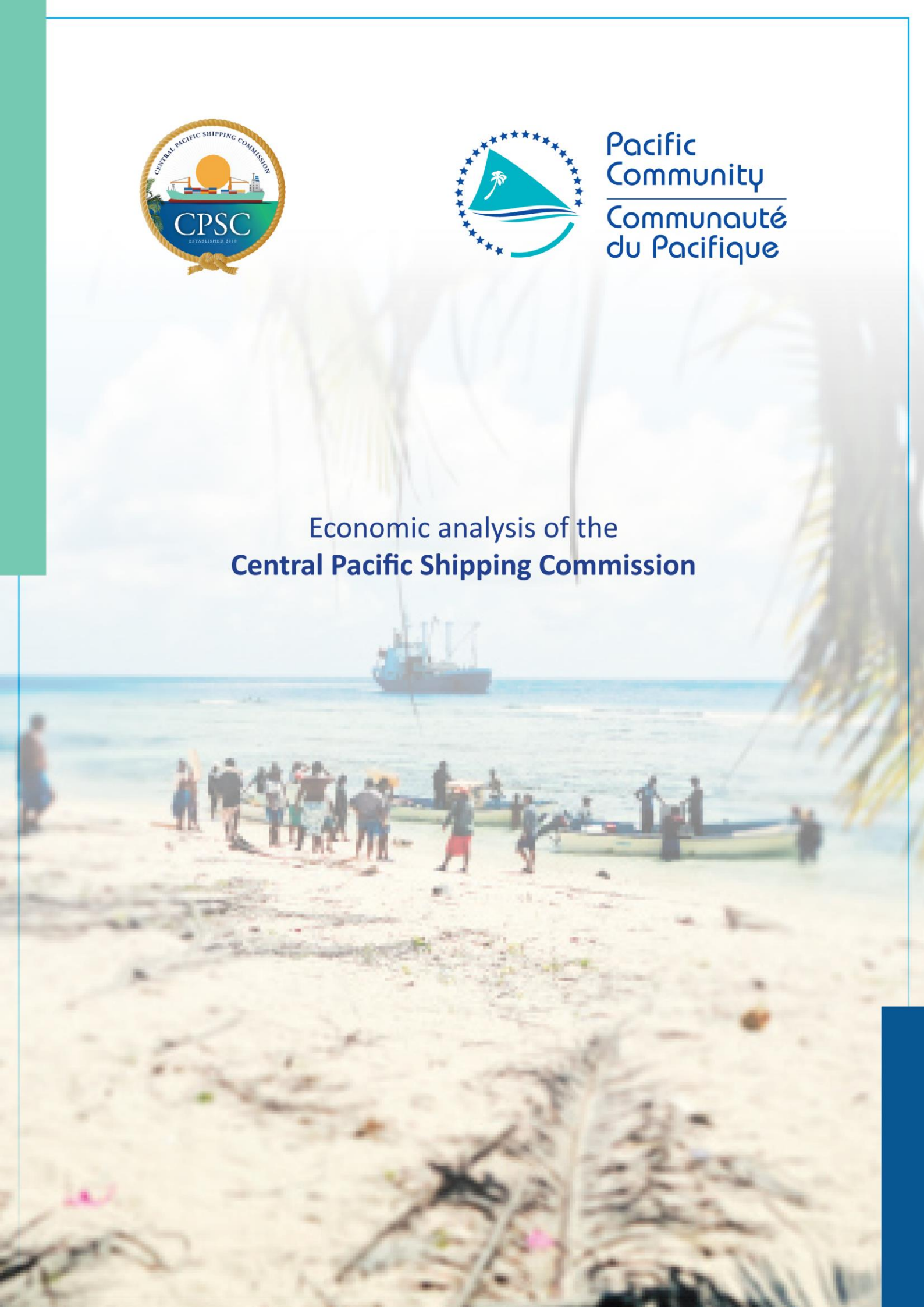
Pacific Community
Communauté du Pacifique

Economic analysis of the **Central Pacific Shipping Commission**



Economic analysis of the Central Pacific Shipping Commission

Prepared by the Economic Development Division
Pacific Community (SPC)

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EXECUTIVE SUMMARY

The inherent and unique geographical, economic and demographic disadvantages faced by small island states (SIS) such as Kiribati, Marshall Islands, Nauru and Tuvalu has hindered the effective functioning of shipping markets. Markets have been constrained in their ability to exploit economies of scale in international transport in relation to the volume of trade from these economies, making it uneconomical for more than one carrier (or a few at most) to service these SIS routes. Failures in the free market conditions resulted in monopoly charges often being applied, with evidence of collusion. The result of this was irregular and unaffordable shipping services, which posed major food security risks to these already vulnerable economies. In response to these longstanding issues, the Central Pacific Shipping Commission (CPSC) was established in 2014 as a contextually appropriate regional solution to this Pacific problem.

With membership currently comprising Kiribati, Marshall Islands, Nauru and Tuvalu, CPSC regulates the provision of shipping services based on a controlled competition model, with the intent to improve the reliability, affordability and sustainability of shipping services. A public–private partnership between the shipping lines and the governments of these four states, the Commission's primary goal is to ensure that central Pacific Islanders are able to access basic food items and other essential commodities to support their livelihoods and economic activities in a timely and affordable manner, while providing an enabling environment for international shipping lines to succeed.

Early observations and anecdotal evidence from the Commission's member states and local stakeholders strongly indicate major improvements in regularity of shipping services and stability of freight rates since CPSC's operationalisation. In light of this, transport officials at the May 2015 CPSC technical committee meeting requested an economic analysis to quantify the impact of CPSC thus far, and to determine the saturation point of the Commission's controlled competition model in terms of the maximum number of shipping lines that can be licensed to ensure that its member states maximise benefits. The Commission has been operational for only just over one year, making it too early to clearly determine the extent of its impact. Quantification of its impact using empirical impact evaluation methodologies is further limited by the absence of or limited baseline and post-intervention data required for such an analysis. This includes commercial data that are not publicly available, and due to commercial sensitivity were not released for the purpose of conducting this study.

Notwithstanding these limitations, the study employed a non-regression-based difference-in-differences estimation to assess the impact of CPSC in terms of improved reliability, affordability and sustainability of shipping services, supported by verified anecdotal evidence. These results serve as a baseline from which a future empirical study can be conducted in the medium term, once appropriate data collection tools have been employed, and sufficient time has elapsed for CPSC's impact to be felt, and for shipping lines and countries (including households, businesses and governments) to respond to the CPSC intervention. Such a study will provide a reliable estimate of the Commission's impact not only on the key shipping indicators, but on the socio-economic development of these maritime economies that rely heavily on shipping for food and livelihoods.

Based on a comparison of available information on vessel calls and freight rates in CPSC countries and Fiji, the analyses carried out in the study strongly indicate positive impacts of the Commission on shipping services in its member states as compared to the pre-CPSC situation. Although the

impact on shipping regularity cannot be adequately quantified, ***the assessment provides a clear indication of an increase in vessel calls over the last year and a half that can be attributed to CPSC***. Results, supported by anecdotal evidence from shipping agents, suggest that member states now receive more frequent services and on a more consistent basis. Under current CPSC arrangements, each member state has at least two shipping lines providing services to them. These findings suggest multiplier effects across the economy. Concerns over food security have reduced, as countries are more confident that their food and essential commodities will arrive as planned, and at predictable costs. Households enjoy greater diet diversity and access to a wider variety of food items. With the predictability of shipments, businesses are better able to plan their inventory and sales, and can take greater investment risks to expand their businesses and diversify their commodity offerings.

Affordability of shipping services has also improved through CPSC's stabilisation of freight rates. The commercially sensitive nature of freight rates presented a major challenge to assessing CPSC's impact on freight rates. The study developed freight rate forecasts based on available freight rate data in a 2007 feeder shipping study and regional inflation rates to construct a credible baseline, which was compared to the available post-CPSC freight rate data. Based on a simple pre- and post-CPSC comparison, ***results indicate a reduction in freight rates on most CPSC routes, since the Commission became operational.*** These findings are however inconclusive and will need to be further tested empirically using actual baseline rates, as they hinge on regional inflation rates being a good (and the only) predictor of changes in freight rate in the sub-region. In addition, the simple pre- and post-CPSC estimation does not account for other factors that could have influenced freight rates. More importantly however, anecdotal evidence strongly indicates that CPSC has stabilised freight rates, removing volatility in shipping costs. The knock-on effects of such stability is already being felt throughout these economies, through stable commodity prices in supermarkets and better planning of inventory and sales by businesses in member states.

CPSC has improved the sustainability of shipping services by guaranteeing countries short- to medium-term certainty of service provision through its five-year contractual agreement. Countries are assured shipping services in the short to medium term through the entry assurance certificate arrangement. Removal of uncertainty associated with the pre-CPSC situation has allowed individuals, businesses and governments to plan their consumption, sales and projects without risk of disruption. In the near future, countries are expected to experience increased small business development and investments, and economic growth.

With the observed improvements in shipping and the positive benefits comes the tendency to want to increase the number of licensed shipping lines to increase such benefits. However, this study finds that, as was evident in the pre-CPSC situation, ***there are diminishing returns to competition in international shipping (increasing the number of licensed shipping lines) in the case of these SIS, particularly on account of their isolation and very low and limited trade volumes***. The saturation point, which is the point where diminishing returns to competition sets in – that is, where profits are zero or shipping lines begin to make losses – is reached early on in these SIS relative to other countries, due to the aforementioned disadvantages and limited growth prospects. Shipping lines in the region operate under a mix of complex arrangements, including hub-and-spoke transhipment and feeder systems, and the use of physical vessels versus slot arrangements for cost-effective service provision on such unprofitable shipping routes. This makes determining the saturation point of CPSC's model a challenge without the requisite information that captures all of the intricacies of

such shipping arrangements. While this study does not provide conclusive results on the saturation point of CPSC due to such data limitations, evidence points to the model nearing its saturation point. Each CPSC country is receiving regular services at stable freight rates from at least two shipping lines, allowing for some level of competition and meeting the cargo demands of the countries, which again are very limited. ***The study therefore recommends that the Commission suspends the issuance of new shipping licenses in the short to medium term***. In the interim, the study recommends increased and regular data collection to inform a future empirical derivation of the CPSC model's saturation point.

Overall, the study's findings reveal the critical role that CPSC has played in improving shipping services in the region, but more importantly, how collective action and cooperation at the regional level, and partnership between the public and private sector, can improve the interests of all involved. It also demonstrates the importance of context-specific solutions, as in this case, CPSC has been a Pacific solution to a Pacific problem. The success of CPSC and its ability to have wider socio-economic impacts is dependent on effective monitoring of its intended impacts. It also requires the involvement of a wide range of stakeholders to support trade facilitation and intra-regional trade development. CPSC also has a wider role to play in raising the profile of the maritime transport sector in government agendas. Accordingly, the CPSC national shipping councils should become formalised forums for discussions on trade and improvements at every stage of the shipping supply chain, including the ports and ancillary services. These councils should be at the forefront of data collection, monitoring of service provision, trade promotion, and identification of port operations and ancillary shipping support service improvements in member states. In doing so, CPSC will be able to increase its contribution to these economies.

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1. Introduction

Shipping is the lifeline of Pacific island countries and territories (PICTs). It is crucial for trade, and impacts upon virtually all aspects of socio-economic and sustainable development. Over 90 per cent of PICT trade is estimated to be carried by ship, with countries relying on shipping to supply essential goods and commodities including food, fuel, building materials and vehicles, and to provide access to international markets for exports. With shipping, trade and economic development inextricably linked, access to reliable, affordable and efficient shipping services is therefore a critical component to the economic growth strategy of individual PICTs and the region collectively.

The challenges of small, remote and fragmented markets, long trading distances, narrow economic base, low import volumes and even smaller export volumes, and lack of competition amongst shipping operators due to small volumes, mean that shipping companies are unable to leverage economies of scale required to provide shipping services profitably and competitively. Market failures created by these geographical and economic disadvantages result in private shipping companies being unable to supply shipping services at socially optimal levels. The market underprovides and shipping services are only profitable at very high freight rates. This is because the peculiarities of these markets generally require freight rates that are higher than the rest of the world for services to be profitable, due to the high fuel costs incurred travelling long distances, small market size, and limited exports to fill containers to cover the cost of the return journey. In fact, PICTs' dependency on imports and limited competition gives shipping companies considerable bargaining power in setting prices, as PICTs have little option but to accept prices they are offered.

The operation of market forces of demand and supply in PICTs, particularly the small island states (SIS), is distorted due to their peculiarities. As a result, PICTs are faced with increasingly expensive and unreliable international shipping services that lead to high costs of doing business and delays in projects, as well as major socio-economic impacts such as high food prices and food security risks. SIS such as Kiribati, Nauru, the Marshall Islands and Tuvalu have long faced such shipping challenges. Over recent decades, countries such as Kiribati and Tuvalu experienced a drop in ship visits and a reduction in the number of shipping companies serving these countries, resulting in limited competition, high freight rates, poor service and frequent disruptions. This placed these SIS in a precarious situation. In 2009, Kiribati importers quoted freight rates for a standard 20-foot container out of Brisbane in the range of AUD3000–5000. Similar containers cost Tuvalu importers FJD5500 out of Fiji. These disproportionately high rates relative to other parts of the world with similar or even larger shipping distances were a major financial burden for the SIS. In December 2012 when ships failed to visit Kiribati before the festive Christmas season, there were shortages of rice, liquefied petroleum gas (LPG) and other essential commodities for over three months.

In response to the long-standing concern of irregular and unaffordable shipping services to South Pacific countries, particularly SIS, the Central Pacific Shipping Commission (CPSC) was formed as a context-specific solution to address this sub-regional challenge. CPSC's main objective was to address the existing market failure by regulating shipping services to Kiribati, Nauru, the Marshall Islands and Tuvalu through a public–private partnership between these countries and the shipping lines that operate in this region. This shipping model involved limiting the level of competition to allow shipping companies to maintain profitability, while creating increased economies of scale through greater member state and intra-regional trade, and international trading links, thus

encouraging improved services in terms of regularity and stable freight rates. It was envisaged that this would provide its member states with regular, affordable and sustainable shipping services.

1.1. Rationale for the study

Since CPSC became operational, eastern Pacific countries facing similar shipping challenges as the central Pacific countries have shown a keen interest in the establishment of a similar shipping commission. However, it is not fully clear to what extent the CPSC has been able to meet its objectives, and whether its member states are maximising the benefits provided by the CPSC in matching shipping service supply to country demands. At the May 2015 CPSC technical committee meeting, CPSC member states and the eastern Pacific countries (EPCs) agreed on the need to conduct an economic analysis of CPSC to highlight its impact and saturation point. This analysis will allow the Commission to assess its impact and improvement areas, and will also provide a strong basis to explore options for a similar arrangement for EPCs – for example to join CPSC or form a separate Eastern Pacific Shipping Commission (EPSC).

The key objectives of the study are therefore to:

1. Analyse CPSC's controlled-competition market model;
2. Assess and quantify the impacts of CPSC;
3. Determine the saturation point for CPSC; and
4. Identify a way forward to ensure the sustainability of this sub-regional shipping model.

1.2. Study limitations

This study primarily relies on anecdotal information from shipping agents, country officials and the CPSC Secretariat due to a lack of actual data on key indicators. The key data challenges faced include poor data collection and availability in member countries; inadequate time to conduct this study, including time to collect and assess the necessary data; and the commercial sensitivity of important information, particularly freight rates. Due to baseline information on virtually every indicator of interest being unavailable, the saturation point of CPSC could not be modelled using empirical methods, and the impact of CPSC could not be assessed using robust quantitative approaches. Given these analytical limitations, a key recommendation from this study is that a future study be conducted, with the necessary data collection mechanisms put in place in the short to medium term to ensure availability of requisite data to enable the study. Surveys should be designed to gather information and assess the experiences of importers, shipping agents and governments, and should be administered on an intermittent basis. Templates to guide the collection of data should be developed and used for consistent data collection across all member states. This will allow for a multi-dimensional approach to assessing CPSC's impact and determining its saturation point.

CPSC has been in operation for only one and a half years at the time of this study. At this point, it is too early to comprehensively quantify the benefits and impacts of CPSC and determine its saturation. Just over a year of being licensed is not sufficient time for carriers to fully understand and respond cost-effectively to the trends in shipping and trade in this sub-region. This finding supports the case for a proposed follow-up study to be carried out in the medium term.

2. Background

2.1. Countries overview

Kiribati, the Marshall Islands, Nauru and Tuvalu – the four member states of CPSC – are small island states located in the central Pacific region. The countries are atoll states – except for Nauru, which is a single phosphate rock island – with very small land masses relative to the size of their exclusive economic zones (EEZs). Together, their total land mass of 1041 km^2 lies within EEZs of over 5.5 million km^2. Nauru, with only 21 km^2 of land area, is the third smallest state in the world by land area. Kiribati, with a land area of only 811 km^2, has an EEZ that extends over 3.5 million km^2 of ocean – more than twice that of Papua New Guinea. Although the extensive EEZs provide a basis for lucrative fisheries for export, and fishing licence revenues, they inherently pose major challenges to both domestic and international transport. Kiribati, for instance, is extremely spread out across three groups of islands – the Phoenix and Line group of islands are located about 1800 and 3300 km from the Gilbert Islands, where Tarawa, the country's capital, is situated. This poses major distance and cost challenges for the transportation of goods within the country, and also makes it difficult for copra producers in the Phoenix and Line islands, where most primary production takes place, to access international markets.

