PORT MANAGEMENT
SERIES

Volume
4

Port Performance

**Linking Performance Indicators
to Strategic Objectives**

UNITED NATIONS
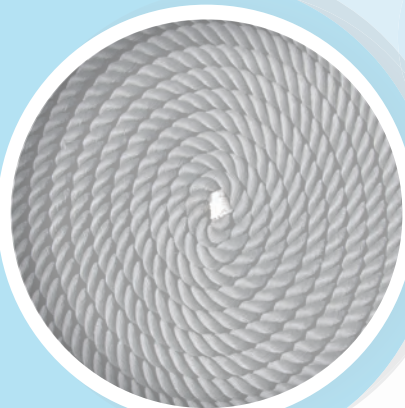
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UNITED NATIONS
New York and Geneva, 2016

NOTES AND ACKNOWLEDGEMENTS

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CONTENTS

Figures

Tables

GLOSSARY OF PORT TERMS AND ABBREVIATIONS

Berth	A specified length of quay wall whe e a vessel can tie up
Breakwaters	Physical structure that protects port infrastructure from the sea
Cargo agent	Person who acts on behalf of the owner of the goods
Cargo mode	There are a number of distinct cargo groupings: LoLo, for containers that are loaded on and off a vessel by crane; RoRo, where containers, people, and vehicles are driven on and off a vessel; and bulk in liquid, solid or loose (break) forms.
Clearance agent	Person who arranges for customs clearance on behalf of the owner of the goods
Common user	A term in ports to define a eas not dedicated to a particular operator/stevedore
Dredged channels	A section of the entrance to a port for vessels that is kept to a specified dept
Freight forwarder	Person who organizes the shipment of cargo for an owner
Gross tonnage	A volumetric measure of the total enclosed spaces of a vessel
Infrastructure	The fixed and immoveable parts of a harbour such as land, oads, quay walls and breakwaters
Landlord port	A form of port model where ownership of infrastructure is maintained by the port authority (public) and port services are managed by the private sector
LOA	Length overall of vessel
LoLo	Lift-on, lift off. See "cargo mode".
Logistics	The process by which goods are managed from their point of origin to their end destination through a series of transport stages.
Net tonnage	A volumetric measure of the spaces enclosed for cargo purposes
Node (transport)	This is the point where cargo and people transfer from one transport mode to another.
Operating port	A form of port model where the port remains fully in the ownership of the port authority (public) and is in turn operated by the port authority.
Port authority	A body established by law to manage a port, or ports, on behalf of the State. They are often constituted as corporate entities.
Port capacity	Generally refers to the engineered volume capacity for cargo in a port
Port services	The range of services provided to ships and cargo in a port, such as towage and stevedoring
Quay walls	The basic physical infrastructure provided to berth ships
Regulator (economic)	Generally refers to a State-appointed body that sets rules, including sanctions, and grants approvals for pricing and investment proposals submitted by port authorities
RoRo	Roll-on, roll-off; see "cargo mode"
Ship agent	Person who acts on behalf of a ship owner
Stevedore	Person who provides cargo handling service
Superstructure	The assets that are generally moveable in a port, for example, cranes
Terminal operator	Person who manages a defined space in a port who is generally he stevedore
TEU	20-foot equivalent unit
Throughput	A measure of cargo volume generally expressed as units or metric tons per annum
Tool port	A port model where all the assets are owned by the port authority (public) but they are in turned leased/hired to the private sector
Transport mode	Cargo and people can move across distinct categories of transport such as sea, air, rail and road

1.
INTRODUCTION

Some 80 per cent of international trade is channelled through ports. Thus, ports play a key role in connecting the many developing countries that have port communities to international trade. Regulatory changes are a major challenge in the maritime transport sector. How the maritime transport sector is organized has a significant impact on trade volume, transport costs and economic competitiveness. Port of calls must therefore be able to keep up with the growing complexities of port management to sustain and create jobs in developing countries with port communities.

Change and reform drive the strategic direction of modern seaports towards greater competitiveness and higher standards of performance. This in turn drives the demand for consistent and reliable methods to measure performance across international ports.

The demand for performance indicators in public services in general and in ports in particular is driven by a number of stakeholders. Policymakers need evidence-based research, investors need a means to chart returns and port managers need a sensible comparative basis for benchmarking and strategic planning. For example, donor countries need a rational basis to assess the efficacy of their contributions to capacity-building programmes.

Members of and donors to the UNCTAD Port Management Programme expect a performance report. The imperative of measuring performance against targets, and against similar ports, is the broad context of this project initiative launched by UNCTAD with support from Irish Aid.

The Programme supports port communities in developing countries in their efforts to achieve efficient and competitive port management. The programme brings together public, private and international entities. The aim is to share knowledge and expertise among port managers and to strengthen talent management and human resources development in port communities, thereby increasing trade flows and fostering economic development.

1.1 External and internal demand

The pressure on port managers to deliver has reached a critical level, as policymakers, port users and other stakeholders, such as those involved in the environment and security, are compiling data

directly and/or regulating performance reporting.[1] Brooks and Pallis (2013) state that "if ports do not proactively participate in efforts to bench their performance, we expect that a number of stakeholders will do it for them". They predict the following:

Modern management practices seek to link performance measurement to strategic planning processes in an increasingly competitive marketplace for port services. Competition itself can be understood as taking place among ports between port authorities, and among ports as well as within a port between operators. Port managers are required to measure and communicate achievements in this dynamic strategic environment.

> Within fiv years, we believe that it is likely that port performance benchmarking will happen on both efficien y and effectiveness vectors, with or without port cooperation in the process, as users become increasingly engaged in understanding and measuring end-to-end supply chain performance in order to improve their own competitiveness and create value for customers.[2]

The Human Resources Development Section of the UNCTAD TrainForTrade Programme is therefore supporting an initiative to produce a set of port performance indicators to be used as an internal strategic management tool and as a benchmarking tool across the networks of the Port Management Programme.

The project has two requirements. First, the ports of the network should commit to the project as owners of the data, given that the role of UNCTAD is to facilitate cooperation. Second, each port should commit a senior manager to spearhead this initiative and contribute to the development of the port performance scorecard. This dual commitment reflects the decisions taken at the Coordination Meeting of the English-speaking network, held in Belfast, Northern Ireland, in July 2013; and endorsed at subsequent meetings of by the French, Spanish and Portuguese networks.

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[1] For example a proposal was made in the United States of America in 2015 to regulate at the federal level performance reporting, although it was in part a response to country-specific labour issues

[2] MR Brooks and AA Pallis, eds., 2013, Advances in port performance and strategy, Research in Transportation Business and Management, Vol. 8 (special issue).

1.2 Port services market

Ports, in particular international seaports, operate as trade facilitators in the global economy. They are strategic instruments of trade policy in the domestic economy and represent a key interface between nations through the efficient and cost-effective movement of goods, people and information. Ports are vital nodes in the world trade network and have been so throughout history. They are also sites where different cultures engage and the veil of sovereignty is negotiated or lifted by goods, information and people. Global trade and investment flows have also provided domestic political agents, used to operating within informal norms of behaviour, with opportunities for rent seeking and the servicing of client needs.

The port industry, a subset of the maritime industry, has changed dramatically with growth in world trade. Global economic growth was facilitated greatly by dramatic falls in transport costs,[3] which are a driving force in the global economy. As shipping began to specialize in vessel design and greater tonnage, the port industry also began to respond to the challenges of servicing these vessels. In considering the policy impact on port organization and development, it is also important to understand the constituent elements of or players in the port community. Such an examination will help develop an appreciation of the varied players within the port community. Ports, as critical nodes in the ever-more complex and sophisticated logistical networks that drive the transport of goods around the globe, are made up of a number of subgroups that together constitute the port community.

The first subgroup develops, operates and funds infrastructure. Generally the State, national or local, owns and develops this foundation to a port in a port authority or equivalent. Infrastructure is typically defined as the land and the permanent assets that configu e the site as a working port, for example quay walls, breakwaters and dredged channels.

The second subgroup owns and maintains the superstructure. As a rule, this includes equipment such as cranes and civil engineering services such as electrical supply and paving. The public and private players in this group are wide and varied, depending on the type of cargo concerned and the national legislative environment.

The private sector, mainly in the form of international shipping groups, participates in the container market through ownership or as concession holders of a container terminal. In turn, the private sector owns and maintains the superstructure. In some ports, the port authority finances, operates and maintains the superstructure in the form of multi-user container terminals. Similar arrangements apply in other cargo modes, although private players are more likely to be cargo owners rather than ship owners in bulk trades.

By far the largest subgroup in the port sector is that of service providers. Cargo-handling services, such as stevedoring, cranes and other handling methods, and cargo processing through the customs institutions, are common to all ports. In this sector, players can include the State as an operator, customs authority and regulator across economic, security, navigation and environmental dimensions. Other players are international shipping groups, local stevedoring companies, cargo agents, freight forwarders and labour unions associated in the main with dock labour.

1.3 Technical challenges

Port performance features a number of measurement dimensions. They range from service quality and value for money, to investment returns and economic efficienc . There are many well-tried tools for such indicators. In ports, the main challenge is to focus the exercise on specific services, locations and entities. This project takes an innovative approach by using a pragmatic, common framework to compare ports to assess their performance.

The traditional narrative is that all ports differ in scale, trading context, governance models and service mix. Therefore, port case studies are common, but there is little in the way of comparisons, that is, performance benchmarking.

The difficulties with developing a coherent cross-national data-sharing process have not changed since UNCTAD published a monograph [4] on the subject in 1987.

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[3] D Hummels, 2009, Globalization and freight transport costs in maritime shipping and aviation, Forum Paper 2009-3, Organization for Economic Cooperation and Development and International Transport Forum, Paris.

[4] UNCTAD and International Association of Ports and Harbours, 1987, Monograph No. 6: *Measuring and Evaluating Port Performance and Productivity* (Geneva, United Nations publication, UNCTAD/SHIP/494(6)).

Making a port performance assessment is a challenging exercise, owing to the following factors:

- The sheer number of parameters involved;

- The lack of up-to-date, factual and reliable data, and that is available for publication or divulgation;

- The absence of generally agreed and acceptable definitions;

- The strong influence of local factors on the data obtained;

- The divergent interpretations given by various interests to identical results.

Comparing ports is complicated further by the wide variety of port types, scale and service configurations. Ports are "long-lived and costly, similar to many utility sectors and transport infrastructure such as highways. However, unlike utilities and highways, ports provide a wide variety of services and functions rather than a few specific outputs"; there are also "multiple actors in the public and private sectors and complex decision-making and production in port development, management and operation".[5] In terms of evolution, ports can be regarded as logistics distribution centres and more recently as total transport solution providers that also "act as information distribution centres".[6] Therefore, the units of comparison continue to change, and not all at the same pace or in the same direction. Therefore, the challenge of comparison should not be underestimated.

The needs of information users vary. For example, policymakers may be interested in cross- national and temporal comparisons on a port-wide basis. Port customers may be interested in operational and financial measures relating to cargo mode. Managers of port authorities are interested in measures that compare performance for limiting factors particular to their immediate circumstances. Political economists are interested in data that compare policy outcomes and performance at the national level. Maritime economists are interested in data that allow them to propose explanations for performance quality, given a defined set of inputs. To produce measures that are of value to prospective policy, research and

industry users require the development of tools and the standardization of assumptions that allow for like-for-like comparisons. This argument resonates with maritime, engineering and finance professionals intent on producing measures for comparison with competitors, targets and technical standards within management disciplines.

The challenge lies in disaggregating port services into strategic business units, which is the product mix. Overlaying the local context as an external data dimension provides further nuance to any comparative work. With this multi-dimensional combination of statistical data, product mix and local context, it is possible to observe the variation resulting from a difference in ownership configurations, investment levels, asset quality, labour training and skillsets, physical and operational constraints, economy-wide factors and regulatory regimes.

Industry practitioners, customers, port managers and policymakers also seek information on performance. Port users and regulators are also taking initiatives because there is so little reliable data coming from ports themselves. At the industry level, the demand for indicators is focused on service delivery to manage costs and drive profitability for port users. For example, a key cost driver in maritime trade is time. The longer a vessel is in port, the higher the costs for the consignment of cargo on board. Therefore, measures that inform port users on the time waiting for a berth and working times are of particular value. For port managers, land is a key resource. Measuring the use of that land in terms of cargo volumes and the dwell time of the cargo are useful performance indicators.

Across the various disciplines, there are different views as to the value of these apparently disparate measures. The approach used here is that each has a different, rather than invalid, research objective and therefore, there is much to be gained from a range of insights and consequential data sharing.

1.4 Building sustainable networks

Despite the obvious challenges, a number of projects are under way worldwide to measure port performance. It is important to differentiate between economic modelling and management benchmarking. It is also important to differentiate between third-party studies

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[5] S Cheon, 2007, World port institutions and productivity: Roles of ownership, corporate structure, and inter-port competition, PhD dissertation, University of California Transportation Centre.

[6] PB Marlow and AC Paixão Casaca, 2003, Measuring lean ports performance, *International Journal of Transport Management*, 1(4):189–202.

Figure 1. Data collection
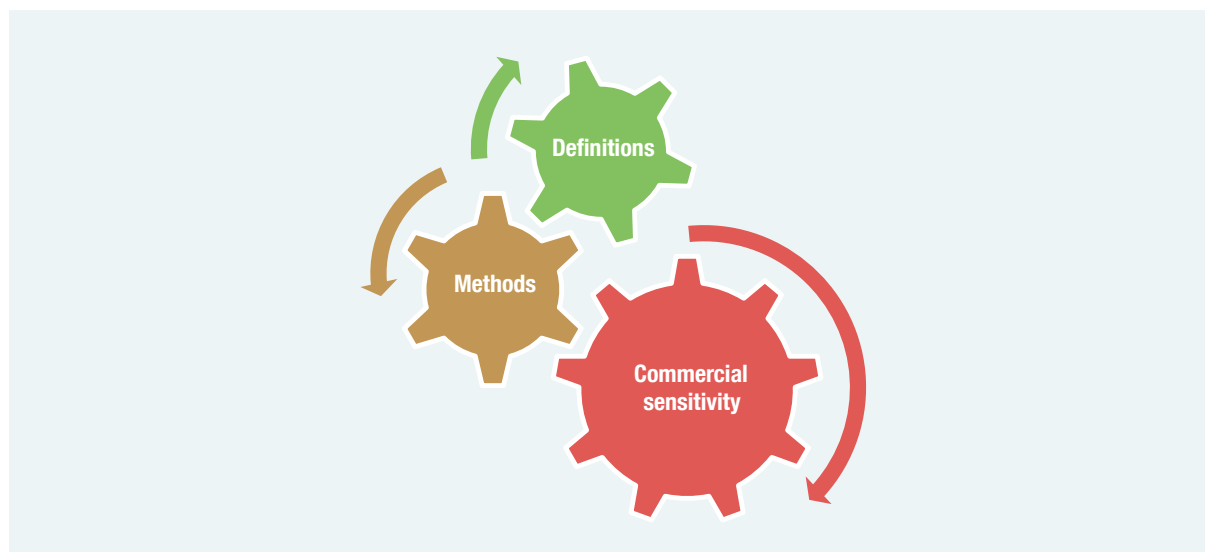
and cooperative networks in project organization. The clear strategy in the port performance scorecard project is to focus on management benchmarking across a cooperative network. Those that are complementary to the port performance scorecard project are discussed in the following paragraphs.

The largest and best funded project is the 2010 European Union project managed by the European Sea Ports Organization called "Port Performance Indicators: Selection and Measurement" (PPRISM).[7] In 2013, the European Union funded a follow-on project coordinated by the Free University of Brussels known as PORTOPIA.[8] This online knowledge base and management system aims to offer an accessible platform for all port industry stakeholders, including those from academia and industry, and policymakers. It has the ideal combination of a network of members (European Sea Ports Organization) and an extensive budget. The findings of PORTOPIA studies are relevant to the discussion on developing the port performance scorecard.

Networks such as the Port Management Association of West and Central Africa have an active project to develop shared indicators for their 31 members and associates. There is a common membership for some of the ports in the UNCTAD Port Management Programme networks and the Port Management Association of West and Central Africa.

