srm

Analysis of Maritime Clusters

Focus on Singapore

maritime economy

2018

"Analysis of Maritime Clusters. A Focus on Singapore"
is a study carried out by SRM within a broader research project named
"Permanent observatory on Maritime Transport and Logistics"
that also led to the creation of a specialized portal www.srm-maritimeconomy.com

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CONTENTS

EXECUTIVE SUMMARY

The main data of Singapore:

Strategic position

- Between 25% and 30% of the world's seaborne oil trade passes through the Malacca strait mainly from Gulf suppliers to Asian markets and an estimated 16 million barrels per day were transported through the strait in 2016, a figure that represents the fourth increase in the past five years.
- 400 routes pass through Singapore connecting 600 ports and 120 countries worldwide.
- The state is home to more than 5,000 maritime establishments and businesses and over 130 of the world's top shipping groups, with 170,000 people employed in the sector.
- The strategic blueprint of the Government aims to create over 5,000 new jobs in the maritime sector and increase its "value-add" by $ 3.50 bn by 2025.
- 33% of all outward investments linked to the Belt and Road Initiative (BRI) flows through Singapore, while 85% of all inbound investment for the initiative makes its way into China through Singapore.
- The direct contribution of the maritime industry to the GDP of the country accounts for 7%.

Competitiveness

- Singapore is the 1st Maritime city in the World (Menon Report 2017).
- It holds the 2nd position in the global ranking of the Liner Shipping Connectivity Index.
- It ranks 9th in the global compound of the Logistics Performance Index.

Shipping

- Singapore is the 1st transshipment hub in the world: transshipment volumes account for around 85% of all containers handled, equal to one-seventh of the world's transshipment containers and 5% of global container throughput.
- As of June 2018, it is the 2nd container port in the World after Shanghai with 18.02 million TEUs handled; an increase of 11.6% on June 2017.

- It is the 3rd global port by cargo throughput with 626 million tons in 2017.
- The flagship terminal of PSA International is 5th in the world with 74.2 million TEUs handled.
- Singapore is also one of the top refrigerator ports in the world: it has more than 9,000 reefer points and handled almost 1.8 million TEUs of reefers.
- When fully operational, the new mega port of Tuas will have the potentiality to handle 65 million containers a year, therefore offering twice as much the capacity as today (33 million TEU).

Energy, Oil & Gas

- The Strait of Malacca is the primary chokepoint in Asia.
- Singapore is the 1st bunkering (ship refueling) port in the world with 50.6 million tonnes of bunkers annually, generating $ 18.2 billion of sales. A closer look at data from January to August reveals that Singapore bunker sales have already reached 33.4 million tonnes.
- Singapore is one of the 3 largest importers of Suez southbound oil flows: it accounts for 31% of Suez Canal southbound oil flows and with China and India accounts for more than 58% of the total.
- 1/5 of all vessels in the port are bunkering ships.
- The overall value of bunkering accounts for 6% of GDP thanks to ships that pass through Singapore and refuel.

Technology & Finance

- The Country is 2nd in the world for Maritime Technology and the 4th global financial hub (Menon Report 2017).

Relationship between Italy and Singapore

- There are 200 Italian companies in Singapore and over than 4,000 Italian citizens.
- 27% of all Italian exports to South East Asia (Brunei, Cambodia, Indonesia, Laos, Malaysia, Burma, Philippines, Singapore, Thailand, Timor Leste, Vietnam) went to Singapore in 2017, which amounted to € 2.2 billion. 54% of this traffic in 2017 was seaborne.
- There is a strong relationship between Italy and Singapore also in the maritime sector: the bilateral relationship – measured through UNCTAD's LSBCI (Liner Shipping Bilateral Connectivity Index) – has shown an upward trend in recent years. This index reached a peak in 2015 when it was 0.72 (maximum value=1), while it showed a slight fall in 2016 (0.66).
- Through PSA International, Singapore has invested in two Italian terminals: PSA Voltri-Pra and PSA Venice.

Foreword

This paper begins by offering an overview of the role of Singapore inside the Strait of Malacca for the development of maritime traffic of goods in the Far East.
Secondly, the study shows the competitiveness of Singapore in comparison with other maritime countries.
In addition, it provides an overview of the port of Singapore focusing on the governance structure of cluster within which it operates. An analysis is undertaken of the main sources of cargoes that pass through the port, especially as port of transshipment and bunkering.
As a matter of fact, Singapore is the most important port in the world both in transshipment and bunkering.
The overall performance of the port is assessed against a range of criteria and different types of operation that take place within the port are explained. In considering the governance structure within which all this takes place, particular attention is paid to the pivotal role of terminal Operator PSA and Maritime and Port Authority (MPA) of Singapore as the statutory regulatory authority for control, security and the overall development and growth of the port of Singapore, which includes terminal operators.
The paper presents, also, an exposition of the next investments in 'Tuas' seen as a possible driving force for further growth.
We would like to underline that this paper is the result of a mission of SRM in Singapore during which several interviews with opinion leaders and professionals in the maritime sector were conducted.
The subjects interviewed are public players, university, terminal operators, bank & insurance companies, bunkering entrepreneurs, trade associations.
These interviews provided us with insights into the key challenges facing the maritime industry and helped to better understand the Singapore Maritime cluster characteristics and operation.

An overview on main data of Singapore

The sovereign city-state of Singapore is a strategic financial, trade and maritime business center thanks to its geographic location in the South East of Asia.
Placed along the Maritime Silk Road, it can play a critical role in the project as a global financial, trade and maritime hub.
Singapore is located 152 km north of the equator, placed on the tip of the Strait of Malacca. The archipelago (60 islands of which the biggest is named Singapore where the capital is located) is separated from Malaysia in the north by the Johor Straits and from Indonesia in the south by the Singapore Straits.

Thus, the State is located at the center of the main trade routes, thus, it is as a maritime gateway to the key Asian markets and a strategic center for maritime business. It can be considered as a hub that connects Asia to the World.

Singapore and the Strait of Malacca

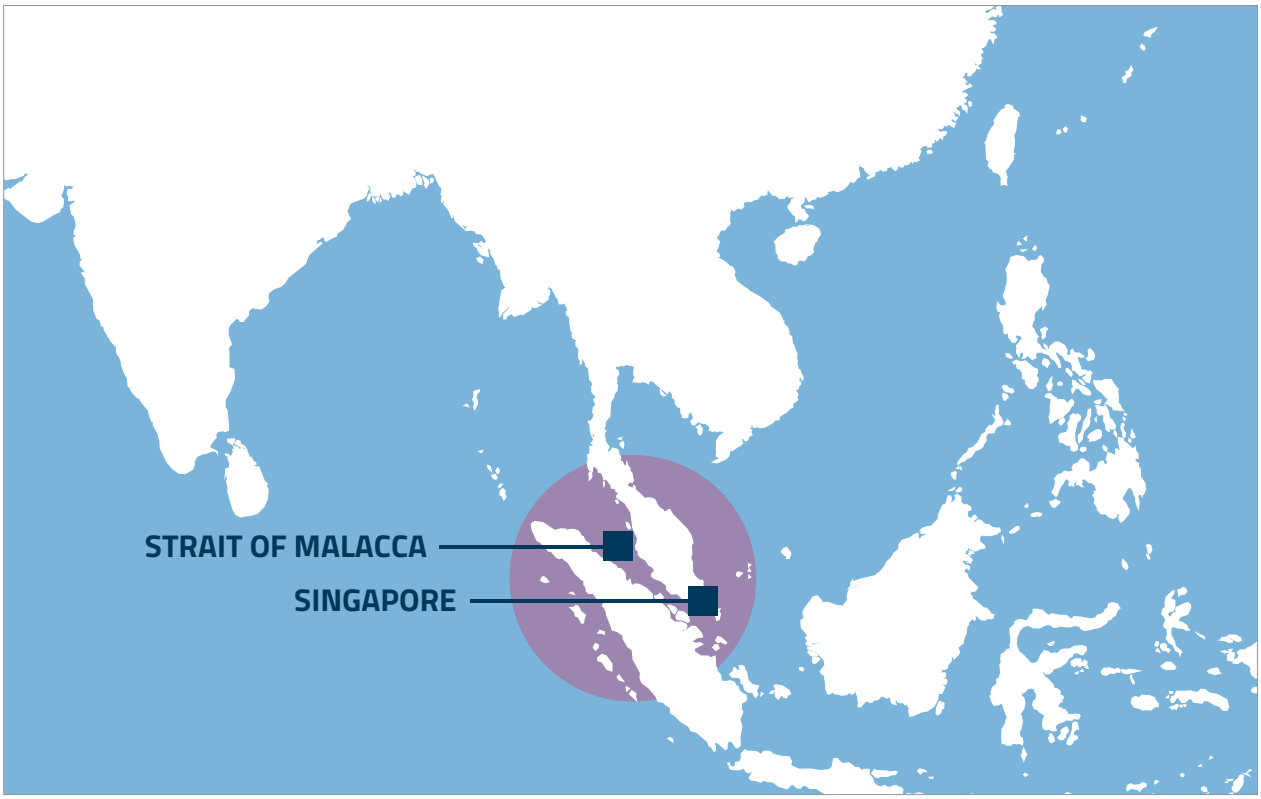


Figure 1 - Source: SRM on Maritime and Port Authority of Singapore

As a matter of fact, 400 routes pass through Singapore connecting 600 ports and 120 countries worldwide. 130,000 vessels enter the port yearly. At any one time there are about 1,000 vessels in the port and a ship arrives or leaves Singapore every 2-3 minutes.

The maritime industry contributes approximately 7% to its gross domestic product and most of this revenue is gained through bunkering and shipping services. Moreover, the industry – with the port at its heart, is responsible for 10% of the service sector, a sector that makes up 75% of the economy.

Singapore is already home to more than 5,000 maritime establishments and businesses and over 130 of the world's top shipping groups, with 170,000 people employed in the sector.

According to the UNCTAD's Liner Shipping Connectivity Index (LSCI)[1] 2018 Singapore ranks second in the World after China for competitiveness in the maritime industry.

[1] The Liner Shipping Connectivity Index (LSCI) summarizes five elements of competitiveness in the maritime industry: number of ships; their container-carrying capacity in TEUs; maximum vessel size; number of services; and number of companies that deploy container ships in a country's ports.

In addition, its strategic position makes the country a crucial logistic hub for global trade. According to the World Bank's Logistics Performance Index (LPI)[2] in 2018, Singapore ranks seventh among all economies. Both the indicators synthesize Singapore's undoubted capacity to combine maritime competitiveness together with logistics capacity.

Furthermore, the little city State achieved impressive results in maritime technology According to the last Menon Report 2017[3] – that examines four maritime sectors: shipping, finance and law, technology and ports and logistics, together with an overall assessment of the cities' attractiveness and competitiveness – Singapore is the leading Maritime Capital of the World.

Considering the maritime industry's pivotal role in Singapore's economy, and the fierce competition between global ports, Singapore's government is determined to ensure the country remains a leading maritime trading hub. The strategic blueprint aims to create over 5,000 new jobs in the maritime sector and increase its "value-add" by US$ 3.50 bn by 2025, by developing technological innovation, workforce talent and connectivity between maritime industry actors.

