

DIGITALES ARCHIV

ZBW – Leibniz-Informationszentrum Wirtschaft
ZBW – Leibniz Information Centre for Economics

Book

Maritime cooperation in SASEC : South Asia Subregional Economic Cooperation

Provided in Cooperation with:

Asian Development Bank (ADB), Manila

Reference: (2019). Maritime cooperation in SASEC : South Asia Subregional Economic Cooperation.
Mandaluyong City, Metro Manila, Philippines : Asian Development Bank.

This Version is available at:

<http://hdl.handle.net/11159/3528>

Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)
<https://www.zbw.eu/>

Standard-Nutzungsbedingungen:

Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte.

<https://savearchive.zbw.eu/termsfuse>

Terms of use:

This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence.



MARITIME COOPERATION in SASEC

SOUTH ASIA SUBREGIONAL ECONOMIC COOPERATION

MARITIME COOPERATION in SASEC

SOUTH ASIA SUBREGIONAL ECONOMIC COOPERATION





Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO)

© 2019 Asian Development Bank
6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2444
www.adb.org

Some rights reserved. Published in 2019.

ISBN 978-92-9261-720-2 (print), 978-92-9261-721-9 (electronic)
Publication Stock No. SPR190418-2
DOI: <http://dx.doi.org/10.22617/SPR190418-2>

The views expressed in this publication are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent.

ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use. The mention of specific companies or products of manufacturers does not imply that they are endorsed or recommended by ADB in preference to others of a similar nature that are not mentioned.

By making any designation of or reference to a particular territory or geographic area, or by using the term “country” in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO) <https://creativecommons.org/licenses/by/3.0/igo/>. By using the content of this publication, you agree to be bound by the terms of this license. For attribution, translations, adaptations, and permissions, please read the provisions and terms of use at <https://www.adb.org/terms-use#openaccess>.

This CC license does not apply to non-ADB copyright materials in this publication. If the material is attributed to another source, please contact the copyright owner or publisher of that source for permission to reproduce it. ADB cannot be held liable for any claims that arise as a result of your use of the material.

Please contact pubsmarketing@adb.org if you have questions or comments with respect to content, or if you wish to obtain copyright permission for your intended use that does not fall within these terms, or for permission to use the ADB logo.

Corrigenda to ADB publications may be found at <http://www.adb.org/publications/corrigenda>.

Notes:

In this publication, “\$” refers to United States dollars.

ADB recognizes “Hong Kong” as Hong Kong, China; “China” as the People’s Republic of China; and “Ceylon” as Sri Lanka. The fiscal year (FY) of the Government of India begins on 1 April. “FY” before a calendar year denotes the year in which the fiscal year begins, e.g., FY2016 begins on 1 April 2016 and ends on 31 March 2017.

Cover design by Cleone Baradas.

CONTENTS

Tables, Figures, and Box	v
Foreword	vi
Abbreviations	viii
Weights and Measures	ix
Executive Summary	x
1 Introduction	1
2 SASEC Strategic Objectives and Operational Priorities	4
3 Overview of World Maritime Trade	9
3.1 World Trade Carried by Sea	9
3.2 World Container Trade	10
3.3 Major Container Operators	11
3.4 Container Ports	14
3.5 Connectivity	15
4 Overview of the SASEC Maritime Environment	17
4.1 Profile of SASEC Trade	17
4.2 SASEC Ports	21
4.3 SASEC Liner Connectivity	41
4.4 SASEC Cruise Liner Sector	43
5 Institutional Framework in the SASEC Maritime Sector	46
5.1 Bangladesh	46
5.2 India	47
5.3 Maldives	48
5.4 Myanmar	48
5.5 Sri Lanka	49

6	Current and Future Issues in the SASEC Maritime Sector	50
6.1	Supply–Shipping Lines	50
6.2	SASEC Port Performance	55
6.3	Port Interfaces	61
6.4	Information and Communication Technology Developments	63
6.5	Development of Port-Based Economic Complexes	68
6.6	Impact of the Cruise Sector on Freight Handling	68
6.7	Indication of Possible SASEC Port Development Priorities	70
7	Scope for SASEC Initiatives in the Maritime Sector	75
7.1	Information and Communication Technology and Port Community System	77
7.2	Legal and Regulatory Issues	79
7.3	Development of External Logistics Infrastructure	80
7.4	Environmental Issues—“Green Ports”	83
7.5	Development of the Cruise Sector	85
	References	86

TABLES, FIGURES, AND BOX

Tables

1	Key Container Trade Routes, 2017	11
2	Largest Container Ship Operators, 2017	13
3	Container Shipping Alliances	14
4	Major Container Ports, 2017	15
5	Liner Shipping Connectivity Index in South Asia, 2010–2018	16
6	Intra-SASEC Trade Routes, 2017	21
7	Indian East Coast Container Ports Throughput, FY2017	29
8	Container Services to SASEC Ports from Regional Hubs	43
9	Dimensions of Container Ships	53
10	Identified, Ongoing, and Future Port Development Projects in SASEC Subregion	71

Figures

1	World Seaborne Trade by Type of Cargo	9
2	Top Container Trade Routes	11
3	Market Share of Major and Minor Indian Ports FY2000–FY2016	27
4	Container Handling in Major and Nonmajor Indian Ports	28
5	Port Information Exchange and Transactions	65
6	Port Community System Information Exchange	66

Box

1	“Green Port” Policy at Long Beach, California, United States	84
---	--	----

FOREWORD

South Asia is one of the fastest growing subregions in the world. Its economic trajectory remains upbeat given the combination of resource advantages, dynamic demographics, and robust domestic demand it enjoys. Its growth is projected to surpass that of other subregions in Asia.

However, the subregion still faces the challenge of sustaining economic and trade growth that will ensure more equitable sharing of such growth across various sectors of society. Regional cooperation and integration is key to overcome South Asia's development challenges, including reducing poverty and attaining more sustainable and inclusive growth.

Since 2001, the South Asia Subregional Economic Cooperation (SASEC) program, a project-based partnership of South Asian countries, has been promoting regional prosperity by developing cross-border connectivity and facilitating more efficient trade among its members. The SASEC program has yielded substantial results in its areas of focus—transport, trade facilitation, and energy—improving transport infrastructure linkages, enhancing trade processes, and building power transmission connectivity, all of which are boosting intraregional trade and commerce.

With the maturing of the SASEC program, the countries recognize the need to also focus on maritime transport as the main means of conveyance of most of their trade—both intrasubregional and external. Five of the seven SASEC members conduct a major part of their international trade through ports, making maritime linkages vital contributors to development. Improving ports and port access has the biggest potential to improve South Asia's connectivity with Southeast Asia, a potentially huge and fast-growing nearby market.

The meeting of SASEC nodal officials and working groups held in Singapore in March 2018 endorsed the conduct of a study of the maritime sector, recognizing that maritime gateways provide the key links for SASEC economies to integrate with global markets. This report contains the findings of a preliminary study, which profiles the maritime sector of the SASEC countries and its linkages both within the subregion and with key external markets.

This report identifies the key issues and potential challenges for the sector, especially in terms of undertaking the needed legal and regulatory reforms and streamlining port customs operations. It recommends opportunities for SASEC cooperation in the sector. Based on practices in other parts of the world, such cooperation could include training, sharing know-how, and strengthening port community systems.

The completion of this maritime study coincides with ADB's recent launch of the *Action Plan for Healthy Oceans and Sustainable Blue Economies*, which underscores the importance of tackling marine pollution and improving sustainability in coastal and port infrastructure development.

Indeed, a robust maritime sector is essential in developing port cities and industrial centers and, ultimately, in strengthening value chains in SASEC with strong linkages to global markets via SASEC gateways and hubs. Moreover, the developmental impact of related SASEC projects, such as transport and trade facilitation initiatives, will be maximized by exploring potential synergies with the maritime sector.

I hope this publication will serve as a catalyst in further deepening and strengthening cooperation and integration between and among SASEC members, harnessing the maritime industry as an important instrument of South Asia's continued economic transformation as charted in the *SASEC Vision: Powering Asia in the 21st Century*.

Hun Kim

Director General, South Asia Department
Asian Development Bank

ABBREVIATIONS

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
ASYCUDA	Automated System for Customs Data
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
CFS	container freight station
CICT	Colombo International Container Terminals
CPA	Chittagong Port Authority
CTMS	container terminal management system
FCL	full container load
GDP	gross domestic product
ICD	inland container depot
ICT	information and communication technology
IT	information technology
KPI	key performance indicator
MHC	mobile harbor crane
PCS	port community system
PRC	People's Republic of China
PSA	Port of Singapore Authority
RTG	rubber-tired gantry
SAARC	South Asian Association for Regional Cooperation
SASEC	South Asia Subregional Economic Cooperation
TEU	twenty-foot equivalent unit
TOS	terminal operating system
UNCTAD	United Nations Conference on Trade and Development
US	United States

WEIGHTS AND MEASURES

dwt	deadweight ton
ft	foot
ha	hectare
km	kilometer
m	meter
MMT	million metric tons

EXECUTIVE SUMMARY

South Asia is one of the fastest growing regions in the world, with the economy showing resiliency despite global headwinds. Growth forecasts remain upbeat, with reforms underway to improve productivity and increase investment. According to the *Asian Development Outlook 2019* of the Asian Development Bank (ADB), South Asia is largely on track to meet growth projections—6.8% for 2019 and 6.9% for 2020. Trade is an important factor in achieving high annual growth. In 2018, it represented 42% of gross domestic product (GDP) in South Asia.

In terms of intraregional trade, South Asia remains one of the world's least integrated regions, with intrasubregional trade representing less than 5% of the total trade in the subregion, far lower than in other subregions such as the European Union (11%) and Association of Southeast Asian Nations (ASEAN) (over 20%). On the other hand, South Asia's trade with countries outside the subregion continues to perform well. This trading with distant markets dominates trade activities in the subregion.

The South Asia Subregional Economic Cooperation (SASEC) program has been actively promoting cooperation through projects designed to drive economic growth and benefit the poor. Developing connectivity between member countries has been the main emphasis within SASEC, having completed or under implementation 50 regional projects worth \$11 billion. As improvements in the SASEC road and railway network are gradually implemented, awareness of the need for cooperation and investment in the maritime sector grows, particularly given that the subregion's trade activities are dominated by trade with distant markets.

SASEC Strategic Objectives and Operational Priorities

Given the subregion's diversity in terms of geography, market size, and resources, regional cooperation is a key approach in achieving South Asia's overall development aspirations. The overarching goals of SASEC are to increase trade and economic cooperation within South Asia, create links with East Asia and Southeast Asia, and promote sustainable and inclusive economic growth through enhanced regional cooperation.

Although SASEC has focused on transport links within the subregion, it has now started to pursue improving its connectivity with markets outside the subregion. This approach has also enabled its connectivity agenda to be more aligned with the frameworks of the Bay of

Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and the South Asian Association for Regional Cooperation (SAARC), as the three subgroupings share a common goal of an integrated and prosperous Asia.

The strategic objectives set out in the *SASEC Operational Plan 2016–2025* represent a more comprehensive, outward-looking, and market-oriented approach. In the context of the maritime sector, the plan directed that these goals should be achieved through enhancing physical connectivity via multimodal transport systems (including the development of the main seaports) and adopting a comprehensive approach to transport and trade facilitation to complement intermodal investments.

Overview of World Maritime Trade

The importance of the maritime sector to international trade is demonstrated by the increased traffic being handled by seaports and carried by shipping. Since the turn of the 21st century, total seaborne trade has risen from an estimated 32 trillion ton-miles to over 55 trillion ton-miles by 2017. Current estimates show that 10.7 billion tons of cargo are being carried worldwide by ships annually, of which 60% is oil and bulk traffic and 40% is general and dry bulk. Containerization is now responsible for the movement of most general cargo. Estimates for 2017 traffic were 1.8 billion tons of cargo in containers with 752 million movements, of which 76% were loaded units and 24% were empties. In total, 26% of these movements involved transshipments.

Annual growth in tonnage by sea was 4% in 2017, much higher than in previous years. It is expected to continue to rise at an average of approximately 3.8% over the next 2–3 years, subject to the impact of possible trade sanctions. Following a modest expansion of only 1.9% in 2016, global containerized trade rose at a much faster rate of 6.4% in 2017.

Freight capacity had been increasing faster than demand, leading to an overcapacity situation. This impacted on freight rates resulting in fiscal problems for operators, particularly in the container sector. The higher growth in 2017 has led to a more balanced demand-supply environment, and hence profitability has returned in the short term. This overcapacity situation was being fueled by the introduction of larger vessels such as mega carriers (18,000+ TEU), combined with low scrapping levels.

The main container trade routes emanate from East Asia, particularly from Japan, the People's Republic of China (PRC), and the Republic of Korea, toward either North America or Europe. The Asia–Europe route passes close to Sri Lanka, thus enabling Colombo to become the main hub port for the SASEC subregion. The leading players are addressing the overcapacity situation through consolidation, mergers, acquisitions, and the development of alliances. There were nearly 20 major container operators in 2016, but this was expected to reduce to about 12 by the end of 2018. The top 10 operators are responsible for over 80% of the capacity on mainline routes.

All these major carriers have services to SASEC ports, either directly or via feeder services. The service levels to or from the hub ports depend on the demand for traffic

to or from the spoke ports. The SASEC ports are relatively small in the context of world container ports. Colombo ranks 23rd with 6.2 million TEU per annum, with the largest ports in India being Mumbai (33rd) and Mundra (34th). The subregion has relatively good connectivity with overseas markets via their hub ports, but has only limited numbers of longer-distance direct services.

Overview of the SASEC Maritime Environment

Intra-SASEC trade represents less than 5% of the subregion's international trade, significantly lower than many other subregions. India is SASEC's largest trade generator, but little of this is with SASEC countries. Based on trade value, the key intrasubregional maritime trade routes are expected to be India–Bangladesh, India–Sri Lanka, and India–Myanmar, though this may not necessarily translate directly into tonnage or container movements, as much of the India–Bangladesh trade uses the land transport route.

Colombo, the world's 23rd largest container port by volume, is SASEC's busiest container port, handling 6.2 million TEU in 2017. It is close to the busy Southern Ocean Corridor and acts as a container hub for the subcontinent. Its annual growth was 16.8% in 2017, and the transshipment activity, which represents almost 80% of handling, was up by over 20%. This high transshipment growth rate suggests its role as a hub for the subregion is increasing, despite more direct mainline calls to Indian ports.

In terms of connectivity and availability of shipping services, the Bay of Bengal is predominantly served by feeder vessels from container hubs at either Colombo or ports in the Strait of Malacca. The SASEC ports in the north and east are draft-constrained and unable to handle deeper draft mainline vessels. The ports along the eastern coast of India have been able to attract some middle-distance mainline vessels such as intra-Asia services, but most containers are still handled by feeder services. Despite this lack of direct services, SASEC is generally well served by these feeder services. There has been a gradual change from feeder vessels calling within a circuit voyage to more dedicated “hub-to-spoke” port services. No specific evidence suggests that SASEC countries are significantly disadvantaged by their continued high reliance on feeder services.

SASEC has a growing cruise liner sector, though it is still at an embryonic stage with approximately 100 calls per year at four main ports in 2017. SASEC cruise activities are highly concentrated in the east with calls at Yangon, principally by ocean cruise liners or intraregional cruises out of Singapore, while in the west the cruise activities tend to be concentrated around the Laccadive Sea. There is virtually no cruise activity on the west and north of the Bay of Bengal, other than the occasional ocean cruise calling at Chennai. Given the population and wealth generation in South Asia, the subregion is considered a prime target for the cruise industry, especially with the large numbers of new vessels scheduled to enter the market in the coming years.

Institutional Framework in the SASEC Maritime Sector

It is important to identify the institutional framework managing the maritime sector in each of the SASEC countries in order to assess their potential participation in any future SASEC sector cooperation initiative. The major institutional responsibilities in the maritime sector relate mainly to ports, as in many cases the government is the ultimate owner of the ports. In the context of future cooperation initiatives within SASEC, it is evident that the port situation varies significantly both within member countries and also between ports within each country. This suggests that any cooperation initiative should be at government departmental level rather than at individual port levels, unless the country has only one dominant seaport or a body that represents its major ports.

Current and Future Issues in the SASEC Maritime Sector

Supply of Services and Shipping Lines

Trade in the SASEC subregion is expected to continue to increase over the next 10–15 years. Maritime transport will remain the dominant transport mode in trade logistics throughout much of the SASEC subregion, as most trade is with distant countries, rather than between the member countries. Containerization can be expected to further dominate the non-bulk international trade with shipping companies increasingly employing larger vessels in order to benefit from the maritime economies of scale. The average size of container ships is anticipated to increase on almost all of the routes servicing SASEC trade, though there will be limiting factors such as traffic demand and draft.

Port Performance

There is increasing competition in port operations, particularly in relation to container-handling activities. The major container shipping lines and their alliances decide on the capacity to be deployed, the specific ports of call and the nature of their regional distribution networks. Ports will need to increasingly respond to the demands of these major customers by being able to offer enhanced performance by reducing ship turnaround times, lowering container dwell times, and ensuring better access to their hinterlands.

Levels of performance and the nature of constraints differ between ports, even between terminals within a port. Performance can be measured in the form of key performance indicators that can be used to identify constraints adversely impacting on facility utilization and operational performance. The three main areas covered by these indicators are the holistic performance of the port, individual wharf or terminal performance, and port facilitation, which relates mainly to cargo dwell times.

Most of the SASEC ports have significant trade imbalances with an excess of import containers over exports, resulting in the accumulation of empty units. In addition, most inbound full containers tend to be 20-foot (ft) units, whereas most outbound full units tend to be 40-ft units. Another key issue at many SASEC ports is gate congestion often caused by “bunching” of truck arrivals at the gate, the complexity of operations at the port gate, and external curfews on connecting roads. Congestion on these external roads is a major issue at city ports where port traffic streams leaving the port intersperse quickly with urban traffic, creating bottlenecks. The development of “last mile” dedicated access roads and more inland container depots and off-dock container freight stations are critical to achieving reduced dwell times in the port’s terminal yards.

Information and Communication Technology Developments and Port Interfaces

The application of information and communication technology (ICT) within the SASEC ports is growing. Most container terminals are managed by established international operators and as a result most terminals have some form of a terminal operating system, often linked to a container terminal management system.

A key party dictating terminal dwell times is the national customs organization. Each of the SASEC countries has now computerized their standard customs operations to a major degree. Residual issues are the continued necessity to provide substantial paperwork to support electronic submissions, the limited application of preclearances and risk management techniques, and the parallel use of both manual and automated systems.

The situation whereby two key parties—the terminal operators and customs—have advanced ICT systems is relatively common worldwide at ports with substantial container traffic. The problem is that there are many other players involved with the movement of cargo through the ports and not all of these parties have advanced information technology (IT) systems. Consequently, the optimum data exchange capability is not being realized, leading to multidata entries in both electronic and documentary formats.

Many major container ports have addressed the need for multidata transfer between the different organizations involved in the movement of containers through their ports by establishing a port community system. This is a modular system that seeks to connect the various players via an integrated IT platform. This approach reduces the need for multiple individual electronic data entries and associated paperwork, thereby enabling faster cargo clearances and improved planning of cargo handling operations. India is already testing a national port community system at Jawaharlal Nehru Port Trust (JNPT) Mumbai, and Chittagong and Colombo ports are engaged in developing similar community systems.

Legal and Regulatory Issues

Both the shipping and port sectors are subject to rules and regulations set out in national or international law, be it in the form of international conventions or national (or even state) regulations. These legal and regulatory aspects are needed to ensure conformance and, in certain cases, have been imposed to protect national interests. The shipping and port sectors have undertaken significant changes, especially with the expansion of the container sector and the introduction of advanced ICT and equipment technologies. In some cases, the changes or updating of rules and regulations have not kept up with the pace of change in the maritime environment and therefore potentially the existing legal and regulatory environment can potentially inhibit sector performance.

External Logistics Infrastructure

Port performance can be adversely affected by the quality and reliability of its inland logistics, particularly the movement of traffic outside the port gate, i.e., the linkage between the port and its hinterland. The closer to the port any logistical constraint is, the greater the adverse impact on the port, whereas further away, such constraints tend to be network-related rather than port-related.

SASEC has many city ports where the city has grown around the port and the port traffic directly interfaces with urban traffic near the port gate, resulting in external congestion. The optimal solution is usually to have a dedicated port access road that segregates the port and urban traffic to a point further away from the port gate, ideally connecting the port directly with the external highway network thereby avoiding adjacent urban roads. Conversely, some new “greenfield” ports suffer from poor direct connectivity to the core highway network. An additional issue impacting on port performance is the shortage of external processing facilities, such as off-dock container freight stations and inland container depots, needed to help reduce terminal dwell times by providing for the clearance of containers outside the port limits.

Environmental Issues

Environmental issues pertaining to port development, cargo handling operations, and infrastructure are expected to become increasingly important in the coming years. Ports are, in reality, major industrial complexes and, as such, should have clear environmental policies and strategies based on their specific situations and risks. At this stage, none of the SASEC ports have publicly available environmental policies and strategies. This situation does not suggest the ports do not recognize the importance of environmental issues, but possibly reflects that these issues may not be perceived as paramount and necessary in promoting and operating ports to the same extent as is happening in developed countries.

Impact of the Cruise Sector on Freight Handling

The development of the cruise sector can potentially harm freight handling performance at ports where dedicated passenger terminals are not available. Cruise liners have berthing priority, and therefore freight vessels may have to be moved off berths that are needed for processing passengers. The larger liners carry 2,000–5,000 passengers and often stay for only 1 day, and therefore processing needs careful planning and the availability of large open processing areas, such as those at container terminals. As more cruise liners call, conflict may increasingly arise between passenger and freight handling activities where passenger terminals are unavailable.

Some SASEC ports have invested in dedicated facilities and berths (Chennai), others rely on “tendering” (Malé) and the use freight berths (Colombo and Yangon). Funding of dedicated infrastructure is often particularly difficult due to the seasonal nature of the business and the relatively low number of calls per year. Projections as to how the sector will develop from its current embryonic stage are critical in assessing the need for and nature of future investments in passenger infrastructure at relevant ports.

Possible SASEC Port Development Priorities

The SASEC *Operational Plan 2016–2025* update identified 11 future port projects worth approximately \$9.9 billion. Future prioritization in the short term is based on infrastructure developments needed to address either existing problems or help resolve rapidly approaching constraints. The medium-term priorities are mainly about addressing the future demands of the container-handling sector, particularly with the trend toward more direct services and larger feeder vessels with deeper drafts.

Scope for Maritime Cooperation in SASEC

When considering the potential options for regional cooperation in the SASEC maritime sector, the focus is on the port rather than the shipping sector. This is because the scope for cooperation in the shipping sector is limited, particularly as it is dominated by foreign operators. There may be some scope for cooperation in developing shipping agreements covering such issues as coastal shipping and cabotage, but these are expected to be principally addressed through bilateral negotiations similar to the recent India–Bangladesh Coastal Shipping Agreement.

Regional cooperation between ports is already a well-developed feature in other parts of the world, especially in the spheres of training, exchange of local know-how, standardization of statistics and tariffs, and participation in the activities of regional or international port forums. Cooperation in the port sector can be grouped into three main types: institutional, industrial, and commercial. In relation to the possible development of a SASEC cooperation forum, the industrial cooperation model would be expected to have the most traction, even though participation would be predominantly at an institutional level.

Analysis of the SASEC maritime environment indicates there may also be potential scope for a SASEC technical assistance initiative covering areas of common interest, such as the following:

- a. Development of information and communication technology and port community systems

One area of possible cooperation could be the application of port community technologies at the SASEC ports. The initial stage could consist of an audit of the use of ICT by the diverse members of the port community and confirmation of the presence of terminal operating systems and transport chain management systems. The next stage would be to assess and quantify the potential benefits of installing a community system and providing initial awareness training on such systems. This could be followed by examining the potential future IT linkages between members of the port community and the form of IT architecture required.

India has recognized the value of such a system and is already undertaking trials. The situation whereby the SASEC country with the most ports is already committed to rolling out such a system suggests the potential for knowledge sharing. This knowledge sharing would enable the other member countries to make more informed decisions as to how, when, and where to develop their own applications.

- b. Legal and regulatory issues adversely impacting on subregional connectivity

Under a SASEC initiative, an audit could be undertaken to identify where national rules and regulations are potentially harming trade connectivity, particularly among SASEC countries, as well as with global trade partners. Given this wide remit, the audit should be restricted to the container shipping and port sectors. The objective would be to identify any legislation that has become a trade inhibitor due to changes in the market environment, highlighting the nature and impact of any constraints.

- c. Development of external logistics infrastructure

The Sagar Mala Program being promoted by the Government of India looks at ports from a more holistic perspective in relation to national economic development. The “last mile” and off-dock container freight stations (CFS) and inland container depot (ICD) facilities are essential components of the initiative, which also stresses the importance of investment in this type of external infrastructure to support and modernize the country’s port sector.

Other SASEC countries may not have adopted similar strategic approaches and consider external infrastructure developments on their individual merits, rather than having a direct linkage with port performance. Port development in isolation will not satisfy future traffic demand, particularly in the container sector, hence the importance of reviewing the need for supporting infrastructure, as in “last mile” road and rail linkages and more inland container depots and off-dock container freight stations.

d. Promotion of greening technologies for port operations

Planning and adopting “green port” strategies is complex, particularly as it has to reflect the specific situation of the port, the types of ships and cargoes that the port services, and its national legislative environment. Programs like the Environmental Management Information Systems applied in Europe could provide a structured approach to the development of robust “green port” policies and strategies.

Under a SASEC initiative, it may be possible to consider developing an environmental management system for SASEC ports by introducing the concept of “green ports” and its relevance in both a commercial and climate-changing market environment. It may also be able to undertake individual port audits, drafting of policies and strategies for port environmental statements, training in specific methodologies and tools toward developing “green port” status, and twinning with existing “green ports” in Asia.

e. Development of the cruise sector

The key issue is defining how the cruise sector will grow, especially in India, with it being the largest market. The cruise lines are continuously seeking to increase their ports of call, but this requires support from local tourist boards in identifying attractive shoreside excursions and ports providing suitable facilities to handle this type of vessels and process large numbers of passengers within a minimal time frame. The provision of dedicated passenger facilities at key ports is an attraction, but requires careful planning to justify such expenditure and ensure that cargo handling is not impeded by passenger ship growth.

A SASEC initiative could assist in this planning process by examining on the one hand how and where the future demand for cruising is expected in the subregion and on the other hand, what the port authorities and local tourist boards must do to attract cruise operators to use their ports. This two-dimensional approach is essential in identifying the scale and nature of future demand in the subregion and the planning of the responses necessary to attract cruise operators to increase their calls in the subregion.

1 | INTRODUCTION

South Asia continues to be one of the fastest growing regions in the world with economic growth projected to be 6.8% in 2019 and 6.9% in 2020, thus steadily regaining momentum after the global economic crisis. The Indian economy, with forecast growth of 7.2% in 2019 and 7.3% in 2020, predominantly drives this high subregional growth. The adjacent Southeast Asian region, which includes Myanmar, also continues to be buoyed by robust domestic demand, particularly for private consumption and investment, and is expected to achieve 6.6% growth in 2019 and 6.8% in 2020.¹

Trade in 2018 represented 42% of the gross domestic product (GDP) in South Asia and therefore is critical to maintaining these high levels of projected growth.² The ongoing friction with trade protection remains a potentially significant downside risk to South Asian trade growth. The challenge for South Asia is how to sustain such levels of economic and trade growth while also ensuring that the benefits of growth are shared across the spectrum of society.

Despite the impressive economic growth since 2011 in Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka, around 800 million people still live below \$3.10 a day. To elevate people out of poverty, the region must continue to create more jobs, raise industrial productivity, boost growth in their poorer regions, and address potential economic vulnerabilities. Increased trade is expected to be an important driver toward the realization of these goals.

Given the subregion's diversity in terms of geography, market size, and resources, regional cooperation is a key approach in achieving these goals. Since 2001, the South Asia Subregional Economic Cooperation (SASEC) program has been promoting such cooperation through projects designed to drive economic growth and benefit the poor. The current focus of the program has been on transport, trade facilitation, and energy. Road and railway networks are being upgraded and expanded to enhance connectivity between and within participating states. In parallel, policy, regulatory, and institutional reforms are being pursued to make trading easier.

SASEC is also addressing improvements in transport links outside the immediate subregion in cooperation with the South Asian Association for Regional Cooperation (SAARC) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation

¹ Asian Development Bank (ADB) (2019).

² World Bank. 2018 Data Statistics.

(BIMSTEC). The *SASEC Operational Plan 2016–2025*, which represents SASEC’s first comprehensive longer-term plan, guides this trade route enhancement within and to adjacent subregions. It builds on SASEC’s achievements since 2001 and expands the scope of regionally oriented investments that are closely aligned with the efforts of the SASEC countries. It clearly defines its current strategic objectives in transport and trade facilitation and energy, with a new focus on economic corridor development. Each strategic objective in the plan has a well-defined set of operational priorities, supported by a long list of specific projects identified by the SASEC countries. This project list is expected to evolve to meet changing needs and circumstances, with several hard and soft infrastructure projects. The Asian Development Bank (ADB) may support some of these in the form of technical assistance or loans.