At an informal workshop held in Geneva in December 2012,[9] these two programmes of work were discussed at length in framing the basis for the port performance scorecard project. The port industry and academic experts at the workshop agreed that the tools for analysing performance were not technically difficult. The real challenge lay in gaining access to regular, reliable and timely raw data.

From this point the project developed from a series of annual workshops (figu e 1). The second informal workshop was held as part of the 2013 Belfast Coordination Meeting. In October 2014, the first International Port Performance Scorecard Workshop (PPS 1) was held in Manila with representatives of the English-, Spanish- and French-speaking networks. The workshop focused on the development of the port performance scorecard. In September 2015, the second Workshop (PPS 2), which representatives of the Portuguese-speaking network also attended, was held in Ciawi, Indonesia.

The workshops have witnessed progress in obtaining more and more data on the number of ports and reported years. There has been a growing consensus on data definitions and a formal structure of port contact points for communication purposes has been established. Participants agreed that although data-gathering methodologies were an issue, it was more important to meet the needs of port service providers to protect their data for competitive advantage. Therefore, the initial focus remains on the port

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7   See pprism.espo.be (accessed 3 May 2016).
8   M Dooms, 2014, Port industry performance management, Port Technology International, Issue 61.
9   Unctad.org/meetings/en/SessionalDocuments/webdtltlb 2013doc1_en.pdf (accessed 3 May 2016).

authority or entity, with subsequent work planned to include cargo-handling entities in the process.

1.5 Project progress

The detailed logic for the construction of the scorecard is set out in chapter 2. The results of the data collection are described in chapter 3. The workshop reports are available on the UNCTAD Port Management Programme platform (learn.unctad.org); a summary of the workshop outcomes is provided in annex II.

The data collection covers the period 2010–2014. The database therefore retains a growing number of data points, which will add significantly to the reporting capacity of the project, thus adding value for stakeholders.

> The number of data points for statistical analysis is therefore, **p x t**
>
> where **p** is the number of port entities and **t** is the number of years.

This in turn provides the opportunity for the participants to ask ever more sophisticated questions in terms of productivity for land, time and labour. It also provides a deeper understanding of port typologies such as governance types on a public to private scale.

The dimensions of the data set will also evolve over time with additional measures to look at environmental sustainability, the efficient use of information and communications technology and customer effectiveness.

The target groups of ports included in the project are those that are, or have been, participants in the Port Management Programme. As there are multiple ports in many of the countries in the four language networks in Africa, Asia and Latin America, they make a credible data set for benchmarking. The countries included in this round of data collection are Angola, Benin, the Dominican Republic, Ghana, Indonesia, Namibia, Peru, the Philippines, and the United Republic of Tanzania. There are 21 port entities in the data set with a further 7 committed to the next round. There are 23 scorecard indicators in this report, including an indicator of female participation in the workforce. Additional details are provided in annex II.

This report concludes the first full round of data collection and describes the key benchmarks that have been circulated to the participating ports. The individual port data remains commercially sensitive so it is held as confidential The tables in this report set out the average best values of the network, along with relevant descriptive statistics.

It is expected that future rounds will move forward in the calendar year to make reports available to port managers in a timely manner for strategic planning.

The success of this initiative is at odds with the predictions of previous studies. To research past projects is to find a range of teams working to deliver on the same indicators included in this project. However, they tended to fall short on the premise that each port is so different as to defy comparison and that data definitions are particular to a given national or regional context. The progress of this project is in large part explained by two factors. First, there is a pre-existing high-quality port network. Second, the project team is entirely made up of port professionals.

Knowledge sharing is a core value that should be sustained; members of the network must develop mechanisms to leverage the strategic issues and knowledge that they have in common. There are many projects and significan funding for studies of the top tier of hub ports, especially container hubs, but little to sustain regional hubs and/or feeder ports.

By contributing to this port performance mechanism, each port will have an external tool to evaluate and position itself in a competitive environment. These tools should be seen by senior managers as a value added resource, developed by UNCTAD, to improve the management and competitiveness of their port.

Figure 2 shows the components of the port performance scorecard and illustrates the project approach. By breaking down the task into discrete dimensions, the project can be managed in a manner consistent with available resources.

Figure 2.   *Port performance scorecard components*
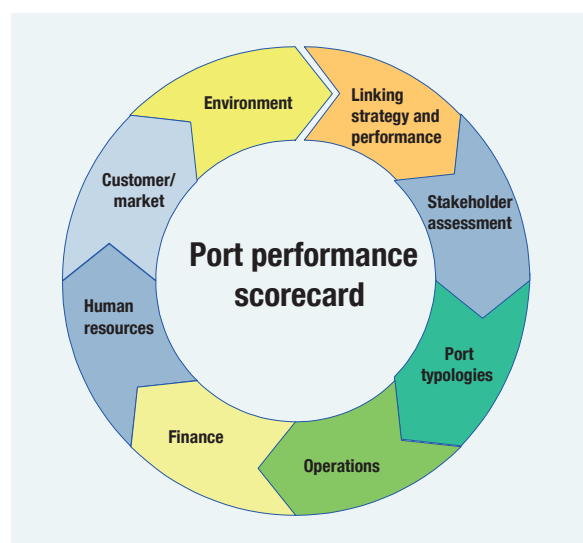
2. CONSTRUCTING PORT PERFORMANCE SCORECARDS
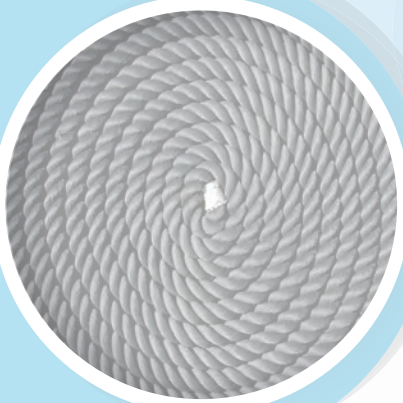
While modern ports collect data for performance purposes, especially for resources that are in limited supply, it is difficult to compare the outcomes with competitors or with ports in similar circumstances. Managers may know that performance is improving year on year but they may not know whether performance is up to the standards of leading ports with similar profiles.

Members of existing Port Management Programme networks in Africa, Asia and Latin America have an opportunity to overcome this barrier and maximize the value derived from their shared membership.

The annual project goals are as follows:

- To ensure delivery by network structures, year after year, thereby not focusing on process alone;

- To define and agree upon performance indicators;

- To agree on data collection methods and timing, which will avoid duplication of effort and make it possible to leverage data already available across the port community;

- To develop data management tools that also protect confidential information shared by network members.

Policymakers seek access to better measures of port performance. This can reflect a need for transparency, which in turn can either focus on corruption or on service cross-subsidization. They might seek performance data to assess various factors such as the quality of competition and the economic benefits of port activities, the scale of returns on public investment and the extent of congestion in a port and its environs. Policymakers may also wish to assess the environmental impact of port operations over and above socioeconomic returns for specific development projects.

Port users seek information that has a direct impact on their business and the commercial choices they make. They are interested in the performance of the port in terms of operational time factors such as vessel waiting or cargo dwell times, or indeed labour productivity. Both factors will affect cargo transit costs.

This chapter sets out the technical issues related to the construction of the port performance scorecard and its delivery by the Port Management Programme networks.

2.1 South–South performance network

The port performance scorecard network is an opportunity to add to other international initiatives for South–South dialogue. In this case the opportunity to share knowledge on a wider basis is obvious.

There are many external data sources and port community players that collect information for performance studies. Nevertheless most analysts, including those from the port performance scorecard network, draw from the same well of the port community in terms of raw data. Figure 3 is a representation of this port data community.

However, a number of publicly available indicators, such as the World Bank infrastructure and service indices, are employed in prominent comparative country studies. These tend to be based on surveys with an inherent time lag, focusing on a perception of ports as a national aggregate. Other indicators also provide economic and trade context to a comparative study, such as the UNCTAD liner shipping connectivity index, World Bank development indicators, and shipped and trans-shipped cargo volumes. These will be used in the scorecard to provide country context when comparing efficiency indicators in the port performance scorecard. [10]

In terms of organization, the idea would be to establish a South–South dimension to the project by recognizing that all the network ports across the four language groupings constitute a single port performance scorecard network (figu e 4). Support for the network would be provided by UNCTAD, with expertise from country port partners, as necessary.

There are two main points of agreement. First, project leadership will be provided by a senior manager, who, acting as the port authority contact point, is directly supported by the chief executive.[11] Second, the contact point must have sufficient seniority and expertise to ensure the sustainability of the project. Fulfilling both these objectives will ensure that the benchmarking reports are of value to senior management and make a meaningful contribution to the strategic planning process in each port authority.

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[10] These indicators are available at data.worldbank.org (accessed 27 April 2016).

[11] Chief executive is the generic term to include all those who have ultimate management responsibility for the port authority, whatever the title used in an organization.

Figure 3.   Port performance data community

Abbreviations: ASEAN, Association of Southeast Asian Nations; IAPH, International
Association of Ports and Harbours; PPRN, PPRN, Port Performance Research Network
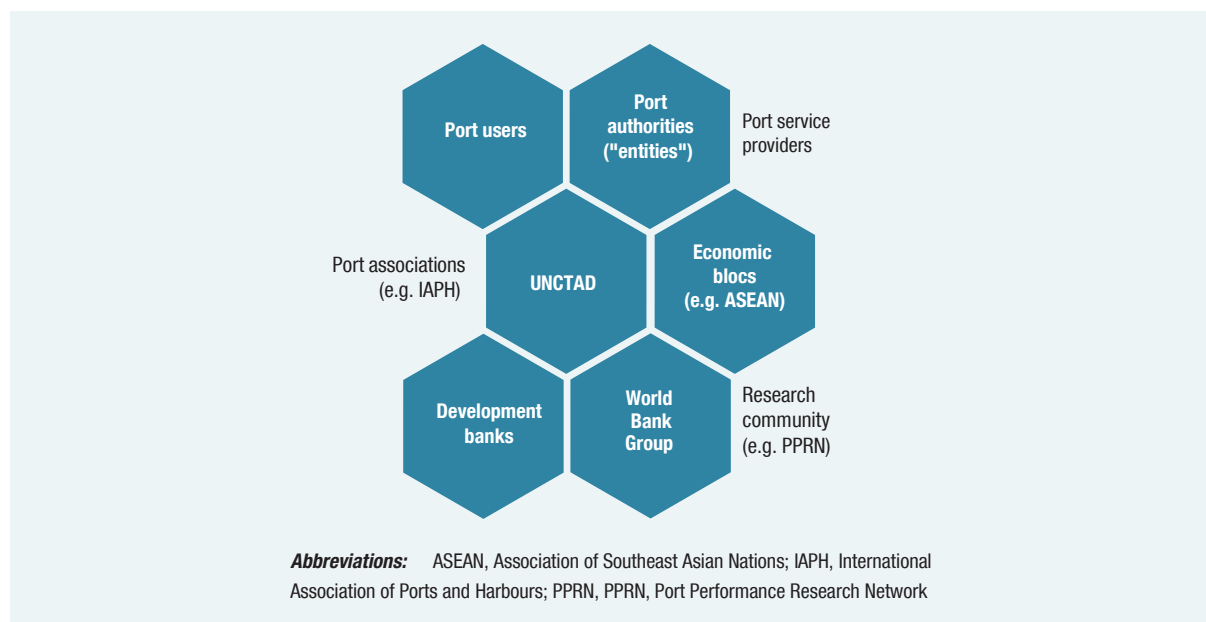
Figure 4.   Port performance scorecard network
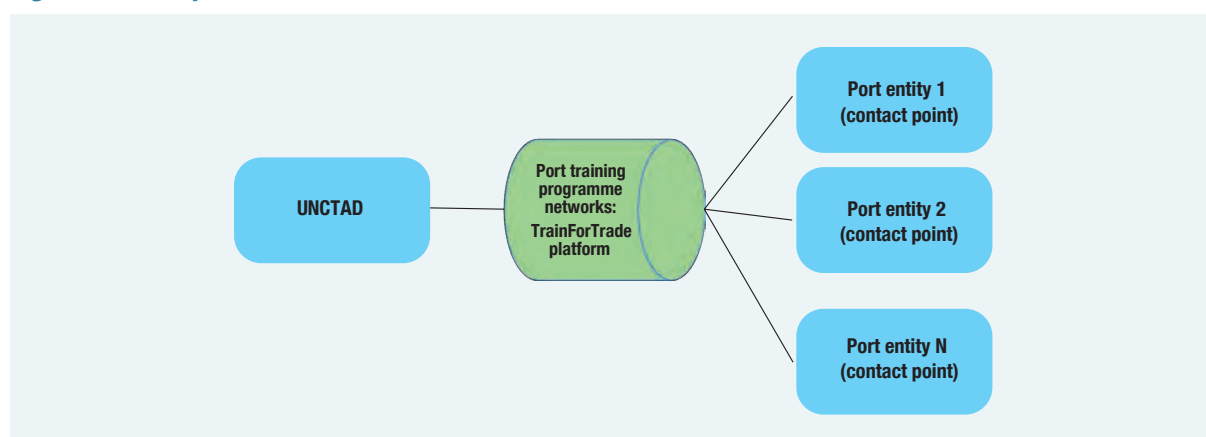
2.2 Selecting the variables

In a recent study by González and Trujillo,[12] port efficiency is understood as the actual level of performance measured against the optimal performance level, assuming a given set of inputs. This is a technical economic definition and requires some conception of the limits or boundaries of performance. Comparisons can then be made over time and across units provided they are qualified for any variation in production inputs. This theoretical point understates

the practical problems that arise in a sector such as a comprehensive multi-modal international port. It is not an exaggeration to suggest that efficiency measures can only be of value for a particular unit and for a particular time, when compared with a production standard that in turn reflects the unique characteristics of ports.

In relation to port benchmarks, effectiveness is another concept defying a common definition. There are tools such as SEAPORT,[13] in which customer satisfaction surveys form a basis for effectiveness measures.

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[12] MM González and L Trujillo, 2009, Efficiency measurement in the port industry: A survey of the empirical evidence, *Journal of Transport Economics and Policy*, 43(2):157–192.

[13] See MR Brooks, T Schellinck and AA Pallis, 2011, A systematic approach for evaluating port effectiveness, *Maritime Policy and Management*, 38(3):315–334.

There are others that measure effectiveness in terms of market position versus normal expected growth, given a level of economic growth. For this to be applicable, the network contact points will need to agree on a definition of what constitutes the market for a specific port, and/or a specific cargo mod

To produce measures that are of value to prospective policy, research and industry users, it is necessary to develop tools and standardize assumptions that allow for like-for-like comparisons. This argument resonates with maritime, engineering and financ professionals intent on producing measures for comparison with competitors, targets and technical standards within management disciplines. However, managers can benefit from the more cost-effective collection of data that produce benchmarks against similar ports. As a result, multi-port comparisons become feasible. The greater the number of ports, the better the value of the benchmarks.

Overlaying the local context with an external data dimension provides a further nuance to any comparative work. For example, the level of economic activity defines the potential market for port services. Slow or low growth in the economy might explain slow or low growth in port activity. The opposite may also be true. Alternatively, constraints on port activity may have a negative impact on local economic growth.

How the port is organized is another context dimension. For example, many academics maintain that cargo-handling services are best provided by the private sector. The same does not necessarily apply to ownership of port authorities. Therefore, comparing port performance will raise the obvious comparisons of ownership and market-governance regimes. Categorizing ports within the spectrum of public to private governance is a useful context indicator.

Two port classification methods were considered useful at this stage of network maturity.

There is the internationally recognized functional port model whereby ports are characterized as regulators, landlords or operators. This is often included as part of a matrix that also records whether the function is carried out by the public or private sectors, or a combination of both. However, there are practical issues with the functional model, as ports may have different models for different cargo types.

To overcome this, a new model[14] is employed to collect original data on port service market characteristics. The dimensions of this typology are competition in cargo handling, control over price setting, scale of private equity, responsibility for funding infrastructure (private or public), and power to approve development projects. Where funding is concerned, this is examined at the level of marine access infrastructure (breakwaters, capital dredging), ship and cargo-handling infrastructure (quays and yards) and quay-side superstructure (cranes, equipment, paving). This gives a more detailed contextual analysis of port characteristics.

