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Container Ports Post-Privatisation – Analysis of the roles of the public and private sectors at Port Botany, Sydney

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ABSTRACT

The evidence base evaluating post-privatised commercial ports is virtually non-existent, especially with respect to sustainability and environmental performance. Despite acknowledged methodological limitations, a case study approach is adopted using Port Botany, Australia, as an example of a "privatised" port. In the post-privatisation period from 2013, we examine the respective roles of the public and private sectors in terms of legislation, policies and practice. How has NSW Ports responded to challenges of sustainability and environmental regulation within the port's jurisdiction? to what extent have governments continued to be involved in planning and investment in the logistics chain to support the import and export of containers? and what are the relative costs to the private sector and the government to achieve more efficiency? The methodology involves material retrieved from websites, government and company reports, and discussions with key informants to verify the factual robustness of our findings. The findings show that the pre-privatisation environmental and regulatory framework has been effective, and that NSW Ports have been part of an Australian-wide ports initiative to implement best practice on climate change, and on economic, social and environmental sustainability countering claims in the literature that privatised ports put shareholder's profits before the "greening" of ports. Despite Port Botany being privatised, Governments continue to enhance the efficiency of the logistical supply chain through policies and investment in transport access to the port via inland intermodal terminals.

1. Introduction

This paper focuses on the privatised commercial container ports and their associated inland intermodal terminals/dry ports, and the roles of governments and private enterprise in both supporting economic efficiency in the logistics supply chain and in protecting the environment on behalf of the community. There have been claims, for example, that the UK government's abandonment of its regulatory role was too drastic (Brooks, 2004: 175) and that "privatization, per se, may not increase port efficiency or competitiveness, certainly not in 'green port' initiatives, as it is 'unrealistic to think that the highly capital-intensive and high-risk areas in clean technology will be "led" by venture capital…" (Pilcher and Tseng, 2017: 983). However, the evidence base evaluating post-privatised ports and dry ports is virtually non-existent, including the total investments made by both public and private sectors.

To shed light on the respective roles of the public and private sectors in the economic and environmental aspects of the supply chain, we resort to a case study of Port Botany, Australia, and its intermodal terminals that were leased by NSW Ports from the New South Wales Government in 2013 for 99 years. To what extent have governments (there are three tiers of government in Australia) continued to be involved in the regulation, planning and investment in the logistics chain to support the import and export of containers through a privatised port in contrast to the role of public container ports? What are the relative capital costs to the private sector and the government to achieve more efficiency? How has NSW Ports responded to challenges of sustainability and environmental regulation within the port's jurisdiction?

To help answer such questions the regulatory and environmental legislation framework before privatisation and after port privatisation in 2013 are described based on data obtained from searches of government websites. How the private landlord at Port Botany has responded to environmental challenges is based on data from the NSW Ports' website, from various reports and from on-site discussions with the port's planning and environmental managers. Information on intermodal terminals

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was collected from interviews with operators by Roso (2009) and updated from company reports.

The originality of the paper is the analysis of the relative roles of the public and private sectors in the investment of infrastructure to support the import and export of containers through a major metropolitan region. The significance of the research is that it demonstrates how privatised ports can be exemplary industrial corporate citizens given the appropriate regulatory framework, and that the government must make substantial contributions to ports, transport access to ports whereas the private sector must invest in inland intermodal terminals. The findings suggest: that the Australian legislative and regulatory has been sufficiently robust and enforceable; that the private enterprise owners of Port Botany and their intermodal terminals have risen to the challenges of sustainability and environmental protection; and that the New South Wales State Government and the Australian Federal Government have together invested enormous sums of money (about A$ 3 billion in current prices) to enhance the efficiency of the logistical supply chain in metropolitan Sydney and the private sector has invested about A$4 billion (in current prices).

The paper is structured as follows. The literature review is summarised in Section 2. Section 3 describes the case study of Port Botany (before and after privatisation) and its intermodal transport terminals and Section 4 explains the research methodology. Section 5 summaries the Australian Federal, State and Local Government environmental legislation and regulatory framework for maritime ports, intermodal terminals and transport infrastructure. Section 6 describes how the operators of ports and inland intermodal terminals have responded to sustainability and environmental issues. Section 7 presents the results of the infrastructure cost analysis. The paper contains a discussion on the findings, before concluding together with suggestions for further research.

2. Literature review and research gaps

A literature search was undertaken using the following the databases Google Scholar, ScienceDirect, Scopus, and TRID (US Transportation Research Board) with the keywords were “ports and post-privatisation ports, intermodal terminals and evaluation”. This literature review focusses on Australian ports. Globally, climate change is one of the drivers behind port authorities taking an interest in formulating mitigation and adaptation strategies, including the branding of a “green port” and a port’s corporate “sustainability”. Finally, studies on the role of inter-modal terminals, or dry ports, in improving environmental performance in the logistical chain are reviewed.

Climate change is one of the problems that falls under the umbrella of sustainable port development. As an island nation, climate change and rising sea levels has attracted a large body of research on adaption and mitigation strategies in Australia – noting of course the considerable regional differences around a vast continental coastline (Ng et al., 2013, Table 1, p. 190). Nursey-Bray et al. (2013) present the results of a vulnerability assessment of ports in Australia to climate change. Results reveal a range of vulnerabilities but, currently, port management has expressed limited concern given the inherent adaptive capacity both in current climate-change initiatives driven by ports, and in the self-confidence of the port industry to be able to adapt to future challenges. Ng *et al.* (2013) took a case study approach and studied four Australian ports in depth to determine the ports’ adaptation strategies but details are missing. Although they reported interviews and available secondary data to verify concerns about climate change are on the agenda of port development planning (Ng et al., 2013: 191), it is impossible to find the location of the four ports, nor whether any of these ports had been privatised.

Table 1
Sydney’s Intermodal Terminals and Weekly Rail Services, 2020.

Terminal	Owner	Operator	TEU p.a. (1000)	Capacity TEU p.a (1000)	Weekly Rail Services
Chullora	Pacific National	Pacific National	250	600	25
Cooks River	NSW Ports	MCS	50	100	5
Enfield	NSW Ports	Aurizon	70	300	12
MIST Minto	Qube	Qube	150	200	5
Villawood	Toll	Toll/DPW	50	100	5
Yannora	Stockland	Qube	60	200	5
Moorebank	MIC	Qube	250	1500	12*

Legend: MCS - Maritime Container Services; MIST Macarthur Intermodal Terminal; *– requires connection to the Southern Freight Line.
(Source: based on PwC, 2017, Table 8, p.40, and updated).

Davarzani et al. (2016) published a comprehensive review of the academic literature on green ports and maritime logistics, noting the explosion in the number of papers starting in the early 21st Century. Greenhouse gases (GHGs) from shipping include carbon dioxide (CO_2), methane (CH_4) and dinitrogen oxide (N_2O), of which CO_2 dominates the global warming potential. Port authorities can influence GHG emissions from ships by supporting systems and technologies, and implementing incentive programs that facilitate fuel savings within the port area (Acciaro et al., 2014). These include onshore power supply, reduced ship speed in fairway channels, reduced turnaround of ships in port berths and alternative fuels in ships. Styhre et al. (2017) have modelled ship emissions in four major international ports, including Port Botany.

Corporate social responsibility and sustainable development notions have also entered the shipping industry (Rahim et al., 2016). The shipping industry has responded to sustainability issues (Tsionas et al., 2012; Wu et al., 2020), including corporate social responsibility (Rintamäki, 2020) in its management structures. The International Maritime Organization (IMO) has been influential in its role and contribution to the shipping industry to achieve the United Nations Sustainable Development Goals (SDG).

Port privatisation in Australia dates back to the South Australian Government’s privatisation of ports from 2001 (Chen et al., 2017, Table 3, p.206) but there is only a limited literature that has evaluated the financial and environmental performance of privatised ports in Australia other than for the Port of Brisbane (Jayasundara et al., 2020). Its financial and environmental performances were found to improve during private ownership between 2012 and 2017 compared to state ownership between 2005 and 2010 (Jayasundara, 2019). Mixed methods research using data analysis and interviews was employed to investigate the relationship between the change of ownership and the financial and environmental performance of the port, under pre- and post-privatisation conditions. The total energy consumption ratio and the total emission of CO_2 values of Port of Brisbane after privatisation had been significantly reduced (Jayasundara, 2019: 114). On the downside, the port did not have adequate environmental protection procedures for greenhouse gas emissions, energy, construction equipment noise, storage of hazardous goods, chemical use reduction targets, and policies to manage water (Jayasundara, 2019: 120).

The research methodology adopted by Chen et al. (2017) uses both case study analysis and content analysis of secondary data to best explain processes of port privatisation in Australia. Five ports that had been privatised since 2010 were selected: Port of Brisbane (Queensland); Port Botany, Port Kembla and the Port of Newcastle (New South Wales); and the Port of Darwin (Northern Territory). They confirm findings from other studies that the outcomes of previous Australian port reform in the 1990s, including labour reform, privatisation, and commercialisation and corporatisation of port authorities have shown that the port productivity and financial performance of port authorities/corporations had improved before privatisation but they offer no firm evidence on environmental performance. They define the “public interest” as a port’s corporate social responsibility and accountability (Chen et al., 2017: Chen et al., 2011) but no empirical evidence is cited as to whether this

has been improved with port privatisation.