In relation to transport, the main emphasis within SASEC has been on enhanced connectivity between member countries principally through the identification of investment needs and opportunities in the road and rail sectors (in terms of hard infrastructure). Investment in both hard and soft trade facilitation infrastructure has been undertaken to strengthen multimodal cross-border transport networks, which can assist in boosting the current relatively low levels of intraregional trade and opening up more trade opportunities with East Asia and Southeast Asia. Since 2001, SASEC has completed or has under implementation 50 regional projects worth \$11 billion in the energy, economic corridor development, transport, trade facilitation, and information and communication technology (ICT) sectors. The main hard investments in the transport sector have mostly been in the road sector, particularly in India, followed by rail, mainly in Bangladesh.

As improvements in the SASEC road and railway network are gradually implemented as part of the *SASEC Operational Plan 2016–2025*, there is a growing awareness of the need for cooperation and investment in relation to the trade-oriented nodes that link the maritime and surface transport modes (ports) and the shipping services that connect SASEC with their overseas markets. To date, SASEC has had limited investment in the port sector, other than a few projects in Bangladesh, Maldives, and Sri Lanka.³ Before the entry of Maldives and Sri Lanka in 2014, and Myanmar in 2016 to the SASEC program, the program was understandably focused on land-based connectivity, particularly in the northeast of the subregion. The inclusion of these two island economies and the weak land-based links with Myanmar have raised the importance of maritime connectivity within the program.

This report profiles the maritime sector in the SASEC countries and its links both within the subregion and with key external markets. It identifies the key issues and constraints and cites potential challenges in coping with the projected growth and changes in the shipping environment. It concentrates on the container market sector that handles the majority of international trade to and from the subregion. The bulk and semi-bulk shipping sectors are more complex and often relate to individual demand factors such as the presence of mines, oil refineries, oil storage distribution

³ ADB, Sri Lanka: Colombo Port Expansion Project; ADB, Maldives: Domestic Maritime Transport Project; and ADB, Bangladesh: Strategic Masterplan for Chittagong Port.

centers, power stations, etc. Even though the cruise sector is currently small, this has been included in the scope of this report since the sector has significant growth potential. The report suggests how SASEC might become more involved in the maritime sector and how this may be beneficial in promoting one of the core roles of SASEC as an enhancer of international trade to help combat poverty.

2 | SASEC STRATEGIC OBJECTIVES AND OPERATIONAL PRIORITIES

The agenda of the *SASEC Operational Plan 2016–2025* for the next decade was framed within the wider integration processes taking place in Asia. Although SASEC had focused on links within the subregion for most of its 15 years, it has now started to pursue transport connectivity with markets outside the subregion. This change is in part due to the addition of Maldives, Myanmar, and Sri Lanka, significantly increasing the geographical size of the subregion. This extended approach has also enabled its connectivity agenda to be more aligned with the frameworks of SAARC and BIMSTEC, as the three subgroupings share a common aspiration for an integrated and prosperous Asia.

SASEC's role in these wider integration processes required definitive strategies to move economic cooperation to the next level. The strategic objectives set out in the *SASEC Operational Plan 2016–2025* represented a more comprehensive, outward-looking, and market-oriented approach. The pipeline of projects, many of which were drawn from the *SAARC Regional Multimodal Transport Study* and the *BIMSTEC Transport Infrastructure and Logistics Study*, were revisited, aligned, and supplemented with projects reflecting the emerging needs and priorities of the SASEC countries, resulting in a more robust project pipeline directly addressing the plan's operational priorities.

The overarching goals of SASEC are to increase trade and economic cooperation within South Asia, create links to East Asia and Southeast Asia, and promote sustained and inclusive economic growth through regional cooperation. In the context of the maritime sector, the plan directed that these goals should be achieved through the following key strategic objectives:

- (i) enhancing physical connectivity through multimodal transport systems that are aligned more closely with the development of markets, including further improvement of the main ports; and
- (ii) following a comprehensive approach to transport and trade facilitation that expands from land-based to seaborne facilitation, thereby complementing investments in multimodal networks.

The plan recognized that transport demand in South Asia would increase substantially, given the positive economic growth outlook for the subregion with rising incomes, increased consumption, and further demand for travel. Expanded trade and increased participation of enterprises in global value chains would inherently generate additional trade and increased demand for transport services. Before 2016, transport systems in the SASEC countries had largely developed within a national context, with limited consideration given to cross-border and third-country connectivity. The need to widen

the focus was further emphasized by the addition of two island economies, almost totally dependent on the maritime mode for their international trade, and by the reliance of the landlocked SASEC countries on trade through select ports in India. The overall low level of intrasubregional trade highlighted the requirement to consider trade in a more holistic context (both internal and external trade) and the development of port infrastructure as a conduit to facilitating overall trade growth.

The operational priorities for transport for the next 10 years in the SASEC operational plan included focus on:⁴

- (i) enhancing multimodal linkages for land-based transport through improved road conditions, additional capacity along the major trade routes, and better rail connectivity; and for maritime transport through the development of deep-sea ports and reduction in container dwell times;⁵
- (ii) improving access to, and reducing congestion at, border-crossing points and ports; and
- (iii) improving the subregion's logistics infrastructure.

The first transport operational priority is to improve the quality of the SASEC road network, recognizing that roads will continue to be the dominant transport infrastructure throughout the subregion. Handling about 70% of the freight movements in the subregion, road transport represents the primary means of not only domestic connectivity but also the conveyance of intraregional and external trade, either directly through land borders or via their intermodal connectivity to the seaports. It proposes that emphasis should be on upgrading the road network along the major trade routes in the SASEC subregion to handle the growth in demand for transport services and expanded trade both within the region and beyond.

This objective is to be achieved by upgrading key SASEC trade routes to Asian Highway Class I standard (dual carriageway) wherever possible and improving important feeder roads to these primary corridors. The development of a more comprehensive regional route network based on trade demand will help extend the catchment areas of key ports and facilitate the opening of potential new trade routes. This upgrading will specifically address the need for improving connectivity to the ports where necessary. This close external link is commonly referred to as "last mile" connectivity. Improved access roads connecting the ports directly with adjacent national highways are needed to take the port traffic quickly and efficiently to or away from the port gate.

The second transport operational priority is to improve rail connectivity in SASEC. The main emphasis is on addressing any capacity constraints on the railway networks in Bangladesh and India through the provision of additional track, locomotives, freight wagons, signaling, and gauge conversion. A specific note was made of the need to improve rail connectivity between the landlocked countries and the Indian seaports, and between the northeastern states of India and the sea, as well as to

⁴ ADB (2016).

⁵ Dwell time is the average time a container spends within the port area.

generally enhance rail connectivity between the subregion's main ports and their national hinterlands.

The third transport operational priority is to develop port infrastructure to enable the efficient handling of the subregion's maritime trade and expand their capacity to cope with the anticipated growth in container traffic. The plan recognizes that maritime transport plays an increasingly important role in trade logistics in most of the subregion with the major SASEC ports dealing primarily with trade outside of SASEC, as trade among SASEC countries remains relatively small. Most ports are predominantly oriented toward serving their limited hinterlands and sometimes fail to consider the opportunities from regional collaboration. Some ports are poorly equipped and congested, with low operating performance, and have limited extra capacity to meet the projected growth in container traffic.

The operational focus in addressing this priority is on two main areas:

- (i) Developing deeper water ports to handle larger, deeper-drafted vessels, especially at the northern end of the Bay of Bengal: The demand for deep draft ports is principally related to shipment of bulk cargoes, both liquid and dry, and large container ships; and
- (ii) Reducing dwell times at SASEC ports by augmenting port operating efficiency, promoting direct delivery of noncontainerized cargo from the hook point, and enhancing container-handling equipment: Some SASEC ports continue to rely on geared container vessels (ships with their cranes), which are more difficult and slower to handle than gearless vessels that can benefit from land-based ship- or shore-handling equipment.

The fourth transport operational priority is to promote coastal shipping and inland water transport to handle more international trade. The focus is on improving navigation conditions on the waterways, providing additional infrastructure, and engaging in a significant regeneration of the waterways. More importantly, it highlights the need to develop coastal shipping services between SASEC countries.

The trade facilitation component in the operational plan focuses on removing barriers to the international movement of goods as a means of lowering trade costs, both at land borders and ports, to make the member countries more competitive in regional and global markets. It recognizes that bottlenecks in trade facilitation lead to the presence of nontariff barriers constraining trade in the SASEC subregion. The trade facilitation objective in the operational plan is to make cross-border trade and transport faster, cheaper, and more predictable, while maintaining the security of the supply chain and ensuring the effectiveness and efficiency of the institutions involved. The trade facilitation component is based on a dual-track approach whereby issues of common interest affecting the subregion are to be considered at the SASEC or subregional program level, while initiatives addressing the unique circumstances and requirements of individual countries are to be pursued at the national level.

The first trade facilitation operational priority is to simplify trade documentation, increase automation, and expedite border and port clearance procedures to facilitate the movement of goods and vehicles. This objective is to be achieved by reducing the overall number of trade documents and copies required to undertake import or export clearances and applying advanced procedures and practices based on international standards and conventions designed to expedite border and port clearances. This will require the use of the processing capacity of advanced customs ICT systems in accelerating clearances, linking the respective ICT systems to all primary and secondary land borders and ports, increasing the application of ICT in the movement of transit cargo, and promoting the overall electronic exchange of data.

The second trade facilitation operational priority is to promote automation in border agencies and facilitate the development of national single windows (NSWs) by maximizing their links with all border agencies and the wider trading community. This objective is to be achieved by promoting automation in other border agencies to enable them to link to the NSWs and assisting in the development of NSWs with connectivity to all the key border agencies and stakeholders. The third trade facilitation operational priority is to assist in strengthening national conformance bodies and developing infrastructure and facilities in sanitary and phytosanitary and other border agencies to help standardize testing and certification, enable the establishment of NSWs, and explore the expansion of mutual recognition agreements. The fourth trade facilitation operational priority is to develop and implement through transport motor vehicle agreements to reduce the levels of border transshipment.

The fifth trade facilitation operational priority is specifically aimed at the maritime sector through developing trade-related infrastructure at SASEC ports, including “last mile” approaches, ICDs, and bonded logistics facilities adjacent to land borders and in the major centers of trade. The plan recognizes the need to improve port operations to support the development of multimodal transport systems in SASEC and to reduce the container dwell times that result in increased transaction costs. The modern trend in import cargo clearance is increasingly to shift the clearance from the port of entry to inland locations such as ICDs and bonded warehouses, closer to the centers of demand where the consignees and consumers are based. This approach facilitates trade as the clearance process happens away from the port, therefore reducing terminal congestion.

The proposed actions to address this priority include the following:

- (i) improving port logistics and facilities for the efficient handling of cargo in the major SASEC ports;
- (ii) resolving nontariff barriers within the port environment to reduce port dwell times and enhancing port facilitation;
- (iii) improving road and rail infrastructure connectivity at the port interfaces;
- (iv) modernizing ICDs and developing new ICDs and bonded logistics facilities in major trade centers or at border crossings;
- (v) developing effective inland transit systems to facilitate the use of ICDs and bonded logistics facilities for clearance purposes;

- (vi) creating a policy framework to support the private sector provision of infrastructure services in partnership with the governments to develop and manage clearance and logistics facilities; and
- (vii) building capacity to support the use of modern techniques and international best practices and enhancing regional cooperation and coordination mechanisms among stakeholders involved in trade facilitation, including those involved in the maritime sector.

This last approach is considered to be the most important given the wide-ranging SASEC trade facilitation agendas that require overarching support in terms of enhanced cooperation and coordinating mechanisms involving intergovernmental bodies, regulators, and private sector stakeholders; the delivery of responsive services to trade; and capacity building. The capacities of concerned agencies may need to be strengthened so that they can effectively meet the demands of new systems and processes. Institutional frameworks at the national and subregional levels may require enhancement to deliver the broad range of trade facilitation initiatives involving:

- (i) capacity building in modern techniques and the application of international best practice, focusing on skills development linked to the organizational and operational changes needed to implement international conventions, agreements, and systems;
- (ii) effective use of the SASEC working group and any subgroups to ensure that initiatives are well executed and are generating concrete and beneficial results;
- (iii) promotion of committees dealing with trade facilitation for cooperation and coordination with the private sector;
- (iv) establishment of trade information portals for enhanced transparency of trade information; and
- (v) creation of client service centers or help desks to improve trade information and services and increase transparency and responsiveness.

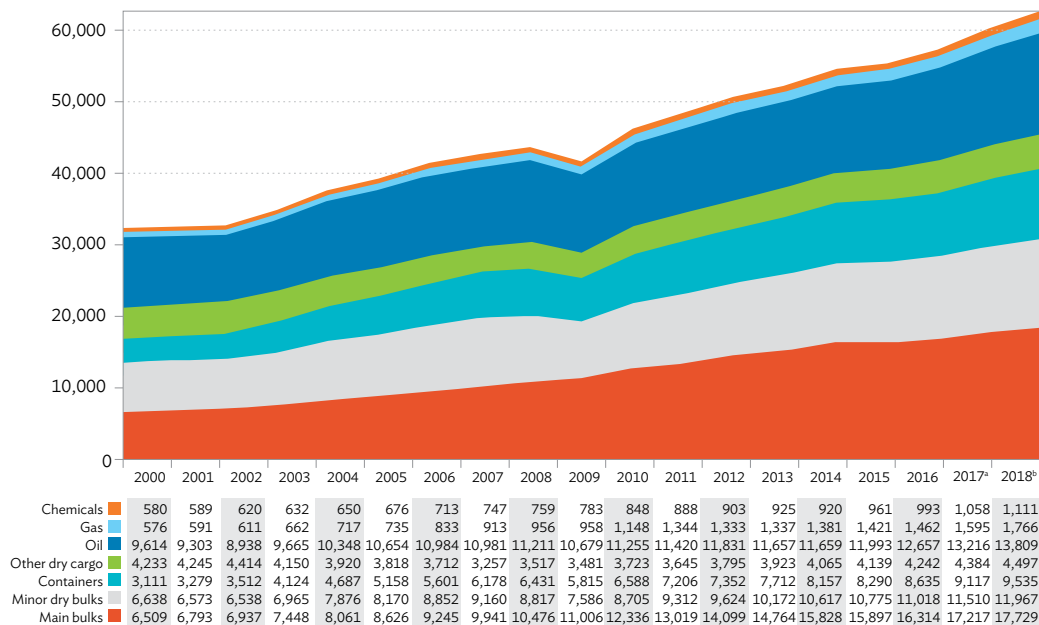
All of the mentioned priorities in the *SASEC Operational Plan 2016–2025* represent the strategic framework within which this report examines the SASEC maritime sector in relation to connectivity, port development, and the identification of potential roles for SASEC in promoting effective and beneficial coordination within the sector.

3 OVERVIEW OF WORLD MARITIME TRADE

3.1 World Trade Carried by Sea

The importance of the maritime sector to international trade is demonstrated by 80% of global trade by volume and more than 70% by value being carried on board ships and handled by seaports worldwide. Shipping trade estimates are often calculated in ton-miles as a way of measuring the volume of trade. Since the turn of the 21st century, total seaborne trade has risen from an estimated 32,000 billion ton-miles to over 55,000 billion ton-miles in 2017 (Figure 1). Current maritime traffic (2017) is around 10.7 billion tons per annum, of which 60% is oil and bulk cargoes and 40% other dry cargo. Containerized cargo represents approximately 1.84 billion tons of cargo and accounts for 17% of overall sea trade.

Figure 1: World Seaborne Trade by Type of Cargo
(billion ton-miles)



^a Estimated.

^b Forecast.

Source: United Nations Conference on Trade and Development (UNCTAD) (2018).

Shipping is particularly susceptible to economic downturns, so the contraction in trade, following the beginning of the credit crunch in late 2008, translated into reduced demand for shipping, as shown in Figure 1. Before 2008–2009, annual growth had been approximately 3.0%. Since 2010, the annual growth rates have been slightly less (2.8%) during the recovery period following the global financial crisis, but rose sharply to 4.0% in 2017 following 2 years of historic lows. The longer-term outlook for the industry remains positive in terms of traffic growth, reverting closer to 3.8% per annum up to 2023, although this could be adversely affected if all the projected trade tariff increases being discussed were to be implemented, hitting trade flows, particularly as the People’s Republic of China (PRC) trade represents a significant percentage of world trade movements. Nevertheless, the world’s population is expanding, and emerging economies continue to increase their requirements for the goods and raw materials being transported by sea. Shipping, being the most fuel-efficient and carbon-friendly form of commercial transport, should work in favor of an even greater proportion of world trade being carried by sea.

Despite this positive outlook for trade growth, the shipping industry has been experiencing significant problems due to recent overcapacity. The growth rate in the capacity has been faster than demand and this has resulted in lower freight rates and earnings. Overall, new ships are becoming larger and bringing more capacity onto the market. However, in 2017, the overall fleet expansion rate fell to 3.3%, appreciably less than the 4.0% trade growth. This decline in fleet expansion has resulted in capacity and demand becoming more balanced, thus supporting improved freight rates and earnings for shipping companies.

3.2 World Container Trade

Following a modest expansion of only 1.9% in 2016, global containerized trade rose at a much faster rate of 6.4% in 2017, with total volumes attaining an estimated 142 million twenty-foot equivalent units (TEU),⁶ approximately 76% were loaded units and 24% empties. This recovery has been mainly fueled by volume growth in the Asia–Europe trade, where volumes had contracted in 2016. Other contributing factors were accelerated growth in intra-Asian cargo flows and positive trends on the trans-Pacific route. In addition, there was significant restocking of supply chains following the 2016 low growth. Together, these developments contributed to raising containerized trade volumes, and growth in overall container traffic is expected to rise as high as 4.7% per annum during 2018–2019 and 4.5%–5.5% annually up to 2023.

Table 1 shows the main container trade routes worldwide. All of the volume routes tend to emanate from East Asia, which are dominated by the East Asian routes to and from North America and Europe. The importance of the sea routes passing between Sri Lanka and Maldives, sometimes referred to as the Southern Ocean Corridor, is shown clearly in Figure 2 and explains why Colombo has become the key hub port for the subregion.

⁶ UNCTAD (2018).

Table 1: Key Container Trade Routes, 2017
(in '000 TEU shipped)

Route	Westbound	Eastbound	Total
Asia–North America	7,490	19,482	26,972
Asia–Northern Europe	9,924	5,139	15,063
Asia–Mediterranean	5,504	2,409	7,913
Northern Europe–North America	3,284	2,120	5,404

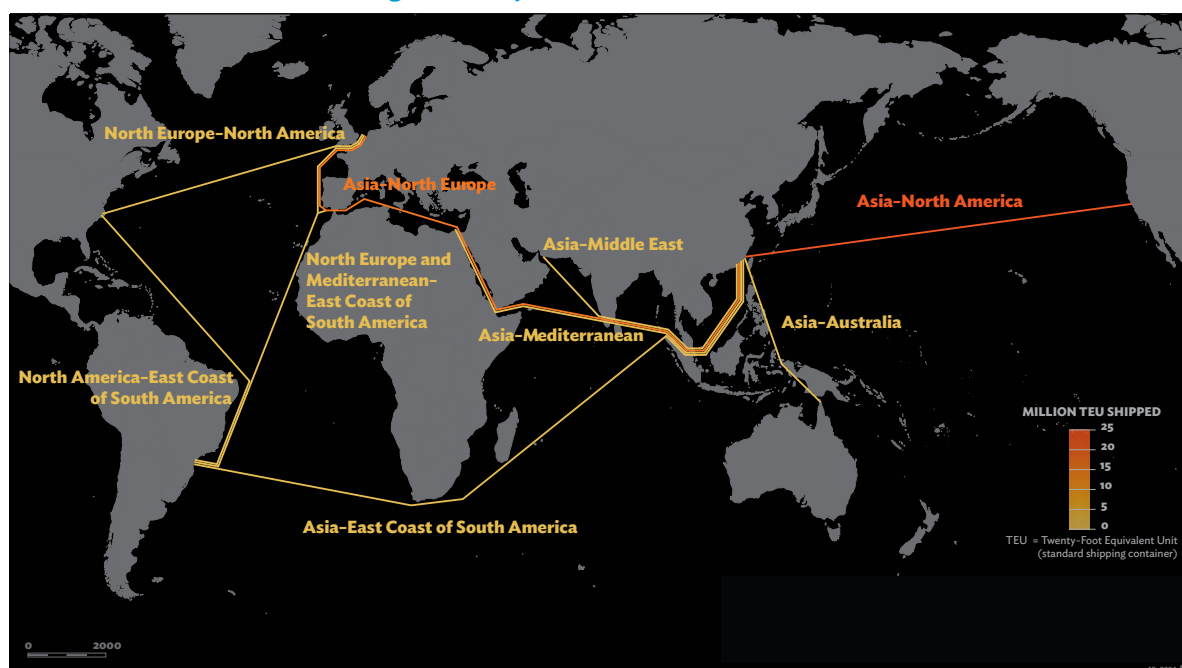
TEU = twenty-foot equivalent unit.

Source: World Shipping Council. Trade Routes. <http://www.worldshipping.org/about-the-industry/global-trade/trade-routes>.

3.3 Major Container Operators

As indicated in sections 3.1 and 3.2, the supply of ship-carrying capacity has in recent years increased faster than the demand, leading to a continued global overcapacity and downward pressure on freight rates and earnings. This issue was particularly relevant in the container sector where the lower demand and high overcapacity environment, on the one hand, constrained freight rates and, on the

Figure 2: Top Container Trade Routes



Note: The points represent the country stoppages along the route and not specific ports. The boundaries, colors, denominations, and other information shown on this map do not imply, on the part of the Asian Development Bank, any judgment on the legal status of any territory or area, or any endorsement or acceptance of such boundaries, colors, denominations, and information.

Source: Geopolitical Futures (2016). Top Container Ship Trade Routes. <https://geopoliticalfutures.com/top-container-ship-trade-routes/>.

other, dampened carrier profitability. The troubles experienced by the liner shipping industry since 2008–2009 have demonstrated the fiscal difficulties for the sector in adapting to a situation where trade flows were growing at a slower pace than GDP. Where the market is oversupplied, operators have been increasingly turning to consolidation and rationalization to optimize capacity utilization and reduce costs. In 2016, average global demand was estimated around 20 million TEU at any one time, whereas capacity was probably closer to 22–23 million TEU. Given the faster traffic growth in 2017, the market has now become more balanced, and major operators have achieved \$7 billion in profits after incurring losses in previous years. Initial indications were that, in 2018, profits would fall due to an element of overcapacity reoccurring.

Given the projected growth in world shipping demand and the need to manage the level of supply, operators are expected to continue to adopt measures to support improved market fundamentals and prop up freight rates. However, for these to materialize, ship supply overcapacity should be reduced by building fewer ships and increasing scrapping levels and capacity sharing, for example, through operating alliances. The recent mergers and partnerships among major container carriers have helped support improved handling of supply and better fleet utilization, which in turn have helped reverse the container shipping sector's adverse financial situation.

In 2016 and the first half of 2017, the container shipping sector underwent consolidation through a series of mergers and acquisitions (M&A) and the exit of Hanjin, a major container shipping company, that filed for bankruptcy protection. The advent of mega container ships has escalated consolidation activity and the formation of new and larger shipping alliances, thus altering the overall liner shipping dynamics and forces. It remains unclear whether this is a temporary cyclical development or a more permanent structural shift. Evidence of such consolidation through M&A has shown that while there were around 20 major container ship operators in 2016, this number was expected to reduce to approximately 12 by the end of 2018.

All of the major operators have services to and from the SASEC subregion, either directly or via feeder ships or slot charter arrangements. There are almost 70 shipping lines operating fully-cellular container ships in the container shipping industry, but more than 80% of fleet capacity is controlled by only 10 of them. The global market is highly concentrated on a few major players, as shown in Table 2.

The relative market share of each of the major carriers can be assessed by their capacity on offer. While there is no direct relationship between capacity on offer and overall market penetration in terms of units transported, there is an indirect relationship as operators generally only provide sufficient capacity to meet traffic demand.

Based on capacity on offer the largest container operator is Maersk Line. With its acquisition of Hamburg Süd in December 2017, Maersk is now much larger than its alliance partner Mediterranean Shipping Company (MSC). It now is estimated to have a global capacity share of 18.0% compared with MSC share of almost 14.6%.

Table 2: Largest Container Ship Operators, 2017
(based on capacity on offer)

Ranking	Operator	TEU	Share of Total Fleet Capacity (%)
1	APM-Maersk	4,157,575	18.0
2	MSC-Mediterranean Shipping Company	3,374,930	14.6
3	COSCO	2,890,694	12.5
4	CMA – CGM Group	2,685,041	11.6
5	Hapag-Lloyd	1,700,677	7.4
6	ONE (Ocean Network Express)	1,538,274	6.7
7	Evergreen	1,272,845	5.5
8	Yang Ming Transport Corporation	643,180	2.8
9	Hyundai MM	424,566	1.8
10	PIL-Pacific International Line	391,831	1.7
Total		19,079,613	82.8

TEU = twenty-foot equivalent unit.

Source: Alphaliner. Top 100 Container Ship Operators.

The cycle of consolidations and M&A continues with Orient Overseas Container Line becoming part of China Ocean Shipping Company in 2018; with their combined capacity now rising to around 12.5%. CMA-CGM and Hapag-Lloyd have 11.6% and 7.4% shares respectively. In April 2018, the container divisions of Nippon Yusen Kaisha, Mitsui O.S.K. Lines, and Kawasaki Kisen Kaisha merged, forming a joint venture called Ocean Network Express; with their combined capacity share being estimated to be 6.7%. Over the last 4 years, the largest 10 container lines have seen their combined market share increase to 82.8% of all container traffic.

The previous adverse fiscal environment for operators has encouraged the development of shipping company alliances. These alliances are intended to promote capacity cooperation by joint scheduling, slot chartering on each other's vessels, and enhanced service coverage emanating from their combined resources. The three major alliances are shown in Table 3. They account for nearly 80% of the global container market, leaving 20% for smaller global and regional carriers.

These trends could alter the bargaining powers between these large carriers and shippers, and potentially have negative implications in terms of higher freight rates and reduced competition. The alliances may alter their networks and areas serviced by their existing port calls at short notice.⁷ Ship upsizing and cascading of capacity also continues to affect containerized trade. For example, the opening of the expanded Panama Canal locks has already created a shift in ship deployment

⁷ UNCTAD. 2017. *Review of Maritime Transport 2017*. https://unctad.org/en/PublicationChapters/rmt2017ch1_en.pdf.

Table 3: Container Shipping Alliances

Alliance	Participants	Service Offerings
2M	Maersk, MSC	223 ships with a capacity of around 2.4 million TEU operating 25 weekly services globally covering 1,327 port pairs
Ocean Alliance	CMA-CGM, COSCO, OOCL, Evergreen	323 ships with a capacity of around 3.5 million TEU operating 40 weekly services globally covering 1,571 port pairs
THE Alliance	Hapag-Lloyd, NYK, Yang Ming, MOL, K-Line	241 ships with a capacity of around 3.3 million TEU operating 32 weekly services globally covering 1,152 port pairs

TEU = twenty-foot equivalent unit.

Source: Alphaliner: The Worldwide Reference for Liner Shipping.

patterns that impacts on overall seaborne trade. The 150 container ships previously on the Asia–East Coast North America route have been replaced by 40 larger vessels capable of transiting the new canal. This trend results in larger vessels cascading down onto secondary trade routes, and this can impact on the traditional balance between transshipment and direct call patterns. This same trend can be expected to continue as carriers aim to limit the numbers of ports of call made by their mega ships due to the high costs and delays involved in making any additional stops.

As these changes take place, regulators may need to monitor developments to ensure the retention of adequate competition in the market. It may also be necessary to revisit the rules governing consortiums and alliances to determine whether these would require revised regulation, balancing the interests of shippers, ports, and carriers to prevent potential market power abuse. In the past, the PRC took action when it considered that earlier alliances could reduce competition and adversely affect their trade interests. It was noted that rates increased significantly in early 2017 during the consolidation period, although they fell later in the year.

3.4 Container Ports

About 752 million TEU were handled through world ports in 2017. Figure 2 identified the major trading routes for container shipping, clearly showing the concentration of major routes on East Asia. This concentration is reflected in the volumes of traffic handled at East Asian ports (Table 4), particularly in the PRC. Seven out of the largest 10 container ports in the world are in the PRC, hence the concern of the major shipping lines if the implementation of United States (US) tariffs were to impact on the demand for exports from the PRC to the US.