These states have very small populations, which coupled with their limited land and other exploitable resources, limit local production and export potential and the ability of these countries to leverage economies of scale. Tuvalu, for instance, the fourth smallest country in the world by land size, has a population of about 11,300 people, and a very narrow economic base; subsistence farming and fishing, the main economic activities, are constrained by poor soil quality and limited access to fresh water. The Marshall Islands' low-lying atolls that average only 2 m above sea level, offer limited opportunity for agricultural production. Given their limited domestic production ability, these countries import nearly all of their essential food items, intermediate goods and manufactured items, but also depend largely on external sources of income to finance imports – primarily external aid, remittances, and fishing licence revenues. Dependence on external sources of income exposes these countries to volatilities in global markets, in particular rapid changes in fuel and food prices.

Tables 1 and 2 summarise the demographics of the four countries, illustrating the small scale of their economies and the limited volume of exports, which coupled with their isolation from major markets, underlie the international shipping challenges these countries face.

Table 1. Socio-economic indicators for Kiribati, the Marshall Islands, Nauru and Tuvalu, 2014.

	Population	GDP (USD)	GDP growth	GDP per capita (USD)	Land area (km^2)	EEZ (km^2)
Kiribati	113,400	166.8 million	3%	1650	810	3,437,345
Marshall Islands	54,900	190.9 million	0.5%	3627	180	750,000
Nauru	10,900	121 million	10%	12,021	21	430,000
Tuvalu	11,300	38.32 million	2%	3880	30	900,000

GDP = gross domestic product.

Sources: ADB (2015a, b); SPC National Minimum Development Indicators.

Table 2. Shipping indicators for Kiribati, the Marshall Islands, Nauru and Tuvalu.

	Distance in **nm** from main source port/ transshipment port	Trade volumes	Inflation

							(2015 proj., millions AUD)		rate
		Australia (Sydney)	South Korea (Busan)	USA (Los Angeles)	UK (London)	Fiji	Imports	Exports	
Kiribati	**Tarawa**	2901	4327	21,282	13,896	1592	118.7	8.4	2.6%
	Christmas Is.	3971	3810	16,911	9640	4629			
Marshall Islands		3225	3945	21,140	13,753	1895	142.3	68.3	1.3%
Nauru		2063*	4141*	20,900*	13,629*	1703*	143.3[+]	47.5[+]	5%
Tuvalu		2655	5084	21,355	13,970	674	35.8	0.5	3.3%

nm = nautical miles; *from Brisbane; [+] 2013 figures.
Sources: IMF (2014a, b, c); SPC PRISM; http://ports.com/sea-route/

As Table 1 illustrates, achieving economies of scale is very difficult as these countries' populations are very small – Nauru and Tuvalu both having less than 12,000 people and even together, the total population of these countries is less than 200,000. The smallness of their land areas, particularly those of Nauru and Tuvalu, further exacerbates the challenges with economies of scale as very limited land area (most of which has infertile soil) is available to cultivate crops and agriculture is mainly limited to subsistence production.

Compounding this challenge is the far distances from global markets (Table 2). These countries are located as far as over 20,000 nautical miles from source markets, with the journey time for goods to reach these SIS as long as 50 days (Kyowa Shipping Co. Ltd., New Zealand – Pacific Islands route 2015). Except for Nauru, whose high economic growth rate is spurred by its phosphate mining industry and construction following the re-opening of the Australian-run Regional Processing Centre for asylum seekers, economic growth in these countries has remained low, driven by donor projects. With low economic growth and little to no agricultural and value-added production, these economies lack domestic economic activities necessary to drive the demand for significant trade volumes.

2.2. Overview of shipping services to SIS prior to the establishment of CPSC

Over the years, several marginally successful attempts were made by regional governments to provide regular and affordable shipping services to the SIS, notably the creation of the Pacific Forum Line (PFL) and operation of Kiribati Shipping Services Limited (KSSL).

Pacific Forum Line

PFL was established in 1977, with donor assistance (financial, technical and infrastructure support), to provide a regional service to 14 Pacific Island countries. This was a direct response to the lack of shipping services to the remote islands of the Pacific, which had little control over the routes and rates fixed by the foreign shipping companies. PFL operated an SIS feeder service from 1983 to 1993 (SPC and PIFS 2007). During this period, service was progressively expanded to SIS countries (Fiji, Tuvalu, Kiribati, Marshall Islands, Samoa, Tonga and Nauru) and to Hawaii using a variety of shipping arrangements (own vessels, chartered vessels and slotting). The service experience sustained revenue shortfalls due to under capitalisation, high cost of leasing containers, high ship charter rates and exchange rate losses. [1] Revenue losses were financed and jointly met by the governments of

[1] http://www.pacificforumline.com/about-us/

New Zealand and Australia and PFL. Later, when Australia and New Zealand withdrew their funding, PFL could no longer sustain the full burden and consequently the service terminated. The Government of Samoa acquired PFL in 2012, and PFL currently provides services to CPSC member countries through a joint venture formed with Neptune Shipping in 2014.

Kiribati Shipping Services Limited

KSSL is a Kiribati Government owned shipping company that was established in 2008 to provide efficient shipping services to remote communities in Kiribati. KSSL expanded its operations in May 2009 through an agreement with the Governments of Nauru, Tuvalu and Kiribati to provide regular feeder shipping services to these countries using Suva as a transshipment point. The service was beset with challenges from the outset: limited cargo resulting in long waiting times in Suva, management challenges and poor vessel conditions, causing an inability to adhere to schedules. Due to these challenges, and its inability to effectively compete with other shipping lines, which operated only on profitable routes, the feeder service ended after 18 months of service. Research by the Secretariat of the Pacific Community (SPC 2014) showed that competition during the limited time of KSSL's feeder service contributed to increased shipping calls to Nauru and Tuvalu and a 25% reduction in freight rates.

3. Shipping and market failures, and an alternative model

3.1. Market failure in international shipping in PICTs

Prior to CPSC, the central Pacific shipping industry operated within a free market system (Box 1). Several shipping companies provided shipping services, competing on price and service quality among other factors, within a deregulated market environment. In the 1980s, as many as eight shipping lines serviced the sub-region, mainly originating from the US, Asia, Australia, New Zealand and Europe, with transshipments via Suva, Guam and Honiara. According to economic theory on markets, having several suppliers should lead to competition, increases shipping service options for the countries, drive freight rates down, and promote efficiency (McNulty 1968). Due to market failures emanating from the unique physical, geographical, economic and demographic characteristics of the SIS in the central Pacific, the free market system failed to realise efficiency in the shipping industry in this sub-region.

Box 1. Free market system and market failure.

Under a free market system, governments view markets as best-suited to allocate scarce resources. Firms are allowed to compete freely, and prices are set based on the market forces of demand and supply. The free market system should in turn deliver allocative, productive and dynamic efficiency. However, markets sometimes fail to allocate resources efficiently due to a number of reasons. For instance, market dominance by monopolies can lead to under-production and higher prices than would exist under conditions of competition, affecting consumer welfare. Market failures provide a case for some form of government intervention to achieve socially optimal outcomes, such as preventing the under-provision of public goods. Such intervention could be through regulations, competition policy, subsidies or even direct government provision, depending on the type or consequence of the market failure.

Located at great distances from major markets, the low trade volumes of each individual SIS did not meet the economic threshold or scale for private shipping companies to profitably provide regular shipping services. Being profit-driven, when left to operate freely in the market, shipping companies will compete and provide services on lucrative routes, where the greatest demand relative to the (least) cost of providing such services is highest, while the less profitable ones are left underserved. This was the case in the PICTs. Shipping companies focused on providing services on profitable shipping routes, while the CPSC states, all located on unprofitable routes, were disproportionately underserved. Their special challenges did not provide ideal conditions for the free market mechanism to be effective, and between the 1980s and the early 2000s these states experienced a marked decline of between 50 and 75 per cent in the number of ships calling into their ports. In Kiribati the number of ships per month declined from eight to two, and in the Marshall Islands from six to three within two decades (SPC 2014). The end result was less competition in this sub-region.

Inability to achieve a profitable level of scale caused the shipping lines to pull out. Where shipping lines provided services, the services became unpredictable and irregular. Across the four SIS, services ranged from once or twice a month in three states to about four times a month in one state.

The low frequency posed major food security risks in the states due to the high risk of shortages of essential goods in the event of shipping delays or bad weather. This happened in Kiribati and Nauru from December 2012 to February 2013 when a shipping service delay of three weeks caused severe shortages of rice, flour and sugar (SPC 2013, 2014).

In addition, with lack of exports leading to return of empty containers, and less competition, shipping companies charged exorbitant rates for inward freight to be able to recoup the cost of return voyages. Irregular shipping led to stockpiling, inability of small and medium enterprises (SMEs) to plan production and trade, very high retail prices and high costs of living. High freight rates were also the result of poor port efficiency in these countries, in particular delay of ships in ports through long vessel turnaround times, and slow unloading and loading rates. Some of these inefficiencies resulted from uncontrollable factors such as bad weather, while others were due to poor port infrastructure conditions, stevedoring arrangements and equipment, and other unfavourable operating conditions. Prior to CPSC, in Nauru discharge of 80 containers could take as long as five days due to port infrastructure challenges, whose impacts were heightened during poor weather conditions. More time spent in a port means that shipping lines accumulate more port charges, but it also causes delays in their schedules to other ports, along with other logistics costs. Shipping lines passed on these economic and opportunity costs to countries in the form of higher freight rates.

Changes occurring within the shipping industry around this period, such as consolidation and inter-line agreements, also impacted shipping service provision to these states. Shipping companies rationalised operations through mergers and/or buyouts, replacing smaller ships with larger ones, and concentrating on lucrative routes. Small operators either had to reduce services, form alliances with other operators, get out of business, or shift to less profitable routes. In some cases, to cover the high cost of providing services on uneconomical routes, ship operators approached PICT governments to provide subsidies to maintain the current level of shipping, or face a reduction.

However, the larger vessels proved uneconomical for this sub-region due to the limited scale and small volumes of cargo being transported. A network of regional hub ports emerged where shipping lines can leverage economies of scale by using larger vessels to transport regional cargo to hub ports. Feeder vessels then ship smaller cargo volumes to their final destinations, or larger vessel carriers sell slots on their ships to cover their costs.

Box 2. Limited competition and cartels.

Assumption: the shipping company's goal is to maximise profits.

Cartel: Very close collaboration amongst shipping companies to restrict output and raise freight rates, rendering little or no competition. Under a cartel arrangement, there is no incentive for other shipping service providers to move in – if an extra player enters the market, everyone loses money.

Cartel-like environment in PICTs:

Lack of profitability on uneconomical routes → some shipping lines pull out; few suppliers able to cope remain (a few large carriers who are able to reduce their costs significantly) with limited competition → this small group *colludes* on price and frequency → fewer services provided and at much higher prices → countries are worse off, as they face both lower frequency of services and higher freight rates.

Anecdotal evidence from CPSC member countries suggests that market failure and peculiarities of the SIS led to the development of collusive behaviour and what emerged as a cartel-like situation. Due to lack of profitability, some shipping lines pulled out altogether, resulting in less competition. To remain profitable on these uneconomical routes, the few suppliers that remained provided limited services on an irregular basis and at very high freight rates. This led to oligopolistic behaviours – with few suppliers and limited competition, shipping companies had a greater incentive to collude. As shown in Box 2, in a cartel-like environment, suppliers agree to restrict output to monopoly levels and split the profits, giving them higher profits than they would obtain if they competed.

This was the situation in the four CPSC member SIS: shipping patterns in the region revealed very close collaboration amongst shipping companies (collusion) that rendered little or no competition, resulting in a near cartel environment. Shipping services were selective, being regular to profitable ports in the region and erratic to unprofitable ports. Services to the CPSC member SIS were neither regular nor affordable, and the quality and frequency of shipping were largely beyond their control, constraining the sustainable development of these small economies.

The shipping vulnerabilities that primarily resulted from the unique characteristics of these states did not provide ideal conditions for the free market mechanism to deliver socially optimal outcomes, and thus needed to be accounted for when designing a strategy to address them.

3.2. Government regulation and controlled competition

The experiences of these small economies clearly show that in the face of certain constraints, market forces of demand and supply will not produce efficiency in the provision of shipping services. In the case of these SIS, their geographical and economic challenges mean that there may not be opportunities for shipping companies to leverage economies of scale in order to provide shipping services in an efficient manner that meets the needs of the countries. Shipping services may be provided on a less regular basis to allow for consolidation of cargo, or at a greater frequency but at a very high cost to countries. Under these circumstances, the countries could face major food security risks or may be at risk of inflation and unaffordable costs of living. The challenge therefore was how to ensure regular and affordable shipping services to the SIS in the face of these constraints.

The CPSC was therefore formed to regulate international shipping services in the central Pacific sub-region by restricting the number of shipping line entrants to ensure an agreed-upon frequency of vessel visits and freight rates were provided. An important feature of the regulatory model is the promotion of sufficient or controlled competition so that monopoly is removed but the service provided by the restricted number of carriers is commercially viable from the perspective of the shipping lines. The selected shipping companies can be guaranteed cargo traffic on pre-established routes and at agreed-upon rates, while member countries can be assured of regular shipping services at stable freight rates. This ensures that *all* routes, both uneconomical and lucrative are serviced. CPSC was formed with an objective to encourage and promote economical, reliable, safe and sustained shipping services that meet the demands for international commercial shipping services to these island nations for the common interest, needs and public welfare of the respective communities through controlled competition. CPSC includes Kiribati, Tuvalu, Marshall Islands and Nauru, with shipping links primarily through Fiji.

***CPSC model*: the promotion of sufficient or controlled competition so that monopoly is removed but the restricted number of carriers for operations remain profitable and are able to meet the shipping demands of the countries.**

The peculiarities of the central Pacific sub-regional SIS provided a basis for adopting a controlled competition model (Figure 1). Controlled competition or controlled entry into a market exists where, on grounds of improving efficiency, the government deems it desirable to limit the number of service providers in a particular industry. Within the transport industry, franchises, certificates of public convenience and necessity, and permits are some of the means used to limit entry to a few service providers. Controlled competition is based on the regular renewal of exclusive rights, rather than on free access to the market. Competition is allowed to thrive, but within a closely regulated environment, where both shipping companies and the countries could be better off. In this case, controlled competition leads to better service at a lower cost than in the absence of such an arrangement.

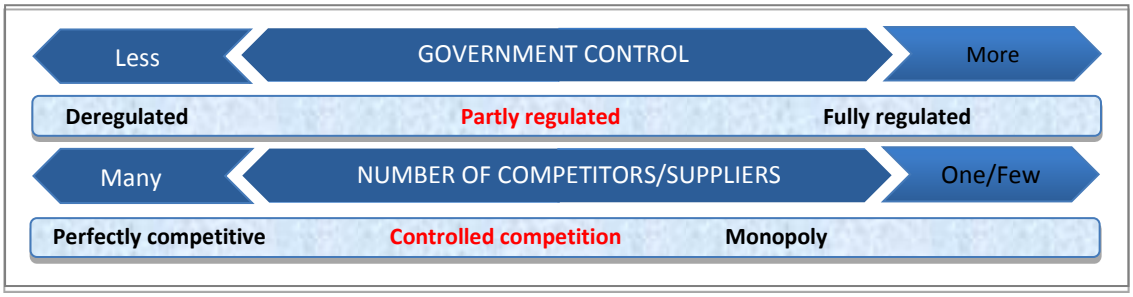


Figure 1. Variations of competition and regulation.

Under the controlled competition model, the price and services are regulated to ensure compliance with requirements set out in agreements. Competition is retained as shipping companies are required to undergo a competitive tendering process to bid on service routes. In addition, at least two shipping lines provide services to each member state, thus preventing the creation of monopolies on routes. Based on the competitive tendering process, the exclusive right to operate a route or a network of routes through the issuance of a shipping licence (entry assurance certificate,

EAC) is awarded to one or more operators. This decision is influenced by the competitiveness of the freight rate offered, and evidence of the operator's ability to provide sustainable shipping services, including financial standing, assets and history operating in the region. The Commission specifies the quality, frequency and performance of service providers on each of the routes. Essentially, shipping companies need an EAC to be able to provide services to CPSC's member states. An annual fee applies for each EAC issued by CPSC. Temporary licences are issued for donor or government projects for the duration of the project. More information on CPSC and its instruments are provided in Section 4 below.

3.3. Public–private partnership at work

CPSC allows shipping companies to maintain profitability on routes to its member states by limiting the level of competition. A public–private partnership between shipping lines and governments, CPSC is a win-win situation for both parties: shipping lines, once licensed, are guaranteed cargo for particular routes for the term of their EAC, with greater profitability than under market competition; and countries have more regular, affordable and sustainable shipping services. CPSC is also a forum for discussion between the private and public sector. Shipping company representatives have access to the highest level of government to raise their issues, and such private sector challenges are taken into account in government decision-making.

CPSC addresses market barriers primarily through consolidation of goods traded into the region to ensure fuller loading of vessels. Countries have access to new markets and more frequent services, which further leads to greater variety of goods and cheaper options. This also benefits exporters as expansion of business and inventory and sales planning are possible with better access to inputs and reliable access to export markets. CPSC further provides regulatory oversight by ensuring that freight rates are set appropriately and justifiably and are transparent, while ensuring reliability of services.

The Commission's mandates lie beyond the quality of shipping service and its profitability. CPSC examines and seeks to address challenges faced in several areas of the transport system, including port efficiency, safety, security, etc. towards realising a sustainable maritime transportation system.