In mid-2018, Schrobback and Meath (2020) sent an on-line questionnaire survey about corporate sustainability (that includes environmental governance) to 20 major container, passenger, and bulk cargo ports in Australia (and 10 ports in New Zealand) and received seven responses (35 per cent response rate). They recommend that it is critical for decision-makers to understand how they can improve stakeholder engagement through effective sustainability governance, although continuous improvement in practice must be the strategic goal of any dynamic organisation. Their findings are now largely academic following the recent initiatives of Ports Australia (2020) who have issued guidelines for Australian ports on how to develop best practice sustainability strategies that draw on the Worlds Ports Sustainability Program that promotes ports to share their innovative sustainable projects across five themes (aligned to specific SDGs): Climate and Energy; Community Outreach and Port-City Dialogue; Governance and Ethics; Resilient Infrastructure; and Safety and Security.

Dry ports as inland intermodal terminals in port's hinterland function as port interface inland and have a potential to reduce the environmental load of the logistical supply chain (Roso et al, 2009; Wiegmans et al, 2020). They may stimulate a modal shift to rail that results in less road traffic and congestion at seaport gates (Khaslavskaya et al, 2021), and reductions in atmospheric emissions by as much as 32–45% (Lättilä et al., 2013). Early research into dry ports established their potential environmental benefits (Roso, 2008; Roso, 2009). Since that time, an additional body of evidence has accumulated in the

Fig. 1. Aerial View of Port Botany (Source: NSW Ports, 2021a: 6).

environmental performance of dry ports (Roso et al., 2019; Tadić et al., 2019; Khaslavskaya and Roso, 2020, Božičević et al, 2021). Black et al. (2018) have described issues in dry port location and implementation in the metropolitan area of Sydney that include environmental concerns.

However, the evidence base evaluating post-privatised ports is virtually non-existent because of the complexity of governance and difference in institutional settings (Brooks, et al., 2017: 7-8) and a host of methodological issues (Song, 1999: 124-5). Our review of the literature supports the absence of published, evidence-based studies on the environmental performance of privatised ports in Australia. Furthermore, we have found no quantitative analysis of the relative investment costs of port infrastructure, intermodal transport terminals and port transport access made by the public and private sectors in an era of a post-privatised port.

3. Methodology - Port Botany Case Study

As the research is a case study approach it is important to describe some aspects of Port Botany (subsection 3.1) and its intermodal terminals (subsection 3.2) to provide a context for readers unfamiliar with the logistical chain in metropolitan Sydney.

3.1. Case study of Port Botany

For sixty years, and in competition with ports in Brisbane and Melbourne, the New South Wales State Government has wanted to maintain Sydney as Australia's premier port. Because of landside capacity constraints for containers in Sydney Harbour (Australia, Bureau of Transport Economics, 1985, Fig. 2-1, p. 4) the state government in 1969 decided to construct container facilities in Botany Bay (Fig. 1). Construction of the port started in June 1971 and Port Botany was operational in 1979. Port Botany was built and operated by the New South Wales Maritime Services Board (MSB) – a government statutory authority (Brotherson, 1975). In June 1995, the MSB was replaced by the Sydney Ports Corporation that was a part of both national and state government policy directives on the process of the corporatisation of government port and airport monopolies – a common policy in some parts of the world during the 1980 s and 1990 s (Vasigh and Howard, 2012).

The port is located in the State of New South Wales (NSW) within the local government area of Botany – part of the greater metropolitan region of Sydney that has an estimated total population of about 5.98 million in 2020 (Population Australia, 2021). Port Botany currently handles 2.5 million TEU and is forecast to handle 7.3 million TEU by 2056 that are within the current capacity of the existing port infrastructure (NSW Ports, 2021b). Sydney Ports Corporation (2011), in anticipation of the strong growth in containers, looked for alternative sites for ports in New South Wales before concluding that expansion at Port Botany was the best option. Furthermore, the construction of a third container terminal would encourage stevedore competition amongst three private-sector operators. The scope of works that included 8 million cubic metres of dredging, 63 ha of reclaimed terminal land and 1.85 km of wharf face – the largest port project in Australia for thirty years – is detailed by U.R.S. Australia, (2003).

As part of the Scoping Study process for the long-term leasing of both Port Botany and Port Kembla that was undertaken by NSW Department of Treasury, the Government considered the competition and regulatory issues, including input into a separation analysis to determine which assets, responsibilities, rights and obligations of the state-owned port corporations should be transferred to the private sector, and which should be retained by the State, as well as the design of a competition and regulatory framework for the post-transaction ports (NSW Government, The Treasury, 2015: 4).

In 2013, the NSW Government awarded a 99-year lease of the state-owned port assets of Port Botany and Port Kembla (about 90 km to the south of Sydney) to NSW Ports - a private-sector consortium with investors from a string of prominent Australian funds and fund managers, including IFM Investors, Australian Super and Cbus. The Port Commitment Deeds, including the conditions of sale and the levy, were not disclosed to the public, nor to the New South Wales Parliament (NSW Legislative Council, 2019: vii). The New South Wales Government oversight mechanism is specified in the lease agreement with NSW Ports that is classified by the Premier of New South Wales as "Commercial-in-Confidence". One agreement signed in 2013 requires the New South Wales Government to compensate NSW Ports if container traffic at the Port of Newcastle, located 170 km to the north of Sydney, exceeds a specified (commercial-in-confidence) cap up to 2063. Any developments of container facilities in Newcastle – despite any potential environmental and benefits to society – will require the New South Wales Government to compensate NSW Ports.

Under the terms of the lease, there is an annual reporting mechanism to government (including NSW Department of Treasury and NSW Department of Planning, Industry and Environment). Under "privatisation" the New South Wales Government retains ownership of the land and water but leases the port land to a private entity to manage the operations of the port. The private entity, in turn, arranges for the subleases for the stevedores and other business operations in the port area. Thus, there is a hierarchy whereby NSW Ports is subject to State Government environmental planning and assessment laws and environmental pollution regulations (under the lease agreement) and the businesses operating within the port are themselves subject to conditions in the lease agreements with NSW Ports.

3.2. Case study of Sydney's intermodal transport terminals

The constrained site area of the port on Botany Bay has meant that intermodal terminals are a prominent and necessary feature of the logistical supply chain in metropolitan Sydney (Fig. 2). The Sydney Ports Corporation (2008a) recognised the need to expand the intermodal network within Sydney as a prerequisite for the greater use of rail in alignment with an New South Wales Government transport policy objective. In Fig. 2, the current intermodal terminals are shown as yellow triangles and those under development as orange triangles.

By 2021, the names of intermodal terminals that serve Port Botany (and other destinations) are summarised in Table 1 together with the names of the owner and operator and their current TEU handled, their future TEU capacity, and the weekly number of rail sevices. NSW Ports owns two terminals –. Cooks River and Enfield. Moorebank Terminal is under construction where a new freight railway spur will link existing tracks on the Southern Freight Line for container train paths to and from Port Botany.

4. Research methodology

The overall research methodology based on the Port Botany is summarised in Table 2 where the sources of data and information are included in the right-hand column. This research is descriptive in terms of the regulatory and environmental legislation framework before privatisation and after port privatisation in 2013 based on searches of national, state and local government websites. How the private landlord at Port Botany has responded to environmental challenges is based on NSW Ports' website, various reports and on interviews. Unlike the mail-out survey questionnaire conducted by Chen et al. (2017) of the sustainability approaches adopted in Australian ports, we conducted on-site discussions with the Port Botany's planning and environmental managers.

Capital costs are allocated to who paid for the infrastructure – government or the private sector – and these costs do not include operations and maintenance. There is no one source of infrastructure costs on Australian seaports and intermodal terminals. Piyapatroomi et al. (2006) have compiled extensive details on existing and planned ports and intermodal terminals in New South Wales, Queensland and Victoria