The principal port in South Asia is Colombo (ranked 23rd in the world). With a geographical position adjacent to the East Asia–Europe, Mediterranean, Middle East corridor, Colombo is the ideal hub port to serve South Asia. Other key hub ports for the

Table 4: Major Container Ports, 2017

No.	Port	Country	Region	Throughput '000 TEU
1	Shanghai	PRC	East Asia	40,230
2	Singapore	Singapore	Southeast Asia	33,670
3	Shenzhen	PRC	East Asia	25,210
4	Ningbo	PRC	East Asia	24,610
5	Busan	Republic of Korea	East Asia	21,400
6	Hong Kong, China	PRC	East Asia	20,760
7	Guangzhou	PRC	East Asia	20,370
8	Qingdao	PRC	East Asia	18,260
9	Dubai	UAE	Arab Peninsula	15,440
10	Tianjin	PRC	East Asia	15,210
12	Port Kelang	Malaysia	Southeast Asia	12,060
19	Tanjung Pelepas	Malaysia	Southeast Asia	8,330
23	Colombo	Sri Lanka	South Asia	6,200
33	Mumbai	India	South Asia	4,830
34	Mundra	India	South Asia	4,240

PRC = People's Republic of China, TEU = twenty-foot equivalent unit, UAE = United Arab Emirates.

Source: World Shipping Council. Top 50 World Container Ports. <http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports> (accessed 19 November 2018).

subregion shown in Table 4 are Singapore, Port Kelang, and Tanjung Pelepas. The largest container ports in India are on the west coast (outside the SASEC subregion). No SASEC port, other than Colombo, is in the top 50 world container ports. Chattogram (Chittagong), handling 2,808 TEU, is the second largest SASEC container port.

3.5 Connectivity

The World Bank indicated that “maritime transport connectivity and logistics performance are very important determinants of bilateral trade costs: in some specifications, their combined effect is comparable to that of geographical distance. Improved liner shipping connectivity can help reduce trade costs and has a direct, positive bearing on trade volumes.”⁸ Containerization is particularly crucial because it links the manufacturer or producer with the ultimate consumer or customer, even if their trade transaction would not economically justify chartering a ship. The network of regular container shipping services with their transshipment operations at their hub ports connects all coastal countries. Despite the growing participation of developing countries in seaborne trade, evidence on maritime connectivity suggests that these countries, except for a few like the PRC, may not have reached their full potential.

⁸ UNCTAD (2017).

In terms of direct connectivity, less than 20% of coastal country pairs have a direct maritime connection, meaning that containerized goods can be transported between the country of origin and destination without the need for transshipment. “The average number of direct maritime connections is half as high in developing countries as developed ones” (footnote 8). Because there is not enough demand, or due to the poor connections restricting trade activity, 80% of country pairs do not have a direct connection. In 2016, about 26% of container movements were transshipments.

To compare and analyze countries’ positions within the global liner shipping network, the United Nations Conference on Trade and Development (UNCTAD) has developed a liner shipping connectivity index. This index is based on the schedules of container shipping fleet and uses five components: the number of vessels deployed to and from each country’s seaports, their combined carrying capacity, the number of companies providing scheduled services, the number of services and the size of the largest ship. The results for South Asia are shown in Table 5.

Table 5 shows that Sri Lanka is better connected than the other South Asian countries by virtue of its hub role, thus providing more direct country-to-country linkages. Conversely, Bangladesh has less connectivity because of its limited number of direct services and the employment of smaller feeder vessels. India has reasonable connectivity with more direct services but still has significantly less direct linkages than Sri Lanka. It is interesting to note that India’s connectivity has declined recently, whereas Sri Lanka’s has risen sharply. This is probably due to the loss of some direct liner services from Indian ports and the rerouting of such traffic through the Colombo hub. Myanmar has not been included, but its connectivity would probably be similar to Bangladesh, given that it is a low volume market highly dependent on feeder services, particularly via Singapore. It is important to note that the general trend is that liner connectivity is improving.

Table 5: Liner Shipping Connectivity Index in South Asia, 2010–2018
(Connectivity Index Score: maximum 100)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bangladesh	7.55	8.15	8.02	7.96	8.40	9.31	10.95	11.87	12.07
India	11.40	41.52	41.29	44.37	45.61	45.85	58.21	56.90	59.90
Maldives	1.65	1.62	1.60	8.12	7.79	7.59	7.97	3.45	7.76
Myanmar	3.68	3.22	4.20	6.00	6.25	6.23	10.03	7.35	9.29
Sri Lanka	40.23	41.13	43.43	43.01	53.04	54.43	61.21	70.62	72.46

Source: UNCTADStat. Liner Shipping Connectivity Index, Annual.

4 | OVERVIEW OF THE SASEC MARITIME ENVIRONMENT

4.1 Profile of SASEC Trade

Analysis of trade can be used to identify the likely primary sea routes between SASEC countries and their external markets. In this section, 2017 trade records are used as the base year wherever possible, and 2016 is used where 2017 data is unavailable.⁹ The trade patterns in 2018 are expected to be broadly similar, even though in many cases the overall trade values will probably be greater than in 2017 due to the continued trade growth in most SASEC countries. Intrasubregional trade represents less than 5% of the total trade in the subregion, far lower than in other subregions such as the European Union (11%) and Association of Southeast Asian Nations (ASEAN) (over 20%).

4.1.1 Bangladesh

Bangladesh was the 57th largest export economy in the world in 2017. It exported \$36.0 billion and imported \$52.8 billion of goods, leading to a negative trade balance of \$16.8 billion. During 2011–2016, exports had been increasing at an annualized rate of 7.3%, from \$26.4 billion in 2011 to \$37.8 billion in 2016, but fell slightly in 2017. The top export destinations were the US (\$6.10 billion), Germany (\$5.49 billion), the United Kingdom (\$3.52 billion), France (\$2.73 billion), and Spain (\$2.52 billion). Exports to SASEC countries were relatively small in comparison, with India (\$657 million), Sri Lanka (\$29 million), Myanmar (\$18.9 million), and Maldives (\$3.02 million).

Bangladesh was the 49th largest importer in the world in 2017. During 2011–2016, imports had been increasing at an annualized rate of 6.4%, from \$29.8 billion in 2011 to \$41.2 billion in 2016, but rose sharply in 2017. The top import origins were the PRC (\$14.30 billion); India (\$5.67 billion); Singapore (\$2.47 billion); Japan (\$1.54 billion); and Hong Kong, China (\$1.49 billion). The main SASEC import countries were India (\$5.67 billion), Sri Lanka (\$119 million), and Myanmar (\$20.2 million).

India is the only SASEC country with significant trade flows with Bangladesh—approximately 13% of imports and 1.7% of exports. It is likely that much of this bilateral trade is routed overland, particularly through the Benapole road and rail crossing. Cotton, which is grown mainly in east and southern India, is one of the major imports. Given the road and rail distances and the cotton's value in its raw state, it is likely that substantial volumes of

⁹ GlobalEDGE Michigan State University, *Global Insights*.

cotton are sent by sea, probably via the Colombo hub rather than direct. Trade with the other SASEC countries is small, with trade with the non-SASEC countries being the core generator of maritime traffic through Bangladesh ports. The importance of India as a trading partner may present opportunities for the development of coastal shipping services, particularly as a coastal shipping agreement was signed between the two countries in 2015. This agreement is expected to be more relevant to trading in bulk commodities and loose cargoes rather than container traffic.

4.1.2 Bhutan

Bhutan was the 184th largest export economy in the world in 2016. It exported \$134 million and imported \$455 million of goods, resulting in a negative trade balance of \$321 million. During 2011–2016, their exports decreased at an annualized rate of 19.8%, from \$397 million to \$134 million. The top export destinations in 2016 were India (\$122 million), the US (\$4.01 million), Germany (\$1.6 million), France (\$1.28 million), and Japan (\$1.03 million). The major SASEC export destination was India, with limited trade with Bangladesh and Nepal.

In 2016, Bhutan was the 182nd largest importer in the world. During 2011–2016, imports decreased at an annualized rate of 13.1%, from \$952 million to \$455 million. The top import origins in 2016 were India (\$371 million), Thailand (\$24 million), Singapore (\$13.8 million), Japan (\$11.1 million), and Germany (\$5.08 million). Intra-SASEC trade with Bhutan is dominated by India, which accounted for 91% of its exports and 82% of imports. Virtually, all Indian trade is by road due to its landlocked status, other than energy trade. Trade with other SASEC countries is relatively minimal. Third-country trade would be expected to be routed through Kolkata and Haldia ports.

4.1.3 India

India was the 17th largest export economy in the world in 2017. It exported \$294 billion and imported \$444 billion of goods, resulting in a negative trade balance of \$150 billion. During 2011–2016, exports increased at an annualized rate of 1.2%, from \$274 billion to \$294 billion. The top export destinations in 2016 were the US (\$46 billion); the United Arab Emirates (\$28.6 billion); Hong Kong, China (\$15 billion); the PRC (\$12.5 billion); and Singapore (\$11.5 billion). The main exports to SASEC countries were to Bangladesh (\$7.21 billion), Nepal (\$5.52 billion), Sri Lanka (\$4.41 billion), Myanmar (\$1.06 billion), Bhutan (\$402 million), and Maldives (\$213 million).

In 2017, India was the 14th largest importer in the world. During 2011–2016, its imports increased at an annualized rate of 0.95% from \$420 billion to \$444 billion. The top import origins in 2016 were the PRC (\$72 billion), the US (\$24 billion), the United Arab Emirates (\$23 billion), Saudi Arabia (\$21 billion), and Switzerland (\$20 billion). Most imports from SASEC countries came from Myanmar (\$738 million), Sri Lanka (\$664 million), Bangladesh (\$591 million), Nepal (\$413 million), Bhutan (\$206 million), and Maldives (\$7 million).

India is the largest trading nation in the subregion and is responsible for the major flows of intra-SASEC trade. However, exports to Bangladesh in 2016 represented 2.45% of their total export activity, Nepal accounted for 1.9% of exports, and Sri Lanka only 1.5% only. Overall intra-SASEC movements account for less than 6% of India's total exports in 2016. None of the SASEC countries are significant import partners, as they account for less than 1% of overall imports. Much of the trade with Bangladesh are by road and rail, but with some maritime movements. All trade with Nepal and Bhutan is by land, whereas trade with Maldives and Sri Lanka is almost all by sea. Most trade with Myanmar will also be by sea, given the current challenging land route.

4.1.4 Maldives

Maldives was the 175th largest export economy in the world in 2016. It exported \$247 million and imported \$2.33 billion of goods, resulting in a negative trade balance of \$2.08 billion. During 2011–2016, its exports increased at an annualized rate of 6.1%, from \$189 million to \$247 million. Exports in 2016 were led by gas, which now represents over 25% of the total exports of Maldives. The top export destinations in 2016 were Sri Lanka (\$82.6 million), Thailand (\$41.4 million), France (\$20.2 million), the US (\$16.2 million), and Germany (\$12.3 million). India (\$6.9 million) was the only other significant SASEC export destination.

In 2016, Maldives was the 153rd largest importer in the world. During 2011–2016, the imports increased at an annualized rate of 8.4%, from \$1.52 billion to \$2.33 billion. The top import origins in 2016 were the PRC (\$343 million), the United Arab Emirates (\$336 million), Singapore (\$314 million), India (\$290 million), and Sri Lanka (\$139 million). Import commodities in 2016 were led by fuel, which represented almost 10% of the total imports of Maldives in 2016. Other SASEC imports were from Bangladesh (\$3.02 million), with only minimal traffic from the other member countries.

As Maldives is an archipelago, almost all of its export and import traffic is routed through the Port of Malé.

4.1.5 Myanmar

Myanmar was the 63rd largest export economy in the world in 2017. It exported \$13.88 billion and imported \$19.25 billion of goods, resulting in a negative trade balance of \$5.37 billion. The top export destinations in 2017 were the PRC (\$5.4 billion), Thailand (\$2.7 billion), India (\$1.13 billion), Japan (\$903 million), and Singapore (\$735 million). As regards SASEC, India was the destination for 7.2% of its exports (\$708 million), mostly legumes. Exports to the other SASEC countries were less significant, with Bangladesh (\$128 million) and Sri Lanka (\$52 million) being the largest.

Myanmar was the 64th largest importer in the world in 2017. During 2011–2016, the imports of Myanmar increased at an annualized rate of 13.3%, from \$12.1 billion to \$22.8 billion. The top import origins in 2017 were the PRC (\$6.12 billion), Singapore (\$2.93 billion), Thailand (\$2.17 billion), Japan (\$1.06 billion), and Malaysia (\$1 billion).

Imports from India (\$975 million) represented 5% of all imports, consisting mainly of sugar and medicines. Imports from Bangladesh were \$24 million, again mainly sugar and medicines, with Sri Lanka imports being only \$1.2 million and other SASEC countries even less.

Given the low volumes of land border traffic between Myanmar and India, it can be assumed that almost all of the trade with other SASEC countries is by sea, mainly being routed through Yangon Port.

4.1.6 Nepal

Nepal was the 157th largest export economy in the world in 2017. It exported \$740 million and imported \$10.04 billion of goods, resulting in a negative trade balance of \$9.3 billion. During 2011–2016, exports decreased at an annualized rate of 6.4%, from \$938 million to \$696 million. The top export destinations in 2017 were India (\$420 million), the US (\$82.6 million), Turkey (\$47.5 million), Germany (\$29 million), and the UK (\$25.4 million). Other than to India and Bangladesh (\$9 million), exports to other SASEC countries were minimal.

In 2017, Nepal was the 74th largest importer in the world. During 2011–2016, imports increased at an annualized rate of 1.9%, from \$5.87 billion to \$6.51 billion. In 2017, the top import origins were India (\$6.52 billion), the PRC (\$1.27 billion), the United Arab Emirates (\$175 million), France (\$155 million), and Argentina (\$134 million). Nepal's dominant import source from the SASEC subregion is India, distantly followed by Myanmar (\$32 million). Only small amounts come from Bangladesh (\$9 million) and Bhutan (\$7 million). The 2017 imports tend to have been distorted by the impact of aid shipments following the earthquake, significantly increasing the overall trade deficit.

4.1.7 Sri Lanka

Sri Lanka was the 66th largest export economy in the world in 2017. It exported \$11.74 billion and imported \$21.3 billion of goods, resulting in a negative trade balance of \$9.56 billion. During 2011–2016, exports increased at an annualized rate of 0.6%, from \$10.7 billion to \$11.5 billion. The top export destinations in 2017 are the US (\$2.92 billion), the UK (\$1.04 billion), India (\$790 million), Germany (\$547 million), and Italy (\$532 million). The other main SASEC exports were to Maldives (\$117 million) and Bangladesh (\$125 million).

In 2017, Sri Lanka was the 58th largest importer in the world. During 2011–2016, imports decreased at an annualized rate of 0.6%, from \$20 billion to \$19.7 billion in 2016. The top import origins in 2016 were India (\$4.49 billion), the PRC (\$4.12 billion), the United Arab Emirates (\$1.56 billion), Singapore (\$1.29 billion), and Japan (\$1.04 billion). Other SASEC imports were from Maldives (\$163 million), Myanmar (\$80 million), and Bangladesh (\$43 million).

Sri Lanka is an island, and therefore almost all imports and exports are carried by the maritime mode, predominantly through Colombo Port and with smaller volumes through Hambantota.

4.1.8 Key Intra-SASEC Trade Routes

International trade is usually classified in terms of fiscal value, often in United States dollars as indicated above, and volume of international transported goods in weight terms, i.e., tons to be carried. There is no direct correlation between value and tonnage, thus making it difficult to translate trade value statistics into physical demand in tonnage terms. Nevertheless, value can often be used as guidance to probable tonnages by excluding extremes such as gold, diamond, ship, aircraft, etc. The main SASEC country-to-country routes in value terms, excluding the two landlocked countries, are in Table 6.

Table 6: Intra-SASEC Trade Routes, 2017
(\$ million)

Country Pair	Northbound/ Eastbound	Southbound/ Westbound	Total
India–Bangladesh	7,210	657	7,867
India–Sri Lanka	790	4,410	5,200
India–Myanmar	1,060	738	1,798
Sri Lanka–Maldives	163	117	280
India–Maldives	7	213	220
Sri Lanka–Bangladesh	125	43	168
Sri Lanka–Myanmar	43	2	45
Bangladesh–Maldives	n/a	3	3

n/a = not available, SASEC = South Asia Subregional Economic Cooperation.

Note: These are approximate as UN Comtrade data between countries are not correlated.

Source: UN Comtrade (2018).

The major SASEC trade flow eastbound is between India and Bangladesh. Most of this traffic is expected to be conveyed using land-based transport, but a proportion is expected to move by sea, especially Indian exports from the south and west of the country. The major SASEC southbound traffic is from India to Sri Lanka, nearly all of which moves by sea using mostly container feeder services. The India–Myanmar trade is also significant, and the majority is to be carried by sea, some of which uses feeder services transshipping through Colombo or one of the Strait of Malacca hubs. Maldives has a small economy and is therefore dependent on connectivity with India and Sri Lanka, and it uses the Colombo hub to connect with other countries including Bangladesh and Myanmar.

4.2 SASEC Ports

This section provides brief profiles of the main SASEC ports, identifying their current tonnage and container throughputs. The main port infrastructure is outlined, especially any that is related to the handling of container traffic. Constraints and capacities are highlighted, together with any proposed remedial plans designed to address these issues.

4.2.1 Bangladesh

Chattogram (Chittagong) and Mongla are the only two ports in Bangladesh capable of handling ocean-going vessels, and both are river ports. Chattogram is the largest port, handling over 90% of the country's import-export trade. Approximately 70% of its traffic is to and from Dhaka, and 30% is local. Mongla is a much smaller port with more limited container services. Its primary hinterland is the southwest of the country, but its catchment area is expanding because of the congestion at Chattogram.

Chattogram (Chittagong)

Chittagong Port is located in the city of Chattogram and is the world's 71st busiest port, handling 23.48 million tons in 2016–2017. It is on the Karnaphuli River, with the approach channel being approximately 11 nautical miles long from the three anchorages at the river mouth. In addition to the many shipwrecks obstructing navigation, three sandbars limit the free movement of vessels. The width and curvature of the river also restrict the length of vessels that can enter. The maximum permissible limits are a draft of 8.5–9.2 m, depending on the berth, and a maximum overall length of 190 m. This means that the maximum size a fully loaded container vessel able to call is approximately 1,200 TEU.

In 2017–2018, the port handled 2.808 million TEU, a 19.6% growth over the previous year (2.348 million TEU in 2016–2017). The container traffic is predominantly handled at one of the five container terminals—New Mooring Terminal, Chittagong Container Terminal, Kolkata Dock System Logistics Terminal, Orient Overseas Container Line Terminal, and Summit Alliance Container Terminal. These terminals provide a total of 14 berths. Containers can also be handled at the six general cargo berths as and when necessary. There are four container freight stations (CFS) with a total area of nearly 60,000 square meters within the port area. Four ship-to-shore gantry cranes operate in the Chittagong Container Terminal. Ten additional gantry cranes have been ordered from the PRC, with the first three having arrived in August 2018 to be operational by the end of the year. They will be positioned in the New Mooring Terminal, which should significantly increase handling performance and allow for the employment of more gearless container vessels without the need for ship's cranes.

The port's container activity is currently operating well over its design capacity, which is estimated at 1.6–2.2 million TEU (well below the current throughput). Every year, during April–October in particular, Chittagong Port experiences severe congestion, resulting in a vessel backup at the outer anchorage lasting from several days to more than a week. For example, in July 2018, the berthing queue reached 26 vessels, with vessels experiencing delays of 6–8 days.

The port's container yards also experience major congestion, particularly as they are also operating at well over their designed storage capacity. This situation is compounded by monsoon weather conditions that hamper operations inside the port and also adversely impacts on the external road conditions. Congestion means that trucks can at times be waiting in line for up to a week to unload outbound cargo. Storage levels in the port have exceeded 41,000 TEU, well above the 39,000 TEU designed storage capacity. More significantly, three-quarters of these were full import

units awaiting clearance and delivery, thus incurring high inward dwell times and extra costs. Shipping companies have on occasion been storing import units back at their Singapore and Colombo hubs due to the lack of space to store import units in Chittagong Port.

The Chittagong Port Authority (CPA) also controls the Kamalapur ICD in Dhaka that has been in operation since 1987. It has a theoretical annual handling capacity of 80,000 TEU, although its operational limit is closer to 65,000–70,000 TEU. It has a holding capacity of approximately 4,000 TEU at any one time. At present, there are two container trains per day each way between Chattogram and the Dhaka ICD. In 2017, a total of 72,000 TEU were carried by rail, and this is expected to increase significantly when the double tracking of the rail line between the port and Dhaka is completed in 2020. The facility has been operating at near capacity for many years, and therefore a second facility is urgently needed.

There have been several proposals for a new ICD in Dhaka. The government suggested a new ICD near Dhirasram railway station attached to the Dhaka eastern bypass. To bring the expected efficiency in container handling, Bangladesh Railway considered that the project should be implemented under a public–private partnership modality. The handling capacity of the proposed ICD would be 354,000 TEU and would be developed on approximately 55 hectares (ha) of land and have a railway spur of 6 kilometers (km) connecting the ICD with the national railway network. There have been proposals also for another ICDs near the Banglabandha western rail station and one in the Pubail area in Gazipur district. To date, none of these proposals have matured into implementation.

Given the port congestion, the Bangladesh Inland Water Transport Authority and the CPA jointly built the Pangaon Inland Container Terminal near Dhaka to help ease the pressure on cargo movements on the Dhaka–Chattogram railway and along the road corridors. This terminal is for the transportation of export and import goods through inland river waterways. It is serviced between the terminal and Chittagong Port by small container vessels. Three operators are currently servicing this route, and each vessel can carry approximately 128–140 TEU. Steaming time between the two ports is 18 hours. The terminal's overall capacity is 116,000 TEU, and 3,500 TEU can be stored at any one time. In 2017–2018, the facility handled 28,702 TEU, up by nearly 140% from the previous year.

The performance of Chittagong Port has a significant impact on Bangladesh's overall trading performance. Unless notable changes are made, the prospect will be for increased congestion and the imposition of further surcharges as and when congestion occurs. The CPA had projected that container traffic would expand to 2.7 million TEU in 2020, 4.4 million TEU in 2025, 5.1 million TEU in 2030, and 5.4 million TEU in 2040. The container traffic has already exceeded the 2020 forecast in 2017–2018. The CPA fully appreciates the need to address the capacity issue in both the short term and long term, planning to develop the general cargo berths (10–13) into an independent container terminal by 2020. With the capacity to handle 770,000 TEU per annum, the terminal will be licensed to a private operator. In the longer term, it is proposed to construct the new Bay Container Terminal 13–16 km

north of the estuary outside the constraints of the river sandbars with a capacity of 2.8 million TEU per annum and that can handle vessels up to 5,000 TEU. In addition, more ship-to-shore cranes and terminal equipment are to be purchased to enhance handling performance.

Through various assistance programs, ADB has helped the port develop the New Mooring Terminal. This project was completed in 2008 for \$63 million. In addition, ADB has provided funding assistance for capital dredging to remove deposited silt due to the construction of a bridge over the Karnaphuli River for \$9 million and purchased new container-handling equipment worth \$46 million. ADB has also undertaken the development of the strategic master plan for Chittagong Port with a planning horizon of 25–30 years.¹⁰ Emanating from this plan are ongoing proposals for the Chittagong Port Enhancement Project, Phase 1 (\$76 million), which is designed to address the shortage of yard-handling equipment, install information technology (IT) systems, strengthen the port's operation and management capacity, and prepare detailed designs and other works for the new Bay Container Terminal development.

The new Bay Container Terminal and associated works are expected to cost \$2.4 billion.¹¹ The project is for one multipurpose terminal (1,500 m of quay), two container terminals (1,225 m and 830 m of quay), and two dolphin berths. For the multipurpose facility, the Government of India has extended a third line of credit of \$450 million, and the CPA is still seeking \$300 million for terminal construction. The new berths will be able to accommodate vessels over 192 m in length with a draft of 13 m. This translates into a maximum container ship that can accommodate approximately 5,000 TEU, which is considered the maximum size operators would employ in the foreseeable future, given the projected overall level of demand. Indications are that land acquisition has been completed and works are expected to commence soon. It is hoped that at least one berth would be operational by the end of 2021.

Mongla

Mongla is the second port of Bangladesh and is in the southwest of the country at the confluence of Passur River and Mongla Channel, approximately 200 km upstream from the Bay of Bengal. The port is surrounded by the mangroves of Sundarbans, a World Heritage Site. It was developed originally to handle the jute trade, but as this traffic declined, the government has attempted to diversify and increase its capacity through investment. The port handled 7.5 million tons in 2017, rising almost 30% from the previous year. However, container traffic has struggled, falling 25% to 26,952 TEU.

The port has five multipurpose berths equipped with dockside cranes, mobile cranes, forklift trucks, storage transit sheds, warehouses, open areas, as well as the midstream facilities consisting of 8 mooring berths, 21 anchorage berths, barges, and a floating craft. Originally, it was purely an anchorage river port but has subsequently been provided with the quay. The port maintains adequate water depths in the channel for

¹⁰ ADB. Bangladesh: Strategic Master Plan for Chittagong Port.

¹¹ Estimate by Hamburg Port Consulting, Germany.

the safe operation of vessels day and night for ships drawing 7.0–8.5 m draft at the jetties and anchorage, respectively.

The government policy has been to develop the port to handle more cargo originating from or destined for the west of the country. Not only would this reduce the volumes to be transported across the country to and from Chattogram, but this would also relieve some of the congestion at Chittagong Port. This strategy has been given increased impetus with the construction of the new Padma Bridge. The new highway connection between Jessore and Dhaka has a more southerly alignment; the port is closer to this important highway and would enable the port to extend its potential catchment area to include Dhaka. Given its excess capacity and underutilized resources, Mongla Port is also seen by the government as having the potential to act as a gateway for a transport corridor extending north through India to Nepal, and Bhutan, thus offering those countries this port facility as an alternative to the ports of Kolkata and Haldia.

The port is expanding its container capacity by 42% to 100,000 TEU. The additional 30,000 TEU capacity will come from the two new berths under construction and due for completion in 2020. In October 2017, India offered loans of \$250 million to expand the container yard and purchase additional equipment. The river is also to be dredged to 10.5 m from the current 8.5 m for \$85 million.

The situation at Mongla Port is different from that of Chittagong Port as its key problem is lack of traffic, rather than too much. Several core problems constrain its growth. Firstly, the port is in the middle of nowhere with poor landside connectivity. There are still connectivity problems with the new Jessore–Dhaka road alignment. Secondly, there is only limited traffic demand in its immediate catchment area, as it has a comparatively low populated hinterland. Most of the demand is further east toward Dhaka, whereby Chattogram becomes more attractive. The potential for through traffic to Nepal and Bhutan at present is considered negligible, given the need to cross India and the additional costs. Such a link may be strategic as an alternative to the use of Kolkata, but it is not yet economically viable. Thirdly, it is not commercially attractive since shipping lines do not want an additional call to those already at Kolkata or Haldia and Chattogram that are only a day apart. This means that the port lacks regular scheduled services. Some feeder services are calling on a fortnightly basis only. Fourthly, major development could raise environmental issues due to its proximity to the Sundarbans. All of the above suggest that Mongla is unlikely to challenge Chittagong Port as the country's primary gateway, and its growth may be limited. Some Bangladeshi traders have recently participated in discussions with Indian Customs to route goods through to Indian ports to avoid delays at Chattogram, preferring this approach rather than using Mongla as the alternative.

Payra

Payra is a small seaport on the south coast of the Ramnabad Channel. It was established by an act of Parliament in 2013 and was officially inaugurated in 2016. Thus, Payra is at an early development stage. In late 2017, Payra Port Authority signed a deal with Jan De Nul, a Belgium-based company, to start capital dredging of the port's main channel to facilitate the entry of large ships that cannot berth at

Chittagong and Mongla ports. The dredging of the 36.5 nautical-mile channel was expected to begin in September 2018 and cost an estimated \$647 million. Jan De Nul will bear 20% of the cost of capital dredging from its equity, and 80% of the funding will come from the Government of Belgium in the form of loans. It has been suggested that the port could have the potential to become a major container facility, as the port draft will eventually be increased from 11 m to 14 m. However, it is unlikely that container vessels requiring this amount of draft would be employed on services to Bangladesh due to the limited level of demand. This issue indicates that the port's main focus will be on accommodating deeper-drafted liquid and dry bulk carriers.

Matarbari

Matarbari is situated on the east coast, south of Chattogram. Bangladesh consented to a contract for Japan to build a deep-sea port at Matarbari, just 25 km away from the government's proposed deep-sea port of Sonadia, hence the eventual dismissal of the Sonadia port project. It has been reported that "Japan International Cooperation Agency is to build the port along with a liquefied natural gas terminal, a series of four 600-megawatt coal-fed power plants, as well as rail lines, roadways, and electrical systems. The master plan is that the port would be used to receive coal, which could power an entire new industrial zone in the far southeast of the country."¹² The project is expected to be completed by 2024. There are proposals for the port to have a wider activity than merely handling coal and liquefied petroleum gas vessels, but its location with limited demand in its immediate hinterland will limit its potential to handling container traffic.