4. Establishment of the Central Pacific Shipping Commission

In 2009, SPC undertook an extended period of data collection and analysis, feasibility studies and stakeholder consultations to better understand the shipping challenges in the region, and to design an appropriate solution that catered to its needs and peculiarities, especially those of its member states. Learning from the experience of the Micronesian Shipping Commission (MSC), the CPSC agreement was signed resulting in the establishment of CPSC in 2013 and its operationalisation on 1 January 2014. CPSC was set up as a Pacific solution to a Pacific problem, with an overarching goal to ensure reliable, affordable and sustained commercial shipping services to its member states.

4.1. Objectives of CPSC

CPSC is an inter-governmental agency for joint cooperation, coordination and regulation of international shipping services in its participating member states. The current membership of CPSC is Kiribati, Nauru, Marshall Islands and Tuvalu, but entry into the commission is open to other Pacific Island states. The objectives of CPSC are to provide:

- Adequate and reliable shipping frequency to guarantee sufficient supply and inventory;
- Access to international markets for the promotion of national trade and commerce;
- Affordable shipping service rates in line with local economies;
- Favourable route structures to serve all member states;
- Licensing of approved service providers to ensure all routes are adequately serviced; and
- Protection to licensed service providers from external interference in exchange for the agreed service.

4.2. Key instruments of CPSC

Shipping services to and from the CPSC member countries are regulated based on an entry assurance system (Figure 2). An entry assurance certificate (EAC) is granted to shipping companies based on an assessment of tender proposals submitted. Criteria for granting a shipping licence include the following: routes must satisfy basic trade requirements of all member states; all tariffs charged should be reasonable for the service proposed; the carrier must demonstrate capability to provide a reliable and stable service in terms of frequency, regularity and on time performance; the service must be flexible to accommodate both specialised and conventional tonnages/cargo; capitalisation or investment should be sufficient to adequately sustain the proposed service; and employment of suitable citizens of the member countries is also expected.

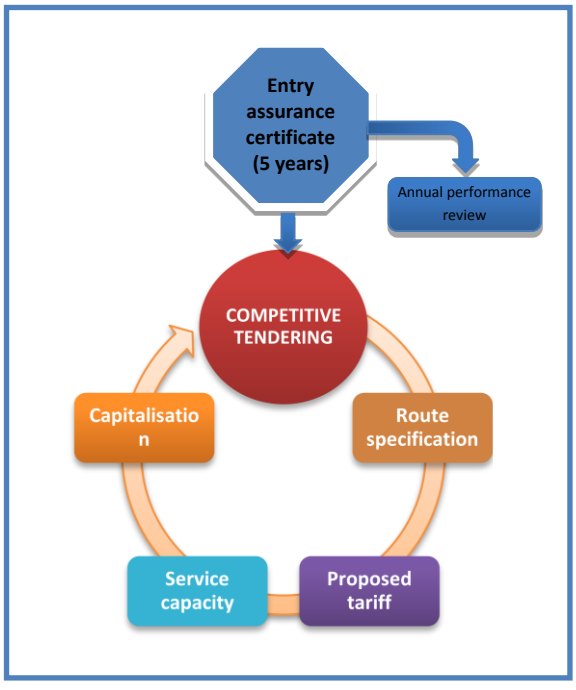


Figure 2. CPSC's entry assurance system.

EACs are issued to each carrier for a 5-year period subject to annual performance reviews based on the approved route (including economical and uneconomical routes) and are subject to services being performed in accordance with international standards and national laws. An annual fee for a Vessel Operating Common Carrier (VOCC) is currently USD10,000 and for a Non-Vessel Operating Common Carrier (NVOCC) is USD5,000, for each respective EAC issued.

4.3. National taskforce

After CPSC was established, the CPSC technical committee in collaboration with SPC initiated the formation of a national taskforce or shipping council in each of the CPSC countries. The role of the national taskforce or shipping council is to assist in collecting and reporting on accurate and timely trade and shipping data to facilitate the commission's analytical work, as well as monitor shipping developments and performance at the national level (freight rates, etc.). Developments, whether positive or otherwise, are monitored nationally and regionally to effectively address the issues of shipping in the central Pacific sub-region.

Membership of the shipping council extends to all maritime and associated sector stakeholders. The council comprises, but is not limited to: the Ministry of Transport, maritime administration, shipping companies, ports authority, marine pilots, maritime training institutions, consumer council, community group(s), shipping agents, freight forwarders, customs department, biosecurity department, Chamber of Commerce, Ministry of Foreign Affairs, Ministry of External Trade, Ministry of Commerce, Ministry of Health, and the national statistics office. The shipping council is accountable for fostering collaboration among national stakeholders to progress the objectives of the shipping council and ensuring that the focus of the partnership at the national level is maintained on the agreed scope, outcomes and benefits.

Thus far, all member countries have formed national shipping councils, and these councils have been instrumental in collating and providing shipping data that has informed this study and other recent studies carried out on CPSC and commodity trade and shipping in the central Pacific region.

4.4. CPSC secretariat

The Commission initially requested the services of SPC's Economic Development Division (EDD)'s Transport Programme to progress this initiative until a proper secretariat is established. The Commission secretariat is headed by an administrator with a minimum number of technical and administrative staff. The functions of the secretariat are to:

- Manage the day-to-day functions of CPSC;
- Maintain general records of CPSC;
- Act as recording secretary or clerk of the Commission;
- Collect, analyse and maintain necessary shipping data;
- Continuously monitor and analyse national and international transport activities and provide member states with appropriate information;
- Prepare for negotiations with shipping lines, shippers, organisations and other interested parties;

- Provide technical assistance to the Commission in various areas such as transport economics, safety and security requirements, port efficiency, networking with EPCs, the Micronesian Spearhead Group (MSG), and other SPC divisions; and
- Organise meetings for exchange of information and experience.

5. Impact of CPSC

The CPSC was designed to deliver shipping outcomes for its member countries, measured by improvement in:

- reliability (frequency and consistency)
- affordability (stability and reduced freight rates)
- sustainability of shipping services – primarily by controlling competition and increasing economies of scale

The question of whether CPSC has had any impact on the shipping services received by its member states since its operationalisation in 2014 has been raised at several recent regional transport meetings. To answer this necessitated an impact evaluation of CPSC to provide credible evidence on the Commission's performance, and on whether CPSC has achieved its desired outcomes. The impact evaluation assesses the changes in the reliability, affordability and sustainability of shipping services to member states that can be attributed to CPSC. The central evaluation question is: what is the impact or causal effect of the CPSC on reliability, affordability and sustainability of shipping services in member states? This evaluation is required to test the effectiveness of CPSC and to inform policymakers on the decision to scale up this model to other sub-regions, including the eastern Pacific. It is important to note however that CPSC has been operational for only a year and a half, and it is too early to make definite conclusions on its impact.

CPSC has been operational for only a year and a half; it is therefore too early to make definite conclusions on its impact

A simple comparison of the indicators of interest in 2013 (the year prior to establishment of CPSC) with those in 2014 (the year the intervention was received) will not provide an accurate estimate of the impact of CPSC, because there could have been other occurrences during the 2013 and 2014 period that could have resulted in improved shipping services to CPSC countries. For instance, shipping lines could have found and adopted innovative cost-saving techniques for shipping to the central Pacific region, allowing them to provide services on a more regular basis during that period, and the impact of these events would be wrongly attributed to CPSC's formation. There is therefore the need to remove such forms of bias to effectively assess the impact of CPSC.

Estimating the impact or effectiveness of CPSC is done by comparing the observed shipping outcomes to those outcomes that we would expect if CPSC had not been formed (the counterfactual). The counterfactual is the outcome that would have happened in the absence of the intervention (CPSC). Since we cannot observe CPSC countries both with and without the intervention, it is difficult to develop an accurate estimate of what would have happened in the absence of CPSC. A key challenge is to develop a counterfactual as a substitute for the true but unobservable outcomes – a comparison group – which is as similar as possible in both observable and unobservable dimensions to the CPSC member countries – the treatment group. Comparison of the outcomes of these two groups allows for the establishment of causality – attributing observed changes in the shipping outcomes of the member countries to the existence of CPSC, while removing

confounding factors. Any difference in the outcomes of the CPSC member countries (the treatment group) and the outcomes of the comparison group that did not receive this policy (the counterfactual/control group) can then be attributed to CPSC's existence.

Quasi-experimental approaches can be used to carry out an ex-post evaluation of CPSC. These evaluation methods hinge on the existence of a good counterfactual, and the availability of baseline data for both the treatment and comparison groups, in this case data on shipping outcomes of interest prior to and after the establishment of CPSC. A suitable counterfactual or control group for CPSC states should have similar economic and geographical characteristics to these states. Some of the key factors include: population size, resource base and exports, volume of trade, and distance from major markets and trading lanes. Obtaining a counterfactual from within the region would be ideal, given the similar geographical, economic and shipping challenges that countries in this region face.

Lack of data is an underlying constraint to the effective use of quasi-experimental methods. Baseline information was neither formally collected on the specific outcomes of interest prior to CPSC's operationalisation, nor readily available for this assessment. In addition, some of the data required to conduct this analysis, in particular freight rates, are commercially sensitive and could not be obtained. Despite these data limitations, the study uses a non-regression-based difference-in-differences method to assess the impact of CPSC on the reliability, affordability and sustainability of shipping services thus far, using available data.

Lack of data is an underlying constraint to effective impact evaluation

Since it is too early to precisely assess the impact of CPSC, and in light of the data limitations, it is recommended that a further rigorous assessment of CPSC's impact be conducted at about 5 years following the establishment of CPSC. This will provide a better timeframe to establish impact, as shipping lines will have had the opportunity to adjust to the new conditions and to optimise their shipping arrangements.

The impact of CPSC is evaluated below against its three main objectives: improved reliability, affordability, and sustainability of services.

Objective 1: Has CPSC contributed to improved reliability of shipping services in member states?

Frequency indicator

The total number of vessel calls in CPSC member countries before and after the establishment of CPSC is provided and illustrated in Table 3 and Figure 3 below[2]. CPSC became operational in January 2014; vessel calls in this year therefore stem from the CPSC arrangement. On a first glance, the total vessel calls in CPSC countries appears to have increased from 2013 (before CPSC) to 2014 (after CPSC), a difference which could in principle be attributed to CPSC. However, on a closer look, it is evident that the number of vessel calls has been on the rise since 2007, with a significant increase recorded from 2012 to 2013. This therefore strongly suggests that the number of vessel calls would

[2] Some of the numbers are estimated based on available information. For instance, information obtained on the number of calls to the Marshall Islands was not disaggregated by CPSC and MSC vessels. The number of carriers operating under CPSC was approximated.

have continued to increase from 2013 to 2014 even in the absence of CPSC, and raises the question of whether (or how much of) the observed increase from 2013 to 2014 can be attributed to CPSC's formation. Even if the frequency of calls had not increased in the years prior to 2014, a simple comparison of 2013 and 2014 might not reveal the answer because, as stated above, 2014 figures could have resulted from other events other than CPSC.

Table 3. Number of vessel calls in Kiribati, Marshall Islands, Nauru and Tuvalu (annual).

	2007	2008	2009	2010	2011	2012	2013	2014
Kiribati	15	24	43	41	38	40	51	66
Marshall Islands	40	47	43	45	49	53	60	72
Nauru	8	8	10	20	21	19	14	15
Tuvalu	12	19	26	16	17	17	21	23
Total	**75**	**98**	**122**	**122**	**125**	**129**	**146**	**159**

Source: SPC (2015).

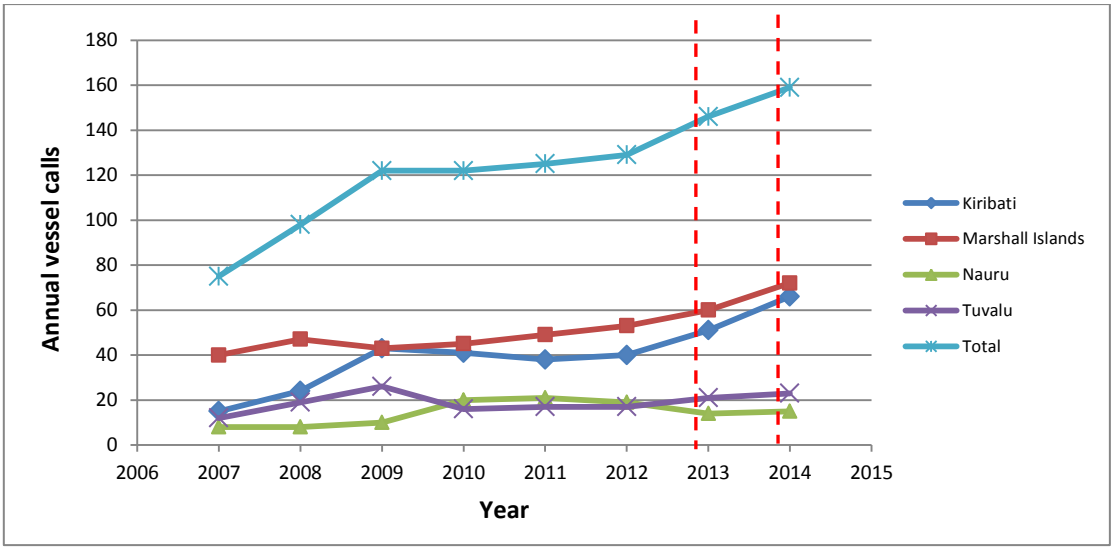


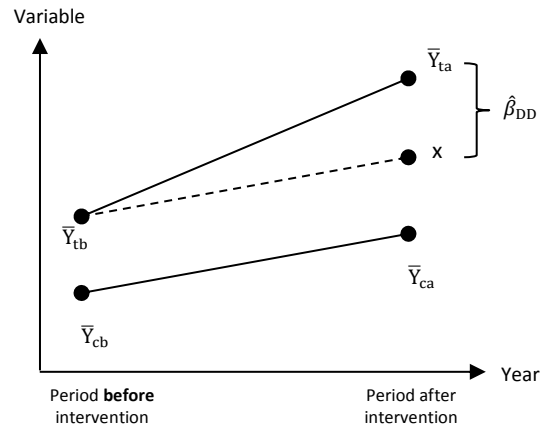
Figure 3. Annual vessel calls in Kiribati, Marshall Islands, Nauru and Tuvalu.

To clarify the situation, a non-regression-based difference-in-differences (DID) estimator is used to attempt to understand the change in vessel calls directly resulting from the existence of CPSC. This compares the difference in outcomes before and after the intervention for groups affected by the intervention (the treatment group) to the difference in outcomes before and after the intervention for unaffected groups (control group). This method hinges on a key assumption – the 'parallel trends' assumption – that in the absence of treatment, the treatment group would have developed in the same way as the control group. That is, changes in the outcome variable over time would have been exactly the same in both treatment and control groups in the absence of the intervention.

Essentially, the two groups would have been on the same trajectory. If this assumption holds, by comparing the treatment and control groups over time, this controls for variation across time and across the groups.

Figure 4 shows how the DID estimator (β_{DD}) compares the change in the outcome variable in the treatment group with the change in the control group.

Figure 4. Difference-in-differences estimation.



The difference-in-differences estimator is:

$$\widehat{\boldsymbol{\beta}}_{DD} = [\overline{y}_{ta} - \overline{y}_{tb}] - [\overline{y}_{ca} - \overline{y}_{cb}]$$
$$[\overline{y}_{ta} - \overline{y}_{ca}] - [\overline{y}_{tb} - \overline{y}_{cb}]$$

where:

β_{DD} is the difference in differences estimator. Interpretation: the outcome variable (y) increased/decreased by β_{DD}% for the treatment group after they received the treatment

Y is the outcome of interest (here, vessel calls)

$\overline{Y}_{tb}$is the average outcome in the treatment group before the treatment

$\overline{Y}_{cb}$is the average outcome in the control group before the treatment

$\overline{Y}_{ta}$ is the average outcome in the treatment group after the treatment

$\overline{Y}_{ca}$is the average outcome in the control group after the treatment

Fiji was chosen as the comparison group. Fiji is located in the same sub-region as the four CPSC countries and serves as a hub for several, if not all, of their ports. Although Fiji is quite different from the CPSC member states on a number of levels, including population and geographical characteristics, it is similar in terms of distance from major source markets, and the same shipping lines that serve these countries also serve Fiji. Figure 5 further supports the choice of Fiji as a control group by providing data from periods before CPSC, showing that both Fiji and the CPSC countries were on the same trajectory.

The graph shows that vessel call trends in Fiji were similar to those in the four CPSC countries combined, particularly in the years leading up to CPSC's operationalisation (2009 to 2012). Although there is some disparity from 2007 to 2009, with the CPSC countries experiencing a much sharper increase in calls, both groups were generally still on an increasing trend. Based on the assumption that in the absence of CPSC, vessel call trends in CPSC countries and Fiji would have developed in the same manner, any difference observed post-CPSC's establishment between the vessel calls in CPSC member countries and Fiji can be attributed to the CPSC. Figure 5 shows that both Fiji and the CPSC countries were on a similar trajectory up until 2013 when they diverged, and the number of vessel calls to CPSC countries in 2014 increased differentially from the calls to Fiji. This change can be attributed to the impact of CPSC. In the absence of CPSC, the member countries would have developed on the trajectory illustrated by the dashed blue line – in parallel with Fiji. The differential change in vessel calls in the CPSC countries (relative to Fiji) after CPSC's operationalisation is the impact of CPSC, and be derived by estimating the value of the gap between the bold blue line and the dashed blue line between 2013 and 2014.