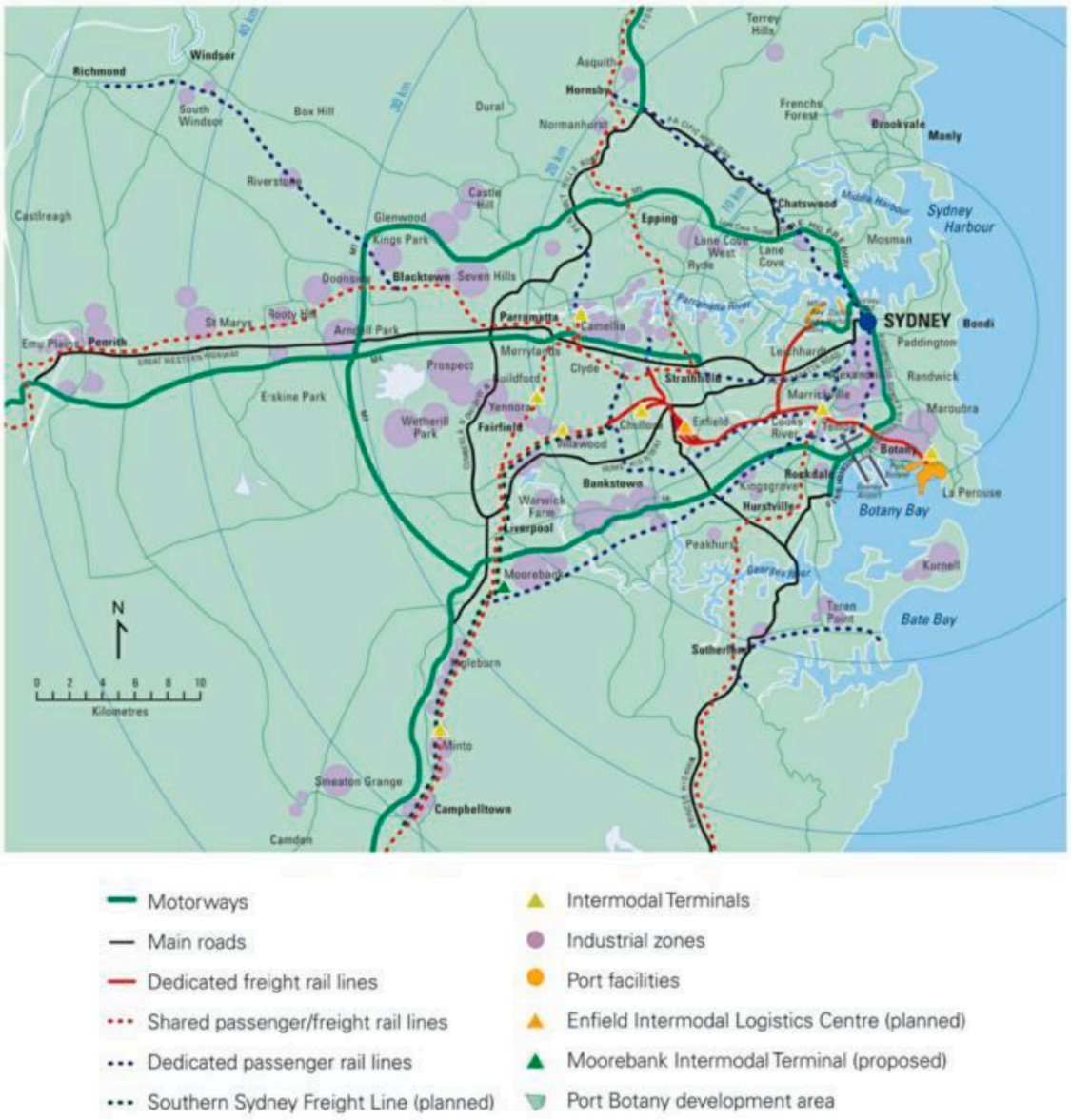


Fig. 2. Location of Intermodal Terminals in Metropolitan Sydney (: 50).
Source: Sydney Ports Corporation, 2009

but fail to include any reference to investment costs. The approximate construction costs of Port Botany, its intermodal terminals and government investment in transport access to the port proved time-consuming. The identification of government and private-sector projects were based on project websites, environmental impact statements (EIS) and ministerial releases. The Dispute Resolution Board Foundation lists Australian construction projects by main contractor, and approximate contract value, but contains a compilation of only some of more recent projects associated with the logistical supply chain.

As constructions have spanned some fifty years the costs reported in this paper are expressed in current (2019) Australian dollars using the Reserve Bank of Australia (RBA) inflation calculator and the Australian Bureau of Statistics (ABS) construction index. The role of the Australian Bureau of Statistics as the central statistical authority for the Australian government includes publishing price index data, and broadly explaining the underlying methodology and general limitations on such data. "Construction prices" refer to residential sub-divisions not major construction projects where price changes over long periods of time are complex to estimate (Williams, 1994). Furthermore, the Australian Bureau of Statistics data base provides quarterly price movements from December 2011 onwards. The Reserve Bank of Australia tool calculates the change in cost of purchasing a representative 'basket of goods and services' over a period of time dating back to 1966 for decimal currency. As a comparison of both indices from 2011 to 2019 shows that the inflation for construction is 0.01 per cent above the general rise in inflation, we use the RBA figures for construction projects pre-2011.

In the case of road transport projects that also serve the general public and airport users, the total road access construction costs cannot be directly attributed to the port. A difficult question to answer is: what percentage of this total road expenditure can be attributed to facilitating truck movements to and from Port Botany? A study commissioned by Sydney Ports Corporation found that Port Botany traffic represents only a small proportion (approximately 1%) of forecast peak hour traffic volumes (Maunsell Australia, 2002: 11). However, trucks trailing full load containers have a greater impact on traffic flow, and on road pavement deterioration, than do private motor vehicles. Passenger Car Equivalent (PCE) is a unit used in traffic engineering to represent the impact of a large vehicle on road capacity by expressing it as the number

Table 2
Summary of research methodology and sources of information relevant to port botany and intermodal terminals in metropolitan Sydney.

Research component	Information source
Description of Case Study	New South Wales Government Ports Corporation; NSW Ports; Interviews
Federal, State and Local Government Environmental Legislation	Downloaded and interpreted from Government websites
Port Botany Sustainability and Environmental Performance	NSW Ports Annual Reports: Interviews at NSW Ports
Infrastructure Costs – Port Botany	Brotherson (1975); Sydney Ports Corporation Annual Reports; NSW Ports Annual Reports; New South Wales Government Budget Papers; Packer (*et al.*,2012),
Infrastructure Costs – Intermodal Terminals	NSW Ports Annual Reports; NSW Government media releases; New South Wales (2011); Austrak (2007); Australian Government, Infrastructure Australia (2016)
Infrastructure Costs – Rail Access to Port	Infrastructure Australia (2018); 2018–2019 Federal Government Budget Papers
Infrastructure Costs – Roads	NSW Government media releases
Infrastructure Costs in Equivalent 2019 Prices	Reserve Bank of Australia inflation calculator; Australian Bureau of Statistics (ABS) construction index.
Quality Control	Feedback from informants; journal reviewers (see Acknowledgements)

(Source: Authors).

of equivalent passenger vehicles. A working group for the Australian Road Research Board estimated for semi-trailers on urban three-lane roads with zero grade the PCE was 1.4 increasing to 2.6 as the grade reached 8 percent (Patrick *et al.*, 2019: Table 2, 9). A more recent study estimated the PCE for large semi-trailers in the range 1.45 to 2.10 (Pajecki et al., 2019: 1). For this estimation of the allocation of road investment serving Port Botany, an arbitrary choice of 1.5 PCE was made. To account for future port road traffic growth, we assume 2 percent port vehicles at a PCE equivalent of 1.5 to arrive at 3 percent of road investment.

5. Government policies, legislation and environmental regulations

The sale of infrastructure, such as airports and seaports, by governments generates once-off revenues for governments under the "assets recycling policy" and was designed to have a more "private-sector business approach" to operations and maintenance. Port privatisation in Australia occurred within the broader context of sustainable development that entails extensive consultation amongst stakeholders. Irrespective of whether the ownership of ports and intermodal terminals in Australia is by the state government or by a private entity, the national, state and local governments have retained the responsibility for environmental policy, regulation and environmental impact assessment procedures. On the environmental governance of Australia ports, a survey by Schrobback and Meath (2020) concluded that Australian ports appear to outperform European ports with respect to the adoption of best environmental management practices. This finding "can be attributed to relatively stringent environmental regulations and their increasing enforcement…" (Schrobback and Meath, 2020: 6).

This section summarises the regulatory framework noting, in particular, any developments post-port privatisation in 2013. In November 1997, the Council of Australian Governments (COAG) agreed in principle to the Heads of Agreement on Commonwealth/State Roles and Responsibilities for the Environment (Parliament of the Commonwealth of Australia, Department of the Parliamentary Library, 1994). Three articles are especially pertinent to marine and coastal environments: management and protection of the marine and coastal environment; reducing emissions of greenhouse gases and protecting and enhancing greenhouse sinks; and development and the maintenance of national environmental and heritage data sets arising from intergovernmental arrangements and international obligations. As noted in Table 3, the national government of Australia has legislation covering marine pollution, safety and biosecurity.

There is only one piece of national legislation - more relevant to ship owners than to port authorities - enacted after the privatisation of Port Botany. The Commonwealth of Australia *Biosecurity Act 2015* (Compilation No. 5) is about managing diseases and pests that may cause harm to humans or to the environment. Goods become subject to biosecurity control when the vessel carrying the goods enters Australian territory. The Act implements the Ballast Water Convention and regulates the ballast water and sediment of certain vessels in accordance with the United Nations Convention on the Law of the Sea. It requires reporting of intended or actual discharges of ballast water in Australian territorial seas to avoid ocean pollution (Federal Register of Legislation).

As ports in Australia are a state government responsibility it is Transport for New South Wales (TfNSW) who exercise a number of powers under ports legislation: port safety; marine pilotage; and marine pollution. TfNSW issues the Port Safety Operating Licence (PSOL) to the Port Authority of New South Wales under the Ports and Maritime Administration Act 1995 (PAMA). The PSOL covers port safety functions that must be undertaken in the NSW designated ports that include Port Botany. TfNSW also provides advice on oil spill prosecutions; pollution from chemicals and garbage; domestic ballast water management for the prevention of marine pest incursions and the implementation of the MARPOL.