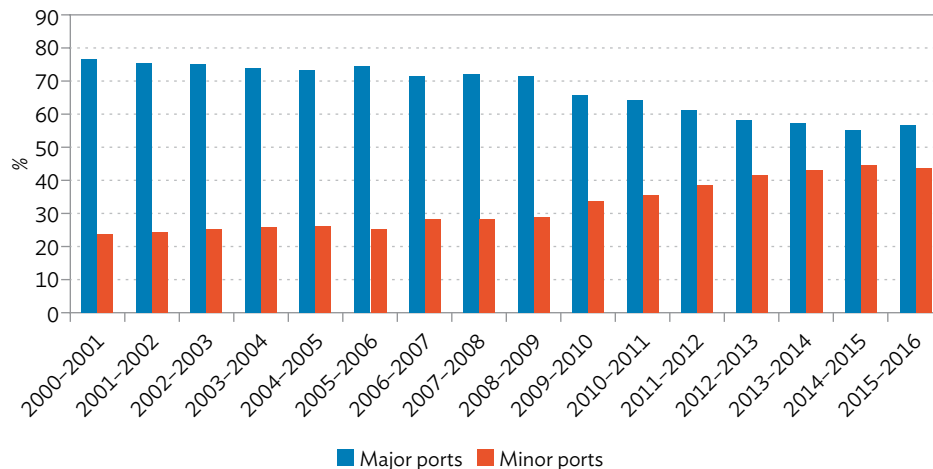
4.2.2 India

The Indian ports are classified administratively as major, minor, and intermediate. The Ministry of Shipping is responsible for all of the major ports, and the departments or ministries in the nine coastal states administer the minor and intermediate ports. There are 12 classified major ports in the country—Kolkata (including the dock complex at Haldia), Paradip, Visakhapatnam, Kamarajar (Ennore), Chennai, V. O. Chidambaranar (Tuticorin) on the east coast and Cochin, New Mangalore, Mormugao, JNPT Mumbai, and Kandla on the west coast. There are approximately 200 registered minor and intermediate ports, but many of these are either very small or inactive.

During FY2018, the major and nonmajor ports handled a total of 1,133 million tons, an annual increase of 5.7%. The 12 major ports handled a record 647 million tons, achieving an annual growth rate of 6.79%, compared with 4.32% the previous year. India's private ports registered a smaller traffic growth rate. Overall traffic included approximately 140 million tons of coastal trade. Around 57% of tonnage passes through the major ports and 46% through the minor, but the proportion of traffic transiting the minor ports has been gradually increasing (Figure 3).

¹² Shepard (2016).

Figure 3: Market Share of Major and Minor Indian Ports, FY2000–FY2016



FY = fiscal year.

Source: JOC Staff. Growth at India's Private, Minor Ports Rapidly Outpacing Public Rivals. *JOC.com*.

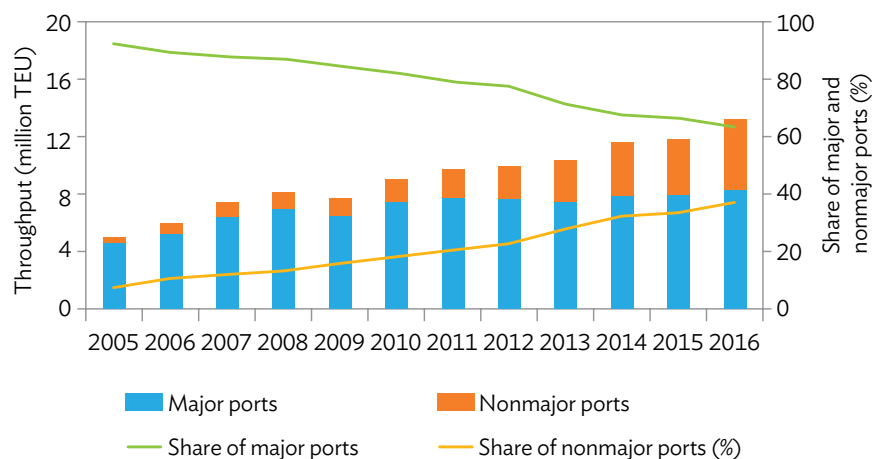
There has been significant growth in the overall capacity at the major ports since 2013. Before then there was a shortfall in national capacity, but this situation has been rectified in the last 5 years to a position whereby there is now an overcapacity. Ports are utilizing about 60% of their capacity, though there are significant variations between ports and the 60% is an overall average.

The profile changes in relation to container traffic. The Indian container trade has witnessed an impressive growth of 11% in FY2017 with 13.71 million TEU, from 12.39 million TEU in FY2016.¹³ This growth has been largely driven by strong import volumes and was expected to continue during 2018, while the exports remain under pressure.

A feature of the container-handling market has been the growth of the minor ports, relative to that of the major ports. The market share of major ports has declined from 92% in 2005 to 63% in 2016 (Figure 4). Much of the growth in the minor ports has been on the west coast in Maharashtra and Gujarat, where ports such as Mundra and Pipavav have developed, partly at the expense of Mumbai. There are many reasons for this trend, including that these minor ports have more flexible charging structures, are generally greenfield sites unhampered by traditional labor arrangements, and often have better access to their catchment areas compared with congested transport routes from the major ports.

¹³ Maritime Gateway (2017).

Figure 4: Container Handling in Major and Nonmajor Indian Ports



TEU = twenty-foot equivalent unit.

Source: Maritime Gateway (2017).

The container capacity of the Indian ports is estimated to over 20 million TEU with current utilization being around 65%. Overall compound annual container growth between 2011 and 2016 has been 6% with 70%–75% of containers passing through the west coast ports that are located outside the SASEC subregion. The balance between east and west coast market penetration has not varied significantly with the SASEC ports in 2016 handling 28% of all TEUs (footnote 13). This suggests that the competition is between ports on the same coasts, rather than between east and west. The main reasons cited for the dominance of the west coast ports are (i) most imports come from the west (Europe and the Middle East); and (ii) their hinterland covers the areas of most demand.

The main competition on the east coast is between Chennai and ports immediately to the north—Krishnapatnam and Kattupalli—that have only been developed since 2013. Their market share of east coast container traffic has risen to 5% and 8%, respectively, while Chennai's market share has fallen from 52% to 38%.

There has been fierce competition to attempt to establish a container hub port in southern India to compete with Colombo. This has been led by Vallarpadam (Cochin) on the southwest coast and Tuticorin in the southeast coast, and to a lesser extent the ports near Chennai. To date, this strategy has had limited success, as Indian transshipments at Colombo have continued to rise faster than the overall growth in these Indian ports. The major shipping lines appear to prefer a single hub with an associated network of feeder services, rather than fragmenting their services with

more hubs. In addition, under existing legislation, India does not generally permit cabotage of containers; thus, containers cannot be landed at one Indian port and transshipped to another.¹⁴ This limits the potential of the Indian ports to act as a hub for containers destined to other Indian ports.

There are currently 25 container terminals in India in 20 ports, of which 9 are on the SASEC east coast. These ports handled 3.89 million TEU in FY2017 or 28.4% of India's container traffic. The main port on this coast is Chennai handling 1.49 million TEU or 38% of all east coast traffic, followed by Tuticorin and Kolkata each handling over 0.6 million TEU. These three ports account for 2.77 million TEU or over 70% of east coast traffic (Table 7).

A vital issue in the selection of ports by the major carriers is the terminal operator. In some cases, the shipping line may have an international agreement with an operator and in other cases may also be an investor in the terminal. Dubai Ports World is the largest terminal operator in India, with an estimated 29% market share. They have six container terminals at Mundra, Jawaharlal Nehru Port (two facilities), Cochin, Chennai, and Visakhapatnam. The second largest operator is Adani with a market share of 19% with five container terminals and four new terminals planned at Dhamra, Ennore, Mormugao, and Vizhinjam (transshipment terminal). A.P. Moller, a subsidiary of Maersk, has 13% market share with terminals at JNPT Mumbai and Pipavav. JNPT operates a terminal within its complex and has a similar 13% market share. Port of Singapore Authority (PSA) International, the fifth largest, has a market share of 10% with terminals at Chennai, Kolkata, and Tuticorin. Its market share is expected to increase with its new facility at JNPT.

Table 7: Indian East Coast Container Ports Throughput, FY2017

Port	Terminal	TEU Handled
Chennai	Chennai International Terminals Private Limited	844,694
	Chennai Container Terminal Limited	646,319
Kolkata	Bharat Kolkata Container Terminal	635,848
Tuticorin	Tuticorin Container Terminal	533,049
	Dakshin Bharat Gateway Terminal	110,173
Visakhapatnam	Visakha Container Terminal Private Limited	366,723
Kattupalli	Kattupalli International Container Terminal	347,956
Krishnapatnam	Krishnapatnam Port Container Terminal	255,436
Haldia	Haldia International Container Terminal	135,828
Kakinada	Kakinada Container Terminal Private Limited	13,674
Paradip	Paradip Port Trust-Containers	2,000

FY = fiscal year; TEU = twenty-foot equivalent unit,

Source: Maritime Gateway (2017).

¹⁴ Certain commodities are permitted to use cabotage services, but these are limited.

The following sections provide a brief profile of the Indian SASEC ports, with emphasis on their container operations and identification of any constraints and development issues.

Chennai

Chennai Port handled 50.06 million tons of traffic in 2015–2016, as compared to 52.54 million tons the previous year. Containerized cargo was 1.49 million TEU in FY2017, representing a decline from 1.56 million TEU the previous year. This is now the third largest container-handling port in India, after JNPT Mumbai and Mundra Port that has overtaken Chennai. Of the total TEU handled in Indian ports, 10% moves to and from this port.

The port has 24 berths, of which 14 are for general cargo handling, 7 for container handling, 1 for iron ore traffic and 2 oil berths. There are two container terminals—one operated by DP World and the newer one operated by Singapore's PSA International, with a combined capacity to handle 2.10 million TEU per year. Based on FY2017 levels, this indicates that the container facilities are running at around 60% utilization.

The largest facility is the PSA-operated Chennai International Terminals, which has become a minor hub for some services. The terminal handled 844,694 TEU in FY2017, representing a growth rate of 21% over the previous year. This growth was achieved by attracting new services from lines and larger vessels calling. The terminal is equipped with 7 super post-Panamax quay cranes capable of handling twin lift containers up to 65 tons, 18 RTGs, and 6 reach stackers to support the terminal operations. It is currently operating at approximately three-quarters of its capacity.

The older DP World-operated Chennai Container Terminal has experienced a decline in volumes of 26% in FY2017, handling 646,319 TEU, compared with the previous year's volume of 867,549 TEU. The facility is now operating at only 54% of its design capacity. It is equipped with 7 super post-Panamax cranes and 24 RTGs and has also taken over from Chennai Port Trust 4 quay cranes, 10 RTGs, 3 reach stackers, 2 top lifters, and 1 empty container handler.

Traditionally, Chennai has been a major coal port, but the traffic has been transferred to Ennore following environmental problems due to Chennai being a city port. Consequently, the port is now focused on handling “clean” cargoes such as container traffic that does not result in significant pollution. Several issues constrain the movements of container traffic through the port. Foremost is the approach road to the container terminals. There is still only one main link road for both entry and exit, and this causes heavy congestion, resulting in delays to cargo movement. For example, it usually takes 24 hours for a truck to reach a container terminal from a CFS in the hinterland of Chennai Port, and at peak times this can increase to 2 days. In addition, the positioning of the railway crossings causes additional truck delays. There is an urgent need to separate the approach road for both entry and exit cargo and relocate it to avoid the problem of the railway crossings.

Most of the container traffic originates or is destined to locations within 400 km of the port. As a result, most traffic is carried by road. The port is in the city with

significant road congestion. In the past, this congestion started at the port gate, resulting in the shipping lines imposing surcharges. At times there were queues of over 1,000 trucks. The situation that all traffic had to be routed through Gate 1 was seen as a major cause. Conditions have improved with additional gates being allowed, but truck queueing remains a concern.

To overcome congestion and connectivity issues, Chennai Port proposed an elevated expressway connecting to the national highway. With a cost of \$300 million, this elevated four-lane link road from Chennai Port to Maduravoyal on National Highway 4 (19.01 km) was started in 2009 and envisaged to be completed by 2013. However, due to some issues between the National Highways Authority of India and the Government of Tamil Nadu (Water Resources Department and Public Works Department), the project has been delayed. This elevated road would pass over the Cooum River and could affect river flow. The National Highways Authority of India has since filed a petition against the objecting parties. Following negotiations, construction could recommence in 2019.

Another important issue impacting on Chennai Port is the competition from Krishnapatnam Port, 200 km to the north and the nearby new transshipment terminal at Kattupalli, which is expected to be the main competing port for Chennai. There is evidence that the landside congestion issues at Chennai have resulted in traffic being rerouted to these two new ports.

Tuticorin

Tuticorin Port, now called V. O. Chidambaranar Port Trust, is strategically located near the Southern Ocean Corridor and theoretically has the potential to serve both east and west coasts. The port handled 36.83 million tons in FY2018, a decline of 5% from the previous year. This tonnage included 651,242 TEU.

The port consists of two parallel breakwaters projecting out to sea for nearly 4 km, with the distance between the two breakwaters being 1,275 m. The harbor is served by an approach channel 183 m wide and 2.5 km long, dredged to a depth of 12.5 m, and oriented southeasterly. There are two main zones—(i) Zone A comprises of nine general cargo berths; a petroleum, oil, and lubricants jetty; two coal jetties; and a container terminal; and (ii) Zone B comprises of shallow berths, mostly used for lightering vessels. The general cargo berth drafts vary but can accommodate vessels from 25,000 to 45,000 deadweight tons (dwt), including handysize bulk carriers. The oil and coal jetties have a draft of 10.7 m and can accommodate vessels up to 65,000 dwt, and the container terminal has a 10.9 m draft and can handle vessels up to 50,000 dwt. There are proposals to deepen the harbor basin and approach channel to handle 15–20 m draught vessels, construct a breakwater or rubble protection bund, strengthen berths 1–6, and widen port entrance channel.

The smaller container terminal is the Tuticorin Container Terminal operated by PSA. The facility has consistently recorded steady growth in the past few years with a 4% increase in FY2017 while handling 533,049 TEU, compared with the previous year's 510,118 TEU. The facility is currently operating at 118% of its capacity. Since its inception in 1999, the terminal has built a strong foundation in south India by serving

the textile sector, the region's major industry. The terminal is well connected by road and rail to all the major industries, with regular train services to Bangalore, Chennai, and Kochi. The terminal has 3 gantry cranes, 8 RTGs, 12 prime movers, and a reach stacker.

The larger terminal is the Dakshin Bharat Gateway Terminal, which commenced operations in 2014. It has recorded a growth rate of 9% in FY2017 while handling 110,173 TEU, compared with the previous year's 101,292 TEU. With a design capacity of 600,000 TEU, it is operating at only 18% of its capacity. The facility is equipped with 3 gantry cranes, 9 RTGs, 18 prime movers, and 2 reach stackers.

Kolkata

Kolkata Port technically comprises the Kolkata Dock System and the Haldia Dock Complex. It handled a record 57.9 million tons of traffic in FY2018, representing a growth rate of 13.61% over the 50.9 million tons in FY2017. Container traffic increased by 10% to 635,848 TEU in FY2018, compared with 577,000 TEU the previous year, and recorded a growth rate of 3.8% in FY2018.

Kolkata Port consists of impounded docks, wharves, and anchorages. Kidderpore Docks has 18 berths, 6 mooring buoys, and 3 dry docks. The Netaji Subhas Dock has 10 berths, 2 mooring buoys, and 2 dry docks. The Budge Budge River Moorings consists of six petroleum wharves, and there are anchorages at Diamond Harbor, Sagar Roads, and Sandheads. The total pilotage distance from the sea to the port is 223 km–148 km of river passage and 75 km of sea approaches.

The Netaji Subhas Dock contains the Bharat Kolkata Container Terminal, which is owned by the Kolkata Port Trust but operated by PSA. Two dedicated container berths have four mobile harbor cranes and four berths for handling container traffic with ship's own cranes. The average draft alongside is 7–7.5 m but can fall as low as 6.5 m in winter. The berths can accommodate vessels up to 172.2 m in length and 24.4 m in breadth, i.e., small feeder ships only. The terminal is equipped with 4 RTGs, 9 reach stackers, and 30 tractor-trailers. The capacity of the facility is only 850,000 TEU, and the terminal is currently operating at over 75% capacity.

A major problem with Kolkata is its limited draft for container vessels. While the forward trend is likely to be for more dedicated calls from the hub ports, as opposed to vessels calling within a feeder circuit, the draft in the dock severely limits the size of vessel that can be handled. A 1,000 TEU container ship has an average draft of 8.3 m. Currently, vessels of this size are calling, but they are limited to 700 TEU. In addition, during the monsoon season, there can be problems further downstream that reduces the available draft, and vessels have been known to have to wait several days to enter. The river draft once fell to a low 5 m in freak conditions.

Kolkata is a city port and suffers the usual problem of congestion at the port or surface transport interface. The rail route Lakshmikantapur–Baruipur–Sonarpur–Ballygunge–Dum Dum–Dankuni, which connects the hinterland to Kolkata and Haldia ports, is already subject to capacity constraints. The movement of rail traffic remains a challenge from and to both ports. An additional problem is the Sealdah–

Namkhana section, which is also a main suburban section, and the alternative route Dankuni–Namkhana is a saturated line. Thus, the availability of train paths for freight trains to and from the port is an increasing constraint. Up to 22 container trains per month travel from Kolkata to Birgunj in Nepal, and the availability of additional train paths for this traffic and for services to ICDs in northern India is becoming an increasing concern.

In relation to road traffic, a daytime curfew is enforced, restricting vehicle entry and exit. Congestion around the main port gates is always a problem in city ports, as the surrounding streets are rarely able to cope with the large volumes of freight traffic having to interface with passenger traffic. An additional issue is the oversupply of freight transport, resulting in trucks waiting around the port to be allocated a load. This issue has been compounded in the past by poor port facilitation, leading to slow transits through the port gate. The collapse of the Majerhat Bridge in 2018 caused additional road restrictions that limited port movements to 900 units per day, compared with the usual 1,700–2,000 units per day.

External road connectivity is also a major problem, as the connectivity project from Netaji Subhas Dock to Kona junction (14 km) has not yet materialized due to land acquisition issues. Related projects delayed in West Bengal include the Dalkhola Bypass, the Berhampore–Farakka section, the road between Raiganj and Dalkhola, and the National Highway 31A. There are seven projects relating to road connectivity with the port, but these are all delayed primarily due to land acquisition or contractual issues.

Haldia

Haldia is technically an official dock complex on the west bank of the Hooghly River, approximately 100 km downstream from Kolkata. It can accommodate larger vessels than Kolkata, although the draft often tends to be dictated by the sandbars downstream. There are 12 berths in the impounded dock area that can take vessels up to 40,000 dwt (including ‘handysize’ bulk carriers) and three oil terminals in the river. The port handled 40.5 million tons in FY2018, including 156,000 TEU. The container traffic had been falling in recent years reaching a nadir in FY2016 of under 100,000 TEU. Since then, there was a 40% increase the following year and another 14.8% in FY2018.

Haldia is principally an industrial port. There are three oil jetties on the river for large vessels and two small jetties for handling oil carried by barges. The capacity of the oil jetties is approximately 18 million tons per year. The handling capacity of the iron ore berth is 2.5 million tons per year, and the six multipurpose terminals have the capacity of 9 million tons per year. The terminals handling coal can also handle 9 million tons per year. The total capacity of the port is 50.75 million tons, as against 40 million tons at present; thus, at this stage, capacity is not a major issue.

The Haldia Container Terminal is owned by the Kolkata Port Trust, but operated by United Liner Agencies of India. The facility consists of two berths and is equipped with 2 Panamax rail-mounted quay cranes, 4 RTGs, 3 reach stackers, and 16 internal transfer vehicles. The terminal area is 45,000 m². With an installed capacity of

250,000 TEU, the facility is operating at just 60% utilization. The terminal is principally competing with the Kolkata Container Terminal and has significant advantages as regards road connectivity. As it is not in a city, there are no curfews and access to the main highways is good. The Ministry of Shipping has recently signed a memorandum of understanding with the National Highways Authority of India to develop an expressway from Haldia to the industrial hub at Panagarh (Durgapur).

As a bulk cargo port, Haldia is better connected by rail than Kolkata, although similar congestion results for northbound traffic as it has to pass through Kolkata where the freight and suburban lines interface. However, for container traffic, the Container Corporation of India only offers an on-demand service. There is usually insufficient traffic to make up the necessary block trains for inland delivery. Consequently, the containers have to be taken to the railhead in Kolkata or await a full trainload volume. As this incurs extra costs, importers of traffic destined to Nepal or inland ICDs in India prefer to route shipments via Kolkata rather than Haldia.

The terminal, as compared with Kolkata, is offering lower terminal handling charges and concessions with regard to demurrage fees to attract users. Improved business sentiment in West Bengal and the rapid industrialization in the neighboring state Odisha have translated into better business for Haldia.

Visakhapatnam

Visakhapatnam Port is a deep-sea port consisting of three harbors—the outer, the inner, and the fishing harbor. The outer harbor has 6 berths capable of handling vessels with a draft of up to 17 m, while the smaller inner harbor has 18 berths that are Panamax vessel compatible. Iron ore, manganese ore, steel products, general cargo, coal, and crude oil are the main commodities handled. Essentially, this is a bulk cargo port but also has a container-handling capability. In FY2018, the port handled 63.5 million tons of cargo.

The Visakha Container Terminal was set up under the aegis of Visakhapatnam Port Trust as a joint venture between DP World and United Liner Agencies of India and commenced operations in 2003. With a natural depth of 16.5 m alongside, it is the only container terminal on the Indian east coast that can accommodate, at any time of the year, the largest container vessels. The terminal is well equipped with modern and efficient infrastructure with 6 rail-mounted gantry cranes, 10 RTGs, 5 reach stackers, and 2 heavy forklifts. It handled 366,723 TEU in FY2017, achieving 25% growth over the previous financial year. It was only operating at 52% of its capacity; nonetheless, work has commenced to extend the berth length and enhance its handling capacity to 2 million TEU by the end of 2020.

The recent growth has largely been due to the organic growth of the industry in the local hinterland covering Andhra Pradesh, Odisha, and Chhattisgarh. With the induction of new mainline services by Maersk, the facility is emerging as an east coast transshipment hub serving Chattogram and Yangon. The port is becoming more competitive than the Kolkata and Haldia ports for northern Indian cargoes and is focusing on attracting Nepal and Bhutan cargoes despite the extra distance.

Kattupalli

Kattupalli Port is 35 km north of Chennai at Ennore, with the container terminal being near the shipyard. The first development phase was to have a 1.2 million TEU capacity by 2012 through two 350 m long L-shaped berths and a total terminal area of around 20 ha, with an option to expand to 1.8 million TEU capacity during the second phase of development. The facility was to be operated originally by the International Container Terminal Services, Inc. for 28 years. Adani Ports and Special Economic Zone Ltd. executed a share purchase agreement with Larsen & Toubro Limited to acquire 97% stake in Marine Infrastructure Developer Private Limited, the developer and operator of Kattupalli Port in 2013.

Since Adani took over Kattupalli International Container Terminal operations from Larsen & Toubro in 2015, there has been exponential growth yearly and also a surge in vessel services. In the first quarter of FY2018, the total cargo handled at terminal showed an increase of 31% against the same period the previous year. Volumes rose from 7,900 TEU per month in November 2015 to over 35,000 TEU per month in FY2017. The terminal handled 347,956 TEU in FY2017, achieving a 202% growth over the previous year. Despite this spectacular growth, utilization is still only 25%. The facilities include 2 berths with a quay length of 710 m, 6 quay cranes, 15 RTGs, and 5,120 ground slots. The terminal has a current capacity of 1.2 million TEU.

The key to the rapid growth has been the addition of new services, especially the Maersk Line shuttle service to Colombo and Salalah that was transferred from Chennai. In addition, the Asia Chennai Service connects Shanghai, Busan, Ulsan, Ningbo, Singapore, and Port Kelang with Kattupalli. The port has managed to attract some portion of the cargo from nearby Chennai Port and also cargo volumes from the hinterland of Bengaluru and Hyderabad. It is more economical for ships to call at Kattupalli as the vessel-related charges at Kattupalli are 30% lower than at Chennai. It is also slowly becoming the preferred port for exporters and importers, particularly those involved in the automobile sector, due to its good hinterland connectivity and the availability of large storage areas.

Krishnapatnam

Krishnapatnam is a new port in Muthukur Mandal of Nellore District, the southernmost coastal district in the state of Andhra Pradesh. The Krishnapatnam Port Company Ltd. was formed by winning the mandate from the Government of Andhra Pradesh to develop the minor port into a modern deepwater and high productivity port based on a 50-year build–operate–share–transfer concession. The port handled 45.3 million tons in FY2018.

Krishnapatnam Port Container Terminal (KPCT) is being developed in three phases; the first was completed in 2008. From 58,577 TEU handled in FY2013, the throughput has risen to 481,408 TEU by FY2018. There was an 88% increase in throughput in the last year. The terminal has 2 berths with a draft of 13.5 m and is equipped with 5 Panamax cranes, 4 RTGs, 10 reach stackers, and 36 ha of container yard.

Transshipment on the east coast has previously been an untapped market, as most of the cargo is still being handled at external hub ports (Colombo or Strait of Malacca ports). KPCT has started handling transshipment cargo under the Pakistan India Express service, which earlier used to service the port through their Singapore transshipment hub. With the launch of this new service, KPCT has now become one of the largest transshipment handling container terminals on the east coast. The surge in exports can also be attributed to the improved rail connectivity between the ICDs at Bangalore and Sanath Nagar and the port. The broad-gauge railway line connectivity between Obulavaripalle in Kadapa and Krishnapatnam Port has now been completed. Hyundai's weekly Asian Chennai Service to East Asia and Southeast Asia has helped drive growth, as have 2M's Maersk Line and MSC services. Also, the largest container feeder companies plying across the Bay of Bengal—Bengal Tiger Line, and FAR Shipping and Xpress Feeders—are also offering services from KPCT. The new Maersk Salalah Service has been added to KPCT services as part of the direct weekly service from Krishnapatnam to Salalah (Oman).

Paradip

Paradip Port is located 210 nautical miles south of Kolkata and 260 nautical miles north of Visakhapatnam. It has 20 berths with a minimum draft of 13 m. The port is essentially a bulk cargo port focusing mainly on coal, having a fully automated coal handling plant with a capacity of 20 million tons of coal imports per annum. It also has a single point mooring system for handling oil tankers. The approach channel has been dredged to increase the depth to 15.7 m to enable the port to handle “capesize” vessels. The western dock with six additional berths has now been completed. The port is expected to expand its handling capacity to over 180 million tons by 2020.

Paradip International Cargo Terminal Pvt. Ltd. was awarded a contract for developing a multipurpose berth to handle clean cargo, including containers, on a build–operate–transfer basis for 30 years. The facility is equipped with three mobile harbor cranes, two RTGs, one reach stacker, and six forklifts. The port is presently handling only 2,000 TEU per annum and has therefore yet to become a major player in the east coast container market.

4.2.3 Maldives

Malé is the only significant international port in Maldives. It is on the southeastern point of the Malé Atoll on the north side of the entrance Vaadhoo Kandhu. The port comprises of an inner harbor used by pleasure craft, the fishing industry, and coastal trade, and an outer harbor where larger ships berth. In 1985, the Malé Commercial Harbor Project involved rebuilding and modernizing the outer harbor, including dredging and reshaping the harbor by constructing new jetties, office buildings, and the container terminal.

Malé has three berths—the Magathufaaalan, Eastern Lighterage Berth, and the Western Lighterage Berth. The container facility is on the Magathufaaalan wharf. The ADB-funded development provided a 101 m long berth with a depth alongside of 10.8 m. Any restriction on container ships calling is likely to be due to length rather

than draft-related issues. In 2017, the port handled 82,761 TEU, representing a growth rate of only 1.2%, and the total volume is less than that in 2015. The adverse economic situation is the reason for the low growth rate.

The major constraint is that the facility is on the city waterfront and there is a shortage of hinterland to accommodate the storage of containers. The terminal is only 21,700 m² with a covered warehouse of 2,400 m². The port relies on the use of ship's cranes, but forklift and reach stackers are available in the stacking area. Storage opportunities on the main island are limited, hence most containers have to be stuffed or destuffed within the terminal. The facility is operating at or near capacity, causing delays in both berthing and cargo handling. There are plans to develop a new port facility on Gulhi Falhu with work scheduled to commence early 2019 for completion in 2022.

4.2.4 Myanmar

Yangon Port is the main port in Myanmar and is divided into two ports. The original Yangon Port lies on the northeast bank of the Yangon River in the city center and is a traditional general cargo port, part of which has been converted to handle containers. The newer Thilawa Port is 25 km downstream from Yangon, next to the Thilawa Special Economic Zone being developed by a Japanese joint venture company. This port is focused more on container-handling, roro, and liquid cargoes. The combined tonnage through the ports was 40.56 million tons in 2016, slightly less than in the previous year. This included 12 million tons of containerized cargo in 1.058 million TEU, an 18% increase from a year earlier. The combined ports handle over 90% of Myanmar's international trade, indicating that the country's maritime trade is highly concentrated. The importance of Sittwe in the north in Rakhine State is growing due to the development of the Kaladan corridor project.