2.3　Unit of analysis

For benchmarks to have value, the unit for comparison must be defined clearly. There are country-level port performance measures, discussed later, which are an average of many disparate port environments. Ports differ in the portfolio of services and products they provide. For example, some ports handle all types of cargo, while others specialize in containers or bulks. There are also differences in scale, ownership (private or public interests) and funding (by markets and/or the State). Therefore, the obvious unit for comparison is that of the port.

The approach adopted at PPS 1 is to make comparisons at port level while gathering additional data to explain variance using subport measures by cargo mode. In particular, this additional layer of data provides insights into general merchandized cargo movements in containers as well as single product shipments in liquid and dry bulk form. These constitute the majority of cargo movements in the network ports, although the data collection model will facilitate the inclusion of other services, such as break bulk, trade cars specialist vessels, cruise vessels and passenger traffic

At PPS 2, the definition of a port was clarified further to reflect the concept of a port entity as a data collection unit. If there is doubt, the selection will be based on a substantive assessment of the port system functions rather their legal form. The functional tests include an assessment of whether the reporting entity is responsible for leading and managing investment in port infrastructure, the collection of port dues, and the management of lands and a rental portfolio.

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[14]　J Hiney, 2014, Politics, path dependence and public goods: The case of international container ports, PhD thesis, Dublin City University, available at doras.dcu.ie/20064 (accessed 27 April 2016).

It is a challenge is to select measures for port services at cargo mode level, which also provides a product mix profile for the port

To ensure meaningful data and cost-effective data collection, network representatives agreed to the inclusion of ports with an annual throughput volume of more than 1 million tons. This is applicable whether the port exclusively engages in domestic or international trade, as the need for high-quality service performance is critical in both scenarios.

2.4 Port performance scorecard

Four strategic dimensions – finance, operations, human resources and market – are adapted here to match the performance dynamics of a modern port. Figure 5 represents both the workshop process and the strategic dimensions of a port authority. Cargo operator returns provide additional data, particularly for operations and human resources, to develop explanations for performance levels.

Benchmark/context variables: port/mode size, service portfolio, governance/economic regulation, economic development (gross domestic product, gross national income per capita), region, distance, connectivity, economic and political institutions, transit role.

The scorecard is analogous to the Kaplan and Norton balanced scorecard, a tool that is used to link strategy with performance.[15] The merits of such management tools that are internal to each port organization are not the issue, however. However, the scorecard is a valuable heuristic device to determine which indicators are important and why. The objective is to take the four strategic dimensions and examine the generic measures that will or should be developed by all port authorities. Inevitably, these will be used to compare ports nationally and internationally.

This can also be a useful device to disaggregate the complex nature of a port system and deliver the project in discrete phases or blocs. A description of the scorecard across financial, operational, human

Figure 5.   Port performance scorecard flowchar
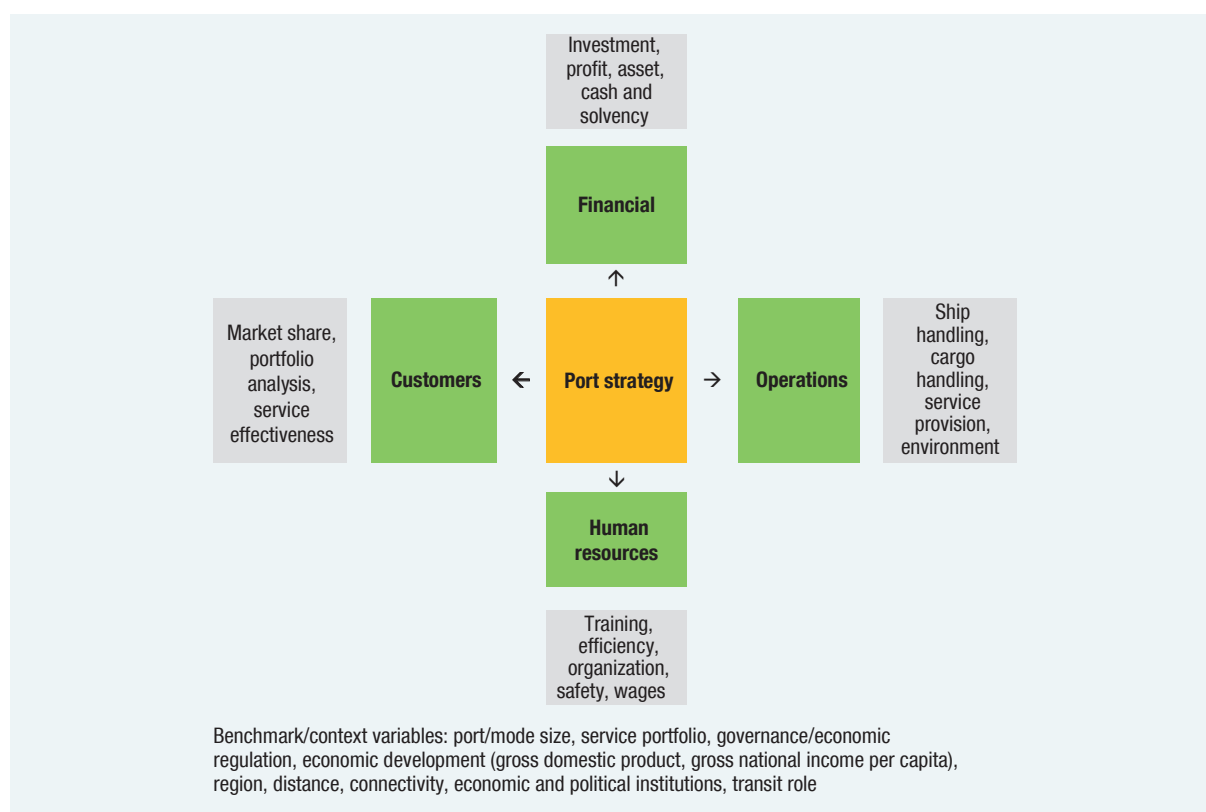
Note: The scorecard is based on metrics that can be benchmarked against similar ports.

[15] R Kaplan and D Norton, 1996, *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Boston.

resources and customer dimensions is provided below. They are further explored in the summary of project findings. Provision is made within the operations dimension for measures that chart environmental sustainability. The following section thus addresses the issue of economic sustainability.

2.4.1 Finance

Measuring the financial performance of a port across all services is the ultimate target, though on the whole an unrealistic one because many service providers in a port operate using a mix of private and public corporate models. Nonetheless, attention can be focused in this report on the financial performance of the entity commonly described as the port authority. To do so it is necessary to have a clear picture of what revenue streams and activity costs are included in a financial report. The data requirements will be constructed by cargo mode and differentiated between port dues (vessel and cargo), service charges (pilot and tugs), stevedoring (cargo handling), land-based activities such as that of landlords, and other activities. A set of finance allocation rules, adopted at PPS 2, will form part of the data collection guidance notes available to the contact points.

Costs can be more difficult to analyse; however, it is possible to separate landlord/regulator costs from those associated with operations. The data requested in the survey focused on high-level revenue streams as a proportion of total sales, on the operating margin that excludes non-routine expenditure and funding costs from the calculation and on the proportion of labour costs to total revenue associated with the port authority.

Future workshops will continue to develop and clarify any definitional issues that may arise. The performance indicators will also be extended into asset and investment quality, cash generation and liquidity, and funding comparisons. Revenue streams by mode are another level of analysis required to produce average price and yield comparators.

2.4.2 Operations

This is the largest and most commonly applied area in port performance assessment. In terms of the primary data concerned with the movement of vessels, people, cargo and information, the measures consist of volume moved in relation to time, area and technical capacity. This is especially centred on the cargo mode (product mix) and the spatial dimensions of the handling location. Typically, the comparative

indicators refer to handling rates for vessels and cargo, producing efficiency indicators for time and space. This dimension is a particular challenge in establishing commonly accepted definitions.

The port performance scorecard in later phases will also include other operational dimensions such as energy, environment and security. Identifying the use of Internet-based technologies (Internet of Things) to drive efficiency will also feature in the development of the scorecard.

2.4.3 Human resources

This bloc of indicators is of particular interest in the context of the Port Management Programme networks, given that the core objective of the Programme is the development of human resources to further enhance port service delivery and trade facilitation, and in turn national economic welfare. The initial data collection focused on numbers employed by broad category, the nature of labour institutional arrangements such as permanent or temporary, gender balance and the incidence of lost time caused by strikes or other labour-related stoppages. The relative cost of types of labour as a proportion of all costs and/or revenue is a useful comparative measure. These types of labour are from the port authority, stevedoring (private and public) and casual pooled resources. From this, indicators related to efficiency can be calculated on a sensible comparative basis.

PPS 2 participants agreed upon a matrix of employee categories for inclusion in the next round of data collection (annex I). Future work will extend this set of indicators to account for a wider set of employee scenarios and their relationship with specified cargo modes. Training indicators, and health and safety dimensions, are of particular interest to port managers and stakeholders as comparators.

2.4.4 Customers

This is an area that is not covered in the initial phase, as the data collection is more expensive and problematic. Nonetheless, it can be divided into customer satisfaction, market share by cargo mode, service effectiveness such as the SEAPORT[16] model and portfolio analysis based on value added for specific types of traffic, such as mode

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[16] Hiney, 2014.

Figure 6.   Market performance matrix

Market performance		Relative market share	
		Low	High
Growth rate	High	High potential	Star performer
	Low	Minor performer	Mature leader

The objective of the portfolio analysis is to identify the market standing of each port in terms of the matrix in figu e 6, which tracks the changes over time of the port market share in relation to market growth. [17] Adapting this approach will provide a basis to measure performance in terms of the port marketplace and the relative competitive position of each port product. The matrix is a one-period snapshot and does not take account of change over time.

The dynamic analysis, including measurements for multiple periods on each port, will illustrate how the port is progressing to or from the star performer category. By relating the selected time periods to policy reform and/or strategic shifts, policy performance can be measured and compared.[18]

2.4.5   Social and economic context

In the initial round, fixed or semi-fixed data were requested on ownership, economic governance, functional models, and market dimensions. As mentioned previously, there is a critical need to differentiate ports based on local conditions in order to contextualize any benchmarking report.

Local context is not only based on internal variables. There are a range of external variables that again can contextualize a benchmarking exercise. They are generally publicly available data such as macroeconomic conditions over time, connectivity and distance to and from markets, and the set of rules in the political economy of local maritime trade. The latter includes capital controls, customs procedures, labour rules, investment regimes and ease of doing business, as well as the relative openness of the political system. By including such context variables, performance can be plotted against indices of economic and political openness; or indeed any combination of the context variables. On such plots, ports can see how they perform relative to other ports adjusted for conditions outside direct management control.

2.5 Data collection

The challenges of collecting data for performance measurement are well documented in the literature. One of the key challenges to this task is accessing the raw data, given the varied distribution of roles and data ownership in port communities; the pliable nature of data definitions, along with problems of comparison cross-nationally; and the wide range of functional areas in a port that should be monitored. This is not because of technical measurement challenges but rather the difficulty of isolating timely and relevant raw data with which to construct measures and comparators.

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[17] R Cruz, J Ferreira and S Azevedo, 2012, A dynamic strategic portfolio analysis: Positioning Iberian seaports, *South African Journal of Business Management*, 43(1):33–43; also drawn from a matrix developed by the Boston Consulting Group.

[18] JI Castillo-Manzano, L López-Valpuesta and FG Laxe, 2010, Political coordination costs in the Spanish port devolution process: A note, *Ocean and Coastal Management*, 53(9):577–580.

As previously mentioned, the port structure included a key role for the national and port contact points. In the context of data collection, these senior managers will take responsibility for the data collection, validation and submission to UNCTAD.

PPS 1 participants agreed to seek returns from two sources:

the body acting as the port authority, and the body acting as a terminal operator. The former generally collects port dues and is responsible for major port infrastructure investments. This is true, regardless of the functional model of landlord, tool, or full service provision, or whether the port authority is publicly or privately owned.

The body acting as a terminal operator is of particular interest in container handling. Where the port authority provides such a service, the data return for cargo handling is also completed. This is true, whether the cargo operator is publicly or privately owned.
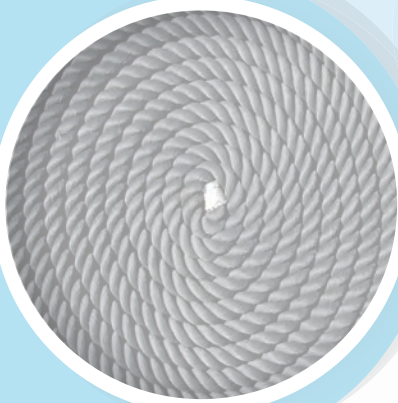
In the case of countries with multiple ports within a single port authority, the data may be validated by the port authority before it is sent to UNCTAD.

This report covers the survey returns from 2010 to 2014. The data, collected annually, are now sufficient in volume and international variety to justify publications of the benchmark results. In future years, the growing time-series data will allow for more sophisticated hypotheses testing and thus offer explanations for varied performances in developing country ports.

3.
PORT
BENCHMARKS

Transport nodes are a complex mix of public and private services, as well as long-term investment cycles. This applies to any major transport node where goods and people are in transit, such as seaports and airports. If in addition, the competitive nature of transport service provision is considered, the significant problem of data access comes to the fore. Understandably, owners of activity data will seek to protect their own interests and may not be inclined to share commercially sensitive information.

To overcome such problems, it is acceptable to develop indicators that approximate the activity data in the form of a proxy performance measure.

For example, charting the performance of a cargo-handling operation on a container vessel is best done with a measure of the number of crane lifts, regardless of the container size, per hour of work. It serves as an indicator of crane, labour and ship productivity. However, this information is gathered and held by the operator. In a competitive scenario, especially if the port authority is also a competing operator, they will be reluctant to share the data. Therefore, a proxy for container-handling productivity is necessary.

Based on the customs manifest that is submitted for purposes of port dues, a port authority will know the number of containers loaded and unloaded from a vessel. It will also know from berth operations the vessel's working times. The requirement for benchmarking is a comparative measure of cargo-handling productivity. Averaging the number of 20-foot equivalent units (TEUs) that are loaded and unloaded per working hour results in a proxy measure that can be compared on a like-for-like basis across ports.

This logic, used to identify comparable measures, is applicable across all scorecard dimensions. For finances, for example, international standards for accounts presentation and verifiable currency conversion factors available from the World Bank data set can be used.

The strategy adopted is to gather data that are readily available across as many ports in the network as possible. This has proved successful and justifies its continuation into a further round.

The countries included in this round of data collection are Angola, Benin, the Dominican Republic, Ghana, Indonesia, Namibia, Peru, the Philippines and the Republic of Tanzania. Great care was taken in the presentation of the results not to identify the ports, now numbering 21, with the best or worst values in

the network. This is the confidentiality agreement that is essential to the success and sustainability of the port performance scorecard network.

The results are discussed in terms of port governance, financial performance, human resources, vessel operations and cargo operations.

3.1 Port governance

The port survey provides valuable information on the type of ports in the network: historical context, legislative background, a functional model identifier and an insight into the management of port services.

Most of the ports have recently been constituted in relative historical terms. The port of Cotonou in Benin was recorded as the oldest, and the port of Dar es Salaam, the newest. Although the ports existed long before the establishment of the current port authority, the data collected gives a sense of the pace of reform. However, it would be wrong to characterize the port of Cotonou as lacking reform; feedback indicates the advanced nature of the original and complementary legislation.

The dates of legislation, independent of port authority constitution, are also provided. The latest reform-based legislation and regulations are in Indonesia (2008/2009). The founding legislation for the Philippines Port Authority can be traced back to 1975, although there are other general legislative developments that have an impact on ports, such as privatization initiatives.

With regard to developments in port governance, there is a global trend towards greater private sector participation, especially in port service delivery. There is also a trend towards the conversion of port authorities from public bodies to corporate entities with a commercial mandate. The data returned supports this trend, as illustrated in figu e 7.

The reform process is accompanied by the retention of control by the State or sub-State administration. Figure 7 shows that all the ports in the network are under central government control and are mostly corporate entities. Therefore, port performance is discussed in the following sections in the context of a post-reform era for governance models.