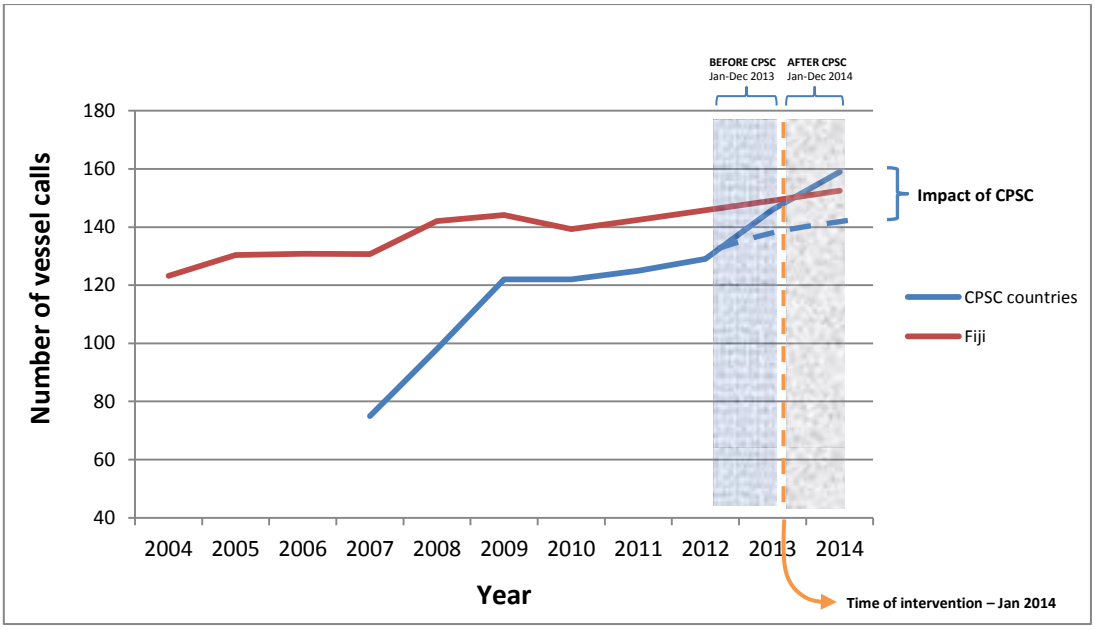


Figure 5. The impact of CPSC on number of vessel calls using Fiji as a counterfactual.

Note: Fiji experienced a decline in the number of calls from 2011 to 2013, primarily due to the use of larger vessels, while the average TEUs remained comparable over the years. To adjust for this decline, the 2011 to 2013 calls are estimated based on the average percentage change in the number of calls in the 3 years prior to 2011. The calls in 2011 and 2014 are therefore an increase in about 1% from the number of calls in 2010. In addition, the number of calls in Fiji is also scaled down by a unit of 6 to bring them to a level that is comparable to those of the four CPSC countries.

A simple calculation of the impact yields the following estimate:

$$(\text{CPSC countries}_{\text{post-CPSC}} - \text{CPSC countries}_{\text{pre-CPSC}}) - (\text{Fiji}_{\text{post-CPSC}} - \text{Fiji}_{\text{pre-CPSC}})$$

$$= (159 - 146) - (152 - 149)$$

$$= 9 \text{ (a positive difference between the pre- and post-CPSC treatment outcomes)}$$

While the DID estimation indicates a positive impact, it is difficult to meaningfully interpret the level of impact without a regression. Furthermore, a regression equation will account for any differences in the two groups pre-CPSC, and all other variables that could potentially bias the estimate. Appendix A provides a full regression equation that can be used to empirically estimate this impact. Furthermore, accounting for variables that could potentially bias the estimates could significantly impact the true estimate of the impact of CPSC in a positive or negative way.

Notwithstanding, the non-regression estimate above indicates that since its operationalisation in January 2014, CPSC has had a positive impact on the frequency of vessel calls to its member countries.

Consistency indicator

The consistency of shipping services can be measured by assessing how well shipping lines are able to maintain their shipping schedules to CPSC countries. For instance, if a shipping line is contracted to provide services fortnightly, this indicator assesses whether shipping lines observe this schedule. Of course shipping line schedules may be affected by poor weather conditions or delays at other ports; however, frequent fluctuations without prior notifications to the ports of call signal poor consistency. There are very limited data on the exact arrival dates of vessels in each of the countries' ports, however consultations with shipping agents and countries suggest that since CPSC became active, shipping lines have been meeting the schedule demands of importers and adhering to their contractual agreements. This strongly indicates that licensed shipping lines are providing services at regular frequencies. This could be further verified if information on schedules is made available.

Further evidence on CPSC's impact on regularity of shipping services

Reports from CPSC countries further support the above analysis. Transport officials from the four member countries have reported improvements in shipping service regularity since CPSC became operational. For instance, during the September 2015 CPSC AGM, the Deputy Secretary for the Ministry of Communications, Transport and Tourism Development (MCTTD) in Kiribati – a member of the technical committee – stated that since 2013, Kiribati has had a consistent and stable number of vessel visits and has not experienced any cargo shortages. In addition, service has been extended to remote areas of member countries, which are included in the agreed routes. For example, regular international shipping services are now provided to Christmas Island in the Line Group of Islands in Kiribati.

With a population of approximately 6,000, Christmas Island was initially serviced quarterly by Pacific Direct Line (PDL) and a connecting service extended to Fanning and Washington Island in the Line Group. This service is now provided every two months and the company foresees increasing to every six weeks with the inclusion of Samoa and Tokelau en route. The more regular service to the Phoenix and Line Groups has resulted in less stockpiling of goods by the community, enabling merchants to free up capital to expand into other areas and to increase the range of goods and services. Regular shipping has also significantly improved the export of copra and other niche products from these islands. In turn this has resulted in enough demand for service to be provided every two months. The challenge still facing Washington Island is the adverse weather often experienced due to the exposure of the boat channel to strong ocean tides and prevailing winds.

Evidence suggests CPSC has improved the regularity and consistency of shipping services

Under CPSC, Nauru now has limited competition, which addresses the longstanding monopoly situation it faced prior to CPSC. The Marshall Islands is able to import goods from the Pacific region, while Kiribati can readily access goods directly from US, Asia and Europe.

In summary, since the issuance of initial EACs there has been an increase in the frequency and reliability of shipping services to participating countries, largely because shipping companies only

have to operate on agreed routes. All member states are serviced whether their routes are economically viable or not. These improvements have removed the uncertainty previously faced by importers, resulting in reduced stockpiling, better planning, and a larger range of goods for customers.

Objective 2: Has CPSC contributed to greater affordability of shipping services?

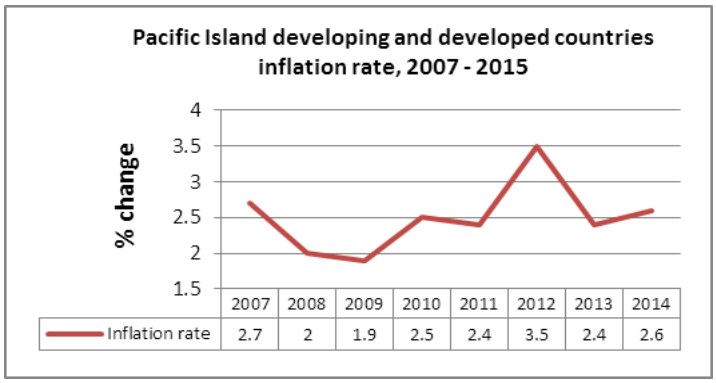
The affordability objective is assessed based on whether CPSC has resulted in lower and more stable freight rates. Consultations with shipping agents in CPSC states indicate that freight rates have not declined since CPSC's inception in 2014, but are stable. This could be indicative of two things: that the shipping lines are operating within a very tight margin and are unable to reduce freight rates; or that the shipping lines are adhering to their initial agreement with CPSC to keep freight rates as they were prior to CPSC, and only reduce rates as port efficiency in member countries improves.

Testing the accuracy of this information requires comparison of post-CPSC freight rates with pre-CPSC freight rates. This relies on the availability of baseline and post-CPSC freight rates. Although post-CPSC rates are available on some routes, baseline freight rates were not collected prior to CPSC, posing a challenge for this comparison.

A simple comparison of the freight rates charged in 2013 (pre-CPSC) with those charged in 2014 (post-CPSC) may provide a biased estimate of the impact of CPSC on freight rates, due to similar reasons as discussed under the frequency indicator. However, due to commercial sensitivity, freight rates for Fiji or any other counterfactual are unavailable. Thus, a simple pre–post comparison is used to derive estimates of the impact of CPSC on freight rates, but it is important to note that these estimates may be biased, and should be interpreted with caution. Where available, actual freight rates are not published, due to commercial sensitivity; impact estimates are reported in percentages.

In the absence of freight rate data for 2013, available information on 1988 and 2007 freight rates for CPSC countries provided in an SPC and PIFS (2007) sub-regional shipping study serve as a good basis for forecasting 2013 freight rates. These forecasts are calculated using the Pacific Islands region's inflation rates provided in Figure 6. For this region, inflation rate (the price of a basket of goods) is perhaps the most important indicator of changes in prices (both commodity and freight rates) over time. Freight rate increases are quickly passed onto consumers through commodity prices in supermarkets, etc. – inflation rates in turn reflect these changes in prices of goods and services. Freight rates also comprise a significant portion of the prices of imports into the region, most of which are essential food items that make up the typical basket of goods used in the calculation of inflation rates. Inflation rates also partly reflect oil price fluctuations, through its impact on freight rates. Despite these SIS being price-takers due to the small size of their economies,

Figure 6. Pacific Island countries inflation rate.



Source: UNESCAP Economic and Social Survey of Asia and the Pacific 2008-2015.

with little likelihood of influencing changes in international freight rates, Pacific regional inflation rates still serve as a better forecasting indicator than global inflation rates. This is because other specific regional factors, such as the state of these economies, that could influence the sub-regions' freight rates are likely to be better reflected in a regional inflation rate than they would in a global inflation rate.

Making a simplifying assumption that international freight rates will change gradually primarily due to inflation, using 2007 as a baseline, forecasts of 2013 and 2014 freight rates were derived. These forecasts are compared against the available freight rates for 2014 (actual rates) on some shipping routes, obtained from the CPSC Secretariat. Table 4 below shows two sets of calculations to estimate the impact of CPSC on freight rates. Column 3 provides a comparison of the actual 2014 rates against the estimated 2013 forecasts.

Results in column 3 suggest that CPSC has resulted in a reduction of freight rates on most shipping routes, although there is indication of freight rate increases on some routes. The reductions range from less than one-tenth of a per cent to over 23 per cent, whereas the few freight rate increases vary between 9 and 14 per cent. Again, these numbers must be interpreted with caution given their basis on forecasting assumptions.

Table 4. CPSC's impact on freight rates.

From	To	2014 actual vs 2013 est.		Robustness check 2014 actual vs 2014 est.
Australia	Tuvalu	−0.02%	↓	−2.37%
	Kiribati	9.12%	↑	6.56%
	Nauru	−9.03%	↓	−11.17%
	Marshall Islands	−14.99%	↓	−16.98%
Fiji	Tuvalu	−13.51%	↓	−15.54%
	Marshall Islands	11.93%	↑	9.30%
	Kiribati	−1.59%	↓	−3.90%
Asia (China/Korea/Japan/Singapore)	Marshall Islands	−23.19%	↓	−24.99%
New Zealand	Tuvalu	−0.67%	↓	−3.00%
	Kiribati	13.82%	↑	11.15%
	RMI	−14.77%	↓	−16.77%

To test the robustness of this calculation, the actual 2014 rates are assessed against the estimated 2014 rates in column 4. If inflation rates are a good predictor of future freight rates, there should be little disparity between the actual and estimated rates; the percentage difference should be close to zero. From column 4, it is apparent that a wide variation exists between the estimated and the true freight rates, as much as a 25 per cent difference between actual and forecasted rates. This clearly suggests that the results in column 3 should not be interpreted as conclusive, as regional inflation rates alone do not appear to be a good predictor of freight rate changes over time. Therefore, based on the above assessment, the impact of CPSC on freight rates is inconclusive.

Although the above assessment does not provide conclusive results on the impact of CPSC on freight rates, going by anecdotal evidence, freight rates have not changed since CPSC became operational. However they have stabilised, as discussed below. Generally, freight rates are still high relative to other parts of the world primarily due to limited exports from the sub-region. For

example, excluding the cost of insurance (commonly referred to as free on board) it currently costs NZD2,500 to ship a 20 foot container from New Zealand to Tuvalu, transhipped via Fiji (approximately 1714 nautical miles), as compared to NZD645–1285 for shipping an equivalent container from mainland China to South Africa (8700 nautical miles, or more than five times the distance). The difference reflects the fact that unlike South Africa, Tuvalu has virtually no exports and therefore lacks the competitive freight rates that would result from higher traffic volumes.

Assessing the freight rate stability requires access to monthly freight rates offered by shipping companies, which due to commercial sensitivity is not obtainable. Testing this indicator therefore relies on anecdotal evidence from shipping agents, importers and countries. It appears that the establishment of CPSC has removed the instability of freight rates that countries faced prior to its formation. Officials and shipping agents from member states report that the agreed-on freight rates have remained stable since 2014. CPSC has allowed countries to secure stable freight rates under the contractual EAC arrangements for specified periods of time. Stability of freight rates has helped countries, buyers and sellers achieve better financial and trade planning.

Since the establishment of CPSC, shipping lines have also been closely observing and monitoring the flow of inward and outward operations, consistency of imports/exports and port efficiency, among the numerous factors that they consider when determining any change in freight rates. This could have implications for the next round of EAC negotiations, as evidence of port efficiency improvements and trade could influence the shipping lines' decisions to reduce freight rates, upon CPSC's request.

Objective 3: Has CPSC contributed to sustainable sub-regional shipping services?

The sustainability indicator is assessed based on the likelihood of shipping service continuity into the foreseeable future. It evaluates the guarantee that shipping lines will continue to provide services to countries in the short to medium term, with no risk of them pulling out within this period. This indicator cannot be tested empirically. Previous studies and country consultations indicate that prior to CPSC, shipping lines provided services on an ad hoc basis, pulling out at any point in time. Countries were not guaranteed service each month or at certain frequencies. There was also a lot of uncertainty around the number of shipping lines that would provide services in a month.

Under the CPSC arrangement, countries are guaranteed service for at least 5 years; shipping companies are obligated by their contracts to provide services for at least this length of time. Therefore, inherent in the CPSC model is the short-to-medium term certainty of shipping services. While such sustainability is not long term, it is a significant improvement from the previous situation. In addition, connectivity for member countries has improved along with certainty of the number of shipping lines expected each month. As Table 5 shows, CPSC member countries have good connectivity with their main trading partners in Asia and the US via hub ports in Fiji, Guam and Busan. The shipping routes covered by each of the EAC holders has not only provided improved connectivity amongst CPSC member states, it has also linked many neighbouring states, and is thus facilitating intra-regional trade which has been on the regional agenda for some time. Increased trade from member states will in turn further improve the sustainability of shipping services as shipping lines will also have greater incentive to service these countries.

Table 5. CPSC shipping lines, routes and frequency.