Yangon

Yangon is the premier port of Myanmar. The approach channel is 32 km long from the Elephant Point on the Gulf of Martaban to the port wharves. Two sandbars control the depth of river channel—the first (the outer bar) has the average draft allowance of 9 m, and the second (Monkey Point) has only 7.2 m.

The riverside port is along the city waterfront and consists of 4 terminals and 15 wharves. The four terminals are the Bo Aung Kyaw Street Wharf Terminal, Myanmar Industrial Port, Asia World Port Terminal, and Sule Pagoda Wharf. Most general cargo vessels use the Myanmar Industrial Port, Asia World Port Terminal, and Sule Pagoda Wharf. The main container facility is the Asia World Port Terminal that claims to handle 40% of all Myanmar's container movements.

The location of these wharves is a particular problem because there is no room for ship-to-shore (STS) gantries, the alongside draft is limited to 7.2 m or less, and the berth backland is restricted; thus, the container yards used for storage are too small. The limited land width means that the cargo following discharge needs to be quickly cleared or taken to an ICD or CFS due to this lack of quayside storage areas. Unfortunately, this process leads to congestion along the adjacent Strand Road, especially at the eastern end with heavy transport mixing with commuter traffic.

Thilawa

The Port of Thilawa is a satellite port of Yangon 25 km downstream and administered by the Myanmar Port Authority (MPA) under the overall management of the Ministry of Transport. The major container operation at Thilawa is at Myanmar International Terminals Thilawa (MITT), fully owned by Hutchison Port Holdings. The MITT operations at Thilawa encompass five container berths, with a total berth length of 1,000 m and backland covering 75 ha. The primary imports are cars and other vehicles, construction materials, and general cargo containers. Unfortunately, MITT's penetration of the Yangon container traffic has been relatively limited, and few of the major container carriers have yet moved to this site. Next to the MITT is a small petroleum, oil, and lubricants berth. The development of the Thilawa Special Economic Zone should boost traffic levels and expedite the transition from city operations.

MITT's low penetration of the Yangon container traffic may be because the import and export traffic is so highly concentrated on Yangon city and clients prefer to ship with carriers who have direct services into the city port. The road connectivity between Thilawa and the city is poor at this stage, and users disapprove of the extra costs of using this terminal, which is their main reason for not transferring their services. It also suggests that there is no real benefit from the additional 1.8 m draft available at MITT, as the traffic demand is such that ships of over 1,000 TEU that could only berth at Thilawa are not yet required on this route. Construction of the road link to the city and NH1 is a priority, not only for the port but also for the Thilawa Special Economic Zone. Investments being undertaken at the Asia World Port Terminal in the city port suggest that the transfer of container operations downstream to Thilawa may be an extended process.

Sittwe

Sittwe Port is a deepwater port in Rakhine State that is administered by the Ministry of Foreign Affairs. The \$120 million port at the mouth of the Kaladan River has been financed and built by India as part of the Kaladan Multi-Modal Transit Transport Project. The \$500 million project was conceived as an alternative to the long-distance road route via the Siliguri Corridor, which transits to the north of Bangladesh, connecting mainland India with its own northeastern states by the combined use of river and coastal shipping across the northern end of the Bay of Bengal. The overall project includes the construction of Sittwe Port, dredging of the river to enable cargo vessels to navigate from Sittwe to Mizoram in India, development of a river port at Paletwa in Myanmar's Chin State, and the upgrading of the highway from Paletwa to Myeikwa on the India–Myanmar border. The overall route is programmed to be operational in 2019.

In April 2017, India handed over the operation of completed Sittwe Port and Inland Water Terminal at Paletwa to Myanmar. Sittwe Port consists of pier jetties that extend out into the river and provide the depth necessary to handle vessels up to 20,000 dwt, although most vessels calling are smaller coastal vessels. In FY2018, the port handled 350,000 tons, and currently about 15 vessels per month are calling. A tender has been issued to appoint an operator for the port, with a decision on the successful tenderer expected by mid-2019.

4.2.5 Sri Lanka

Sri Lanka has two main ports—Colombo and Hambantota. There are minor ports at Galle and Trincomalee, but neither of these ports is engaged in container operations. Galle is a naval base, and Trincomalee is to be developed to handle bulk cargoes, especially coal.

Colombo

Colombo is not only the main port in Sri Lanka but also the only significant container hub in South Asia. Total cargo through the port increased from 73.7 million tons in 2015 to 81.9 million tons in 2016. More importantly, it has become the 23rd largest container port, as its container throughput increased to 6.2 million TEU in 2017, a 16.4% annual increase in its total container throughput. Despite competition from the southern Indian ports, the transshipment operations at the Port of Colombo that represent approximately 80% of handling also showed a 20.4% year-on-year increase. The port anticipated handling 7.0 million containers in 2018, up 12.9% from the 6.2 million TEU in 2017.

As the port was reaching capacity, the government implemented the Colombo Port South Harbor Development Project through a public-private partnership. The project involved constructing a new 6.8 km breakwater, dredging over 285 ha of the basin to accommodate three terminals with an 18 m depth alongside, establishing a new marine operations center, relocating submarine oil pipelines, providing additional navigational aids, and building shore utilities. This initial expansion was funded with a \$300 million loan from ADB and \$100 million from the Sri Lanka Ports Authority (SLPA) and Ceylon Petroleum Corporation. This development with its 18 m draft places the port in the shortlist of global ports capable of servicing the latest generation of mega container vessels. The first terminal in the development opened in 2013.

Four major terminals handle the container traffic—Jaya Container Terminal (JCT), South Asia Gateway Terminals (SAGT), Unity Container Terminal (UCT) in the inner harbor, and Colombo International Container Terminals (CICT) in the south harbor extension. JCT is managed and operated by the state-owned SLPA, as is the smaller UCT facility. In 1999, the government privatized its first port project when it signed a contract with the SAGT, which is owned by a consortium of John Keells Holdings, Sri Lanka's premier blue-chip conglomerate, and the next major partner being A.P. Moller Group (Maersk). Other shareholders include Evergreen International S.A., Peony Investment S.A., and SLPA. The concessionaire under the 30-year contract has increased the capacity of the Queen Elizabeth Quay facilities from 280,000 TEU to 1.1 million TEU per year by expanding the terminal area from 7.5 ha to 20 ha, extending the berth to 940 m and strengthening the ground, as well as adding handling facilities.

The JCT facility operated by SLPA has four mainline container berths and two feeder berths with 13 m depth alongside. It is equipped with 20 quayside container cranes (Panamax and super post-Panamax), 59 RTGs, 4 rail-mounted gantry cranes, 210 terminal tractors and trailers, and 24 top lifters. The terminal has 45.5 ha of container

yard with a stacking capacity of almost 50,000 TEU.¹⁵ The smaller UCT facility has two container berths only and a multipurpose berth with a draft alongside of 11 m. It is equipped with 2 quay container cranes, 8 RTGs, and 45 tractor or trailer units. The container yard covers 1.53 ha and has a stacking capacity of 8,000 TEU. The larger SAGT has three container berths with alongside draft of 15 m. It is equipped with 12 quayside container cranes (Panamax and super post-Panamax), 31 RTGs, 70 tractors and trailers, a reach stacker, and a heavy forklift truck.

The newer CICT is a joint venture company between China Merchants Port Holdings Company Limited (CMPH), a listed blue-chip company on the Hong Kong Stock Exchange, and the SLPA. Under a 35-year build–operate–transfer, the container terminal with a 2.4 million TEU capacity was constructed under the Colombo Port Expansion Project (formerly Colombo Port South Harbor Development Project). CMPH holds 85% of the partnership, and SLPA holds 15%. This terminal has four berths with a draft alongside of 18 m and thus can handle the mega container vessels. It is equipped with 12 quay gantry cranes with an outreach of 70 m, 49 RTGs, 72 terminal tractors, and 2 reach stackers.

The East Container Terminal is in the south harbor extension, adjacent to the CICT facility. It is designed to have a similar capacity to CICT and to be managed by SPLA. Only the first 440 m of the berth has been completed. The partly completed facility remains nonoperational for container activities, other than for geared vessels. SLPA has put forward a proposal for its development to the government and is awaiting approval. As the port is nearing its capacity in handling mega carriers, the need for this additional terminal with its deeper draft in the south harbor extension is becoming ever more urgent.

There have been other issues that have adversely affected performance in the last few years. The first was congestion on the roads between various terminals. This issue is critical for a port engaged in hub activities, as there is the need to transfer between the mainline vessels and feeder vessels, which are often at different berths. A dedicated roadway between terminals has been constructed to facilitate this transfer operation. In addition, the operators have entered into a cooperation agreement to assist in processing transfers between terminals.

Another problem has been congestion at the port gate. The customs have developed new procedures to expedite clearances, and this has proved helpful. However, outside the port gate, there is congestion where the port traffic interfaces with city traffic. Therefore, much of the port movements are at night to minimize this problem. A 5.3 km elevated link road from the port to the Kelani junction is to be built with funding assistance from ADB. Under this project, a maritime center with tracking and tolling equipment will be set up to bring all the port services under one roof. With this new highway, the port will be connected to the country's expressway network and will have enhanced gate operations. Construction is expected to commence in 2019.

¹⁵ Container terminals engaging in transshipment activities need more storage space due to the potentially higher average dwell times.

Hambantota

The Hambantota Port is a new port constructed at the southern tip of the island, being developed largely based on its strategic location adjacent to the Southern Ocean Corridor.¹⁶ The PRC both funded and constructed the port in two phases with the outer basin Phase 1 being commissioned in November 2010. Despite a few ships calling, the second phase (inner basin) was commenced almost immediately.

Two breakwaters, dredging of a 210 m wide entrance channel, a 600-m turning circle, excavation of a 17 m deep basin area, a 600 m general purpose berth, a 610 m oil quay, a 105-m service berth, roads, and associated buildings were also constructed in Phase 1 at a cost of \$380 million, mainly funded by the Export–Import Bank of China. The Export–Import Bank of China is financing the second phase for \$810 million that was originally expected to be operational in 2014 but has yet to be fully commissioned.

Aside from some bunkering activities and car carriers diverted from Colombo, the port has failed to attract the expected traffic levels, resulting in the need for financial restructuring. In December 2017, the government completed the formal handover of the port of Hambantota to the PRC, which will take control of the facility on a 99-year lease. Hambantota International Port Group and Hambantota International Port Services, two new companies set up by the CMPH, and the SLPA will own the port. In July 2017, CMPH agreed to pay \$1.12 billion for an 85% share in Hambantota Port for the 99-year lease.¹⁷

Trincomalee

Trincomalee in the northeast has the second-best natural harbor in the world and has 10 times the available water and land area of Colombo. It has been tentatively identified to cater for bulk and break bulk cargo and port-related industrial activities including heavy industry, tourism, and agriculture. The present facilities include three alongside berths, one of which has a 13-m draft. The SLPA is redeveloping Trincomalee as a metropolis growth center and has completed a zoning plan to use the vast area of unutilized land within its jurisdiction.

4.3 SASEC Liner Connectivity

The container services in the Bay of Bengal are dominated by hub and spoke operations. The mainline carriers identified in section 3.3 operate along the busy sea lanes shown in Figure 2 using their mega and large container vessels and predominantly service the smaller ports with feeder ships that then distribute traffic to and from their regional hubs. The high cost of operating mega vessels results in carriers seeking to minimize both the number of ports called and deviation from the major shipping lanes. Consequently, the major carriers all establish transshipment hubs along the main routes to service ports in subregions adjacent to these sea lanes.

¹⁶ Ship Technology. *Port of Hambantota*.

¹⁷ Panda (2017).

Four key hub or relay ports compete in the feeder market serving the SASEC subregion—Colombo and three ports in the Strait of Malacca (Singapore, Port Kelang, and Tanjung Pelepas). All of these ports are along, or adjacent to, the Southern Ocean Corridor east–west trunk sea route and can accommodate mega container vessels with 16 m draft. The importance of transshipment traffic is demonstrated by the percentage of transshipment to total traffic at these hubs—Tanjung Pelepas 92%, Singapore 84%, Colombo 80%, and Port Kelang 62%. The key SASEC spoke ports served from these hubs are Chittagong (Chattogram), Kolkata, Haldia, Visakhapatnam, Chennai, Tuticorin, Malé, Yangon, and more recently Kattupalli and Krishnapatnam.

The decision as to which SASEC traffic will be routed through which hub to provide the optimum service level depends on many factors such as the individual carrier, feeder costs, and scheduling. However, it is possible to generalize regarding third-country trade traveling along the east–west shipping lane that is destined for SASEC spoke ports. Containers coming westbound from East Asia are more likely to be transshipped in the Malacca ports than Colombo, although units destined for south and west India and Maldives may use Colombo Port. Containers coming eastbound from Europe, the Middle East, and Africa are more likely to be transshipped in Colombo, except for cargo for Myanmar, which is mostly routed through the Malacca ports. However, all four hub ports have services to and from most of the spoke ports, thus providing good connectivity to worldwide shipping networks. Intra-SASEC container traffic moves on these feeder services either directly port-to-port or within a feeder circuit that covers several spoke ports. Alternatively, it may be routed back through a hub using feeder-to-feeder services.

Some idea of the level of intraconnectivity within the SASEC ports can be gauged by the service frequency of feeder links from the Colombo hub. From Colombo, there are 28 sailings to Tuticorin per month, 18 to Chennai, 13 to Kolkata/Haldia/Visakhapatnam, and 12 to Chittagong. Table 8 shows the routes of some of the main feeder services from Colombo and the Strait of Malacca hubs to SASEC ports. The schedules of the main feeder companies are predominantly weekly, except where ports are only a short distance apart such as Colombo–Tuticorin, where there is a higher frequency, and minor ports such as Mongla, which is mainly fortnightly or even monthly.

The east–west connections between India and Myanmar appear less well served, but services have increased in recent years as trade with Myanmar has gradually expanded. There are now regular services with the Chennai–Kattupalli–Krishnapatnam–Yangon, Chennai–Yangon, and Visakhapatnam–Yangon links. Similarly, the services between India and Bangladesh have increased with competing rail container services and under the new bilateral coastal agreement services between Kolkata and Pangaon river port. Traditionally, Chittagong was more often served on a circuit basis that offered opportunities for bilateral movement between Chittagong and the Indian ports, but now most services from the hubs to Chittagong are dedicated services. This change is partly due to increased cargo flows to and from Chittagong and partly in response to the previous delays at Chittagong Port that had a knock-on effect at other ports when ships were being scheduled on a circuit basis.

Table 8: Container Services to SASEC Ports from Regional Hubs

Feeder Operator	Colombo Hub	Strait of Malacca Hubs
Bengal Tiger Line	To Kolkata/Haldia, Chennai, Tuticorin	To Chennai, Visakhapatnam, Kattupalli, Kolkata
Ceylon Shipping Corporation Ltd	To Chittagong	No container service
Bangladesh Shipping Corporation		
Far Shipping Line	To Chittagong–Visakhapatnam–Krishnapatnam To Kolkata–Haldia	To Kolkata To Chittagong
HRC	No container service	To Chittagong, Mongla
Lily Shipping Line	To Maldives	No container service
Orient Express	To Kolkata–Haldia–Kakinada To Chittagong	To Chittagong
X-Press Container Lines	To Visakhapatnam–Krishnapatnam–Kattupalli To Chennai	To Chittagong To Yangon To Chennai–Visakhapatnam
Yangon Express	No container service	To Yangon
Herbilan Shipping	To Chennai–Yangon	No container service

SASEC = South Asia Subregional Economic Cooperation.

Source: Author's analysis from shipping schedules.

Except for Colombo, the SASEC ports have few long-distance mainline services. The ports along the east and south coasts, such as Tuticorin and Chennai, have now attracted a limited number of middle-distance inter-Asia services. At the northern end of the Bay of Bengal, ports are unlikely to attract these direct interregional services, due to the draft limitations and the overall level of demand. Developments at these ports in relation to container traffic are more likely to focus on the ability to service larger feeder vessels than those used at present.

4.4 SASEC Cruise Liner Sector

The world cruise sector has experienced compounded annual growth of 6.63% from 1990 to 2017 with 26.7 million passengers in 2017. This market expansion is expected to continue, passing 30 million passengers in 2019 due to both higher demand and an increase in capacity on offer with 13 more ships in 2018 and 37 more due by the end of 2020. A total of 108 new cruise liners worth \$58 billion are scheduled to come into the market between 2018 and 2027. The growth in demand is mainly fueled by the increase in middle-income wealth and the availability of short duration, price competitive regional cruises. The average overall cruise duration has fallen to 9.1 days, thus reflecting the dominance of relatively short cruises.

In general terms, the cruise sector consists of three main categories—ocean, intraregional, and adventure. The ocean cruise sector involves longer distances between various regions of the world and accounts for all the longer duration cruises (over 21 days). These cruises tend to have longer sea time between wider spaced ports of call. The main clients tend to be older, wealthier, and from developed countries attracted by the luxury of sea travel. Examples of this sector are the around-the-world and intercontinental cruises. The largest cruise sector is the intraregional, consisting of much shorter cruise durations with more port calls for passengers to visit shore attractions. While the clientele is broadly similar to that of the ocean sector, this is gradually changing as the intraregional sector is attracting younger middle-income families. The emphasis is still on luxury, but the main attraction is the ports of call. Examples of this sector are the Baltic, Mediterranean, Caribbean, and Pacific Islands cruises. Adventure cruises focus on shoreside or offshore activities, sometimes going to remote locations or places that are not accessible by the larger ships operating in the other two sectors. The clientele tends to be younger passengers, and the vessels are significantly smaller. Examples of these are trips to the Arctic and Antarctic, Galápagos Islands, and northern Australia.

Cruising in the SASEC subregion is still in an embryonic stage, but it has major potential. Given the capacity coming on stream, operators will have to source new markets. This is already taking place with significant growth in attracting passengers from the PRC. While the population of India is 1.3 billion, only about 180,000 Indians engage in cruising, most travel to Singapore for cruise holidays. The emphasis has been on getting passengers from the SASEC subregion to undertake cruises outside the subregion or cruises that start or finish outside the subregion in ports such as Singapore and Dubai.

The profile of cruise activities in the SASEC subregion is that it is highly concentrated in the east by calls at Yangon, principally by ocean cruise liners or intraregional cruises out of Singapore. In the west, the cruise activities tend to be concentrated around the Laccadive Sea bordering southwest India, Sri Lanka, and Maldives and up the west coast to Kochi, Goa, New Mangalore, and Mumbai. There is virtually no cruise activity further north in the Bay of Bengal, other than the occasional ocean cruise call at Chennai. The distances between suitable ports with adjacent onshore attractions and draft restrictions severely limit the potential for future cruise activities along the Indian coast north of Chennai, in Bangladesh, and in Myanmar (northwest of Yangon).

In the southwestern part of SASEC, the main cruise activities consist of long-distance ocean cruise liners mainly calling at Colombo and middle-distance ocean cruises linking with either Singapore or Dubai, i.e., cruising through the region calling at Colombo and Malé in addition to west coast Indian ports. The only current intraregional cruises are from Mumbai to Colombo and Malé, sometimes supported with intermediate calls along the Indian coast. The main cruise season in the west is November–May and in the east, November–mid-April, with some occasional around-the-world cruises calling out of season.

Cruise activities based within SASEC have been relatively limited. The Government of India under its “blue economy”¹⁸ initiative recognizes the importance of the cruise sector, but the basing of cruise activities in India has been constrained by issues such as tax, customs duties, visa problems, etc. Thus, the sector is not yet compatible with cruise operations in other parts of the world. These constraints particularly impact on the potential of the intraregional cruise sector, but less so on the ocean cruise sector. No SASEC ports have cruise operators permanently based there, although two lines nominally are seasonally based in Mumbai (MSC and Costa).

The main SASEC cruise ports are Colombo, Yangon, and Malé, with occasional calls at Chennai. In 2018, there were 45 ocean liner calls at Colombo, while there were 20 liners calls at Yangon in 2017. While the overall numbers are relatively small at this stage, their seasonal concentration can present problems at ports without dedicated passenger terminals due to the need to use freight quays on a priority basis. Maldives, Myanmar, and Sri Lanka are already major tourist hotspots based on their airline connectivity. The distances around the Laccadive Sea are relatively short, and therefore the area is well-suited to attract cruise liners. The potential for cruise activities along the east coast of India and Bangladesh appears limited in the short to medium term.

¹⁸ Blue economy is the “sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem.” Source: World Bank (2017).

5 INSTITUTIONAL FRAMEWORK IN THE SASEC MARITIME SECTOR

It is important to identify the institutional framework managing the maritime sector in each of the relevant SASEC countries to comprehend the roles and responsibilities of the various parties in managing the sector and to assess their relevance with regard to their participation in any SASEC cooperation initiative. The shipping services are predominantly operated by the private sector, mostly by foreign-owned international entities, and the role of the national institutions as regards shipping is mainly limited to maritime compliance issues regarding ships calling at their ports and their manning. The major institutional responsibilities are in the port sector in many cases, as they are often the ultimate owners of the ports.

Trade activities in each country create the demand for shipments, and the shipping lines provide the necessary supply to satisfy that demand. The ports represent the intermodal interface between maritime supply and trade demand at a national level. Efficient ports can balance the demand and supply, whereas inefficient or congested ports cannot satisfy either the demand or the supply needs or both. The institutional framework for the efficient administration of this critical demand–supply interface is important in ensuring that ports can adequately satisfy both the requirements of the trading community and the shipping industry.

In this section, the institutional framework in each of the SASEC countries with a coastline is examined. Where national fleets exist, the container shipping sector, rather than the general cargo or container sector, tends to be active in the dry or liquid bulk markets. Consequently, any cooperation within SASEC concerning the maritime sector should concentrate on the port sector. The focus is on how the country's ports are administered at both governmental and operational levels, with less importance given to the shipping sector. Cooperation mechanisms already exist in the container shipping sector through their alliances, slot chartering arrangements, and combined use of feeder networks.

5.1 Bangladesh

The Ministry of Shipping is the apex body responsible for the formulation and administration of the rules and regulations and laws relating to shipping, as well as the ports, land ports, and inland waterways. It implements its policy and decisions, and administers allocated business through the following 10 directorates:

- Directorate General of Shipping;
- Chittagong Port Authority;
- Mongla Port Authority;

- Payra Port Authority;
- Bangladesh Land Port Authority;
- National Maritime Institute;
- Bangladesh Inland Water Transport Authority;
- Bangladesh Inland Water Transport Corporation;
- Bangladesh Marine Academy; and
- Bangladesh Shipping Corporation.

The Department of Shipping under the Ministry of Shipping is the competent authority to regulate the maritime sector in Bangladesh. It is responsible for the enforcement of maritime regulations concerning both Bangladeshi vessels and foreign vessels using Bangladesh ports. Bangladesh Shipping Corporation runs the national fleet, but its presence in the container sector is limited to a joint venture with the Indian and Sri Lankan state shipping companies in operating feeder services to Chittagong and Mongla.

The Chittagong Port Authority is a government agency responsible for the management, maintenance, and governance of Chittagong Port, whereas the Mongla Port Authority is an autonomous organization responsible for similar roles at Mongla. The Payra Port Authority is also an autonomous organization.

The objective of any SASEC coordination committee is to discuss and exchange views of mutual interest and explore avenues where subregional cooperation would be beneficial. Given this likely remit, Bangladeshi participation would probably need to be at the Department of Shipping level, as opposed to the individual port authority.

5.2 India

The Ministry of Shipping operates under the transport minister and is the body responsible for maritime affairs. This includes both the shipping and port sectors, as well as shipbuilding and repair, national waterways, and inland water transport. The ministry's role is to define policies and programs on these activities and the Department of Shipping is responsible for their implementation. The department has a secretary (shipping) who is assisted by joint secretaries (shipping, ports, and Sagar Mala), advisors, and other officers at the level of directors, deputy secretaries, undersecretaries, and other secretariat and technical officers.

The government has a federal structure whereby maritime transport is administered both centrally and at state government levels. The central Ministry of Shipping administers the major ports, while the minor ports are governed by the relevant departments or ministries in the nine coastal states.

The central Ministry of Shipping undertakes its responsibilities for the major ports through the establishment of individual port trusts for each major port, which act as autonomous bodies under the ministry:

- Chennai Port Trust;
- Cochin Port Trust;
- Jawaharlal Nehru Port Trust;
- Kandla Port Trust;
- Mumbai Port Trust;
- New Mangalore Port Trust;
- Paradip Port Trust;
- Kolkata Port Trust;
- V.O. Chidambaranar Port Trust; and
- Visakhapatnam Port Trust.

These port trusts are responsible for their respective ports and, in many cases, compete with each other and with the minor ports that are not subject to centrally agreed tariffs. The Indian Ports Association is accountable for the major ports under the administrative control of the Ministry of Shipping. This structure would suggest that any SASEC cooperation would probably be most effective at the Ministry of Shipping level, supplemented by the Indian Ports Association.

5.3 Maldives

The responsibility for the maritime sector was with the Ministry of Transport and Communication, which was abolished by the President in June 2014. The policy mandate was transferred to the Ministry of Economic Development, while the Maldives Transport Authority retained regulatory functions. In November 2018, the Ministry of Transport and Civil Aviation was established, and the policy mandate was reassigned. Malé is the only major port in the country. This port is owned and operated by Maldives Ports Limited, which is a 100% state-owned corporation and was created to be the sole port authority of all the ports in Maldives. Any cooperation mechanism discussing the maritime sector, particularly ports, could be addressed either by the new ministry or the Maldives Ports Limited upon approval by the ministry.

5.4 Myanmar

In Myanmar, the Ministry of Transport and Communications is responsible for the maritime sector. The responsibility is then divided among different agencies including the Department of Marine Administration, Myanma Port Authority (MPA), Inland Water Transport, Myanmar Shipyards, Directorate of Water Resources and Improvement of River Systems, Department of Meteorology and Hydrology, Myanmar Maritime University, and Myanmar Mercantile Marine College. The Department of Marine Administration is responsible for maritime carrier services, while MPA is in charge of port management.

MPA, a department under the Ministry of Transport and Communications, is responsible not only in administering ports and supervising the application of rules and regulations but also in earning revenue for the state. Its organization is based on a typical corporate structure with a managing director overseeing a general manager and line managers. It is also responsible for Yangon Port, Asia World Port Terminal, Myanmar Industrial Port, Myanmar International Terminals Thilawa, and Myanmar Integrated Port Limited.

Given MPA's wide remit covering all the activities in the Yangon region, any regional cooperation representation could be addressed at the departmental level, by the MPA on behalf of the Ministry of Transport and Communications.

5.5 Sri Lanka

Sri Lanka's Ministry of Ports and Shipping and Southern Development is responsible for both port and shipping sectors, thus reflecting the importance of the sectors to the national economy. The ministry formulates and implements national policies on ports and shipping and other subjects that come under its purview. Its vision is the "provision of high quality and user-friendly marine services by developing Sri Lanka as the most competitive hub of maritime activities in the South Asian region," and its mission is the "formulation of a more appropriate policy framework and an efficient mechanism that will lead to the provision of competitive and qualitative port and shipping services in order to fulfil the local and international requirements in the field of maritime activities for national economic development."¹⁹

Sri Lanka Ports Authority (SLPA) is a state-owned entity under the ministry with the mandate to develop, operate, and manage the ports. It was constituted under the provisions of two acts, effecting the merger of the Colombo Port Commission and two statutory corporations, resulting in a unified organization with a streamlined structure. SLPA does not receive direct financial allocations from the government but operates on its own revenue and resources.²⁰ It is engaged in the development and operation of the port sector and, in effect, is both landlord and operator. It earns most of its revenue through cargo handling and other charges at the ports, but capital allocations for specific major port developments are generally made through the treasury. Any cooperation mechanism could be addressed at SLPA level, as the port sector—rather than the whole maritime sector—is the likely focus.

¹⁹ Government of Sri Lanka. Ministry of Ports and Shipping (2016).

²⁰ Sri Lanka Ports Authority. <http://www.slpa.lk>.

6 | CURRENT AND FUTURE ISSUES IN THE SASEC MARITIME SECTOR

In this section, the SASEC maritime sector is examined regarding its ability to satisfy the existing and future supply and demand aspects of trade, especially of general cargo in containers. Trade volumes represent the demand, the international shipping industry, the supply, and the ports the intermodal interface required to help in balancing supply and demand efficiently. Trade in the SASEC subregion is expected to continue to increase over the next 10–15 years, in relation to both intra-SASEC movements (mostly by land) and trade outside the subregion (mostly by sea). Each of the ports has its individual internal traffic forecasts, and these form the basis of their forward planning of infrastructure development in response to their predicted demand.²¹

The initial section analyzes the market situation from the maritime provider perspective—the shipping lines. The next section reviews how the ports must respond to meet the expectations of its key stakeholders, the traders, and the shipping lines in ensuring service efficiency, and explains key performance indicators (KPIs) used to measure port and cargo handling efficiency. The next section examines the interface between the port and the inland distribution networks and identifies potential bottlenecks both within and adjacent to the port that need to be addressed. The next sections evaluate the potential role of ICT in enhancing port performance, the development of port-based economic complexes, and the impact of cruise liner activities on freight handling. The last section highlights some of the priority investment projects in the SASEC ports that are required to cope with increased traffic and maintain quality services to the port's clientele.