In some reform projects, an independent regulator is established to monitor market activities in pricing and investments. This is often done to prevent monopolistic

Figure 7.   Governance models
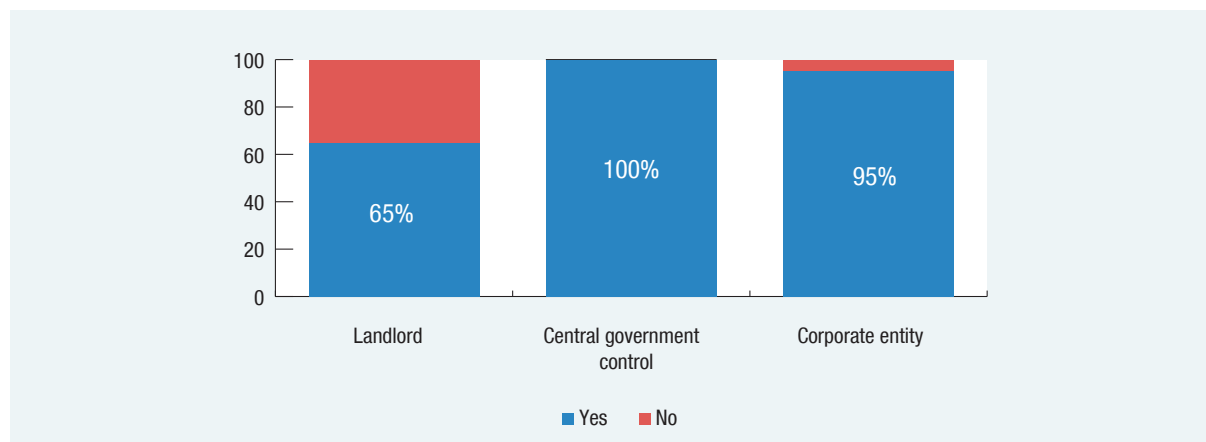
behaviour by both public and private players. In this network, about one third of the ports are subject to market control by a regulator. It may be reasonably assumed that the remaining ports are subject to similar regulation by a governing department of a State.

Another reform trend is the promotion by policymakers of the landlord model. This leads to the provision of cargo handling and other port services by the private sector; the port authority becomes responsible for regulatory matters, estate management and the provision of port infrastructure. This is a difficult model to apply in practice, as a port may have a different strategy for each cargo mode.

The survey listed the functional model based on either a legislative or State policy declaration. The majority of the ports are recorded as landlords. Those that are not are among the smallest ports in the network, suggesting that scale is a factor in such policy decisions. A reasonable conclusion is that to be economically sustainable, smaller ports will need

to engage in all port service deliveries; and/or that the market for port services is too small to sustain private providers.

The privatization debate for public services applies to the port sector. Interestingly, there are no privatized port authorities in the network. This finding is consistent with many studies; the more common finding is that cargo-handling operations are privatized. The data in the survey returns are fully consistent with this global trend.

A number of additional questions on market governance profiles were included in the survey. Figure 8 summarizes the results.

With regard to cargo operations, more than half of the ports have intra-port competition, and 50 per cent of all port authorities are participants in this marketplace. The port authority holds an equity stake in the private cargo operators in three of the ports.

In a considerable number of ports (80 per cent in the returns) price changes are subject to public approval.

Figure 8.   Market characteristics
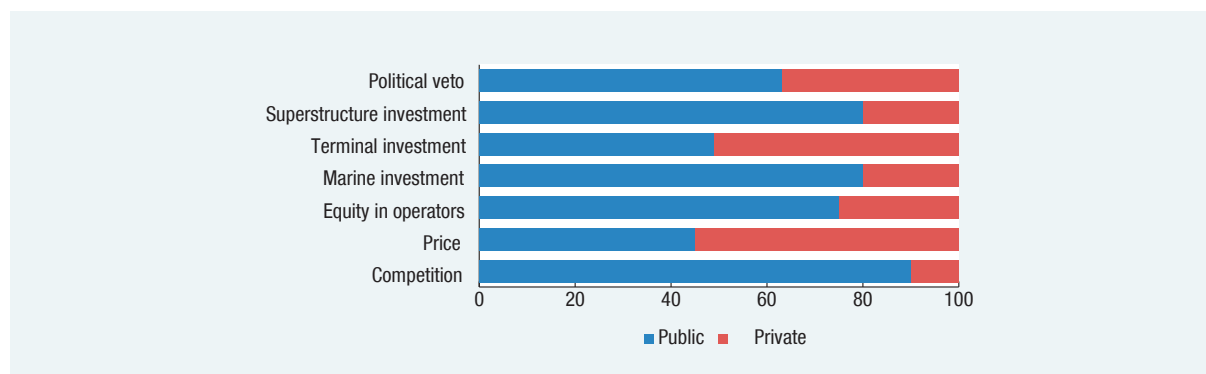
This generally applies to port dues, but can also apply to other service charges. This represents an intervention in the operation of the market, although it is often rationalized as being in the public interest. For example, it is important to protect against an abuse of a dominant position by a monopoly. However, it can also be a constraint on efficient operation if prices are set too low to generate a return that can recoup investments. If prices are set too high, then they may become uncompetitive.

In line with other studies on port governance, the survey returns confirmed that all the ports are subject to some level of political approval when planning development projects. The argument is that such approval mechanisms are often not independent and that the planning cycle is significantly delayed. From a public policy perspective, the need to control port developments is justified to prevent overcapacity and ineffective investments.

In this area of investment, the results provide interesting information and may reflect the influence of local economic development on policy actions.

Port investments in hard infrastructure generally fall into three categories:

- Marine access infrastructure, which provides safe access to a port for all vessels. This includes breakwaters at the harbour entrance and capital dredging to deepen the entrance channel;

- Quay infrastructure, which provides a place of sufficient depth for a ship to berth and have cargo loaded and unloaded. It also includes a wider quay used for processing the cargo to onward land connections, or trans-shipment to another vessel;

- Quay or terminal superstructure, which provides the necessary services and equipment to the quay operations for vessel and cargo handling.

Studies[19] of global ports suggest that marine access infrastructure is on the whole funded publicly, although the financial instruments may vary considerably. The data returned confirms this as a trend across the network.

On a global scale, terminal or quay-side infrastructure funding trends are mixed; both private and public entities play a role therein, depending on the cargo mode processed across the quay. In the case of

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[19] Hiney, 2014.

containers, larger ports tend to offer concessions to private operators that may include an obligation to fund the infrastructure. For mixed cargo operations, a port authority is more likely to fund the investment. In the network, the trend is for a port authority to fund all such investments.

The private sector invests heavily in port superstructure, which reflects the privatization of service delivery. The data returns show public sector investment in superstructure consistent with 50 per cent of port authorities having a cargo operations presence in the market.

In chapter 2 the argument for a sensible basis for port comparisons was made based on the classification of ports so that the reader can assess the value of the comparison. In the reporting ports of the network, the governance and functional models are remarkably consistent. Most ports are classified as landlords, and most ports have a similar mix of private and public participants. Most ports also have a similar mix of funding regimes. Therefore, they can be reasonably compared.

One point of differentiation is that of economic scale, both for the port and for the hinterland economy. With scale comes the opportunity for efficiencies, so the larger the port, the better the relative performance.

Therefore, all indicators discussed describe the types, as well as the range, of values.

3.2 Financial performance

Performance indicators are often expressed in terms of a scarce resource, such as time, space or a monetary value. To produce consistent monetary comparisons, each port contact point reported financial data in the local currency unit. As part of the analysis, the UNCTAD team converted the data set from the local currency unit to United States dollars based on annual average rates available from the World Bank data set. Therefore, all financial performance indicators are expressed in United States dollars.

There are two uses for monetary returns:

- When combined with a volume measure such as tons or full-time labour equivalents, an average rate per unit of volume can be calculated. An example is the average port dues per ton of throughput at a port. Another might be the average earnings per full-time equivalent employee;

Figure 9.   Average revenue profil
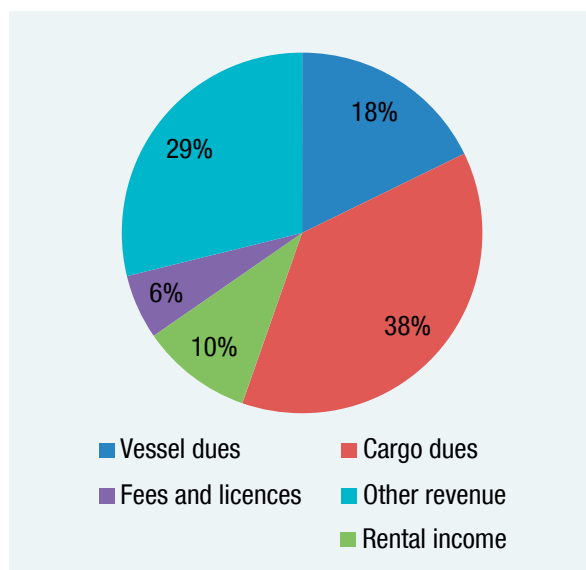
- Monetary values as an absolute number or as a proportion of another monetary value provide useful indicators of financial performance. For example, total revenue is a comparative number when used over time for a port or against another port for the same time period. Likewise, calculating port dues revenue as a proportion of total revenue is a useful indicator of the income profile for a port authority. In figu e 9, port dues constitute more than 50 per cent of revenue; property and fees, 16 per cent; and other income, 29 per cent. On average, therefore, non-port dues represent about 45 per cent of total revenue of the ports in the survey.

Financial reports are available from all the ports in the network. While there is substantial convergence in the production of audited financial accounts, some remaining differences may distort comparative indicators. Therefore, the strategy agreed at PPS 1 is to focus on readily available data in financial operations where there is substantial common ground.

There are three parts to the financial accounts from which data can be drawn. The profit-and-loss account provides useful information:

- The balance sheet provides information on the assets owned and the liabilities owed by a port authority. There are two points of measurement at the beginning and at the end of the reporting period. They provide a snapshot. As there are differences in rules concerning valuation

and recognition, as well as differences in corporate structures when funding variances are considered, no balance sheet data were used in this round of data collection;

- The cash flow statement charts the source of all funds from operations and from external bodies such as the State. It also indicates the use of these funds to finance infrastructure, working capital, investments and other allocations. While this is a critical report for internal port management, it has less value for port-to-port comparisons. This can be explained by the different statutory regimes for funding or payments to the State. Also, investments in capital works can vary greatly from one period to another and from one port to another. Therefore, a port that receives considerable external aid will not be comparable with a port where capital works are funded from retained profits

- The profit-and-loss account is the monetary image of port operations. It records the revenue and expenditure of the port for a defined period. For ease of comparison, the returns are all based on the calendar year. Within this financial report, there can be difficulties with comparison. The strategy adopted by the workshop participants is to use the values that derive the operating profit (earnings before interest, tax, depreciation and amortization). This excludes values derived from capital movements in the balance sheet, taxation (as it depends on local policy), and interest on borrowings that may be subsidized.

Port authorities with multiple ports are likely to produce their accounts on a group basis. This limits the data collected at a port level to operational volumes only. The agreed solution is to adopt a management accounting strategy to allocate and apportion revenue and costs to each port based on common practices in the industry.

For example, revenue may be distributed based on cargo and/or vessel volumes. Labour costs may be distributed based on average full-time equivalents assigned to a port. The resultant distributions in a working document can be reconciled with the totals in the audited financial reports. The annual workshop process will continue to develop this management accounting strategy so that financial comparisons for ports within and across countries are based on the

Figure 10. Revenue mix for reported years
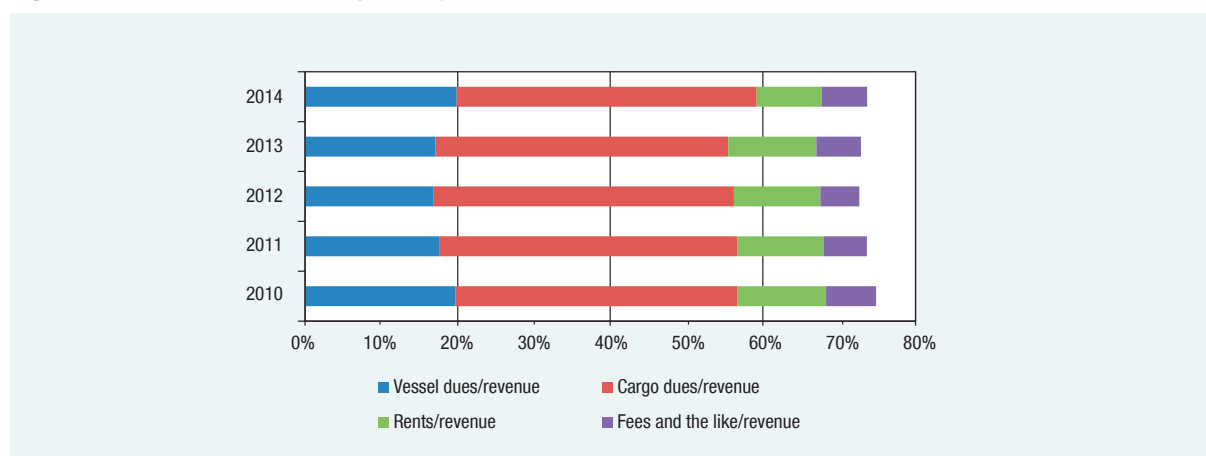
same allocation rules. This is a relatively simple ad hoc accounting exercise that will yield considerable value to the benchmarking process.

One of the first points of comparison in port financial performance are the relative components of the revenue headings. The similarity across the ports is typical of such revenue profiles seen elsewhere with port dues (vessel and cargo dues) making up the majority of the profile. Figure 10 is another illustration of the revenue spread for each of the reported years. It shows little sign of variance over time. It illustrates the relative relationship between cargo and vessel dues at 2:1 approximately.

There are seven core financial benchmarks used in this round of data collection (table 1). The final two are discussed further under the heading, Human Resources. Each port has an individual scorecard report with which to compare these benchmark values. The summary scorecard report in the table describes the range for each measure.

Earnings before interest, tax, depreciation and amortization/revenue. This charts the relative profitability of port operations. When expressed as a proportion of sales (turnover or revenue), it becomes a measure that is comparable across time and across other ports in the network. In the returns, the average operating profit levels are consistent with benchmarks for capital-intensive enterprises. It is argued that levels above 40 per cent are required to generate sufficient funds to pay for significant infrastructure investments. The drop in 2012 can be attributed to losses incurred by ports during that period. Excluding these, the average returns are in line with previous years. The average across the reported years is 38 per cent. Figure 11 illustrates the range of values across the data points (ports multiplied by years) with significant clustering in the 50–60 per cent range.

Vessel dues/revenue. This charts the relative proportion of vessel dues to total revenue. On average, port dues from vessel handling amount to 18 per cent of total revenue, ranging from 1 per cent to 32 per cent. Where

Table 1. Financial performance (Percentage)

Financial ratios	2010	2011	2012	2013	2014
EBITDA/revenue (operating margin)	40	42	25	40	37
Vessel dues/revenue	20	18	17	17	20
Cargo dues/revenue	37	39	39	38	39
Rents/revenue	12	11	11	12	9
Fees and the like/revenue	7	6	5	6	6
Wages/revenue	23	25	23	23	20
Training/wages	1.1	0.3	0.7	1.2	1.3

Abbreviation: EBITDA: Earnings before interest, tax, depreciation and amortization

Figure 11. Earnings before interest, tax, depreciation and amortization: Margins
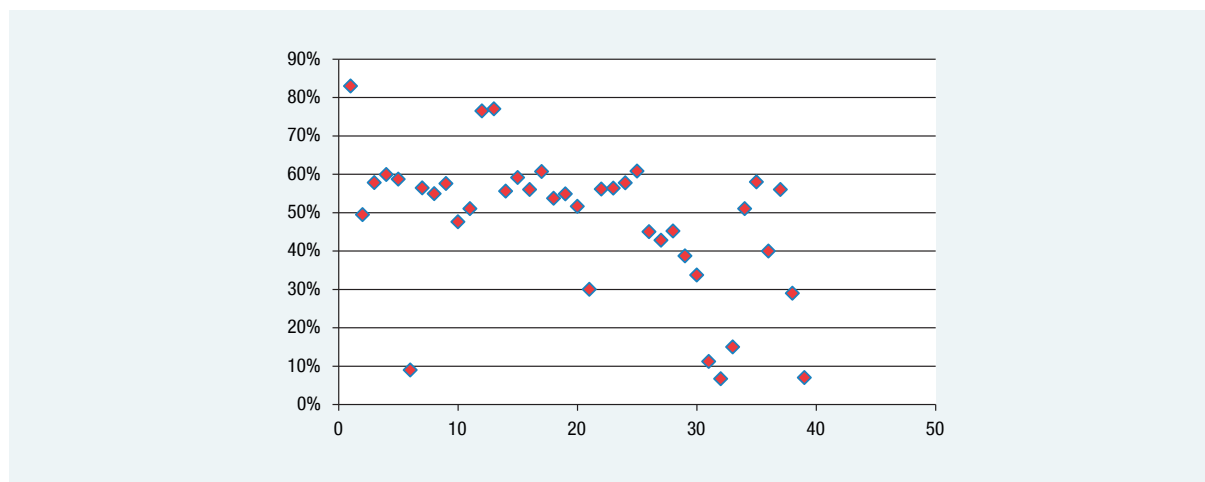
the values are higher, this suggests that the cargo or passenger cargo prices are at the low end of the spectrum. These levies, charged for vessels entering a port, are usually the smaller proportion of port dues, the other being cargo dues. Where the vessel dues are low, it suggests that smaller passenger vessels are a large part of this revenue heading.

