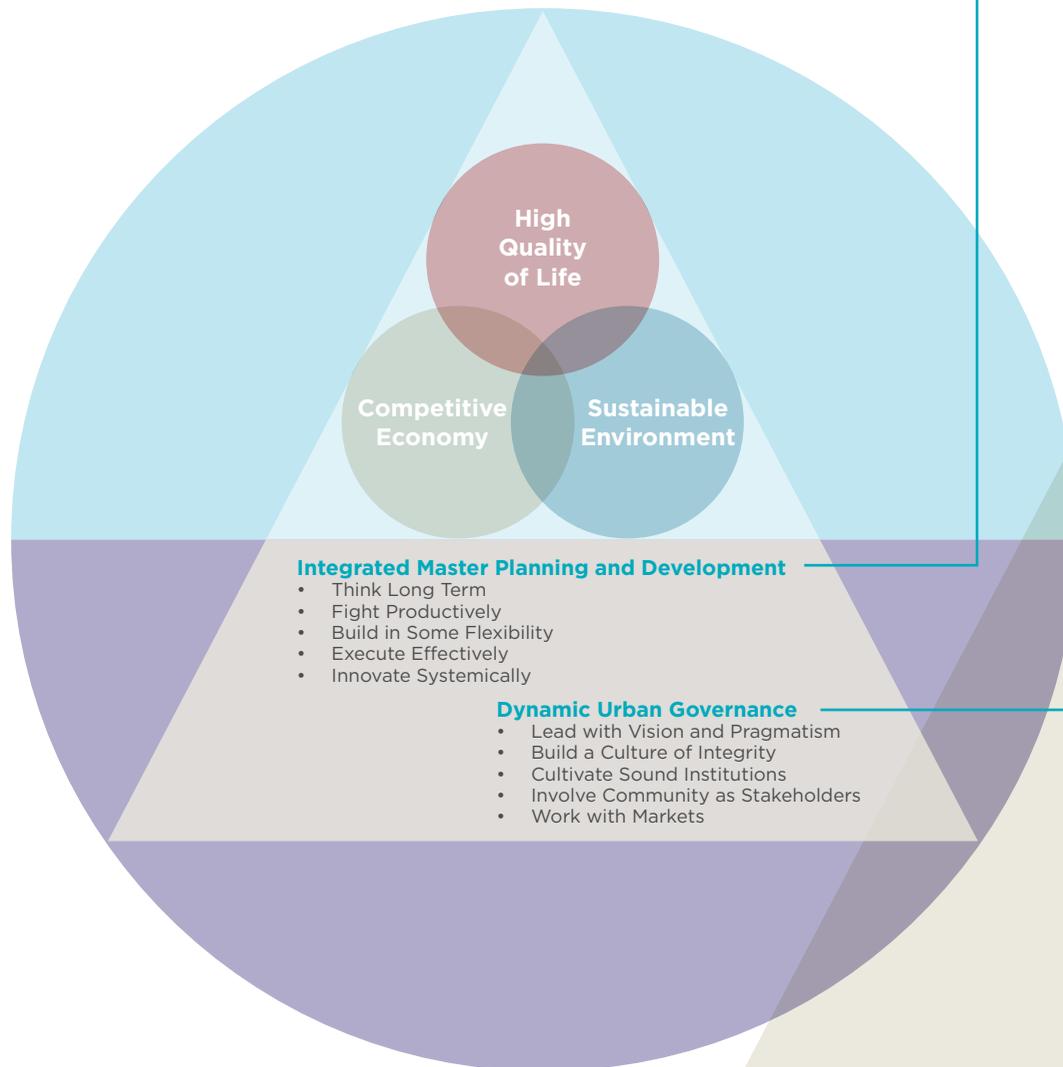
The Centre for Liveable Cities (CLC) gratefully acknowledges the Maritime Port Authority (MPA) of Singapore and PSA Corporation Ltd for assistance provided in the preparation of this book.

The researcher, Michelle Chng, would like to extend special thanks to CLC colleagues and cluster mates, Cherub Ho and Mina Zhan who provided advice and encouragement throughout.

THE CLC LIVEABILITY FRAMEWORK

The CLC Liveability Framework is derived from Singapore's urban development experience and is a useful guide for developing sustainable and liveable cities.

The general principles under **Integrated Master Planning and Development** and **Dynamic Urban Governance** are reflected in the themes found in *Port and the City: Balancing Growth and Liveability*, detailed on the opposite page:



Integrated Master Planning and Development

Think Long Term

The inter-modal nature of transport in the container trade was recognised early in the integration of land-use and transport planning at the onset of containerisation during the 1970s. The Area Licensing Scheme (ALS), the forerunner of today's Electronic Road Pricing (ERP) system, was introduced in 1975 to manage traffic demand and congestion within the city, and subsequently adjusted to also modulate the movement of goods vehicles. So, despite the close proximity of the city container terminals to the Central Business District (CBD), the system paved the way for container freight trucks to move smoothly outside of the port area, even till this very day.

(see *Creating Seamless Connections for Inter-modal Transport* p. 49)

Fight Productively

When the growth in container trade placed constraints on the existing port infrastructure during the early 1990s, robust discussions within the government were held on whether to site the new port at Pasir Panjang or Tuas. Technical, operational and industrial concerns as well as the trade-offs in land use were debated before the final decision was made.

(see *Planning for Further Expansion of Port Facilities — Pasir Panjang Terminal*, p. 35)

Innovate Systemically

With the rise of containerisation as an efficient mode of transport for the maritime and trade industry, warehouses that were originally built to store conventional break-bulk cargo fell into disuse. During the mid-1970s, the Port of Singapore Authority (PSA) worked with the Singapore Tourist Promotion Board to convert disused warehouses at the World Trade Centre (WTC) into a conventions and exhibitions hub at a time when the tourism authority had difficulty finding venues to host events.

(see *Urban Redevelopment of the Greater Southern Waterfront*, p. 60)

Dynamic Urban Governance

Lead with Vision and Pragmatism

Against a backdrop of uncertainty in the 1960s, when the transport of goods via containers had not yet taken off in Asia and international advisors had expressed doubt over the readiness of Singapore's port infrastructure to handle container ships, then Minister for Finance Dr Goh Keng Swee made the bold decision to invest in building container facilities at Tanjong Pagar. This paved the way for the port's success in the years to come, and marked the start of the development of port infrastructure in the city.

(see *The Bold Move — Tanjong Pagar Terminal*, p. 25)

Work with Markets

The role of PSA evolved from that of a regulator to that of a facilitator of business. Preferential berthing schemes and joint-venture terminals, for instance, enabled the government to respond to the private sector's demand for greater control over their operations and business efficiency.

(see *Harnessing Market Forces*, p. 70)

The 1991 Concept Plan envisaged new commercial areas of growth outside the central region. These areas included PSA's prime waterfront site anchored by the existing WTC. The process of redeveloping this massive area into offices and retail/entertainment spaces required strong collaboration between the private and public sectors.

(see *Urban Redevelopment of the Greater Southern Waterfront*, p. 60)

Involve Community as Stakeholders

The Maritime and Port Authority's programme "Enhancing Singapore's Coral Reef Ecosystem in a Green Port" encouraged the community to be guardians of the ecological environment in the waters off the future Tuas Mega Port. Corals in close proximity to the development were relocated with the help of nature volunteers, and environmental monitoring of the relocated corals continues to be carried out by established academics in NUS. These efforts have helped to raise public awareness and promote community participation in protecting the environment of an important economic infrastructure.

(see *Beyond Economics — Green Port Development*, p. 82)

OVERVIEW



Singapore's *raison d'être* was its port. Singapore must strive to remain a major hub port.

Lee Kuan Yew, late former Prime Minister¹

These words clearly demonstrate how the growth of Singapore's seaports was instrumental to the country's survival and overall economic success post independence. In spite of our limited land space and natural resources, coupled with a small domestic market, Singapore has come a long way in our maritime journey. We are the world's busiest transshipment hub and have a high connectivity to 600 ports worldwide.² The maritime industry contributes approximately 7% to our gross domestic product (GDP), and most of the revenue is gained through bunkering and shipping lines. Apart from being large financial investments, seaports are also land-intensive.³ Currently, 3% of the country's land is zoned for ports and airports, with this figure projected to double by 2030.⁴ These areas include infrastructure such as port areas, port-related facilities, ferry points/terminals, cruise centres and landing sites.⁵

Over the last few decades, Singapore has become a well-developed major port with enhanced infrastructure backed by efficient marine services. This is made possible through Singapore having a deep water harbour and being strategically located along the major shipping routes. In addition, the success of Singapore's seaports would be impossible without a "good workforce, ranging from the highest executive talent to the man who actually handles the cargo".⁶ Given Singapore's scarce resources, this study looks at the importance of urban governance and integrated master planning in managing our ports as part of a global city that is both liveable and sustainable. In particular, it will examine the trade-offs involved in city planning in relation to the port.

CHAPTER 1

THE BIRTH OF A MODERN PORT INDUSTRY (1960S – 1970S)

“ We became a hub because of the convenience. For shipping, you have to pass Singapore, it’s the southernmost point of Continental Asia ... We were poor and were underdeveloped, so we had to work hard.

Lee Kuan Yew, late former Prime Minister⁷

COLONIAL LEGACY

Singapore’s origins as a trading port dates back to 1819, when Sir Stamford Raffles, as an agent of the East India Company (EIC), chose the island as a base to set up a trading post to further Great Britain’s influence in the region. Singapore’s strategic location was to serve as a focal point to attract ships from Britain to Singapore, as well as to facilitate trade between India and China.⁸ Singapore’s free port status was declared as part of the earliest port regulations in 1823, which stated that “... the Port of Singapore is a Free Port and the Trade thereof is open to ships and vessels of every nation free of duty equally and alike to all.”⁹ This early economic policy spurred the growth of the country’s port, which started at the mouth of the Singapore River.

The river’s calm waters were ideal for trading activities. It soon became the lifeline of the country’s economy, and early city development evolved around the trading activities here. By the mid-1850s, early port facilities such as transit sheds (or “godowns”), ricemills, sawmills, and boatyards to service and repair vessels had been established in Telok Ayer, while anchorages had been constructed at Boat Quay to facilitate the riverine trade.^{10,11}

The advent of steamships in the 1850s, coupled with the opening of the Suez Canal in 1869, increased the number of ocean-going ships calling at New Harbour (as Singapore’s harbour was called until it was renamed Keppel Harbour in 1900). This necessitated the expansion of port infrastructure such as deep-water wharf facilities, dry docks, and roads to link the port to town. It was an era of privately-owned docks



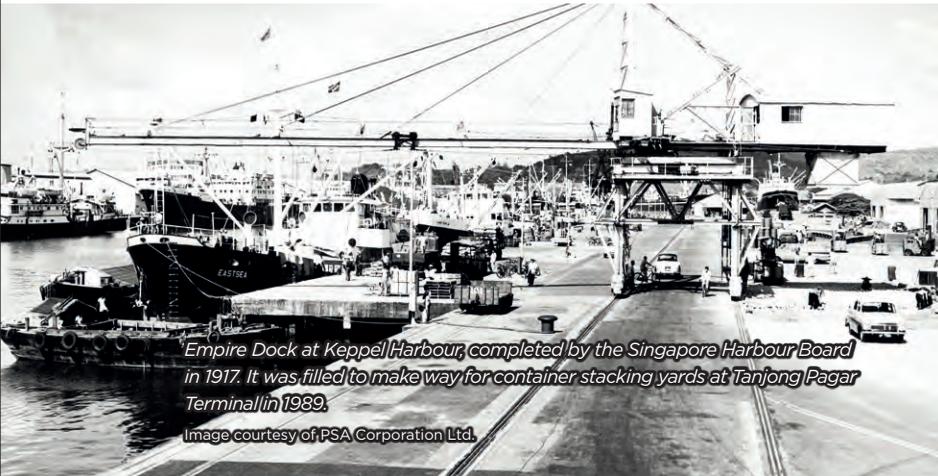
Singapore River, 1930.

Coolies unloading bags of rice from lighter boats.

Image courtesy of Vereeniging Nederlandsche Historisch Scheepvaart Museum and National Archives.

and wharves, with the Tanjong Pagar Dock Company controlling almost three-quarters of all wharf space at New Harbour by 1885.¹² The company also developed several new dock facilities to handle the increasing traffic from ocean-going ships. The first of these facilities was Victoria Dock, completed in 1868. A 300-metre wharf was built together with the dock to allow ships to lie alongside for the unloading of cargo while waiting their turn to use the dock. The wharf, rather than the dock, would later become the mainstay of the company.¹³ In the subsequent years, the Tanjong Pagar Dock Company slowly bought over potential rivals and other docks and wharves along New Harbour. The company’s expansion culminated in a merger with its biggest competitor, the New Harbour Dock Company, in July 1899. The merged entity owned almost the whole wharf frontage, from one end of the harbour to the other, effectively allowing the company to monopolise the port and shipping business.¹⁴

In 1905, the colonial government stepped in to acquire the Tanjong Pagar Dock Company to form the Tanjong Pagar Dock Board, as the company had incurred huge debts over the construction of large drydocks, had monopolised services and was inadequate in building



Empire Dock at Keppel Harbour, completed by the Singapore Harbour Board in 1917. It was filled to make way for container stacking yards at Tanjong Pagar Terminal in 1989.

Image courtesy of PSA Corporation Ltd.

port facilities ahead of demand.¹⁵ As part of a series of infrastructure developments carried out by the Board, the connectivity between Keppel Harbour and the town centre was improved with the extension of the Tank Road-Kranji Railway to the harbour in 1907.¹⁶ A few years later, in the face of increasing shipping activities, the government sought to modernise the port industry with the 1912 Straits Settlements Port Ordinance, which led to the reconstitution of the Tanjong Pagar Dock Board as the Singapore Harbour Board (SHB).¹⁷

Over the next few years, SHB undertook an extensive modernisation programme at Keppel Harbour. It replaced the old wooden wharves with concrete ones, set up modern machinery, introduced the use of electricity, built new roads and godowns, and constructed a rail connection to the Malayan Railways network, including 17-kilometres of metre gauge track for the interchange of traffic between Keppel Harbour and the Malayan Hinterland.¹⁸ The exchange of cargo was further facilitated with the opening of the Causeway in 1923, and the Tanjong Pagar Railway Station in 1932, which allowed cargo to be transferred more easily between steamships and railway trains due to the station's location directly opposite the Tanjong Pagar docks.¹⁹ The Board also saw to the expansion of port facilities, including the building of Kings Drydock at Keppel Harbour, which was Asia's largest drydock when it was completed in 1913. Shortly after, in 1914, the mile-long Offshore Mole was completed, paving another gateway for the Port of Singapore and providing protection for some 40 coastal vessels during the north-east monsoon.²⁰ Empire Dock was completed in 1917 and served as the main cargo-handling area in the port until the 1960s, before it was finally filled in for redevelopment as part of Tanjong Pagar Container Terminal in 1989.^{21,22}

SHB continued to practise the principles of free trade laid out during Raffles' time. There were no charges for entering the port, and shipping lines carrying general cargo were subjected to minimum charges in the form of stevedorage^a and wharfage charges.^b For ships carrying coal, stevedorage charges for discharging only were levied on the shipping line, while the coal company would have to pay the other charges. All goods were allowed free storage in the godowns for three days from the day on which the vessel completed discharge; there were further, substantial concessions for storage of transhipment cargo.²³ The conditions put in place by SHB were generous and so favourable to trade such that by the early 1900s, the Singapore River had become a hotbed of activities. A large community of Chinese immigrants had also formed in the downtown area adjacent to the port at the southern tip of the island. Their livelihood was highly dependent on the port activities and retail services along the river, with most working as low-income "coolies" and petty traders.²⁴ Apart from the City Council and the Singapore Improvement Trust (forerunner of the Housing and Development Board), SHB was a major employer, with a workforce of 7,000 people by 1939.²⁵ However, with the advent of World War II in 1941, key port infrastructure at Keppel Harbour was devastated and many ships were sunk, disrupting subsequent trade activities.²⁶



Tanjong Pagar Railway Station.

Image courtesy of National Archives of Singapore.

Exhibit 1: Map showing Inner and Outer Harbours



In the immediate years after World War II, the colonial government tasked SHB to restore the port facilities at Keppel Harbour. Shipping activities soon increased as a result of the need to bring in food and essential supplies for a population still reeling from the aftermath of the war. Nevertheless, the shipping industry faced challenges from other modes of cargo transport such as rail, which carried the majority of rubber goods to and from the coastal steamers in Malaya.²⁷

During the 1950s, the Singapore River continued to be the mainstay of Singapore's shipping activities. Although the majority of ocean-going steamers berthed at SHB's wharves, many vessels were discharging and loading in the Inner and Outer Harbours, which necessitated a continual flow of lighters to and from the warehouses along the Singapore River. In 1959, then Minister for Finance Dr Goh Keng Swee remarked in the Legislative Assembly that "more goods were handled in the river than at the wharves at the SHB", leading to increased congestion at the narrow waterway.²⁸ Meanwhile, expansion of port facilities at Keppel Harbour continued with the addition of new wharves at the East Lagoon and the completion of Queen's Dock in 1956, to cater for the increasing tonnage and size of ships calling at Singapore.²⁹ However, a series of events during the early 1960s were about to change the priorities of Singapore's port as an important entrepôt centre.

FORMATION OF THE PORT OF SINGAPORE AUTHORITY

On 3 August 1957, the colonial government initiated a commission of inquiry, led by Sir Eric Millbourn, Honorary Adviser on Ports to the British Ministry of Transport and Civil Aviation, to assess and make recommendations for the management and development of all port and landing facilities in Singapore.³⁰ At the time, the administration of the Singapore port was divided between SHB and the Master Attendant. The Master Attendant's role originated in 1819 when Singapore became a trading port, with the main responsibilities of regulating shipping lying in the roadstead and offering advice on nautical matters to the Governor. Over time, the Master Attendant's Office became responsible for not only the control of shipping throughout the port, but also the maintenance of the registry of shipping, the upkeep of signal stations and navigational aids, the engagement and discharge of seamen, and the examination of masters and mates.³¹ Meanwhile, the Marine Branch of the Public Works Department (PWD) was responsible for the maintenance of jetties and sea-walls, river works and minor foreshore reclamation schemes.³²

The findings of the commission were detailed in the Millbourn Report, submitted to the Governor in September 1957. The commission had found that the functions of SHB were too diverse, which hindered the Board's ability to focus on its primary role of port administration. Hence, based on the Millbourn Report, then Deputy Prime Minister Toh Chin Chye proposed in the Legislative Assembly on 5 April 1963 that the Port of Singapore Authority (PSA) be established as the single authority to administer the Singapore port as a whole. PSA was eventually formed on 1 April 1964 to replace SHB and take over its functions as well as certain duties of the Master Attendant and the functions of PWD's Marine Branch.^{33,34} The new port authority was to undertake the mammoth task of turning Singapore's port into a major hub port.