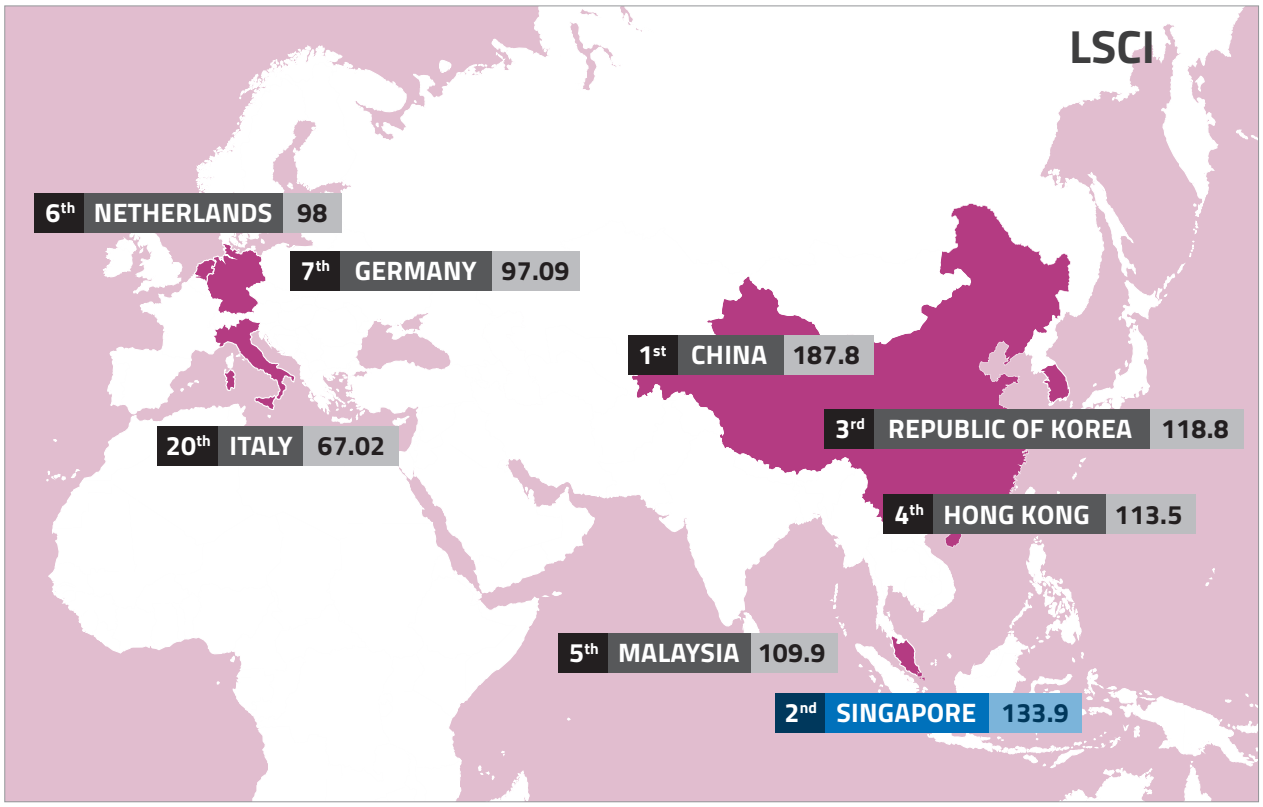
[2] The Logistics Performance Index is an interactive benchmarking tool created to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. The LPI 2018 allows for comparisons across 160 countries.
The Logistics and Performance Index summarizes the results of the countries on 6 complemen¬tary areas of evaluation.

- Efficiency of the clearance process.
- Quality of trade and transport related infrastructure.
- Ease of arranging competitively priced shipments.
- Competence and quality of logistics services.
- Ability to track and trace consignments.
- Timeliness of shipments in reaching destinations within the scheduled or expected delivery time.

In particular, the LPI provides a multidimensional assessment of logistics performance of a country by placing it on a scale ranging from 1 (worst score) to 5 (best score). The evaluation is the result of the survey carried out online on more than 5,000 individual country assessments provided by about 1,000 international shippers and express carriers in order to compare the logistics profiles of 160 countries. The selected sample of operators is based on the assumption that their opinions count as they decide the traffic routes to follow and influence companies in matters of choice of location, selection of suppliers and identification of the target market.

[3] Menon Economics (2017), *The Leading Maritime Capitals of the World 2017*, Menon Publication No 28/2017.

LSCI and LPI in the World: logistic efficiency and connectivity are the new challenges in international maritime competitiveness. Singapore on the top



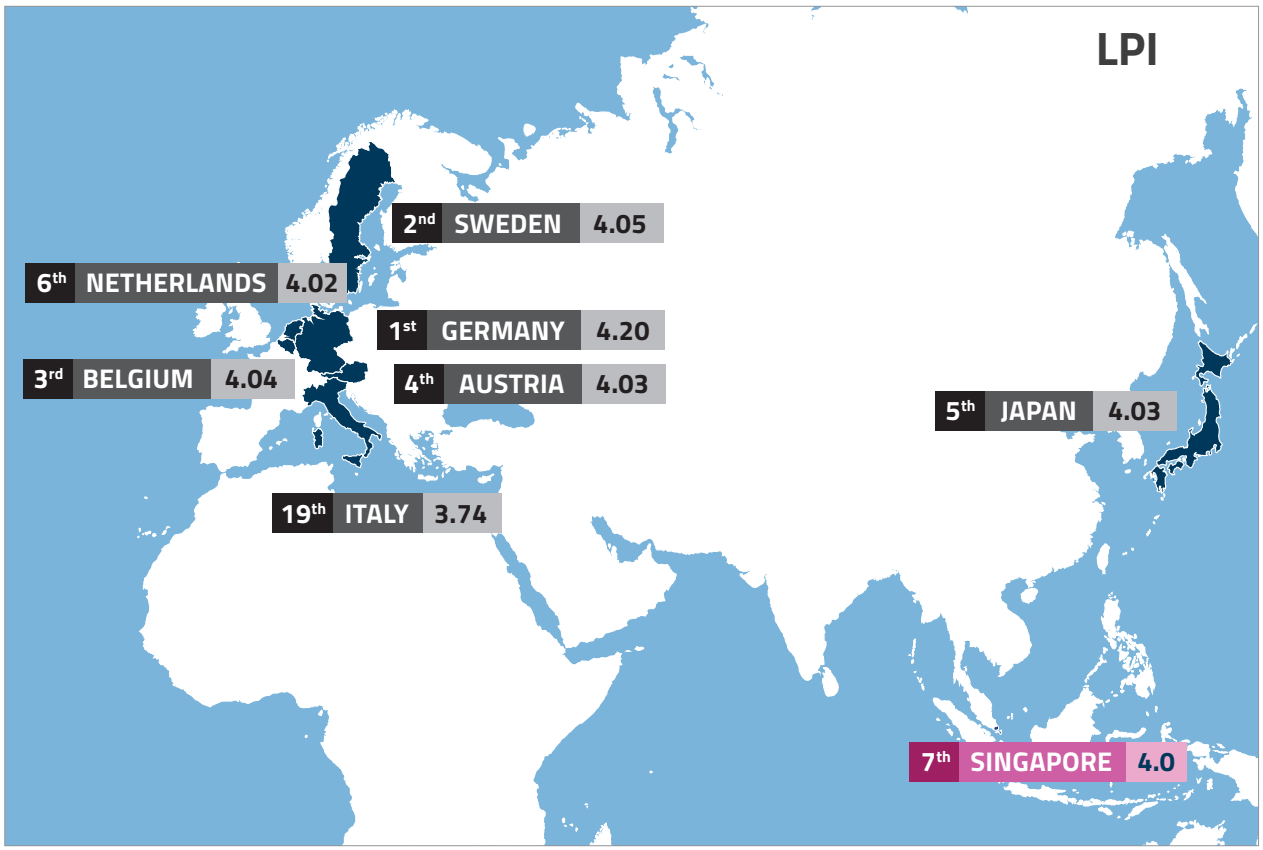


Figure 2 - Source: SRM on WB and UNCTAD

Maritime traffic and port sector of Singapore

Singapore is the third port in the world in terms of cargo throughput, with 626 million tons in 2017, which represent a growth of 5.5% on the previous year. The port comes after the two Chinese ports of Ningbo-Zhoushan and Shanghai.

Top 10 ports by cargo throughput 2017 (million tons)

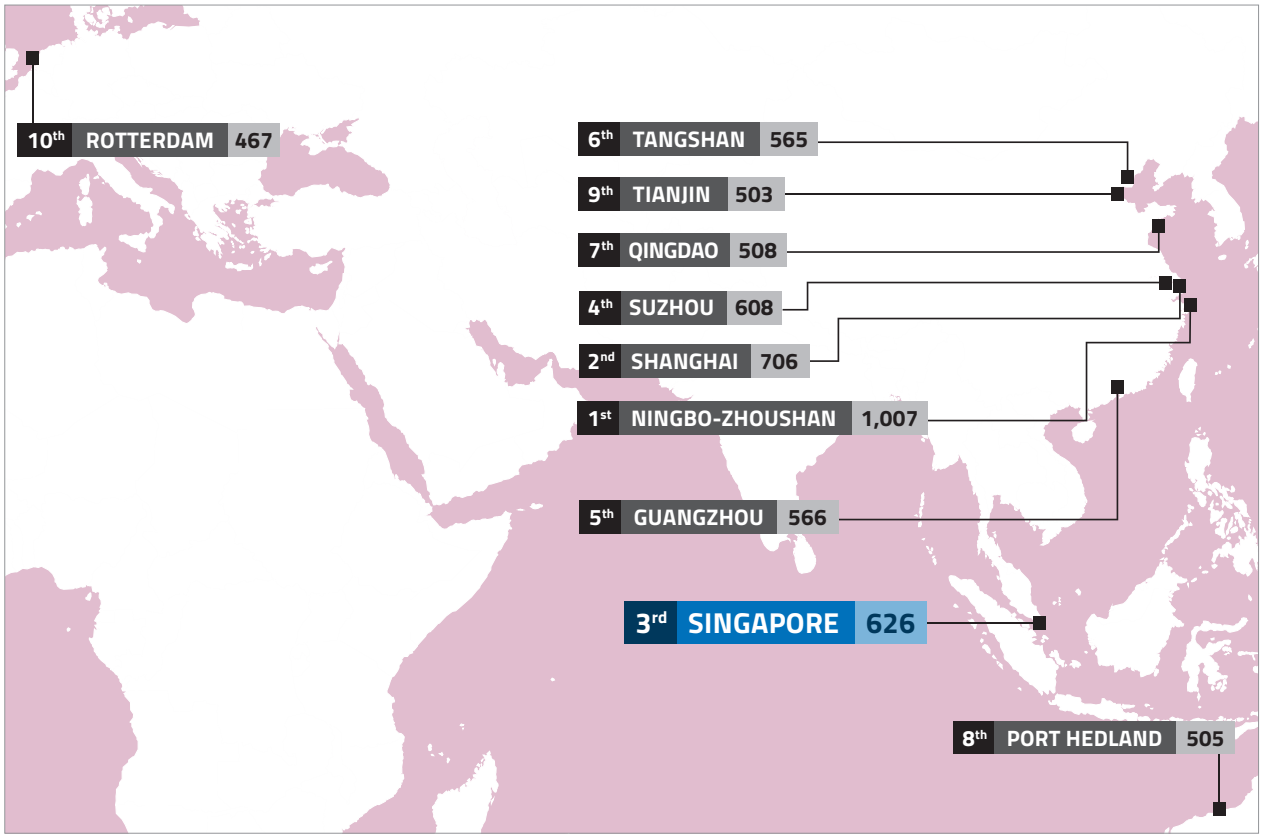


Figure 3 - Source: SRM on UNCTAD

Singapore's characteristic of port hub is highlighted by its position in the new global ranking of container ports. In the first half of 2018 Singapore is the second container port in the World after Shanghai with 18.02 million TEUs handled; an increase of 11.6% on the first semester 2017.
In Singapore transshipment volumes account for around 85% of all containers handled equal to one-seventh of the world's transshipment containers and 5% of global container throughput. Thus, Singapore is considered the first transshipment hub in the World.
The Port is also one of the world's largest refrigerated container (reefer) ports. It has more than 9,000 reefer points and handled almost 1.8 million TEUs of reefers[4].