Vessel dues are also considered to be the recovery mechanism for investments in the channel and navigation infrastructure. The value over time is reasonably stable in reporting ports. However there is a fall in vessel numbers and a rise in vessel size as measured by gross tonnage. This is consistent with known developments in shipping.

Cargo dues/revenue. This is the larger part of port dues and is expressed as a proportion of total sales. The average for the network of cargo dues is 38 per cent of total revenue, ranging from 10 per cent to 63 per cent. The high number illustrates the benefit from comparisons as well as the need to gather more detailed information by cargo mode. For example, this high number might reflect high value cargo on smaller vessels. It might also reflect a different pricing structure from other ports, an outlier.

The statistical values for this revenue heading are stable for the period under review. They are levied on the volume of cargo landed or loaded by cargo type. Port dues in general are usually a small part of the total transit cost of cargo through a port. This is a high-level proxy for revenue and volume performance in terms of its significance for the port and its movement in proportion to trade growth. Revenue is reported as a total value in this round of data collection; however,

reporting by cargo mode in the future will facilitate average mode price comparisons for port authorities.

Rent/revenue. As the term "landlord port" suggests, one of its functions is to provide real estate at the waterside for operations and back-up space for storage and ancillary activities. While berth-related space is a common demand of all ports, the role of port authorities in wider estate management varies. There are global examples of ports with significant land portfolios where the resultant rental income can be greater than trade-related revenue. In the reported data, the relative share of rent to total sales is stable over time, suggesting that the ports in the network do not have substantial property portfolios beyond direct port requirements. Equally, the proportion, an average of 10 per cent, is consistent with experience from other studies.

The maximum value of 57 per cent illustrates the potential for ports to generate significant income other than port dues or port service income. In this case, the income is generated from a combination of turnover levies, rents and concession fees payable by terminal operators to a port authority. The low value is an example of a small port with no land bank, servicing passenger ferry operations.

Fees/revenue. There is a growing trend in ports to allow private service providers to work in a port based on a licensing arrangement or concession. In both cases, there will be an income stream to a port authority. The high value of 23 per cent may be indicative of this growing revenue source. This trend is also a proxy measure for the advancing role of the private sector in the industry. Concessions are a growing trend in the container-handling industry.

The rationale for licensing arrangements is that a port will regulate providers as long as they comply with certain by-laws and instructions. There may be many suppliers for a single service type.

Concessions relate to a single provider of a service, generally cargo handling, at a specific location in a port. This may be a dedicated terminal. Therefore, concessions combine the features of land management and regulation. Concessions are likely to be issued as part of a competitive tendering process for a fixed term. This revenue may be recorded by some ports as rent. However, both revenue lines are consistent across the period; therefore, there is no significant change in t ends over the period.

Training/wages. This is the first of the two labour cost measures included. It is a non-standard performance indicator in port management studies but it is entirely relevant to the networks of the Port Management Programme and to the donors. It is expressed as a

proportion of the cost of wages for the port authority rather than as a proportion of sales. This will take account of differences in employment and revenue profiles, given that some ports handle significant amounts of cargo. It is therefore, a better basis for port-to-port comparisons. The measure is consistently low at just below 1 per cent across the network where Workshop discussions suggested budget targets of 3 per cent.

Wages/revenue. There is a current trend towards reducing employment in port authorities. In some cases, labour is replaced by private operators. This generally results in a net reduction. Wage levels are likely to be different across the countries in the network, suggesting two reasons for varied levels of cost: the numbers of employees and the average rate of pay. While there is a range of numbers, the average for each year is a high number in terms of financial performance (table 2). There are two explanations for this: First, labour costs are less because of

Table 2. Full scorecard

Port entity only	Indicators (23)	N value (p x t)	Mean	Minimum	Maximum
Finance	EBITDA/revenue (operating margin)	44	38%	-75%	83%
	Vessel dues/revenue	42	18%	1%	32%
	Cargo dues/revenue	41	38%	10%	63%
	Rents/revenue	39	10%	1%	57%
	Labour/revenue	38	23%	7%	63%
	Fees and the like/revenue	30	6%	0.1%	23%
Human resources	Tons/employee	34	38 435	4 202	204 447
	Revenue/employee	38	$179 971	$138	$1 039 739
	EBITDA/ employee	33	$93 556	-$16 696	$555 835
	Labour cost/ employee	24	$23 863	$4 489	$93 589
	Training costs/wages	33	0.95%	0.03%	4.60%
Vessel operations	Average waiting time (hours)	62	17	0	89
	Average overall vessel length per vessel (m)	55	136	44	289
	Average draft per vessel (m)	55	8	2	22
	Average gross tonnage per vessel	66	14 260	552	43 216
Cargo operations	Average tonnage per arrival – all	41	4 739	201	20 510
	Tons per working hour, dry or solid bulk	28	116	20	350
	Box per hour, containers	46	18	8	35
	Twenty-foot equivalent unit dwell time (days)	29	7	3	18
	Tons per hour, liquid bulk	16	42	17	63
	Tons per hectare – all	41	173 986	75 772	425 800
	Tons per berth metre – all	41	3 920	890	7 439
World development indicator data	Quality of port infrastructure	Year 2014	3.8	2.7	5.2
	Liner shipping connectivity index		21.9	11.8	33.6
	Burden of customs procedures		3.5	1.8	4.4
	Female participation rate		21%	6%	44%

Note: See glossary for definitions and text for indicator calculations

modernization and reform; second, the average rate of pay in the economy is low. The returns show average wages ranging from $4,489 to $93,589, with the mean nearer the lower number. This suggests that the low pay argument has some merit. Port managers at future workshops might consider comparing their average port wages with their own average national wage levels.

3.3 Human resources

Two key numbers in terms of labour performance data were discussed in the financial performance section above. They pointed to low levels of training expenditure and the possibility of low wages. However, these measures lack context. For example, training spend may include spending on activities external to the port authority. Internal training might not be counted in the returns. Furthermore, the type and level of training, as well as the type and level of the staff member receiving the training, have an impact on the relative spending. To overcome this difficult , future workshops may choose to consider more detailed data collection by employment group. This will include a gender profile per g oup (annex I).

Low wages may be the obvious conclusion in a benchmarking report. However, account should be taken of local context and staff profile. With regard to context, it is relatively easy to convert the average wage rate to a factor of the local average wage as published by national statistics units. Stratifying staff into categories and/or levels is more problematic.

PPS 1 considered the inclusion of useful methods of measuring work stoppages in terms of frequency and duration, and labour data by employee grouping. Participants agreed to focus on the labour-related financial measures and proxies for labour productivity.

From a performance perspective, the connection between berth and cargo productivity measures and lost time caused by stoppages was often highlighted by port users. External perceptions and customer satisfaction surveys most likely also reflected labour performance that included lost time as a major component. Capturing the data was problematic, as the Workshop discussions revealed. Work stoppage was defined in terms of a dispute. It was agreed that time lost in maintenance work or breakdowns should not be included in the data. There was a need to record local data in a consistent manner.

The tons-per-employee measures reflected the differences across the network ports in terms of scale and cargo mode mix. For smaller ports with a high volume of ferry operations, the relative number of tons was low but the number of passengers was high. For operations that are not labour intensive for a port authority such as lift-on, lift-off (LoLo) containers, the productivity levels in cargo tons were much higher. Productivity per employee as measured by profit and sales levels showed an equally varied set of returns. Again, port size and cargo mix were factors to be considered for both indicators.

In a more general sense, the performance outcomes for female participation in the workforce interesting. They range from 6 per cent to 44 per cent with a mean value of 21 per cent for the year 2014. The next round of data collection will include employee information by work category, which will add greater nuance to this indicator. This will be a useful indicator over time.

3.4 Vessel operations

This is the category of performance that can be found regularly in port-specific case studies. Efficiency concerns are focused on minimizing the time in port and providing infrastructure that is adequate for the vessel type and size.

Gathering data for vessel productivity is generally done at the port-wide level. Therefore, data on vessel operations by type remains outside the scope of this round of data collection. As vessels become more specialized and different in their operational parameters, it makes sense to gather information in a segmented fashion. For example, container vessels differ from dry bulk vessels in terms of physical dimensions and time to work in port. Comparing them becomes problematic.

The data returned support the argument with each measure having a wide range. Some ports in the survey engaging in significant ferry operations use smaller vessels on regular visits. The vessel working time is short, as it can be measured in hours. There are other ports in the survey that have significant dry and liquid bulk vessels. These tend to be significantly larger; the working time may be measured in days and sometimes weeks.

With regard to physical dimensions, the low length overall of 44 m is typical of a small passenger ferry vessel, while the high value of 289 m is more typical

of a dry bulk vessel that will require substantial time to work. Gross tonnage data show a similar pattern in table 2 with an average of 14,260 gross tons, ranging from a low of 552 gross tons to 43,216 gross tons.

Vessel draft is intended to gather comparative data and to chart this against the dredged capacity of ports. As a moving value over time, it charts the critical demands on infrastructure. The data set will provide information on the port capacity to service larger vessels. It will also have information on how near to that capacity the average vessel for the reported time period is. At a later stage, the project can link such infrastructural demands to investment supply. It also provides an explanation of poor port performance when such investments do not materialize in a timely manner.

The range is also significant with regard to waiting time. There are other plausible explanations for this. For example, a port with fewer berths may have disproportionally longer waiting times. A port with larger vessels to work, such as in dry bulk, may have a higher berth occupancy value. This in turn may lead to delays in getting to a berth to work.

Vessel productivity is a critical competitive factor for ports, as delays to port users result in in demurrage payments. Charting efficiency values in this category highlights differences in performance and the limitations of port infrastructure.

Participants in PPS 1 acknowledged the challenges in the vessel data and agreed to proceed with readily available information from all the Network members. Extending the data profile in future rounds is a substantive topic for future workshops. At PPS 2, the data requirements for vessel port times were extended to include down or idle time, time on berth and gross working time.

3.5　Cargo operations

There is an element of interaction between all the categories in the operations scorecard. For example, long working times may reflect vessel inefficiencies as much as cargo-handling inadequacies. It was agreed at PPS 1 that information would be gathered on the basis of cargo modes. For the larger modes of containers, dry bulk and liquid bulk, there is a basis for quality benchmarks across the network.

Future rounds will expand the data for other modes such as break bulk, ferry and passenger operations and cruise vessels

The approach involves a comparison of efficiency indicators in terms of time and land usage. For time, the focus is on handling rates per hour. For land, the focus is on throughput in terms of land available for processing and the length of berths available for handling.

The headline values for tons worked at the port per vessel are consistent with the vessel size values above. The best known productivity numbers refer to containers; the handling rates expressed in terms of boxes per hour range from 8 to 35. The higher number appears to be a reasonable performance level for the reporting ports; however, it raises new questions for discussion, such as the number of cranes used.

The time value for containers is also very interesting in these data. Dwell time, the average time a container remains in the port before movement from the yard, is often expressed as an ideal target value in low single figu es. In the case of large specialized container operations in the leading 50 terminals, such efficiencies are achieved based on investment and economies of scale. Nonetheless the average number in the data is reasonable for the reporting ports with the minimum value among the best globally.

For ports in the high range above seven days, the challenge is to understand the limiting factors causing the delays. The reasons can often be beyond the control of the port authority with inefficiencies in the goods clearance process, or port users, or information exchange driving the poor values. It can also result from poor hinterland road and rail connections. For example, restrictions on travel times for ports in a city can have a dramatic and rapid impact on dwell time numbers. Among network members at PPS 1, port congestion caused by constraints on road access was obvious in Manila.

The data for dry bulk handling rates is interesting, pointing to different technological scenarios that explain the high maximum value. Some products – salt, for example – can be handled at high rates using pumping equipment or conveyors. They differ from handling rates using grab cranes.

The range in liquid bulk is less dramatic, as the process is similar internationally. However there may be differences by product and in the quality of the handling equipment.

Table 3 Illustrative case study

Port entity only	Indicators (23)	N value (p x t)	Mean	Minimum	Maximum	Port X 2010	2011	2012	2013	2014
Finance	EBITDA/revenue (operating margin)	44	38%	-75%	83%	49%	58%	60%	59%	
	Vessel dues/revenue	42	18%	1%	32%	16%	16%	14%	15%	15%
	Cargo dues/revenue	41	38%	10%	63%	40%	40%	42%	42%	59%
	Rents/revenue	39	10%	1%	57%	1%	1%	1%	1%	7%
	Labour/revenue	38	23%	7%	63%	19%	18%	18%		10%
	Fees and the like/revenue	30	6%	0.1%	23%	0.1%	0.4%	0.4%	0.3%	1.0%
Human resources	Tons/employee	34	38 435	4 202	204 447	20 174	21 683	21 809	21 873	7 074
	Revenue/employee	38	$179 971	$138	$1 039 739	$101 599	$113 418	$128 492	$138 730	$17 963
	EBITDA/ employee	33	$93 556	-$16 696	$555 835	$50 265	$65 587	$76 965	$81 464	
	Labour cost/ employee	24	$23 863	$4 489	$93 589	$19 198	$20 962	$23 580		
	Training costs/wages	33	0.95%	0.03%	4.60%	0.2%	0.2%	0.2%	1.0%	
Vessel operations	Average waiting time (hours)	62	17	0	89	0	0	0	0	4
	Average overall vessel length per vessel (m)	55	136	44	289					67
	Average draft per vessel (m)	55	8	2	22			3	3	3
	Average gross tonnage per vessel	66	14 260	552	43 216	2 212	2 066	2 555	2 710	2 219
Cargo operations	Average tonnage per arrival – all	41	4 739	201	20 510	335	382	400	412	
	Tons per working hour, dry or solid bulk	28	116	20	350	24	24	24	24	20
	Box per hour, containers	46	18	8	35	20	20	20	20	25
	Twenty-foot equivalent unit dwell time (days)	29	7	3	18	6	6	6	10	11
	Tons per hour, liquid bulk	16	42	17	63	40	40	40	40	
	Tons per hectare – all	41	173 986	75 772	425 800	221 914	233 865	239 895	240 604	
	Tons per berth metre – all	41	3 920	890	7 439	6 264	6 601	6 771	6 791	
World development indicator data	Quality of port infrastructure	Year 2014	3.8	2.7	5.2	2.8	3.0	3.3	3.4	3.5
	Liner shipping connectivity index		21.9	11.8	33.6	15.2	18.6	17.2	18.1	20.3
	Burden of customs procedures		3.5	1.8	4.4	3.0	3.0	3.2	3.2	3.5
	Female participation rate		21%	6%	44%					11%

It is difficult to assess a target value for land usage. The values in the returns reflect the varied historical development of harbours across three continents. Many are constrained by city environs; this trend is certainly obvious in developed country ports. Therefore, charting changes in tons per hectare over time provides an indicator of efficient land use perhaps driven by external demands to limit the port footprint. Equally, the range of values from a low of 75,772 tons per hectare to a high of 425,800 tons per hectare is indicative of varied physical port configurations. With an average in the middle of the range it suggests a normal distribution of values for throughput per hectare.