DEVELOPMENT OF EARLY INDUSTRIES IN TANDEM WITH PORT INFRASTRUCTURE

In the years following self-governance in 1959, Singapore faced high unemployment and economic survival was a top priority. Upon the invitation of the government, a United Nations survey mission arrived in Singapore in 1960 to examine the country's industrialisation prospects. Leading the mission was Dutch industrial economist Albert Winsemius, who remarked at the time that the country "was a poor little market in a dark corner of Asia".³⁵ He submitted his observations and recommendations in 1961 in what became known as the Winsemius Report. Winsemius subsequently remained as Singapore's chief economic adviser and held this position until 1984. His early recommendations included re-opening barter trade with Indonesia and sharing a common market with Malaysia.³⁶ In 1965, however, Singapore separated from Malaysia. With the loss of this extended domestic market for its manufactured goods, Singapore was forced to adopt an export-oriented industrialisation strategy.^{37,38} The situation was exacerbated by the withdrawal of British forces from the late-1960s to the early 1970s, as the military bases were contributing one-fifth of Singapore's GDP prior to the withdrawal and the pull-out resulted in massive job losses among the local population.^{39,40} It was against this backdrop of relentless challenges that Singapore transformed its economy through rapid industrialisation.

In 1959, the Pioneer Industries (Relief from Income Tax) Ordinance was passed to boost Singapore's industrialisation programme by giving pioneer industries certificates that entitled the companies to tax holidays of up to five years.⁴¹ Two years later, arising from proposals in the Winsemius Report, the Economic Development Board (EDB) was established to drive the industrialisation programme, and the development of industrial estates in Jurong began.⁴² Winsemius's recommendations formed the basis of Singapore's first Development Plan, which covered the period from 1961 to 1965. The plan proposed an acceleration of infrastructure development and improvements to kick-start industrialisation in Singapore.⁴³ Four sectors were also identified as key to helping the country overcome its challenges: trade, tourism, shipbuilding and manufacturing.⁴⁴



Jurong Port.
Using a pulley system to unload pallets of cargo.

Image courtesy of Ministry of Information and the Arts Collection, National Archives of Singapore.

In the area of manufacturing, Winsemius encouraged the setting up of low-value industries, such as by employing women in factories to produce shirts and pyjamas. This industry had low barriers to entry, as the women had prior experience and sewing machines could easily be rented.⁴⁵ When EDB opened its first overseas centres in Hong Kong to attract foreign investors to Singapore in the early 1960s, the textile and garment industry had already taken root in Singapore. The prospect of a common Malaysian market attracted Hong Kong garment manufacturers such as Wing Tai Holdings, which stayed on after 1965 to export garments from Singapore, supported by a large quota under the Multi-Fibre Agreement.^{46,47} The early textile and garment factories (e.g., Pelican Textile) were sited in Jurong Industrial Estate.⁴⁸

The manufacturing of electronics was another early labour-intensive industry that employed large numbers of unskilled workers. As Dr Goh Keng Swee put it: “The electronic components we make in Singapore probably require less skill than that required by barbers or cooks, consisting mostly of repetitive manual operations.” One of the electronics companies courted by EDB was Texas Instruments from the United States, which set up its manufacturing facility in Kallang Basin Industrial Estate in 1968, employing 1,400 workers.⁴⁹

In the 1960s, pioneer certificates were awarded to a variety of manufacturing companies producing goods ranging from fertilisers to chewing gum and chocolates.⁵⁰ To support these industries in the newly developed Jurong area, Jurong Port commenced operations in 1965. The natural deep waters off Jurong were ideal for establishing the port, with the first wharves constructed in 1963 to allow the import of raw materials and the export of finished products from the factories in Jurong. Initially run by EDB with PSA's assistance, Jurong Port handled an assortment of cargo such as steel plates, industrial chemicals, timber, clinker (a residue of steel mills and furnaces that is used to make cement) and even farm animals. The port eventually came under the charge of the newly established Jurong Town Corporation (JTC) in 1968, and an infrastructure-financing loan package from the Asian Development Bank provided the funding for an expansion during the 1970s.^{51,52}

In the initial years of its development, Jurong lacked adequate road infrastructure for the transportation of goods. To solve this problem, Jurong Railway was built. Work on the railway began in 1963 and was

completed in 1965.⁵³ Constructed by EDB with Keretapi Tanah Melayu (KTM, or Malayan Railways Limited), Jurong Railway was used to transport clinker and timber from peninsular Malaysia into Jurong and bring manufactured products the other way. It ran as a spur from the main Malaysia–Singapore railway, starting from the Bukit Timah Railway Station next to King Albert Park, running through Pasir Panjang, and ending at Shipyard Road near the Mobil refinery. Jurong Railway was eventually made defunct in the mid-1990s due to changing trends in logistics and more efficient methods of transportation.⁵⁴

To support the nascent industries during the 1960s, the government put in place a system to find markets for local products and facilitate trade to increase the number of ships making Singapore their port-of-call. From 1968 to 1974, Sim Kee Boon, then Permanent Secretary for the Ministry of Finance, was seconded to set up the International Trading Company (Intraco), a government-owned trading and manufacturing corporation.⁵⁵ Intraco's main goals were to create new overseas markets and find new sources of raw materials at competitive prices to support Singapore's export-oriented industrialisation strategy. A product specialist department was set up to gather overseas market knowledge on products as diverse as textiles, food, and shipbuilding materials and accessories.⁵⁶ During the 1970s, Intraco even contributed to Singapore's food security by utilising its trade links to develop a rice stockpile at a time when the government was concerned that the volatility of rice prices and supply could lead to social unrest in the country.⁵⁷

The inception of Singapore's national shipping line, Neptune Orient Lines (NOL), in 1968 was another piece of the puzzle that contributed to the success of Singapore's trade and the corresponding need for sound port infrastructure.⁵⁸ Dr Goh had initiated the formation of NOL to support Singapore's industrial development by transporting part of the nation's trade at fair freight prices and maintaining a supply line of essential cargoes during times of emergency. NOL's early years were fraught with difficulties such as not gaining an equitable share of the trade and carrying only low-value cargo, as the Far-East Freight Conference (FEFC) controlled the majority of the trade, setting freight rates and even the ports a shipping line could visit. However, with the government's support in terms of capital investment and the advent of containerisation, NOL started to turn a profit during the 1970s.⁵⁹

As part of the overall economic strategy in the 1960s, shipbuilding and repair facilities were key components of the port infrastructure. Ship repair facilities for ocean-going vessels, which were limited to the dockyards at Keppel Harbour up until the late-1950s, were inadequate in keeping up with demand as manufacturing output increased. In order to capitalise on the newly formed Jurong Industrial Estate and Jurong Port in the early 1960s, Jurong Shipyard was formed in April 1963 to construct, maintain and repair all types of ships and vessels. The establishment of Jurong Shipyard was not without obstacles, though, as noted by Dr Goh: “Jurong Shipyard had difficulty at the beginning in getting capital from people, many of whom thought the whole idea was quite crazy.”⁶⁰

During this period, the country’s large petroleum trade and post-1959 growth as a refining centre led Singapore to be dubbed as “the Houston of the East”.⁶¹ However, the majority of job creation in the petrochemical industry came not from oil refining, but from the construction of drilling rigs and support vessels for exploration in the region, as well as tanker repair and construction, which formed the basis for the development of our shipyards. The government saw a huge potential in the ship repair market and estimated that it would be worth \$500 million a year by the end of the 1970s. After setting up Jurong Shipyard with Japanese partners, the government went on to develop shipyards at Keppel and Sembawang, and even encouraged the formation of private yards, including the smaller ones at Tanjong Rhu.⁶² With Sembawang Shipyard, the government was faced with the particularly difficult task of converting the lavish facilities of the former naval dockyard into a commercial yard that could repair ships efficiently for a quick turnaround of commercial vessels. Nonetheless, as recounted by former Minister for Finance Hon Sui Sen:

*“The Government approached the task of conversion of the Naval Dockyard with a resolution that was born of dire need”.*⁶³

The ship repair industry became a cornerstone of the early port infrastructure that grew in tandem with our economic demands. After a commission of inquiry recommended that the government’s functions of cargo handling and ship repair be separated, the Singapore Drydocks and Engineering Company (later renamed Keppel Shipyard Private Limited) was formed on 3 August 1968 to take over PSA’s

Dockyard Department. Between the government and private shipyards, the industry employed 18,000 people by 1971, which was over an eighth of the workforce in manufacturing. By 1974, the industry’s turnover reached \$720 million.⁶⁴ After its formation in 1968, Keppel Shipyard went on to expand and diversify its business, starting with the acquisition of a 40% stake in Far East Levingston Shipyard (FELS) in 1971, which would eventually put Singapore on the world map as a force to be reckoned with in the area of oil rig construction and offshore technology. In 1973, Keppel began building its first drydock on a 50-hectare reclaimed site in Tuas.⁶⁵

Apart from manufacturing, shipbuilding and ship repair, the petrochemical industry was another economic pillar that grew Singapore’s fortunes in the 1960s. Port facilities for the petrochemical industry were actually developed as early as 1852 when the Peninsular and Oriental Steam Navigation Company opened its first coal bunkering pier (forerunner of today’s petroleum refining and bunkering industries) to meet the fuelling demands of its steamships. In 1894, Shell Transport and Trading Company established its oil storage and wharf facilities on Pulau Bukom to serve the Far East, other Asian markets and Australia.⁶⁶ After the Pioneer Industries Ordinance came into effect in 1959, Shell became the first foreign company to receive a pioneer certificate for its investment to build an oil refinery on Pulau Bukom.⁶⁷ Shell’s move to establish the country’s first refinery in 1961 was in response to news of competition from Japanese oil trading company Maruzen Toyo, which was the first to propose building an oil refinery in Singapore. As recounted by former EDB Chairman Ngiam Tong Dow:

*“Shell, which had been operating in Singapore for over a hundred years distributing kerosene and petrol from the offshore island of Pulau Bukom, was shocked into immediate action.”*⁶⁸

Maruzen’s refinery was subsequently completed at Pasir Panjang Estuary in 1962, but it was sold to British Petroleum two years later.^{69,70,71} Thereafter, during the 1960s and 1970s, other big players in the petrochemical industry came on board and set up their refineries and bunkering facilities in Singapore, including Esso on the offshore island of Pulau Ayer Chawan and Mobil in Jurong.⁷²

CHAPTER 2

CONTAINERISATION IN THE RISE OF SINGAPORE'S PORT (1970S – 1980S)

“ Even if there is a chance, let’s say half a year that container port is lying idle, using interest and doing nothing, Singapore has to be the first one as to attract it.”

Albert Winsemius, Singapore’s former chief economic advisor ⁷³

SINGAPORE RIVER CLEAN-UP

While Jurong Port served the needs of fledgling industries in the new Jurong Industrial Estate, the Singapore River remained the mainstay of trade activities up till the early 1980s. However, as businesses proliferated, the toll of development on the river became more apparent. The waterway grew increasingly congested with lighters bringing in general cargo from ocean-going ships anchored in the Outer Harbour at Keppel Harbour. Pollution was also a worsening problem, as businesses situated along the river such as gambier processors, sago factories and seaweed works dumped their waste into the river.⁷⁴

In 1970, an action committee was formed to tackle the extensive dumping of domestic and trade refuse into the Singapore River and to clean up its banks.⁷⁵ The committee’s recommendations were subsequently incorporated into the 1971 Concept Plan, a strategic land-use plan that was drawn up with assistance from the United Nations. Under this first Concept Plan, unregulated urban development was curtailed as land was zoned according to the purpose of utilisation (e.g., industrial, residential and nature areas). The Concept Plan also made provisions for the expansion of port infrastructure at Keppel Harbour and Jurong Port and the development of port facilities at Sembawang Shipyard.⁷⁶ The 1971 Concept Plan was to guide Singapore’s physical development for the next 20 years.



Singapore River, 1930.

Lightermen resting, urban renewal activity in background.

Image courtesy of Ronni Pinsler Collection, National Archives of Singapore.

Change of Tides — Phasing out of the Lighterage Industry

In 1968, the Landing Goods Act was passed to reduce traffic on the Singapore River, with the intent of phasing out the lighterage industry. However, this legislation was difficult to implement and had little effect in restricting the activities of lightermen, who continued to ply their trade along the river. As recounted by Wong Hung Khim, then Executive Director of PSA: “These lightermen refused to move. And they are rough and tough people ... our fathers, our fathers’ fathers; our forefathers have been here for generations. We helped Singapore to develop; we contributed to the Singapore economic development. Now you cannot just chuck us out! We are still making a living. If you want us out, you give us an alternative.”⁷⁷ When Alan Choe, then Head of the Housing and Development Board’s (HDB) Urban Renewal Department, further outlined in October 1970 that all godowns and warehouses were to be relocated to Pasir Panjang as part of the urban development programme, the lighterage companies protested strongly and petitioned the government to “preserve the beneficial usage of the Singapore River when implementing the various schemes of urban renewal”.⁷⁸

The opportunity to relocate the entire lighterage industry came later in the 1970s, when the government intensified its efforts to clean up the Singapore River. When the clean-up was formally kick-started in 1977 by then Prime Minister Lee Kuan Yew, there was greater political will and urgency to identify and eliminate the sources of pollution at the river. The programme was a massive, multi-agency effort coordinated by the Ministry of Environment and the Resettlement Department of HDB. It required not only a physical clean-up of the river and its surroundings but also the relocation of a vast number of homes, streetside hawkers and other trades located in areas that lacked pollution control facilities.⁷⁹ One of the key agencies involved was PSA, which undertook the dredging of the riverbed as accumulated debris had resulted in toxic sediments that made the river unsuitable for aquatic life. In addition, PSA was tasked with removing abandoned boats, logs and other associated debris along the river banks as the area was within port limits. However, PSA was unable to remove the bulky sunken scrap on its own and required the cooperation of other agencies. As recalled by then Head of the Pollution Control Department under the environment ministry, Chiang Kok Meng:

“We got the drainage contractors who were working in the area to help clear these for them. So this kind of co-ordination helps, when one party finds difficulty in getting the work done, you get another party who has the facilities to help out.”⁸⁰

Similarly, once the lighters plying the Singapore River were identified as a major source of pollution as they dirtied the waterway with oil and debris, various agencies came together to work on addressing the issue. PWD constructed kerbs and drew double yellow lines along the roads to reduce vehicular access to the river banks; the Parks and Recreation Department landscaped the area; and the Land Office demolished the jetties at the river. Still, despite the government’s efforts, lighterage activities continued to take place illegally along the banks of the Rochor River instead of the wharves situated at Clifford Pier, with pollutive products such as oil and debris fed into the Marina Bay.⁸¹

To tackle the difficult challenge of resistance from the lighterage companies, Wong Hung Khim sought the help of Ow Chio Kiat, a personal friend and Chairman of the Stamford Group, who had earlier taken over his father’s lighterage business, Hai Sun Hup. As Honorary Advisor to the Lighter Association, Mr Ow held discussions with the lightermen to understand their concerns. Justifying their refusal to

move, the lighterage companies argued that the rough sea conditions off the proposed Pasir Panjang berths, especially during the monsoon, would be dangerous for the lightermen and their boats.⁸² In response, PSA set about building a breakwater at Pasir Panjang to shelter the lighters and completed it in September 1976.⁸³ In addition, to create an overall conducive working environment for the lighterage industry, the new facilities at Pasir Panjang included mooring buoys, modern canteen facilities, toilets and office accommodation, costing the government a total of \$44 million, which was a huge sum in the 1970s.⁸⁴ For lightermen who wanted to exit the trade due to diminishing prospects, PSA also helped to dispose of their wooden boats without a fee. The lighters were sunk off Pempang Reefs (offshore reefs situated south of Singapore) and eventually served as artificial reefs to attract fishes and associated marine life.⁸⁵ In 1977, PSA commenced a major operation to remove over a hundred discarded boats that were clogging the Singapore, Geylang, Rochor, Serangoon and Kallang Rivers.^{86,87}

In September 1983, a high-tech cargo centre was opened in Pasir Panjang, further easing the transition of the lighterage industry from the Singapore River, where lighters traditionally offloaded and stored cargo at the warehouses along Boat Quay.⁸⁸ By that same month, all lighterage activities, involving some 800 lighters, had been relocated to Pasir Panjang.⁸⁹ A month earlier, to address the public perception that the government was trying to phase out the industry, then Minister for Communications and Environment Ong Pang Boon had highlighted in a speech that lighters remained important in regional trade and noted that “it would have been far cheaper to pay cash compensation ... instead of building these costly new facilities if it were intended to completely phase out the lighter industry”.⁹⁰

Singapore River lightermen must go by August

THE Communications Ministry has turned down an appeal by lightermen plying the Singapore River for a three-month extension to the July deadline that required them to move out to Pasir Panjang wharves.

But it has granted them an extra month. The deputy director of the Land and Sea Transport Division, Mr Lim Tock Ee, said the Singapore Lighter Owners' Association had been informed that relocation must be completed by the end of August.

He said the Ministry saw no reason for further delays as facilities at Pasir Panjang, such as the mooring buoys, lighter wharves, breakwater, were ready for use.

Singapore River lighterman must go by August.

Source: [Singapore Monitor] © Singapore Press Holdings Limited. Permission required for reproduction.

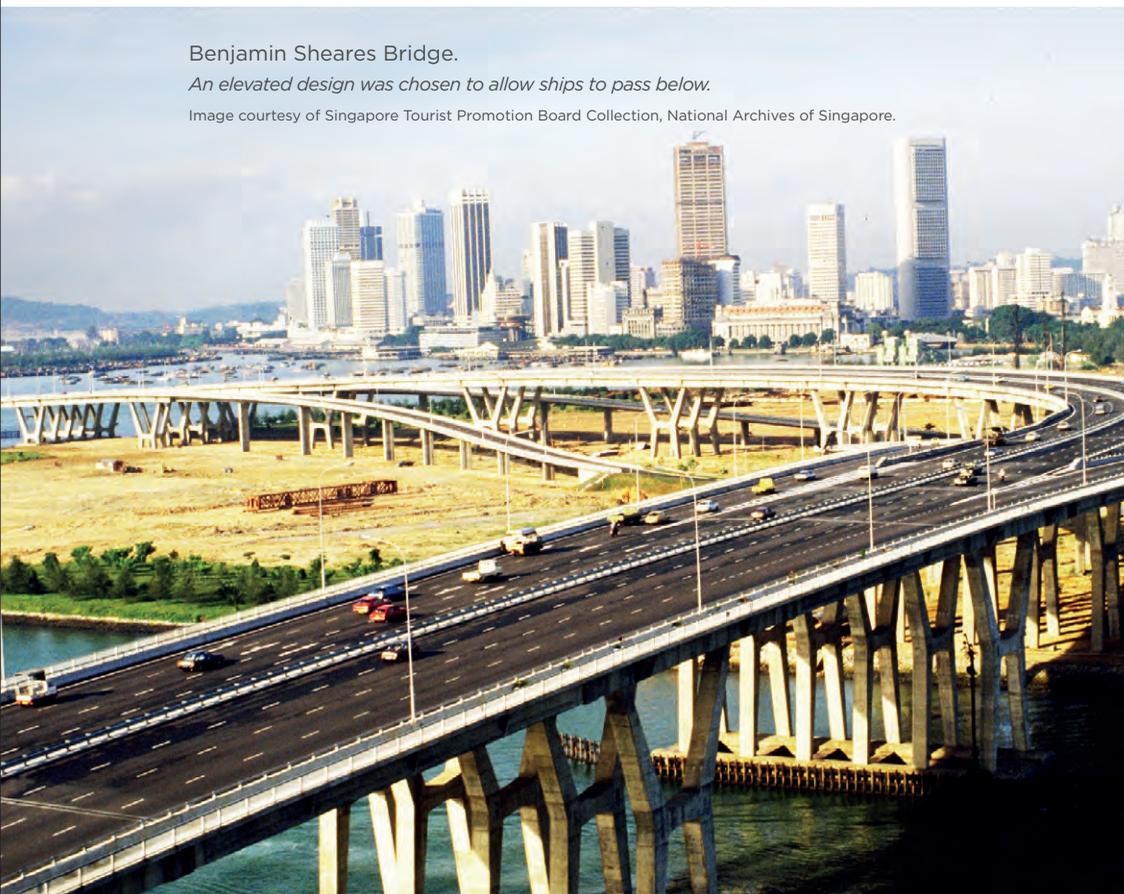
Relocation of the Shipyard Industry

The shipyards located in Kallang and Tanjong Rhu were another source of pollution that the government had to deal with in cleaning up the Singapore River. However, as the industry remained profitable, EDB was against relocating the shipyards.⁹¹ Adding to the complexity of the relocation was that some of the shipyards were situated on JTC land while others were on private land. Then Deputy Commissioner of Public Health Loh Ah Tuan offered a practical solution: “Why don’t you try to get them to amalgamate into bigger ones and get rid of the smaller ones so that they can survive, so that they are better able to provide pollution control facilities?”⁹²

Benjamin Sheares Bridge.