6.1 Supply–Shipping Lines

Maritime transport is expected to remain dominant in trade logistics throughout much of the SASEC subregion, even for some intrasubregional trade. There are many reasons for this, but probably the most important are the high concentration of both production and demand in many of the countries along their seaboards, the presence of island economies like Maldives and Sri Lanka, and the dominance of trading activity to and from distant markets.

In the freight sector, the main categories are liquid bulk, dry bulk, containers, and general cargo. The general surplus in shipping due to new vessels coming onto the market faster than tonnage is being decommissioned means that there are limited problems in obtaining

²¹ Analysis of traffic forecasts at SASEC ports has not been considered in this report.

sufficient tonnage to satisfy the dry bulk and tanker sectors. Ships carrying these bulk cargoes are normally chartered for specific voyage(s) on either time or spot charters. There is an increasing tendency to employ larger vessels to benefit from the economies of scale, although this trend may be constrained by the unit size of the individual shipments or the limitations at the intended ports of call. Along the northern and eastern coasts of the Bay of Bengal, the main pressures for deepwater ports²² are related to the ability to handle larger tankers and bulk carriers rather than for container ships.

The main focus in this SASEC maritime report is on container shipping. This is because it is responsible for processing an ever-increasing percentage of the general cargo trade. Container shipping represents the premium freight sector of the maritime mode and is the most important mode impacting on the development of port infrastructure and regional trade distribution logistics. Despite enhanced international road and rail connectivity in the subregion under the *SASEC Operational Plan 2015–2025*, containerization can be expected to even further dominate non-bulk trade logistics.

The average size of container ships is anticipated to increase on almost all of the routes servicing SASEC trade, but there will be limiting factors such as traffic demand, port draft, and ship operational economics. The largest container vessels operate on the busiest routes where there is the most concentrated demand—East Asia to Europe/Middle East, and East Asia to North America as shown in Figure 2. These routes are currently dominated by the major carriers like Maersk, MSC, CMA-CGM, and China Ocean Shipping Company. Since 2010, these major carriers have introduced new mega carriers capable of carrying 20,000–21,000 TEU, each having a length of 400 m, a beam of 58.8 m, and a draft of 16 m. The largest vessel in operation is 21,400 TEU, but a new class of ultra large carriers (23,350 TEU) for MSC is on order.

These huge vessels are often referred to in the shipping industry as mother ships, and they operate along the primary sea lanes where their economies of scale can be fully utilized. Given the high capital cost of such vessels at approximately \$150 million–\$190 million each, the diversion costs for such large vessels are so high that operators attempt to limit the number of calls to the minimum necessary to fill the vessel. This means that they only call at ports with major import or export movements, such as in Japan, the PRC, and the Republic of Korea or in regional hubs such as Colombo or Singapore, where container traffic to and from various ports can be consolidated for the longer-distance sea leg. Any such hub has to be close to a primary route, in this case the Southern Ocean Corridor. Currently, Colombo meets the necessary criteria to handle such mega vessels and to act as a consolidation and distribution hub for much of the traffic to and from the subregion through feeder services.

²² Deepwater ports require a channel and berthing depth of a minimum of 12 meters.

A key issue is whether container ships will become even larger and impact on the current networks, adversely effecting SASEC connectivity with distant markets. Technically, it is feasible to build even larger vessels, but some factors suggest that much bigger ships may start to become less economic. The ratio of port time to steaming time is critical to profitability. The adage that “ships earn money while steaming and spend money when in port” may not be entirely correct. The larger the vessel, the more time it will spend in port and less in proportion at sea. An example has been the demise of the ultra large crude carrier tankers of 300,000–500,000 dwt, whereas the very large crude carrier tankers of 250,000–270,000 dwt have survived and become the standard large tanker. The ultra large crude carrier could only access a limited number of ports and spent a significant proportion of time static, loading and discharging, such that they became generally uneconomic. A similar trend could exist in the container sector, and mega carrier sizes may soon be reaching their economic limits. Larger vessels will also require wider beams, and existing gantry cranes would have outreach problems in handling such vessels. Consequently, larger ships would require major investment in port superstructure and equipment to handle them. Existing cranes mainly have a reach capable of handling vessels stowing 23 boxes wide, but the new ultra large carriers on order will be 24 boxes wide (61.3 m beam).

While mega container ships may not continue to grow much, their introduction on the primary sea routes has already had a significant cascading effect, making smaller vessels on those routes redundant. These redundant vessels have been employed to replace smaller vessels on secondary routes. Thus, average ship sizes on individual routes serving SASEC ports are expected to increase, unless there are limiting factors such as length and draft restrictions.

Mother ships on secondary and middle-distance routes can be as small as 4,000 TEU and offer direct transocean services. Chennai, Tuticorin, and even Visakhapatnam can already receive vessels of this size from South Asia and Southeast Asia. Similar operating parameters generally prevail with the operator still attempting to minimize the numbers of calls, but, since the vessel is smaller and therefore less expensive to operate, the vessel can divert further off these key sea routes and serve secondary routes. The larger container lines are unlikely to make a direct call with even a small mother ship unless the annual traffic at that location exceeds 1 million TEU per annum.

The major container lines operate hub and spoke systems to extend their coverage beyond the top 20 ports. They use smaller container vessels to operate the spoke services, feeding traffic between the hub and smaller ports. Depending on the size of the vessel, operators will often directly service ports with throughputs as low as 100,000 TEU per annum or 30,000–40,000 TEU within a circuit. However, even these vessels are still expensive to operate, so minimization of calls remains important. In addition, more ports of call on a feeder service circuit can cause extended voyage times and therefore a deterioration in overall service level. More ports also cause stowage problems and consequent slower vessel turnaround.

There are draft limitations in some ports in the Bay of Bengal whereby large vessels cannot enter, even if the demand were present. A good example is Chittagong Port that has an annual throughput of 2.8 million TEU, which should be sufficient to attract some direct middle-distance services were it not draft-constrained and

therefore dependent on feeder services. The draft for different sizes of container ships is shown in Table 9. The northern part of the Bay of Bengal covering Kolkata/Haldia, Chittagong, and Mongla ports, for example, has only approximately 9 m maximum draft, thus limiting ships to below 1,500 TEU fully loaded, and often less in the monsoon period. Similar scale constraints exist at Yangon and Thilawa.

Table 9: Dimensions of Container Ships

Vessel Size Band (TEU)	Average Length (m)	Average Draft (m)
0–499	104.6	6.0
500–999	134.1	7.8
1,000–1,499	161.9	9.1
1,500–1,999	182.5	10.2
2,000–2,499	203.3	11.2
2,500–2,999	220.7	11.7
3,000–3,999	250.8	12.0
4,000–4,999	279.2	12.9
5,000–5,999	282.8	13.7
6,000–6,999	300.4	13.8
7,000–7,999	328.1	14.5
8,000+	337.2+	14.6+

m = meter, TEU = twenty-foot equivalent unit.

Source: Based on data provided by Clarksons Research Services.

Currently, there are major plans for the development of deep-sea container ports at the northern end of the Bay of Bengal and along the Andaman Sea coast. These should be treated with a degree of caution, considering that the potential trade demand may be insufficient and the diversion costs too high to make such calls economical. Mega container ships are unlikely to call at any port outside the top 20 largest ports, or ports with annual throughputs of less than 5 million TEU. Smaller mother ships are likely to call at other large ports with a throughput of over 1 million TEU per annum, such as Chennai.

The further up the Bay of Bengal, the less attractive it is for mother ship operations due to low demand, high diversion costs, and limited draft. The current traffic through Chittagong is approximately 2.8 million TEU, Kolkata 0.64 million TEU, and Yangon 1.1 million TEU. The total of all the Bay of Bengal ports is less than the volume of Colombo. Thus, the potential for mother ship operations in the upper and east of the Bay of Bengal is unlikely. SASEC ports in the north (Kolkata, Haldia, Mongla, and Chittagong) and the east (Thilawa and Yangon) will continue to be serviced for the foreseeable future by feeder vessels operating out of the four regional hub ports—Singapore, Port Kelang (Malaysia), Tanjung Pelepas (Malaysia), and Colombo. The main change is likely to be an increase in direct calls to and from the hub ports, replacing circuits and the employment of larger feeder vessels up to the limit possible at that particular port.

Further southward along the Indian coast, the draft restrictions become less of a problem. These ports lack the necessary traffic volumes for shipping lines to employ mega carriers. Nonetheless, due to the cascading effect, they have the potential to attract larger vessels, including smaller mainline ships. Some of these ports are already attracting direct or mainline services (middle-distance container services) from East Asia and Southeast Asia and the Middle East. An increase in such direct calls is expected, especially Visakhapatnam southward. Larger vessels on these routes are unlikely to have a draft of more than 14 m and can mainly be accommodated with the existing infrastructure. The largest vessels on these inter-Asia routes are expected to be 4,000–5,000 TEU, with 5,000–7,000 TEU being the maximum.

The development of the new Bay Container Terminal is critical for Bangladesh. A facility that can accommodate vessels with an overall length greater than 192 m and 13 m draft can theoretically accommodate container vessels up to 5,000 TEU. However, it is doubtful that these large vessels will be used for direct calls, other than perhaps within a circuit incorporating the eastern Indian ports. A more likely scenario in the short or medium term is for larger gearless feeder vessels up to the maximum size to be on direct services from the hubs, provided the congestion constraints can be adequately resolved.

Another important issue is whether the southeastern Indian ports can become hub ports in competition with Colombo. The success of Colombo as a hub is based on its location, feeder network, and handling performance. Given that ships would have to divert further north, operators would require the establishment of a comparable feeder network and handling performance similar to that at Colombo. Major carriers are likely to want to concentrate on one hub, rather than create more hubs or mini-hubs.

Container transport in recent years has minimized the operating speed of vessels, particularly of the larger ones. This was partly to reduce global capacity on offer as a response to the reduction in demand arising from the global economic downturn, and partly to save fuel by steaming at the optimum fuel consumption speed. This practice is estimated to have taken out 3 million TEU of capacity annually. In effect, the shipping lines have adjusted their service offering by lowering the speed but raising their reliability (due to the ability to speed up vessels if necessary to meet schedules). Feeder operations have been less affected, as capacity has been adjusted by the laying up of older vessels. In general, the mainline vessels are owned by the larger carriers, whereas feeders are more often chartered in. As trading conditions improve, the shipping industry can switch on capacity at relatively short notice. Capacity is unlikely to be an issue. Thus, demand will tend to dictate future ship sizes on individual routes.

Operators need to balance demand and frequency. Importers and exporters want regular services, such as weekly rather than monthly calls. A limited overall demand means deploying smaller vessels to cater to the needs of traders. Thus, even if channels and ports were deepened, larger vessels would not necessarily be employed. Capacity on offer must be balanced with both demand and service level issues.

A key focus of shipping companies will also be on reducing their carbon footprint, either by new or more fuel-efficient propulsion systems or increased application of economic steaming speeds to reduce fuel consumption. These factors will likely not have any significant impact on service levels or sea freight rates in isolation.

6.2 SASEC Port Performance

Ports are facing increased competition especially in the container sector, due to the consolidation of the container operators arising from mergers and acquisitions and the formation of alliances. There are less ‘players’ in the main container trades and the larger companies are becoming more dominant with greater market shares. These organizations decide on their ports of call and overall their network structure, thus determining which ports and terminals to use. This situation where the shipping lines are becoming more influential and demanding makes it vital to monitor and measure the operational performance of ports.

Adapting to this new environment means that ports must upgrade their operational performance to remain competitive, including faster turnaround times (lapse time of ships in port), lower cargo dwell times (time cargo stays in port), rapid gate operations, enhanced hinterland connections, and better intermodal connectivity. The shipping lines represent the key clients of any port, and their primary demand is quality service in terms of cargo handling performance and the elimination of any constraints that adversely impact on their offerings to their clients—the importers and exporters. Both the levels of performance and nature of the constraints will differ between ports and even between terminals within a port. Performance levels can be measured in the form of KPIs that can be used to:

- (i) determine which ports have constraints adversely impacting on international trading activities as manifested by their poor performance indicators;
- (ii) highlight the likely capacity of existing facilities once these operating deficiencies have been resolved and the performance indicators reaching the levels of efficient facilities; and
- (iii) assess the need for additional investment in infrastructure or equipment to support the level of throughput in the selected forecasting horizon using the projected performance indicators applicable at that time.

The first two forms of performance indicators are conventionally described as benchmarking. It can be internal, i.e., the indicators can be used to measure both steady improvements in performance and the impact of experimental changes in processes, and/or they can be used as a component of managerial performance assessment systems. In addition, comparisons can be made between the performance levels achieved by different facilities of similar nature, such as between container terminals within the same port or between those owned by different businesses where they do not directly compete to determine the “best in class.”

KPIs are well-defined measures of various aspects of port activities. To fulfill their purpose, such indicators must be easy to calculate and understand, providing insight for port and terminal management into the operation of key areas. They can be used to compare performance with a target and observe the trend in performance levels.²³ It may also be possible to make meaningful comparisons between the different ports factoring in their individual operational environments.

There are three main areas where port-related KPIs are generally applied. The first is based on the performance of the port holistically. The second is the most common form of operational KPI and relates to individual wharf or terminal performance within a port, most often in connection with container-handling activities. The third is port facilitation, which is mainly about the time cargo dwells within the port or terminal. This depends partly on customs clearance and partly on how the port is linked to other nearby freight yards. These forms of KPIs are outlined below.

Port KPIs are indicators of the overall performance of the port (mainly performance of the port's infrastructure assets), rather than the specific handling performance within individual terminals or at specific wharves (traffic handling). The most common published KPIs are demand-side statistics of overall traffic throughput, such as numbers of vessels calling or total tonnage processed on an annual or monthly basis. These KPIs tend to highlight the relative size of the port, the scale of its operations, and its volumetric performance over time, but they do not indicate its operational efficiency in relation to the handling of those vessels or tonnage. Most of the SASEC ports publish these basic indicators.

Some of the SASEC ports also publish additional KPIs such as service level KPIs based on customer satisfaction surveys and fiscal KPIs. These may not be very meaningful in assessing performance since the largest ports often cater to various types of trade, which may be served by different terminals under separate management. Many of the larger ports also maintain, though not necessary publish, several operational KPIs of the performance of port assets and infrastructure. Examples of these types of KPI are as follows:

- Berth occupancy or utilization – the amount of time a quay or individual berth is occupied. It measures utilized berth time versus available occupation time. Allowances may be included for tidal and weather delays;
- Berthing delay or pre-berthing time – refers to the incidence of vessels having to wait at anchor or nonworking berths because their allotted berth is not available;
- Berth availability – measures the percentage of time a berth is available for potential occupation, reflecting maintenance downtime such as berth closures for repairs or dredging;

²³ UNCTAD (1976).

- Berthing transfers – indicates the instances where vessels have to move off a particular berth or quay to accommodate another vessel such as cargo ships having to free up a berth for a passenger vessel; and
- Weather delays – refers to the number of days per annum that the port is closed due to adverse weather conditions such as cyclones, monsoon winds (may cause exceptionally low tides that restrict draft), excessive swell, tidal surges, etc.

Some of these operational KPIs may relate to individual terminals catering to different customers or traffics. In this case, the disaggregated KPIs give a better picture of performance. Generally, the larger the port, the more likely it is to have the administrative and IT resources to maintain these operational KPIs and to use them as an effective management tool to boost efficiency. Initial indications are that none of the SASEC ports publish such detailed operational data in the form of KPIs, although some of the data may be available internally.

Of these operational KPIs, berth occupancy is probably the most relevant for planning purposes, e.g., when berth occupancy exceeds 70%–80%, additional berths may need to be planned to avoid future congestion and possible increases in offshore waiting time. At this point, alternative solutions to the bottleneck usually need to be considered as part of an operational study. For example, traffic growth can mean that larger vessels may be expected to serve the port, thus requiring deeper water, though possibly little additional quay length. If that is not the case, then increasing the number of quay cranes to reduce vessel turnaround time and enhancing the productivity of the quay may be more cost-effective than providing additional berths.

The most common application of operational KPIs relates to the working of particular terminals within a port, especially those handling container traffic. At this level, it is easier to define robust KPIs since the operational requirements tend to be more standardized. As in the case of port KPIs, operational KPIs consist predominantly of historical throughput data as a baseline but with the increased application of operational performance-based KPIs. Such KPIs are used by terminal operators to measure the performance of their individual terminals, help maintain a consistent quality of work, and drive incremental improvements in operational efficiency. The actual KPIs used, and the detailed definitions of how they are measured vary from terminal to terminal depending on its major traffic and its equipment. Thus, there is still a great deal of debate on how KPIs should be used. Once a set of KPIs are established that provides an accurate reflection of the terminal's performance, these KPIs may also be used in terminal service agreements—the contracts between terminal operators and shipping lines—as minimum agreed service levels to be achieved by the terminal operator.

The higher-level terminal KPIs deal with the provision of infrastructure and handling machinery and their overall annual productivity. For container terminals, the most commonly quoted provision measures are the quay length; the container yard area; and the numbers of quay cranes, yard cranes, and tractor/trailers sets. These higher-level KPIs should be available for most of the SASEC ports. From these KPIs, the following standard comparative measures are usually calculated to assess the overall

productivity and adequacy of the infrastructure in connection with the throughput and to allow comparisons between various terminals:

- Effective yard depth – measures the balance between quay length and yard provision. The requirement is higher for gateway ports than for transshipment ports, such as Colombo, for two reasons: (i) container dwell times are longer; and (ii) a container must be held in the yard, once for each ship-to-shore move for import and export containers, but twice for each two transshipped containers. An effective depth of at least 300 m is normally needed for major gateway ports, and 400–500 m is preferable. If less is provided, expensive high-density stacking solutions are required (as in Hong Kong, China where land costs are very high), or empty containers and sealed full containers must be moved rapidly to and from satellite yards. Some SASEC ports are city ports with constrained yard depths, combined with an inability to implement high-density stacking solutions, as at Yangon;
- Average quay crane spacing – indicates the level of provision of quay cranes. Some of the SASEC ports still rely on ship's gear. However, where mobile harbor cranes (MHCs) are provided, the ratio is about 1 crane to each 250 m of quay length. Terminals serving gearless container vessels generally require at least 1 crane to each 130 m of quay length. The largest ports now provide about 1 crane to each 80 m of quay, as the largest vessels are wider and deeper and carry more containers per m of overall length;
- Yard density – is measured in two ways: the number of ground slots per hectare for storing containers and the total number of containers that can be stored. The number of ground slots is relatively fixed, but stacking heights can vary between two high for loaded units and four high for empty containers within small terminals and in highly mechanized terminals it may be possible to stack loaded containers six high and empties ten high;
- Quay face productivity – is usually calculated as the total TEU crossing the quay face per year divided by the quay length, to give TEU per m per year. Figures range from about 800 or less in small terminals, particularly those serving multipurpose vessels, general cargo vessels, and container vessels, to about 3,000 in huge gateway ports with large vessels, high container transfers per vessel, and a preponderance of 40 ft containers. The majority of large international terminals range from about 1,400 to 2,200 TEU per m per year;
- Quay face occupancy – is measured in the same way as the port as a whole, and the same criteria apply. Annual average figures below 60% suggest spare capacity, whereas a figure of 80% or more will, due to fluctuations in vessel arrival rates, result in unacceptable waiting times at peak periods;
- Quay crane productivity – is measured in moves (or sometimes TEU) per quay crane per year and ranges upwards to about 160,000 moves per crane per year. In small terminals, using MHCs to support ship's gear, reduced figures are likely, both as a result of lower berth occupancy by container vessels and lower handling rates;
- Yard productivity – corresponds to the quay productivity measure and is recorded as containers handled per year per hectare of yard space. It depends highly on the maximum stacking height and the ratio of transshipped to import and export containers; and

- Average yard occupancy – is calculated from the capacity and the average number of TEU stored at any one time. Similar to berth occupancy, average figures over 80% indicate congestion, which will impact on container-handling speeds.

At one point, indicators such as quay face productivity and yard productivity could be used directly as measures of efficiency, and statistical techniques such as frontier analysis were used to rank terminals based on indices and their underlying throughputs. Research has since shown that this is not the case; the nature of the shipping calling pattern at the terminal has a profound effect on the performance that can be achieved, and detailed calculations are needed to estimate the productivity frontier for each terminal and the point beyond where extra physical capacity is required.

Attention has been concentrated on the operational KPIs, which relate more closely to the actual efficiency of operation and lie more within the control of the terminal operators and a deeper analysis of the productivity frontiers for each terminal based on individual studies. The following are common forms of operational KPIs applied in relation to the larger container terminals and used as input to such studies:

- Ship-to-shore crane efficiency – is the most common indicator of the productivity of container terminal operators since it has a direct effect on the costs and service reliability to the shipping lines. It measures two main components—the crane rate and the ship rate. The crane rate records the number of containers handled by an individual ship-to-shore crane divided by the elapsed crane time, being the total allocated crane hours less operational and nonoperational delays. As noted previously, the critical figure is that which can be achieved regularly over an 8-hour shift, not the peak hourly rate. The ship rate is the crane rate multiplied by the crane intensity, which is the total number of allocated crane hours divided by the elapsed time from labor first boarding the ship and labor leaving the vessel;
- Terminal equipment cycle – measures the hourly rate of various equipment types operating within a terminal. The most critical is the time cycle of the equipment transferring containers between the ship-to-shore crane and the container stacks, and vice versa, ensuring it is compatible with the ship-to-shore crane performance. As noted earlier, the cycle time depends on the size and shape of the terminal and the type of equipment used. The optimal choice may be found experimentally. Other equipment cycles relate to handling speeds between container stacks and road and rail transport and for re-stowing movements within container stacks;
- Vehicle waiting time – calculates the truck delays incurred while loading units from container stacks onto trucks for onward delivery (forwarding performance), or unloading trucks with exports or returned empties; and
- Equipment availability – measures the downtime of the different types of container-handling equipment within the terminals, such as the ship-to-shore cranes, rubber-tired gantries or straddle carriers, forklifts and reach stackers, and tug/trailer combinations. Large terminals in developed countries tend to have relatively low equipment downtime, whereas in developing countries

higher downtime is often incurred due to poor maintenance practices, lack of spares, and the higher levels of equipment damage caused during operations. There are indications that this has been a significant problem in some SASEC ports, as at Chittagong, particularly with more advanced equipment controlled through computer interfaces and relying on regular maintenance of critical electrical and hydraulic components.

No two terminals are identical, although as terminal operations increase in scale, the likely efficiency levels should become broadly similar to other terminals. The productivity levels should also converge, provided the terminals are handling like sizes and types of vessels with similar unit mixes and proportions of transshipped containers. Some of the main external determinants impacting on the relative efficiency of container terminals as reflected in operational KPIs are as follows:

- Container mix – is the composition of trade in relation to the ratio of 40 ft to 20 ft containers, with a 40 ft container being equivalent to 2 TEU. It takes approximately the same time to handle a 40 ft unit as a 20 ft unit. The larger container terminals usually handle a higher proportion of 40 ft units and therefore tend to have higher handling performance in terms of TEU handled per hour. The ratio of 20/40 ft units at major hubs is often 1:1.4 or 1:1.5 in the region, and as high as 1:1.7 in the PRC–Europe trade. At many of the SASEC ports, 20 ft units inward and 40 ft units outward are dominant due to the differing types of cargo. Given this potential distortion, terminals in smaller ports tend to measure performance in units moved per hour, rather than TEU; and
- Vessel size and cargo exchange – vessel size and cargo exchange (containers loaded and unloaded per ship) are critical determinants impacting on recorded terminal efficiency. A larger vessel can generate significantly higher crane rates because of the improved access, with most large container ships being gearless (no deck equipment obstructions), having cell guides, having a wider beam (thus increasing the number of movements across the vessel moving in a lateral dimension), having a higher proportion of deck cargo, etc. Smaller vessels tend to be more difficult to work due to more complex stowage, the lack of cell guides, the presence of deck equipment such as ship cranes, etc. In addition, larger vessels invariably have a larger cargo exchange at an individual port. This enables a more constant supply of units to be handled, reduced longitudinal movements, and sometimes even the ability to discharge and load during the same crane cycle. Larger container ships also enable the ship rate to increase significantly due to the ability to employ more cranes per vessel. For example, for major international container terminals handling over 500,000 TEU per annum, the crane rate KPI for STS gantry cranes would normally be 25–30 moves per crane hour and the ship rate about 100–125 TEU per hour.

The following are sample benchmark or target KPIs in relation to container operations in the SASEC ports based on best performance at international ports of similar size:

- berth occupancy—under 80%;
- berth availability—over 90%;

- berthing delays—under 5% of overall berth time;
- crane rate—gantry 25 moves per hour, MHC 15 moves per hour, ship's cranes 10 moves per hour;
- ship rate—50+ moves per hour; and
- availability of terminal-handling equipment—over 75%.

6.3 Port Interfaces

The KPIs mentioned measure the performance of berths and handling equipment, which is the responsibility of the port or terminal operator. A common problem at many of the SASEC ports is yard congestion; in most cases, this is mainly the responsibility of the trader or his agent. This is a major issue at some ports where the numbers of containers in transit or stored within a terminal facility is nearing capacity, such as at Chittagong and Kolkata. There is a separate set of KPIs used to measure port facilitation relating to cargo transiting through the terminal. The main port facilitation KPI measures the time between when the vessel discharges an inbound container from a vessel to when it leaves the port for final delivery, or in the case of exports from coming in through the port gate to loading on board the vessel. This is usually referred to as port dwell time in the case of containerized traffic. Trade facilitation, which covers the clearance of cargo with the respective authorities, forms a major component within port facilitation but represents only a part of the overall export and import processes within a port.

Export dwell times are generally easier to control because they tend to be dictated by the carrier, who nominates when the cargo can be received within the port area and the preference of the shipper to deliver to the port as late as possible to minimize potential storage charges. The various trade facilitation procedures for export cargoes also tend to be simpler than for imports, and many of the bureaucratic processes can be commenced before the cargo is physically dispatched to the port. Longer periods are needed where the containers are to be shipped to the US to allow for screening or scanning.

Most of the SASEC ports have significant trade imbalances corresponding to an excess of import containers over exports, thus resulting in the accumulation of empty units. The approach at many ports worldwide is that once an inward container leaves the port, either to the importer or to container freight stations or an ICD, the empty unit cannot be returned unless it has already been booked for export. As a result, many ports tend to be surrounded by a preponderance of empties depots, as at Colombo. These depots do not require strong pavements, and the empty containers can be handled using lightweight equipment. The net result is that the port dwell time for empty containers—the main outbound traffic at some ports—tends to be low, often only 1–3 days.

Conversely, import container dwell time can often be a major cause of terminal congestion due to the increased complexities of the clearance processes and the control element required by the various border agencies to ensure payment of the

appropriate fees, taxes, and duties as well as the cargo's compliance with different technical standards. There is a need to enable the conducting of elements of the port and trade facilitation processes on import shipments to be undertaken prior to the physical arrival of the cargo and its associated documentation in SASEC ports. This would speed up the final clearance. The lack of prior clearance activities in the SASEC countries means that dwell times can regularly exceed 2–3 weeks, whereas in developed countries 5–10 days is more common.

In some countries, ports and container terminals often encourage the use of spare yard space for storage of imported containers in the early development years, since it is a source of income. As congestion increases, the free time (generally 4–6 days) is progressively reduced by improvements in customs and other import procedures, and steeply increasing storage rates are brought in to discourage long dwell times. Simultaneously, import dwell times can be reduced significantly by the use of off-dock CFS and ICD. These facilities are subject to customs control, thus enabling containers to be removed quickly from the port under seal for final inspection and clearance by customs and biosecurity staff. The use of these off-port facilities is common in SASEC countries, but in other countries there are restrictions on the types of cargoes that can be moved from the port to these external facilities.

The main differences between port facilitation and trade facilitation relate to the additional processes required to clear shipments with the port authorities, the sea carriers and their port agents, and the land transporters. These processes can and often do extend the dwell times, though usually less than for the trade facilitation-related processes. For example, customs and other regulatory authorities may not process import declarations unless they are accompanied by documentation from the carrier or his agent that the freight charges have been paid (evidenced by a release note from the carrier), and a gate pass cannot be issued unless the cargo is customs cleared and all handling and storage charges have been paid. Thus, port facilitation and trade facilitation are integrated to a certain extent.

Without accurate data, it is difficult to provide meaningful port facilitation KPIs for SASEC ports. In the longer term, dwell times will need to fall to the following levels to be competitive with international best practice being achieved at the world's major container ports:

- import dwell time—3–5 working days;
- export dwell times—2–3 working days; and
- empties dwell time—3 working days.

These KPIs should be attainable with a combination of enhanced trade facilitation with faster clearance performance and the use of off-port facilities (ICD/CFS) to support port operations. Further development of ICDs and off-dock CFS will become increasingly critical to container yard performance and reductions in terminal dwell times. The ability to move units out of the port without having to wait for their clearance means that customs or other agencies are not the determiners of dwell

times. In general, Indian ports are well supported by both ICDs and off-dock CFS, but there is a shortage of such facilities particularly in Bangladesh and to a lesser extent in Sri Lanka (where many off-dock ICDs are in reality empties depots).