[4] 2016 data. Source https://www.logasiamag.com/2017/08/automating-cranes-psa-singapore/

Top 10 Ports - 1H 2018 container throughput vs 1H 2017 (million TEUs)

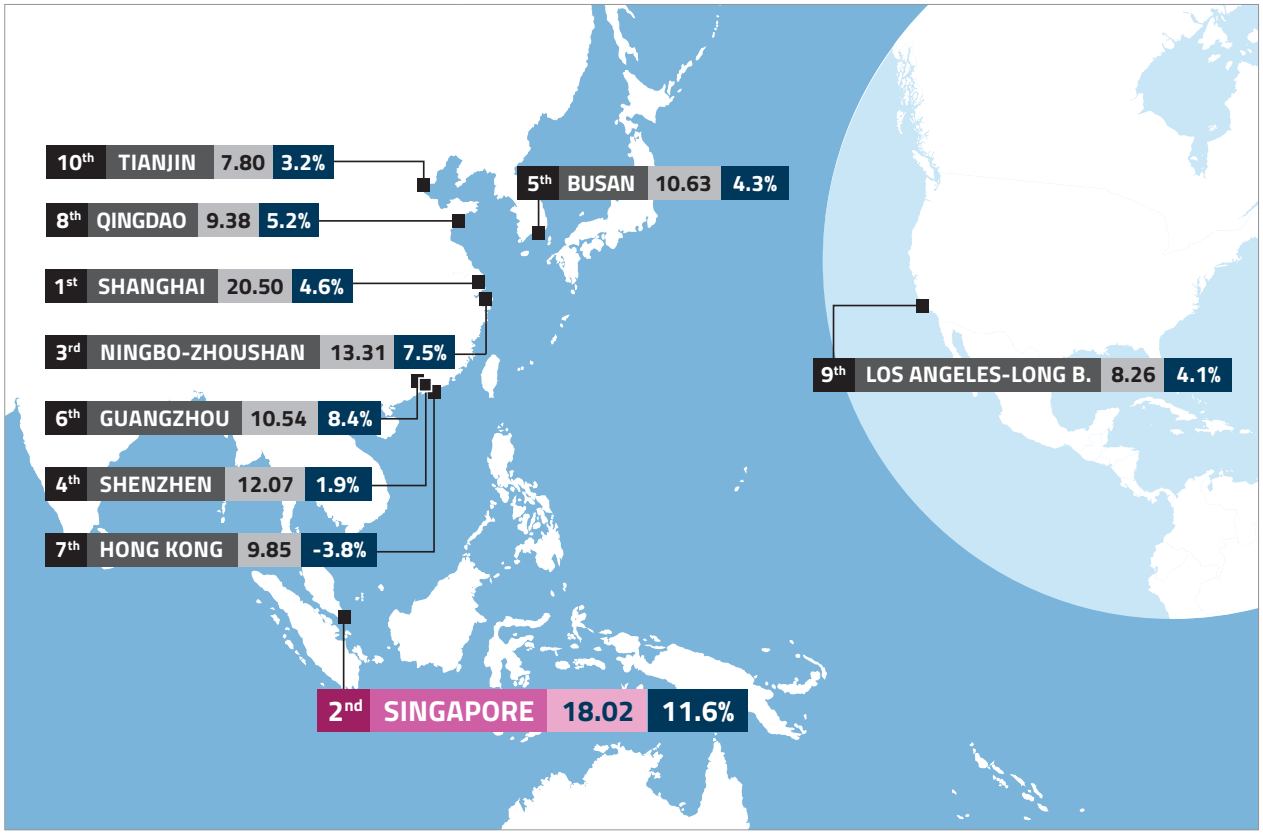


Figure 4 - Source: SRM on Alphaliner 2018 SRM on Alphaliner 2018

Cargo tonnage handled by Singapore reached a record 626.2 million tonnes in 2017, up 5.5 per cent on the previous year. Singapore is one of the five busiest ports in terms of shipping tonnage. Morevoer, it retained its crown as the world's top bunkering port surpassing the 50 million tonnes mark for the first time with 50.6 million tonnes of bunkers sold in the port in 2017, up 4.2 per cent on the previous year. This is equivalent to $ 18.2 billion in terms of sales. And looking at data from January to August, Singapore bunker sales reached 33.4 million tonnes.

1/5 of total vessels in the port are bunkering ships. Singapore is often listed as the leading oil trading hub in Asia (third in the world after New York and London) and 4th Refined Oil Exporting Country[5]. It has a refining capacity of nearly double its rate of petroleum products consumption[6]. In conclusion, we have to underline that Singapore is one of the 3 largest importers of Suez south-bound oil flows, with China and India accounting for more than 58% of the total. In particular, Singapore accounts for 31% of Suez Canal southbound oil flows.

[5] http://www.worldstopexports.com/refined-oil-exports-by-country/

[6] Source: The U.S. Department of Commerce's Office of Trade Agreements Negotiations and Compliance.

Performances of the Port of Singapore

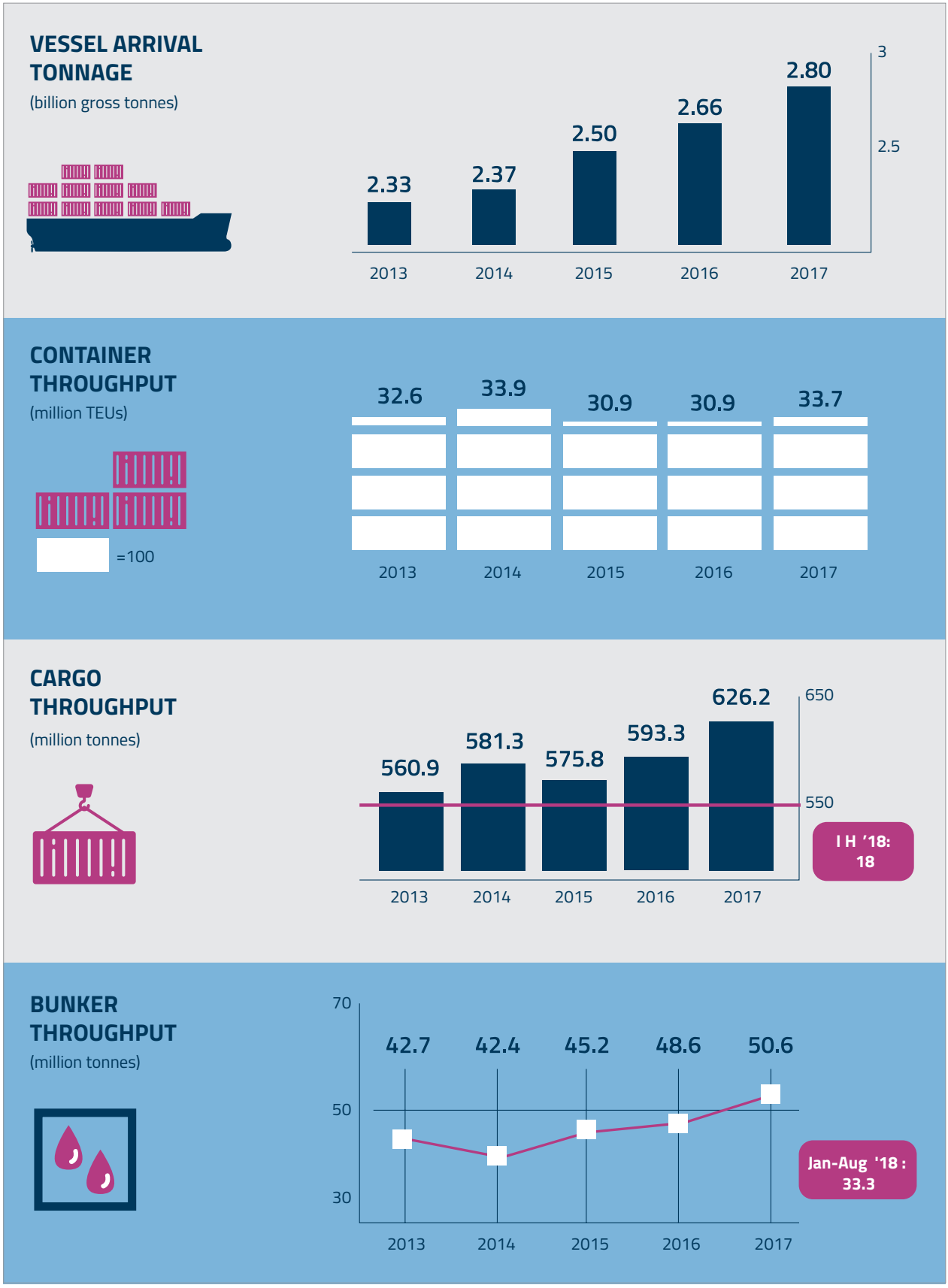


Figure 5 - Source: SRM on MPA

It must be said that Singapore is a small-sized state that serves a bigger area. The port of Singapore will continue to grow not only because its internal demand increases but, mostly, because the demand of the surrounding countries will also increase.

Overseas volumes grow faster than Singapore. Experts estimate[7] a growth of maritime traffic in the Strait of Malacca because in Southeast Asia there are at least 2-3 developing countries in excess of 100 million of people with low container volumes that are due to increase. Thus, Southeast Asia and, more in general, Asia, are growing and Singapore is in the right position on the Strait of Malacca to intercept this traffic. Moreover, Singapore can play a critical role in the Belt and Road Initiative[8]; the Chinese initiative aimed at strengthening commercial traffic between Africa and Eur-Asia. This refers to the fact that 33% of all outward investments linked to the BRI flows through Singapore, while 85% of all inbound investment for the initiative makes its way into China through Singapore on the Strait of Malacca[9].

Thus, the Strait of Malacca could be considered as important a global transit point as Suez and Panama; an important transit point between East and West and Singapore, with its new investments further discussed throughout the following section (The next investment: the mega-port of Tuas), would like to play a pivotal role providing the best transshipment to every customer.

Main strategies of Singapore to remain a global maritime hub: a strategic position, transshipment, an advanced technology system, megaships accommodation and bunkering

Thanks to its strategic geographical position, it plays a significant role in serving the global markets with over 400 routes and 62 weekly containership services connecting the port of to more than 140 ports worldwide.

With its unrivalled connectivity, many small feeder vessels bring containers to Singapore. At the Port, these containers get loaded onto large vessels which will then carry the shipment to their

[7] PSA Interview in Singapore.

[8] See chapter "The Belt & Road Initiative and the Role Mediterranean Region should Play" in SRM (2018), *Italian Maritime Economy. China, energy corridors, ports and new routes: geomaps of a changing Mediterranean, 5th Annual Report*, Giannini, Naples.

[9] Mr Chan Chun Sing Minister in the Prime Minister's Office of Singapore and Secretary-General of the National Trades Union Congress (NTUC), WEF Forum 2018.

final destination. The value of transshipment lies in that it is more cost efficient and time saving than the vessels making a single direct voyage.
Shipping lines use PSA for these modes of transshipment:

- Hub & Spoke (Main Line Operator to Feeder)
- Cross Strings (Main Line Operator to Main Line Operator)

Singapore is equipped to satisfy the shipping needs on a local and international level. It has a technologically advanced structure; cranes are fully automated and no longer require an operator each, 18 to 25 workers in the control centre handle 186 cranes at a time (1 worker controls from 7 to 10 cranes simultaneously). The Port of Singapore is open to ships 24 hours a day, 365 days a year. It has very deep depths for the accommodation of megaships.
This predisposition in accommodating megaships allows it to better intercept this type of traffic from around the World, allowing Singapore to remain one of the world's major hubs.
This reception capacity becomes even more relevant when analyzing the orderbooks 2018-2020, which show an increase of the container fleet equal to about 2.4%, a figure that rises to 24.7% for megaships of 18,000-23,000 TEU and to 7.5% for the 13,000-18,000 TEU fleet. So, it is expected that the already significant traffic of the area will intensify even further.
The possibility of bunkering ships at a competitive price allows Singapore to be a hub leader; a benchmark for others hub too.

Singapore Maritime cluster: the key role of Terminal Operator PSA international

Singapore was traditionally a "re-export economy" by virtue of its historical role as an entrance door for Southeast Asia. Today, it remains the first re-export point of the globe[10] and the shipping and logistics cluster of Singapore is considered number one in the world.
The gradual creation of the cluster dates back to 1996 when the Maritime and Port Authority of Singapore was established with the old name of PSA that was formerly the Port of Singapore Authority, a statutory board regulating, developing, operating and promoting the port of Singapore's terminals.
In 1996, PSA's regulatory functions were handed over to the Maritime and Port Authority of Singapore (MPA). PSA Corporation Limited was subsequently corporatised[11] in 1997 as the successor

[10] Source: United Arab Emirates Yearbook 2013.