An elevated design was chosen to allow ships to pass below.

Image courtesy of Singapore Tourist Promotion Board Collection, National Archives of Singapore.



As early as 1982, shipyards were asked by JTC to move out or merge to form bigger companies so that they could invest in anti-pollution measures. However, there was resistance from the industry as the additional measures meant increased operational costs that would not yield much returns.⁹³ Furthermore, with the drop in oil prices during 1982 due to falling demand, oil tankers were being left idle at sea, thus leading to fewer contracts to install and repair systems on board the vessels. That year, ship repair turnover fell by 21% from \$1,088 million to \$860 million.⁹⁴ Still, the consolidation and relocation of shipyards remained slow until the 1985 economic recession, which resulted in a drastic decline of the shipping trade and finally prompted many of the shipbuilders to close down or merge. Eventually, some bigger shipyards remained in Kallang and installed anti-pollution equipment such as floating barriers to prevent oil and debris from flowing into the river; while others relocated their operations to Tuas or Jurong.⁹⁵

However, the initial resistance to the shipyard industry’s relocation in the 1970s had long-term repercussions on the city’s development. The most distinctive consequence would be the Benjamin Sheares Bridge, which crosses the Singapore and Kallang Rivers. Completed in 1981, the bridge was specially designed to enable larger ships to go under it. Its elevated design was more expensive and required vehicles to travel a much longer distance compared to an at-grade (low-level) design.⁹⁶ Sato Kogyo Company, the Japanese firm tasked with the design of the bridge, had initially come up with three proposals, of which two had elevated structures to accommodate the ships plying the rivers. The third proposal, favoured by then Chairman of PSA Howe Yoon Chong, was a low-level design where ships would be unable to pass, thus making it necessary for the port authority to help relocate the shipping industry.^{97,98} The various proposals were discussed at the Cabinet level before the final decision was made to adopt an elevated design. However, former Permanent Secretary of National Development, Koh Cher Siang recalled that the decision to construct an elevated bridge could have been avoided:

“But the irony of it is that the moment we awarded the contract and start building a bridge, a decision was made that all the shipyards had to move out. So actually the bridge was not needed. We could have a low level bridge. But that’s one of those policy things that I find quite strange.”⁹⁹

URBAN RENEWAL ALONG THE SINGAPORE RIVER

The 1968 River Godown Survey highlighted that many of the establishments along the Singapore River no longer made use of their riverside locations for goods handling, in part due to existing port development policies, which supported containerisation. The storage warehouses or “godowns” occupied an area of 2 million square feet (185,806 square metres) in the middle and upper reaches of the Central Area and 650,000 square feet (60,387 square metres) in the southern part, adjacent to Keppel Harbour and Telok Ayer Basin. As the government sought to redevelop the Central Area, the godown operators faced increasing pressure to relocate their business to Pasir Panjang and Geylang Serai.¹⁰⁰

With the gradual shift of shipping and trading activities away from the Singapore River, the godowns and commercial houses situated along the river had fallen into a state of decline.¹⁰¹ However, the government saw value in retaining the old façade along the river even as it undertook its clean-up of the Singapore River during the 1970s. The basin between Collyer Quay and North Bridge Road was of special importance due to its size and its relationship with the civic buildings south of the Padang and the commercial area around Raffles Place. This part of the Singapore River was also uninterrupted by bridge structures. The construction of a new river crossing here to ease traffic congestion was considered during a transport analysis of the 1971 Concept Plan, but the proposal was eventually shelved as it would have been environmentally unsound.¹⁰² On the other hand, some design guidelines and development control measures were recommended in the Concept Plan to ensure that areas of the city that had a special relationship with the sea were not only preserved, but enhanced by extending opportunities for views of the sea and by considering the city skyline as seen from the seaward approach.¹⁰³

In 1982, the Urban Redevelopment Authority (URA) initiated the conservation of shophouses and godowns along Boat Quay and Clarke Quay. These plans were supported by the Singapore Tourist Promotion Board (STPB, later renamed Singapore Tourism Board), which saw heritage conservation as a tool to enhance Singapore’s identity as a tourist destination.¹⁰⁴ To further the tourism agenda, the Singapore River Concept Plan was prepared in 1985. The plan envisaged the river as a commercial and leisure corridor, and proposed enhancing the character of the area by retaining old buildings with historical and architectural merit while constructing new buildings on a compatible scale.¹⁰⁵ As part of STPB’s efforts to strengthen the area’s unique identity and

bring life back to the waterway, licences to run boat tours on the Singapore River were tendered out by the government in 1987.¹⁰⁶ This saw some members of the lighterage industry stepping in to fill the role as bumboat tour operators along the river, where bumboats carrying tourists have since remained a common sight. Boat Quay and Clarke Quay have also become vibrant hubs of activity frequented by both locals and tourists.

THE BOLD MOVE — TANJONG PAGAR TERMINAL

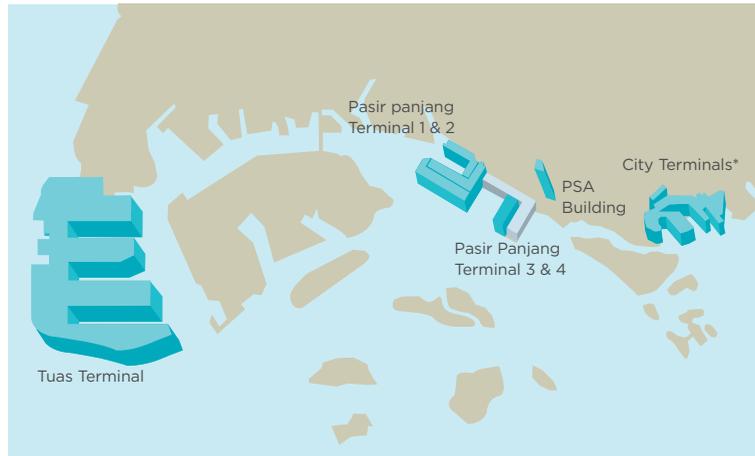
As trade volume increased, Keppel Harbour’s facilities became inadequate to handle the break-bulk cargo brought by ocean-going vessels. External competition and emerging trends in the shipping industry added further to the need to expand Singapore’s port infrastructure, as put forth by then Prime Minister Lee Kuan Yew in 1966:

“Do you know how many ships we lost to Hong Kong because we did not modernise our harbour, our dockyard? Our dockyard today in Keppel Harbour is too small. Have you read in the newspapers about the new oil ships? They are 300,000 tons — automatic, electrically-operated. The ships cannot go into King George V Dock. The Keppel docks are too small, too narrow. We are planning now for a complete re-thinking of the programme.”¹⁰⁷

Both PSA and the government were intent on ensuring that port infrastructure was ready to provide the fastest possible turnaround for shipping. Towards this end, the construction of the first deep-water berths at East Lagoon (renamed as Tanjong Pagar Container Terminal in 1982) started in 1966, even though not a single shipping line in Asia had committed to building container ships for the Europe–Far East run. PSA also formed a special committee to scrutinise developments in containerisation taking place in the United States and Europe. Although it was clear that Singapore needed to have container facilities, the decision on whether to invest in such facilities was a difficult one, as it meant expensive handling equipment and fewer portside workers at a time when the British military pull-out threatened to lead to massive unemployment.¹⁰⁸ However, the push for containerisation was endorsed by Singapore’s chief economic advisor Albert Winsemius. The World Bank had concerns that the facilities would be ahead of their time and the idea seemed far-fetched, but Winsemius had cautioned:

“Even if there is a chance, let’s say half a year that container port is lying idle, using interest and doing nothing, Singapore has to be the first one as to attract it.”¹⁰⁹

Exhibit 2: Map of City Terminals, Tuas and Pasir Panjang Terminals



* City Terminals = Keppel, Tanjong Pagar and Brani Terminals

Then Minister for Finance Dr Goh once again took heed of Winsemius's advice and made the bold decision to build the country's first container facilities. The pragmatism of the early leaders in adapting to the winds of change brought about by containerisation stood the country in good stead. If Singapore had delayed its decision, it would have been overtaken by other ports in the region such as Hong Kong, Port Klang and Penang.¹¹⁰ Financially, the move was not supported by the World Bank as it did not think that Singapore was ready for containerisation. Its loan of \$45 million was given on the condition that it would be used to cover the expansion of existing port facilities for conventional cargo at Keppel Harbour. In order to build the container facilities, PSA supplemented the World Bank loan by floating its own bonds (approximately \$70–80 million), which were bought by other government institutions.¹¹¹ Six years later in 1972, Singapore opened its first container port, beating its closest rival Hong Kong by just a few months. Tanjong Pagar Terminal had three container berths at the time and was the first container port to open in Southeast Asia.^{112,113} The first container vessel to call at the terminal was the MV Nihon, which arrived from Rotterdam in June 1972 with a cargo of 300 containers.¹¹⁴

To ensure a constant stream of business for the ports, government agencies went the extra mile to continue attracting foreign investments. After an EDB review of the pioneer status incentive scheme, it was amended in 1970 to give tax reliefs to qualifying foreign companies for

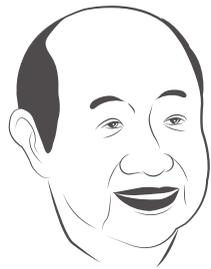
a fixed five-year period, and again in 1975 to extend the duration to a fixed period of 10 years. During the late-1970s, the tax incentive scheme was expanded to support small, Singapore-owned manufacturing enterprises, as well as to include benefits for companies that provided services to the existing pioneer status companies. PSA also actively conducted overseas promotion trips to woo shipping customers to call on Singapore along the Europe–Far East route.¹¹⁵

Apart from offering economic incentives, the government created an ecosystem to support the inter-modal movement of cargo. To prepare for the advent of containerisation, Container Warehousing & Transportation Pte Ltd (renamed as CWT Distribution in 1990) was formed on 25 June 1970.¹¹⁶ Its shareholders included government institutions such as PSA, DBS Bank, Intraco and NOL.¹¹⁷ The company's mission then was to build up Singapore's container trucking capabilities, establish container depot operations and prepare for land-based container operations that would be required with the start of container terminal operations by PSA.¹¹⁸ CWT was subsequently listed on the Singapore Exchange (SGX) in 1993.¹¹⁹ Former PSA Chief Executive Officer (CEO) Ng Chee Keong recalled, "This is a good example of how a government initiative served as an industry catalyst because the country was not ready. The private sector was not ready so we founded it and after that a lot of companies came in, when they saw how stably it was run."¹²⁰



**Arrival of the first container ship to Singapore, MV Nihon on 23 June 1972.
Operations at first container berth commence at Tanjong Pagar Terminal.**
Image courtesy of PSA Corporation Ltd.

The large increase in trade volume brought about by containerisation during the 1970s meant that urban planning decisions on port infrastructure locations became even more important, as they had a long-term impact on city development and involved sizeable investments. Apart from the land-use zoning laid out in 1971 Concept Plan, another important policy tool in planning for the provision of port infrastructure was the 1967 Land Acquisition Act, which paved the way for acquiring coastal land and initiating reclamation works on a large scale.¹²¹ Due to the scarcity of land in Singapore, reclamation usually has to be carried out to create land for port development. The earliest known land reclamation for port infrastructure took place in 1879, when the foreshore at Telok Ayer Street was extended to Raffles Quay to provide additional land for new access roads to facilitate the movement of cargo between Keppel Harbour and the Singapore River.¹²² With the 1967 Act, the government was able to undertake huge reclamation projects that extended the land along the coast from the Singapore River to Changi in the east and to Pasir Panjang in the west, and merged the islands at Jurong.



(1923 - 2007)

This started a new era in the development of Singapore's modern ports and maritime activities.¹²³ The long-term view taken in the planning of port infrastructure in Singapore has allowed the country to build facilities in tandem with demand brought about by worldwide trends. As aptly put by the first PSA Chairman, Howe Yoon Chong:

"As Singapore's industrialisation programme continues to grow, the parallel growth of the port and its services and facilities will continue to involve it as an inseparable partner of the country's progress."¹²⁴

As the infrastructure works began at Tanjong Pagar to prepare for container ships calling on Singapore, planning of shore-side transportation networks to facilitate the movement of goods was underway too. However in the 1960s, when the decision was taken to build the first container terminal at Tanjong Pagar, few anticipated the exponential increase in trade volume in the following years and the full impact that containerisation would have on the transportation networks.

One of the early transport decisions was the building of an inland container depot at 6 mile Holland Road, at the junction of the Malayan Railway lines from Tanjong Pagar and Jurong. To be completed in 1971, the proposed depot was for the stuffing and unstuffing of



King's Dry Dock at Keppel Harbour, c.1918.

Image courtesy of National Archives of Singapore.

containers before they were loaded onto the ships, and it would be connected by rail to Tanjong Pagar Terminal, Jurong Industrial Estate and West Malaysia.¹²⁵ The proposed development was met with strong opposition from the Hakka Fong Yun Thai Association as 130 acres (52.6 hectares) of the 180-acre (72.8-hectare) site was an ancestral cemetery sacred to the community. PSA's offer of \$1 million as compensation for the land was rejected by the community, who took the case to then Prime Minister Lee Kuan Yew and suggested alternative sites.¹²⁶ However, the decision to proceed with the land acquisition was made at the Cabinet level, where Lee, Howe and then transport minister Yong Nyuk Lin, all of whom were Hakkas, overrode the community's protests in view of the economic importance of port infrastructure, and even threatened to dissolve the association.¹²⁷ The acquisition of the entire cemetery hill was eventually completed in 1977, allowing the construction of the new depot to proceed at the Holland Road/Bukit Timah Road junction. The following year, excavated material from the site was used as reclamation fill for Sentosa Island.^{128,129} When Lim Kim San took over as the second Chairman of PSA in 1979, the plan for the inland container depot was shelved due to a policy shift to consolidate PSA's investments and a change in the nature of container operations.¹³⁰ Specifically, there was a trend towards full container load, where the cargo could be delivered directly to consignees, thus reducing the need for depots where loose cargo could be stored before being sent to consignees.¹³¹ Furthermore, the area was primarily residential, and the resulting heavy vehicle and container truck traffic would worsen traffic congestion along trunk roads such as Bukit Timah Road.¹³² Eventually, the depot was built at present-day Keppel Road.¹³³

In the aftermath of the 1973 oil crisis and stock market crash, the total cargo volume handled by PSA decreased for the first time since Singapore's independence, by approximately 13.8%, due to increased protectionism in global trade. However, cargo volume soon returned to positive growth and continued growing through the energy crisis of 1979 and the decline in economic activity in the early 1980s.¹³⁴ The substantial increase in trade volume at Tanjong Pagar Terminal during the 1970s and 1980s prompted plans for further expansion of the container berth facilities.

As part of PSA's earlier drive to improve productivity during the 1960s, shift work had been introduced and housing quarters for port workers had been built at Everton Park and Blair Plain so that they could live near their workplace at Tanjong Pagar. These rental quarters were eventually demolished less than 20 years later, with those at Everton Park redeveloped into new HDB flats and those at Blair Plain torn down to make way for a \$500 million expansion of Tanjong Pagar Terminal.



Everton Park Housing Estate Opening.

Image courtesy of Ministry of Information and the Arts Collection, National Archives of Singapore.

As early as 1968, then Prime Minister Lee Kuan Yew had urged the port workers not to consider the flats as permanent dwellings. Instead, he had encouraged the workers to purchase the HDB flats at Toa Payoh as they would not be able to continue living at the PSA quarters upon their retirement, adding that the value of their HDB flats would increase in the future.¹³⁵ Eviction notices were sent to the affected residents at Blair Plain in June 1981; with help from PSA and the Singapore Port Workers Union, all were resettled elsewhere by the end of 1984.^{136,137} As part of the \$500 million port expansion plan, PSA invested \$216 million in 1982 to convert its conventional berth at Keppel Wharves and Keppel Shipyard's Victoria and Albert Docks into two new container berths, completing both by 1984.¹³⁸ In return for the two docks, PSA gave Keppel Shipyard Pulau Hantu, an island situated 250 metres from Keppel's main yard. Keppel later renamed the island as Pulau Keppel and converted it into a repair facility with a floating dock.¹³⁹

While the development of port infrastructure was spurred by containerisation, these new developments meant that land-use planning for maritime industries became increasingly important as ship repair and container port activities grew to take place in close proximity along the coastline of Keppel Harbour. Not long after, in early 1983, the offshore drilling platform Eniwetok collided with the Sentosa Cableway when it was unberthing to leave Keppel Harbour. Eniwetok was originally a bulk carrier and had undergone conversion works at the nearby Keppel Shipyard, but the conversion had resulted in an increase in its height, making it taller than the cableway.¹⁴⁰ The accident led to the death of seven people on board the cable cars, and served as a timely reminder of the importance of urban planning in siting port infrastructure.