Shipping line/Vessel name(s)	Agent/Route	Frequency	Transit
KYOWA LINE	**Agent: TRANSCO INTERNATIONAL C/- TRUK TRANSPORTATION CO. INC**		
Vessel name	**ROUTE**		
KYOWA CATTLEYA	**CHINA>KOREA>JAPAN**:KOBE>NAGOYA>YOKOHAMA>SAIPAN>**GUAM**>CHUUK>KWAJALIEN>EBEYE>MAJURO>KOSRAE>POHNPEI>YAP>KOROR:PALAU	2 calls/month	30 days ex China - Chuuk
KYOWA HIBISCUS	**CHINA>KOREA>JAPAN**:KOBE>NAGOYA>YOKOHAMA>SAIPAN>**GUAM**>CHUUK>KWAJALIEN>EBEYE>MAJURO>KOSRAE>POHNPEI>YAP>KOROR:PALAU	2 calls/month	30 days ex China - Chuuk
KOYWA ORCHID	**CHINA>KOREA >JAPAN**: KOBE>NAGOYA>YOKOHAMA>SAIPAN>**GUAM**>CHUUK>KWAJALIEN>EBEYE>MAJURO>KOSRAE>POHNPEI>YAP>KOROR:PALAU	2 calls/month	30 days ex China - Chuuk
MATSON LINE	**Agent: SEA VENTURE COMPANY**		
Vessel name	**ROUTE**		
KYOWA CAT/HIBISCUS/ROSE	**USA**:SEATTLE/OAKLAND/LA>HAWAII:HONOLULU >GUAM>**YAP>PALAU**	2 calls/month	23 days ex USA - Palau
KYOWA CAT/HIBISCUS/ROSE	**USA**:SEATTLE/OAKLAND/LA>HAWAII:HONOLULU >GUAM>**RMI: KWAJALEIN>MAJURO>KOSRAE>POHNPEI>CHUUK**>GUAM	2 calls/month	21 days ex USA - Chuuk
KYOWA CAT/HIBISCUS/ROSE	**USA**:SEATTLE/OAKLAND/LA>HAWAII:HONOLULU >GUAM > **RMI: EBEYE>KWAJALEIN>MAJURO>KOSRAE>POHNPEI>CHUUK>**GUAM	1 call/month	21 days ex USA - Chuuk
MARIANA EXPRESS LINE (MELL)	**Agent: PACIFIC COAST AGENCY**		
Vessel name	**ROUTE**	**Frequency**	
MV JOST	**USA**:TACOMA/OAKLAND/LA>HAWAII:HONOLULU >RMI: MAJURO>**EBEYE**>KOSRAE>POHNPEI>**CHUUK**>SAIPAN>YAP>PALAU:KOROR	2 calls/month	29 days ex USA - Chuuk
MV JAN	**USA**:TACOMA/OAKLAND/LA>HAWAII:HONOLULU >RMI: MAJURO>**EBEYE**>KOSRAE>POHNPEI>**CHUUK**>SAIPAN>YAP>PALAU:KOROR	2 calls/month	29 days ex USA - Chuuk
SUDONG	**USA**:TACOMA/OAKLAND/LA>HAWAII:HONOLULU >RMI: MAJURO>**EBEYE**>KOSRAE>POHNPEI>**CHUUK**>SAIPAN>YAP>PALAU:KOROR	2 calls/month	29 days ex USA - Chuuk
SPRINGWOOD	**USA**:TACOMA/OAKLAND/LA>HAWAII:HONOLULU >RMI: MAJURO>**EBEYE**>KOSRAE>POHNPEI>**CHUUK**>SAIPAN>YAP>PALAU:KOROR	2 calls/month	29 days ex USA - Chuuk
KYOWA SHIPPING SERVICES	**Agent:**		
Vessel name	**ROUTE**		
KYOWA CATTLEYA/HIBISCUS/ORCHID	VIETNAM>CHINA>KOREA>JAPAN:KOBE>NAGOYA>YOKOHAMA>SAIPAN>GUAM>CHUUK>**RMI:KWAJALIEN>EBEYE>MAJURO**>KOSRAE>POHNPEI>YAP>KOROR:PALAU	1 call/month	47 days ex Asia>Busan>FSM
KYOWA CATTLEYA/HIBISCUS/ORCHID	NZ/AUSTRALIA>BUSAN/KOREA>JAPAN: KOBE>NAGOYA>YOKOHAMA>SAIPAN>GUAM>CHUUK>**RMI: EBEYE>MAJURO>**KOSRAE>POHNPEI>YAP>KOROR:PALAU		50 days ex Aus/NZ>Busan>FSM
CORAL ISLANDER	ASIA & AUST: MEL>SYD>BNE>BUSAN>**TARAWA**	1 call/month	21 days ex Asia>Busan>Tarawa 37 days ex Aus>Busan>Tarawa
MATSON SHIPPING	**Agent:**		
Vessel Name	**ROUTE**		
IMUA II	AUST: BNE> (NZ T/Ships) Collected @ SOLOMON IS: HONIARA>NORO>**NAURU**	1 call/month	
PACIFIC DIRECT LINE	**Agent:**		
Vessel name	**ROUTE**		
SOUTHERN PEARL & PHOENIX	NZAKL>FIJI: SUVA>LTK>WALLIS>FUTUNA>**TUVALU:** FUNAFUFI>**KIRIBATI**: TARAWA>**RMI:** MAJURO	1 call/month	
CAPITAINE FEARN			
SWIRE SHIPPING (TOL)	**Agent:**		
Vessel ame	**ROUTE**		
MICRONESIA N CHIEF/KIRIBATI & HIGHLAND CHIEF	KOREA:BUSAN>JAPAN:YOKOHAMA>**RMI:**MAJURO**>TARAWA>**PAGOPAGO>APIA>SUVA>LTK>SANTO>HONIARA>**TARAWA>MAJURO**>JAPAN:YOKOHAMA	1 call/month	21 days ex Asia>Busan>Tarawa
NEPTUNE/PFL SERVICES	**Agent:**		
Vessel name	**ROUTE**		
CAPITAINE FEARN	SUVA>MELBOURNE>SYD>BNE>HONIARA>**NAURU**	1 call/month	
Vessel name	**ROUTE**		MARSHALL ISLANDS
MV Southern Pearl	SUVA>Wallis/Fotuna>Funafuti>Tarawa>Majuro>Nauru.	CPSC	KWAJALEIN

Source: CPSC secretariat (2015).

Non-quantified benefits

Several non-quantified and unquantifiable benefits have resulted from CPSC, impacting these SIS economies and the shipping industry. These socio-economic impacts are felt across households, businesses, governments and the shipping companies. A number of these are discussed below. Future impact evaluation studies of CPSC should empirically assess and quantify these benefits where possible.

At a household level, CPSC has resulted in cost of living improvements. Although there are insufficient data to quantify this benefit, the freight rate impact analysis suggests some positive changes in freight rates. These will translate into improved costs of living if the savings from freight rates are passed onto consumers. However, it is difficult to say if this has been the case, as information on the prices of goods in supermarkets prior to and after CPSC became operational is unavailable. In order to fully assess this, a comparative analysis of the price of a typical basket of goods purchased by a CPSC member country household before and after the establishment of CPSC will need to be conducted. The improved shipping frequency suggests that the standard of living in households, from a dietary and consumption standpoint, has improved. This results from improved nutrition through increased availability of a variety of food groups that allow for a balanced diet, but also potentially through lower costs of food and other imports, which free up funds for other important household expenses. Poor frequency of ship calls previously meant that households were subjected to frequent shortages of meat, vegetables, fruits and other key food items that comprise a balanced diet. During such periods, households would have had to rely on consumption of mostly fish and breadfruit, given their mostly limited agricultural potential.

Businesses will be gaining significantly from both improved frequency of shipping and more stable freight rates. Through more stable freight rates, businesses are able to set their prices with greater certainty, and also save on the cost of making frequent price changes. Having more stable import schedules means business can plan their sales and inventory a lot better, and are guaranteed stable revenues in the short-to-medium term. Such stability increases their ability to take risks and make greater investments, such as store expansion, diversification of product base, etc.

Governments are benefitting both directly and indirectly through the impact of CPSC on the economy and their direct investments. Better shipping services and stable freight rates (and commodity prices) have likely impacted these SIS economies' performance through increased household purchases and improved business cash flows and investments. Government projects also rely on the effectiveness of shipping services, as raw materials for construction projects are transported by ship. Governments are better able to plan projects and implement them on schedule without delays in the delivery of construction materials. Through this regional partnership, governments also have greater control and oversight on shipping arrangements through a transparent and effective regulatory regime. The establishment of CPSC demonstrates the successful outcome and empowerment that can result when countries work collectively to achieve a common objective, in this case better shipping services for their people. CPSC countries, on this sub-regional platform, are better empowered to influence the international shipping industry's decisions and to have a greater say and impact than they would have if bargaining at an individual level. The Commission has raised the level of governments' interest in improving performance in ports, associated areas and export opportunities that all have a bearing on freight rates that in turn affect the cost of landed goods.

Shipping companies have also benefited substantially from this shipping arrangement. One such positive impact is the sub-regional discussion forum that CPSC has created between shipping lines and states. Previously, shipping companies engaged with individual member states but not in a close and ongoing working relation. With this new public–private partnership, governments see the private sector as a partner and not as an adversary, and vice versa. With increased confidence, shipping lines may take on more risks to improve the shipping services in the sub-region. The challenges faced by shipping lines in this region are common; this platform for discussion has made it easier for member states and shipping companies to seek solutions in a transparent way.

Overall, both the quantified and non-quantified benefits indicate that CPSC has resulted in improved shipping services across the sub-region, and key stakeholders have benefited directly or indirectly. Though the road to reducing freight rates and achieving other objectives of CPSC may be long, these benefits are not negligible and illustrate that private–public partnership arrangements are the best way to accomplish these.

6. Maximising the benefits of CPSC: The saturation point

The analysis in the previous section suggests that membership in CPSC has improved international shipping services to its member states. Service is now reliable, and freight rates have stabilised. Prior to CPSC the sub-region was served by four shipping lines; since January 2014, six shipping lines service these routes and with greater frequency (CPSC AGM 2014). Freight rates however remain high compared to other regions of the world, in part due to limited exports.

In January 2014, three shipping companies were granted EACs by the Commission. In April of the same year three more companies applied and were also granted EACs. Each of the states now has at least two shipping lines providing services on their routes, bringing cargo either directly from the ports of origin or through a major transshipment port in the South Pacific such as Suva. Other shipping companies not currently participating in CPSC have expressed interest in applying for an EAC; however the Commission is mindful of not saturating the small market. The question of the maximum number of shipping lines to be granted EACs by the Commission has therefore been a major topic of interest.

6.1. Optimisation theory and the saturation point

A primary role of CPSC is to ensure that the optimal number of shipping lines is licensed to provide the required level of vessel calls and containers that meets countries' shipping demands. On the supply side, the number of shipping lines that are licensed should be sufficient to meet the shipping needs of the member states (in terms of TEUs (Twenty Foot Unit) and frequency), while maintaining some level of profitability based on the agreed freight rates. On the demand side, the volume of cargo that countries require (imports and exports, in terms of TEUs) needs to be sufficiently high to allow the number of licensed carriers to operate with some degree of profitably on these routes. Identifying the optimal point for such arrangements is critical to CPSC meeting its objectives.

The saturation point for CPSC's controlled competition model is the point at which licensing an additional carrier on a particular route will no longer make the operations (within the CPSC arrangement) efficient or commercially viable. Identifying the saturation point of the CPSC model requires answering the following question: ***what is the maximum number of shipping lines required to address the demand needs of the countries while also retaining competitiveness and profitability for these shipping companies on these routes?***

The saturation point for CPSC is the point at which licensing an additional carrier will no longer make the operations efficient or commercially viable

The economic explanation for the saturation point is based on the principle of diminishing marginal returns, which states that keeping all other factors constant, the benefit or returns/output gained by another unit increase of an input variable will increase up to a point, beyond which the marginal per-unit output gained will start to decrease. In other words, increasing a particular variable will at some point yield lower per-unit returns, if all other variables hold constant. The point at which diminishing returns sets in is the saturation point, or the optimal benefit per investment. Applied to the CPSC arrangement, as the number of licensed shipping lines increases,

the benefit of having an additional shipping line, in terms of greater competition and potentially lower freight rates, increases up to a point where an additional shipping line, and the resulting competition, will lead to losses and inefficiency, as too many shipping lines try to ship very limited cargo volumes. Diminishing returns occurs in the short run when cargo volumes are fixed. However, in the case of these SIS, since cargo volumes are limited and somewhat fixed because of limited growth, diminishing returns continue even into the medium to long term. Additionally, because CPSC contractual freight rates are likely just at the brink of breaking even, diminishing returns set in very early on under the CPSC arrangement. In other words, increased competition resulting from an additional licensed shipping line will decrease freight rates down to the level of the cost of operations very quickly.

The graph in Figure 7 illustrates diminishing returns and saturation point. Licensing a number of shipping lines will yield benefits in terms of competition and lower freight rates. As more shipping lines are licensed, profits decline until they are driven to zero (or a minimum threshold), or even negative levels. This point at which profits are zero or at the minimum threshold below which shipping lines will be unwilling to provide services, is the saturation point. Beyond this saturation point, shipping lines make losses and will withdraw their services.

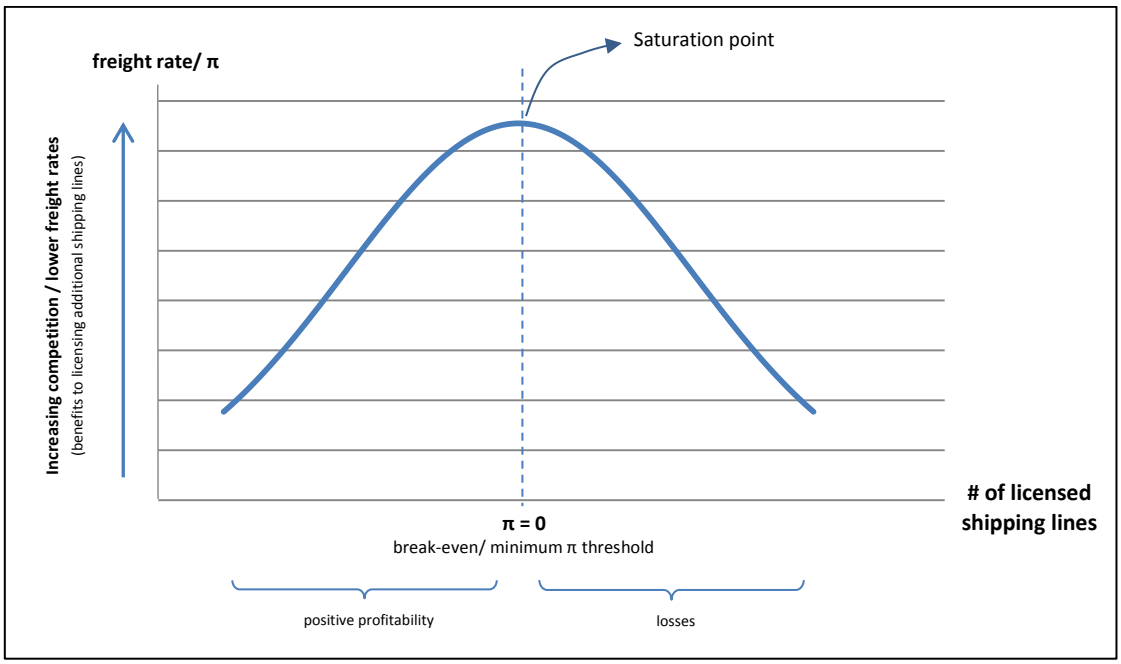


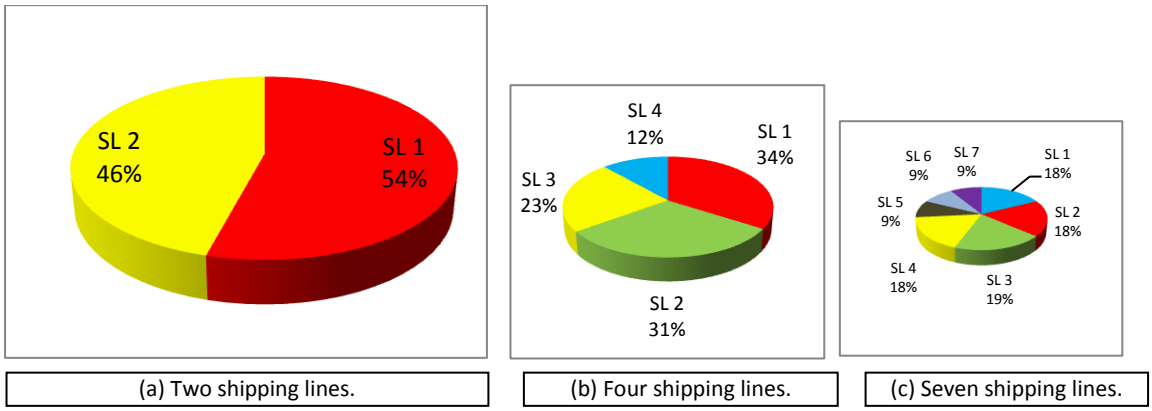
Figure 7. Diminishing returns and the saturation point.

An undersupply of shipping services will mean that not enough shipping lines are licensed to meet the cargo demands of the countries: this is represented by the extreme left part of the curve, where few shipping lines are operating and they are making significant profits. This signals that more shipping lines could operate profitably on the route. An oversupply of shipping services will mean that too many shipping lines have been licensed, and each individual shipping line will not have sufficient cargo volumes to be able to operate profitably: this is represented by any point to the right beyond the mid-point of the curve. This, in addition to fierce price competition for limited cargo volumes, may result in some shipping companies making losses and pulling out. In the event of this happening, this could revert to the pre-CPSC situation of unreliable shipping services. Given the new contractual agreements under CPSC, it will be imperative not to create a situation where shipping

lines may be forced to break their contracts as a result of having too many players competing for very low cargo volumes, even over the medium terms.

As Figure 8 shows, because the cargo volumes and profit levels are limited, as more shipping lines are licensed the profit pie gets smaller and smaller, until a level where several shipping lines will in fact start making losses, since it becomes impossible to cut costs further.

Figure 8. Competition and profit shares under limited cargo volumes and profits. Initially, in (a), the profits are shared between two shipping lines (SL). In (b) and (c), the profit pie declines as competition drives freight rates down and the cost of shipping fewer containers increases for each individual shipping line, further decreasing the available profits that can be shared by the increasing number of shipping lines.



(a) Two shipping lines. (b) Four shipping lines. (c) Seven shipping lines.

Currently, each CPSC country receives at least two vessel calls a month, as Table 5 (in the previous section) shows. Anecdotal evidence from shipping agents in the four member states indicates that country demands are met. On average two vessels call each month, and the volume of cargo currently imported and exported, are adequately met by shipping lines. This evidence suggests that countries require at least two vessel calls a month to meet their cargo demands.

Generally, shipping lines provide services to several countries on each voyage to ensure cost-effectiveness. In the case of CPSC countries, a shipping line may service several CPSC countries on the same voyage (for example, Swire calls at both Marshall Islands and Kiribati ports on the same voyage), or only one (for instance, Neptune/PFL calls only at the Nauru ports on its shipping voyage). Such complexity creates a challenge to understanding the optimal number of shipping lines required for each particular country. For instance, it might be ideal to license four shipping lines to provide services sufficient to meet the schedule and total tonnage requirements of the countries, but because each of these shipping lines does not service all four countries, some countries might be underserviced. In addition to this are complexities around the transshipment and hub arrangements, as well as the slot-sharing agreements between different shipping lines.

Adequate data to accommodate the complexity of shipping arrangements is required to carry out the extensive analysis needed to assess the saturation point. Such data would include information on each of the service routes taken to these four states, the number of physical vessels, slot arrangements, freight rates, costs of shipping operations and profits, hub port and transshipment arrangements, the volume of cargo each country demands, and the volume that shipping lines are able to carry on each of the routes in question. Accurate estimation of the saturation point also hinges on knowing the actual shipping demand and supply levels. Due to limited data available for

such analysis, this paper presents saturation points under a number of scenarios with varying assumptions. This sets the stage for further analysis to be carried out when data are available.