[11] Corporatisation involves the transformation of government enterprises into separate corporate entities with clear objectives, the establishment of a board whose members are appointed on the basis of their expertise, and managers who are given commercial objectives and the powers to raise funds on private capital markets. In other words, a public

to the Port Authority to manage and operate its terminals and related businesses. Since 1997 PSA has been focusing specifically on port operations and common shore operations.

In this way, the MPA has been assigned the task of providing the addresses in the maritime and logistic field while PSA International has focused on operations.

In December 2003, PSA International became the investment holding company for PSA's businesses in Singapore and worldwide. PSA International is fully-owned by Temasek Holdings[12] the sovereign wealth fund of Singapore.

Nowadays, there are two big actors that have different but synergistic roles:

The MPA has the role of developing and promoting Singapore as a premier global hub port and an international maritime centre, and to advance and safeguard Singapore's strategic maritime interests.

PSA International's mission is instead "to be the port operator of choice in the world's gateway hubs, renowned for best-in-class services and successful partnerships"[13]. Thus, PSA has been working to create a big network overseas and investing worldwide.

In 2016 Singapore introduced a Master plan called "Industry Transformation Map". The programme integrated different restructuring efforts, taking a targeted and industry-focused approach to address issues and deepen partnerships between the Government, firms, industries, trade associations and chambers.

Under the programme, there are Industry Transformation Maps (ITMs) developed for 23 industries under 6 clusters[14]. The value added of this plan is given also by the synergy among the ITMs; they dialogue together. There are 23 of them, and the overall of these 23 is administered at government level, by the Prime Minister's office. But every division of ITM will have one government agency.

One of these is the" Sea Transport Industry Transformation Map". This was launched in 2018. Lead Agency for the ITM is Maritime Port Authority.

The aim of the Sea Transport ITM is to grow the sector's value-add by S$ 4.5 billion and create more than 5,000 good jobs by 2025. It represents the policy of the government on the how transport is transforming Singapore: developed by the Maritime and Port Authority of Singapore (MPA) in partnership with the industry, unions and other government agencies, the Sea Transport

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enterprise faces exactly the same market conditions as competing organisations in the private sector.

[12] Temasek was incorporated under the Singapore Companies Act in 1974 to own and commercially manage investments and assets previously held by the Singapore Government. This allowed the Ministry of Finance to focus on its core role of policymaking and regulations, while Temasek would own and manage these investments on a commercial basis. In accordance with the well-established Singapore Financial Reporting Standards, the Group Financials for Temasek are a consolidation of financial information of Temasek and its operating subsidiaries, such as PSA, Singapore Airlines, Singtel, ST Engineering, etc.

[13] Source: PSA Website.

[14] The 6 clusters are Manufacturing, Built Environment, trade and Connectivity, Essential domestic services, modern services and lifestyle.

ITM builds on MPA's strategic long term plans to develop Singapore's next-generation port. To sustain Singapore's competitive advantage and strengthen port connectivity, MPA is also working with the industry to develop the port eco-system in adjacent sectors, such as logistics and e-commerce.

The port of Singapore and its governance structure

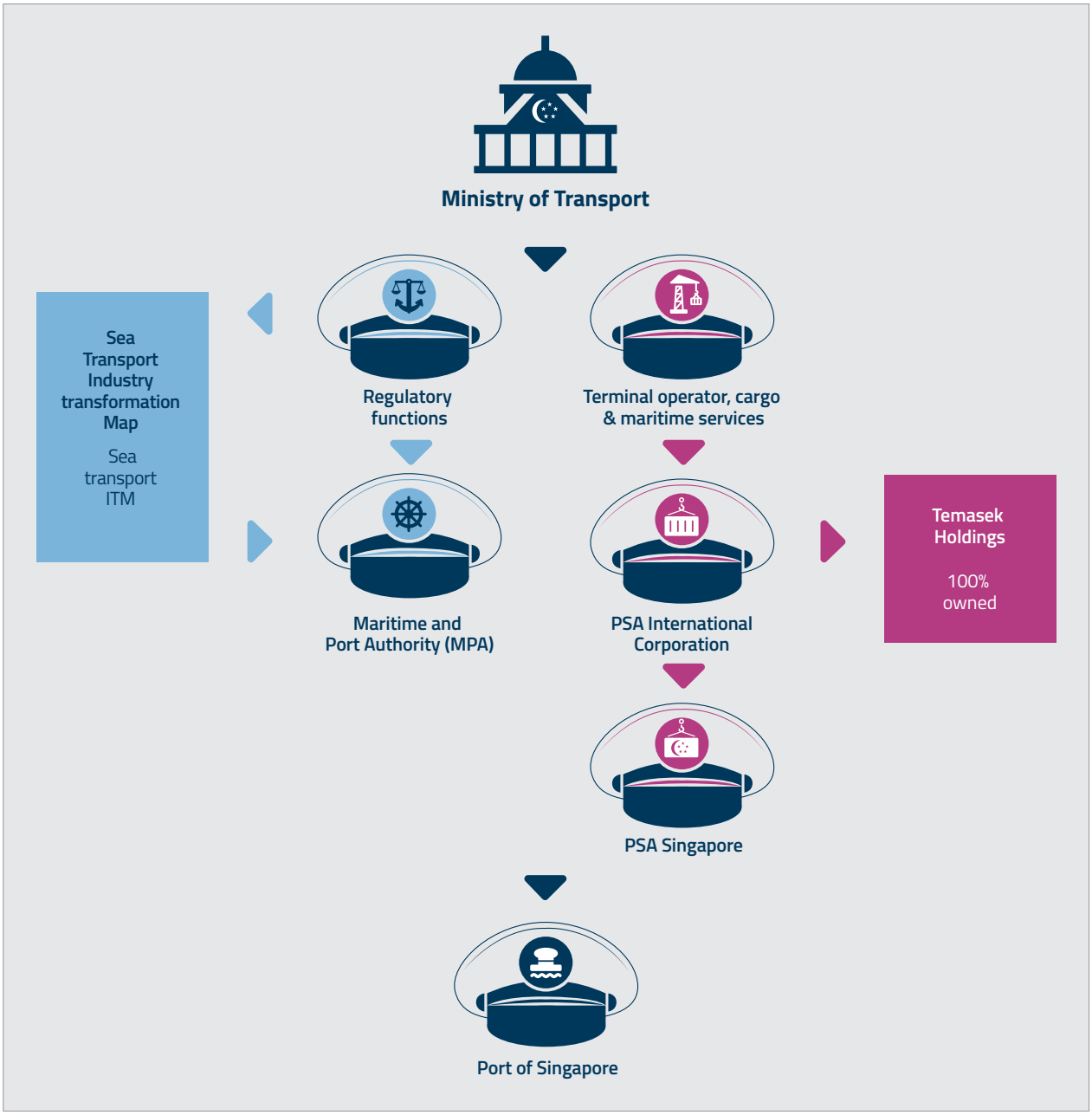

Figure 6 - Source: SRM on PSA

PSA International is ranked 5th in the world in terms of Terminal operators and covers 10% of the global market of container flows[15].

Ranking Global container Terminal operator 2017

Company	Throughput (MlnTEUs) 2017	Var. 2016-2017	Global Container Market
CMPort (China Merchant Port Holdings)	102.9	7.50%	14%
Cosco Shipping	87.3	-8.20%	12%
Hutchinson Port Holding Trust (HPH Trust)	84.7	7.90%	11%
APM Terminals	78.6	30.30%	11%
PSA	74.2	9.80%	10%
DP World	70.1	10.30%	9%
Top 6	**497.8**	**9.00%**	**67%**
Global container Throughput 2017	**743.5**	**6%**	

Table 1 - Source: SRM on Terminal Operator sites

PSA International, in fact, is one of the main international companies specialized in handling port operations with 40 maritime terminals in 16 countries across Asia, Europe and the Americas with flagship operations in Singapore and Antwerp (the locations include Genoa Voltri and Venice in Italy too) and a cargo traffic in the last year equal to more than 74 million TEU (+9.8%).
More than half of the traffic of Singapore international (40.89 million TEUs) was handled outside the State, confirming the international projection of PSA and the amazing capacity of handling a large amount of traffic. This has been possible thanks to high management capacity and advanced technology which have enabled this group to achieve the highest level of traffic in 2017 (starting from 2011).

[15] Source: various sources and sites of the top 10 Terminal Operators.

Global container terminals of PSA International

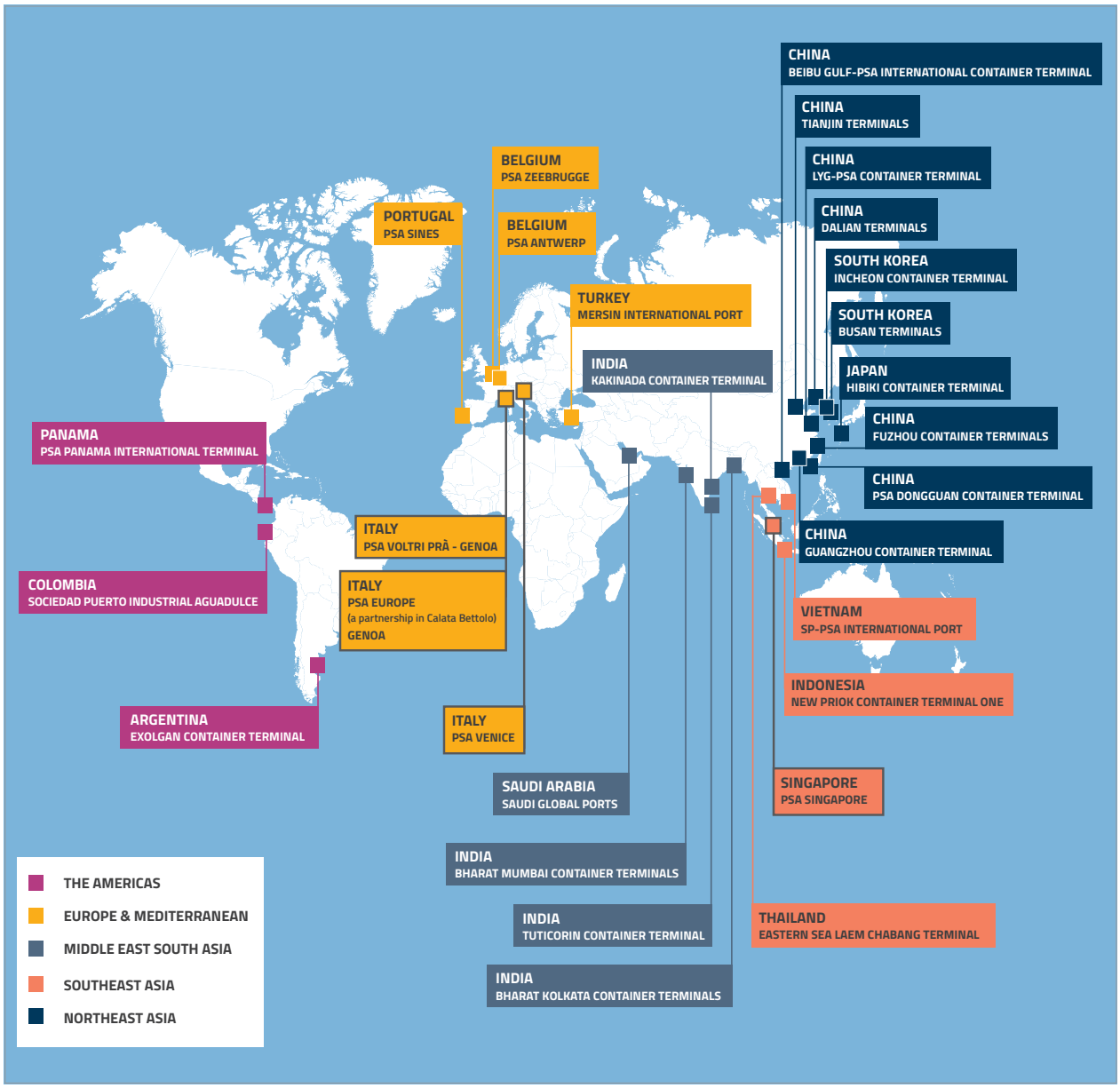

Figure 7 - Source: SRM on PSA International

The role of PSA Singapore for port, infrastructures and services

PSA Singapore is the terminal operator of Singapore port. PSA Singapore is the flagship terminal of PSA International.