At the time of the accident, the cableway, which was completed in 1974, was operating amidst heavy shipping activities as numerous PSA berths receiving ships of any height lay to the east of the cableway, while Keppel Shipyard facilities were situated to the west. Compounding the problem was the narrow waterway in which ships could navigate. Apart from the close proximity of the shipyard's activities at Pulau Keppel to ships plying the waters off Keppel Harbour, there was a lack of consultation between PSA and Keppel Shipyard on two critical matters — the placing of the cableway across Keppel Harbour in the first place, and the berthing of Eniwetok at Oil Wharf (the eastern-most wharf in the main yard).¹⁴¹ In hindsight, regulations such as Height Restricted Areas (HRAs) could have been implemented earlier to safeguard against possible collisions between ships with tall masts and the cableway.¹⁴²

Just two years before the tragedy, PSA missed an opportunity to implement an HRA at the harbour. In 1981, the proposed opening of the new Changi International Airport had led to discussions on the problem of tall vessels that could obstruct flight paths while transiting or remaining in the East Johor Strait. As a result of the discussions, regulations were drawn up to implement HRAs at the East Johore Strait, Kallang Basin (Benjamin Sheares Bridge), Eastern Special Purpose Anchorage and Eastern Explosives Anchorage. However, Keppel Harbour was excluded from height restrictions as PSA had argued then that the physical obstruction of the cableway was more visible than the conceptual overhead navigational obstruction posed to the aircraft.

In the aftermath of the *Eniwetok* accident, the commission of inquiry set up to investigate the causes highlighted the need to improve the communication between PSA and Keppel Shipyard. It also recommended considering the movement of Keppel Shipyard's repair facilities to Tuas in the long term although there were draught limitations in the approach channel at Tuas then. Other measures proposed included requiring the repair of vessels taller than 48 metres to be done at Pulau Keppel, situated further east of the cableway.¹⁴³ The HRA Scheme was finally implemented at Keppel Harbour in 1985, where ships more than 52 metres in height were banned from entering the harbour.¹⁴⁴ Improvements were made to existing HRAs as well, particularly at Benjamin Sheares Bridge. Following discussions with PSA, PWD implemented safety features such as the illumination of the bridge at night to highlight the overhead span and the display of signboards indicating the height clearance.¹⁴⁵

Tragedy strikes high above the waters off Sentosa

Seven die as two cable cars plunge into sea



Seven die as two cable cars plunge into sea.

Source: [The Sunday Times] © Singapore Press Holdings Limited. Permission required for reproduction.

PORT INFRASTRUCTURE DEVELOPMENT TO SUPPORT GROWTH (1980S – 1990S)

“Howe Yoon Chong, as chairman of PSA, was instrumental in guiding the decisions on how and where to site future container terminals. He was very wise and commissioned some studies and also looked at it and said, ‘There’s no way you can really expand Tanjong Pagar. You’ve got to move your port away, developed it from other...’ So he promoted the idea of developing Sembawang port. Then his concept really was that you ultimately moved your container port from the city, more to the west coast area and then to Sembawang and maybe into Changi.”

.....
Herman Ronald Hochstadt, former Permanent Secretary (Communications)¹⁴⁶

PLANNING FOR FURTHER EXPANSION OF PORT FACILITIES — PASIR PANJANG TERMINAL

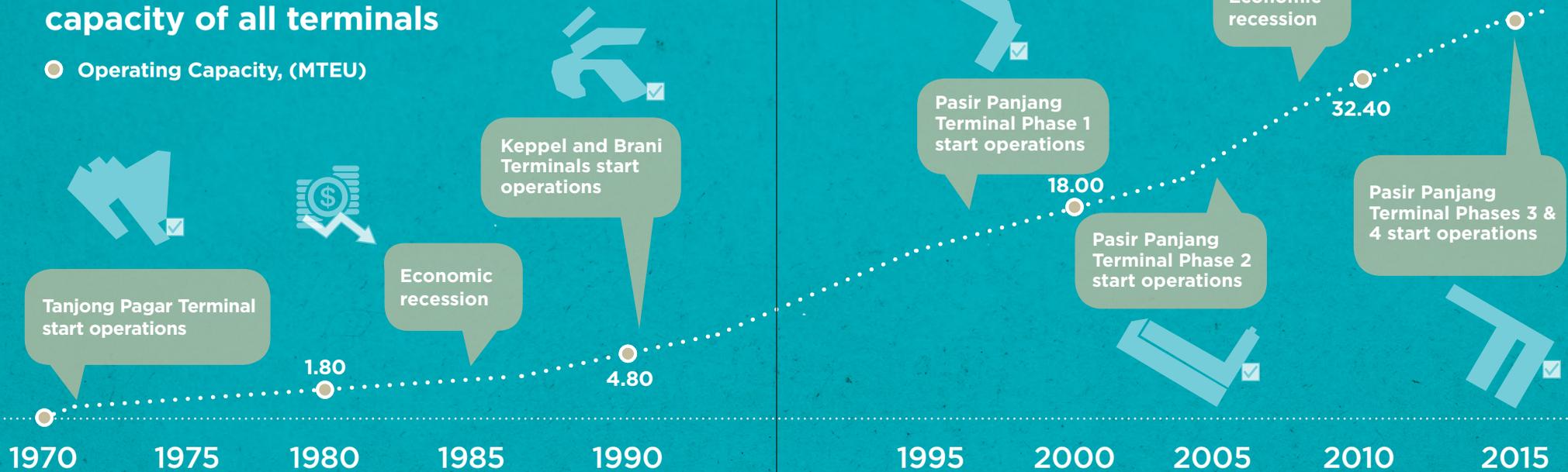
Continued investment in port infrastructure remained a priority in Singapore’s development as trade volume increased. The overseas promotion trips conducted by PSA were very effective and contributed to an exponential increase in the number of container ships calling at Singapore. In 1982, Singapore overtook Rotterdam as the world’s busiest port in terms of shipping tonnage, and we are still one of the world’s 10 busiest ports today.^{147,148} By the early 1980s, it became clear that Tanjong Pagar Terminal was unable to handle the huge trade volume and would be operating at maximum capacity by the 1990s. There was also a natural limit to which facilities at Tanjong Pagar Terminal could be expanded. Former Permanent Secretary (Communications) Herman Ronald Hochstadt recalled that Howe Yoon Chong, as chairman of PSA, was instrumental in guiding the decisions on how and where to site future container terminals: “I think he was very wise and commissioned some studies and also looked at it and said, ‘There’s no way you can really expand Tanjong Pagar. You’ve got to move your port away, developed it from other...’ So he promoted the idea of developing Sembawang port. Then his concept really was that you ultimately moved your container port from the city, more to the west coast area and then to Sembawang and maybe into Changi.”¹⁴⁹

Howe was in favour of the idea that Tanjong Pagar would serve the immediate needs of trade while major container ports would be developed elsewhere. To build up PSA’s technical capabilities in site selection, he set up the hydrological department to study water flows and contours along the coastal areas for port construction. At one point, Howe even considered co-locating a container terminal with the upcoming airport at Changi, as preliminary studies had identified the site as an “ideal interchange facility for the transfer of air/sea cargo”.^{150,151} However, since the proposed integrated development could only become operational in the late-1980s, the plan was short-lived and abandoned by PSA in 1979 as it needed more urgent and less costly measures to cope with the rapid growth of container cargo.¹⁵²

EXHIBIT 3:

Growth in container operating capacity of all terminals

● Operating Capacity, (MTEU)



Refer to Exhibit 2 for map of all terminals

Furthermore, the site at Changi was not ideal for an integrated air/sea terminal, as the containerisation process required tall cranes to move cargo to and from the ships, and flight paths across Changi would impose height restrictions unsuitable for the deployment of such cranes.¹⁵³ As a result, PSA's attention turned to building new container berths at Pulau Brani, an offshore island previously identified in the 1971 Concept Plan as a potential port area before a naval base was opened there in 1974.¹⁵⁴ Situated across from Tanjong Pagar Terminal and Keppel Terminal, the site would offer the benefit of centralising container handling operations. However in 1983, PSA suspended its plan to develop Pulau Brani after container traffic grew slower than expected due to weakening world trade.¹⁵⁵ A stock-take of existing port infrastructure then had assured PSA that it had the capacity to meet projected demand as additional facilities had already been constructed at Tanjong Pagar Container Terminal, while procedural improvements, automation and computerisation had enhanced the efficiency of port operations.¹⁵⁶

In 1985, Singapore entered its first economic recession since independence. Demand for the country's goods and services had fallen as world trade had slowed down and regional countries were trading directly and bypassing Singapore as a transshipment port.

Indonesia, Thailand and the Philippines had also implemented taxes on goods exiting their respective countries, while Malaysia had introduced a 50% tax on goods bought from Singapore by its residents. In addition, Singapore's oil refining, shipbuilding and ship repair industries were performing poorly in the face of new competitors.¹⁵⁷ The recession prompted the government to review the economy and identify new strategies for growth. In line with the overall economic review, PSA strove to increase productivity and reduce redundancy by working closely with the unions and upgrading workers' skills. Meanwhile, the expansion of port infrastructure continued at a cautious pace, with PSA completing four new coastal berths at Jurong Wharves and two new warehouses at Sembawang Wharves in 1985. That year, PSA also granted tariff concessions and rebates to the shipping and related sectors.¹⁵⁸

By mid-1986, the Singapore economy had made a full recovery.¹⁵⁹ In the same year, then Minister for Communications and Information Dr Yeo Ning Hong announced plans to build a container port at Pulau Brani as part of a \$1.5 billion development project to cope with future increases in container throughput.¹⁶⁰ Construction of the new terminal commenced in 1989 and was completed ahead of schedule in 1991.^{161,162} Brani Terminal comprised nine berths, with support facilities and back-

up space of 55 hectares. To facilitate the movement of cargo to and from the mainland, a causeway link was completed at the same time. A public access road connecting Sentosa to the mainland via Pulau Brani was opened the following year.

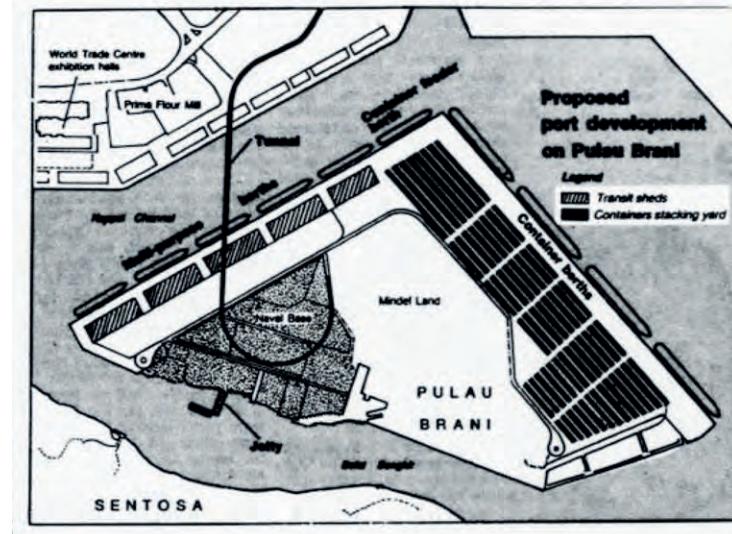
While Brani Terminal was being built, PSA was already looking for another location to site its third container port. With container traffic growing by as much as 30% annually in the late-1980s, PSA had estimated that Tanjong Pagar and Brani Terminals would be operating at full capacity (totalling 8 million twenty-foot equivalent units or TEUs) by the mid- to late-1990s. In August 1989, news broke that a proposed waterfront park development next to the existing Pasir Panjang Wharves might have to be dropped because PSA was planning to reclaim land off Pasir Panjang to build the third terminal.¹⁶³ The reclamation was approved by Parliament in 1992, paving the way for PSA to expand the port facilities at Pasir Panjang to support containerisation.¹⁶⁴ This was a prime example of how the planning, regulation and relocation of non-essential functions in land-scarce Singapore helped to achieve higher productivity.

When planning the expansion of port infrastructure, from the location of the facilities to the design and layout of the berths and terminals, PSA has had to take into account the rapid increase in the container ships' cargo carrying capacity and dimensions. At the time when Brani Terminal commenced operations, our ports received ships that measured 260–300 metres long and had a cargo carrying capacity of 4,000 to 5,000 TEUs. Less than a decade later, by the year 2000, standard container ships calling on Singapore measured 300–330 metres in length and carried 6,000 to 8,000 TEUs of cargo. While Keppel and Tanjong Pagar Terminals could accommodate a maximum draft of 14.6 metres, the berths at Brani were 15.0 metres deep. To keep up with the growing size of container ships, future terminals would have to provide not only deeper waters for berthing but also adequate shore-side facilities for loading and unloading the increased amount of cargo brought by larger ships.¹⁶⁵

The development of Pasir Panjang Terminal was carried out in stages, as PSA was cautious about building ahead of demand following the lessons learnt during the 1985 recession, which had affected the maritime industry and caused a decline in the total cargo handled by PSA.¹⁷⁵ Construction of the first phase started in 1993 and was completed in 1997, while Phase 2 was completed in 2005, bringing the

Pulau Brani to have \$1b container port

By LINDA CHEE



Map of Pulau Brani.

Converted from a naval base to a container port.

Source: [The Business Times] © Singapore Press Holdings Limited. Permission required for reproduction.

total number of container berths at Pasir Panjang Terminal to 23.^{176,177} By spreading the development of Pasir Panjang Terminal over four distinct phases, PSA had more flexibility in pacing the growth of port infrastructure with global trends. Another key development in the Pasir Panjang area in the 1990s was the opening of the domestic ferry terminal to cater to increased industrial activity at the Southern and Jurong islands.¹⁷⁸ Completed in 1995, the terminal was used mainly by workers of Shell Eastern Petroleum Company located at Pulau Bukom, but it also received water taxis ferrying crew to and from container vessels and commercial ships calling at Singapore.¹⁷⁹

PASIR PANJANG VERSUS TUAS

When the decision to develop Pasir Panjang Wharves was made in 1972, it was mainly to serve as a gateway for ocean-going and coastal vessels plying the region's trade in rice, rubber and other raw materials. The facilities constructed there would also serve the lighterage industry, which was to be moved out of the Singapore River (Telok Ayer Basin) and Keppel Wharves. When Pasir Panjang Wharves underwent upgrading works in the 1980s, there was no hint of any plan to expand the port's usage beyond the handling of conventional cargo.¹⁶⁶ In the 1985 Master Plan, the port area off Pasir Panjang measured 277 hectares; but by the 1991 Concept Plan, the total area zoned for port use was 650 hectares.¹⁶⁷



Aerial view of Pasir Panjang before reclamation.

Image courtesy of National Archives of Singapore.

Apart from Pasir Panjang, another site was also considered for the siting of a new container terminal during the preparation of the 1991 Concept Plan. Located in Tuas, this alternative site had undergone extensive reclamation during the 1980s and was zoned mostly for industrial purposes in the 1985 Master Plan. Pasir Panjang was the eventual choice. In May 1992, Parliament approved the reclamation of 122 hectares of land off Pasir Panjang to commence the building of a container port that “would bring the Port one step closer to being a mega-port”.¹⁶⁷ Unknown to most, discussions had taken place behind the scenes before this decision was finally made.

While the port authority was in no doubt that Pasir Panjang was the most suitable location to site the future mega-port, the urban planners at URA were for the idea of situating it at Tuas. Dr John Keung, who was then Deputy CEO of URA, recalled, “When we did the 1991 Concept Plan, we never foresaw this huge increase in volume in container traffic”, but the planners eventually suggested that port infrastructure should go to Tuas for the long term due to other considerations. In response to the planners’ suggestion, Lim Kim San, then PSA Chairman, had counter-argued that the waters off Tuas were not deep enough for the container ships to berth.¹⁶⁹

Besides the insufficient depth of the waters at Tuas, the port authority had economic considerations as well. During the late-1980s, the amount of cargo handled by the existing port terminals increased significantly as PSA rode the wave of global manufacturing expansion driven by China.¹⁷⁰ Hence, there was a growing sense of urgency to expand container facilities in Singapore to cope with the increased volume of containerised cargo. As former PSA CEO Ng Chee Keong recalled, “The container penetration factor (the percentage of cargo that can be containerised) in Singapore was about 90% at that time as compared to 20 to 30% in India, which surpassed organic growth such that I can even pressurise efforts to convert conventional facilities to container facilities.”¹⁷¹ This was in contrast to the situation during the early 1960s, when Singapore’s port was mainly a Hub-

PASIR PANJANG VERSUS TUAS

Continued...

and-Spoke (main line operator to feeder) transshipment port serving the adjoining Malayan hinterland. Gradually, over the two decades after independence, Singapore's export-oriented industrialisation strategy coupled with increasing ship sizes and networks fuelled the growth of relay transshipment, where shipping lines using PSA's terminals for transshipment were mainly operating on Cross Strings (main line operator to main line operator) routes. As explained by the current PSA CEO, Tan Chong Meng, "The crossovers of mainlines create an opportunity to transact and transfer boxes from one main line to another main line. Hence, the design of the port and connectivity becomes important, as it's not just single delivery efficiency." The economics of relay transshipment thus meant that locating the new port at Pasir Panjang would offer cost savings of a couple of hundred million dollars annually, given the greater connectivity to existing city terminals (Keppel and Tanjong Pagar).¹⁷²

The urban planners, on the other hand, were exploring other uses for the waterfront land at Pasir Panjang under its planning paradigm for the city as a whole. With Singapore's population growth placing increasing



Aerial view of Pasir Panjang Terminal.