Another key issue at many of the SASEC ports is gate congestion. When units are collected from the container yard, they need a gate pass to transit outside the port. This pass is not usually issued by the terminal operator until all fees payable to the operator have been settled and customs clear the goods in the form of a clearance or transit note. On the other hand, empty vehicles entering often have to obtain an entry pass from the terminal operator indicating a container has to be picked up. If it is an outbound container, the operator has to produce documentation indicating a confirmed booking. Theoretically, this should be a simple process with the paperwork completed in advance. However, there are queues both coming in and going out at many of the SASEC ports. One of the causes is “bunching” of arrivals at the gate due to the timings of the issuance of exit passes; others include the complexity of operations at the port gate and external curfews on connecting roads.

Congestion on external roads is a major issue at city ports. In most cases, the city has grown around the port, as at Chattogram, Chennai, Kolkata, Malé, and Yangon. The traffic streams entering or leaving the port intersperse quickly with urban traffic, creating bottlenecks. The newer ports as at Haldia, Kattupalli, Krishnapatnam, and Mongla do not face the same problem, as these ports are not surrounded by a city and access to and from the highway network is relatively unimpeded. In some cases, as at Tuticorin and Visakhapatnam and more recently Chattogram, dedicated connecting roads have been built to alleviate this potential bottleneck. Unfortunately, planned dedicated port roads at Chennai and Kolkata have faced land acquisition and legal problems, delaying their implementation. These last mile links are critical developments toward improving overall port performance.

6.4 Information and Communication Technology Developments

Ports undertake the intermodal transfer between surface-based transport and maritime transport and form one of the key components within any international logistics chain. Performance is critical, and therefore activities within the port must be considered both holistically and as separate activities to be assessed in isolation. Port efficiency and reputation are based on enhancing overall performance, rather than the individual components within the process. KPI data extracted from a port or terminal operator's IT systems firstly measure overall performance and secondly help in the identification of specific operational constraints to which management can respond.

The application of information and communication technology (ICT) within parts of the SASEC ports is considered to be relatively high.²⁴ Most of the container terminals are operated by established international operators, all of whom have their own terminal IT systems. All the national customs have automated systems, with most now further progressing to the development of national single window (NSW) applications. However, the use of ICT is much lower in terms of data exchange between the other numerous parties involved in port activities—the port community. The extent of data being transmitted between these parties, plus the fragmentation of data exchanges, results in inefficiencies and potential delays in clearances. Figure 5 shows a typical data exchange map at most large ports, as at Colombo, the Indian ports, and Chittagong.

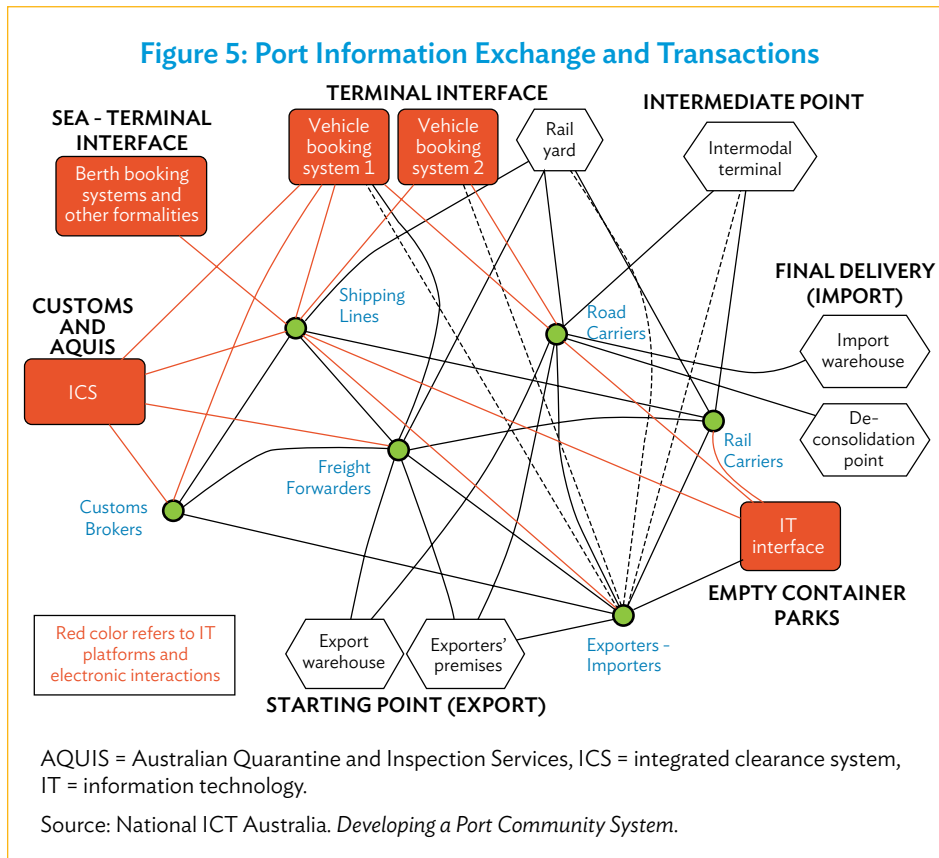
Most container terminals in the SASEC subregion have some form of terminal operating system (TOS). Given the operational complexity and capital investment requirement involved in such facilities, terminal concessionaires apply advanced computer applications to facilitate the optimization of their operations, in order to achieve their full potential and to deliver the high levels of efficiency and service demanded by their customers. The TOS generally focuses on the control of the overall movement and storage of units within the terminal, often with real-time tracking applications. The TOS is usually linked to the container terminal management system (CTMS). This linkage enables terminal operators to make improved use of their assets—labor and equipment—and to get prompt (or real-time) information allowing more timely and cost-effective decision-making.

Many of the SASEC ports have outsourced their container terminal operations to major international operators such as PSA, Maersk, and Adani that have the latest TOS and CTMS. About 60% of all container movements worldwide are handled by the leading international terminal operators, 20% by private companies, and 20% by state operators and other parties. Ports, such as Chittagong where Chittagong Port Authority is the operator, have developed their CTMS with the assistance of a consortium of international system providers.

The other key party dictating port efficiency, particularly concerning terminal dwell times, is the national customs organization. Each of the SASEC countries, to a major degree, has computerized their standard customs operations. The most common application is the ASYCUDA World developed by the United Nations Conference on Trade and Development (UNCTAD) or variants thereof. Bangladesh and Maldives both use ASYCUDA World and Sri Lanka an advanced application of an ASYCUDA-based system. India has developed its own system called Indian Customs EDI System with ICEGATE as its external gateway. Myanmar has recently completed its Myanmar Automated Cargo Clearance System. While the various customs IT systems are not identical, all these national customs organizations are using ICT for import, export, and transit clearances, meaning these systems have similar functionality. Residual issues are the continued necessity to provide substantial paperwork to support

²⁴ Based on author's research of container terminals at the main SASEC ports and national customs.

electronic submissions, the limitation in preclearance applications before the cargo physically arrives, the application levels of risk management, and the parallel use of manual and automated systems.



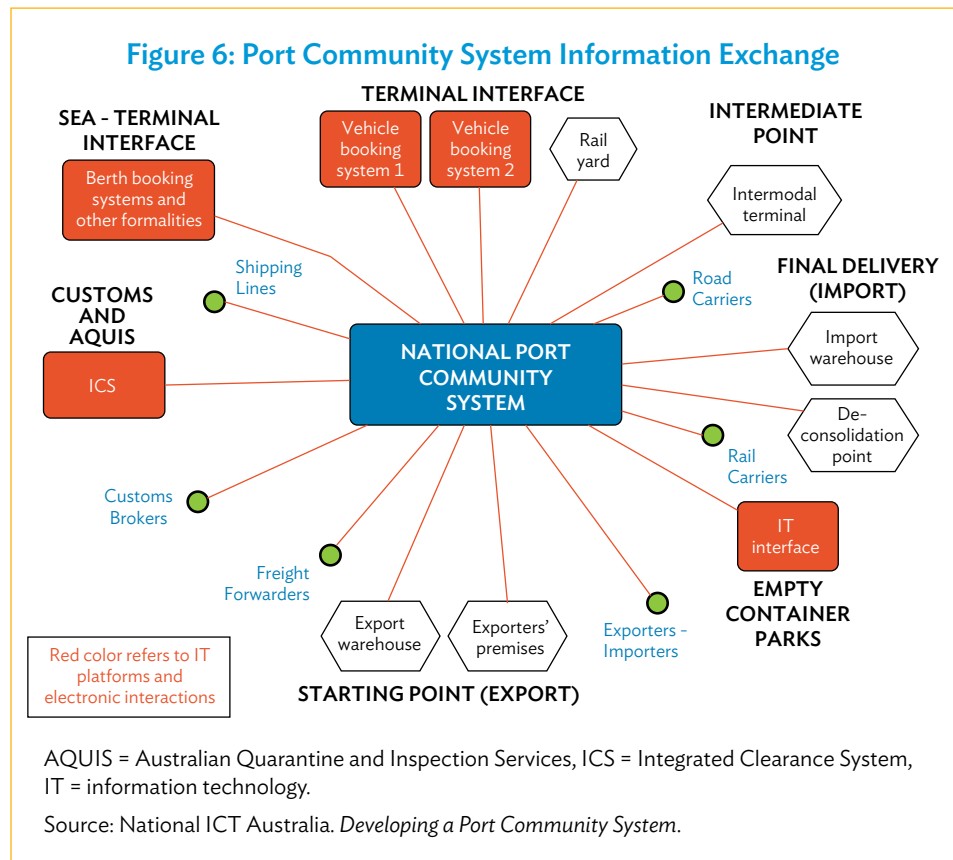
This situation whereby two key parties—the terminal operators and the customs—have advanced ICT systems is relatively common at ports with appreciable container traffic. The problem is that, as shown in Figure 5, there are many other players, and not all of these parties have advanced IT systems. Consequently, the optimum data exchange capability is often not realized, leading to multidata entries in both electronic and documentary formats.

The solution at leading ports has been to develop a port community system (PCS). A PCS is a neutral and open electronic platform enabling the intelligent and secure exchange of information between public and private stakeholders in order to improve the competitive position of the ports' communities²⁵. It seeks to optimize, manage, and automate the various port and logistics processes through a single submission of data linking transport and logistics chains. It is an integrated modular system

²⁵ United Nations Economic and Social Commission for Asia and the Pacific. Bangkok. *Capacity Building Workshop*. United Nations Economic and Social Commission for Asia and the Pacific (2018).

developed for port users by port users that addresses the various cargo handling and clearance activities and processes in real time.

The sample architecture of such a system is shown in Figure 5 and demonstrates how the data exchanges in Figure 6 can be centralized, whereby the single window approach allows the various parties involved in trade and transport to lodge standardized information and documents once without the need for making separate entries of identical data to other parties on an individual basis.



The major benefits for all parties involved are higher efficiency and speed regarding the various port processes, particularly through the automatization and reduction of paperwork. Their functionality is aimed at eliminating unnecessary paperwork that can constrain cargo handling activities. Through electronic data exchange, the PCS is an effective real-time information system designed to improve efficiency at all stages of the process of manifesting, through vessel discharge and loading, customs clearance, port health formalities and delivery of traffic in and out of the port. It also can provide improved security, cost reductions and potentially improve the competitiveness of each user.

While the application of PCS has initially been mainly in developed countries, this is changing. Any significant container port needs a PCS to be a meaningful player. For example, India's Ministry of Shipping has issued an order to make a PCS mandatory for all Indian seaports including public and private ports. The Indian Ports Association, an autonomous body under the Ministry of Shipping, has awarded a contract to roll out a pan-India PCS by December 2018. The proposed PCS will involve connectivity with all the various stakeholders. Technological changes will have to be made by the ports and other stakeholders to enable real-time information exchanges with the PCS.

The appointed system designer has been asked to include, other functionalities such as transportation solutions, a vehicle booking system (for better vehicle planning to reduce port congestion), and cargo booking activities (cargo, containers, vessel slots, etc.). The system will include linkages covering intermodal shipments, railways (container train operations and general cargo booking), and coastal/inland waterways and act as a single point for collection of dues. The PCS will link with the customs through ICEGATE. A pilot project is to be undertaken at JNPT Mumbai to test transactions, based on the application programming interface between PCS and ICEGATE, as the customs has initiated the upgrading of ICEGATE for real-time data exchange.²⁶

Other SASEC ports, such as Chittagong and Colombo, are actively engaged in the development of their PCS. During the development phase, the systems often tend to initially focus on the port authority, terminal operators, and customs, but with its coverage gradually expanding to encompass more and more of the community as shown in Figure 6. The increased development of ICT applications in the port environment will be an essential component in enhancing port efficiency and enabling the tracking of cargoes throughout the entire logistics chain in order to comply with international and customer requirements.

As with all ICT systems, a key issue is system security. There have already been instances of cyberattacks on the IT systems of the major container carriers. PCS handles sensitive information. Therefore, adequate firewalls and preventive systems should be inherent in the system design.

Terminal equipment automation is also being introduced at some of the world's leading ports, such as at the new Rotterdam terminal by Maersk. The key drivers are reduced labor costs, increased safety, and more efficient use of assets. Such high levels of automation of terminal equipment, used by only 1% of ports worldwide, may not cascade down to SASEC ports for some years. However, some ports are semiautomated in that some operations within the container yards have been automated. SASEC countries must tackle the challenges associated with greater use of automation, including the high initial costs and expertise required to maintain and repair these advanced applications and the potential loss of jobs due to reduced staffing levels.

²⁶ Manoj (2018).

6.5 Development of Port-Based Economic Complexes

There has been a growing tendency to anchor economic activities around the ports by creating special economic or free zones near them. This development generates captive traffic for a particular port and is being promoted in countries with centralized planned economies, such as the PRC. This reflects a more structured approach, with industries being set up around ports, particularly those with a higher dependency on imported products. In some cases, ports have become a part of a heavy industrial complex.

Changes in the profile of exports, with more products being generated by light industry as opposed to heavy industry, has meant that export origins have often become much more diversified and are usually concentrated around major cities where labor resources are more readily available. The development of economic zones around ports is often to promote export-related activities, particularly by those industries that require imported components from overseas, and as an approach to attract foreign direct investment. Incentives are provided to concentrate economic activities around ports, specifically to generate more port traffic. The Sagar Mala Program in India is a good example as it is specifically designed to promote ports as a component in economic development in the area around them, rather than viewing ports as an intermodal transfer point in isolation.

With improved performance, ports will be more attractive to importers, exporters, and shipping lines, and thus can indirectly attract economic activity. However, governmental planning at central or state level in promoting and establishing port economic zones, especially given their ability to offer incentives, means they are probably in the “driver” position rather than in the port authorities. Economic development will inevitably grow around the ports, but the planning of special and economic trade zones around ports will provide further incentives and secure development land in a more structured way.

6.6 Impact of the Cruise Sector on Freight Handling

The cruise sector is still at an evolutionary stage with approximately 100 cruise liner calls at SASEC ports, the majority of which are ocean liners and intraregional calls. Intraregional cruise activities are currently limited to operations along the west and south coast of India (i.e., outside SASEC), to Colombo and Malé, and between Yangon and Singapore. The cruise industry recognizes that it must target new markets to sustain growth and the programmed increase in vessels. The SASEC subregion has both high population and economic development, which will mean more people engaging in leisure activities such as cruising. Consequently, interest in cruising in the subregion is

expected to increase significantly, as has been the case in the PRC. The current demand comes mostly from outside the subregion and partly within, especially Myanmar in the east and southern India, Maldives, and Sri Lanka in the west.

The development of the cruise sector can harm freight handling operations at ports. Cruise liners have berthing priority, and therefore freight vessels have to be moved off berths that are needed for passenger processing. The larger liners carry 2,000–5,000 passengers and often stay for 1 day only, and therefore passenger processing has to be carefully planned and requires the use of large open processing areas. In many cases, container terminals are often used due to their open areas. As more cruise liners call, conflict may arise between passenger and freight handling activities at ports where dedicated passenger berths are not available. Cruise liner programs are published well in advance and are relatively fixed, whereas freighter berthing is predominantly based on short-term operational planning. The result is that it is difficult to exclude situations whereby passenger ships arrive as programmed, but schedules of freight vessels have changed due to unforeseen circumstances such as bad weather or delayed arrival. Thus, there can be situations when the working of freight vessels has to be suspended due to the arrival of a cruise liner with priority berthing. In addition, when passenger vessels use freight berths, cargo often has to be moved to provide additional passenger processing areas.

Colombo is currently the major SASEC cruise port, accommodating both ocean and intraregional cruises. Cruise liners berth at the Bandaranaike Quay, impacting on residual freight operations. Plans to develop a dedicated international passenger terminal have been on hold for some years, but in late 2018 expressions of interest were issued to construct a terminal. The national tourist industry sees the provision of such infrastructure as crucial to attracting new cruise business to the island.

Myanmar has experienced significant tourist growth in recent years as the country opens up to international tourism. This growth has placed pressure on the national tourism industry and related infrastructure in coping with such high demand. The cruise sector remains relatively small (other than river cruising), but it is growing. All the larger cruise liners have to berth at the Myanmar International Terminals Thilawa downstream of Yangon due to the draft restrictions in Yangon Port. While the facility has spare capacity at present, the growth in the economic zone around the port suggests potential conflict as the number of container ships calling increases. The absence of dedicated passenger facilities adversely impacts on passenger perceptions of the port, as well as the one-hour drive to the city.

Maldives is a popular tourist destination, with cruise traffic representing only a small component of its tourism sector. The cruise liners predominantly anchor off the Hulhumalé Cruise Terminal. While this facility is used for domestic services to neighboring islands, it can also be used for handling cruise passengers that are brought ashore by tender. Tendering passengers ashore by small craft is a well-established practice internationally, but can be a limiting factor given the age profile of passengers on ocean cruises.

Chennai is the only port on the east Indian coast with a cruise terminal. The first terminal was built in 1959 to handle the Chennai–Singapore passenger service, and in October 2018 modernization of the facility was finally completed. The port had in recent years been handling 4–5 liners per annum, but this dropped to 2–3 vessels during the terminal upgrade. It is expected that the number of calls will increase, at least to previous levels in the next few years.

There is a mix between some SASEC ports that have invested in dedicated facilities and berths (Chennai), relied on tendering (Malé), and used freight berths (Colombo and Yangon). The funding of dedicated infrastructure is often particularly difficult due to the seasonal nature of the business and the relatively low numbers of calls per year. Projections as to how the sector will develop from its current embryonic stage are critical in assessing the need for and nature of such investments and addressing the risk of conflict between freight and passenger handling.

SASEC, in its *SASEC Powering Asia in the 21st Century*, highlights the growth in tourism and its positive impact as a catalyst for economic growth.²⁷ It identifies the potential for short sea circuit cruising on the Laccadive Sea and along the southwest Indian coast. Thus, SASEC is already engaged in the promotion of tourism in general and by inference in the development of the subregional cruise activities.

6.7 Indication of Possible SASEC Port Development Priorities

The *SASEC Operational Plan 2016–2025* update identified 11 projects valued at \$9.85 billion, consisting of port developments being undertaken; projects being planned with funding identified, which may or may not have to be finalized; and projects in the planning stage with no funding identified (Table 10).

Demands exceed the availability of funds to implement all these projects in the short to medium term, and therefore an element of prioritization is essential. The priorities discussed below are based on their potential beneficial impact in a SASEC regional context. This prioritization, when assessed in a national context, may not necessarily be identical to the individual governments. The short-term prioritization is on infrastructure development to address either existing problems or rapidly approaching constraints. The medium-term priorities are about addressing the future demands of the container shipping environment, particularly with the trend toward more direct services and larger feeder vessels with deeper drafts.

²⁷ ADB (2017).

Table 10: Identified, Ongoing, and Future Port Development Projects in SASEC Subregion

Serial No.	Project Name	Project Description	Estimated Cost (\$ million)	Indicative Funding Source
1	Chittagong Port Enhancement Project (including Karnaphuli Container Terminal at Chittagong Port)	Project will expand capacity of Chittagong Port to meet demand and also support subsequent port development projects. It will integrate those related to SASEC corridors. Chittagong Port will serve as regional gateway port, providing access to SASEC landlocked countries as well as the proximate region.	200	Government of Bangladesh
2	Upgrading of Chittagong Port: a. New Bay Container Terminal b. craneage c. Laldia Multipurpose Terminal/Bulk Terminal	a. construction of new port outside the River Karnaphuli at Chattogram to provide new capacity and enable deeper-drafted container ships to call b. installation of 10 new gantry cranes for container terminal c. development of terminal mainly for bulk carriers with some container berths (funded on a PPP basis)	2,772	CPA, Government of Bangladesh, Government of India
3	Matarbari Port Project	Construction of deepwater commercial port north of Cox's Bazar	1,500	JICA and Government of Bangladesh
4	Mongla Port development	Construction of container terminal (2 jetties), container-handling yard, container delivery yard (including modern equipment), expansion of port protected area with security system, construction of service vessel jetty, port residential complex and community facilities, expansion of Bandar Bhaban, construction of mechanical workshop, marine workshop complex with slipway, overpass at Digraj rail crossing, procurement of harbor crafts (5), expansion and development of existing road, construction of multilevel car yard	715	Government of Bangladesh and Government of India
5	Expansion of inner harbor at Paradip Port	Addition of two new coal berths	226	Government of India
6	Development of outer harbor nearer to south of southern breakwater at Paradip Port	Development of outer harbor to be able to handle deeper draft bulk carriers	2,454	Government of India
7	Haldia Port upgrading: a. augmentation of capacity of dock complex b. Construction of 3 new berths	a. augmentation of capacity of Haldia Dock Complex by way of new lock gate in existing dock/basin and modification of existing lock gate b. provision of two liquid cargoes and one dry bulk facility to augment capacity	295	KPT
8	V. O. Chidambaranar Port Trust, Tuticorin	Deepening of the harbor basin and approach channel, construction of a breakwater or bubble protection bund, strengthening of berths 1–6, and widening the port entrance channel	462	Government of India, banks through competitive tender

continued on next page

Table 10: *continued*

Serial No.	Project Name	Project Description	Estimated Cost (\$ million)	Indicative Funding Source
9	Colombo: completion and equipping of East Container Terminal	Development of the eastern terminal to be able to process 2.4 million TEU per annum	430	TBD
10	Colombo: construction of West Terminal	Construction of facility to complement southern and eastern terminals to enable port to handle over 7 million TEU in outer harbor	600	TBD
11	Colombo: SASEC Port and Logistics Development Project	Development project design to help Colombo Port as an international multimodal transport hub	200	TBD

CPA = Chittagong Port Authority, JICA = Japan International Cooperation Agency, KPT = Kolkata Port Trust, PPP = public-private partnership, SASEC = South Asia Subregional Economic Cooperation Program, TBD = to be determined, TEU = twenty-foot equivalent unit.

Source: ADB (2016).

Short Term 2018–2020

Completion and Equipping of the East Container Terminal, Colombo. This is probably the most critical development in the region, as Colombo acts as a hub for the SASEC countries. The south harbor extension is the only part of the port capable of handling fully loaded mega container ships transiting the Southern Ocean Corridor. Only one of the three container terminals, i.e., the Colombo South Container Terminal, has been completed. Opened in 2013, the facility is fast approaching high utilization levels. For Colombo to attract more calls by these passing mega carriers, additional capacity is urgently needed. The supporting East Container Terminal is only partly built, and its completion has been much delayed. Decisions should be made to finish it, as without this facility Colombo's role as a regional hub will become increasingly threatened. If more of these large carriers call, there are service benefits to other ports in terms of enhanced feeder connectivity with distant markets.

Developments at Chittagong Port. Despite significant improvements, the port remains the most congested in the SASEC subregion, and this will only become more severe unless remedial action is taken. Given that some feeder calls are based on circuits, delays at Chittagong have adverse implications on service levels at the other ports within the circuit. A three-pronged solution is planned to address the situation. The first is the delivery of container cranes to the New Mooring Container Terminal. This will significantly improve ship-to-shore handling speeds from 10 to 15 moves per hour with mobile harbor cranes and ship's gear to 22 to 25 moves per hour, thus boosting ship handling performance and enabling more gearless container vessels to be employed on services to the port.

The second element is the development of the Karnaphuli Container Terminal. The terminal will provide not only more berthage for container vessels but also more backland container yard area to store inbound containers. The shortage of space to

store containers is partly driven by excessive dwell times, which must be addressed by enhanced port or trade facilitation. The third element is the construction of an ICD in Dhaka. Containers destined for Dhaka could quickly be cleared for transit to Dhaka by rail, thus releasing more storage capacity within the port. Development of the line to Dhaka could mean increasing the two container trains per day, thus relieving pressure on the road network.

In India, the key short-term issue is the landside interface constraints at Chennai Port. The port is losing both traffic and its competitiveness to the minor ports to its north. The solution would be to complete the elevated expressway that connects the port to the nearby national highway network. This partially completed road has been delayed by legal challenges but is scheduled to recommence construction in 2019. In parallel, the development of their container corridor program should help in addressing the interface issue by enabling traffic to move faster in and out of the port.

The next priority is undertaking technical assistance projects designed to address the planning of future infrastructure developments through port master planning. Three countries need strategic master planning of their port sectors, similar to that in Bangladesh at Chittagong (Chattogram) Port achieved with ADB funding. First is Sri Lanka where there is a need to define the strategy for enhancing Colombo's container hub role, including external supporting infrastructure and the longer-term roles of Hambantota and Trincomalee ports in a national maritime context. Second is Maldives where Malé Port is already operating at near capacity levels. Due to low or negative growth in recent years, the port has been able to handle the demand. However, as the economy picks up, congestion with resultant service delays will be almost inevitable. A solution will be costly and needs to be planned now due to the significant lead time in commissioning a new port, or even in extending the port area. Third is Myanmar where there are several plans to develop the Yangon/Thilawa port complex. There may be a case for undertaking a port master plan study to adopt a single solution, thus ensuring that limited funding is directed most efficiently.

The last priority is improvements in both port facilitation and trade facilitation. In the case of port facilitation, there is a need to develop port community systems designed to reduce clearance times and the amount of hard copy material and data entries and exchanges between members of the port community. Parallel improvements in trade facilitation must be achieved through the development of national single windows that can interface with the new port community systems.

Medium Term 2021–2025

Construction of the new Bay Container Terminal, Chattogram. Despite the three-pronged approach to address the current congestion problems, the residual constraint of draft limitation will have an increasingly adverse impact on Bangladeshi trade. The trend is for more direct middle-distance services such as those to and from Southeast Asia and East Asia, the Middle East, and Africa, as well as for larger feeder ships from the hubs. Chattogram has the necessary demand to attract these direct services but lacks the capability (draft) to be able to handle these larger vessels due to the restrictions of the River Karnaphuli. The port, with the assistance of ADB,

is already planning the development of the new terminal outside the river confines, which will enable the handling of much larger container vessels.

Development of Payra Port. Bangladesh lacks a deepwater port and is dependent on Chittagong Port for over 90% of its international trade. This concentration of supply at a single location is a strategic and economic risk. Payra has specific advantages as its location means it has access to deeper water to enable it to handle larger vessels. While its development has been cited in relation to container traffic, the construction of the new Bay Container Terminal at Chattogram will erode much of this benefit as a container port due to the similarity in draft. However, the new port will have major benefits for handling liquid and dry bulk cargoes by being able to handle large tankers and bulk carriers, thus benefiting from the economies of scale.

Development of Malé Port. The ADB-funded Malé Commercial Harbor has reached capacity, with the vessels often queueing to use the facility. The current location is unsuitable for future operations given its position on the city waterfront. Alternative sites have been assessed, and the preferred location is on Gulhi Falhu. Work on the new port is scheduled to commence in 2019 with completion within 3 years.

7 | SCOPE FOR SASEC INITIATIVES IN THE MARITIME SECTOR

When considering potential areas for regional cooperation as part of a SASEC maritime initiative, the focus is expected to be more on the port sector rather than the shipping sector. This is because the scope for cooperation in the shipping sector tends to be more limited, especially as foreign operators dominate this sector and there are well-established international standards and protocols to which most SASEC countries are signatories. While there are some state-owned shipping companies in all five countries, their penetration of the maritime sector globally and even regionally is relatively minimal.

However, there may be some scope for cooperation in developing shipping agreements covering such issues as coastal shipping and cabotage, although these are expected to be principally addressed through bilateral negotiations rather than regional agreements. The recent India–Bangladesh Coastal Shipping Agreement is a good example of such a bilateral agreement.

Regional cooperation between ports is already a well-developed feature in other parts of the world, especially in the spheres of training and capacity building, the exchange of local know-how, standardization of statistics and tariffs, and participation in the activities of regional or international port forums. Types of regional cooperation in the port sector can be grouped into three main categories: institutional, industry, and commercial.