In 2017, PSA Singapore handled 33.35 million TEUs of containers. The Port of Singapore is:

- **The World's Busiest Transshipment Hub** – accounting for almost one-seventh of the world's total container transshipment throughput and 5% of global container throughput.
- **One of the World's Largest Refrigerated Container (Reefer) Ports** – more than 9,000 reefer points; it handled almost 1.8 million TEUs of reefers in 2016.
- **Excellent Connectivity** – connected to 600 ports, with daily sailings to every major port in the world. Singapore port has daily connections to Asia, Europe and USA.

Daily Containership Sailing from Singapore to the World

Daily Sailing to:	
Southeast Asia	34
China, Hong Kong & Taiwan	12
South Asia	8
Europe	3
Japan	3
Usa	2
Total	**62**

Table 2 - Source: PSA Singapore Terminal

In Singapore PSA Singapore operates a total of 60 berths at its container terminals of Tanjong Pagar, Keppel, Brani, and Pasir Panjang. The particularity is that they operate as one seamless and integrated facility.

The terminals at Pasir Panjang are PSA's most advanced. The berths at Pasir Panjang 3 and 4 are up to 18 metres deep and equipped with quay cranes able to reach across 24 rows of containers to serve the world's largest container ships. They also feature the latest port innovations – such as a zero-emission, fully-automated electric yard crane system – which raises the port's productivity.

Innovation, automation, Automotive and Joint venture in Pasir Panjang

As underlined by Alphaliner[16], PSA International is making progress with a recently-launched program to increase automation at its Pasir Panjang Container Terminal.

The project consists of two main features: firstly, PSA plans to gradually convert ship-to-shore gantries at the older part of Pasir Panjang (T1, T2 and T3) from conventional operation to remote controlled drive. A comparable system had already been introduced from scratch in the more recent phases (T4, T5 and T6) of PSA's largest container facility.

Further to this, container shuttles between the quay crane and the – already automated – storage yard are to be automated as well. So far, these shuttles are manually operated on all phases of Pasir Panjang, including on the newer eastern terminals T4, T5 and T6.

To achieve this, PSA plans to replace the current prime mover (i.e. truck or tugmaster) and chassis system with a fleet of automated guided vehicles.

Under the new system, quay cranes will move containers mostly automatically, though a crane driver, working remotely in a control centre on the terminal, will still take care of placing the container onto the vessel and the shuttle. However, PSA said that its engineers were working on ways to automate the entire process.

The operator claims that, compared to the original layout of the terminal, these measures could increase overall berth productivity by up to 25%.

There are also two multi-purpose terminals: Pasir Panjang Automobile Terminal and Sembawang Wharves.

Pasir Panjang Automobile Terminal started operations in January 2009. It is PSA's vehicle transshipment hub and Singapore's first dedicated car terminal. PPAT has three dedicated berths and is supported by an open car yard and a multi-storey car storage yard, which together provide some 20,000 car park lots. As for containers, the Ro-Ro terminal not only serves Singapore's internal consumption demand but it was also created because of the interesting way Southeast Asia is distributed.

This continent is very dispersed; a region of peninsulas and islands. Thus, it was necessary to have a central point where to collect/distribute all the car manufacturing coming, for example, from Indonesia, Australia or Thailand. In this way, Singapore has become a hub for Southeast Asia's Ro-Ro shipping lines.

The Multi-Purpose Terminal Sembawang Wharves handles break-bulk and specialised cargo which includes heavy equipment, steelworks, and cables. In addition to product innovation, PSA has also carried out some process innovation and this has resulted in the implementation of joint ventures with some major international groups. Companies like CMA-CGM, COSCO and the merged Ocean Network Express (ONE), have increased their corporate presence in Singapore.

[16] Alphaliner (2018), *Alphaliner Newsletter*, No 30/2018.

These joint ventures grant priority to the groups with whom they are subscribed. In particular, CMA CGM and PSA have joined forces to form a company named CMA CGM-PSA Lion Terminal Pte. Ltd. (CPLT). This new company will operate and use four mega container berths at Pasir Panjang Terminal (PPT) Phases 3 and 4.

CMA-CGM has also established its Asian regional office, its global Navigation and Port Operations Centre and, most recently, its Asian digital activity hub in Singapore.

COSCO-PSA Terminal Pte Ltd, is a joint venture company formed by COSCO Shipping Ports and PSA(CPT) at Pasir Panjang Terminal (PPT) Phases 3 and 4.

There is another joint-venture with MSC: MSC-PSA Asia Terminal (MPAT). The MPAT berths at Pasir Panjang Terminal are capable of handling mega vessels with capacity exceeding 14,000 TEUs.

In addition, Pacific International Lines (PIL) entered into a joint venture with PSA Singapore (PSA), forming PIL-PSA Singapore Terminal Pte Ltd (PPST) at Keppel Terminal.

There is also a joint-venture in the automobile sector and it is formed by PSA, Nippon Yusen Kabushiki Kaisha (NYK) and Kawasaki Kisen Kaisha Ltd (K Line). Located at Pasir Panjang Terminal, this joint-venture (Asia Automobile Terminal Singapore - AATS) operates two dedicated berths and is a vehicle transshipment hub for the region.

In addition, ONE has chosen Singapore as its global liner headquarters. These activities in turn have drawn in other maritime services providers such as insurances, broking, financial services, classification societies, P&I Clubs, legal and arbitration.

Pasir Panjang Container Terminal

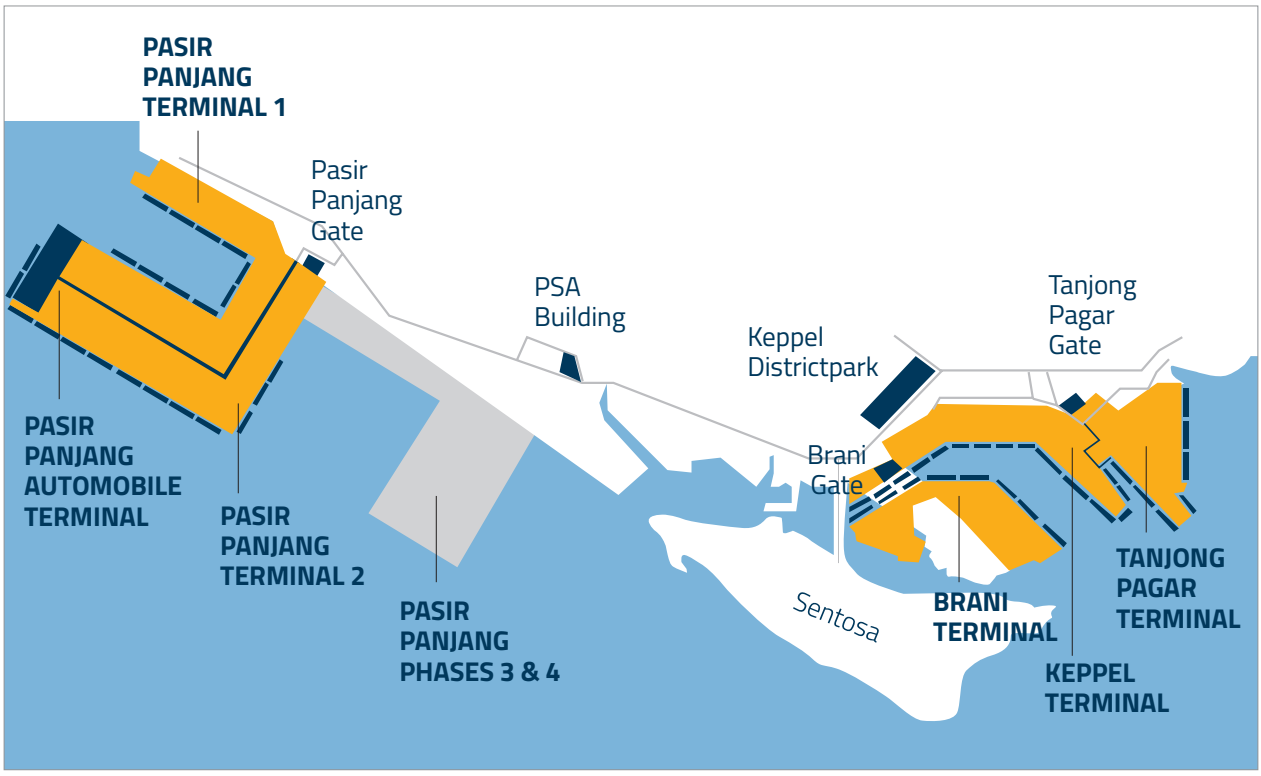

Figure 8 - Source: SRM on researchgate.net

The next investment: the mega-port of Tuas

Singapore port is growing and to meet new demands it is building a new mega-port located in 'Tuas' which will be built in the west part of the city, to free up prime land in Pasir Panjang and Taniong Pagar for future residential and mixed-use development. The project will create one consolidated port, to replace the current container terminals, namely Pasir Panjang Terminals, Brani, Keppel and Tanjong Pagar.

The Tuas terminal's consolidation will be conducted in a phased manner. It will open in four phases from 2021 to around 2040. Thus, this transition is part of an overall long-term plan to consolidate container port facilities at Tuas.

The port movement of the city terminals of Tanjong Pagar, Brani and Keppel are due to happen by 2027. Pasir Panjang's operations will run out in 2040. The new Tuas Mega port will be opened progressively from 2021 and the big move to Tuas is will take place by 2040.

Port relocation in Singapore: Tuas Mega Port

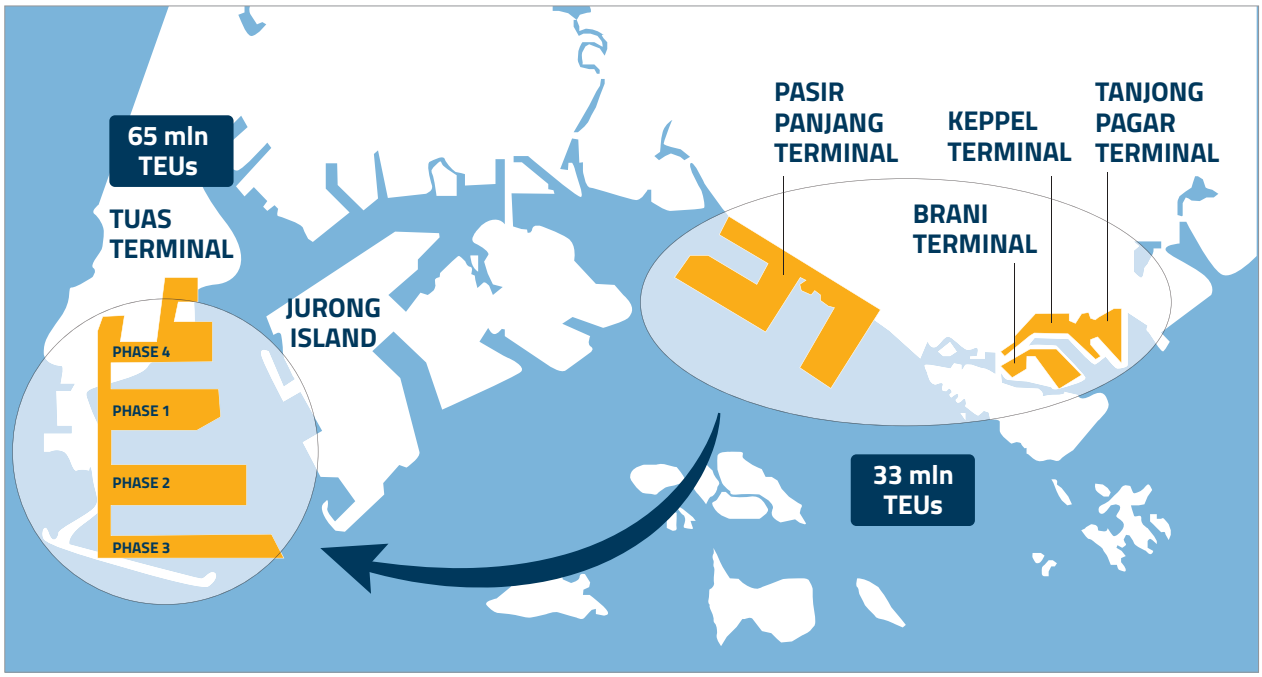

Figure 9 - Source: SRM on Straits Times Graphics

When fully operational, the new mega port will handle 65 million containers a year, an increase of more than 85% capacity and it will occupy up to 1400 hectares of land. In addition, the new port will be more efficient than the current port system.