Image courtesy of PSA Corporation Ltd.

demands on the city, the sites occupied by port infrastructure were seen as prime land for housing or mixed urban developments. Former Deputy Secretary of MND Lim Hng Kiang later recounted how MND had advocated for the port to be situated at Tuas, just as how the airport was shifted to Changi, so as to free up land at Tanjong Pagar for other purposes.¹⁷³ S. Dhanabalan, who was the Minister for National Development then, also believed that alternative sites such as Tuas or Jurong should have been chosen, as Pasir Panjang "really should have been residential". However, at that time, PSA had maintained that close proximity to existing port facilities at Tanjong Pagar was necessary for transshipment, which required the fast movement of containers from one point to another.¹⁷⁴

During the construction of Pasir Panjang Terminal in the 1990s, PSA demonstrated the importance of long-term planning and governance in maintaining a competitive economy while creating a sustainable environment. The Executive Director of PSA then, Commodore James Leo, was sympathetic to the proposal put forth by various nature groups (represented by Professor Leo Tan) to save Labrador Park, which was situated adjacent to the Pasir Panjang port expansion. They had recommended the conservation of the mainland's last natural rocky shore to protect its high biodiversity. Labrador Park thus given a reprieve from development for 10 years, before it was finally gazetted as a nature reserve in 2002.¹⁸⁰ Apart from showing a sensitivity to nature, PSA demonstrated flexibility in balancing the demands of port infrastructure with that of other land uses when it exempted then PSA-owned Pasir Panjang Wholesale Centre from relocation plans.¹⁸¹ Recalled Commodore Leo, "After taking into account the stallholders' appeals, the reclamation design profile off Pasir Panjang was changed to accommodate the people such that impacts on their livelihood would be minimal. In addition, the compensation process to the people would have been endless and delayed the work project during a time when sand supply was uncertain due to the politically-sensitive challenges of sand extraction from neighbouring countries."¹⁸²

RAISING PRODUCTIVITY THROUGH TECHNOLOGICAL BREAKTHROUGHS

Apart from capital investments in the physical infrastructure, PSA's efforts in ensuring the port's competitiveness have included investments in technology and innovation. In 1967, PSA formed a data processing department to computerise operations such as payroll and billing in order to increase operational efficiency and reduce costs.¹⁸³ On the ground, the handling of cargo was mechanised, such as by using forklifts to move conventional cargo and later containers. The use of machines not only improved the productivity of the port, but also the workers' quality of life as wages increased for workers who had to further their education to handle more complex machines.¹⁸⁴ To help workers cope with the technological changes, a training department (renamed as the Singapore Port Institute in 1990) was set up to

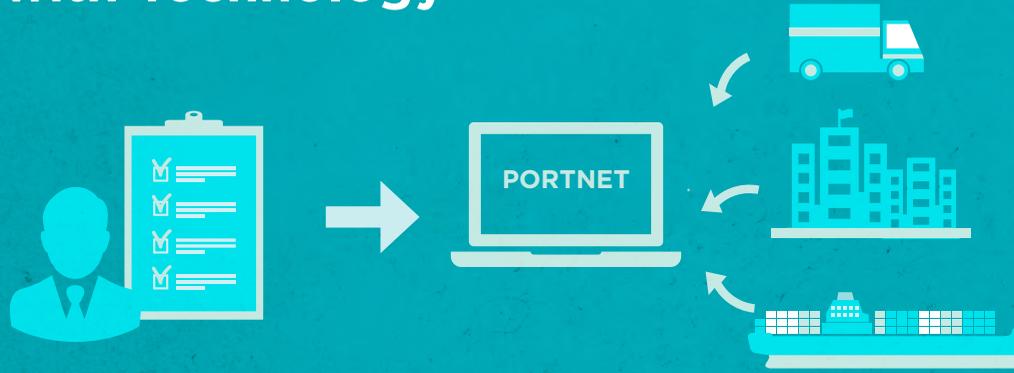
upgrade workers' skills. When Tanjong Pagar Terminal was ready to handle container ships in 1972, workers from the conventional wharves were already trained and could be diverted to handle the more complex operations at the container terminal.¹⁸⁵

PSA went on to develop in-house software capability, which laid the foundation for the development of technological systems to aid the movement of containers at the port. In 1973, the first online system for handling containers became operational at Tanjong Pagar Terminal. This reduced the time taken to locate containers and allowed port users to expedite the delivery of their goods. In 1984, BOXNET, an electronic data interchange (EDI), was introduced so that shipping lines and freight forwarding companies could obtain real-time information on their containers directly from PSA's computer system. The idea for BOXNET was adapted from the airline industry's reservation system, where passengers who made reservations on connecting flights were akin to containers en route to a destination. PSA approached one of its clients, Maersk Line, which was using the same computer system by IBM at the time, to be the inaugural user of BOXNET. The trial was a success and opened the doors for other shipping lines and hauliers to adopt the system. BOXNET was later upgraded to PORTNET in 1989.¹⁸⁶

As the volume of container trade increased in the 1980s, the handling of containers bound for transshipment grew increasingly complex. Containers were being stacked higher at the yards as they awaited transfers to outbound ships. At the same time, it was important for the containers to be stacked in a way that minimised the waiting time for the transfer to another ship. Hence, a sophisticated tracking system was required. In 1989, PSA introduced the Computer Integrated Terminal Operations System (CITOS) to help it plan and direct all container handling operations, including the use of berths, yards, equipment and manpower. CITOS was a technological breakthrough that created a greater integration of port operations. With the new system, PSA was able to handle the highest vessel rate in the world despite the complexity, number and speed of box connections between vessels. CITOS was even made a permanent exhibition at the Smithsonian's National Museum of American History in 2000.¹⁸⁷

EXHIBIT 4:

Streamlining Processes with Technology

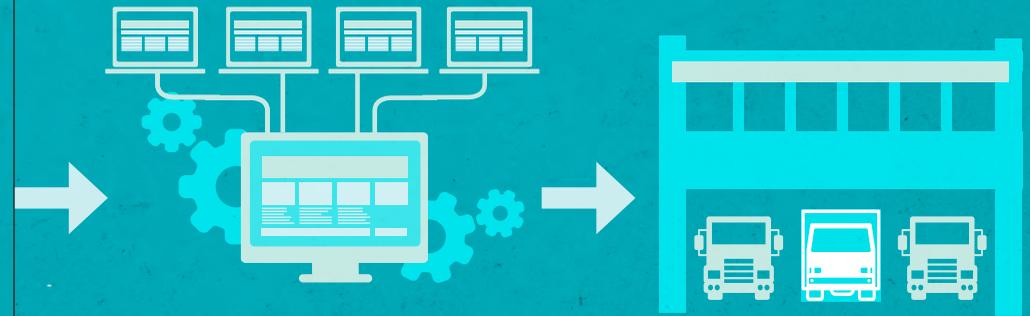


TRADENET (1989)

IES' e-platform for handling trade declaration documents.

PORTNET (1989)

PSA's e-business platform for port community (shipping lines, hauliers etc.)

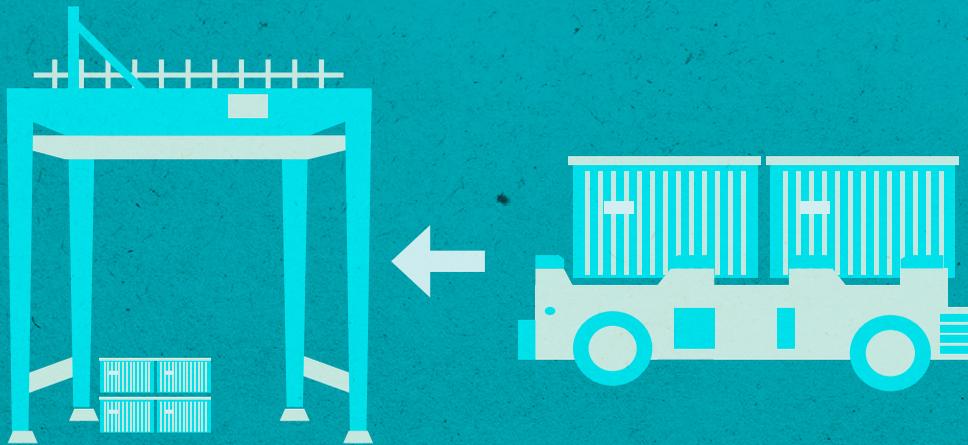


CITOS (1988)

PSA's Computer Integrated Terminal Operations System to plan and direct all container handling operations.

FLOW-THROUGH GATE (1997)

PSA's ERP system which automatically clears container trucks within 25 seconds.

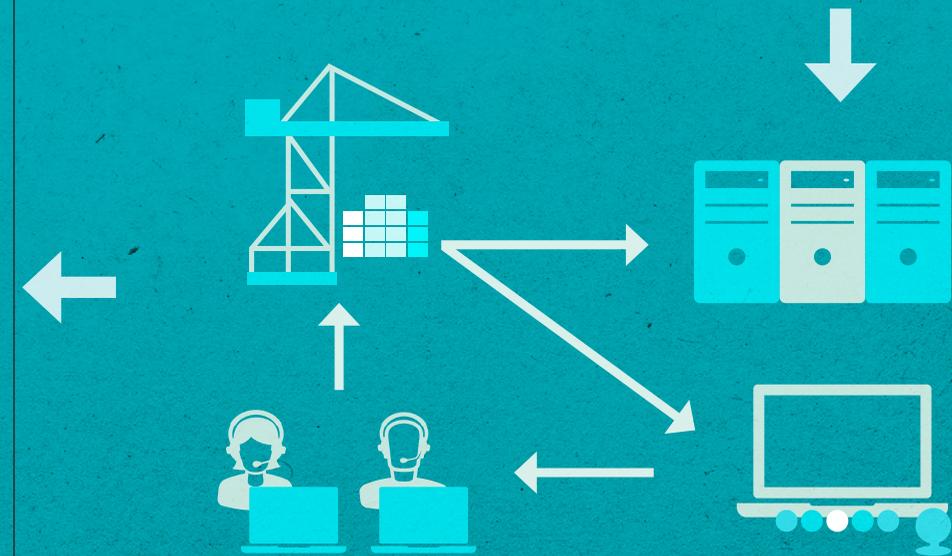


ARMG

(to be implemented at Tuas Port in the future) PSA's automated rail mounted gantry

AGV (2015)

PSA's automated guided vehicles used for shuttling containers between the quayside and container yard.



RCOC (2000)

Remote Crane Operations and Control system which supports wireless yard operations

To complement the computerised port operations, the Trade Development Board (TDB, the predecessor of the International Enterprise Singapore) implemented a government EDI system called TRADENET in 1989 to enable trading papers to be processed and approved rapidly by the relevant government agencies.¹⁸⁸ The idea for TRADENET had arisen from a 1980 report by the Committee on National Computerisation (CNC), which recommended developing key competencies in information technology (IT) to provide economic opportunities. One of the areas targeted was external trade, which led to comprehensive efforts to introduce IT initiatives in the port and airport. TDB undertook the task of streamlining the process of handling trade declaration documents, with the aim of reducing the two-day turnaround period for the approval of shipments. When TRADENET was launched in January 1989, the first transaction processed through the system took only 10 minutes from beginning to end.¹⁸⁹ Earlier, in March 1988, Singapore Network Services Pte Ltd (SNS) (now known as CrimsonLogic Pte Ltd) had been created to own and operate TRADENET, with PSA, the Civil Aviation Authority of Singapore (CAAS) and Singapore Telecoms each holding a 15% share of the new company while TDB held the remaining 55%. Having the buy-in of other agencies involved in the trade process was crucial to the success of TRADENET.¹⁹⁰ The formation of SNS also came about after considerations that the private sector may not be willing to bear the financial risks of developing and implementing a system that would perform the government's regulatory functions. With SNS running TRADENET, the government avoided the cost of operating nationwide network infrastructure and services, while trading companies benefited by paying for the use of the services without incurring developmental or maintenance costs.

On the ground, technology was also a game-changer by making it possible for multiple containers to be handled with ease and efficiency. When the decision was taken in the early 1990s to develop the new container terminal at Pasir Panjang, PSA studied the option of breaking away from the conventional yard operations, where operators were needed to manoeuvre every yard crane. The move towards automated crane operations was a logical step towards improving productivity, as recounted by the former Deputy Group President of Logistics at PSA, Lee Chee Yeng:

"We find that for every yard crane, you need to put an operator on there. As a result, it is very manpower intensive, especially during three shifts, and every crane does not have jobs all the time. With the remote control room operator, you can feed him jobs regardless where each crane is".¹⁹¹

The Remote Crane Operations and Control (RCOC) system was finally introduced at Pasir Panjang Terminal in 2000.¹⁹² These remote-controlled bridge cranes utilised the latest wireless technology for their navigation and allowed each operator to handle up to six cranes, not necessarily in sequence. To ensure minimal disruption to the workforce, PSA once again trained its workers to adapt to the new technology, and opened up opportunities for more women to join the male-dominated workforce. Apart from solving manpower constraints, this technological breakthrough also increased the turnaround rate of containers bound for transshipment, saving the amount of space needed to temporarily house containers within the port area. Overall, the port's productivity gains contributed to a more competitive economy, as the benefits were passed on to port users in the form of lower prices for port services and faster clearance of containers for transshipment.¹⁹³

CREATING SEAMLESS CONNECTIONS FOR INTER-MODAL TRANSPORT

With 85% of the cargo arriving in Singapore meant for re-export, outbound containers should ideally be stacked close to the berthing position of the corresponding vessel. However, it is not always possible to connect outbound containers immediately to the next available feeder ship. To cater for situations where containers are located far from their outbound ships, PSA has worked to minimise the time taken to transport containers from one point to another by building internal road networks within the port area and developing warehouses in close proximity to the terminals.

Outside of the port area, an efficient inter-modal transport system is needed to support the movement of goods from the manufacturing companies in the west to the warehouses and container terminals in

the south. As road-based goods vehicles carry most of the last-mile freight and form an indispensable part of this system, planners need to integrate land-use and transport planning to facilitate inter-modalism.¹⁹⁴ The importance of doing so became more apparent after Tanjong Pagar Container Terminal opened near the CBD in 1972 and added to the traffic congestion in the area. To address the worsening traffic problem, the Road Transport Action Committee (RTAC) was formed in 1973 to coordinate transport planning efforts and formulate policies to manage traffic demand within the city. RTAC was an inter-ministerial committee that was chaired by then Permanent Secretary (National Development) Cheng Tong Fatt, and involved the Permanent Secretaries from several other ministries such as Finance, Home Affairs, and Communications.¹⁹⁵

One of the most significant schemes that arose from RTAC's recommendations on traffic management in the Central Area was the Area Licensing Scheme (ALS), the precursor of today's Electronic Road Pricing (ERP) system. When ALS was introduced in 1975, goods vehicles were among those exempted from having to pay a special fee to enter the Restricted Zone.¹⁹⁶ However, a survey at the cordon points of the Restricted Zone revealed that goods vehicles utilised the roads more often during the restricted hours, and that half of these vehicles did not carry any goods but used the Restricted Zone to bypass other routes across the city. In addition, it was suspected that lighter goods vehicles were being used as alternatives to private cars for entering the Central Area. Subsequently in 1989, the ALS was revised to include goods vehicles.¹⁹⁷ The ALS was eventually replaced by the ERP system in 1998, and ERP has come to be accepted as an effective pricing system to manage traffic congestion over the years. One drawback of the ALS was that it merely diverted traffic to areas outside the Restricted Zone, thereby increasing traffic volume along the ring roads and parallel expressways. This highlighted the importance of looking beyond the Central Area when undertaking road planning. The facilitation of freight transport also became an increasingly important consideration from the mid-1980s to 1990s, as manufacturing continued to play a key role in driving the country's economic growth.

During the mid-1980s, the manufacturing industry in Singapore grew as companies began to shift their operations from higher-cost countries like Japan to Southeast Asia. At the same time, Singapore's Free Trade Zone (FTZ) Advisory Committee wanted to position the country as

a warehousing and distribution centre. The government thus began to actively develop Singapore into a transshipment centre for regional products from Malaysia, Indonesia and Thailand.¹⁹⁸ However, the yards for container storage within the port area were inadequate to cope with the new demands of the transshipment business. As a solution to this problem, PSA worked closely with EDB and TDB to promote the growth of a logistics hub in Singapore.¹⁹⁹ This called for the establishment of centralised logistics centres to provide comprehensive services to businesses located in Singapore, ranging from transport and forwarding to warehousing and distribution. It was against this backdrop that the Distribelt concept was mooted in 1989. It was conceived as a 3,700-hectare distribution zone stretching 20 kilometres along the southern coast, encompassing the existing facilities at Tanjong Pagar Terminal, Keppel Terminal, Pasir Panjang Terminal, Alexandra Distripark and Pasir Panjang Distripark.²⁰⁰ In 1993, Keppel Distripark was completed within the Distribelt. Redeveloped from the former Nelson Road Residences, which was originally quarters for port workers employed by the Singapore Harbour Board, Keppel Distripark was built specifically to complement the functions of a transshipment port by being situated in an FTZ.²⁰¹ FTZs facilitate transshipment as goods can be stored without charges for 14 days and are exempted from tax until they leave the FTZ for sale in Singapore, while re-exported goods from the FTZ remain tax-free.²⁰² Structurally, Keppel Distripark was designed with a vehicle ramp to connect all floors and a 14-metre-high ceiling to support high-rack automated storage and retrieval systems.²⁰³

In 1994, the Indonesia-Malaysia-Singapore Growth Triangle (IMS-GT) was established. The IMS-GT generated a considerable amount of container traffic for the three countries, totalling over 4.5 million TEUs in 1994.²⁰⁴ The growth triangle originated from a 1989 tripartite arrangement between Singapore, Johor (Malaysia) and Riau (Indonesia) to relocate Singapore's labour-intensive manufacturing activities to Johor and Riau, which had abundant natural resources and a low-skilled, low-wage workforce.²⁰⁵ By then, Singapore was no longer positioning itself as the low-wage economy that it was during the 1960s and 1970s, and the government had realised that the country needed to expand its economic activities beyond its borders by investing in the region. The Woodlands Causeway, which was opened in 1923 and connected to the North-South Expressway in Malaysia, was the primary route via which hauliers transported cargo from Malaysia to Singapore.²⁰⁶ Most hauliers

preferred using this road link instead of the Malayan Railway that ran parallel to the expressway due to the limited number of freight trains in operation (only two daily in both directions).²⁰⁷ To cater to the growth in Malaysia–Singapore trade and the resulting increase in demand for the road transportation of cargo, planning for an alternative crossing started in the early 1990s. The Second Link was eventually built in Tuas, a sufficient distance away from Woodlands and far enough from residential areas. However, after it opened to traffic in 1998, the higher toll charges levied here meant that hauliers still preferred to travel via the Woodlands Causeway.²⁰⁸

Road infrastructure planning during the 1980s and 1990s was important in accommodating the increasing use of roads for freight movement while minimising traffic congestion. Careful planning of freight routes was also necessary to mitigate the impact of pollution from heavy goods vehicles by situating routes away from residential areas. One of the early expressway projects that accounted for the movement of goods traffic was the Ayer Rajah Expressway (AYE), which was completed in 1988.²⁰⁹ During the construction of the AYE, the road planning and design department of the Public Works Department (PWD) held discussions with KTM, the owner of Malayan Railway, to re-route the AYE to better facilitate goods and traffic movement. As a section of the proposed AYE was to run through some land belonging to KTM, road planners from PWD negotiated to relocate disused portions of the railway and build compensating infrastructure elsewhere so that the land could be used to build the new expressway. The former Director of Planning at the Land Transport Authority (LTA), Mohinder Singh, who had worked on the design of the AYE when he was at PWD, revealed:

“We had to relocate all the railway lines and the marshalling yard lines. We had to build godowns and housing for them on this side at Spooner Road, as a condition of them giving up this land and allowing the construction of the AYE. We built a lot of the godowns close to the Kampong Bahru work site which is near to Jalan Bukit Merah.”²¹⁰

Apart from coordinating with different stakeholders in planning the most optimal routes for freight transport, the transport planners at PWD also worked to provide seamless connections for inter-modalism by developing a goods vehicle corridor to support the Distribelt concept. Road upgrading projects were thus implemented to create an efficient and smooth-flowing arterial corridor for vehicles travelling into and out of the industrial areas in Tuas and Jurong. Mohinder recalled, “This transport corridor was needed in order to be able to handle the goods vehicle traffic more directly. If you don’t provide it, there is a cost for the economy; there is also a cost because these goods vehicles will travel along other corridors which are more sensitive. So as such, Telok Blangah Road viaduct was built, the West Coast Highway was upgraded; Jalan Buroh was widened, improved, and taken all the way to Pioneer Road.”²¹¹

EXHIBIT 5:

Evolution of cargo transport

Coolies

Pallet and pulley system

Container port crane

Container port crane

Container port crane



230m

260 - 300m

300 - 330m

1930

1953

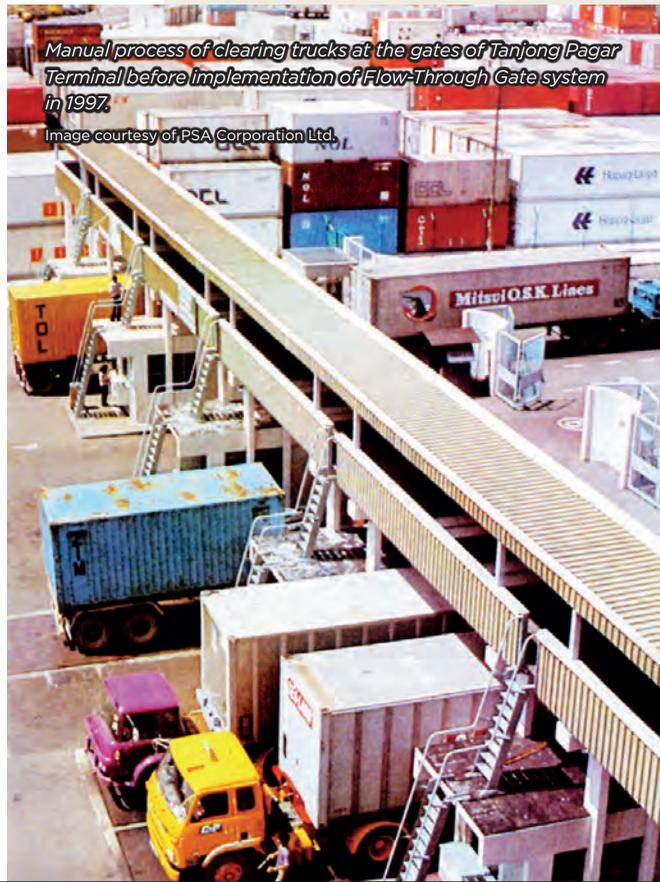
1972

1992

2000

TECHNOLOGY AS A KEY ENABLER IN FACILITATING FREIGHT MOVEMENT

Although effective road planning is important for facilitating freight movement, the fast clearance of container trucks entering or exiting the port area is also essential for ensuring a quick turnaround time in port operations. By the late-1980s, the manual process of clearing trucks at the gates of Tanjong Pagar Terminal had become inadequate to handle the port's high container volume.