The NSW Environmental Protection Agency is the environmental regulator setting industry standards for noise and air pollution. In terms of a port or intermodal terminal owner wanting to expand facilities, or develop a new site, the relevant legislation is the NSW Environmental Planning and Assessment Act. Any development application requires extensive documentation in the form of an environmental impact statement (EIS) whose standard scope includes matters of economic, social and environmental sustainability in accord with COAG agreements.

The main change in legislation post-port privatisation was to ensure that development applications from Port Botany and the adjacent industrial premises were handled by the state government and not local government. A State Environmental Planning Policy (SEPP) is specified in the act and there is a SEPP specifically relating to Port Botany: the *State Environmental Planning Policy (Three Ports) 2013* (the current version of October 2018 is found at: https://www.legislation.nsw.gov.

Table 3
List of National and State Government Legislation and Policies of Direct Relevance to Port Botany and Intermodal Terminals (Details in Appendix A).

Legislation/Policy	Authority
Council of Australian Governments (COAG) agreed in principle to the Heads of Agreement on Commonwealth/ State Roles and Responsibilities for the Environment (National Strategy for Ecologically Sustainable Development, 1992)	Three tiers of government
Convention for the Prevention of Pollution from Ships (MARPOL)	Federal Government
The Australian Maritime Safety Authority	Federal Government
Biosecurity Act 2015 (Compilation No. 5)	Federal Government
State Owned Corporations Act 1989 (NSW),	NSW State
Ports and Maritime Administration Act 1995 (PAMA)	NSW State
NSW Environmental Protection Agency (EPA)	NSW State
NSW Environmental Planning Assessment Act 1979 (and New South Wales, Planning Legislation Amendment Bill 2019)	NSW State
State Environmental Planning Policy (Three Ports) 2013	NSW State
Ports and Maritime Administration Regulation 2012 - TfNSW Cargo Movement Coordination Centre	NSW State
NSW Environmental Planning Assessment Act 1979 (and NSW Planning Legislation Amendment Bill 2019)	Local Government

(Source: Authors' compilation).

au/#/view/EPI/2013/228 accessed 11 January 2021). This is a legal planning instrument that governs development and planning in the Port Botany area that contains Port Botany and some adjacent industrial lands. Specific planning controls for development within this area are addressed by this instrument.

The NSW Environmental Planning and Assessment Act requires any development proposed on the land at Port Botany (and its intermodal terminals) leased from the NSW Government by NSW Ports is subject to this act. The *State Environmental Planning Policy (Three Ports) 2013* specifies that the NSW Government is the determining authority on the grounds that any future development at Port Botany is a matter of "state significance." The current determining authority is the NSW Department of Planning, Industry and Environment. In the case of development applications for expanded facilities or green-field sites for intermodal terminals the local government council is the determining authority under the *NSW Environmental Planning Assessment Act 1979 (and New South Wales, Planning Legislation Amendment Bill 2019),* unless its size and function make it a state-significant proposal.

6. Post-Privatised Ports' challenges on the environment

Before detailing how a privatised port has responded to the above regulatory framework, an overview is provided. The left-hand column of Table 4 summarises some of the elements of this framework (underlying principles, government policy instruments, environmental objectives, the roles and responsibilities of the port operator, the ports' environmental plans and policies, public consultation and transparency, environmental assessment and government oversight. The right-hand column of Table 4 summarises the policy responses.

Table 4
Environmental Regulatory Framework an NSW Ports' Policy Responses.

Environmental framework	NSW Ports' Policy Responses
Underlying principles	Ecologically sustainable development; environmental reporting; polluter pays principle; biosecurity
Policy instruments	NSW Environmental Planning and Assessment Act; The State Environmental Planning Policy (Three Ports) 2013; Port Safety Operating License (includes dangerous goods);Leasing of port operations to private sector under long-term contract; asset recycling
Environmental objectives and hierarchy in port authorities' mandate	1. Sustainable Environmental Management 2. Materials Selection 3. Waste Management 4. Water Use and Quality 5. Energy Use and Greenhouse Gas Emissions 6. Green Buildings and Indoor Environments 7. Outdoor Environment/Landscaping 8. Amenity (noise, light, odour)
Roles and responsibilities	Environmental, ecological and heritage stewardship of land leased from the government
Environmental policies, plans, and systems	ISO 14000 Environmental magement system; Paris Climate Agreement; Navigating a Changing Climate; World Ports Sustainability Program; Green Port Checklist; Infrastructure Sustainability Ratings
Required representation of environmental interests	Community consultation under terms of the lease
Public consultation and transparency	Project proposals subject to Environmental Planning and Assessment Act and its statutory requirements for public consultation; port operator's lease agreement to constitute an industry peer review, stakeholder feedback and employee workshops.
Government oversight mechanisms	Under conditions of the long-term lease between the NSW Government and NSW Ports
Environmental impact assessment	Under the NSW Environmental Planning and Assessment Act

(Source: Authors based on template provided by World Maritime University, PRISM research project).

The current Australian and NSW governments' regulatory frameworks allow the port management by a private entity the potential to initiate measures to reduce its environmental impact, and improve the local, natural environments in which their activities are located. As a private business, NSW Ports recognises that along with delivering value for shareholders (i.e. profits), it also needs to "protect the environment and act in an ethical and transparent manner" (NSW Ports, 2019a: 5).

As a basis for protecting the environment NSW Ports maintains a comprehensive environmental management system for compliance which includes an overarching Environmental Management Plan (EMP) at each of its sites, including Port Botany. The NSW Ports EMPs set the standard for environmental management. Its tenants are required to report compliance with these plans. NSW Port works on a process of "continuous improvement by regularly monitoring potential environmental impacts and considering future environmental impacts/risks" (NSW Ports, 2019a: 50).

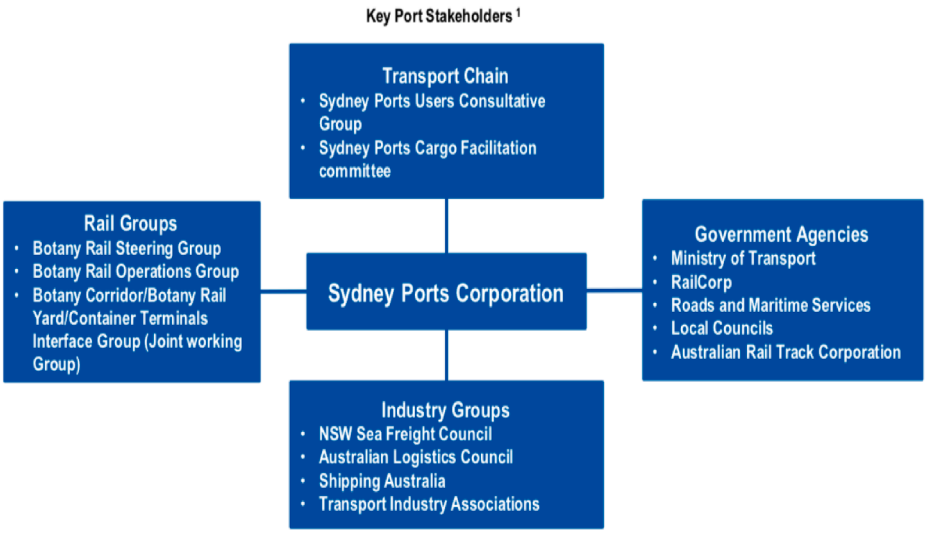
NSW Ports has identified "protecting the environment as one major issue amongst four issues – environment; carbon management and climate change; environmental compliance; and ecological and heritage conservation (NSW Ports, 2019a: 35). For example, NSW Ports has set emissions reduction targets to 2030, and beyond, and aims to reduce emissions by 20 per cent by the FY2024. Environmental sustainability challenges are explained under three sub-headings: stakeholder consultation; international best practice and the environment; and managing development applications for port and intermodal terminal expansion.

6.1. Stakeholder consultation

As part of its business, community engagement is required as specified in the terms of the lease with the NSW Government. Previously, Sydney Ports Corporation were engaged in extensive stakeholder consultation with key groups (see Fig. 3) and this practice has continued after privatisation. NSW Ports initiated community and port stakeholder consultative committees that include the Port Botany Community Consultative Committee and the Enfield Community Liaison Committee. Over the last few years, it has demonstrated being a good corporate citizen: by funding (in partnership with Conservation Volunteers Australia and Bayside Council, NSW), a project to rehabilitate Sir Joseph Banks Park - a nature reserve on the Botany foreshore that provides community space with ponds, wetlands and picnic facilities. To support its aim of reporting transparently to stakeholders, it has developed a sustainability reporting framework to provide a clear representation of sustainability indicators and results. This is underpinned by monitoring and data management systems for key environmental factors.