Currently, containers that arrive in Singapore and need to be transhipped are often required to be transported between terminals on trucks. This dramatically increases the time and cost of the operation, not to mention the road congestion caused. By consolidating all the terminals in one

place, this will bolster efficiency, economies of scale, eliminate inter-terminal transfers and result in cost savings and increased productivity. Additionally, the industry is changing rapidly. Ships are getting larger and more complex – and will continue to do so, and there is a rise in the use of alternative fuels, such as LNG. A modern port needs to be able to cater for all of these new demands. By creating a port that is as future-proof as possible, and also one that can be run as efficiently as possible, Singapore is demonstrating that it will continue to be a major player in both the region, and the world when it comes to the shipping and container industry.

The Tuas mega port will be outfitted with new technologies such as automated container port systems, to improve the efficiency of terminal operations. At Tuas, the number of automated yard cranes will rise to almost 1,000.

Tuas, when fully developed, is going to be the single largest fully-automated terminal in the world. The Maritime and Port Authority of Singapore (MPA) and the Dredging International Asia Pacific-Daelim Joint Venture (DDJV) have linked a contract for the USD 1.83 billion Tuas Terminal Phase 1.

The Tuas Terminal Phase 1 project is large in scope, and entails the construction of a new port terminal with 20 deep-water berths having a total capacity of 20 million twenty-foot equivalent units (TEUs) per annum.

The Joint Venture will be responsible for the erection of an 8.6-kilometre quay wall and its foundation, the dredging of the fairway and basins, as well as the reclamation of 294 hectares of new land.

The Tuas terminal, for example, will deploy advanced port technologies and will have numerous automated systems. In the progress are Automated Guided Vehicles (AGVs), automated yard and quay cranes and an Automated Storage and Retrieval System for containers to increase the yard storage capacity and create a mega intelligent container terminal. The terminal will have also Green Technologies such as Electrified port handling equipment to reduce carbon emissions and usage of renewable energy such as solar power.

A contract for a value of SGD 1.46 billion (USD 1.11 billion) for the port development project Tuas Terminal Phase II in Singapore, also referred to as Tuas Terminal Finger Pier 3, has been signed between the consortium formed by Royal Boskalis Westminster N.V. (The Netherlands), Penta Ocean Construction Company (Japan), Hyundai Engineering & Construction Company (Korea) and the Maritime and Port Authority of Singapore (MPA).

The Tuas Terminal Phase II development is a part of the Tuas Port project and includes the design and construction of 387 hectares of land reclamation works bounded by 9.1 kilometers of caisson walls. The nearly 30-meter-high caissons designed for this project will be amongst the largest ever used in the world. The activities will take place over a 9-year time frame and are expected to be completed in 2027. To forge ahead, Singapore is investing in new port capabilities that will capitalise on emerging technologies arising from Industry 4.0. Tuas Port will be an efficient and intelligent port that harnesses data analytics to optimise operations, such as just-in-time vessel arrival.

Singapore on the Strait of Malacca, a key oil trade chokepoint

Another strength of Singapore Maritime sector is bunkering.

Generally speaking, world chokepoints for maritime transit of oil are a critical part of global energy security. According to UNCTAD, about 61% of the world's petroleum and other liquids production moved on maritime routes. In addition, oil tankers accounted for almost 29% of the world's shipping by deadweight tonnage in 2018.

The Strait of Malacca is the main shipping channel between the Indian Ocean and the Pacific Ocean by volume of oil transit. It links major Asian economies such as India, China, Japan and South Korea. At its narrowest point in the Phillips Channel of the Singapore Strait, the Strait of Malacca is only about 1.7 miles wide with an average minimum depth of 82 feet (25 metres). The strait offers the shortest route for tankers between the Persian Gulf and Japan.

Over 83,000 vessels passed through the strait carrying about 25/30% of the world's traded goods including oil, Chinese manufactures, and Indonesian coffee. About 25% of all oil carried by sea passes through the Strait, mainly from Gulf suppliers to Asian markets. An estimated 16 million barrels per day were transported through the strait, which represented the fourth increase in the past five years and made it retain its position as the second busiest transit chokepoint in the world.

Petroleum transit volumes through select maritime routes 2016 – million barrels per days

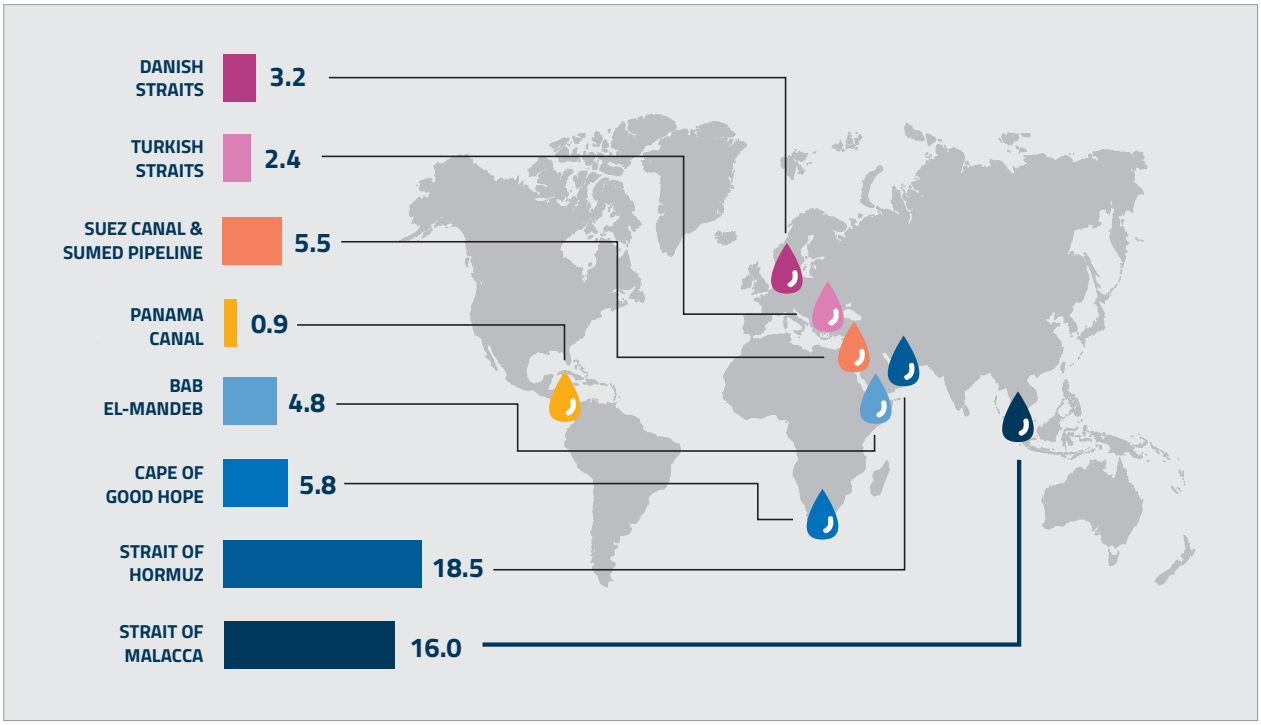

Figure 10 - Source: SRM on EIA, 2017

The Strait of Malacca is the primary chokepoint in Asia, and in recent years, between 85% and 90% of overall annual petroleum flows through this chokepoint was crude oil. The Strait of Malacca is also an important transit route for liquefied natural gas (LNG) from Persian Gulf and African suppliers, particularly Qatar, to East Asian countries with growing LNG demand. The biggest importers of LNG in the region are Japan and South Korea.

Strait of Malacca oil and liquefied natural gas (LNG) flows – Period 2011-2016 (million barrels per day)

Location	2011	2012	2013	2014	2015	2016
Total oil flows through Strait of Malacca	14.5	15.1	15.4	15.5	15.5	16.0
crude oil	12.8	13.2	13.3	13.3	13.9	14.6
refined products	1.7	1.9	2.1	2.2	1.6	1.4
LNG (Tcf per year)	2.8	3.5	3.9	4.1	3.6	3.2

Notes: Tcf = Trillion cubic feet.
Table 3 - Sources: U.S. Energy Information Administration analysis based on Lloyd's List Intelligence, IHS Waterborne, BP.12

If the Strait of Malacca were blocked, nearly half of the world's fleet would be required to reroute around the Indonesian archipelago, namely through the Lombok Strait between the Indonesian islands of Bali and Lombok, or through the Sunda Strait between Java and Sumatra. Rerouting would tie up global shipping capacity, add to shipping costs, and potentially affect energy prices.
Several proposals have been made to build bypass options and reduce tanker traffic through the Strait of Malacca. In particular, China and Myanmar (Burma) commissioned the Myanmar-China natural gas pipeline in 2013 that stretches from Myanmar's ports in the Bay of Bengal to the Yunnan province of China. The pipeline has a capacity of 424 billion cubic feet per year. The oil portion of the pipeline was completed in August 2014 and it is now operational at full capacity since the 260,000 b/d refinery in Yunnan, China, began operating in June 2017. The Myanmar-China oil line transports Middle Eastern oil, allowing it to bypass the Strait of Malacca.

Singapore as a Bunkering Hub

Singapore's strategic location on the strait of Malacca between the Indian and Pacific Oceans has allowed it to become one of Asia's major petrochemical and refining hubs.
It is a major transit point and a refining center in the region. Singapore has a crude refining capacity of 1.4 million bbl/d in 2017 and the majority comes from three refineries: Royal Dutch Shell, ExxonMobil and Singapore Refining Company (a joint venture between PetroChina and Chevron). Singapore has no indigenous hydrocarbon reserves and must import all its crude oil and natural gas.

Singapore's total primary energy consumption included approximately 87% of crude oil and petroleum products, 13% of natural gas, and less than 1% of other fuel sources.[17]

Although the country does not produce crude oil, it is a major hub for refining crude oil and for storing and transshipping crude oil and petroleum products. In 2016, 95% of Singapore's crude oil exports passed through the South China Sea. Most of these volumes originally came from the Middle East, and about half went to China.

According to recent forecasts, Singapore will remain a major importer of crude oil, refined fuel and LNG over our 10-year forecast period, thanks to its status as a global shipping and fuel re-export hub. Nonetheless, rising competition in the fuel exports, led by China, represents a key risk for Singapore, and domestic refiners will need to continue to invest in upgrades to remain competitive.

Crude coming east from the Strait of Malacca and intra-sea trade is refined and sent forward as petroleum products to the major energy consumers in Asia. At the same time, the NOC Singapore Petroleum Company aims to become a significant regional producer and has acquired rights to exploration blocks in the Gulf of Thailand, the Pearl River Mouth basin, and offshore Indonesia.

With no own reserves of natural resources, Singapore is a net importer of crude oil and natural gas. Crude oil is mainly imported from the Middle East, whereas natural gas is imported through pipelines from Malaysia and Indonesia.

Thanks to its geographically strategic location, efficient logistics and favourable business climate, Singapore has developed into a major oil and gas hub and is the world's third largest country both in terms of refining exports and in oil and gas trading.