During peak periods, it took approximately 3–4 minutes to clear each truck at the two gates of Tanjong Pagar Terminal, Gate 1 (leading to Cantonment Road) and Gate 2 (leading to Telok Blangah Road). Compounding the problem, the waiting space at each gate could hold only five trucks at a time. Long queues of trucks outside the terminal were a common sight and often caused traffic congestions due to the terminal's proximity to the CBD.²¹²

In its search for a solution, PSA tapped on the in-house technological capabilities that it had built up since the 1970s. Adapting existing technologies, PSA developed the Flow-Through Gate and implemented it in 1997, fully automating the clearing of trucks and shortening the gate processing time to just 25 seconds for each truck. As the system required the installation of transponders in the trucks, the port authority worked closely with the Ministry of Trade and Industry to encourage freight forwarding companies to install the devices. To incentivise the companies, PSA installed the first device gratis for each haulier, with damaged ones to be replaced subsequently at the companies' own cost.²¹³

The Flow-Through Gate made use of the Container Number Recognition System (CNRS), which accelerated the process of clearing trucks at the gates by capturing the container number via Closed Circuit Television (CCTV) cameras.²¹⁴ Adapted from a signature-recognition system initially targeted at the banking industry, the CNRS worked by recognising the letter and number sequence on the containers. To develop this system, PSA had partnered with the Institute of Systems Science at the National University of Singapore (NUS).²¹⁵

The Flow-Through Gate system was a win-win solution for both PSA and the truckers, as there were no charges for using the transponder, and the long queues at gates due to slow manual clearance became a thing of the past.

**STAYING AHEAD
OF THE GAME —
STRENGTHENING
CORE OPERATIONS
(1990S — 2000)**

“ The corporatisation of PSA, is more than just a change of name. It is part of a fundamental shift in the way we manage our port, a shift that is necessary in order to ensure that our port remains responsive to the developments of the shipping industry and the demands of the market-place. It comes amidst fundamental changes in the industry as well as some storm clouds or should I say the haze shrouding the economic outlook for the region.”

Mah Bow Tan, former Minister for Communications²¹⁶

URBAN REDEVELOPMENT OF THE GREATER SOUTHERN WATERFRONT

In the earlier years of Singapore's port development after independence, the maritime industry was key to providing employment opportunities. Supporting the growth of the industry led to productivity drives in the form of technological breakthroughs and infrastructural developments to keep ahead of shipping trends such as containerisation and increasingly larger, sophisticated vessels. The effects of containerisation on the city's development from the 1970s to 1990s were wide-ranging, from the expansion of container terminals to the building up of the transport network to support freight movement.

While building port infrastructure to support the country's economic goals, PSA was also mindful of creating a high quality of life in Singapore as part of sustainable port development. Infrastructure such as the World Trade Centre (WTC), completed in 1972, was built with the larger population in mind. In the early years, port infrastructure was developed to support Singapore's regional warehousing and transshipment role. However, PSA's core business of handling cargo at the ports and the increased cargo throughput in the form of containers during the 1970s meant correspondingly less utility of the warehouses at the WTC, which were originally built to store conventional break-bulk cargo and led to the subsequent neglect of land-use for these facilities. At that point in time, PSA was a member of World Trade Centre Organisation (WTCO), an organisation of various ports which fostered commerce in the industry. This led then PSA Chairman Howe Yoon Chong to come up with the idea of converting the disused warehouses into exhibition centres—an idea that was to become a catalyst for the exhibition business in Singapore.²¹⁷ To put the plan into action, PSA collaborated with the Singapore Tourist Promotion Board (STPB), which was looking for suitable venues to cater to the demand

World Trade Centre before the rejuvenation of HarbourFront Precinct in early 2000s.

Image courtesy of PSA Corporation Ltd.



After rejuvenation of HarbourFront Precinct, shopping centre, VivoCity completed in 2006.

Image courtesy of Fai Chong.



for purpose-built convention facilities during the mid-1970s as part of its efforts to establish Singapore as a conventions and exhibitions hub. Together, PSA and STPB converted some unused godowns at the WTC into an exhibition space. The former head of the Singapore Convention Bureau (SCB), Jennie Chua, credited PSA with paying for the conversion upfront, prior to cost recovery from venue rental. This inter-agency cooperation was an innovative approach to solving the space crunch in the exhibitions industry.²¹⁸

At the WTC, PSA also ventured into the international cruise business by building a new cruise terminal in 1991. The Singapore Cruise Centre (SCC) was highly modern for its time. Innovative features included baggage carousels modelled after travellers found in airports, and disembarkation/embarkation gangways fitted with sensors so that they could move according to the changes in tidal heights.²¹⁹ The opening of the cruise centre contributed to a higher quality of life for the community, as it provided leisure-seekers with more options for a quick weekend getaway.²²⁰ Shortly after, the WTC became a concert venue as well with the completion of the Harbour Pavilion in 1992.

Having a seating capacity of 5,000, it was the second-largest indoor performance venue in Singapore.^{221,222} However, then PSA Chairman Lim Kim San was determined to bring PSA back to its main line of business, that is, to manage the ports. In response to the construction of the WTC Auditorium, he had quipped, “Look, what are you doing, are you going to build a theatre, a 5,000-seat theatre in the World Trade Centre? Change.”²²³

Besides the godowns at the WTC, there were other PSA-owned warehouses in the vicinity that also lay fallow. One such site was St James Power Station, a former coal-fired power station located at Keppel Road near the entrance to the island of Sentosa. It was used by the port authority as a commercial warehouse from 1982 to 1992, after which it was largely vacant.²²⁴ Within PSA, there were differing opinions on the future of the building. The operations department suggested for it to be demolished to make way for a container stacking yard. Meanwhile, the commercial department proposed to URA to conserve the building for the local arts industry. The proposal to use the building for the arts did not take off. Eventually, it was converted into a multi-concept entertainment hub and nightclub in the mid-2000s.²²⁵

During the early 1990s, the urban planners at URA worked closely with PSA to optimise land use and to rejuvenate Maritime Square (now known as the HarbourFront Precinct), the mainland belt that overlooked Sentosa and was anchored by the WTC. Khoo Teng Chye, who was Deputy CEO, then CEO, of URA during this period, before he became PSA CEO in 1996, saw an opportunity to redevelop the area through the lens of an urban planner:

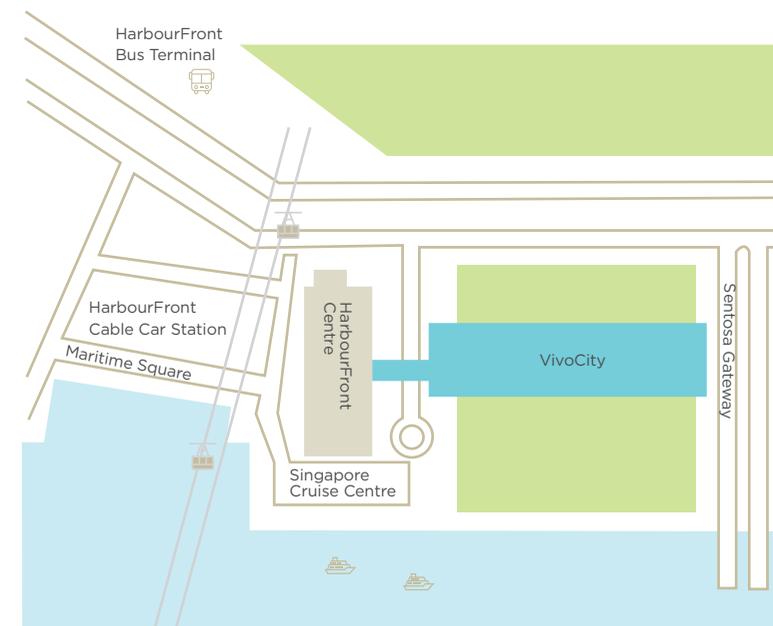
“PSA wasn’t paying a lot of attention to the way they used the land around the WTC, these warehouses that were being used as exhibition halls were not generating a whole lot of revenue, and so one decision was to move it all to Changi (present day Expo). I also pushed PSA to draw out a masterplan for that area around the cable car, what is now VivoCity, as Keppel were downsizing and moving their shipyards offshore at the same time. To me, this is a good example of transit-oriented development.”²²⁶



These efforts were in line with the overall policy of decentralisation proposed in the 1991 Concept Plan, where new commercial areas outside the central region were envisioned to allow increased economic growth without taxing the city's core.²²⁷ At the same time, new road links were constructed to connect the southern waterfront area to the neighbouring islands of Pulau Brani and Sentosa. Completed in 1992, the 380-metre-long Sentosa Causeway across the Selat Sengkir Channel greatly improved public access to the resort island, which had up till then been accessible from the mainland only by ferry or cable car. Alan Choe, who was then Chairman of the Sentosa Development Corporation (SDC), recounted, "The construction of the causeway bridge was the most significant project that impacted the success of Sentosa. It dramatically changed the whole development objectives and character of Sentosa."²²⁸ The link to Pulau Brani was completed earlier, in 1991. Built to support port operations, the 330-metre-long causeway across the Keppel Channel served to ensure the smooth movement of freight to and from the container terminals at Pulau Brani without affecting the traffic going in and out of Sentosa.²²⁹

Apart from the Brani link, there were further efforts to de-conflict passenger and freight vehicles in the area during the late-1990s. These included the upgrading of Telok Blangah Road to construct a 2.4-kilometre viaduct directly above the stretch between Kampong Bahru Road and Henderson Road. The viaduct was completed in 2001. Built alongside the Brani Gate entrance to Tanjong Pagar Terminal, near Kampong Bahru, it served as an important carriageway for container traffic travelling into and out of the port. Vehicles using the viaduct could travel smoothly uninterrupted by traffic lights.²³⁰ The viaduct thus cut the travel time of motorists using it and improved the efficiency of port operations by providing container trucks with more direct and easier access to the port gates and terminals. The viaduct also had special ramp structures to support the container trucks and was linked to Pulau Brani by a separate road along the Sentosa Causeway so that this freight traffic could stay within the free trade zone.²³¹

Exhibit 6: Map of HarbourFront Precinct after urban rejuvenation during the 1990s



HARBOURFRONT AND ALEXANDRA PRECINCTS



MBC and PSA buildings side by side (redevelopment of old port areas).

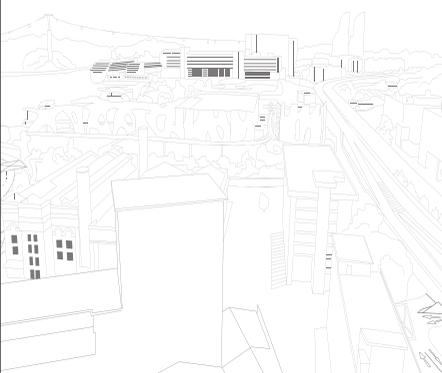
Image courtesy of Choo Yut Shing .

The rejuvenation of old infrastructure built on the 24-hectare HarbourFront Precinct and the 13.5-hectare Alexandra Precinct started back in the 1990s and continues even today. Developments located within these areas included the WTC, St James Power Station and the warehouses at Alexandra Distripark.

In March 1998, URA approved PSA's master plan for redeveloping a 20.3-hectare site in the vicinity of the existing WTC Building. This would create a sprawling waterfront development known as The HarbourFront, which would consist of five areas: a Special Interest Village (at the site occupied by Keppel Automated Warehouse); a retail/entertainment hub to the east of the WTC Building;

HARBOURFRONT AND ALEXANDRA PRECINCTS

Continued...



the existing WTC Building, which would be refurbished; an office park to the west of the WTC Building (near the Cable Car Towers); and a cruise terminal. To kickstart the project, PSA formed a joint venture with Keppel Corporation to develop two office blocks flanking the Cable Car Towers; the twin towers were completed in 2003.²³² Construction of the new shopping mall, VivoCity, commenced the following year.²³³ Earlier, in 2000, Mapletree Investments had been established to hold non-port properties transferred from PSA to Temasek Holdings. These properties included undeveloped land in the HarbourFront area, the WTC Building, St James Power Station, as well as ageing industrial facilities such as Alexandra Distripark and Pasir Panjang Distripark.²³⁴ The properties in the redeveloped precincts were subsequently managed by Mapletree.

The redevelopment of the HarbourFront area into the vibrant hub that it is today would not have been possible without the close working relations between the private and public sectors. As then CEO of Mapletree Investments Khoo Teng Chye recalled, “The HarbourFront redevelopment was because Yeo Ning Hong was chair of PSA, Sim Kee Boon was chair of Keppel, and Lim Chee Onn was running the development company Keppel Land. So we all kind of know each other very well, we can sit down at a table and talk. At the senior level, sometimes

you can see what the value of these things is; you just cut through all the bureaucracy and get things done.”²³⁵

During the HarbourFront redevelopment, ideas to better integrate Sentosa with the mainland were also considered. Philip Ng, who was then Chairman of the SDC Board, requested for fellow board member Khoo Teng Chye to advise on a master plan to rejuvenate the island resort. The plan was eventually drawn up with the following considerations: (a) to design centralised nodes of activities (such as an integrated resort and recreational beaches) to conserve existing nature areas where possible; (b) to incorporate a people-mover system to replace the ageing monorail; and (c) to safeguard the foreshore for public use. To implement these plans, collaboration among the different parties involved was needed to balance the trade-offs in liveability outcomes. In the case of the people-mover system, the developers of the shopping centre, VivoCity, had to be convinced of the merits of giving up shop space and rental income and incurring the higher construction costs arising from accommodating a train station in its design.²³⁶ The new train system, Sentosa Express, was finally opened for operations in 2007, with one station located within VivoCity and the rest of the stations on Sentosa.²³⁷ The decision proved to be a good one, as VivoCity has benefited from a higher volume of shopper traffic while contributing to a better quality of life for the people through improved connectivity to Sentosa for recreational purposes.

Riding on the success of the HarbourFront Precinct rejuvenation, Mapletree made further plans to redevelop the adjacent areas occupied by low-yielding and under-utilised warehouses. In 2008, work began on revitalising the Alexandra Precinct, a 13.5-hectare site in the Alexandra/Telok Blangah business corridor about five minutes’ drive away from the HarbourFront Precinct.²³⁸ This involved converting three blocks of the former Alexandra Distripark into the Mapletree Business City (MBC). MBC was completed in 2010 and formed the new focal point of the Alexandra Precinct.²³⁹

Currently, the PSA Building and the adjoining Alexandra Retail Centre (ARC) as well as The Comtech are being redeveloped into MBC II, which is slated for completion before the end of 2016.^{240,241}

HARNESSING MARKET FORCES

During his term as PSA Chairman, Lim Kim San had pushed for the consolidation of PSA's businesses to focus on the running of the port. After he left the chairmanship in 1994, PSA continued the drive to harness market forces to improve the efficiency of port operations. In 1997, PSA was corporatised. Renamed PSA Corporation Ltd, it became a wholly owned subsidiary of Temasek Holdings.²⁴² This was at a time when ports all over the world were being corporatised or privatised to remain competitive. Following the move, PSA Corporation focused on the business of managing the port while the Maritime and Port Authority (MPA), formed earlier in 1996, oversaw the regulatory functions of the former port authority. As the maritime industry was an important pillar of Singapore's economy, the government was clear about maintaining a level of control and not wholly outsourcing or privatising the business, but it also recognised the need to streamline operations to stay ahead of competition so that the port could remain an economic powerhouse. As explained by then Minister for Communications Mah Bow Tan:

*"The corporatisation of PSA, is more than just a change of name. It is part of a fundamental shift in the way we manage our port, a shift that is necessary in order to ensure that our port remains responsive to the developments of the shipping industry and the demands of the market-place. It comes amidst fundamental changes in the industry as well as some storm clouds or should I say the haze shrouding the economic outlook for the region."*²⁴³

In January 2001, Jurong Port — the first port established during the country's industrialisation drive in the 1960s and the main gateway for Singapore's bulk and conventional cargo — was also corporatised. It was previously a business division of JTC, which itself was corporatised and renamed JTC Corporation a few months earlier. The corporatisation allowed Jurong Port to enhance its competitiveness and build in flexibility to respond more effectively to international competition and serve its customers better. With Jurong Port corporatised, JTC Corporation could also concentrate on its core functions of providing industrial infrastructure and experimenting with different solutions for the knowledge-based economy. With MPA adopting a light regulatory touch, PSA Corporation and Jurong Port Pte Ltd were given more freedom to enter into new business ventures either on their own or through alliances with other operators to provide comprehensive and integrated services to their customers.²⁴⁴

In spite of the corporatisation efforts, some representatives of the international shipping community were vocal about the limited private sector participation in Singapore's port governance (ownership, management and control of operations of a port). Some members of the World Trade Organization (WTO), including the United States, even went as far as to call on Singapore to reduce the role of government-linked corporations within the economy.²⁴⁵ However, this view was refuted by then Prime Minister Goh Chok Tong, who emphasised during his National Day Rally Speech in 2002 that the running of future berths was open to any operator capable of doing the best job:

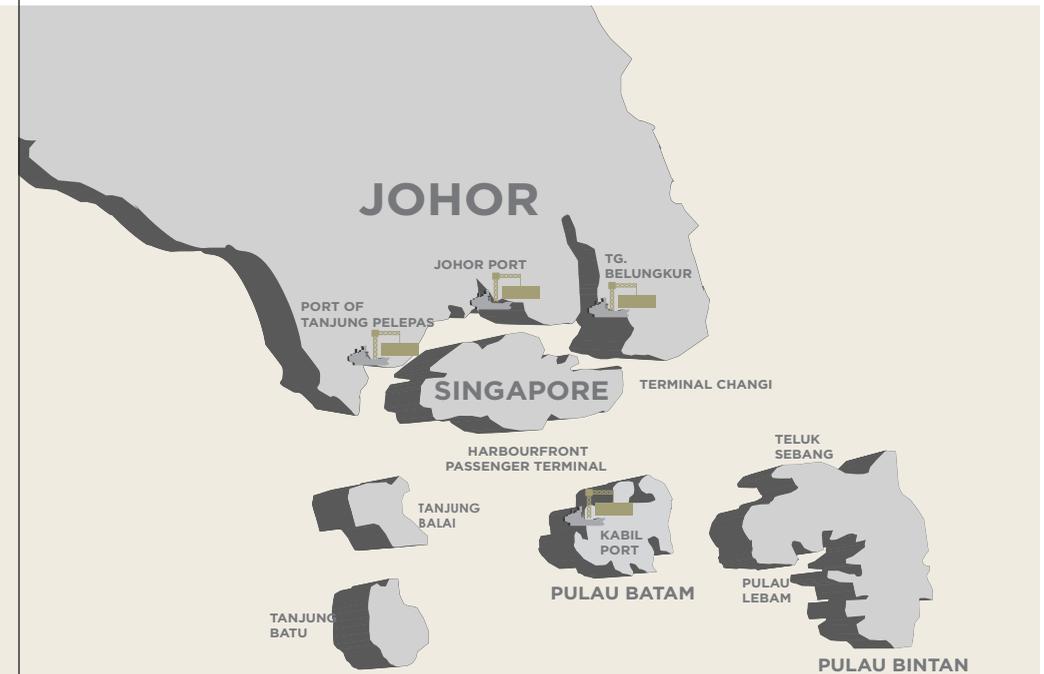
*"The Government has set aside land for 20 additional berths at Pasir Panjang, for whoever can best run the berths, be it PSA, Jurong Port, other port operators or shipping lines. We are open to all options that will enhance the competitiveness of shipping lines hubbing in Singapore."*²⁴⁶

The robustness of the port corporatisation exercise was put to the test in the face of severe competition from regional ports during the 1990s and early 2000s. Up until 1994, the rapid growth in container throughput at the port of Singapore was aided by the adoption of containerisation in the regional economies (Thailand, Malaysia and Indonesia), whose trade fed into Singapore's port. However, after 1994, the establishment of the IMS-GT to promote better trade links in the region inevitably led to greater competition among the ports situated along the sea trade route between Europe and the Far East. In 1994, the Malaysian government, anxious over the diversion of transshipment cargo from Malaysia's west coast ports (Klang, Penang and Johor—which made up about 58% of the country's exports) to Singapore, began developing Port Klang in Selangor as the hub port for Malaysia.²⁴⁷ The opening of the Port of Tanjung Pelepas in south-western Johor in 1999 led to even stiffer competition among the region's ports. Malaysia's port development posed a real threat to Singapore's leading position in the transshipment business as it attracted more carriers, particularly common feeder operators, to call at the ports.²⁴⁸ In response to the regional competition, PSA made significant changes to its traditional policies on container terminal operations in the early 2000s.

REGIONAL COMPETITION TANJONG PELAPAS

For many years, Singapore's port administrators adopted a transparent operating model of having a multiple-user port facility and did not give preferential berthing rights or lease its container terminals to shipping lines. This changed in 1978 when PSA introduced the Appropriated Berth (AB) Scheme at Keppel Harbour, later extending it to Pasir Panjang Wharves in 1981.²⁴⁹ Under the AB Scheme, a shipping line is given priority in berthing its vessels at a designated berth and has exclusive use of the warehouses behind it. In return, the shipping line has to guarantee a minimum cargo throughput and use its own stevedores and equipment. To sustain the competitiveness of the ports, a revision was made to the scheme in 1986, where operators were given a 20% reduction of their annual guaranteed throughput as well as volume discounts on service charges.²⁵⁰

On the port authority's long-standing policy to maintain control of terminal operations in the ports, Tan Puay Hin, former Regional CEO (Southeast Asia) of PSA, explained, "Singapore is a hub. We have a lot of exchange of boxes. If we operate as a dedicated terminal, we cannot optimise the berth capacity for other lines. There are some customers who will think that we should give the surplus berth capacity to them. Sure. When you give the line a dedicated terminal, they will still operate it by



themselves, even if it is empty, just to kill off competition by not letting other lines use."²⁵¹ As Singapore is land-scarce, PSA has to constantly optimise operations and land use, which includes the careful planning of how shipping lines utilise available berths.

During the 1990s, the head of the Batam Industrial Development Authority, B. J. Habibie, set forth a vision to develop Kabil Port in Batam into a large deep-sea port to service fourth-generation container ships to rival Singapore's port.²⁵² Although the plans did not materialise, then PSA CEO David Lim was mindful of the intense regional competition that posed challenges to Singapore's dominance as a regional hub for transshipment. In the 1990s, several ports in the region were looking to expand beyond serving the demand of their respective catchment economies and to gain access to the profitable feeder line networks transporting containers to and from

REGIONAL COMPETITION TANJONG PELAPAS

Continued...

tributary ports. These networks would give the transshipment port good connectivity, which would continue to strengthen through the “ripple effect”. Lim recounted, “I was completely against the idea of sharing with either Batam or Malaysia or Pelepas as we cannot split a regional hub, so when Batam came up I said, ‘no’. So I flew to the States and I spoke to American President Lines (APL)”.²⁵³ The trip allowed PSA to gain a better understanding of the shipping line’s concerns in terms of costs and operational flexibility. This, in turn, helped PSA to make more informed decisions on how to maintain Singapore’s position as a regional transshipment hub.

Against the backdrop of increased regional competition for the transshipment trade, the Virtual Terminal Agreement was signed in 1996 between PSA and The Global Alliance, which consisted of PSA’s oldest customers in the container shipping industry. This long-term contract allowed PSA to retain the management rights of the terminals while its customers could berth on arrival (that is, no waiting time at the anchorages) and still enjoy the advantages of a common-user terminal, such as PSA’s economy of scale and wide common-feeder network.²⁵⁴

Nevertheless, in 2000, Singapore’s largest shipping customer, Maersk-Sealand, shifted its transshipment

operations from Singapore to Tanjung Pelepas in exchange for a 30% stake in the port as well as management rights.²⁵⁵ Apart from the lower costs offered by Tanjung Pelepas, Maersk’s decision was supported by the ability to transport a sufficient volume of cargo into Tanjung Pelepas through its own feeders such as APM Saigon and Anchor Transport; most other carriers relied instead on common feeders.²⁵⁶ Shortly after in 2002, Taiwanese shipping line Evergreen and its subsidiary Uniglory shifted most of their container operations, estimated at 1-1.2 million TEUs of annual throughput, to Tanjung Pelepas as well.^{257,258}

Following the withdrawal of the two shipping lines, the Singapore government realised that it had to devise new strategies to retain and win back major customers, in addition to ensuring adequate capacity to accommodate increasing transshipment traffic in an environment with limited land and sea space. As a result, PSA moved away from its traditional policy of maintaining common-user terminals to one that gave shipping lines a joint-venture stake in PSA’s terminal facilities in return for assured capacity in the berths they invested in.²⁵⁹

In December 2003, then Minister for Transport Yeo Cheow Tong officiated the opening of PSA’s first joint-venture terminal, a two-berth facility at Pasir Panjang Terminal jointly operated with COSCO, the Chinese government-controlled container shipping line.²⁶⁰ In February 2008, Pacific International Lines (PIL) became the first homegrown shipping company to enter into a joint venture with PSA to run a dedicated container terminal. PIL Managing Director Teo Siong Seng explained, “Not only do we commit our vessels to come alongside the wharf, but we also operate the warehouse facilities behind.” Consisting of three berths at Keppel Terminal, PIL Managing Director S.S. Teo explained that the venture demonstrated the strong working relationship between PSA and the private sector at all levels.^{261,262}

Despite the challenge posed by regional competition, Singapore has managed to maintain its position as the premier transshipment hub in Southeast Asia. Although Singapore’s high connectivity to other ports is a key reason why many shipping lines have continued to choose the country as a base for their operations, our ability to adapt and respond swiftly to changes in the external environment has also been a key factor in our port’s success.

Following corporatisation, PSA began to actively acquire stakes in ports overseas in its drive to become a global terminal operator. With a growing global portfolio, PSA was restructured in 2003, creating PSA International Pte Ltd as the main holding company for the PSA Group.²⁶³ As part of the restructuring, PSA further divested its non-core businesses, including the Singapore Cruise Centre, which was subsequently managed by Singapore Cruise Centre Pte Ltd, an independent company under Temasek Holdings.²⁶⁴ PSA International has since continued to expand globally through partnerships and operating agreements to diversify the Group's investments and strengthen its relationship with key shipping lines. This has allowed PSA to expand its international presence, which has in turn helped to bring more trade to our shores.

CHAPTER 5

PRESENT AND FUTURE CHALLENGES OF THE PORT INDUSTRY (2000S – PRESENT)

“As one of the world’s busiest ports, I see it as critical that MPA works closely with our partners and the maritime industry to ensure that Singapore stays relevant amidst the changing global trading and logistics network.”

Andrew Tan, MPA Chief Executive²⁶⁵

RISING ABOVE PHYSICAL CONSTRAINTS — CONSOLIDATION OF CONTAINER TERMINALS

By the year 2000, the amount of container trade handled by PSA’s terminals reached 17.1 TEUs. In 2004, the gross tonnage of vessels arriving at the port exceeded one billion gross tons for the first time in our maritime history.²⁶⁶ During the same year, the government decided to expand the container facilities at Pasir Panjang to raise Singapore’s total cargo capacity to 50 million TEUs. Extensive land reclamation works were then carried out, costing the government almost \$2 billion. Finally, in June 2015, the new berths at Pasir Panjang Terminal Phases 3 and 4 were opened.²⁶⁷ Even as the Pasir Panjang port expansion was underway, long-term plans were being made on where to relocate the container port once the port leases of the city terminals at Tanjong Pagar, Keppel and Pulau Brani expire in 2027.

As early as 1991, then Minister for Communications Dr Yeo Ning Hong had mentioned the possibility of redeveloping the land occupied by the city terminals upon the expiry of their leases: “If new expert systems and other advances in automation and computer technology permit us to increase the productivity of the port significantly in the early 21st century, one exciting possibility could be the option of returning the land occupied by the existing port at Tanjong Pagar for

future development as an extension of the existing financial district of Robinson Road and Shenton Way. Another option could be the conversion of Pulau Brani into a resort island for Singaporeans and tourists alike to complement Sentosa and the other Southern Islands.”²⁶⁸

In 2008, Singapore was badly affected by the global financial crisis and fell into a recession, its worst since independence. Amid the challenges of the recession, Prime Minister Lee Hsien Loong formed the Economic Strategies Committee (ESC) in May 2009 to develop strategies for maximising opportunities to achieve sustainable and inclusive growth.²⁶⁹ In its report submitted in January 2010, the committee suggested long-term measures such as enhancing land productivity to secure future growth. Its recommendations included formulating a master plan for the progressive development of a new waterfront city at Tanjong Pagar, and studying the feasibility of a consolidated port at Tuas to free up existing port land to support new economic activities in the future.²⁷⁰ In 2015, the Prime Minister conceded that Tuas had previously been considered as a site for building a port:

“We looked at Tuas before, we were not ready. Since then we have made more reclamation in Tuas and we have looked at it again and this time we think we can do a really first class port from scratch in Tuas.”²⁷¹

Based on the ESC’s recommendations, the 2011 Concept Plan proposed the development of a new Greater Southern Waterfront that would include the areas currently occupied by port infrastructure. The planned relocation of the city terminals (Tanjong Pagar, Keppel and Brani) and Pasir Panjang Terminal to Tuas is expected to free up 325 and 600 hectares of waterfront land, respectively. With such a vast land area, the Greater Southern Waterfront could be developed into a new waterfront city that offers a wide array of housing and lifestyle options while serving as an extension of the existing business district.²⁷²

TUAS MEGA PORT

In 2012, then Minister for Transport Lui Tuck Yew confirmed that the government would be building a mega port at Tuas to consolidate all the existing container terminals into one location. This would enhance transshipment operations by removing the need to move containers between different terminals by trucks and reducing the turnaround time and business costs in port operations. Congestion on the roads caused by inter-terminal haulage would also be eliminated. When ready, the mega port will be equipped to handle up to 65 million TEUs per annum, which is nearly double the existing capacity of Singapore's port.²⁷³

As with the development of Pasir Panjang Terminal, the development of Tuas Mega Port will take place in four phases to pace it with the growth of the maritime industry. Phase 1 of the development commenced in 2015 and is expected to be completed in 2021. The contract, which included reclamation, dredging and wharf construction works, was awarded to Dredging International Asia Pacific Joint Venture (DDJV), a consortium of Korean and Belgian developers.²⁷⁴ As part of the project, the navigation channels off Tuas will

be deepened to accommodate larger vessels, resolving a constraint that the port authority had brought up back in the early 1990s during the debate over whether to site the future port at Pasir Panjang or Tuas.²⁷⁵

As a greenfield site, Tuas offers a blank slate to test innovative technologies such as automated container port systems, optimisation techniques and technologies, and green port technologies.²⁷⁶ These technologies are already being developed under the Port Technology Research and Development Programme (PTRDP), which was launched by MPA and PSA in April 2011 as part of the nation-wide efforts to upgrade productivity in key industries through the use of technology. MPA had earmarked \$10 million from the Maritime Innovation and Technology Fund (MINT Fund) to finance the programme over five years. PSA, together with local institutes of higher learning and other industry partners, had also committed to provide co-funding and in-kind resources of up to \$10 million over the same period.²⁷⁷ Phase 1 of the PTRDP has seen the development of automated guided vehicles (AGVs) that, if fully implemented at Tuas, will solve the shortage of drivers to carry containers through busy terminals. Andrew Tan, MPA CE, has reiterated the importance of automation in future port operations:

"This will enhance productivity and operational efficiency. We're also looking at the development of the software necessary to integrate these AGVs to our terminals. It's conceivable that in the not-too-distant future, we will see our terminal operations as automated as possible."²⁷⁸

Beyond technology and innovation, the government is also looking at ways to involve the community in generating ideas on how to increase the efficiency of the port and enhance our competitive edge. The Next Generation Container Port Challenge held in 2013 by MPA and the Singapore Maritime Institute invited ideas to build a hypothetical terminal on a 1-kilometre by 2.5-kilometre plot of land.²⁷⁹ The winning team led by NUS proposed a double-storey stacking yard to address Singapore's land scarcity and reduce the time spent transporting containers over a sprawling yard space. The design would also reduce the time wasted on reshuffling containers stacked in the wrong order.²⁸⁰

Looking to the future, the development of Tuas Mega Port needs to be considered consciously as part of the city's development as the future port will be situated at the far western end of Singapore, away from existing residential and commercial areas. Furthermore, the new site has a higher land take than all the city container terminals combined. Prime Minister Lee Hsien Loong has indicated that the development could be not only well integrated with its surroundings but also accessible to the public, unlike the traditional model of making ports completely out of bounds to the public.²⁸¹



Artist impression of future Tuas port.

Image courtesy of Maritime Port Authority of Singapore.

BEYOND ECONOMICS — GREEN PORT DEVELOPMENT

From its beginnings along the Singapore River up until the present day, the port has remained a key pillar of Singapore's economy. As the country takes on increasingly complex planning parameters in a land-scarce environment, port development policies are expected to continue building on current best practices and contributing to other aspects of Singapore's liveability, such as on the environmental and social fronts.

During the reclamation works for Tuas Terminal Phase 1, over 60% of the total land fill (60 million cubic metres) was sourced from recycled dredged and excavated materials. Inter-agency collaboration between LTA and MPA had led to LTA disposing of its excavated materials from underground construction projects at an earmarked reclamation site for port development. Through this innovative solution, LTA saved \$32 million as it could dispose of the excavated materials immediately instead of stockpiling and re-handling the materials and dumping them offshore later. At the same time, MPA avoided having to import sand to supplement dredged materials and saved the government \$90 million in land reclamation costs for the Tuas project.²⁸²

In line with efforts to build a sustainable future for Singapore, MPA carried out an Environmental Impact Assessment (EIA) for the proposed Tuas Mega Port in 2012 and found that the development near the shoal would have an adverse impact on the nearby coral colonies.²⁸³ To save these corals, MPA worked with the National Parks Board on a coral relocation programme, and successfully relocated some 1,600 coral colonies to the Southern Islands in 2014 with the help of nature volunteers and the private sector. Some of these corals can be viewed underwater at Sisters' Island Marine Park, where dive trails have been open to the public since November 2015.²⁸⁴ MPA also worked with academics at NUS on a programme called "Enhancing Singapore's Coral Reef Ecosystem in a Green Port", which assessed the survivability, adaptability and evolution of the remaining corals off Tuas.^{285,286} To increase public awareness of MPA's coral conservation efforts, the public was invited to take part in a T-shirt design competition in 2015.²⁸⁷ As part of best practices in Singapore's urban planning process, all development proposals today are comprehensively assessed by various agencies, and EIAs are required for major development projects occurring in close proximity to sensitive ecological areas inland and around the coast such as Nature Reserves and nature areas.²⁸⁸

The environmentally sustainable development of Tuas Mega Port is in line with the shift away from the traditional model of port development. Prior to the construction of Pasir Panjang Terminal in the 1990s, reclamation works did not account for environmental impacts. However, MPA has been proactive in its conservation efforts in recent years as part of sustainable coastal zone development, which champions the natural environment while providing for economic growth and other community needs. As with land-use issues shoreward side, sustainable port development will require working with various stakeholders involved in activities in the waters off Singapore, such as shipping, water sports and recreation, and marine biodiversity conservation. Moving forward, the development of port infrastructure could entail spatial planning of the seas to provide a strategic framework to reduce spatial conflicts amongst stakeholders.