6.2. International best practice – The environment

The main environmental role and responsibility of NSW Ports is the monitoring of key parameters (see Annual Sustainability Plans) within its obligations to conform to environmental regulations and ensuring its tenants are informed in the lease agreements of these government environmental standards. The guiding framework for operations is the ISO 14000 family of standards developed by ISO Technical Committee ISO/TC 207 and its various subcommittees (https://www.iso.org/*iso*-14001-environmental-management.html., accessed 22 January 2021). A new action for the 2019 NSW Ports Sustainability Plan has been to review the Green Port Checklist. The Port Development Codes are now replaced with NSW Ports Sustainable Development Code covering the following 8 environmental and sustainability aspects that concern most port and intermodal terminal operations and facilities: sustainable environmental management; materials selection; waste management;



Note - As of 2021, the Government Agencies identified in the figure are now Transport for NSW who are responsible for rail (RailCorp) and Roads (RMS)

Fig. 3. Key Stakeholders - Port Botany Infrastructure Development and Operations Under Sydney Ports Corporation and Continued by NSW Ports (: 20). Note - As of 2021, the Government Agencies identified in the figure are now Transport for NSW who are responsible for rail (RailCorp) and Roads (RMS).
Source: GHD, 2011

water use and quality; energy use (renewable energy sources and supply) and greenhouse gas emissions; green buildings and indoor environments; outdoor environment/landscaping; and amenity, covering noise, light through transition to energy efficient lighting and odour.

NSW Ports engages in a number of international and national organisations on best practice port operations. For example, it has signed on as a supporter of *Navigating a Changing Climate* (an initiative of the World Association for Waterborne Transport Infrastructure) and has committed to take action to ensure that port infrastructure is designed, constructed and maintained to mitigate and adapt to climate change. NSW Ports supports the World Ports Sustainability Program (WPSP) through Australia's national peak body, Ports Australia. Established in 2017 by the International Association of Ports and Harbors, the program aims to demonstrate global leadership of ports in contributing to the United Nations Sustainable Development Goals (SDG). NSW Ports is working with the Infrastructure Sustainability Council of Australia (ISCA) to achieve a Design and As-Built rating for the Brotherson Dock Life Extension project at Port Botany. ISCA seeks to promote infrastructure that is designed, constructed and operated to optimise environmental, social and economic outcomes over the long term.

Furthermore, NSW Ports participates as an incentive provider in the Environmental Ship Index, a key initiative of the WPSP to promote cleaner shipping: from January 2019 NSW Ports introduced financial incentives (levy discounts) for ships visiting Port Botany whose environmental performance surpasses the International Maritime Organisation (IMO)'s requirements (NSW Ports, 2019a: 10). In addition, NSW Ports aims to minimise its own carbon footprint by pursuing energy efficiency and renewable energy opportunities. It also works with tenants and port users to identify opportunities to reduce emissions associated with port use, intermodal assets and related supply chains.

An environmental issue for all industries, including port management and operators of intermodal terminals, is noise propagation from the site into surrounding residential areas. The NSW EPA specifies daytime and night-time noise standards that must not be exceeded. In response to concerns by residents living near to the port and its two intermodal terminals, NSW Ports engaged the expertise from acoustic consultants Wilkinson Murray Co. Ltd. to carry out a noise investigation, and to conduct residential noise monitoring at four locations within close proximity to Port Botany (Wilkinson Murray, 2021). NSW Ports plans to develop a noise model for Port Botany to plan for buffers and controls and is installing a noise monitoring network at its Enfield terminal.

6.3. *Managing Port development applications*

For any proposed development on the land leased (including the two intermodal terminals owned by NSW Ports), or the maritime channel accessing the port, NSW Ports are the proponents with the responsibility of submitting a development application to the determining NSW Government authority. NSW Ports holds development approvals for a number of Major Projects pre-privatisation and it is responsible for ensuring compliance with the Conditions of Approval. These conditions set out requirements for the environmental management of the construction and operation of the facility and for ongoing community engagement.

The environmental impacts of port developments and NSW Ports intermodal terminals are thoroughly assessed prior to commencement of work through environmental impact statements (EIS), as was the case under the previous government-ownership structure. Impact assessments consider the likely effects of proposed developments on air and water quality, noise levels, terrestrial and aquatic ecosystems, traffic and transport systems, public access and amenity and sustainability principles. The business case (with a short summary of all quantitative and qualitative impacts) is taken to the determining authority (a state government department in the case of a port or a major intermodal terminal) or, in the case of some intermodal terminals, local government is the determining authority. Once approved, project-specific environmental management plans are prepared to monitor and protect the environment during construction and operation. If approved development can proceed under any conditions of approval with appropriate monitoring and reporting mechanisms in place (e.g. through annual reports to government). Active dialogue is maintained with regulators and local residents to ensure that appropriate management practices are in place.

7. Public and private sectors – Relative contribution to supply chain efficiencies

The logistical supply chain involves agents from both the

government and the private sectors. First, we asddress the role of the New South Wales Government when a port has been leased to a private sector operator. Subsection 7.2 identifies who has paid for the original government port at Botany Bay and subsequent developments that have taken place. Similarly, subsection 7.3 determines the construction costs of the intermodal transport terminals in metropolitan Sydney and the relative contributions of the public and private sectors. Finally, transport access to the port is considered. This includes the upgrade of the Botany Goods Railway line (funded by the Federal Government) and the Gateway Road project that is currently under construction in 2022.

7.1. The role of the NSW Government in managing the logistical supply chain

Post-port privatisation in 2013, the major role for the NSW Government has been to support an economically efficient container port to serve the state's economy. More specifically, the revised roles of the state government in relation to major economic infrastructure assets leased to, and managed by, private entities (such as rail networks, Port Botany, Port Kembla and Newcastle Port) are: to ensure participants in the supply chain have access to them; and to monitor pricing and compliance with lease agreements (Transport for New South Wales, 2018: 24). In addition, from the time of the Kirby Enquiry (New South Wales Government, 1980). The NSW Government continues a policy of encouraging more containers to be shipped to and from Port Botany by rail with its associated environmental benefits of reducing road traffic congestion and truck noise and atmospheric pollution.

The role of governments is to formulate policies that increase the modal share of railways in the movement of containers. One initiative was the TfNSW Cargo Movement Coordination Centre (CMCC), established in 2014, with powers under the Ports and Maritime Administration Regulation 2012 to work with road carriers, rail operators, stevedores and related supply chain stakeholders to maximise use of existing transport network capacity and continuously improve the efficiency of cargo movement through Port Botany (and Port Kembla and other regional NSW ports). The CMCC oversees compliance by stevedores and road carriers with mandatory standards that regulate more efficient road movements to and from Port Botany.

TfNSW is investigating productivity boosting technologies that can improve the efficiency of the Port Botany supply chain, including (Transport for New South Wales, 2018: 55) the following: drones to investigate reasons for delays in moving goods within the Port Botany precinct); a tracking system for containers using latest technology such as sensors with barcodes or licence plate recognition software; a new Port Community System to remove repetitive entry of the same information, as well as offering better visibility to the NSW Government and stakeholders; an Advanced Container Booking System to ensure certainty of collection and utilisation of unused booking slots; a live performance data app relating to the movement of cargo from and to Port Botany by rail (building on the road freight app released in August 2017); how to improve both the movement of empty containers into and out of Port Botany (including the use of rail) and their utilization; construction of a second truck marshalling area in the Port Botany area to cater for additional growth, serve all stevedores and possibly offer specialised transport services for dangerous goods vehicles.

The storage of empty containers is a vexing issue in many port cities of the world. In August 2020, TfNSW established the Empty Container Park Working Group (ECWG) to address issues that impact Sydney empty container parks (ECPs). Problems have been evolving with the Container Transport Alliance Australia - a nationwide coalition of container logistics firms - raising concerns to government about the falling performance of the DP World Logistics Australia container parks 1 and 2 at Port Botany. This has been exacerbated by the increasing numbers of empty containers being moved to the site by shipping lines (Reef Group, 2018). The Freight & Trade Alliance (2020) point out that NSW Ports has brought online new empty container capacity at Port Botany – totalling about 8,000 TEU (comprising an expansion of the existing Tyne St Peters ECP at Port Botany and a new ECP operated by ACFS Port Logistics at Port Botany).

In response, NSW Ports have liaised with TfNSW to secure an extension on the closure of the Tyne St Peters ECP. Throughout 2020, the empty container parks (ECPs) in Sydney have continued to face high demand by carriers and customers for empty container de-hire. Despite requests by NSW Ports to ECPs to manage their throughput and demand for empty container de-hire trucks, the size of the truck queues for some ECPs has become excessive, resulting in congestion and safety problems leading to the port issuing a directive notice last year (NSW Ports, 2020).

Clearly, there are underpinning reasons as to why government policies – both national and state – are directed at a better management of the logistical supply chain. One reason is the substantial sunk capital costs in ports and associated transport access infrastructure. To shed light on the amount of this total investment by governments we look at historical costs and convert them into current (2019) prices. Also, now Port Botany is privatised we look at its capital expansion since 2013, that includes two intermodal terminals. To complete the picture, we document how much other private sector companies have spent on developing their intermodal terminals in metropolitan Sydney as part of the logistical supply chain. In turn, we examine the costs of Port Botany, the intermodal terminals, and transport access infrastructure serving the port.

7.2. Capital costs of Port Botany

The reported cost in current prices (2019) of the Maritime Services Board construction of Port Botany in the 1970s is A$656 million. The Sydney Ports Corporation spent A$827 million on dredging, land reclamation and construction on the Port Botany Expansion project completed in 2012 (New South Wales, 2011: 4-70). The Australian construction company, Baulderstone Hornibrook, formed a joint venture with Belgian company Jan de Nul (specialists in dredging and land reclamation) to win the design-and-construct contact of this project. As reported by Packer *et al.* (2012), with its innovative design solutions and construction methodologies, the project was delivered on time, and within budget. As can be readily seen in Table 5, the current asset of Port Botany has been paid primarily by the New South Wales Government prior to the long-term leasing to the private sector.