The institutional type occurs when countries sharing common interests create dedicated regional institutions. In this form of cooperation, agreements may be signed by governments to adopt common principles and actions on port-related issues. Another example of regional institutional cooperation is the enforcement of international conventions through “port state control” agreements. The second type is industry cooperation and is aimed primarily at promoting port activities on a nonprofit-making basis. The focus is principally on exchanging ideas and information. The third type is commercial cooperation, whereby ports are linked together financially. In relation to the possible development of a SASEC cooperation medium, the industry cooperation model would be expected to have most traction, despite participation being predominantly at an institutional level.

Analysis of the port sector in the SASEC countries suggests that these countries have identified different priorities in moving forward. Bangladesh is concentrating on addressing congestion, increasing capacity, and tackling draft limitation issues. As the Indian east coast ports have capacity, they prioritize attracting traffic and seeking to become potential hubs or mini-hubs. Maldives priority is to address its lack of capacity, while Myanmar seeks to determine where best to locate any future capacity. Sri Lanka is mainly focused on how to

retain and strengthen its hub role. This gamut of interests reflects, to a major extent, their differing national operating environments.

Despite these differences, ports in the region are subject to some common external pressures, particularly concerning container activities. Ports are the interface between the supply (shipping lines) and the demand (importers/exporters), neither of which they control. Ports are merely the interface of one mode of transport to another. How global transport networks change will have a major impact on individual port activities.

Demand, as represented by import and export traffic, is predominantly dictated by trading communities in the SASEC countries. In general, future traffic through the ports can be forecast based on historical throughputs and projected growth rates, with allowances for individual traffic streams subject to specific circumstances such as the opening or closing of industrial or mining activities or competition from neighboring ports. Thus, there is some predictability in future demand to which the port will need to respond.

Supply is less transparent, other than that shipping companies will inevitably provide sufficient capacity in response to demand. The difficulty for the port sector is knowing exactly how the shipping lines are likely to respond to satisfying that demand in terms of their ports of call and networks, as well as vessel sizes. Chapter 3 highlights recent changes in the container shipping environment with the introduction of mega container ships, its cascade effect to larger vessels calling, and the impact of overcapacity leading to the formation of strategic alliances and more direct feeder services. This more balanced demand–supply since 2016 has resulted in the suppliers (shipping lines) being in a much stronger position to dictate how and where they will meet the future level of traffic demand and the costs of doing so.

The consolidation in the container sector, in particular, has emboldened shipping lines to rationalize and consolidate their services and enabled them to raise freight rates. In relation to ports, the carriers are now in a position whereby they are expected to be more demanding in terms of handling performance and costs. Shipping lines will concentrate their activities and investments on ports having the optimum cost and performance parameters. The changes in traffic flows in the Indian port sector with the gradual transfer of traffic from the major to the minor ports are symptomatic of this trend. The SASEC port sector faces common external pressures and therefore an element of cooperation or knowledge sharing would be useful in addressing approaches to enhancing their performance and introducing more advanced technologies.

The focus of a potential SASEC cooperation initiative should be compatible (though not necessarily identical) with that of other regional initiatives. The ASEAN, for example, aims to (i) provide the ASEAN port authorities and harbor organizations with a vehicle for regional cooperation in port and harbor development, operations, and management; and (ii) promote and protect the interests of member port authorities. The specific objectives of the ASEAN are as follows:

- to promote and assist in the development and implementation of efficient methods on cargo handling systems, port procedures and documentation, administration of port personnel, port statistics, and port information systems;
- to improve the exchange of data and information on shipping and cargo traffic within the port authority area;
- to upgrade the skills and knowledge of port personnel through on-the-job training and seminars and workshops on port planning, operations, and management;
- to promote cooperation in the coordination of ports and harbor operations and management; and
- to develop and maintain close relationships with other ASEAN organizations, especially ASEAN shippers, shipowners, and inland transport agencies.

In the context of SASEC, there are opportunities to participate in exchanges of ideas and experiences between the agencies involved in the maritime sector through meetings, technical visits, and other forms of communications. This exchange of information could include technical data such as KPIs and PCs. Obtaining information on specific issues, comparing solutions implemented in other ports, or simply knowing the decision-makers of other ports is a compelling reason for port authorities or their ministries to cooperate in a regional context. The organization of meetings where members can present papers on topics of interest to the port community is a well-established practice. Sister ports or twinning schemes have also been implemented between the ports in developing and developed countries. Friendly relationships are often the starting point of more technical and formal cooperation.

Analysis of the SASEC maritime environment indicates that there may be potential scope for a separate regional technical assistance initiative covering areas of common interest:

- (i) information and communication technology and port community systems;
- (ii) legal/regulatory issues adversely impacting on subregional connectivity;
- (iii) development of external logistics infrastructure;
- (iv) environmental issues (“green ports”); and
- (v) development of the cruise sector.

7.1 Information and Communication Technology and Port Community System

The elevated application of ICT in the subregion’s port sector will be crucial in ensuring improvements in port performance. Most of the SASEC ports have some form of terminal operating system and container terminal management system, mainly by virtue of the container terminal operators introducing such systems as part of the concession arrangements. These systems should include real-time tracking

and tracing applications and be capable of generating detailed KPIs. Collation and publication of KPIs could be a useful tool in demonstrating to shipping clients when they are negotiating contracts that performance improvements are taking place, albeit at a port or individual terminal level. KPIs also provide a level of performance transparency that is presently rarely available at SASEC ports.

The main residual ICT demand in the future will be the need to link the various parties involved in the movement of containers through the port, thereby minimizing the need for separate party-to-party data transmissions. In connection with customs and border clearances, the concept is similar to the NSW platform being pursued in many countries. Currently, the traders and their representatives and agents have to submit data separately to the port authority, customs, sanitary and phytosanitary and other border control agencies, the shipping line's agent, the terminal operator, the road or rail transporter, etc. A port community system links these diverse parties through a neutral and open electronic platform, enabling the secure exchange of information between public and private stakeholders thereby improving the competitive position of seaport communities. It optimizes, manages, and automates port and logistics efficient processes through a single submission of data and connects transport and logistics chains. The system enables the sharing of data between parties and provides access in real time to the status of consignments throughout the various transactions between the arrival of goods at the port—by sea in the case of imports and transshipments—and its exit by either sea or land.

India has already recognized the value of having a port community system. The Ministry of Shipping acknowledges that importers and exporters have a complex supply chain because of the different “windows” they need to approach for clearances. For example, there are 21 various government departments involved in the import–export chain. On average, it takes 7–10 days to complete the necessary documentation—7 days for exports, 10 days for imports. These agencies often have different ways of interpreting procedures, sometimes leading to litigation that can take years to resolve, hence the need to commission the development of a nationwide PCS (starting in December 2018) that standardizes procedures and processes.

The government has mandated Portall to roll out a cloud-based, blockchain-ready pan-India PCS application that is designed to reduce paperwork and cut transaction times and costs. One major port operator, Adani Ports and Special Economic Zone, has indicated that it expects the PCS to bring more transparency and visibility of movement. The role of intermediaries will be redefined with data on customs activities, shipping movements, transport movements, the locations of boxes, etc., all being accessible through the PCS, thus leading to data integrity.

The situation in India is not unique, with similar bureaucratic practices and procedures in most other SASEC countries. India is now adopting a solution that has already been undertaken by many of the world's leading ports. It recognizes that for its major ports to be more competitive on the world stage and to assist their trading community, it needs to embrace such modern technologies. Chittagong and Colombo, and later Myanmar and Maldives, will also have to consider similar ICT applications.

Given this common interest, one area of possible cooperation could be the application of PCS technologies at the SASEC ports. The initial stage would consist of an audit of the use of ICT by the diverse members of the port community, i.e., who sends what data between which parties, and confirm the presence of terminal operation and container terminal management systems. The next stage would be to assess and quantify the potential benefits of installing PCS at individual ports and providing awareness training on PCS. This could be followed by examining the potential IT linkages between members of the port community and the optimum form of IT architecture required, both in the initial trial and developmental phases.

The situation whereby the SASEC country with the largest number of ports is already committed to rolling out a PCS suggests the additional potential for knowledge-sharing. This would be particularly relevant to the imminent testing of the Indian system at JNPT Mumbai. Feedback would be of value to the other member countries considering installing PCS within the next few years. Knowledge sharing would enable the other member countries to make informed judgments as to how, when, and where to develop their own PCS.

7.2 Legal and Regulatory Issues

Both the shipping and port sectors are subject to rules and regulations set out in national or international law, be it in the form of international conventions or national (or even state) regulations. When trading with certain countries, the ports have to conform to additional security measures on export shipments imposed by foreign governments such as the US and the European Union. Thus, both shipping and port sectors are operating within a highly regulated environment.

These legal and regulatory aspects are needed to ensure conformance and, in certain cases, have been imposed to protect national interests. The shipping and port sectors have undertaken significant changes in recent years, especially with the expansion of the container sector and the introduction of advanced ICT and equipment technologies. In some cases, the changes or updating of rules and regulations have not kept pace with these changes in the maritime environment and can therefore inhibit sector performance. For example, the United Nations Convention on a Code of Conduct for Liner Conferences that was designed to ensure developing countries' participation in maritime trade appear logical at the time it was drafted but became a potential maritime trade inhibitor as the international container trade grew.

Another example is the India–Bangladesh Coastal Shipping Agreement signed in June 2015 that was designed to promote bilateral river–sea shipping and use of the respective inland waterway networks. This agreement only covers bilateral river–sea trade between India and Bangladesh and prohibits the handling of third-country trade. Application of this agreement has prevented the transshipment of Bangladesh trade at Indian ports such as at Chennai, thus becoming a trade inhibitor. The December 2018 joint meeting discussed how to resolve this issue.

These examples demonstrate how rules and regulations can become outdated and restrictive as the market continues to develop. They were designed to promote the maritime sector but failed to adapt to change and move beyond their original concept. While these are issues unique to specific agreements, there are many similar cases of rules and regulations becoming obsolete in the maritime sector.

Another major issue is cabotage, i.e., the conveyance of cargo from one port to another within the same country. Many countries restrict such movements to carriage by national flag vessels. This has been a particular problem for the container shipping industry, as cabotage limits the potential for national transshipments. For example, India, like some other countries, did not permit containers to land at one Indian port and then transship to another Indian port, thus limiting the potential for Indian ports to act as national hubs at a time when more middle-distance direct services were being introduced. In May 2018, a more liberalized cabotage policy was introduced—foreign-flagged vessels can now transport full import–export containers for transshipment and empty containers for repositioning between Indian ports without specific permission or a license. This change in policy has already resulted in increased transshipments of such traffic at Indian ports. The rules have been adjusted in response to changes in the external market whereby Indian ports are seeking to attract transshipment traffic and feeder vessels are predominantly foreign-flagged ships under charter.

Under a SASEC initiative, an audit could be undertaken to identify where national rules and regulations are potentially harming trade connectivity, particularly between SASEC countries as well as with their global trade partners. Given this wide remit, this audit should be specifically restricted to the container shipping and port sectors, requiring discussions with ministries and port authorities, as well as with shipping lines and port agencies. The objective is to identify any legislation that has become a trade inhibitor due to changes in the market environment, highlighting the nature and impact of the constraint.

7.3 Development of External Logistics Infrastructure

The port is a key transport node in any international transport chain with port performance being critical to the efficiency of the modal transfer. The chain extends nationally beyond the node via its surface-based transport networks and inland logistics. Port performance can be adversely affected by the quality and reliability of its inland logistics, particularly the movement of traffic outside the port gate, i.e., the linkage between the port and its hinterland. The closer to the port any logistical constraint is, the greater the adverse impact on the port, whereas further away such constraints tend to be network-related rather than port-related.

This is a particular problem for the city ports. SASEC has city ports where the city has grown around the port and port traffic interfaces with urban traffic near the port gate,

resulting in external congestion. This adverse situation exists at Chattogram, Chennai, Colombo, Kolkata, Malé, and Yangon. The solution is usually to have a dedicated port access road that segregates the port and urban traffic further out from the port gate, ideally connecting the port directly with the external highway network thereby avoiding urban roads. Visakhapatnam, for example, has constructed such a dedicated road link based on port funding. ADB, through the SASEC initiative, has funded construction of a port road link at Chattogram and is due to fund a further extension. ADB will also help finance a dedicated elevated highway at Colombo. Work on a port highway at Chennai is scheduled to recommence in 2019.

These last mile developments demonstrate the importance of investment in road linkages to ports. Ports developed on greenfield sites have limited direct connectivity to the core highway network. Ports such as Krishnapatnam, Kattupalli, and even Paradip are some distance away from the NH5, and so are the ports of Mongla from the N7 and Thilawa from the NH1. The growth in container activities has created significant additional volumes of road traffic having to transit through adjacent urban areas to reach the main highway network.

Port or highway last mile connectivity is a common issue. The *Strategy for New India @75* of the Government of India specifically highlights that the country “suffers from the absence of last mile connectivity and infrastructure.” In some cases, improvements are already programmed and funded, while others remain unfunded and have no agreed connectivity solution yet. Given SASEC’s involvement in the funding of last mile investments with ADB, an audit of all last mile connectivity at the main SASEC ports could be undertaken to identify whether further or new dedicated road links are needed and, if so, the potential costs involved in such developments.

The report concentrates on the last mile connectivity issue, as this specifically impacts on the efficient movement of all traffic transiting through the ports. However, constraints within the external road and railway networks effectively raise overall transport costs and thereby adversely affect trade competitiveness. Investments in the national transport network linkages to the SASEC ports are also required to enhance inland logistics, thus generating additional trade. While the priority in developing some of these network improvements may be driven by the need for improved domestic connectivity, the beneficial impact on the port sector should not be underestimated. ADB is a key partner in funding network upgrades, especially those along the designated SASEC corridors.

Another key external issue impacting on port performance is the provision of external support facilities, such as CFS and ICDs, to reduce dwell times within the port’s container yards. The situation varies between countries. In India, many of the ports are surrounded by off-dock CFS that process less-than-containerload and full container load traffic. These terminals function both as CFS and ICD. In Bangladesh, off-dock CFS are restricted in terms of the products they can handle. In Yangon, most containers are transferred to nearby CFS and ICDs due to the lack of storage area within the port yards. In several countries, there is some reticence in forwarding containers to these external depots because of the restrictions on return of the empty units.

In the initial containerization stages, many ports developed CFS facilities within the port warehouses to stuff or destuff consolidated (mixed load) traffic, avoiding the necessity to transfer mixed load traffic to external locations due to the complex customs bonding requirements. More importantly, CFS facilities also absorbed the excess port labor from the transfer of loose cargo to container operation. As traffic increased, the space within the port was insufficient for conducting all CFS activities. The result was to allow the development of off-dock bonded facilities to handle less-than-containerload and in many cases full containerload (FCL) cargoes. The performance of these commercial off-dock facilities was often significantly higher than those in port facilities using port labor.

With containerization, FCL traffic could be quickly forwarded “under bond” to inland facilities such as ICD closer to the end user. In Bangladesh and India, the development of ICDs has been closely linked to transferring the inland distribution of containers to and from the port by rail, thus relieving the congested road network. India now has many ICDs, but Bangladesh has only one main ICD (in Dhaka) that is operating at full capacity. Myanmar has several nominal ICDs in Yangon—in practice, these ICDs are similar to the CFS around the ports in India in that they act as combined CFS and ICD. In Sri Lanka, the nominal ICDs are mainly empties depots for inbound FCL traffic, as the empty unit cannot be returned to the port without an outbound vessel booking.

Expansion of container yards within the ports is becoming increasingly difficult due to space constraints. Therefore, as trade volumes increase, external infrastructure will be needed to support the ports in assisting in reducing dwell times thereby ensuring that ports expand their role as a transit rather than a storage facility. Improvements in clearance performance through national single windows and PCS would be expected to help reduce dwell times, but this alone will not alleviate the need for external CFS and ICDs given predicted traffic growth rates of 3.8% annually. Similar to the last mile audit, an analysis could be made of the demand for both CFS and ICD developments required to support future port operations, as well as of any regulatory constraints on their operation. An additional feature would be to identify funding sources, either public or private, to realize any required developments.

The Sagar Mala Program being promoted by the Government of India looks at ports from a more holistic perspective in relation to national economic development. It is designed to unlock the potential of its waterways and coastline, envisaging (i) investment in new mega ports; (ii) modernization of India’s existing ports; (iii) development of coastal economic zones; (iv) enhancement of port connectivity via road and rail; (v) establishment of multimodal logistics parks, pipelines, and waterways; and (vi) promotion of coastal community development, resulting in increased exports and employment opportunities. Its focus is on port-led development to integrate ports, industrial clusters, and hinterlands. The program has recently been revalidated by the *Strategy for New India @75*.

This ambitious \$120 billion program differs from conventional port development initiatives, as it views the port as the driver of economic development rather than an intermodal node in isolation. Thus, it directly links ports with the development

of external infrastructure for economic gain. Last mile and off-dock CFS and ICD facilities are essential components within this holistic concept. The program specifically stresses the importance of investment in external infrastructure to support and modernize the country's port sector.

Other SASEC countries may not have adopted similar approaches and consider external infrastructure developments on their own merits rather than on any direct linkage with port reform and enhanced performance. Despite this, there is general recognition that port development in isolation will not satisfy future traffic demand, particularly in the container sector, hence the importance of reviewing the need for both last mile and ICD and CFS investments.

7.4 Environmental Issues—“Green Ports”

Environmental issues pertaining to port development, cargo handling operations, and infrastructure are expected to become critical in the coming years. Climate change is now accepted as a reality, with the resultant rising sea levels placing two SASEC member countries (Bangladesh and Maldives) at risk as well as certain parts of India and Myanmar. Port authorities and terminal operators should recognize that ports have a poor environmental image, being subject to higher levels of air and water pollution, waste, limited spoil control, etc. Ports are major industrial complexes and should have clear environmental policies and strategies based on their situations and risks to demonstrate that they take environmental issues and their promotion seriously.

Climate change issues, balanced with the demand to enhance the competitiveness of port operations, represent an important future development challenge. A key response by major ports in developed countries has been the promotion of the “green port” concept, which seeks to reduce the negative environmental impacts of the port without jeopardizing its economic growth. A “green port” is broadly defined as a “product of the long-term strategy for the sustainable and climate-friendly development of port’s infrastructure.”²⁸ “Green port” management seeks to also include the broader topic of ecosystem protection through port sustainability plans and environmental planning regulations.

Publicity on climate change and the environment will inevitably lead ports in developing countries, such as those in SASEC, to focus on adopting environmental policies that demonstrate individual port’s commitment to achieving specific environmentally goals and practices. Such policies provide a framework within which a port can be seen to be operating in a green or environment-friendly manner. An example of a “green port” policy at a major US container port (Long Beach, California) is shown in Box 1.

²⁸ Pavic et al. (2014).

Box 1: “Green Port” Policy at Long Beach, California, United States

The Port of Long Beach is committed to improving the environment, as demonstrated by its 20-year record of environmental protection programs. The “Green Port” Policy is an aggressive, comprehensive, and coordinated approach to reduce the negative impacts of port operations. The policy serves as a guide for decision-making and established a framework for environmentally friendly port operations.

Guiding principles:

- protecting the local community and environment from the harmful impacts of port operations;
- employing the best available technology to minimize port impacts and exploring advanced technology solutions;
- promoting sustainability in terminal design, development, and operations;
- distinguishing the port as a leader in environmental stewardship and regulatory compliance; and
- engaging with and educating the community about port development and environmental programs.

Goals:

- Air: reductions in air emissions from port activities;
- Water: improvements in the water quality in the harbor and surrounding environs;
- Wildlife Protection: maintenance or restoration of aquatic ecosystems and marine habitats;
- Soil/sediment: removal, treatment, or rendering suitable for beneficial reuse of all port-contaminated soils and sediments.
- Sustainability: implementation of sustainable practices in terminal design, development, and port operations;
- Community: interaction with and education of the community regarding port; and
- Engagement: environmental programs.

Source: Port of Long Beach. *Green Port Policy*.

At this stage, none of the SASEC ports have an environmental policy or strategy published in the public domain, although some may have internal policies. This does not suggest that ports fail to recognize the importance of environmental protection in development issues, but possibly that these issues may not be perceived as necessary in promoting and operating ports to the same extent as is the case in developing countries.

Planning and adopting “green port” strategies is complex, particularly as it has to reflect the specific situation of the port, the types of ships and cargoes the port services, and its national legislative environment. Programs similar to the Environmental Management Information Systems applied in Europe can provide a structured approach to the development of robust “green port” policies and strategies through:

- conducting environmental audits;
- adopting an environmental management system;

- undertaking an environmental review; and
- training and twinning.

Under a SASEC initiative, it may be possible to consider developing an environmental management system for SASEC ports by introducing the concept of “green ports” and its relevance in both a commercial and climate-changing market environment. It may also be possible to undertake individual port audits, help the drafting of policies and strategies for port environmental statements, provide training in specific methodologies and tools toward developing “green port” status, and possible twinning with existing “green ports” in Asia.

7.5 Development of the Cruise Sector

The cruise sector in SASEC is still at an embryonic stage with only about 100 calls per year at only four ports in 2017. The SASEC subregion, with its high population and growing personal wealth, represents a prime target for the cruise industry. The travel companies in SASEC countries may initially be more focused on directing this potential demand toward existing cruises based outside SASEC. The main demand is likely to be for relatively short cruises such as intraregional cruising. The growth in cruises from Mumbai to Colombo and Malé in recent years confirms that latent demand exists for such cruises. There has also been a significant increase in cruises out of Singapore and Dubai that pass through and call at SASEC ports.

The key issue is defining how the cruise sector will grow, especially in India with it being the largest market. The seasonal nature of the cruise business can provide opportunities to cruise operators as they can transfer their vessels between different markets, such as between the northern and southern hemispheres, thus avoiding colder winter periods when the cruising demand is limited. In the case of India, it is necessary to avoid the monsoon period when cruising demand is low. The cruise lines are continuously seeking to increase their ports of call, but this requires support from tourist boards in identifying attractive shoreside excursions and ports providing suitable facilities to handle these vessels and process large numbers of passengers within a very limited time frame. The provision of dedicated passenger facilities at key ports is an attraction, but requires careful planning to justify this type of expenditure and ensure that cargo handling is not impeded by passenger ship growth.

A SASEC initiative could identify potential cruise hubs and assist in this planning process by examining on the one hand how and where the demand for cruising is expected in the subregion and on the other what port authorities and local tourist boards must do to attract cruise operators to use their ports. This two-dimensional approach is essential to ascertain the nature of future demand and the required actions by ports to attract more calls. The best practices in other regions with nascent cruise sectors could also be shared with SASEC countries in order to highlight and quantify the benefits emanating from the development of the sector.

REFERENCES

- Alphaliner: The Worldwide Reference for Liner Shipping. <https://www.alphaliner.com/>.
- Alphaliner. Top 100 Container Ship Operators. <https://alphaliner.axsmarine.com> (accessed 19 November 2018).
- Asian Development Bank (ADB). Bangladesh: Strategic Master Plan for Chittagong Port. Manila. <https://www.adb.org/projects/45078-001/main>.
- . Maldives: Domestic Maritime Transport Project. <https://www.adb.org/projects/37265-013/main>.
- . Sri Lanka: Colombo Port Expansion Project. <https://www.adb.org/projects/39431-013/main>.
- . 2016. *South Asia Subregional Economic Cooperation Operational Plan 2016–2025*. Manila.
- . 2017. *SASEC Powering Asia in the 21st Century*. Manila.
- . 2018. *South Asia Subregional Economic Cooperation Operational Plan 2016–2025: Update Prioritization Exercise*. Unpublished.
- . 2019. *Asian Development Outlook: 2019: Strengthening Disaster Resilience*. April. Manila.
- Atlas Media Collective Learning. 2016 Observatory of Economic Complexity Trade Statistics 2016. <https://atlas.media.mit.edu/en/>.
- Geopolitical Futures. 2016. Top Container Ship Trade Routes. <https://geopoliticalfutures.com/top-container-ship-trade-routes/>.
- GlobalEDGE Michigan State University. *Global Insights*. <https://globaledge.msu.edu/countries/united-states/tradestats>.
- Government of India. 2015. *Sagar Mala Program*. New Delhi.
- Government of Sri Lanka. Ministry of Ports and Shipping. 2016. *Performance Report 2016*. Colombo. p. 221. <https://www.parliament.lk/uploads/documents/paperspresented/performance-report-ministry-of-ports-shipping-2016.pdf>.

- International Chamber of Shipping. 2017. *Shaping the Future of Shipping*. London.
- Japan International Cooperation Agency. 2016. *Data Collection Survey on Cross-Border Maritime Traffic in South Asia*. Tokyo.
- JOC Staff. 2016. Growth at India's private, minor ports rapidly outpacing public rivals. *JOC.com*. 5 September. https://www.joc.com/port-news/asian-ports/portjawaharlal-nehru/growth-indias-private-minor-ports-rapidly-outpacing-publicrivals_20160905.html.
- Kavirathna, Chathumi et al. 2018. Transshipment Hub Port Selection Criteria by Shipping Lines: the Case of Hub Ports around the Bay of Bengal. *Journal of Shipping and Trade*. 3 (4).
- Manoj. P. 2018. Govt to Explore Legal Framework to Make Trade Transactions Mandatory through Port Community System. *The Hindu Business Line*. 27 September. <https://www.thehindubusinessline.com/economy/logistics/govt-to-explore-legal-framework-to-make-trade-transactions-mandatory-through-port-community-system/article25055476.ece>.
- Maritime Gateway. 2017. *Indian Container Market Report 2017*. Hyderabad.
- National Institution for Transforming India. 2018. *Strategy for New India @75*. New Delhi.
- National ICT Australia. *Developing a Port Community System*. <https://research.csiro.au/data61/wp-content/uploads/sites/85/2015/02/PCSFlyer-ver2.pdf>.
- Panda, Ankit. 2017. Sri Lanka Formally Hands Over Hambantota Port to Chinese Firms on 99-Year Lease. *The Diplomat*. 11 December. <https://thediplomat.com/2017/12/sri-lanka-formally-hands-over-hambantota-port-to-chinese-firms-on-99-year-lease/>.
- Pavlic, Bostjan et al. 2014. Sustainable Port Infrastructure, Practical Implementation of the Green Port Concept. *Thermal Science*. 18 (3). pp. 935-948. <http://thermalscience.vinca.rs/pdfs/papers-2014/TSCI1403935P.pdf>.
- Port of Long Beach. *Green Port Policy*. http://www.polb.com/environment/green_port_policy.asp.
- Shepard, Wade. 2016. Bangladesh's Deep Sea Port Problem. *The Diplomat*. 7 June. <https://thediplomat.com/2016/06/bangladeshs-deep-sea-port-problem/>.
- Ship Technology. *Port of Hambantota*. <https://www.ship-technology.com/projects/port-of-hambantota/>.
- Sri Lanka Ports Authority. <http://www.slpa.lk>.
- UN Comtrade. 2018. *International Trade Statistics Yearbook 2017*. New York.

- United Nations Conference on Trade and Development (UNCTAD). 1976. *Port Performance Indicators*. Geneva. <https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=395>.
- . 1996. *Potentialities for Regional Port Cooperation*. Geneva.
- . 2016. *Bilateral Liner Shipping Connectivity since 2006*. Geneva.
- . 2017. *Review of Maritime Transport 2017*. Geneva.
- . 2018. *Review of Maritime Transport 2018*. Geneva.
- UNCTADStat. Liner Shipping Connectivity Index, annual. <https://unctadstat.unctad.org/wds/TableView/tableView.aspx?ReportId=92>.
- United Nations Economic and Social Commission for Asia and the Pacific. Bangkok Capacity Building Workshop March. 2018. https://www.unescap.org/sites/default/files/ICTConsultant_Port%20Community%20System.pdf.
- World Bank. Worldwide Governance Indicators. <http://info.worldbank.org/governance/wgi/index.aspx#home> (accessed 19 November 2018).
- . 2017. *What is the Blue Economy?* <http://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy>.
- . 2018 Data Statistics. *Trade as a % of GDP*. <https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS> (accessed 19 November 2018).
- World Shipping Council. Trade Routes. <http://www.worldshipping.org/about-the-industry/global-trade/trade-routes> (accessed 19 November 2018).

Maritime Cooperation in SASEC

Most South Asia Subregional Economic Cooperation (SASEC) countries rely on maritime transport for their international trade. Stronger maritime links are crucial for the subregion to achieve its economic growth potential. For example, improved ports and port access will create better connectivity with Southeast Asia, one of the world's fastest growing economic regions. However, enhanced cooperation among the seven SASEC countries is essential to strengthen maritime links. This report provides an overview of the SASEC maritime sector, identifies the key challenges, and identifies priority collaboration initiatives to overcome them.

About the South Asia Subregional Economic Cooperation Program

The South Asia Subregional Economic Cooperation (SASEC) program brings together Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, and Sri Lanka in a project-based partnership that aims to promote regional prosperity, improve economic opportunities, and build a better quality of life for the people of the subregion. SASEC countries share a common vision of boosting intraregional trade and cooperation in South Asia, while also developing connectivity and trade with Southeast Asia through Myanmar, to the People's Republic of China, and the global market.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members—49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.



ASIAN DEVELOPMENT BANK

6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org