6.2. Shipping services demand

The demand for shipping services in member countries is determined by a variety of factors including demographic changes (population growth or decline); economic growth; tourism; donor projects and associated construction activities; private sector activities; price (freight rates); and exogenous factors or random shocks such as natural disasters, economic crises, global growth, etc. Underlying all of this is trade, in terms of imports and exports, which drives the demand for shipping services. Each country generally has a steady-state level of demand for shipping services, but this can be disrupted by seasonal events in the country such as festive activities, or unanticipated demand, for example new donor projects or post-disaster reconstruction.

The steady state level of demand is known based on the number of containers that each country demands each month. For instance if, based on total average monthly imports and/or exports by individuals, businesses and governments, a country demands 20 containers fortnightly, at a frequency of two vessel calls a month, this means that the stable demand is 40 containers a month, or 480 containers a year. As this shows, there are two parts to the demand – the number of containers and the frequency. Both of these factors are determined by the level of consumption and production within each country's economy, which are influenced by the frequency at which importers exhaust their stock, or their inventory requirements, and the time period in which exporters are able to produce and get their items ready for export. The latter is also impacted by the nature of the commodity being exported, including the perishability of the goods.

The true level of demand for shipping services from a member country under CPSC can be defined as the volume of goods retailers or importers would ideally want to receive (import) or deliver (export), at a particular (consistent) schedule.

Observed dd = *f*(number of containers, frequency)

Ideal dd = *f*(preferred number of containers, preferred frequency)

Where:

dd = level of demand

f = function of

6.3. Supply of shipping services

The supply of shipping services to member countries is primarily determined by the number of shipping lines available to provide services to these countries, but also by the level of demand from the countries, competition, freight rates, profitability of the route, volume of trade, and the cost of providing services on that route. Factors that determine demand also indirectly determine supply, including exogenous factors or random shocks. As with demand, each country generally has a steady-state level of supply of shipping services, which is determined by the number of containers and the level of frequency of vessel calls that shipping lines deliver containers based on their profitability but also on the needs of importers. For instance, if importers would want to import

and/or export an average of 20 containers, at a frequency of 3 vessel calls a month, this means that the steady state supply should be on average 60 containers a month, or 720 containers a year.

In the CPSC member countries however, supply levels have primarily been determined by the schedules of the shipping companies, which essentially define when countries will be able to receive their items. Therefore, shipping companies' fixed schedules and vessel capacities could force the steady-state supply to a much lower level (or even a much higher level). In the long run, importers re-adjust their demand to match these supply levels, and this in turn maintains the stable supply at this level for the foreseeable future. This means that the supply of containers and/or vessel calls, based on the shipping lines schedules, may not be sufficiently meeting what countries would ideally want to receive on a regular basis. In addition, several other key factors influence the volume and frequency at which containers are supplied, for instance the number of containers that suppliers from the ports of origin are willing and able to provide to the importer at a certain time, based on their stock.

Under CPSC, the level of supply of shipping services is determined by the number of shipping lines that are licensed to provide shipping services on a specific route at a particular frequency, which in turn reflects the number of vessels and ship calls coming into a country. Shipping companies generally determine their schedules based on receipt of the EAC, and past trends in shipping services on the route they are licensed to service (e.g. demand levels). Shipping companies will only be willing to increase the frequency of their calls on a particular route if the value of the cargo being shipped is greater than the cost of shipping those items. In addition, they will also need to be convinced that this is a consistent shipment to warrant integrating this additional call into future shipping schedules.

Anecdotal evidence suggests that existing licensed shipping lines/vessels have allowance for additional containers on their vessels, if the demand for the number of containers were to increase. Based on the above premise, and with other determining supply factors being out of control of the shipping companies, this paper assumes that the supply, in terms of number of containers, is meeting the demand. Shipping companies will take into account the profitability of providing shipping at specific frequencies. Therefore, the optimal frequency of shipping services will also have to be such that allows for shipping companies to remain profitable.

Observed ss = *f*(number of containers, frequency)

Ideal level of ss = *f*(preferred number of containers, preferred frequency)

Where:

ss = shipping service

f = function of

6.4. Assessing the saturation point

While growing competition creates greater efficiency and could reduce freight rates, the volumes traded from these four countries are very limited. For instance, between 2007 and 2014, these countries received a total average of 122 containers (20 ft.) annually. This indicates that the volumes

might be too small for several competitors to make a decent level of profit. CPSC is faced with the issue of whether the saturation point for carriers has been reached.

Given the long distances travelled to service these small countries, and the history of shipping lines pulling out due to lack of profitability, one can assume that shipping to CPSC countries is a low-margin business. However, it is also safe to assume that the current EAC holders are making some profits, although they may be small. In addition, being profit-driven, there is generally a profit threshold below which shipping lines will be unwilling to provide services on a particular route. This profit threshold is another piece of important information to consider when assessing saturation levels; however the commercially sensitive nature of shipping lines' costs and profits has prevented access to this information. Under the assumption that these shipping companies are operating at the brink of breaking even, this study assesses how many vessels will be able to transport these 122 containers while remaining profitable. Saturation point will set in early on in the short-to-medium term under a controlled competition model, because the freight rate is 'controlled' and not allowed to increase beyond a certain level.

Typically, shipping within the Pacific consists of a complex mix of service provision arrangements. Shipping lines may provide services with their vessel(s) either direct from ports of origin to CPSC countries, or to a transshipment port from which another shipping line then transports the cargo to the CPSC countries. Shipping arrangements within the region have developed to use slot-sharing or slot-chartering arrangements, whereby one shipping line buys bulk space or slots (space on a vessel for a container) on a vessel owned or managed by another shipping line, for a particular route. Shipping lines also service different shipping lanes, based on profitability and service demands, and CPSC countries fall under different service lanes, based on a shipping line's route preference. These are only a few of the layers of complexity of service arrangements within which CPSC is set.

In an attempt to simplify this complexity, the saturation point is estimated based on several assumptions. The underlying assumption is that two possible shipping scenarios exist: the first where each shipping line provides one vessel to service a route, termed a 'vessel-on-voyage arrangement'; and the second scenario where shipping lines buy slots on another shipping line's vessel, termed a 'slot arrangement'. The saturation point is calculated under these two different scenarios. The main assumptions for the two scenarios are summarised below, and form the basis of the following analysis:

- CPSC member states are all on the same shipping lane – vessels drops off cargo at each of the four member states, and then continue on to drop off cargo in other PICTs;
- Shipping lines provide direct services to countries – from the ports of origin to the point of destination (there are no transshipment points involved);
- Based on turnaround time, each vessel is only able to provide services once a month;
- Each shipping line will not service a loss-making route – they will at least break even (profits must be ≥ 0);
- Shipping costs to all four countries are the same – CPSC maximum freight rate is on average $5000 to each of the countries, and freight rate charged by each carrier is determined by the level of competition resulting from an additional shipping line being licensed;
- Once an additional shipping line is licensed, the cargo volume is shared equally by the new number of shipping lines;
- Each shipping line licensed has only one vessel.

Note that all figures under both scenarios are arbitrary, and the results will be sensitive to changes in any of the assumptions.

Scenario 1: Saturation point under vessel-on-voyage arrangement

Under this scenario, each licensed shipping line provides one vessel to service the CPSC route, and shipping services in the central Pacific are organised based on further assumptions specified below:

- Shipping lines each provide individual vessels to service a particular route – there are no slot arrangements;
- Each shipping line has only one vessel, therefore if two vessels are required for a particular route, two shipping lines will have to be licensed;
- For each individual shipping line, the cost of shipping one less container increases by 0.6% for every additional shipping line licensed by CPSC. This is because if a shipping line loses one container to a competitor, their unit cost per total containers carried increases;
- The licensing of an additional shipping line reduces freight rates by a fixed percentage of 0.6%. The freight rate reductions are the result of competition, where the freight charged by an additional shipping line is based on the following equation:

  Freight rate$_y$ = current freight given z number of licensed shipping lines + percentage freight reduction (current freight rates given z number of licensed shipping lines)

  Freight rate$_y$ = Freight$_z$ $(1 + x)$

  where: x = percentage decrease in freight due to competition
  y = current freight given z number of licensed shipping lines
  z = number of currently licensed shipping lines

Under this scenario, assume that on a monthly basis Kiribati requires 50 containers, the Marshall Islands requires 45 containers, Nauru requires 40 containers and Tuvalu requires 25 containers, i.e. together these countries require a total of 160 containers monthly. Assume that each vessel has capacity for 100 containers. If one shipping line is licensed, and it has only one vessel, it cannot supply more than 100 containers a month in total to these countries. Additional container requirements can be met by either transferring the remaining containers demanded to the next cycle of shipments, or by licensing an additional carrier. The former is not favourable, because the countries require this cargo for day-to-day operations. The latter will only happen if the additional carrier is able to profitably deliver these additional containers; or if the total number of containers is shared between both carriers and these container volumes are sufficient to ensure profitability. The saturation in this case is the maximum number of vessels that can sufficiently and profitably carry the total number of containers.

Table 6 estimates the maximum number of shipping lines/vessels required based on the above assumptions. The figures apply to each individual shipping line under various conditions.

Table 6. Saturation point under vessel-on-voyage arrangement.

No. of SLs	Total no. of containers dd	No. of containers per SL	Meeting country demand?	Cost to SL under competition	Freight rate under competition[2]	SL total revenue[3]	SL total cost[4]	SL profit[5]	SL profit ≥ 0?
1	160	100	No (<160)	3500	5000	500,000	350,000	150,000	YES
2	160	80	Yes (160)	3945	4433	354,640	315,586	39,054	YES
3	160	53	Yes (160)	4627	3776	201,372	246,778	-45,405	No
4	160	40	Yes (160)	5011	3485	139,384	200,450	-61,066	No
5	160	32	Yes (160)	5257	3321	106,266	168,221	-61,955	No
6	160	27	Yes (160)	5427	3216	85,758	144,729	-58,971	No

SL = shipping line; dd = level of demand

More than one shipping line is required to deliver the 160 containers. With two shipping lines, if the number of containers is split equally, their individual profits will be lower because they are carrying fewer containers, but also due to the reduction in freight rates driven by competition. In addition, the cost of bringing smaller cargo volumes will increase, if shipping lines are not able to make up the gap in cargo volumes by increasing volumes delivered to the non-CPSC countries. However, CPSC countries' demands will be met, in terms of total number of containers required.

The saturation point is the point at which licensing an additional shipping line will yield either zero profit or losses. As the table shows, under the given assumptions, two vessels is the optimal number required for bringing in CPSC countries cargo. Therefore, two vessels is the saturation point under this scenario. The optimal frequency under this scenario will be one shipping line calling at the beginning of the month, while the other calls mid-month or towards the end of the month, in order for the countries to get the 160 containers they require in one month. Technically, these two vessels could be operated by the same shipping line, in which case only one shipping line would need to be licensed on the condition that it provides two vessels to service these countries; but in our scenario a maximum of two shipping lines should be granted EACs to service the countries. However, it is important to note that doing so may yield losses for the shipping line; though shipping lines may be able to recover their costs, if there is an increase in exports in the long term, or if they are able to secure additional cargo volumes from other non-CPSC countries on the same shipping lanes.

The equation to determine the saturation point under a vessel-on-voyage arranged is provided in Appendix B.

Scenario 2: Saturation point under slot arrangement

This scenario is based on the assumption that only one shipping line, A, provides a vessel, and additional licensed carriers buy slots on this vessel. Depending on the number of slots bought, the slot buyer can negotiate a low-enough price to make a significant profit. However, the number of slots available will depend on how many competitors are in the market to buy the slots. Therefore, as the number of competitors grows, this profit diminishes until it eventually becomes zero.

The process of the slot arrangement is described as follows. The slot buyer purchases the slot from shipping line A at a price lower than the maximum freight rate allowed under CPSC, and this buyer in turn sells this slot to shipping agents at a price again below this CPSC maximum, but high enough to makes a profit on the sale. The shipping agents, in turn, charge the importers a freight rate that allows it to make some profits on the price received from the slot buyer, but still within the CPSC

maximum freight rate. It is evident that at every stage of purchase and resale, the profit margin decreases even further.

The saturation point under this scenario will be determined based on the number of shipping lines that are licensed under a slot arrangement. Assume that only the first shipping line licensed puts a physical vessel on the route while, due to the unprofitability of using additional vessels, any additional shipping line licensed will buy slot arrangements on the existing vessel. Under this arrangement, the number of shipping lines using slot arrangements will be maximised where each shipping line within this arrangement at least breaks even, given the cost at which they are buying these slots. The following assumptions apply to this scenario:

- There is only one shipping line A with a physical vessel A1, on which future licensed shipping lines buy slots on a particular route.
- As the number of licensed shipping lines increases, the number of containers per shipping line declines.
- The purchase cost of containers/slots increases as the number of containers falls. This cost increases by 5% – if a shipping line buys 30 containers versus 10 containers, it is able to bargain a low price for 30 containers as opposed to the price for 10 containers. Given that there is a fixed number of slots/containers on vessel A1, as the number of shipping lines licensed increases, and slot purchases increase accordingly, the number of containers that each of these shipping lines can buy falls. The fewer containers purchased, the more expensive the cost of these containers to each individual shipping line. The selling price of these containers to shipping agents/importers will also decline as the number of shipping lines increases, as competition will drive down the selling price of these containers.
- The number of containers available is evenly split amongst the licensed shipping lines.

Assume CPSC countries demand 160 containers, and one vessel is able to transport all 160 containers on a monthly basis. To encourage competition, more shipping lines can be licensed but strictly under a slot-sharing arrangement. Table 7 shows the saturation point under this scenario.

Table 7. Saturation point under slot arrangements.

No. of SLs[1]	No. of containers per slot buyer	Purchase cost[2]	Resale price under competition[3]	SL total revenue[4]	SL total cost[5]	SL profit[6]
0	160	4000	5000	800,000	640,000	160,000
1	80	4200	4900	392,000	336,000	56,000
2	53	4410	4802	254,506	233,730	20,776
3	40	4631	4706	188,238	185,220	3018
4	32	4862	4612	147,579	155,585	-8006
5	26	5105	4520	117,510	132,733	-15,224
6	22	5360	4429	97,443	117,928	-20,486

[1] Column 1 corresponds to the additional number of slot-buying shipping lines that purchase slots from the existing shipping line. The first row represents no additional slot-buying shipping line; only the shipping line with a vessel is licensed and operating in this market.

[2] Fixed cost per container. $4000 is the starting cost – the true cost of shipping the container, which is borne by the SL with a vessel; the cost increases (assume, by 5%) as the number of containers declines, because the SL selling slots will give the slot buyer a good price if they buy bigger slots. Assume a = 0.05, the percentage increase in cost as container slot purchased decreases.

[3] Selling price per container – under competition. 5000 is the starting revenue, based on the assumption that the sole slot buyer under a slot arrangement will charge the maximum freight rate allowed under CPSC. Assume revenue falls by 2% (b = 2%).
*re-sale price to the shipping agents.
[4] Revenue per individual SL as competition grows, i.e. as an additional SL is licensed and enters the market.
[5] Cost per individual SL as competition grows.
[6] Profit per individual SL as competition grows.

Under these assumptions, a maximum of three additional slot-buying shipping lines should be licensed in addition to the first shipping line that has the vessel. If more than three slot-buying shipping lines are licensed, each individual shipping line will make losses from the slot arrangement. In this case, a total of four shipping lines will be the saturation point. Beyond this, the shipping lines will no longer be able to provide services profitably, and will pull out. This is assuming that the single vessel is able to meet the demands of the country's cargo requirements.

The equation to determine the saturation point under slot arrangements is provided in Appendix B.

Estimating the actual saturation point for CPSC

In reality, shipping arrangements in the central Pacific consist of a mix of vessel-on-voyage and slot arrangements, with no particular pattern. The true saturation point will depend on this mix. Saturation will also depend on a number of other factors. These include the volume of cargo being transported to each country, which some shipping lines provide directly from the ports of origin, while others provide via a transshipment port in the south Pacific, and others through a mix of both types of services. Also, given the long turnaround times of some of the services, and the long distances that have to be travelled, one shipping line often cannot provide all the services needed for a particular country, even if it has more than one vessel on that route. Knowing the amount of cargo being transported on each of these routes, the time from port of origin to destination, as well as the transshipment ports from which the CPSC countries are serviced, will make it possible to estimate how many vessels will be optimal to provide service on these routes, and in turn, how many shipping lines will be sufficient to provide these vessels for these routes.

Knowing the capacity of licensed shipping lines, it is possible to ascertain the number of vessels required to bring in a particular number of containers to a country. The saturation point in this case will be the maximum number of vessels required to bring in the country's cargo volumes, such that profitability is maintained. This point is based on the existing capacity of the licensed vessels, and how much of that capacity can comfortably accommodate the volume required for each country on the route that is being serviced.

Competition reaches a point of diminishing returns where it drives countries to the situation prior to CPSC

Cargo to (and from) CPSC countries arrives from (and is exported to) from Asia, Europe, Australia, the Americas and the Pacific, requiring different shipping lines originating from these various ports to bring this cargo into CPSC countries (depending on their ports of origin and their own transshipment arrangements), or requiring a hub-and-spoke system in the Pacific, such that all the cargo coming from the various continents is transshipped at one or two

hub ports within the region, from which they can then be distributed to CPSC countries and other PICTs.

Estimating the saturation of the CPSC sub-region will require data on the true level of demand for shipping services from the member countries under CPSC, and the true level of supply of shipping services.