In addition, Singapore is also an engineering hub for oil rig building holding 70% of the global market.

The centre of Singapore's oil and gas activities is Jurong Island – home to nearly 100 leading oil and gas, petrochemicals – and speciality chemicals companies from around the world.

Natural gas in Singapore

- Singapore's government has promoted the use of natural gas over the past several years. Singapore's natural gas consumption increased from 230 billion cubic feet (Bcf) in 2005 to 400 Bcf in 2015[18].

  Over the same period, the share of natural gas in Singapore's electricity generation fuel mix increased significantly from 74% to 95% as many gas-fired generators have replaced the use of oil-fired generators.

  In the country, the first liquefied natural gas bunkering terminal was opened in 2017.

[17] BP, *Statistical Review of World Energy*.

[18] *Ibidem*.

- The government intends to rely exclusively on liquefied natural gas (LNG) imports by 2024, following the expiration of several gas pipeline import contracts. Until Singapore commenced its first LNG regasification terminal in 2013, Malaysia and Indonesia had supplied all of Singapore's natural gas demand via pipelines. Singapore's sole LNG receiving terminal at Jurong Island currently has a capacity of 292 Bcf, and is expected to expand to at least 535 Bcf by 2018. The terminal has the potential for a capacity of 730 Bcf with the use of as many as seven tanks. LNG imports are expected to diversify Singapore's import sources.
- Singapore has shown interest in adding two floating storage and regasification units (FSRU) by inviting tenders from consultants to carry out feasibility studies at potential sites.
- Singapore aims to become a regional LNG trading hub and has created an index to perform spot pricing for LNG. Singapore's only LNG regasification terminal has facilities with the ability to transfer LNG from ocean liners to smaller vessels, which can access more regional terminals. The terminal also has storage and reloading capabilities, so LNG can be unloaded, temporarily stored, and eventually delivered to its final destination. However, Singapore's small infrastructure compared to that of other Asian importing LNG countries could challenge its becoming a major LNG trading hub.

The players' vision: the results of an ad hoc mission of SRM

The economic analysis on Singapore shows the significant role which this port plays in the global economy and its role in the evolutionary scenario of international trade.
Generally speaking, when we talk about "shipping" we intend the term in a broader sense which includes various infrastructure, i.e. ports but also the intermodal structures connected to them. We also include companies, not only the big players such as carriers, terminal operators and ship-owners but also a dense network of players operating in larger businesses of the maritime industry.
This analysis offers an overview of the current situation of the industry and its possible evolution, in the light of the continuing change in the demand of world consump¬tion, in which the operating efficiency of a carrier has acquired growing relevance. The impact of Singapore will depend on many factors affecting, among others, the capacity of the port and its inland infrastructure to manage to remain one of the most innovative and efficient in the world.
Based on this background knowledge – which is in the style of research of SRM – we derived the choice to integrate and refine the economic analysis of the sector with a "terri-

torial" evaluation in order to track down information, testimonies and first-hand considerations of the great players involved in the Singapore maritime cluster. The analytical tool used in this stage of the paper consists of meetings and interviews with opinion leaders in Singapore.

In this regard, a specific mission took place in Singapore in March 2017. It involved researchers from SRM who directly witnessed Singapore's new state-of-the-art infrastructure at Pasir Panjang and the secondary activities already carried out or being realized for the future development of container terminal at Tuas. SRM's researchers also verified the model of the Singapore maritime cluster. Last but not the least, they also verified the primary role of bunkering of Singapore for the world.

This study is not limited to authorities that represent Singapore, but includes the companies of the maritime industry that support the activities of transport and logistics as well as the associations category and also universities that deal with transportation and logistics. According to estimates released by Maritime and Port Authority of Singapore (MPA), the Maritime sector is worth 7% of GDP and employs over 170,000 people. Outlining a unitary and systematic picture of shipping from the analysis provided by companies and institutions – which, though operating in the same sector, represent strong global interests that are very dissimilar – proved complex, but allows an interpretation of the sector in its various current and prospective aspects, which can really be defined as innovative and comprehensive.

The following players showed availability for an interview in order to illustrate the criteria that guide the operational and strategic management of the entire maritime cluster:

- **Raffaele Langella**, Ambassador of Italy to Singapore
- **Chio Kiat Ow**, Singapore Ambassador in Italy
- **Simon Neo**, Regional Manager of the International Bunker Industry Association-IBIA
- **Federico Donato**, President of the Italchamber of Singapore
- **Stephen D Girvin**, Director of the Centre for Maritime Law of the National University of Singapore
- PSA Singapore – **Ong Kim Pong**, Regional Ceo Southeast Asia, **Ho Ghim Siew**, Head Group Commercial & Group Strategy, and **Rosalind Chua**, Assistant Vice President Group Commercial & Group Strategy
- **Timothy Cosulich**, Fratelli Cosulich CEO & Board Member

The subjects interviewed are public actors, universities, terminal operators, bank & insurance, bunkering entrepreneurs, trade associations. These interviews provided us with some insights into the key challenges facing the maritime industry and were useful to bet-

ter understand the Singapore Maritime cluster characteristics and operation.
Our aim is to represent the common interests of the entire sector, given the num¬ber and the momentousness of the changes that are affecting the economy and global trade and which are beginning to produce their effects on the industry. This has resulted in a product highlighting the driving forces, the critical issues, the problems and the strategies of a maritime cluster that, despite geographically gravitating around a small area, seems to have what it takes to play a crucial role in global shipping.
The interviews started from the considerations that Singapore will continue to have a pivotal role in maritime sector and in particular in the Malacca strait. Moreover, Singapore will be important for the countries around the strait which are currently showing great potential of growth. There are many developing Countries (densely populated and with a need for transshipment services such as Bangladesh) near Singapore that are growing and ask for services and in particular for transshipment. From this observation arises the awareness that the great infrastructures of Pasir Pajang and Tuas (in the future) may pave the way for new development. To confirm this, new partnerships are emerging in Singapore: companies like CMA-CGM and COSCO and the merged Ocean Network Express (ONE), have increased their corporate presence in Singapore. For instance, COSCO has expanded its joint-venture with PSA investing in a third berth at Pasir Panjang Terminal.
In addition, Singapore is diversifying its operations investing in Ro-Ro. Southeast Asia is very dispersed with islands everywhere, so you need to have a central point to collect all the car manufacturing, whether they come from Indonesia, or Australia, or Thailand. So Singapore became a business proposition, a hub for the Ro-Ro shipping lines.
Singapore is also investing in new port capabilities that will capitalise on emerging technologies arising from Industry 4.0. Tuas Port will be an efficient and intelligent port that harnesses data analytics to optimise operations such as just-in-time vessel arrivals and quicker port clearance.
The meetings and interviews also helped to outline the importance of the bunkering business. Oil is the most important sector in Singapore. If we take a closer look at fuel volumes of bunkering (ship refuelling), we notice that they reached over 50 billion tonnes in 2017. Fujairah, the second supplier, made up 12 million tonnes. Singapore's GDP is equal to $ 290 million, thus the value of bunkering covers 6% of GDP and this only depends on ships that pass through Singapore and refuel.
The leadership of Singapore in bunkering depends on the price of fuel, which is lower than in other ports due to the stiff competition among big players operating in Singapore. The low price on the route Asia-Europe through Suez determines the presence of a lot of ships

in Singapore and this has caused the developing of transshipment in Singapore.
If Singapore hadn't been so strong in bunkering, it would not have been so captivating. The development of one sector (bunkering) has determined the leadership also in another one (container transshipment) in a virtuous circle.
There are numerous factors that might affect the design of world routes chosen by carriers, and one of these is the price of oil, which has made this hub crucial in shipping.
The leadership of Singapore is based on both container and bunkering because, as we will show after, they are linked. The leadership of Singapore in bunkering depends on the price of fuel along the route Asia-Europe through Suez.
Three different types of ships call in Singapore:

- Containerships that wait for a place on a dock for loading and unloading containers, as a matter of fact, Singapore is a busy port thus there are waiting times;
- Ships anchored waiting for barges;
- Barges of refuel. In Singapore there are about 200 barges in the port (1/5 of the total ships present every day) functioning as floating refuel pumps.

The future challenge will be to become a "clean and green" reality, but this is also a global challenge. By 2020 there will be new IMO Sulphur regulations on fuel. Thus, after this time the old fuel cannot be used any more unless ship-owners install scrubbers on their ships. Unfortunately, this may cause higher prices for ship-owners that are currently using heavy fuel oil.
At the moment there are two possible solutions for ship-owners:

- The easiest solution – but also the most expensive – could be to switch to diesel fuel. A 100% increase of fuel price could put ship-owners budgets to the test. To understand the impact of such an increase, it must be underlined that fuel costs make up 40% of a ship-owner total costs. Furthermore, it is also unlikely that ship-owners will be able to discharge the cost increase on the final consumer. In addition, nowadays the maritime sector is suffering from oversupply and this will make competition even stiffer.
  Thus, great uncertainty comes from the enforcement of this measure because the gap in price between heavy fuel and LNG is huge. One solution could be that the enforcement will be done by the flag-government. Unfortunately, the fact that many vessels fly a different flag from that of their company creates confusion as to which state is supposed to subsidize the operation.
- The second solution could be the use of scrubbers which implies investments for $ 6/7 million on each vessel. This solution is cheaper than the first but after 1/1/2020 the availability of heavy fuel oil is uncertain.

At the moment, the option of using LNG is not feasible as this is not widely available to supply ships because there is not a supply network yet. It is likely that, once primary players of the Oil and Gas Market such as ExxonMobil, Shell, Chevron invest, second-tier companies such as Cosulich will follow.

Singapore is also the first place that has introduced the flow meter. When Singapore made it mandatory for fuel oil deliveries to be made using mass flow meters at the start of 2017, there were some concerns that demand would shift away, but a closer look at what happened in terms of volumes shows that shipowners welcomed the measure.

A summary of the highlights emerged from the interviews was noted in the following SWOT table:

Strengths	Weaknesses
Infrastructure, skills, equipment ready to handle megaships	Singapore is a small country that cannot count on internal demand to develop his business
Leadership in bunkering	
Diversification of activities also with Ro-Ro	
Planning of major investments in infrastructure, and in services in support of cargo	
Threats	**Opportunities**
Reduction in profit margins in case of oversupply of infrastructure	Container traffic growth
Growing role of China in Energy	Development of activities related to transshipment, which originates revenues and creation of new jobs
	Development of new trade, especially in the energetic field and Business of bunkering
	Hub role for Southeast Asia
	Increase of traffic thanks to the Belt and Road Initiative

The growth of investments may lead to an increase in traffic and international relations not only with Asia but also with Europe and Italy.

Relations between Italy and Singapore

Singapore and Italy share strong relations in several areas. Over than 4,000 Italian citizens live in Singapore. The Italian community is one of our largest in Asia, having almost doubled in the last five years.

The number of Italian companies in Singapore has increased reaching about 200. These companies operate in Shipping & Logistics, Banking & Insurance, Shipbuilding, Oil & Gas, Food &Beverage, Textiles and clothing.

In addition, Singapore is our first destination for exports in Southeast Asia[19] equal to 27% of total (2.2 billion euro in 2017). In 2017, 54% of this traffic was seaborne.

In 2017, the most exported products were Machinery (41%), Chemistry and Plastic (14%), Oil &Gas (17%), Textiles & clothing (9%), Automotive & Aerospace (5%), Food & Beverage (4%). One of the most important Italian companies, leader in the bunkering sector, is Fratelli Cosulich. They are also physical suppliers able to move about 250,000 tons of bunker per month.

Italy was Singapore's seventh-biggest trading partner in the European Union last year and the 39th-biggest trading partner globally.

Referring to the maritime sector, the bilateral relationship – measured through UNCTAD's LSBCI (Liner Shipping Bilateral Connectivity Index)[20] – has been growing in recent years. This index reached a peak in 2015 when it was 0.72 (maximum value=1), while it had a slight stop, which brought it to 0.64 in 2018 overall showing a trend growth. It testifies that the bilateral trade made between Italy and Singapore is high and is increasing too.