Post-privatisation, the private-sector costs of the landside terminal wharf are reported by NSW Ports as A$106 million. The major capital expenditure by NSW Ports commencing in 2019 has been the first stage (to 2023) of building on-dock rail infrastructure at Patricks Terminal costing A$120 million (Patricks are delivering automated rail operating equipment costing A$70 million). Table 5 summaries the components and costs of the current port configuration in current prices – in total, this figure exceeds A$ 1.7 billion of which the State Government has invested nearly 90 per cent to date. Future costs for any expansion at Port Botany will be the responsibility of the private sector until the lease expires.

Table 5
Capital Costs of Port Botany in 2019 Prices – Public and Private Sector Contributions.

Component	Agent	A$ million	Sector	%
Port Botany Construction	MSB	656	Public	38.1
Port Botany Landside	Sydney Ports Corp.	14[a]	Public	0.8
Port Botany Expansion	Sydney Ports Corp.	827[b]	Public	48.0
Terminal Wharf	NSW Ports	106	Private	6.2
On-dock Rail	NSW Ports	120	Private	7.0
Total		**1723**		**100.0**

a – New South Wales (2011: 4–70) budget allocation only; b - New South Wales (2011: 4–70).
(Source: Authors' compilation).

7.3. Capital costs of intermodal terminals

Port Botany is on a constrained site, so suburban (inland) intermodal terminals are part of the solution for lack of space within the port precinct. Sydney Ports Corporation (2008) recognised the need to expand the intermodal network within Sydney as a prerequisite for the greater use of rail in alignment with an NSW Government transport policy objective. The New South Wales Government allocated A$579 million (in 2019 prices) to develop a network of Intermodal Terminals, such as the enhancements of Botany and Enfield Rail Yards.

By 2021, the existing network of intermodal terminals that serve Port Botany (and other destinations) are listed in Table 6 (their locations are shown on the map as yellow triangles in Fig. 2). The table shows the terminals's size in hectares, who owns and operates the terminal and the approximate construction costs in 2019 prices with the total assets worth an estimated A$3.6 billion. Some company's regard the size of their site to be a matter of commercial-in-confidence, so the costs shown in this table are based on costs that are reported and are in the public domain.

The scope of demolition and construction activity varies by the intermodal terminal project but the development application for Chullora provides a detailed case study that could be followed up in more detail to determine the components of the costs associated with an intermodal terminal (Barr Property & Planning, 2020). The development of an intermodal terminal at Moorebank is part of a long-term national and state government strategy to increase the carriage of freight by rail. NSW Ports invested A$250 million to develop the 60 ha Enfield Intermodal Logistics Centre as part of strategy to move freight on rail on a dedicated line to and from Port Botany in an efficient and sustainable manner. This is a key logistics hub in central-west Sydney and includes an intermodal terminal, empty container storage and industrial lots for logistics, freight forwarding, packing and unpacking, transport and warehousing. Moorebank Intermodal Terminal in the outer western suburbs of metropolitan Sydney is the latest facility to be added to the network, and is a worthy case study in its own right as documentation is in the public domain.

Table 6
Sydney's Intermodal Terminals – Owners and Construction Costs (in 2019 prices).

Terminal	Ha.	Owner	Operator	Capital Costs (A$ m)
Chullora	30	Pacific National	Pacific National	16 [a]
Cooks River	17	NSW Ports	MCS	5[b]
Enfield	60	Sydney Ports Corp.	Sydney Ports Corp.	83[c]
Enfield	60	NSW Ports	Aurizon	250[b]
MIST Minto	30	Qube	Qube	655[d]
St Marys	10	Pacific National	Pacific National	40
Villawood*	15	Toll	Toll/DPW	0
Yannora	70	Stockland	Qube	600 [e]
Moorebank	241	MIC	Qube	1909[f]
All Terminals				**3558**

Legend: MCS - Maritime Container Services; MIST – Macarthur Intermodal Terminal;
MIC – Moorebank Intermodal Company; * - Villawood no longer operating as intermodal.
terminal as rail spur was too short for rail operations. a - NSW Government (https://cgrgroup.com/project/australia/new-south-wales/sydney-freight-terminal-chullora); b – NSW Ports; c – New South Wales (2011: 4–70); d- Austrak (2008:2); e – https://www.stockland.com.au/-/media/leasing/common/newfiles/yennora_brochure_fa_singles_jun19.ashx; f- Australian Government, Infrastructure Australia (2016: 1).
(Source: Authors' compilation).

7.4. Transport access infrastructure to Port Botany

A state-owned single-track railway served the Botany industrial area before Port Botany was constructed. The current Sydney Freight Network with access to Port Botany via the Botany Goods Line (ATRC, 2019: 5). The Australian Rail Track Corporation (ARTC) and the NSW Rail Corporation (now Sydney Trains) signed a Deed of Agreement for the Metropolitan Freight Network (MFN) Lease and License. In December 2008, ARTC commenced the first phase of the MFN lease, with the lease of the Port Botany Rail Yard. Subsequent leases for Enfield West to Sefton and Port Botany to Sefton Park Junction were executed in July 2011 and August 2013, respectively. The timing of the MFN leases generally coincided with major capital projects (ARTC, 2015: 3).

For example, ARTC developed, as a potential candidate for funding from the Federal Nation Building Program 2009–2014, a staged upgrading program for the Metropolitan Freight Network and Port Botany line to meet projected growth in demand for container transport by rail, and was successful (Infrastructure Australia, 2018). The Port Botany Rail Link (PBRL) project was in two phases. A third phase has now been funded under the current Infrastructure Investment Program. A Federally-funded project costing A$ 75 million - Stage 3 upgrade of the 18 km South Sydney Freight Line - involving track reconditioning, concrete re-sleepering, new rails, new drainage and new retaining structures was completed in 2020. The 2018–2019 Federal Budget, announced on 4 May 2018, allocated A$ 400 million including new rail bridges, civil works and duplicated rail tracks across the 2.9 km length of the freight line between Mascot and Botany, along with the construction of a 1.4 km passing loop between Cabramatta and Warwick Farm.

Currently, a massive new road construction program is underway in the inner west of metropolitan Sydney. The WestConnex Motorway is an ambitious public–private partnership project costing A$15 billion (with the State Government holding 40 per cent equity) linking the M4 and the M5 toll roads (both carrying a high percentage of commercial vehicles). As seen in Fig. 4 (grey dashed lines), the easterly extension of the new M5 heads to Sydney Airport and Port Botany to become the Sydney Gateway project. The recent sale of the WestConnex Motorway to Transurban provided the NSW Government with money to build the airport and port road link under its Assets Recycling Policy. The NSW Government was responsible for the costs of a new intersection at the Foreshore Road at a cost of A$800 million (New South Wales, 2019).

The Gateway Road project (Fig. 4) will provide a new road link between Sydney airport terminals and the WestConnex Motorway at St Peters interchange, but there are some short- term adverse impacts for trucks travelling to and from Port Botany (Trembath, 2019). Contracts for the A$2.6 billion project were signed in mid-2020 with work to be completed by 2023 to coincide with the opening of WestConnex (funded under NSW Restart Program). Daily traffic flows along roads close to the port - O'Riordan Street and Botany Road – are forecasted to drop by up to 30 per cent. There are reduced travel times to Port Botany of up to 17 min in 2026, increasing to more than 20 min in 2036. Based on the methodology described in section 3, the allocation of port traffic to the capital cost is about half a billion Australian Dollars (A$ 528 million in 2019 prices) of which 40 per cent is government money.

8. Discussion

The literature search has reinforced that the evidence base aimed to evaluate post-privatised international ports and intermodal terminals from an environmental perspective is virtually non-existent. This confirms the findings and reasons given by Brooks *et al.* (2017: 7–8), who point out that the complexity of governance and the differences in institutional settings makes such evaluation problematic and by Pilcher and Tseng (2017: 982) who imply that any comparative studies of ports are of limited value given that, in the field of governance, "many key terms are highly ambiguous and understood with huge variety and range". This is reinforced by Notteboom and Haralambides (2020: 336)