6.5. Assessing the equilibrium levels in member countries

When CPSC was established, as the number of shipping lines licensed increased, the returns to or benefits of licensing an additional shipping line increased. These returns were in the form of greater competition on routes, more reliable shipping services to countries, and more stable freight rates to countries. To shipping lines, these returns were in the form of guarantee of a specific and consistent volume of cargo and revenues, and protection from outside competition. However, these benefits will only increase up to a certain level – the optimal or saturation level – beyond which licensing an additional shipping line will bring about diminishing returns, as exports and imports remain constant. If CPSC licenses more shipping lines than the volume/frequency of cargo demands, this will lead to a glut in the system; eventually, some shipping lines will withdraw, and those that remain will focus on the profitable routes and abandon the uneconomical routes. Countries will face unreliable shipping services again, especially the SIS located on unprofitable routes; there will be a return to the situation prior to the establishment of CPSC.

Addressing the diminishing returns – or justification for increasing the number of licensed shipping lines – requires increasing the level of imports and exports, to ensure positive marginal returns to licensing an additional shipping line. Exports from these countries are currently low or almost non-existent, and one of the reasons for the experience prior to CPSC was that shipping lines had to recover the cost of both legs of the journey from carrying goods one way only. Evidently, the ability of these member countries to increase cargo volumes is very limited, due to narrow economic bases. Even with an increase in imports/exports, because of the nature of shipping services (vessels can add containers instead of adding a shipping line), this may still not warrant licensing an additional shipping line, as the existing ones would likely be able to accommodate a few extra containers each call. This indicates that CPSC will have to continue to regulate international shipping services in the long term.

In order to ensure that CPSC maximises benefits for countries, service provision should be carefully matched with anticipated cargo volumes. To ensure a sustainable CPSC regime, the right balance has to be achieved between competition and oversupply in the market. Service provision also needs to allow for anticipated future growth, in both imports and exports. The correct routes must be chosen to ensure cost-effectiveness and adequate market sources. The quoted freight rates must be verified with oversight on reliability. A well-designed system will provide benefits to the countries, while ensuring sustainable revenue for shipping companies (but not excess profits!).

While it is difficult to say whether the CPSC model has reached or is nearing its saturation point, based on the analysis above, since each CPSC country is receiving regular services at stable freight rates from at least two shipping lines, the study recommends that CPSC Commissioners suspend the issuance of new shipping licenses in the short to medium term (within the next 5 years). In the interim, the necessary tools should be put in place to determine the model's true saturation point.

Based on this, if a new shipping line can prove the commercial sustainability of its EAC application and there is no reasonable opposition from the existing EAC holders, issuance of further licenses can be considered.

7. Sustainability of CPSC

7.1. Financial sustainability

CPSC is financed by the EAC licensing fees charged to shipping companies and country membership fees, which are its sole sources of revenue. As previously discussed, the Commission requested to initially utilise the services of the SPC EDD's Transport Programme to progress this initiative until a proper secretariat is established. In addition to being its secretariat, SPC has also been funding several of CPSC's expenditures on meetings and associated services. These include, but are not limited to: annual general meetings, technical assistance and other secretariat operational and administrative duties. SPC is likely to continue in this role in the short to medium term, until CPSC can become a stand-alone entity with good financial standing. Ad hoc meetings called by the shipping lines or the countries to bid for an EAC or address queries between countries and shipping companies are paid for by the respective bodies. CPSC produces semi-annual financial reports for its members, in accordance with the Commission's reporting requirements. As at July 2015, the Commission has net positive income and zero expenditure. SPC has been assisting the Commission with developing the legal, policy and financial frameworks necessary to establish its own secretariat. A procedure manual, an annual budget, technical and administrative staff requirements, and a physical location choice are all being considered.

Although it is too early to determine when and if CPSC can become a stand-alone entity that is financially sustainable, this paper provides indicative estimates of the financial costs of operating CPSC as a stand-alone organisation, and proposes recommendations for the way forward on this issue. To operate as a stand-alone entity, CPSC would require at the very least: one administrative staff, two technical staff, a consultant legal staff, a physical office space that will consist of its core operating expenditure, in addition to CPSC meeting expenses. To finance these operating costs, it will need a constant stream of revenues/income. CPSC's major sources of revenues and expense areas are outlined in Table 8.

Table 8. CPSC's major revenue sources and expenditures areas.

Major revenues	Major expenditure
Annual carrier licence fees	Staff costs
Annual membership fees	Office space and utilities
	Annual general meeting and two technical meetings per year
	Consultants
	Other CPSC meetings

Table 9 provides an estimate of the costs of running CPSC with SPC serving as the secretariat. The figures provided are based on actual costs and revenues from CPSC's operation in FY2013–14 and FY2014–15*.

Table 9. Financial estimates for CPSC with SPC as the Secretariat (USD).

Major revenues	Amount	Est. annual revenues	Major expenditures	Amount	Est. annual expenses
Annual carrier licence fees	$ 65,000[1]	$ 13,000	**Staff costs**	SPC financed	SPC financed
Annual membership fees	$ 20,000	$ 20,000	**Office space and utilities**	SPC	SPC

				financed	financed
			AGMs and bi-annual technical committee meetings	SPC financed	SPC financed
			CPSC special meetings		
			Shipping lines	$ 6,700[2]	$ 6,700
			Joint meeting with EPCs and MSG	SPC financed	SPC financed
Total	**$85,000**	**$33,000**	**Total**	**$ 0**	**$ 0**

[1] Annual carrier license fees: assuming $10,000 for 5 years for 5 licences issued ≈ USD$10,000 annually.
[2] Paid by shipping companies.

As Table 9 shows, since SPC has been covering all of the expenses of CPSC, the Commission has zero expenditure and has been able to accumulate revenue over the last two years.

Table 10 provides an estimate of the cost of running CPSC as a stand-alone entity. Several of these estimates are based on actual costs and revenues from CPSC's operation in FY2013–14 and FY2014–15.

Table 10. Financial estimates for CPSC as a stand-alone entity (USD).

Major revenues	Amount	Est. annual revenues	Major expenditure	Amount	Est. annual expenses
Annual carrier licence fees	$ 65,000[1]	$ 13,000	**Staff costs (including a legal consultant)**	$ 90,000[2]	$ 90,000
Annual membership fees	$ 20,000	$ 20,000	**Office space and utilities**	$ 15,000	$ 15,000
			AGM and 2 technical committee meetings[3]	$ 130,000	$ 130,000
			CPSC special meetings		
			Shipping lines	($ 6,700[4])	–
			EPCs/MSG	$ 12,000	$ 12,000
			Economic and trade studies	$20,000	$20,000
			Technical Assistance including trainings	$40,000	$40,000
Total	**$85,000**	**$33,000**	**Total**	**$ 297,000**	**$ 297,000**
Potential annual deficit: $264, 000					

[1] Annual carrier license fees: assuming $10,000 for 5 years for 5 licences issued ≈ USD$10,000 annually.
[2] Staff costs (2 technical staff, 1 administrative staff, a consultant legal staff) ≈ USD$100,000.
[3] Includes 1 technical committee meetings, one with the inclusion of invited EPCs/MSG and translators; AGM costs will vary based on location, length of meeting and member country attendance.
[4] Paid by shipping companies.

Based on its 2014–15 records, CPSC's annual expenditure is expected to total USD167,000. About 30 per cent of this comprises its core operating expenditure of about USD90,000 annually, not accounting for inflation, based on 2015 average wage, office rental and utility estimates. The annual meetings account for the bulk of the total annual expenditure, about 50 per cent, estimated at about USD155,000. Revenues from VOCC fees of USD10,000 and NVOCC fees of USD5,000 every 5 years, for the six shipping lines with issued EACs (6 VOCCs and 1 NVOCC), and total annual membership fees of USD20,000 for the four member countries, amount to about USD33,000. Notably, CPSC fees are much lower in comparison to those charged by MSC – shipping lines pay an average of

USD25,000 for licences and USD10,000 in membership fees. This offers some scope to improve the financial viability of CPSC after the initial set of EACs expires.

This raises questions around the financial sustainability of CPSC. Evidently, based on these financial estimates, CPSC's revenues will not be sufficient to finance its expenses on a long-term basis if it becomes a stand-alone entity. CPSC will incur an annual average deficit of USD264,000 from its operations, which will need to be covered by member countries, since the shipping licence fee is fixed for a period of 5 years. Even if CPSC builds up enough savings in the short to medium term, these savings will only be able to carry it through for a few years at most. Ensuring the commissions' sustainability may therefore require that CPSC retains SPC as its Secretariat for the foreseeable future.

Although the financial viability and sustainability of CPSC as a stand-alone entity may not be feasible at current revenue levels, it is essential that CPSC establishes a financial plan for its future, including assessing revenue sources and expenditure needs, a financial budget, and sustainable financing arrangements. These need to be evaluated within the context of CPSC's goal of maintaining affordability of shipping services to member states, so as not to incur additional costs that will undermine these gains. To achieve these goals, CPSC needs to assess means to reduce its existing operational costs. This study recommends a number of measures to reduce its operational costs:

CPSC is unlikely to be financially sustainable as a stand-alone entity at current revenue levels

- Retain SPC EDD as the CPSC secretariat, and pay a fraction of the cost of technical expert and administrative staff services;
- Considering meetings comprise the bulk of CPSC's expenditure, the study recommends the following measures:
  - Streamline annual meetings to one AGM/technical committee meeting instead of two or three; expenses for this one meeting should be covered by CPSC's annual revenues;
  - Utilise virtual meeting alternatives including video conferencing tools such as Skype, in lieu of travel for additional technical meetings;
  - Piggyback on regional transport meetings to hold technical committee or special meetings, where necessary; and
  - Requests for special meetings must be covered by the party placing the request.

Such steps will ensure that CPSC is able to remain financially stable, obtain a consistent stream of revenues that can adequately cover its reduced costs, while yielding the greatest monetary and non-monetary benefits to its member states.

SPC has financed CPSC's core expenditures, such as its technical and AGM meetings, leaving its revenues untouched since it became operational. Notwithstanding funding limitations, CSPC should consider using a portion of its revenues to finance activities and initiatives that will improve the effectiveness of the Commission and enhance its visibility. The Commission should consider setting a reserve fund (e.g. 6 months expenditure cover), and avoid using its revenues to finance meeting attendance costs. A forward-looking 3-year budget should be prepared (up to the time of renewal of

the first set of EACs) to model what increase in EAC licensing fees can be envisaged. Project funding should be limited to about 50 per cent of annual revenue in any one year.

7.2. Technical sustainability

CPSC is not merely a solution in and of itself; it is perhaps more importantly a means to encourage and effect changes on a national and sub-regional level that will improve its member states' ability to enjoy long-term reliable, affordable and sustainable shipping services, potentially without a formal regulatory body. For this to happen, and in order for the Commission to effectively deliver on its mandate, the Commission needs to develop and implement an adequately funded work plan to improve and monitor the activities and impacts of CPSC. In particular, the work plan should focus on facilitation of agricultural and value-added exports from member states to improve trade volumes, as well as improving countries' capabilities to address other underlying contributors to high freight costs, such as port inefficiencies. The work plan should also include the provision of assistance to facilitate the formation of national shipping councils and monitoring and evaluation of their activities.

In addition, although the above analysis strongly indicates stabilised freight rates, and potentially some reductions, it is not apparent that such cost savings and efficiency gains are being transferred to final consumers through lower commodity prices in supermarkets. It is therefore imperative that such a work plan for CPSC includes the assessment of the cost and standard-of-living impacts of CPSC to ensure that households ultimately reap the benefits from improvements to international shipping services and freight rates. Similarly, as countries make port efficiency and tariff improvements, it is just as important to monitor whether these efficiency gains are met by potential reductions in freight rates. For instance, during the CPSC AGM in September 2015, Kiribati reported that following Cabinet approval, its port tariffs were reduced in 2014; yet there has been no evidence of a decrease in freight rates. The complexity of freight rate structures, however, needs to be considered when assessing the potential for tariff rate reductions to be matched by freight rate reductions. The work plan could include investigating the potential for such corresponding freight rate reductions from efficiency improvements.

The study therefore recommends that CPSC formulates a medium- to long-term work plan consisting of various projects/components and their corresponding activities and initiatives, as well as results that stakeholders are required to deliver on, and indicators to report against. Key components of the CPSC work plan, which can be further developed, are presented in Box 3. A number of these project activities should be carried out within the short to medium term, as prioritised below.

Each of these components should be costed, with sources of financing for the implementation of the activities identified. With regards to the 5-year impact evaluation of CPSC (Component 5, Activity 2), the Terms of Reference for this study should be provided to the countries ahead of time to ensure that the needs of the countries are accurately reflected.

Box 3. CPSC work plan (indicative)

Component 1: Improving port operations and shipping support services (priority 3)

Activity 1: Port efficiency benchmarking and training

Activity 2: Streamlining and automation of port procedures

Activity 3: Biosecurity and custom operations review; port tariff review

Component 2: Strengthening national shipping councils (priority 1)

Activity 1: Training on data collection and analysis – survey design and administration; template design and execution; review, verification and analysis of data

Activity 2: Formalisation of the national shipping councils; technical assistance to improve the effectiveness of the councils; reporting requirements

Activity 3: Increasing the visibility of CPSC at agriculture, trade and shipping fora

Component 3: Trade facilitation and development (priority 5)

Activity 1: (Intra-regional) trade expansion and facilitation feasibility study – identification of niche products, export destination, and shipping arrangements

Activity 2: Trade commodities development; import-substitution possibilities and policy development

Component 4: Shipping and trade knowledge development (priority 4)

Activity 1: Training of shipping agents and importers

Activity 2: Development and administration of surveys on demand and consumption patterns, tastes and preferences, and elasticity and responsiveness to alternative commodities. Household, shipping company, importer and port operator surveys to improve data collection and to provide a basis for medium-term impact evaluation

Activity 3: Awareness raising amongst consumers on commodity alternatives and pricing

Component 5: Socio-economic analysis of CPSC's impacts (priority 2)

Activity 1: Post-CPSC cost of living and standard of living evaluation

Activity 2: 5-year impact evaluation of CPSC

Activity 3: Case study and economic analysis of MSC and CPSC saturation point

8. Next steps

In only a short period of time, CPSC appears to have been instrumental in improving the accessibility, affordability and sustainability of shipping services to its small island state members. Anecdotal evidence suggests CPSC has met its goals of ensuring access to and sustainability of shipping services, as well as stability of freight rates. Affordability still remains a challenge, one which the countries will need to tackle through actions on a national level. It is possible to conclude that the Commissions' non-monetary impacts have significantly outweighed its monetary impacts, and that the former are perhaps of greater significance to member states (e.g. ensuring food security).

To fully realise the benefits of CPSC, countries will need to undertake complementary initiatives to tackle inefficiencies in the maritime sector. Since the geography of these countries means that the cost of shipping services both to countries and shipping companies will always be high relative to other regions, member states need to identify and act on addressing these inefficiencies to reduce the overall costs incurred from shipping. Essentially, CPSC will need to set a baseline on all of its outcome indicators, monitor improvements, and use this as a negotiating tool to obtain low freight rates if certain benchmarks are met. A number of these improvement areas are noted below.

Port efficiency improvements

Member countries need to improve the efficiency of their ports. Efficiency from shipping companies' perspective is of major importance. Time is money. The longer shipping companies' vessels remain on a country's wharf, the higher the costs incurred, which are passed on to the countries through higher freight rates. Since countries cause this delay, the shipping companies factor this opportunity cost into the shipping costs of servicing the country in question. The impact of this is felt across the entire economy, as the higher freight costs are passed on to importers, and are then passed on to consumers through higher retail prices. This in turn raises the cost of living in the country. Reversing both a high freight rate and the cost of living impacts is very difficult. Shipping companies are more likely to raise freight rates than to reduce them. Even if shipping companies reduced their freight rates, retailers are unlikely to pass the benefits on to consumers through lower shelf prices, but would rather retain the higher profits. Investment in infrastructure (new and planned maintenance) can also have a huge economy-wide multiplier effects.

Port efficiency spans virtually all the functional areas of the supply chain, from the moment the ship enters the port area of a country to the time it leaves the port. The operational performance of a port is generally measured by the ship turnaround time, tonnage handled per ship day in port (the rate at which cargo is handled), and the length of time that cargo stays in port. Average vessel turnaround in member countries ranges from 1 to 2 days in the Marshall Islands, Kiribati and Tuvalu; however Nauru averages 4–10 days during good weather and much longer (up to 60 days) in adverse weather (SPC 2015). Delays in ship turnaround in these countries are often due to the poor conditions of infrastructure, or time spent waiting for a berth, pilot, tug, stevedores or export cargo. Generally, turnaround time can be influenced by a myriad of factors including the availability and conditions of navigational aids, the ease of navigating through the channel (determined by depth and width of the channel in relation to the vessel, or congestion within the channel area), size and condition of port infrastructure and facilities, port traffic/wharf congestion and availability, availability of a pilot and/or tug, the cargo handling time, port and stevedoring operating hours (daytime vs night-time operations), and customs processing time.

Load and discharge rates in the member countries average between 10 and 15 containers per hour in the Marshall Islands, Kiribati and Tuvalu, and are much lower in Nauru. These rates are influenced by numerous factors including the number of gangs employed per ship per shift, tons moved per gang hour, fraction of time the gang is idle, condition, capacity and sophistication of equipment, and stevedoring operating hours. The number of stevedoring companies in each country could also impact port performance, and competition between companies should improve efficiency. Port working practices could be improved by extending port and stevedoring operating hours, and allowing for night-time operations, weekend hours or overtime where needed.