Handling rates per metre of berth are linked directly to vessel efficiencies. The average rate of 3,920 tons per metre is a useful indicator. It can be complimented by measures that provide information on berth occupancy and waiting time. Cargo mode is also a valuable indicator, provided ports can specify how many metres are dedicated to each mode. At PPS 1, participants agreed that such calculations were not typical and that the data was not readily available. At PPS 2, participants adopted a proposal to add berth occupancy to the data collection requirements in the next round of data collection.

3.6 Port performance scorecard: An illustrative case

This case, taken from the data set, provides an insight into data collection issues and the output available to port managers (table 3). Some vessel measures were difficult to compile for this port. They are not critical to their operation and therefore, they are not currently collected. Both indicators, length overall of a vessel and draft, will be modified in the next round of data collection to reflect this, as it was a common issue among PPS 2 participants. With regard to financial measures, there are two gaps reflecting timing and sensitivity issues. For example, for some ports, releasing such information requires formal approval as they are not typically shown in published accounts. In terms of the benchmarks, it is worth examining the scorecard to understand the performance of the port over the period.

The financial scores appear positive in comparison with other ports in the network. The operating margin is considerably higher than the network average. It suggests a profitable operation with a cash-generating

capacity to self-finance infrastructure development. The port dues mix is different from the mean values, but when combined, it is in the same range. The income from property-related charges is low and suggests that this port entity works to a full-service model. Labour costs are competitive for a modern port, at 19 per cent of total revenue, declining over the period.

One of the difficulties with the labour data is drawing conclusions other than the straight comparison with the network average. The numbers are at or below the average for all categories. This might suggest a high labour force number on lower-than-average pay. In the next round of data collection, averages by work category and a comparison with the country average earnings statistics will provide helpful information.

There are gaps in the vessel returns for this port. However it can be concluded that the average ship size is small, draft is low and waiting time is not a problem. This suggests regular small vessels and no problems with berth availability. This is mirrored in the cargo returns with a low average per ship. Berth utilization appears to be good, as there is a high turnover of cargo in terms of hectares and metres per berth. This is consistent with the zero waiting time for vessels.

With regard to cargo-handling productivity, the port scorecard is at the bottom of the range for dry-bulk-handling rates. This may be because of the product or the handling equipment used for relatively small loads. The port compares well against the network for box-handling rates and dwell times. For liquid bulk cargo, the handling rate is consistent with the network average.

The ports studied to date are similar in terms of port type, for example, landlord and size. However, as the network grows, it will be possible to differentiate the network average values based on size and functional model. This case report suggests that the port scale is such that investment in higher turnover-handling equipment may not be justified comme cially.

3.7 External measures

Scorecard indicators provide a reasonable assessment of the economic context and user perception of ports. The measures are prepared using country units to reflect an assessment of the performance of a leading port, perhaps based in a capital city, rather than all the ports in the network.

Three values are featured in the scorecard:

- The quality of port infrastructure is an index value compiled by the World Economic Forum. The scale runs from 1 to 7. The higher the score, the better developed and efficien the port when compared with international standards. For the reporting ports, the values are in the mid-range of this index;

- The liner shipping connectivity index is compiled by UNCTAD. It is an index of values based on the number of connections a port has to offer. The base year is 2004, where the port with the highest level of connectivity was given a score of 100. Each year the index is calculated against this benchmark value. In the reporting ports, the values are relatively low. This reflects their relative size and their position in relation to global maritime networks. Therefore, the ports are more likely to be feeder or regional hubs in nature. It is an interesting point of reference because it also highlights the differences between major international hubs and evolving ports in an economic development context;

- The burden of customs procedures is another World Economic Forum indicator ranging from 1 to 7. The index reflects different levels of efficiency as judged by the expert survey participants. Again the values are in the mid-range of the scale. It is interesting that the two World Economic Forum values are highly correlated across all the countries in the Port Management Programme networks, not just those that are immediate participants in the port performance scorecard project. There is a strong likelihood that survey participants have a common view on port efficiency based on experience with customs, and vice versa.

Participants in PPS 2 adopted a proposal to examine the relationship between dwell times and reported times for customs clearance. This ratio will provide a measure of the relative burden of time that the port can control, which in turn affects transit cost and congestion in modern ports.

Another valuable resource for port managers seeking context variables for benchmarking or other research tasks can be found in UNCTAD online data tools such as UNCTADStat (unctadstat.unctad.org; accessed 28 April 2016).

3.8 Summary of project findings

The findings and recommendations based on the project work are listed below. The findings include project experience and the key scorecard data.

- Scorecard indicators are a valuable strategic planning tool for port managers. The contact points in each port are in charge of the scorecard content;

- A key theme of the project is to respond to participant port feedback on developing future opportunities to cooperate across the port management networks. The idea of knowledge sharing was discussed at a number of training sessions and coordination meetings. There are online communication tools for this on the training platform; however, this is a specific area requiring a structured dialogue;

- The data collection is based on an annual survey. One suggestion is that the survey could be divided into semi-annual or quarterly surveys, each bearing a specific strategic theme;

- Developments in port management worldwide and across the networks of the Port Management Programme clearly reflect an increasing demand for performance assessment. Often this is narrowly focused on terminal efficiency studies. Recently, however, there has been a growing interest in port authority measures of efficiency and effectiveness;

- Port managers should report on how they are managing environmental issues. There are two types of performance measures in this operations dimension: measures that indicate the existence of recognized international management protocols, which can be captured in a simple survey return, and measures of the relative emission levels of different pollutants in air, water and soil, and of the impact of noise on local communities. This is costly and technically difficult

- The technical growth of the scorecard to the reported 22 benchmarks (25 in the next round of data collection) is based on readily available port information;

- While UNCTAD resources supply expertise and facilitation skills, the network contact points are in charge of generating these unique data.

In turn, they require a mandate from senior management to commit time and share data with the port performance scorecard network;

- As the benchmarking scale, membership and tools evolve, the need for a management, steering and communications structure increases. This will be necessary for the process to be sustainable;

- The reported data for this round included port authority information only. A number of terminal operators also submitted data. The scorecard has potential for significant growth; an additional scorecard is also a possibility;

- An interesting point included in the feedback to the project team is that such surveys, which are regular and fixed by nature, are not the only way to develop a port community. There is also an option to use the survey tools and the Port Management Programme networks to consider topics of interest across the ports on a one-off basis. For example, a port may be interested in comparing customs regimes and performance in similar contexts. A survey can be developed and shared with all members. There are many such comparative projects that port managers can gain from. Another example for consideration could be typical construction costs per unit of infrastructure, such as linear metres of berth;

- The technology used to collect the data is at the embryonic stage, similarly to other projects that focus primarily on the indicators and access to the raw data. The development and sophistication of the tools for the port performance scorecard project will be reviewed by the UNCTAD team for implementation in future rounds of data collection;

- A number of critical performance measures are highlighted below. They suggest that on average the ports in the port performance scorecard network have many data elements in common and that a number of the indicators represent strong performance in the context of their size and service profile.

  o The average container dwell time is seven days;

  o The average operating margin is 38 per cent;

  o The ratio of cargo dues to vessel dues is on average 2:1;

  o The average waiting time for a vessel to berth is 17 hours;

  o The average yearly wage of the employees considered in the survey is $23,863;

  o Average training expenditure is less than 1 per cent of total payroll costs;

  o No port authorities are privatized;

  o State contributions to long-term public interest assets such as breakwaters are common.

In this round of data collection, participants in PPS 1 adopted a scorecard approach and selected measures that are readily available from most ports at a minimum collection cost. From the 36 measures discussed at the workshop, a final 23 are reported here. There will be 25 measures in the next round of data collection. The remaining measures for smaller cargo modes and balance sheet values will be included in later rounds. Additional measures for market performance and environmental management will follow. Measures concerning accidents and safety, and detailed work on labour downtime, are on the agenda.

The data returns in this data collection round are sufficient in scale and validity to justify the scorecards and the analyses. It is a strong foundation that needs to be consolidated over time with additional data.

ANNEX I – SURVEY QUESTIONS 2015

Port Governance, Competition, Ownership, and Economic Regulation	
What is the name of the Port Authority?	**For coding and identification purpose**
When was the Port Authority in its current form established?	To identify any change on governance structures
What is the current governing legislation for the Port Authority?	To identify national and/or local ports policy
What year was this legislation passed?	To identify changes in policy
What is the name of the port regulator (if any)?	To establish if an economic regulatory structure is in place
Is the port authority controlled privately or by central, regional or municipal government?	To identify the ownership structure for the Port Authority, private or public. If public then identify the level of government involved.
Is the Port Authority classified as a Landlord, Tool, or full service (private or public) organisation	This is often a policy definition.
Is Port authority a corporate entity?	To identify the governance regime and degree of commercialisation of the Port Authority
Where the Port authority is privatised or part privatised what is the private share?	This will identify any private control of the Port Authority.
Does the Port Authority directly provide stevedoring/cargo-handling services?	This is to identify any operating role for the Port Authority
Are there two or more competing stevedoring/cargo-handling providers?	To establish levels of competition intra-port
On an equity basis what proportion of the stevedoring/cargo-handling entities is owned by the port authority or another public body?	This will identify any joint venture (or equivalent) arrangements in place
Is public sector approval required for price adjustments for port dues, stevedoring, or other port services?	Where government (at any level) approval is required for price setting
Does the public sector fund investments in infrastructure or superstructure?	To identify policy approaches to port development spending across terminal infrastructure and superstructure, plus marine access infrastructure.
Is public sector/political approval required for major port projects (outside of standard approval process for infrastructure planning]	To identify the level of political control or veto over port generated development plans

Port Governance, Competition, Ownership, and Economic Regulation	
What is the name of the Port Authority?	**For coding and identification purpose**
Additions post-Ciawi Workshop September 2015	
Are geared vessels a significant feature at your port?	To better view any port crane measures. Significant can be mo e than 5% of all handling activity.
What is maximum vessel draft for port?	To provide context for capacity measures.
Is self-pilotage allowed at your port?	To identify any reform measures for regular visitors to the port
Are towage services provided by the private or the public sector; or on a joint venture basis?	To identify the regime for market regulation for port services
Does your port have an environmental management system in place? *Please describe in terms of compliance with international standards*	To compare environmental management regimes
Finance data	
Total revenue	This is the total revenue for port dues and port related services provided to third parties. Excluded are any value added taxes.
Operating profit before interest, tax and depreciation (EBITDA)	This is a conventional measure known as earnings before interest, tax, depreciation, and amortisation. This is a useful comparative measure as it excludes cost items that can vary in policy approaches cross nationally.
Port dues – vessels	This is the total figu e earned by the port authority on revenue headings associated with servicing vessels. They are various local charges against all seagoing vessels entering a harbour (or at anchor), to cover maintenance of channel depths, buoys, lights, etc. They are typically referred to as tonnage dues (wharfage) and charged on the vessel size e.g. GT (gross tonnage). They relate to the use of assets.
Port dues – cargo	This is the total figu e earned by the port authority on revenue headings associated with provision of cargo-handling infrastructure/facilities. Charges are raised typically based on cargo categorisation using an international convention such as Standard International Trade Classification (Rev.4). The dues relate to the use of assets.
Port services revenue	This is the revenue received for the provision of pilotage, towage, and crane services to port users by a port authority. The value is nil if the service is not provided by the port authority.
Property portfolio income	In many port environments there can be substantial income earned from the wider port estate. (see Ciawi memo 11b)
Concession fees	This is a growing source of income where the private sector is involved in cargo handling, and other port services.
Labour costs	This relates to direct port authority employees.

Vessel operations	
Number of arrivals for period.	This is the total vessel arrivals, excluding those smaller vessels that move within the port or to and from local destinations such as fishing and small local ferry operations.
Average waiting time for berth *(Hours plus part of as a decimal)*	This is calculated from the time of first eporting at the port to the time of completion of the berthing process before working.
Average time on berth *(Hours plus part of as a decimal)*	This is calculated from the time of completing the berthing process to the time of completion of the un-berthing process on final departu e.
Average working time on berth *(Hours plus part of as a decimal)*	This is calculated from the time of starting the unloading process to the time of completion of the loading process before departure.
Down/idle time	This is calculated as the total time work on the vessel actually comes to a stop. Future rounds will incorporate a reason code e.g. breakdown.
Number of pilots used (in/out = 2)	The number of vessel operations that require and use a pilot. An arrival, a shift if necessary, and a departure are separate operations.
Average gross tonnage (GT) *It is a volumetric measurement and replaced the GRT measure, thus standardising measurement systems.*	The gross tonnage of a vessel is recorded on the ships tonnage certificate in accordance with the measurement rules of the International Convention on Tonnage Measurement of Ships adopted by the IMO in 1969 and fully implemented in 1982.
Additions post-Ciawi Workshop September 2015	
Berth occupancy data	To be defined in consultation with port and national contact points or next data round
Vessel type	A schedule of vessel types, comparable with cargo mode, is to be drafted for consultation with port and national contact points.

Cargo operations	
Total cargo handled for period *(data for RoRo and break bulk will be collected in the next round)*	This is a total number of units handled in the period. ALL cargo / LoLo / Liquid Bulk / Dry Bulk / RoRo / Break bulk Tons / TEU / Tons / Tons / Units / Tons
Average number of cranes per vessel on quay	This is a simple measure based on the number of working cranes allocated to a vessel loading or unloading. The separate numbers reflect ports in the Network where cargo is also handled by on board cranes.
Average movement per hour	Average movement per hour on and off the vessel - (tons for bulks, Box for LoLo)
Average yard dwell time per box *FOR LOLO ONLY*	The measure simply calculates the average time a container remains in the yard in the port.

Port cargo throughput capacity (Tons)	This is the volume capacity of the port and will be the lower of yard, berth or gate volume capacity
Total hectares	A limiting factor in many ports is the availability of land for direct cargo handling. This measure is intended to capture the extent of land allocations to port operations.
Total berth metres	A limiting factor for many ports is the availability of berth space for ship and cargo handling. This measure is intended to capture the extent of berth metres.
Total berth numbers	A further measure of berth availability or otherwise is the number of berths.
Number of cargo-handling operators	From this a measure of intra port competitiveness is possible

Human resource data	
Average employed by PA for period	Full time equivalents (FTE) are the relevant measure for employees, especially if there is a strong element of part-time workers in the port authority.
Number of labour stoppages by PA employees	Work stoppages are often a critical factor in explaining poor performance.
Average duration of PA labour stoppages	The number of days lost due to work stoppages by PA employees is a useful comparator.
What percentage of Port Authority employees are female?	Gender distributions can vary significantl .
Training spend as proportion of total PA wages and salaries	The total costs associated with training in proportion to the workforce labour costs
What is the dock worker hiring regime?	This is intended to capture the arrangements for dockworkers such as permanent, casual, and/or labour pool. Part b of the survey distinguishes between private and public employers

Additions post-Ciawi Workshop September 2015			
Employment Data – please complete the table			
Employment status	Job category		
	Management, administration, corporate	Operations, technical, marine and engineering	Cargo handling (stevedoring, cargo operations)
Male: Permanent			
Male: Temporary			
Male: Contract/other			
Female: Permanent			
Female: Temporary			
Female: Contract/other			

Note: This questionnaire is reproduced as issued in 2015.

ANNEX II – WORKSHOP DELIBERATIONS

The annual meeting process is a critical element of the port performance scorecard project, providing a means to engage across borders and language networks, as well as a formal structure to debate and agree on the technical aspects of the port performance scorecard. This section is an overview of the core dynamics of these workshops. It covers programme development, the literature pertaining to port economics and other relevant performance projects, and public indicators currently produced by international institutions. This material will continue to be relevant in future workshops and will be used as an aid for new entrants to the process. There are also a range of other documents held on the port performance scorecard section of the UNCTAD Port Management Programme platform to which participants can refer.

Project origins

The port performance scorecard programme can trace its origins to structured reviews of the English-speaking Port Management Programme networks, where the goal of producing port performance measures was included in the reviewer recommendations.

Port efficiency indicators were proposed in the report on training cycle 1 to provide a stronger monitoring framework to measure results and outcomes.