Not only is Italy increasing its presence in Singapore but the opposite is also happening.

Through PSA International Singapore has made investments in Italy that are rapidly increasing; in particular, in Genoa and Venice. As a result, PSA International now has sites on both the Adriatic and Tyrrhenian seas.

[19] Brunei, Cambodia, Indonesia, Laos, Malaysia, Burma, Philippines, Singapore, Thailand, Timor Leste, Vietnam.

[20] LSBCI includes 5 components. For any pair of countries A and B represented in our sample, the LSBCI is based on: 1) the number of transshipments required to get from country A to country B; 2) the number of direct connections common to both country A and B; 3) the geometric mean of the number of direct connections of country A and of country B; 4) the level of competition on services that connect country A to country B; 5) the size of the largest ships on the weakest route connecting country A to country B. All the components are normalized. For further information see UNCTAD's LSBCI.

Liner Shipping Bilateral Connectivity Index Italy-Singapore 2018

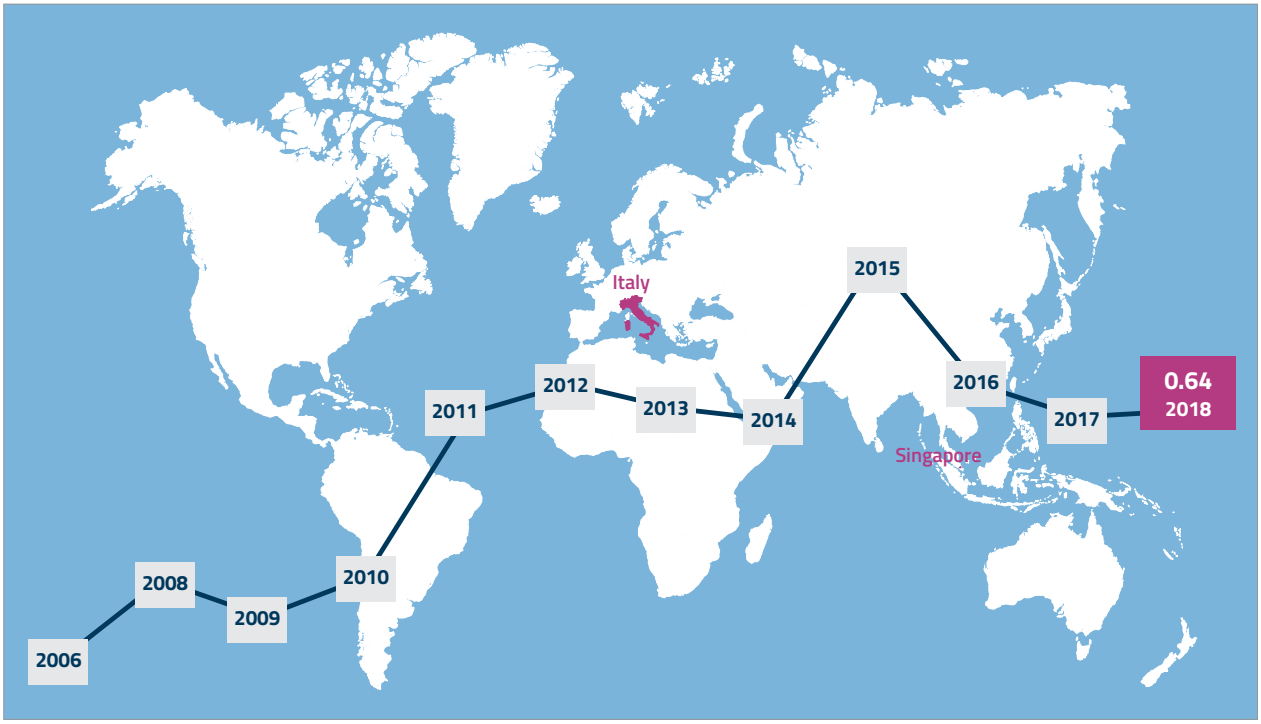

Figure 11 - Source: SRM on UNCTAD

The investments of PSA International in Italy

PSA Voltri-Pra, VTE, is the Port of Genoa's leading container terminal and ranks as the premier terminal in the North Tyrrhenian Sea. In 2017 it registered 1.6 million TEUs (+16.5% on the previous year) equal to 61.5% of total TEUs of the Port of Genoa.

PSA Voltri-Pra began operations in 1994. Located in the northwest of Italy, VTE is the gateway port for shipping lines serving the vast hinterlands of southern continental Europe. Far East services coming through the Suez Canal could consider Genoa Voltri as a natural access to Europe, using its intermodal connections to distribute their cargo directly to major central European destinations, instead of sailing an extra six days to Northern European ports.

Since 2015 a global expansion plan has been up and running, allowing PSA Voltri-Pra to develop a safer, more modern and efficient terminal. For these reasons in 2015 the company decided to invest more in the renewal of its equipment, purchasing new and modern ship-to-shore container cranes during 2016. The new cranes are part of a big investment plan worth 250 million euros.

One of the major characteristics that makes PSA Voltri-Pra a competitive Italian and European port is its geographically strategic position. The terminal is directly connected to the rail and road transportation system of Italy, which extends to all of Europe.

On the equipment front, VTE offers modern, efficient and specialised facilities which include 12 cranes including 8 super post panama quay cranes. This terminal has a designed capacity of 2.0 million TEUs.

Genoa's PSA Voltri Prà (VTE) Facilities

Container berths	4
Quay length (m)	1,433
Area (ha)	116
Max depth (m)	15
Quay cranes	12
Designed capacity (000 TEUs)	2,000

Table 4 - Sources: PSA International

Singapore has been interested in another terminal of Genoa called Calata Bettolo. As a matter of fact, in 2018, PSA Europe through Consorzio Bettolo, a joint group of Itaterminaux (65%, MSC-controlled) and Seber (35%, Gruppo Investimenti Portuali and PSA Europe), entered into an agreement with the Port of Genoa[21].

The Calata Bettolo terminal is expected to add some 750,000 TEU of annual capacity to the port of Genoa and – despite not being fitted with large ship-to-shore gantries but with mobile cranes – it will be able to handle megamax ships of 20,000 TEU.

PSA Venice administered by Vecon Spa (PSA International subsidiary) also known as Venice Container Terminal) is the main facility of the Port of Venice. Located in the north of the Adriatic Sea, it could be considered the gateway between Northeast Italy and the Mena Area.

PSA Venice

Container berths	5
Quay length (m)	852
Area (ha)	28.3
Max depth (m)	11.5
Quay cranes	5
Designed capacity (000 TEUs)	430

Table 4 - Sources: PSA International

[21] Alphaliner (2018), *Alphaliner Newsletter*, No 42/2018.

Conclusions

The paper highlighted how the Singapore hub managed to become a world leader, notwithstanding its reduced domestic demand capacity. The strong point of the port was undoubtedly its geographical positioning but also its capacity for governance able to plan and implement long-term infrastructure plans (the investment in Tuas for instance). Singapore owes its leadership to the fact that it has become a centre for petroleum storage and handling.

In addition, the development of financial activities (such as banking) also has contributed to the inflow of shipping activities to the Singapore port.

In this paper the central role of Singapore becomes clear as a hub of the Southeast Asian market in transshipment, bunkering and even Ro-Ro.

It is undeniable that the concerted efforts of the Singapore government, MPA and PSA added a much-renewed focus of the direction the port of Singapore has taken. In keeping with growing competition, PSA has gradually added value to its activities not only in regional perspective but also internationally. As such, its modern day success is attributable to its far fetching aims and the continuous thirst to develop technologically as well as to compete internationally.

Patterns of port calls have changed, leading to the emergence of the Singapore port being a 'hub' and the further growth of bunkering and refueling services.

Its presence along the Maritime Silk Road will increase the further development of the port thanks also to the growth and development of the surrounding economic areas.

In Singapore, Italian companies could create and use their synergies to address the challenges we have previously highlighted.

For all these reasons, Singapore as a maritime hub in Asia-Pacific seems to be the right place to be the site for the Italian maritime companies operating in the region. All the subsectors belonging to the global maritime industry are present in Singapore: Shipping & Logistics, Banking & insurance, Shipbuilding, Oil & Gas.

Strategic key points in Singapore

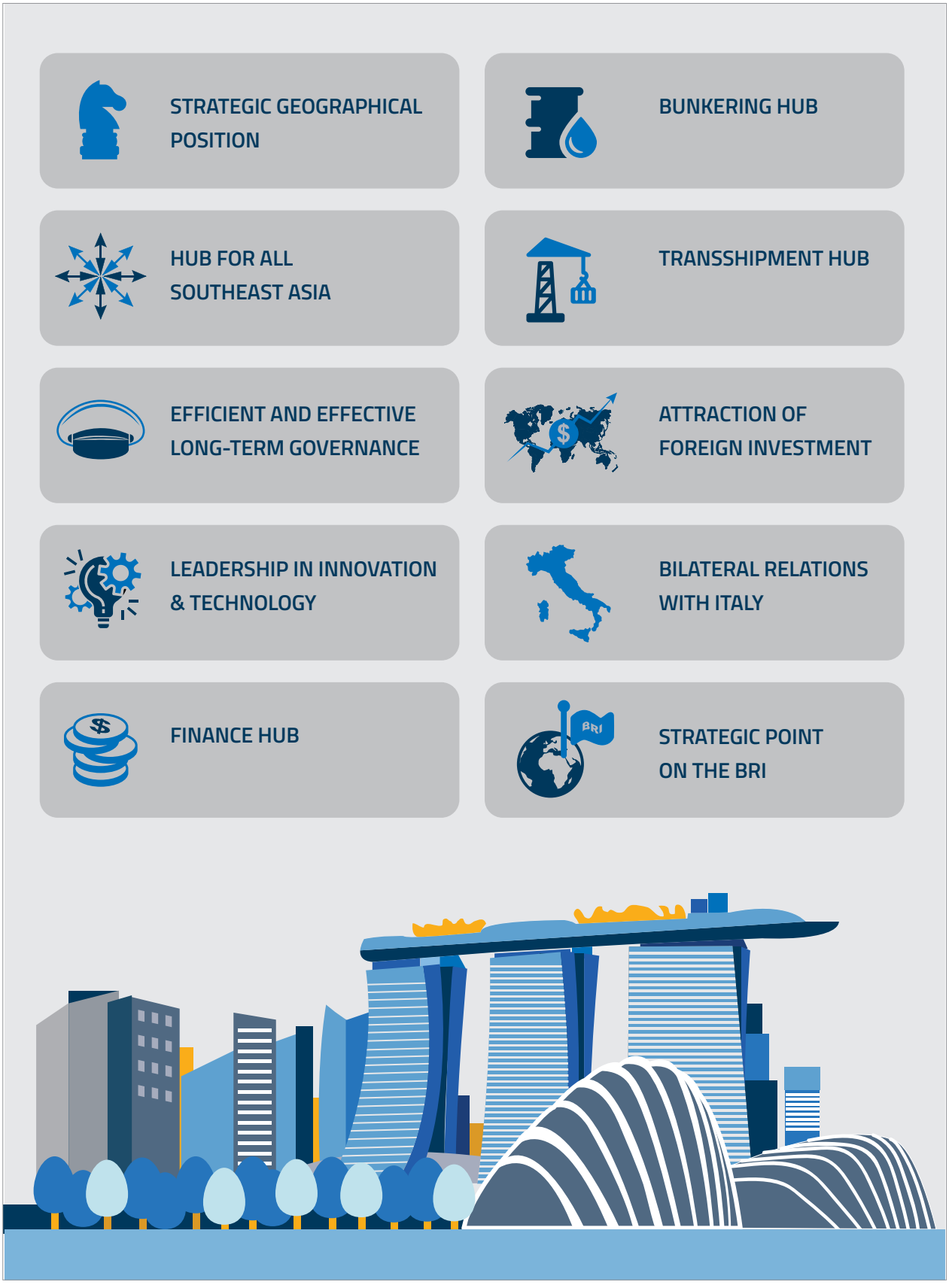

Figure 12 - Source: SRM

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