According to the CPSC secretariat, during EAC issuance, shipping companies indicated that if countries are able to make port efficiency improvements, they may potentially reduce their freight rates. This should be a strong impetus for countries to address major inefficiencies in their ports. At the CPSC AGM in December 2014, Kiribati reported a significant improvement in one of its port efficiency indicators – its average turnaround time reduced from 3 days to under 24 hours, a 70 per cent change in this port efficiency indicator, which this paper notes and commends. It is hoped that this improvement will be sustained and that the other member countries will be able to follow. The development of regional port efficiency benchmarks will also be useful to target and measure port performance improvements.

Recent consultations from shipping agents (July 2015) in all four member states indicate that there have been no freight reductions offered by shipping lines. Shipping agents attribute this to cargo operations being slow due to poor conditions of port equipment. This calls for actions by member states to reform their port tariffs, including tariff harmonisation, automation of port procedures, and setting tariffs that incentivise shorter vessel turnaround times. Labour issues could also be closely examined to address incentive issues that potentially exist around stevedores' payment structures. For instance, to increase motivation among stevedores, performance-based payment structures, such as basing stevedores' pay on volumes unloaded rather than hours worked, could be explored as a strategy. Over time, countries can point to these during negotiations to get more favourable freight rates, gains that can be passed onto the economy.

Export development

Low cargo volumes are one of the underlying causes of the shipping challenges member states face. Trade facilitation is therefore a necessary requirement to address the sub-region's shipping issues. It is evident that shipping companies will be responsive if cargo volumes pick up. As a long-term strategy, and also for food security reasons, countries should develop their export sector to fill return containers, and in turn, reduce freight rates. A number of short-term exports (e.g. scrap metal, recyclable plastics, glass or paper/cardboard waste) are available within these countries, but will not provide a consistent volume of exports; the viability of exporting such low-value materials is perhaps also questionable, as the fuel and labour costs associated with loading and unloading these materials may very well exceed the value of the scrap/recyclable material(s). Underlying issues hindering

Trade (primarily export) facilitation and promotion of intra-regional trade are key ingredients to achieving long-term reduction in freight rates and sustainable shipping service in member states

large-scale agricultural production or the establishment of small-scale manufacturing, including property rights, access to financing, consistency of production and biosecurity requirements, should be addressed.

Primary exports continue to be dominated by agricultural produce, which are generally not profitable, given sluggish global agricultural commodity prices. Several countries are also facing a significant decline in commodity prices, especially for the agricultural commodities exported by member states. Copra, which is the main export of CPSC member states, has been fluctuating since the beginning of the global financial crises, plummeting in recent years, prompting most countries to subsidise its production. Therefore, diversification of exports, including through value-addition, is necessary. New markets for exports should also be explored through better marketing. Authorities from member countries believe that there are trading opportunities for niche products, such as virgin coconut oil, green coconuts, coconut juice and cream, noni juice and oil, fresh fish cuts, coconut fibre and furniture, seaweed and copra. Recent trends in trade (e.g. demand from Japan and the EU) suggest that there are additional opportunities, particularly for niche products. Tanna coffee from Vanuatu, for instance, has done well as a niche product exported to Australia and New Zealand. Over the long run increasing exports should result in lower freight rates since shipping lines would be able to cover costs from both legs of the journey.

Intra-regional trade

The promotion of intra-regional trade cannot be overemphasised. Many basic commodities consumed in PICTs are produced regionally. Recent trade analysis suggests that there is potential to increase trade between Pacific markets (SPC 2013). With Fiji as a natural hub for the region, commodities can be transported to and from these CPSC countries, as all shipping lines serving CPSC countries transship goods via Fiji. This will substantially reduce costs to PICTs, most of which have to pay a huge price to import similar items from markets located very far from the region. Consistency in production will however have to be maintained for intra-regional trade to be sustainable.

Data and analysis

Informed policy advice and technical assistance requires good evidence. Without data, decisions are based on guesses. Countries have taken positive steps towards providing required data to carry out some analysis. Systems for monitoring shipping and cargo movements and freight rates, and for collecting and analysing data, are crucial. Success of this shipping regime is dependent on robust monitoring of operational performance and analysing trends in shipping and cargo, which will enable future planning and adjustments where necessary. The CPSC secretariat has provided data templates to facilitate the collection of these data. These templates will also ensure collation of similar data to allow for country comparisons and benchmarks. Providing timely and accurate data will enable the secretariat and other relevant agencies to identify regional trade opportunities, benchmark port efficiency and performance indicators against other efficient ports in the region or globally, and highlight where key inefficiencies are and where priority action is needed, and other technical advice pertinent to improving the shipping arrangements for member countries and Pacific Islanders.

Success of CPSC depends on timely data collection and analysis to inform decisions, and identify and leverage opportunities. Robust monitoring of port and shipping company performance and freight rates are key to

Statistical agencies or commerce commissions should be involved in the collection of baseline information on prices and freight rates to be able monitor any changes in them, and also to make suggestions as to when full competition amongst the private sector can commence. Better collation and storage of shipping and port statistics is required for accurate analysis. Having data both prior to and after the establishment of future interventions is required to effectively assess the effectiveness and impact of those interventions.

Monitoring of consumer prices and goods available is also required to ensure that the benefits of CPSC, especially in terms of greater access and choice, and lower prices, are being passed on to consumers. Ports and shipping agents should be involved in the monitoring of the actual freight rates being charged by shipping companies to ensure that they tally with the agreed-upon rates. Countries must assume these monitoring responsibilities. The national taskforces established within each of the member states have a primary role in ensuring that all of these critical pieces of information are collected, stored and monitored, in an accurate and timely fashion.

Lessons to inform the establishment of other commissions

The formation of CPSC provides several lessons which will improve its performance as well as provide guidance on the establishment of other shipping commissions in the future. Some of these are outlined below.

- It is important to undertake a thorough viability analysis before establishing a shipping commission and to share the results with all stakeholders.
- Prior to and upon establishment, increased awareness among stakeholders is necessary to improve understanding of shipping commissions and their associated benefits. This also helps to boost stakeholder confidence in the venture and to minimise opposition.
- Given that there is no single solution to small island states shipping, all stakeholders have a responsibility to contribute to the solution. It is therefore important that national shipping councils or taskforces are formed before a shipping commission is established. These special groups play a key role in getting community involvement and ownership, facilitation of data collection for accurate analysis and reporting, etc.
- The public–private partnership arrangement allows for the creation of employment opportunities or attachments on-board licensed ships. It also for monitoring of performance on those ships related to safety and pollution prevention through exchange with MoU or database consultation, and ensuring that shipping companies are insured in case of pollution according to international law.

9. Conclusion

CPSC was established as a solution to the longstanding international shipping challenges faced by central Pacific small island states. The Commission was set up in 2014 to ensure that despite the geographical and economic disadvantages faced by these states, they are able to access regular, affordable and sustainable shipping services at stable freight rates. In May 2015 the CPSC technical committee requested an assessment of the Commission to provide lessons for improvement and inform the establishment of other shipping commissions. Accordingly, this study was designed to assess the Commission's impact, and to determine the saturation point in terms of the maximum number of shipping lines that can be licensed to ensure that countries are able to maximise benefits.

The extent of analysis carried out in this study was greatly limited by the lack of data on the key indicators of interest, due to poor data collection and commercial sensitivity. This paper therefore largely relies on anecdotal evidence. The timing of this assessment – only a year and a half after operationalisation – also posed a major challenge. Not enough time has passed to allow shipping lines to adjust to the intervention and develop cost-effective shipping arrangements in response to the new framework. A medium-term impact evaluation carried out four to five years after establishment of the CPSC will allow for the use of more sophisticated empirical analysis to determine the Commission's impact and saturation and will yield more accurate results.

Notwithstanding these limitations, the study findings indicate that overall, CPSC has had a positive impact on shipping services in its member states. First and foremost, CPSC is an effective Pacific solution to a Pacific problem, given the market peculiarities of its member states that hinder the efficient functioning of free markets. Compared to the pre-CPSC situation, findings suggest that countries now have more regular shipping services – countries receive more frequent services and on a more consistent basis. This has in turn led to greater food security as food and other essential commodities arrive as planned. Households enjoy more nutritious diets and access to a variety of food items. Businesses are better able to plan their inventory and sales, which will in turn lead to greater risk-taking and investments to expand their businesses and sell greater variety of commodities. Affordability of shipping services has also improved through CPSC's stabilisation of freight rates. Estimates derived from the available freight rates point primarily to a decrease in freight rates, with a few routes experiencing some rate increases. However, these estimates are inconclusive as they are based on forecasts of freight rates solely using regional inflation rates. When tested for robustness, the regional inflation rates do not appear to be a good predictor of future freight rates. Data collection and monitoring of freight rates will be critical to the future assessment of this indicator. Additionally, by its nature, CPSC has improved the sustainability of shipping services by ensuring countries short- to medium-term certainty of service provision through its five-year contractual agreement. Removal of uncertainty that was associated with the pre-CPSC situation has allowed individuals, businesses and governments to plan their consumption, sales and projects without risk of disruption. This in turn will lead to more investment and economic growth.

There was again a lack of information necessary to robustly assess the saturation point of CPSC, and this study attempted to demonstrate how saturation can be derived based on the limited information available. The study finds that shipping lines operate using a mix of vessel-on-voyage and slot arrangements. Under both scenarios, it is evident that there are diminishing returns to competition (increasing the number of licensed shipping lines) given the region's limited and virtually fixed cargo volumes. The saturation point is the point where diminishing returns to

competition sets in – that is, where profits are zero or shipping lines begin to make losses. In reality, shipping lines trade under a mix of both arrangements. Therefore, there is a need to study sub-regional shipping lines' behaviour in terms of the use of both arrangements to develop a model that reflects the situation on the ground. A key finding is that diminishing returns or saturation sets in early in these SIS relative to other countries, due to low and fixed cargo volumes coupled with the other geographical disadvantages. It is therefore imperative for the Commission to gradually introduce and monitor the impact of every additional shipping line that is licensed on service provision and on the carriers' profitability.

A study of MSC, which has been in operation for over a decade and has been able to determine over time how many shipping lines are sufficient to serve the region, will be more effective in determining the saturation point of the controlled competition model that both commissions adopt. Data on key variables required to develop a model that fits the CPSC context should be collected to inform a future study to determine CPSC's true saturation point. A regional port efficiency benchmarking study should also be carried out to assess and identify improvements against which CPSC ports can target and measure their performance.

It is evident that improvements in shipping services to PICTs within the context of sustainable development will be achieved through economic and political leverage, and regional and international cooperation among PICTs and with shipping lines. The importance of including a wide range of stakeholders across the shipping services supply chain for the effective operation of CPSC cannot be overemphasised. This will include the involvement of and coordination amongst trade officials, port operators, shipping agents and other maritime support officials (customs, biosecurity), governments, importers and consumers, along with the shipping lines, to fully realise the potential of this Commission to facilitate economic growth and development. Requirements include education and training on provision of effective shipping agency services; training on and benchmarking of port efficiency improvements; and education to influence consumer behaviour, response to and culture on tastes and preferences for alternative and cheaper products that can be sourced from closer regional markets.

The profile of the maritime transport sector, particularly the importance of shipping, needs to be raised for governments to recognise this industry as a key facilitator of economic activities and the mainstay of Pacific Islanders' livelihoods. To support this, the national shipping councils should be formally recognised as political and economic forums to improve shipping, with demand for greater accountability in terms of their role in data collection, monitoring of service provision, promoting trade, and identifying improvement areas in port operations and shipping support services. Intermittent surveys should be administered to access information on indicators for measuring CPSC performance. The project elements outlined in the work plan in Section 7, including a benchmarking study, technical assistance on improving the effectiveness of the shipping councils, a case study on MSC, and a trade expansion and facilitation study, should be developed and implemented for the continued success of CPSC. In doing so, CPSC will be able to improve its potential contribution to these economies.

Appendix A. Difference-in-differences regression estimation equation to derive the causal impact of CPSC on vessel frequency and freight rates

Without experimental data, difference-in-differences (DID) estimation is a way of estimating causal effects. The basic idea is to compare a treatment group to a plausible control/comparison group over time. In this case, a good comparison group would be a neighbouring country with similar shipping challenges and geographical and economic characteristics. The key assumption is parallel trends between the treatment and control group – this assumption cannot be tested directly, but additional evidence should be provided to strengthen this assumption. By comparing changes over time in the treatment and control groups the DID regression controls for any omitted variable that does not vary differentially between the treatment and control group. The DID will identify the causal effect of the treatment on the outcome variable (*y*) if the treatment group would have experienced the same change in the variable as the control group in the absence of the treatment.

Regression form of DID:

$$y_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 (Treat_i \times Post_t) + u_{it}$$

where:

y is the outcome of interest (here, change in vessel calls/freight rates)
β_0 is the control group pre-CPSC
β_1 is the difference between the TG and CG *before* the treatment
β_2 is the slope of the line of the CG *only* over time (before and after)
Treat is a dummy variable equal to one if the observation is from the treatment group (here, CPSC countries)
Post is a dummy variable equal to one if the observation is from the period after the treatment (here, post-CPSC)
$\beta_{DID} = \beta_3$ is the DID estimate for the outcome of this treatment. It is the differential change in the treatment group (relative to the control group) after the treatment occurs. Interpretation: the outcome variable (*y*) increased/decreased by β_3% for the treatment group after they received the treatment.

The DID estimator is:

$$\beta_3 = \hat{\beta}_{DID} = [\bar{y}_{tPost} - \bar{y}_{tPre}] - [\bar{y}_{cPost} - \bar{y}_{cPre}]$$

where:
$\bar{y}_{tPost}$ is the average vessel calls in the treatment group post-CPSC
$\bar{y}_{tPre}$ is the average vessel calls in the treatment group pre-CPSC
$\bar{y}_{cPost}$ is the average vessel calls in the control group post-CPSC
$\bar{y}_{cPre}$ is the average vessel calls in the control group pre-CPSC

The DID estimator compares the change in the outcome variable in the treatment group with the change in the control group. In contrast to the simple difference estimator ($\bar{y}_{\mathbf{tPost}} - \bar{y}_{\mathbf{cPost}}$), the DID controls for pre-existing differences between the treatment and control group In contrast to a first difference estimator ($\bar{y}_{\mathbf{tPost}} - \bar{y}_{\mathbf{tPre}}$) it controls for any time trends that affected both groups similarly. By focusing on the change in *y* over the course of the experiment, the DID estimator removes the influence of initial values of *y* that vary between the treatment and control groups.

Appendix B. Equations to estimate the saturation point

The following provides a breakdown of the derivation of the saturation points under the two shipping arrangements discussed in Section 6.4.

Scenario 1: Vessel-on-voyage arrangement

Saturation point occurs where π = 0, which is where for each licensed shipping line, total cost – total revenue = 0. If:

y = total number of containers demanded by CPSC countries
x = total number of shipping lines (SL)
$\frac{y}{x}$ = number of containers transported by each shipping line
m = freight rate under competition
n = current cost under competition
π = profit
a = percentage change in operational or delivery cost when an additional shipping line is introduced/licensed (cost will increase as more shipping lines are licensed)
b = percentage change in freight rate when an additional shipping line is introduced/licensed (freight rate will decrease as more shipping lines are licensed)

Total revenue = $\frac{y}{x}(m_{x-1}((1-b\%)^{(\frac{y}{x})x-(\frac{y}{x})x-1})$

Total cost = $\frac{y}{x}(n_{x-1}((1+a\%)^{(\frac{y}{x})x-(\frac{y}{x})x-1})$

π = 0 where total revenue – total cost

i.e., where $\frac{y}{x}(m_{x-1}((1-b\%)^{(\frac{y}{x})x-(\frac{y}{x})x-1}) = \frac{y}{x}(n_{x-1}((1+a\%)^{(\frac{y}{x})x-(\frac{y}{x})x-1})$

Saturation point under a vessel-on-voyage arrangement:

Under slot arrangements, saturation point is determined where for each additional line:

$$\pi = 0 \text{ or } \frac{y}{x}(m_{x-1}((1-b\%)^{(\frac{y}{x})x-(\frac{y}{x})x-1}) = \frac{y}{x}(n_{x-1}((1+a\%)^{(\frac{y}{x})x-(\frac{y}{x})x-1})$$

Scenario 2: Slot arrangements

Saturation point occurs where π = 0, which is where for each shipping line licensed to buy slots, total cost – total revenue = 0. If:

y = total number of containers demanded by CPSC countries
x = total number of shipping lines, including the slot buyer(s) and the SL with the physical vessel; where x–1 means indicates the number of slot buyers, as there is always only 1 SL with a vessel
$\frac{y}{x}$ = number of containers transported by each shipping line
n = purchase cost of slot (per container)
m = selling price of slot

π = profit
a = percentage change in purchase cost of slot (purchase cost will increase as more shipping lines are licensed)
b = percentage change in selling price of slot (selling price will decrease as more shipping lines are licensed)

Total revenue = $\frac{y}{x}\ (m_{x-1}(1-b\%)$

Total cost = $\frac{y}{x}(n_{x-1}(1+a\%)$

π = 0 where total revenue = total cost → $\frac{y}{x}\ (m_{x-1}(1-b\%) = \frac{y}{x}(n_{x-1}(1+a\%)$

Saturation point under slot arrangements:

Under slot arrangements, the saturation point is determined where for each additional slot buyer:

$$\pi = 0 \text{ or } \frac{y}{x}\ (m_{x-1}(1-b\%) = \frac{y}{x}(n_{x-1}(1+a\%)$$

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