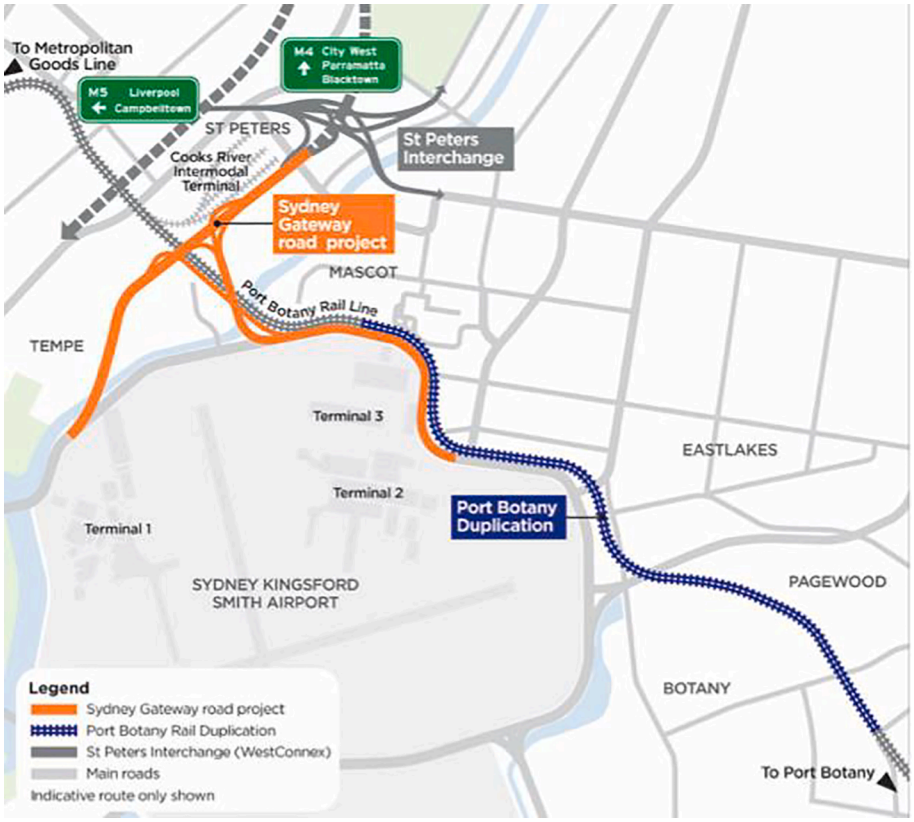


Fig. 4. Sydney Gateway Project and Port Botany Rail Duplication (Source: NSW Government, 2018: Fig. 1.1., p. 1).

in that every port is confronted with "specific challenges and opportunities in terms of economic and social development priorities, port–city relations, spatial dynamics, environmental pressures and more".

In reviewing the Australian privatisation experience of government-owned enterprises in terms of efficiency improvements, Chen et al. (2017) and Abbott and Cohen (2014) argue most of the improvements took place after corporatisation, rather than following privatisation, but they have largely ignored the environmental dimension. The significance of our research is that it has revealed that a "privatised" port has embraced challenges of sustainability and the environment. Port Botany is managed by a private company, NSW Ports, with a long-term lease (99 years) from the NSW Government. The long-term lease provides certainty to the operator in terms of planning, port development, environmental responsibilities, maintenance and financing (NSW Ports, 2015; 2018b). Port Botany's Five-Year plan provides certainty to investment decisions whilst allowing flexibility and agile management in the face of any external shocks (such as Covid-19). Although we have documented the actions of NSW Ports post-privatisation on its environmental and sustainability challenges, we concede that it is impossible to determine how the Sydney Ports Corporation would have performed as a government entity given changes over the past decade in community values and expectations on sustainability, the environment and on climate change.

One general concern about privatisation is that port management will place profit for its shareholders before its environmental performance. For example, a criticism of the U.K.'s privatisation approach was the government abandoned its regulatory role too drastically (Brooks, 2004: 175). However, (Monios, 2017) points out that the 2011 UK ports policy confirms the view that it is not the role of government to plan and build ports but simply to approve or reject development proposals and ensure ports meet their legal, environmental and social constraints and objectives. Pilcher and Tseng (2017: 983) have stated: "privatization, per se, may not increase port efficiency or competitiveness, certainly not in 'green port' initiatives, as it is 'unrealistic to think that the highly capital-intensive and high-risk areas in clean technology will be "led" by venture capital…" In the case of Port Botany, a SWOT analysis was conducted to identify the strengths, weaknesses, opportunities and threats of the current regulatory framework (Table 7).

Amongst the major international port stakehohers, Notteboom and Haralambides (2020: 331-332) point out that the growing role of

Table 7
SWOT Analysis of Environmental Regulatory Framework for a Privatised Port Botany.

SWOT	Summary of findings
Strengths	Long-term lease (99 years) from the New South Wales Government provides Board of Management, and investors, significant advanced over a government-owned port enterprise: The contact is enforceable by law and the conditions of the lease cannot be charged by any political party because the contract is ultimately backed by the Crown of England. The long-term lease provides certainty in terms of planning, port development, environmental responsibilities,maintenance and financing.
Weaknesses	Any changes to the NSW and Australian Government's environmental frameworks require a period of industry and public changes before any new regulations are issued.
Opportunities	Port Botany's Five-Year plan provides certainty to investment decisions whilst allowing flexibility and agile management in the face of any external shocks. The current regulatory framework allows the port management the potential to initiate measures to reduce its environmental impact, and improve the local, natural environments in which its activities are located.
Threats	The COVID-19 Pandemic has introduced an economic threat.There are no immediate potential threats to the current framework as clarity is provided in the detailed clauses of the 99-year lease. Hinterland transport access is not covered by any environmental management framework of which the port has any mandate introduces a risk.

(Source: Authors).

environmental and social considerations:

> "shape the behaviour and strategies of port-related actors, with a greater role attributed to and to rolling out initiatives in the field of corporate social responsibility (CSR), stakeholder relations management and green supply chain management."

As noted by the Chief Executive Officer of NSW Ports, Marika Calfas:

> "Sustainability is integral not only to our business, but to the long-term success of the supply chain industries. We recognise we have a responsibility to enact sustainable environmental, social and governance measures which minimise the impact our business has on the natural environment and the communities in which we operate" (Ports Australia, 2020: 43).

The policy to privatise Port Botany has not diminished the role of the state government to encourage greater efficiencies in the logistical supply chain. Policies by the NSW State Government have steadfastly supported initiatives to improve efficiency in the transport of containers to and from Port Botany (Rimmer and Black, 1982). The NSW Legislative Council (2019: 4) highlights that the state's freight and ports policy has consistently sought to: (a) "Make better use of existing capacity in roads, rail lines and warehouses to lower transport costs; (b) Reduce the distance, cost and complexity for moving freight by building on investments in Port Botany due to its close proximity to customers and distribution centres; (c) Increase the proportion of containers moved by rail to improve efficiency and reduce the growth of trucks on roads; (d) plan for container port capacity into the future and avoid unnecessary investment by taxpayers; and (e) provide certainty and confidence for investment." Recent initiatives taken post-privatisation of Port Botany by Transport for New South Wales include: the TfNSW Cargo Movement Coordination Centre (CMCC) to work with road carriers, rail operators, stevedores and related supply chain stakeholders to maximise use of existing transport network capacity and continuously improve the efficiency of cargo movement through Port Botany and to employ productivity boosting technologies.

By far the greatest government contribution to a more efficient port operation at Botany Bay have been the Federal and State Governments funding of new rail and roads. The Australian Rail Track Corporation has developed a staged upgrading program for the Metropolitan Freight Network and Port Botany line to meet projected growth in demand for container transport by rail. The 18 km South Sydney Freight Line involved track reconditioning, concrete re-sleepering, new rails, new drainage and new retaining structures was completed in 2020. The Port Botany Rail Link (PBRL) project includes new rail bridges, civil works and duplicated rail tracks across the 2.9 km length of the freight line between Mascot and Botany, along with the construction of a 1.4 km passing loop between Cabramatta and Warwick Farm.

Currently, a massive new road construction program is underway in the inner west of metropolitan Sydney. The WestConnex Motorway will link the M4 and the M5 toll roads (both roads carrying a high percentage of commercial vehicles). The recent sale of the WestConnex Motorway to Transurban provided the NSW Government with money to build the airport and port road link under Assets Recycling Policy (COAG, 2014; Dossor, 2014). The Gateway Road project will provide a new road link between Sydney airport terminals, Port Botany and the WestConnex Motorway at St Peters interchange and substantially reducing journey times for container trucks (Trembath, 2019).

Finally, we address the public and private sectors' relative contribution to the current and committed construction costs of Port Botany, the suburban intermodal terminals and rail and road access infrastructure to the port. The implementation of any policy requires funding. As these construction projects have taken place over nearly half a century their costs are presented in current (Australian Dollars in 2019 prices) as explained in the methodology section. Also, the construction costs are derived from numerous different sources so all must be treated with a degree of caution on their final out-turn cost. Allocating a proportion of the funding of the WestConnex and the Gateway Project to road traffic generated by Port Botany is a highly approximate exercise based on a series of assumptions that have been set out in Section 4. The interchange costs met by government with Foreshore Road are allocated to port-related traffic although other road users will drive along Foreshore Drive. Notwithstanding limitations in the data, and the assumptions made, Table 8 presents the results of construction costs, together with the relative funding contributions of both sectors. The data suggest an allocation of capital costs in the logistical chain of about 57 per cent to the private sector and 43 per cent to the public sector.

9. Conclusions

Policies by the Australian Federal Government in the 1980 s saw major initiatives to enhance national productivity through the liberalisation of the economy, such the corporatisation of government business enterprises and the progressive deregulation in the transport and telecommunications sectors. They became the keystones of the so-called 'microeconomic reform programs' of both Commonwealth and State and Territory Governments (Kain et al., 2003; NSW Parliament, 2017). A component of this reform has been the move from the public/private port model to a private/public model with the private sector as the landowner and utility functions holder, with the regulatory functions the responsibility of the public sector (Chen et al., 2017: 208).