In the report on cycle 2, the task became a joint undertaking by members of the Port Management Programme networks:

> In order to better measure the effectiveness of the Programme, UNCTAD/TrainForTrade and the member port communities will exchange information on a set of indicators necessary for measuring port efficienc . The indicators have yet to be determined on a consensus basis due to business sensitivities in certain areas. Port efficienc Indicators will provide a solid measurement for the programme, as well as keeping track of the progress in the port communities.

The action plan of the port performance scorecard project stems from the decisions taken at the Belfast Coordination Meeting. The meeting specified two essential requirements.

- The ports of the network should commit to the project as owners of the data, given that the role of UNCTAD is to facilitate the cooperative process;

2013 Belfast Coordination Meeting with Supachai Panichpakdi, then Secretary-General of UNCTAD, and Joe Costello, TD, Irish Minister of State for Trade and Development.

Belfast Coordination Meeting 2013

Based on the finding of a recent pilot study on port performance measurement, participants agreed that gaining access to raw data depended on who collected and controlled the information. Because of variations in data definitions comparing ports proved to be problematic without some form of port categorization. Definin the unit of analysis was thus a problem.

Participants in the coordination meeting concluded that the port performance scorecard project was essential for participating ports and was consistent with the recommendations made by Irish Aid for a monitoring process. It was a valuable tool for policymakers and international institutions alike. Representatives of senior management, including from new member countries, agreed that the process would benefi from the appointment of local managers who would participate in future port performance workshops. The balanced scorecard model, as applied to port business processes, was the best approach to the design and implementation of performance benchmarks.

- Each port should designate a senior resource as a contact point to lead this initiative and contribute to the port performance scorecard development process.

While the proposed indicators are not intended to be used as a means to measure the effectiveness of traiing programmes, they add to the knowledge base of donors and participants and provide benchmarks to chart relative performance cross-nationally and they monitor improved performance over time.

The Belfast Coordination Meeting rightly emphasized the need for a clear structure to ensure regular delivery of port performance scorecard reports. The core of such a structure is the chief executive officer/di ector from each of the Port Management Programme networks across all the language groupings, providing the necessary leadership. This is matched by high-level managers responsible for strategic planning and performance measurement, who commit themselves to achieving the project goals. UNCTAD, in this context, will provide expertise and facilitation support. The TrainForTrade Port Management Programme can support such a process, but it will only prosper when the network members agree to a shared structure.

There are two main project components: first, the networking- and knowledge-sharing component; second, the measurement approach. The first is achieved by hosting an annual workshop by a member country for port contact points who will contribute to the indicator development process. In this regard, the first workshop (PPS 1), hosted by the Philippines Port Authority, was held in Manila in October 2014, where the indicator definitions, as set out in the workshop manual and memorandum, were adopted by participants (learn.unctad.org/; accessed 27 April 2016).

The second workshop (PPS 2) was held in Ciawi, Indonesia, by the Indonesian Port Corporation at the Corporate University. Further progress was made on indicator selection and definition across a greater range

First International Port Performance Scorecard Workshop, Manila, October 2014

Port entities in the port performance scorecard network, 2015				
Number	Country	Port	Data	New entrants
1	Angola	Port of Luanda	✓	
2	Benin	Port de Cotonou	✓	
3	Dominican Republic	Haina Terminal	✓	
5	Ghana	Takoradi	✓	
4	Ghana	Tema	✓	
6	Indonesia	Belawan	✓	
13	Indonesia	Bitung		✓
12	Indonesia	Cilacap (Tanjung Intan)		✓
9	Indonesia	Cirebon		✓
7	Indonesia	Dumai	✓	
14	Indonesia	Makassar		✓
10	Indonesia	Panjang	✓	
11	Indonesia	Tanjung Perak		✓
8	Indonesia	Tanjung Priok	✓	
15	Namibia	Walvis Bay	✓	
16	Peru	Callao	✓	
17	Peru	General San Martin	✓	
18	Peru	Paita	✓	
26	Philippines	Batangas		✓
23	Philippines	Cagayan de Oro	✓	
27	Philippines	Cebu	✓	
24	Philippines	Davao	✓	
19	Philippines	General Santos	✓	
21	Philippines	Iloila	✓	
20	Philippines	Manila	✓	
22	Philippines	Tagbilaran		✓
25	Philippines	Zamboanga	✓	
28	United Republic of Tanzania	Dar-es-Salaam	✓	

Note: This listing was agreed by PP2 participants in 2015.

of ports and countries. At the close of the workshop, 9 countries covering 28 ports (21 active; 7 in transition) had joined the project: Angola, Benin, the Dominican Republic, Ghana, Indonesia, Namibia, Peru, the Philippines and the United Republic of Tanzania. There are ports from the French, English, Portuguese and Spanish-speaking networks of the Port Management Programme. A listing of the membership in 2015 is provided in the following table:

The measurement approach was endorsed at the Belfast Coordination Meeting. The strategy is to adapt the balanced scorecard management tool to produce a set of benchmarks for efficiency and governance across the dimensions of finance, operations, human resources and marketing. This underwrites the technical strategy designed to add value to port-management planning processes.

Second International Port Performance Scorecard Workshop, Ciawi, Indonesia, 29 September–2 October 2015

While the workshops are focused on organization and indicator definition, the work is done in the context of the latest literature and best practice for port management, port economics and the value of publicly available country-level measures. The following sections summarize the material discussed and provide a continuing basis for dialogue among the port contact points.

The literature review also positions the balanced scorecard strategy in terms of economic approaches and industry-led approaches.

Economic objectives

Definitions of port performance depend on the economic objectives of the policymakers and the choices they make from the many variables. Control over these variables will be measured as the key performance indicators for port management.[20] In a study of a two-cargo port, Talley identified a number of choice variables to be considered by management to maximize performance. There are two key points: first, the economic objective must be clearly stated by policymakers; second, there are choice variables for port managers and therefore, there should also be choice variables for policymakers. The effective

management of these variables will determine the success of policy decisions.

For example, although Talley assumes pricing is within the purview of port management, pricing is controlled directly by the State in many developing countries. Bichou also discusses port performance and refers to its assessment in the context of trade facilitation. This presents conceptual and analytical difficulties, given the multitude of variables, their interaction and the need to choose the correct data.[21] The assumption that there is one port model poses a challenge to any attempt at performance measurement.

A series of World Bank reports examines trade facilitation in some detail. One study argues that in the literature "it has been found that poorly performing ports can strongly reduce trade volumes and may have a greater dampening effect on trade for small less-developed countries than many other trade frictions…..Thus we may expect that improvement of port infrastructure affects positively the trade flows"[22] Another economic study showed that privatization

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[20] WK Talley, 2006, An economic theory of the port, *Research in Transportation Economics*, 16:43–65.

[21] K Bichou, 2006, Review of port performance approaches and a supply chain framework to port performance benchmarking, *Research in Transportation Economics,* 17:567–598.

[22] D Njinkeu, BP Fosso and JS Wilson, 2008, Expanding trade within Africa: The impact of trade facilitation. Policy Research Working Paper 4790, World Bank Development Research Group

has a positive impact on port efficienc . However, this conclusion is qualified in the context of a port functional model separating the landlord, regulator and operating roles.[23] Privatization arguably has the best results when port policy establishes port authorities as landlords and regulators, leaving the private sector to provide port services, especially in cargo handling.[24]

This project makes the simple assumption that port performance indicators should be based on cargo mode as the base unit. These in turn can be combined into port-level, regional and national indicators, depending on data user requirements. External data sources tend to focus on the national level, and from the outside in, while this project is based on an inside-out approach. Therefore, the owners of the data, port authorities and port service providers must be the drivers of the process.

Other performance assessment projects

A monograph produced by UNCTAD and the International Association of Ports and Harbours[25] highlights the challenges faced by port performance projects. Many of these challenges remain true today. A recent contribution by the World Bank states that "in most cases, it is not possible to determine benchmarks which would be applicable for any port, and that all expressions of port performance do not address the same requirements". Furthermore, "port performance should be assessed for an homogenous set of berths or a terminal".[26] Maritime economists also conclude that "any port comparison can only be valid and meaningful if a port's efficienc is compared with a similar port".[27] The most significan advance in constructing a comparative port data set is clearly the Port Performance Indicators: Selection and Measurement (PPRISM) research project [28] funded by the European Union, led by the European Sea Ports Organization and completed in 2010. The outcome of the project was a dashboard of performance indicators.

The PPRISM project also highlighted issues of relevance to this initiative. In sum, any such project requires trust among the stakeholders to underwrite a data-sharing programme and minimize transaction costs by relying on standard data generated by ports. A demonstrable value proposition is also necessary. Some progress has been made among European Union countries towards the establishment of a European ports observatory.[29] This is made possible in no small measure by institutional funding for research and collaboration and by a European-Union-wide legislative context allowing statistical definition and collection

Another project funded by the European Union is currently involved in the next stage of the observatory project by developing tools for data collection and dissemination across participating European Union ports. The PORTOPIA port industry performance platform, funded under the seventh Framework Programme for Research and Technological Development, commenced in 2013 with a planned duration of four years.[30] The Programme is funded by the European Union (70 per cent), the shipping industry and an information and communications technology provider. The objective is a cloud-based technological solution with a user-friendly interface managed by an entity that has the trust of port industry stakeholders. Again progress is underwritten by investment, industry engagement and an institutional arrangement to manage delivery.

A group of maritime economists from the International Association of Maritime Economists is coordinated by Mary Brooks, Professor at Dalhousie University in Canada, and brings together interested scholars under the banner of the Port Performance Research Network.[31] The network was founded in 2001, and its members have published widely on port governance and performance individually and in special-issue book compilations of the group's work. They are organized in a number of working groups, covering topics such as port efficienc , effectiveness, concessions and strategies. They also consider issues pertinent to climate change and cruise ports. For example, the survey tool SEAPORT[32] is used to measure port service

[23] K Cullinane and DW Song, 2002, Port privatization policy and practice, *Transport Reviews*, 22(1):55–75.

[24] J Tongzon and W Heng, 2005, Port privatization, efficiency and competitiveness: Some empirical evidence from container ports (terminals), *Transportation Research Part A: Policy and Practice*, 39(5):405–424.

[25] UNCTAD and International Association of Ports and Harbours, 1987.

[26] P Fourgeaud, 2000, Measuring port performance, World Bank; see also Port Strategy (magazine), June 2007.

[27] JL Tongzon, 1995, Systematizing international benchmarking for ports, *Maritime Policy and Management*, 22(2):171–177.

[28] European Sea Ports Organization – PPRISM Project Coordinator, 2010, Port Performance Indicators: Selection and Measurement, work package 1; P Verhoeven, 2011, *European Port Governance*, European Sea Ports Organization, Brussels. See also Marlow and Paixão Casaca, 2003.

[29] See portopia.eu (accessed 27 April 2016).

[30] Ibid.

[31] See dal.ca/faculty/management/schools_and_centres/centre-for-international-trade-and-transportation/port-performance-research-network.html (accessed 29 April 2016).

[32] See MR Brooks, T Schellinck and AA Pallis, 2011, A systematic approach for evaluating port effectiveness, *Maritime Policy and Management*, 38(3):315–334.

effectiveness. SEAPORT reaches carriers, cargo interests and service providers to establish the factors that contribute to effectiveness. Views outside the port authority are used to gain insights into performance. The port performance scorecard project for the networks of the Port Management Programme was first debated at a meeting of UNCTAD ad hoc port experts in 2012.[33] A key finding of the meeting was that analytical tools are plentiful but that source data are scarce.

Brooks and Pallis (2013) consider a range of topics relevant to port management in the modern era. One topic that relates to port governance in the post-reform period covers Brazil, China and Libya. A relevant finding is that there is a cultural element to port policy frames consistent with the matching framework model proposed by Baltazar and Brooks.[34] In a later study, this is developed into policy measures to compare policy frames across 26 countries.[35] This is adapted in this project as a means to explain performance change based on governance and market context. Brooks and Pallis (2013) call for research on policy performance in terms of a feedback loop from policy initiatives to expected improvements in performance. Value can be added from this to future policy debates across the network and countries. The base port data, macroeconomic data and context variables will provide useful insights for port stakeholders in this area.

Brooks and Pallis (2013) also look at port performance measurement and port strategies. In the latter case, they explore the strategic context, given the difference between a port authority and purely private or public organizations. They also look at literature that considers new strategic directions such as city–port relations, stakeholders as citizen interest groups, international diversification, private equity considerations, environmental risks (green portfolio analysis) and corporate social responsibility. This is of particular interest, given that the ultimate goal of a comparative project is to link strategies to performance indicators. How to measure and benchmark them is the challenge.

In the literature on port performance measurement, one contribution points to the development of port

benchmarks by stakeholders, since ports have in large measure not succeeded to do so. For example, the *Journal of Commerce* conducts a survey of terminal efficiency among shippers (PIERS-port productivity tool).[36] As stated in Brooks and Pallis (2003), "if ports do not proactively participate in efforts to bench their performance, we expect that a number of stakeholders will do it for them". A number of the articles focus on terminal efficienc . For example, some economists use econometric tools that measure technical efficiency based on a theoretical production model. The models do not accommodate context variables, which are generally of more interest to port managers. They provide the means to explain variations in performance against practical frontiers of efficienc .[37]

Another paper proposes that as concession agreements are drafted and/or reviewed, consideration be given to data-sharing issues. Operators do not willingly share key data for commercial reasons. The emphasis of the paper is on using these data as a means to ensure concession performance.[38] Another issue raised as a performance measurement requirement is intermodal connectivity,[39] reflectin the door-to-door demands of international logistics, adding another dimension to the operations element of the port performance scorecard. This is a critical issue for ports serving landlocked countries.

Brooks and Pallis (2003) conclude with the following prediction:

> Within five years, we believe that it is likely that port performance benchmarking will happen on both efficiency and effectiveness vectors, with or without port cooperation in the process, as users become increasingly engaged in understanding and measuring end-to-end supply chain performance in order to improve their own competitiveness and create value for customers.[40]

[33] See issues, presentations and reports from the meeting at unctad.org (accessed 5 May 2016), Trade and Logistics Branch.

[34] R Baltazar and MR Brooks, 2006, Port governance, devolution and the matching framework: A configuration theory approach, *Research in Transportation Economics*, 17:379–403.

[35] Hiney, 2014.

[36] See piers.com (accessed 29 April 2016).

[37] AS Bergantino, E Musso and F Porcelli, 2013, Port management performance and contextual variables: Which relationship? Methodological and empirical issues, *Research in Transportation Business and Management*, 8:39–49.

[38] C Ferrari, P Puliafito and A Tei, 2013, Performance and quality indexes in the evaluation of the terminal activity: A dynamic approach, *Research in Transportation Business and Management*, 8:77–86.

[39] P De Langen and K Sharypova, 2013, Intermodal connectivity as a port performance indicator, *Research in Transportation Business and Management*, 8:97–102.

[40] Brooks and Pallis, 2013.

Figure A1. Port logistics
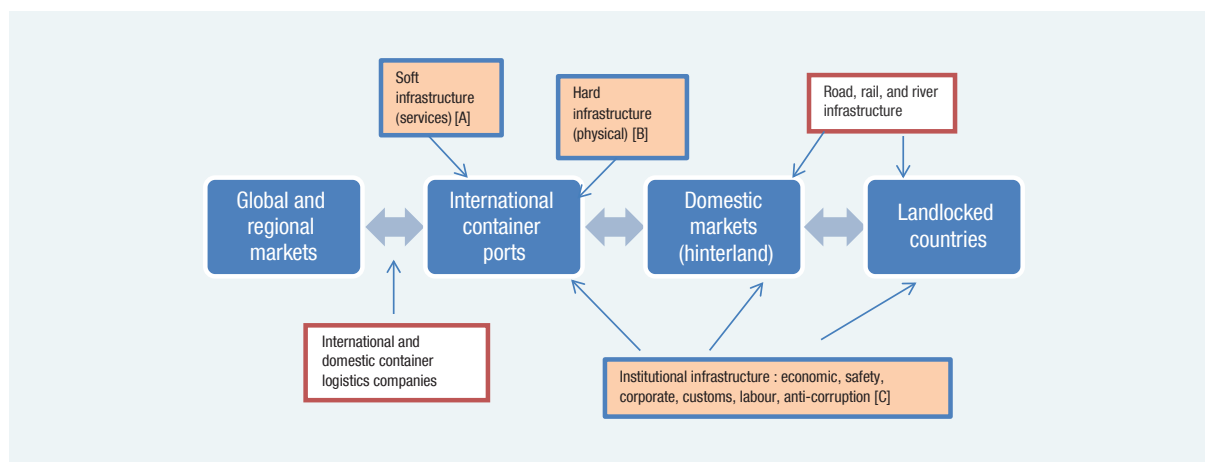
Note: Adapted from African Development Bank, 2010.