Group photo with diver volunteers from the MPA TMSI Volunteer Programme.
Photo courtesy of Maritime Port Authority of Singapore

THE FUTURE OF SINGAPORE AS A PORT CITY

Singapore's port has done well over the years to remain as the world's leading hub for container transshipment and bunkering services. However, maintaining this position is not without difficulty, as the industry is heavily influenced by external developments and continues to face cost pressures and increased competition. Potential challenges include the possible opening of alternative shipping routes that could threaten Singapore's standing as an important port-of-call along the Far East-Europe route. One such route is the Kra Canal, which has been

proposed as part of China's Maritime Silk Route expansion plans. As the canal would cut through the Kra Isthmus and connect the Gulf of Thailand with the Andaman Sea, it would create a shorter route that would result in time and cost savings for China when importing oil from Africa and the Middle East, and improve China's access to export markets.²⁸⁹ In addition, the opening of the Arctic Pathway, brought about by global climate change, could reduce shipping distances between Asia, North America and Europe by thousands of miles.²⁹⁰

However, rather than simply viewing these new routes as threats to Singapore's maritime position, the government has embraced them as opportunities for the country. Just as it had studied worldwide trends before establishing Southeast Asia's first container port in 1972, the government continues to be proactive by taking part in international forums that address global governance issues so as to better prepare the maritime industry for future challenges. In 2011, Singapore applied for observer status in the Arctic Council, the inter-governmental forum set up in 1989 by countries with territorial rights in the Arctic to address issues such as sustainable development and environmental protection.²⁹¹ Other than gaining access to discussions on the future development of the Arctic region, the government hoped to find a market for Singapore's cutting-edge maritime technologies in the form of drilling platforms to tap the region's natural resources.²⁹² In 2013, Singapore was accepted into the Arctic Council as an observer. In the case of the Kra Canal, Prime Minister Lee Hsien Loong has welcomed the chance to deepen multilateral ties with China and other countries in the region through increased trade and investment, with Singapore providing part of the services through the country's vast seaport and airport network.²⁹³

Singapore's global connectivity is a key factor that will ensure our port remains relevant amidst increased competition and other external developments. Currently, our port is connected by approximately 200 shipping lines to more than 600 ports in over 120 countries, and has unparalleled access to markets through 50 Double Taxation Agreements, 7 Free Trade Agreements and 6 Bilateral Agreements that serve to enhance trade and investment as well as minimise the turnover time of containers transferring to feeder vessels. Another critical success factor is our continued investment in excellent port infrastructure.²⁹⁴ As the container shipping environment continues to evolve, new challenges to our port infrastructure are constantly emerging. In recent years, the industry has seen an unprecedented increase in the number and size of vessels ordered, as shipping lines

pursue the lowest slot cost to improve business sustainability. As the global fleet expands, shipping lines will place increasing demands and expectations on container ports. Terminals will need to have berths with deeper drafts and wider turning basins for manoeuvring, in order to serve their customers well.²⁹⁵ As more Ultra Large Container Carriers (with a cargo capacity exceeding 14,501 TEUs) are phased in, the trend towards larger vessels will be cascaded downstream across all trade lanes.²⁹⁶ This will in turn place more demands on terminal facilities, and only ports that can keep up with the customers' requirements through timely and appropriate infrastructure investments will be able to remain relevant.²⁹⁷

Besides mega vessels, mergers and alliances will also have an impact on port planning. Partnerships among shipping lines can take the form of either strategic alliances, which allow shipping lines to share risks and enhance their vessel utilisation on a global scale across multiple trade lanes, or loose agreements such as slot exchanges. Currently, four strategic global alliances command more than 90% of the global shipping capacity, and further consolidation is expected in the near future.²⁹⁸ With shipping lines pooling their cargo through mergers and alliances, terminal operations will become more complex, as there will be a need for greater coordination in the exchange of containers between vessels within an alliance.²⁹⁹ Another implication is that ports will face increased pressure to expand, and raise berth and equipment productivity through technological improvements.³⁰⁰

In Shanghai, where the lack of deep-water access posed a limitation to further port expansion on the mainland, the Yangshan offshore port was built in 2004 to serve as the core hub for international container handling and transshipment. The port's container throughput grew rapidly over the next few years. By 2008, Yangshan Port handled 8.23 million TEUs, of which 48% was transhipped to other mainland Chinese ports and another 8-9% was transhipped internationally, with the rest sent for domestic consumption through trucks over the Donghai Bridge.³⁰¹ Singapore has not had to go down the path of developing an offshore port due to judicial land-use planning on the mainland and effective governance. Nevertheless, there are numerous challenges to continued port expansion shoreward side, such as the ecological impact of dredging and limits to reclamation in terms of international sea boundaries. Given that container ports are less labour-intensive than break-bulk ports, proximity to a large workforce is not essential, thus making an offshore location a possibility to consider in future.

Beyond global trends, the maritime industry also needs to deal with local issues such as developing a strong, quality workforce that can seize opportunities in the industry. Hence, apart from developing key infrastructure, the government has taken steps to boost maritime research and development (R&D) capabilities and grow a core group of local maritime talent. In 2010, Deputy Prime Minister Teo Chee Hean announced the establishment of the Singapore Maritime Institute (SMI) to drive R&D activities and develop local talent. SMI would receive funding of up to \$200 million from MPA over the next 10 years, with further funding coming from the Agency for Science, Technology and Research (A*STAR) and EDB. SMI works with the industry, academic institutions and other key stakeholders to define and drive R&D in key areas such as green shipping, maritime logistics and operations, as well as marine and offshore engineering.³⁰²

In addition, as Singapore developed its competitiveness as a global hub port, the government saw the need to enhance the country's capabilities in other segments of the maritime value chain, so as to maintain its continued relevance and attractiveness as a port city. This led to the adoption of the "London-plus" development framework put forth by the Economic Review Committee in 2002.³⁰³ Learning from how London grew its maritime services, Singapore aims to sustain and leverage on its strength in port facilities, ship registry, ship repairs and logistics while positioning itself as a leading international maritime centre (IMC) by developing vibrant and influential shipping and maritime services clusters.³⁰⁴ Taken in totality, the "London-plus" strategy will create good employment for the local maritime workforce. As Tan Beng Tee, MPA's Assistant Chief Executive (Development), explained:

"Developing Singapore as a premier global hub port and a leading international maritime centre enhances our overall value proportion through providing comprehensive solutions to meet the diverse needs of global businesses today. It also helps Singapore differentiate itself from other alternative locations and allow us to become a key node in the global maritime landscape."³⁰⁵

Key to this strategy is the creation of a pro-business environment that will meet the needs of the shipping community. Towards this end, the

government has created the Maritime Sector Incentive (MSI) scheme, which offers concessionary income tax rates to attract international shipping and maritime service providers to set up operations in Singapore.

Through concerted efforts under the "London-plus" framework, Singapore is gradually being recognised as one of the leading IMCs in Asia. Today, there is a healthy maritime ecosystem in Singapore. Shipping lines calling at Singapore not only get access to world-class port services and a wide port network, but they are also able to conduct business and exchange ideas with over 130 international shipping groups and a large cluster of maritime services providers that have chosen Singapore as their base of operation. This has helped Singapore maintain its status as the world's busiest transshipment hub and largest bunkering port, a quality ship registry and an attractive base for shipping businesses.

To create an identity for "Maritime Singapore" (a collective term referring to Singapore's maritime industry) and to position Singapore as a thought leader and a place of opportunities, MPA launched the Singapore Maritime Week in 2006. Held annually, the event brings together key players in the maritime industry to discuss current developments and issues such as shipping, port, bunkering as well as maritime policy and business services.³⁰⁶ While many of the discussions are targeted at industry professionals, certain activities are also open to public participation, such as the Maritime Heritage Exhibition, Learning Journeys and Maritime Trails, so as to give Singaporeans a sense of ownership in our rich maritime history.³⁰⁷

Looking ahead, the development of Singapore's shipping and maritime services clusters appears promising. Our investments in the development and management of the port over the years, coupled with our efforts to develop Singapore as an IMC, has created a community of maritime companies providing various services along the regional value chain from their base in Singapore. These include not only Singapore-owned companies such as Keppel, PSA Corp, Jurong Port and PIL but also international maritime companies such as Maersk.

PORT AND THE CITY: BALANCING GROWTH AND LIVEABILITY

1819

▶ Stamford Raffles set up a trading post in Singapore.

1823

▶ Port of Singapore declared a free port.

1859

▶ First dry dock opened.

1864

▶ Formation of Tanjong Pagar Dock Company.

1890

▶ Formation of Straits Steamship Company (predecessor of Keppel Corporation).

1905

▶ Tanjong Pagar Dock Company bought by government to form the Tanjong Pagar Dock Board (a port trust).

1912

▶ Formation of Singapore Harbour Board to take over Tanjong Pagar Dock Board operations.

1959

▶ Pioneer Industries Ordinance established to boost industrialisation.

1963

▶ Establishment of Port of Singapore Authority (PSA) to take over the functions, assets and liabilities of the Singapore Harbour Board.

1964

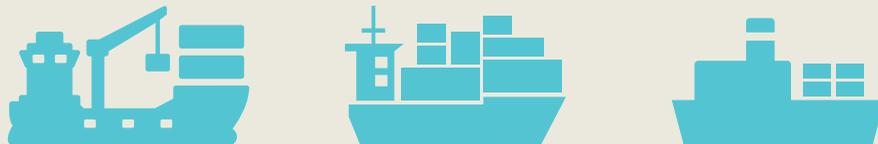
▶ Formation of PSA which replaced the Singapore Harbour Board.

1965

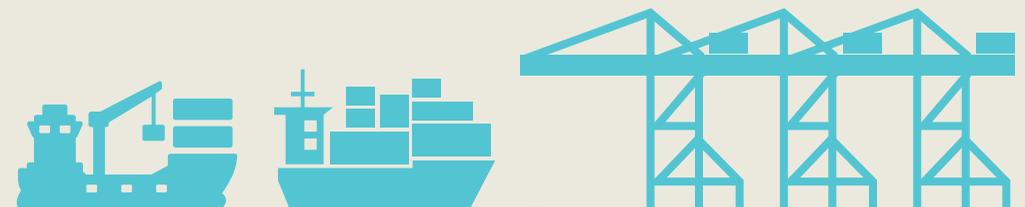
▶ Jurong Port was opened.

1966

▶ PSA built its first deep-water berths at Tanjong Pagar Wharves.



Before 1960



1960

1967

- ▶ PSA formed a data processing department to computerise operations.

1968

- ▶ Formation of national shipping line (Neptune Orient Lines, NOL) and Keppel Corporation to run shipyards.

1969

- ▶ Free trade zones (FTZ) were first established in Singapore to preserve entrepot trade by keeping prices competitive.

1972

- ▶ PSA set up the World Trade Centre (WTC).
- ▶ Opening of first container port, Tanjong Pagar Terminal (TPT).
- ▶ The MV Nihon was the first container ship to call at TPT.

1976

- ▶ Development of Tanjong Pagar as new centre for regional trade. First 30-tonne container yard crane begins operating at TPT.

1977

- ▶ Singapore River clean-up.
- ▶ Completion of first phase of Pasir Panjang Wharves.

1978

- ▶ Appropriated Berth Scheme introduced at Keppel Harbour to allow shipping lines designated berths.

1982

- ▶ Singapore overtook Rotterdam as the world's busiest port.
- ▶ PSA invested \$216 million to convert conventional berths at Keppel to container berths.
- ▶ The Urban Redevelopment Authority (URA) initiated the conservation of shophouses and godowns along Boat Quay and Clarke Quay.

1984

- ▶ Implementation of BOXNET to link port users online to the port computer systems, which was subsequently upgraded to the PORTNET system in 1989.

1989

- ▶ TRADENET implemented to handle trade declaration documents.
- ▶ Computer Integrated Terminal Operations System (CITOS) was implemented to plan and direct all container handling operations.
- ▶ Singapore Distribelt concept mooted to facilitate transhipment.

1991

- ▶ PSA opened the Singapore Cruise Centre and commissioned the \$1.14 billion Brani Container Terminal.
- ▶ Completion of Keppel-Brani Causeway to facilitate freight movement within the free trade zone.

1996

- ▶ Maritime Port Authority formed to oversee port regulations.

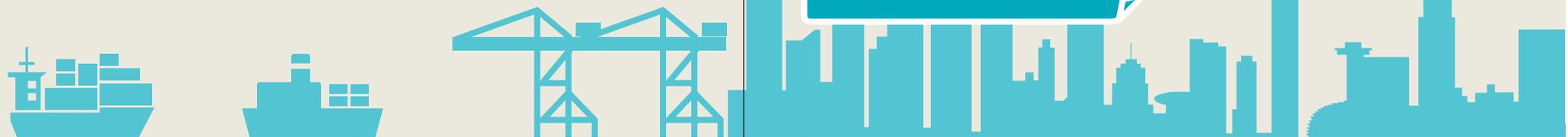
1997

- ▶ The Port of Singapore Authority was corporatized and succeeded by PSA Corporation Ltd on 1 October.
- ▶ Pasir Panjang Terminals Phase 1 completed.

1970

1980

1990



1998

- ▶ URA approved PSA's master plan for redeveloping areas of disused warehouses, the former WTC Building and surrounding areas.

1999

- ▶ 'Flow-Through' container gate system reduced processing time of container trucks from 5 mins (1988) to 25s.

2000

- ▶ Remote Crane Operations and Control system introduced to make crane operators more efficient.
- ▶ Mapletree Investments established to hold and manage non-port properties transferred from PSA to Temasek Holdings.

2003

- ▶ Opening of the first joint-venture terminal with COSCO.

2004

- ▶ PSA gross tonnage exceeded one billion gross tons.

2005

- ▶ Pasir Panjang Terminals Phases 2 completed.

2006

- ▶ MPA created the Singapore Maritime Week.

2012

- ▶ Plans to build a mega port at Tuas to consolidate all the existing container terminals into one location were announced by then Minister of Transport, Lui Tuck Yew.

2014

- ▶ MPA worked with NParks to carry out coral relocation programme for corals situated off proposed port development at Tuas to the Sisters' Island Marine Park.

2015

- ▶ Launch of Phases 3 and 4 of Pasir Panjang Terminal.

2000



CONCLUSION

Singapore has come a long way to transform itself from a small fishing village into today's global hub port and premier IMC during the course of its urban development journey. The systems put in place have allowed the maritime industry to overcome hurdles such as the global financial crisis and strong competition from regional ports. The timely development of port infrastructure and transportation networks to support the industry, spurred on by containerisation, was a key contributing factor. In addition, the devolution of regulatory functions and service provision over time was vital in providing the business autonomy needed for nimble port operations, which allowed inroads into internationalisation. Further contributing to Singapore's growth as an IMC was the creation of a supporting ecosystem of companies and services in the maritime industry, which helped to add value to traditional maritime sectors.

Nevertheless, Singapore faces a plethora of challenges in its quest to become a global port city. The business of transshipment is very much influenced by external economic trends, which will require the constant improvement and expansion of our port infrastructure. At the same time, there is a need to plan and develop the liveability aspects of the future port. Ensuring the sustainability of our maritime industry is thus a formidable task that will require the efforts of both the public and private sectors. As MPA CE Andrew Tan opined, "As one of the world's busiest ports, I see it as critical that MPA works closely with our partners and the maritime industry to ensure that Singapore stays relevant amidst the changing global trading and logistics network."³⁰⁸

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APPENDIX A

Governance Tools of Singapore's Port Infrastructure Development

(I) Legal Instruments

Tool	Description
Foreshores Act (1872) Section 4	Gives the authority for Government to construct works and to reclaim foreshore or sea-bed for construction of quays, wharves jetties or other public works along or out from the foreshore of the Singapore or in the adjacent sea-bed.
Land Acquisition Act (1967)	Paved the way for acquiring coastal land and initiating reclamation works on a large scale for infrastructural development.
Landing Goods Act (1968)	Passed to reduce traffic on the Singapore River, with the intent of phasing out the lighterage industry.
Free Trade Zones Act (1966)	Allows declaration of Free Trade Zones (FTZs) in certain areas of Singapore, which are primarily used for the temporary storage of goods and to facilitate entrepôt trade, as duties and Goods and Services Tax (GST) on cargo within these zones are suspended. A Free Trade Zone Advisory Committee is also appointed, which also led to the Distribelt Concept, where Singapore is positioned as a warehousing and distribution centre.

(II) Executive Policies

Policy	Result
Virtual Terminal Agreement (1996)	Signed between PSA and The Global Alliance, which consisted of PSA's oldest customers in the container shipping industry. This long-term contract allowed PSA to retain the management rights of the terminals while its customers could berth on arrival (that is, no waiting time at the anchorages) and still enjoy the advantages of a common-user terminal, such as PSA's economy of scale and wide common-feeder network.
PSA Master Plan for HarbourFront Redevelopment (1998)	Plan to redevelop a 20.3-hectare site in the vicinity of the existing World Trade Centre Building to create a sprawling waterfront development known as The HarbourFront. To kick-start the project, PSA formed a joint venture with Keppel Corporation to develop two office blocks flanking the Cable Car Towers.
Economic Review Committee Recommendations (2002)	Following the review, the "London-plus" development framework recommended learning from how London grew its maritime services, whereby Singapore aims to sustain and leverage on its strength in port facilities, ship registry, ship repairs and logistics while positioning itself as a leading international maritime centre (IMC) by developing vibrant and influential shipping and maritime services clusters.

(III) Institutions

Institution	Role in Port and the City Development
Jurong Town Corporation (JTC)	Took over management of Singapore's first port, Jurong Port from EDB and PSA in 1968.
International Enterprise Singapore (IES)	Started out as the Trade Development Board (TDB) which implemented a government EDI system called TRADENET in 1989 to enable trading papers to be processed and approved rapidly by the relevant government agencies.
PSA Corporation Ltd	Former port authority, Port of Singapore Authority (PSA) was corporatized in 1997, Renamed PSA Corporation Ltd, it became a wholly owned subsidiary of Temasek Holdings to focus on the business of managing the port.
Maritime Port Authority (MPA)	Formed in 1996 to oversee the regulatory functions of the former port authority, Port of Singapore Authority (PSA).
Mapletree Investments	Established in 2000 to hold non-port properties transferred from PSA to Temasek Holdings.
Sentosa Development Corporation (SDC)	Formed on 1 September 1972 to oversee the development, management and promotion of the island resort Sentosa. SDC worked with URA on a master plan to rejuvenate the island resort, including a people-mover system to replace the ageing monorail to connect VivoCity and Sentosa.



PORT AND THE CITY: BALANCING GROWTH AND LIVEABILITY

Singapore's port is one of the busiest in the world, and its maritime industry makes up some 7% of Gross Domestic Product. How has the city-state maintained the primacy of its port in the face of regional competition, unlike many other global cities?

The natural advantages of Singapore's port — a deep water harbour and a strategic location along major shipping routes — helped it become a major transshipment hub. More importantly, Singapore took efforts to provide excellent infrastructure and efficient maritime services, made possible by a high-quality workforce — from top executive talents to workers who handle cargo.

However, squeezing in the substantial land needed for a world class port is a big challenge given Singapore's high urban density. Some 3% of the land is zoned for ports and airports, and this is projected to double by 2030. *'Port and the City: Balancing Growth and Liveability'* traces how dynamic governance and integrated planning helped Singapore to manage difficult trade-offs and ultimately balance port growth with urban liveability.

"Singapore's favourable geographical location has been instrumental in the contribution to the success of the country. As the world's island city-state with land scarcity and no natural resources, our port has been the key contributor for the country's economic sustainability. 'Port and the City: Balancing Growth and Liveability' lend us a microscopic insight into Singapore port's evolution since 1819, enriched with strategic and dynamic urban strategies over the years."

Mr S. S. Teo, Managing Director, Pacific International Lines