The research design for the case study of the Port Botany privatisation was formulated to answer three main questions: to what extent have governments (there are three tiers of government in Australia) continued to be involved in the regulation, planning and investment in the logistics chain to support the import and export of containers through a privatised port in contrast to the role of public container ports?; what are the relative capital costs to the private sector and the government to achieve more efficiency?; and how has NSW Ports responded to challenges of sustainability and environmental regulation within the port's jurisdiction?

In Australia, the rigourous and robust regulatory frameworks in place, and the conditions specified in the 99-year lease from the New South Wales Government, have ensured that Port Botany, owned by NSW Ports, has met, and probably exceeded, its required sustainability and environmental performance expectations Section 5. The constrained site area of the port on Botany Bay has meant that intermodal terminals are a prominent and necessary feature of the logistical supply chain in metropolitan Sydney. The Sydney Ports Corporation (2008) recognised the need to expand the intermodal network within Sydney as a prerequisite for the greater use of rail in alignment with an NSW Government transport policy objective. By 2021, the existing network of intermodal terminals that serve Port Botany (and other destinations) have been summarised in Tables 1 and 6. More intermodal terminals are planned for outer western Sydney around the Second Sydney Airport under construction.

Table 8
Approximate Construction Costs (in 2019) of Port Botany, Intermodal Terminals and Road and Rail Access and the Relative Contributions of Government and Private Sectors.

Economic Infrastructure	Amount A$ billions	Government Contribution	Private Sector Contribution
Port Botany	1.72	86.8%	13.2%
WestConnex / Gateway	0.53	40.0%	60.0%
Foreshore Road Interchange	0.80	100%	0%
Freight Rail	0.46	100.0%	0%
Intermodal Terminals	3.56	2.3%	97.7%
	7.07	43%	57%

(Source: Authors' compilation).

If the construction of Port Botany, its transport access and the intermodal terminals all took place today the total investment by the public and private sectors would be approximately A$ 7.1 billion. The new South Wales Government paid for port construction in preparation for a sale of port assets. Rail infrastructure have largely been funded by the Australian Federal Government and the New South Wales Government, wheras the private sector has primarily invested in the intermodal transport terminals. In the future, Greater Sydney's freight task is forecast to almost double in the next 40 years when it is expected that investment will be made entirely by the private sector. The Western Parkland City has the largest supply of industrial lands in Greater Sydney with two planned intermodal terminals that will support large-scale logistics growth (Greater Sydney Commission, 2017).

It is safe to conclude from this study, and from other published research, that the role of governments should be to protect the nation's interests by using regulation to ensure equitable development, good economic, social and environmental performance and fair charging and to provide the necessary enabling transport port access infrastructure. The private owners of Port Botany not only "keep Australia's economy moving" but do so with respect for the ecological, social and environmental systems of within which it is embedded.

Further research could use this descriptive approach of a case study, along with its methodology, to establish the environmental regulatory framework, to analyse port-related construction projects, and to discuss with key informants in other global ports that have been privatised. Perhaps, through an international collaborative study, such as that initiated by the World Maritime University, a comparative data base on legislation, policies and practices could be constructed and the performance of privatised ports documented.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A:. National and State Government legislation and policies

A.1. Australian national Government

The main instrument controlling shipping emissions is the International Convention for the Prevention of Pollution from Ships (MARPOL) enacted through Commonwealth legislation. Australia is a MARPOL signatory and implements its global requirements. The Australian Marine Safety Authority is the Commonwealth agency which implements MARPOL in Australia. To protect air quality, MARPOL Annex VI sets limits for sulphur dioxide and oxides of nitrogen emissions from ship exhausts and sulpher in shipping fuel (State of New South Wales and Environmental Protection Agency, 2015: 10).

The Australian Maritime Safety Authority (https://www.amsa.gov.au) is responsible for pollution prevention in the marine environment. Australia regulates emissions from all ships (including cargo ships, bulk carriers and other vessels) to protect the marine environment and human health from air pollution and to ensure international emission standards are met. Its response capabilities are coordinated and maintained under the National Plan for Maritime Environmental Emergencies. The authority cooperates with state and territory agencies, and industry stakeholders, such NSW Ports, to respond to pollution incidents. The Australian Government, Department of the Environment and Energy, is responsible for the National Pollution Inventory (NPI). The NPI provides the community, industry and government with free information about substance emissions in Australia.

The national (and state policy) context for the sale of government assets, such as Port Botany, involved the recycling of capital. The National Partnership Agreement on Asset Recycling (Rossor, 2014) was created subject to the provisions of the Intergovernmental Agreement on Federal Financial Relations (COAG, 2014). The advantage of the agreement is increased investment in productivity-enhancing infrastructure by encouraging the sale of state-owned assets to unlock funds and recycle the capital into additional infrastructure (Duffield et al., 2019: 67-69). In 2011, the NSW Government introduced its asset recycling strategy: to effectively manage the State's balance sheet by unlocking equity, de-risking the balance sheet, and recycling proceeds into new economic and social infrastructure investment. The Government established Restart NSW, to quarantine net proceeds from asset transactions for the delivery of new infrastructure projects, such as WestConnex and NorthConnex road projects.

A. 2.1. NSW State Government

Transport for NSW (TfNSW)

Under the Australian Constitution, the regulatory control over ports rests with state governments. Transport for New South Wales (TfNSW) exercises a number of powers under ports legislation: port safety; marine pilotage; and marine pollution.TfNSW issues the Port Safety Operating Licence (PSOL) to the Port Authority of New South Wales under the Ports and Maritime Administration Act 1995 (PAMA). The PSOL covers port safety functions that must be undertaken in the NSW designated ports of Port Botany (and Eden, Port Kembla, Sydney Harbour, Newcastle and Yamba). TfNSW also provides advice on oil spill prosecutions; pollution from chemicals and garbage; domestic ballast water management for the prevention of marine pest incursions and the implementation of the MARPOL.

A.2.2. Port Authority of New South Wales

The *State Owned Corporations Act 1989 (NSW),* and the *Ports and Maritime Administration Act 1995 (NSW*) establish the Port Authority of New South Wales (Port Authority) - a state-owned corporation managing the navigation, security and operational safety needs of commercial shipping in Port Botany. Port Botany remains subject to the pre-privatisation price-monitoring framework contained in Part 6 of the *Ports and Maritime Administration Act 1995* (NSW) (PAMA).

The PSOL (Port Safety Operating License) is issued by the State government to the Port Authority of New South Wales to ensure that NSW ports are managed to world's best practice on safety and compliance. This entails the auditing of the safe transfer of bulk dangerous liquids in the ports, work permits and pilotage vessel operations. The Marine Operations team operates in the ports of Sydney and Botany Bay where they provide maritime expertise to all port stakeholders, including a 24-hour emergency response for port-related marine incidents for both Sydney Harbour and Botany Bay. (Only 2% of reports

are found to be related to commercial shipping activities). And attributed to pollution from recreational vessels, debris, or land-sourced runoff. The Port Authority of New South Wales (2018) has the responsibility to control the conditions under which dangerous and hazardous goods are handled or kept in defined port operational areas.

A.2.3. NSW environmental Protection Agency (EPA)

The EPA is the state's primary environmental regulator. The New South Wales EPA has particular interest in environmental issues and incidents in the "North Botany Bay Industrial Precinct" because it is home to a quarter of NSW's major hazardous facilities, including chemical manufacturing plants at Botany Industrial Park and the location of Port Botany. Atmospheric and noise pollution standards, for example, are evidence-based practices using international studies of dose–response relationships. (https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/whoweare/18p1011-epa-strategic-plan-2017-21-updated-2018.pdf, accessed 11 September 2019).

The NSW EPA sets noise limits in environment protection licences (the Protection of the Environment Operations Act 1997) for industrial premises, such as Port Botany, to maintain and encourage ecologically sustainable development while safeguarding human health and the environment. The Noise Policy for Industry (NSW EPA, 2017) balances the need for industrial activity with the community's desire to minimise intrusive sounds. It sets assessment noise levels, and best practice measures to manage industrial noise based on latest scientific research regarding noise's health effects.

Port Botany is also expected to fund, and lead, remediation and pollution reduction efforts where these become necessary. The legislation mandates that businesses are responsible for keeping communities informed about their activities and practices, and for consulting with and requesting feedback and input from them.

A.2.4. NSW Environmental Planning Assessment Act 1979 (and New South Wales, Planning Legislation Amendment Bill 2019)

Any land-use development proposal (from residential to major industrial) is subject to this act. In general, local government is the consent authority but major economic infrastructure projects, such as motorways, railways and ports, may be designated of "state significance" whereby the consent authority is the NSW Government. All major development applications are supported by an environmental impact statement (EIS) that follow the principles of ecologically sustainable development (Commonwealth and State Guidelines) and include formal public consultation. The determining authority may accept or reject proposals and invariably publishes conditions attached to approval. Appeals are handled through the Land and Environment Court.

A.3. Local Government

Local development is the most common type of development in New South Wales with projects ranging from home extensions to medium-sized commercial, retail and industrial developments. Section 68 of the *Local Government Act 1993* specifies a range of activities where approvals are required to be obtained from the local council, including freight terminals. Under the *Environmental Planning and Assessment (EP&A) Act 1979*, all development applications (DA) s must be formally assessed by Council. For freight terminals, the current practice specifies that providing a project is estimated to cost less than A$ 30 million the DA is assessed by the local council.

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