Figure A2. Trade and public sector institutional quality, 2010
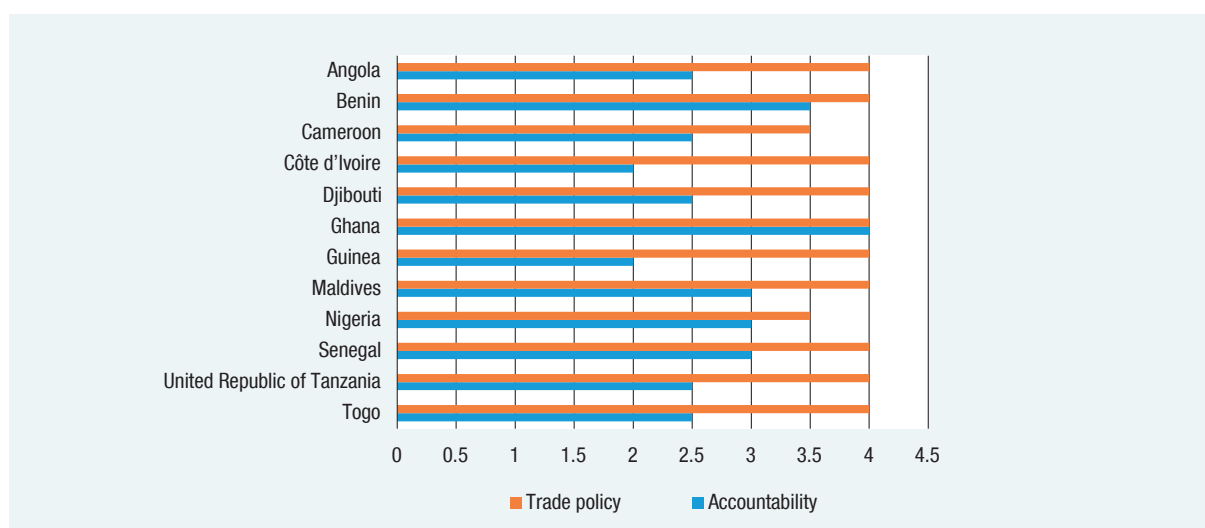
Much of the research and initiatives to date stem from developed and/or countries belonging to the Organization of Economic Cooperation and Development. There is little evidence of such work in developing or transitional economies. There is a strong case therefore, for a South–South initiative, drawing on the organizational potential of the networks of the Port Management Programme, to develop a port performance platform for port stakeholders. The organizational focal point for this is the port authority, with UNCTAD providing support.

The view from outside

For this project, there is a wealth of data that is being collected and shared at the nation–State level.

International institutions such as UNCTAD, the World Bank and the International Monetary Fund, along with academic and research resources such as the World Economic Forum, the Frazier Institute (Canada), the Quality of Governance Institute (Sweden) and many others provide a range of data relevant to maritime logistics. They do not, however, provide port-specific data. Nonetheless they provide a context for specific port performance and a basis for explanations across the port performance scorecard indicators. For example, where economic growth is slow, data from these institutions may provide some explanation for slow port growth. Also where trade barriers, including non-tariff barriers, are high, then port growth may be slow. The intent here is to highlight their value with illustrations for the countries included in the project.

It is important to bear in mind that a number of the measures are based on survey data, that is, they are based on the perceptions of the business community at a point in time. Often performance systems will provide useful data on business activity and infrastructure quality. External soft infrastructure – institutional and policy arrangements that govern trading and logistics activities – is a key driver of port performance. Equally, the absence of a set of rules to govern the port service market constructs a de facto regime of past custom and practice. Many of the measures in this area are again based on perception. Figure A1, drawn from a report by the African Development Bank in 2010,[41] describes this mix of hard and soft infrastructure in terms of the international container market. It also highlights the role of institutional or policy frames for the efficient operation of port logistics. This includes customs regimes and business environments that facilitate investment and the movement of capital. They also cover the rules and institutions that govern labour practices in each country.

The World Bank publishes a set of measures that consider the institutional arrangements in each country.[42] These are country policy and institutional assessments, which are compiled by World Bank staff, based on the evaluation of institutional quality using agreed criteria.
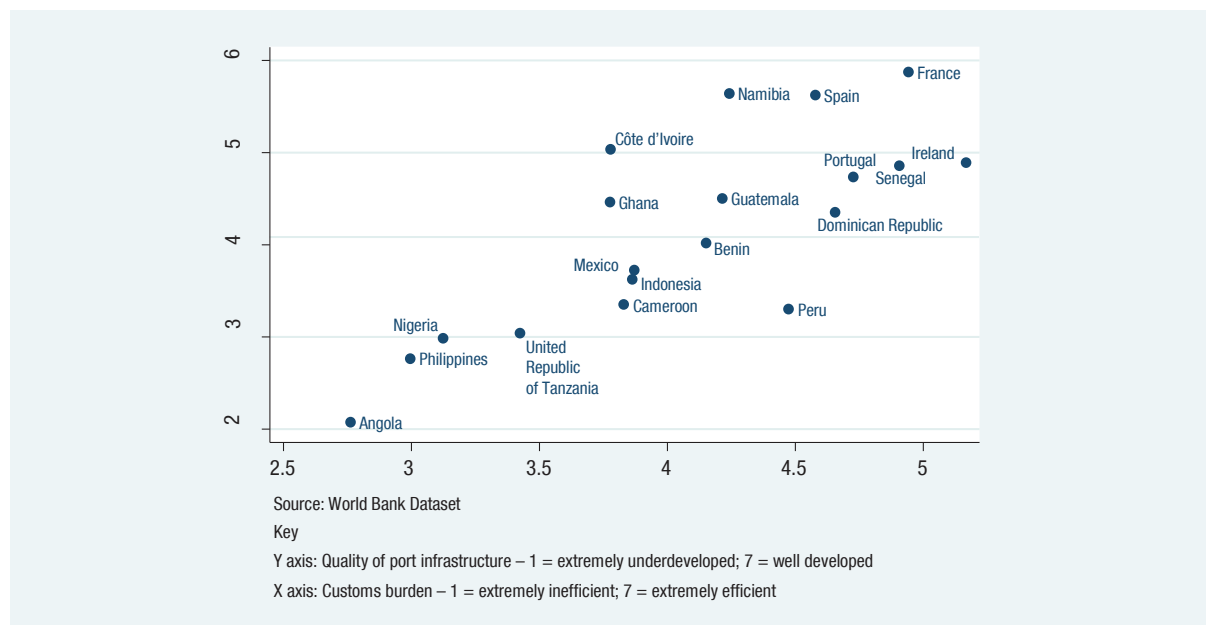
For the year 2010, which is used for consistency in the figu es in this section, not all countries are given a value. Nonetheless, figu e A2 provides an illustration of how each country is rated in terms of transparent and accountable regimes compared, for example, with corruption in the public sector, and in terms of institutions that support trade in goods.

No country with data for 2010 reached the maximum score of 6, which represents strong institutions. Most countries achieved a score of 4 for trade policy, with notable variances occurring in the area of an accountable public sector. Ghana shows the strongest institutions, and Guinea and Côte d'Ivoire, the weakest. The value of these data depends on the authors' collective assessment of these institutions as contributing factors to port performance.

An example of survey data is drawn from World Economic Forum[43] data that rate the quality of port infrastructure and the level of customs burden (figu e A3). The result is a ranking of countries' perceived performance in the area of trade facilitation. There appears to be a relationship between the rising quality of customs procedures and the perception of port quality.

As with all such relationships, the apparent association may be accidental and certainly does not indicate

Figure A3. Perceptions of port infrastructure quality, 2010

Source: World Bank Dataset
Key
Y axis: Quality of port infrastructure – 1 = extremely underdeveloped; 7 = well developed
X axis: Customs burden – 1 = extremely inefficient; 7 = extremely efficient

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[41] African Development Bank, 2010, *African Development Report 2010: Ports, Logistics, and Trade in Africa*, Oxford University Press, Oxford.
[42] Available at data.worldbank.org (accessed 29 April 2016).
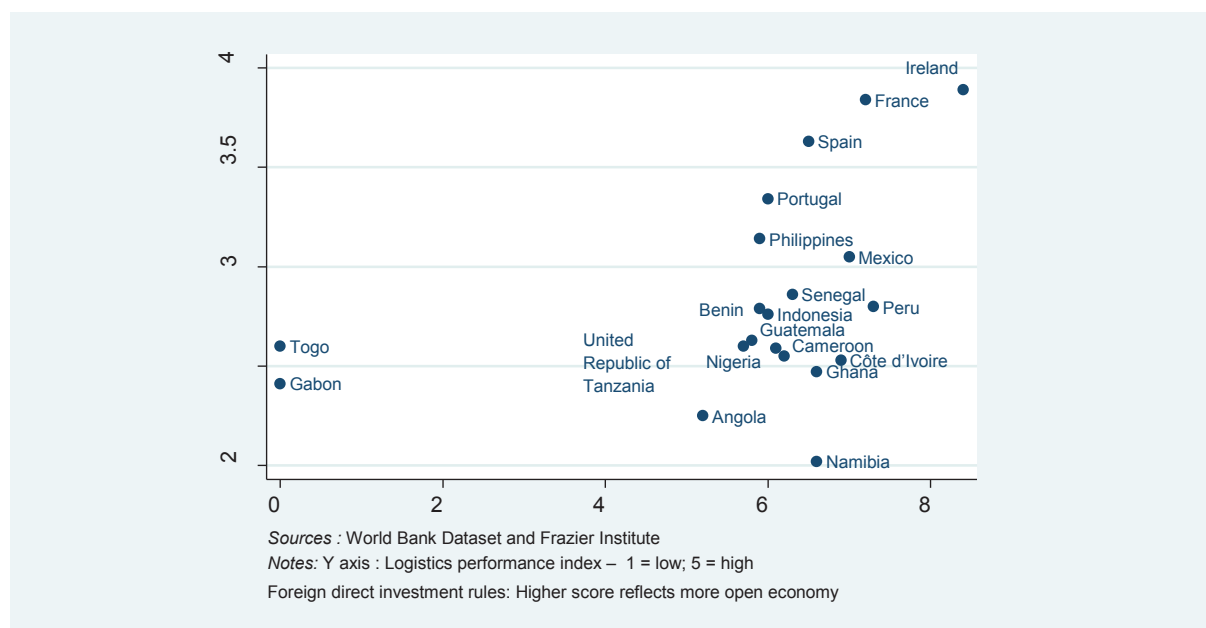
[43] Ibid.

a causal relationship. It may, however, indicate that perceptions of one factor may leak into perceptions of a related factor. Both numbers are of interest to the port community as indicators of how potential and actual port users perceive port service quality.

Figure A4 makes this comparison based on a mixed set of data from the World Bank country policy and institutional assessment measures and economic
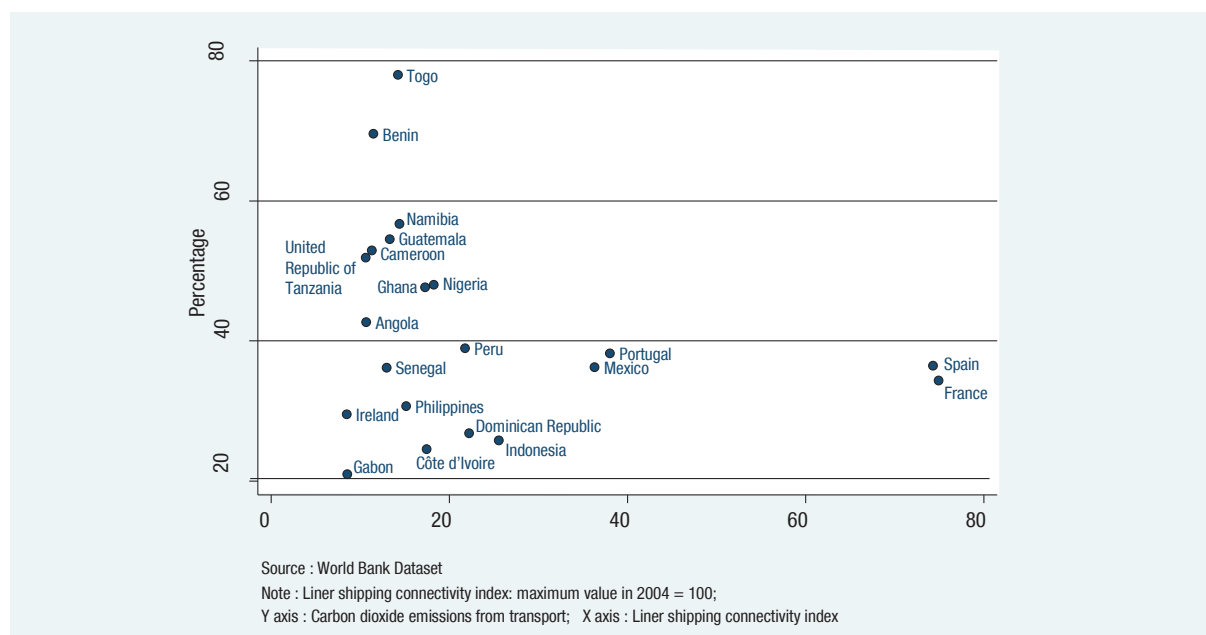
institution indices compiled by the Frazier Institute. As the values cluster around a narrow range of openness to foreign direct investment, the expected improvement in logistics performance is not obvious from these data, and there is a wide variation in performance levels.

There are two explanations for this: first, the mix of survey and objective data may not be compatible

Figure A4. Perceptions of port performance, 2010

Sources : World Bank Dataset and Frazier Institute
Notes: Y axis : Logistics performance index – 1 = low; 5 = high
Foreign direct investment rules: Higher score reflects more open economy

Figure A5. Environmental performance, 2010

Source : World Bank Dataset
Note : Liner shipping connectivity index: maximum value in 2004 = 100;
Y axis : Carbon dioxide emissions from transport;   X axis : Liner shipping connectivity index

and may be different in timing; second, perhaps such a relationship between investment rules and performance does not exist, and performance is driven by other factors.

A growing dimension for port managers is the impact of environmental regulations on port operations and port cost structures. From a policymaking perspective, the contribution made by the transport sector to national emission levels is an indicator of environmental performance. Figure A5 compares trade activity through ports with emission levels.

The liner shipping connectivity index[44] is used as a proxy for port activity, as higher levels of connectivity to mirror higher throughputs can be expected. There is no obvious association with low levels of connectivity showing most countries with varying levels of carbon dioxide transport emissions as a percentage of total national levels.

Figures A1–A5 are intended to provide initial survey data for the countries in the network. The figu es are descriptive only and consider some common external perceptions of ports. Members of a port community may have many reasons to dispute the use of such data, but they must also be aware that they are in common use among policymakers and port users. There is a need therefore, to engage with these data in any benchmarking analysis.

Summary of workshops

The deliberations of the participants in the workshops focused on pragmatic solutions. For example, proxies were identified where data were difficult to collect. A critical part of the continuing discussions remains the organizational structure and the supports in place, locally and in UNCTAD, to support the port contact points.

Future workshops will include other language streams, contact points for cargo-handling operators and data from donor countries. Placing them on the annual calendar and developing enhanced tools for collection and analysis of data are priorities for the 2016 workshop.

According to the concept discussions held at the Belfast Coordination Meeting, the project has developed to become an annual feature in the Port Management Programme. It has also contributed enhanced material for a revised version of Modules 5 (Statistics) and 6 (Finance) of the Programme.

The port performance scorecard project can look forward to continuing growth in membership, with good prospects for performance indicators, and a time-series data set to test explanations for high and low performance.

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[44] See unctad.org (accessed 29 April 2016).

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