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# Other port industry and supply chain indicators

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## Other port industry and supply chain indicators

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DELIVERABLE 8.2

## **Other port industry and supply chain indicators**

### **Abstract**

Work Package 8 (Development of a strategy map and a balanced view) identifies all international indicators of supply chain and port performance of third parties, and their relations with PORTOPIA. It is concluded that various external indicators do add value to the dashboards developed within PORTOPIA. Some of these are publicly available, while some others are not.

DELIVERABLE 8.2

**Other port industry and supply chain indicators**

List of Contents

Abstract.....3

1 INTRODUCTION .....7

2 EXECUTIVE SUMMARY.....7

3 Relevant external indicators on ports & supply chains .....8

    3.1 The World Economic Forum (WEF) ‘quality of port infrastructure’ indicator .....9

    3.2 The UNCTAD Liner Shipping Connectivity Index (LSCI).....12

    3.3 The World Bank’s Logistics Performance Index.....15

    3.4 The JOC container terminal productivity indicator .....17

    3.5 The Drewry Shipping Consultants Carrier Performance Insight. ....17

4 Conclusions and implementation issues .....18

5 Appendix 1: international initiatives not reviewed above. ....19

6 References.....20

7 Appendix 2: Noteworthy national/regional initiatives .....21

DELIVERABLE 8.2

**Other port industry and supply chain indicators**

List of Tables

Table 1: Quality of port infrastructure: the World Economic Forum ranking (top-10 and selected countries) .....9

Table 2: Rising stars and laggards in the WEF rankings.....10

Table 3: Top 15 countries with best LSCI scores and WEF Quality of port infrastructure world ranking for year 2016 .....14

Table 4: Top 20 overall LPI countries with their scores of all LPI components .....16

DELIVERABLE 8.2

**Other port industry and supply chain indicators**

List of Figures

Figure 1: Scatterplot WEF Q indicator vs. the WB Q indicator ..... 12

Figure 2: Scatterplot scores LSCI per country and WEF indicator on quality of ports infrastructure..... 15

## **1 INTRODUCTION**

PORTOPIA aims to develop a set of port performance indicators. However, PORTOPIA is not the only initiative to look at port performance indicators. The most relevant other international initiatives are discussed in this paper. National initiatives are not discussed, since these are abundant but the key aim of PORTOPIA is to scale up from local / national indicators to internationally shared ones.

## **2 EXECUTIVE SUMMARY**

The most relevant externally provided indicators are:

1. The World Economic Forum (WEF) 'quality of port infrastructure' indicator, as well as other components of the WEF Global Competitiveness Report. Some of these indicators also appear in other WEF publications such as the Enabling Trade Report.
2. The UNCTAD Liner Shipping Connectivity Index (LSCI).
3. The World Bank's Logistics Performance Index and other World Development Indicators.

The three first indicators are produced periodically and publicly available. On top of these three, other indicators are proprietary:

4. The Journal of Commerce (JOC) container terminal productivity indicator
5. The Drewry Shipping Consultants Carrier Performance Insight.

Each of these add value to the PORTOPIA dashboards, but only the first two can be integrated as these are publicly available.



### **3 RELEVANT EXTERNAL INDICATORS ON PORTS & SUPPLY CHAINS**

An in depth analysis of relevant port / supply chain indicators was made. This analysis was based on:

- Available knowledge from all senior consortium partners.
- Analysis of reporting in industry magazines of port / supply chain performance indicators.
- Established contacts with international institutions active in ports & supply chains.

The most relevant externally provided indicators are:

1. The World Economic Forum (WEF) ‘quality of port infrastructure’ indicator, as well as other components of the WEF Global Competitiveness Report. Some of these indicators also appear in other WEF publications such as the Enabling Trade Report.
2. The UNCTAD Liner Shipping Connectivity Index (LSCI).
3. The World Bank’s Logistics Performance index.

The three indicators are produced periodically and publicly available. On top of these three, other indicators are proprietary:

4. The JOC container terminal productivity indicator
5. The Drewry Shipping Consultants Carrier Performance Insight.

Each of these indicators are discussed in detail in the following paragraphs. The final paragraph analyses these indicators in relation to the PORTOPIA initiatives. Appendix 1 provides a short overview of indicators that are not included in the core list of five indicators given above. Appendix 2 provides a short review of noteworthy national / regional initiatives.

### 3.1 The World Economic Forum (WEF) 'quality of port infrastructure' indicator

The World Economic Forum (WEF) indicator provides an insight in the quality of port infrastructure in different countries. The ranking is based on survey results from industry leaders. The top-10 countries with the best port infrastructure for 2016-2017 are given in Table 1, together with their score 5 and 10 years ago. Note that some developing countries score very well (Panama), some advanced countries remarkably low (Italy) and many developing countries very low (Brazil). This directly impacts their competitiveness in a global market place.

Table 1: Quality of port infrastructure: the World Economic Forum ranking (top-10 and selected countries)

Country	Quality of port infrastructure, according to 2016-2017 WEF survey	2011-2012 WEF survey Score	2006-2007 WEF survey Score
Netherlands	6,8	6,8	6,7
Singapore	6,7	6,8	6,9
Hong Kong SAR	6,4	6,5	6,7
United Arab Emirates	6,4	6,4	6
Belgium	6,3	6,3	6,4
Panama	6,3	6,4	5,7
Finland	6,2	6,3	6,2
Iceland	5,9	6,2	5,8
Denmark	5,7	5,8	6,3
United States	5,7	5,6	5,7
Germany	5,6	6	6,6
Sweden	5,6	5,9	5,8
United Kingdom	5,6	5,8	5,4
Spain	5,5	5,8	5,3
Canada	5,4	5,7	5,6
Malaysia	5,4	5,5	5,8
France	5,3	5,4	6
Japan	5,3	5,2	6
New Zealand	5,3	5,5	5,5
Korea, Rep	5,2	5,5	5,2
Bahrain	5,1	6	5,3
South Africa	4,9	4,7	4,4
China	4,6	4,4	3,7
Oman	4,6	5,4	
India	4,5	4	3,5
Turkey	4,5	4,4	3,1
Italy	4,4	3,9	3,1
Mexico	4,4	4,3	3,4
Indonesia	3,9	3,6	2,4
Colombia	3,7	3,2	2,9
Brazil	2,9	2,6	2,7
Nigeria	2,8	3,6	2,8

Source: World Economic Forum, Global Competitiveness Report (2016-2017)

Some countries traditionally have a high quality port infrastructure, but some ‘rising stars’ have seriously improved their ports in the past decade, while some others have lagged behind. The best improvement has been Ecuador that in 2006-2007 still was part of the worst 50% performers and has moved up to now belonging to the best 30% performers. The contrary can also happen, while Israel’s port infrastructure was around top 35% in 2006-2007, it has fallen and now is an underperformer. Tunisia has suffered from a similar fate: it was above average and now is part of the bottom 35% performers.

*Table 2: Rising stars and laggards in the WEF rankings*

Country	Score 2016-2017	Score 2006-2007	Relative position 2016-2017 (100 is maximum)	Relative position 2006-2007 (100 is maximum)
Ecuador	4,7	2,8	73,7	46,1
Albania	4,2	2	59,2	31,6
Macedonia, FYR	3,8	1,8	48,0	27,6
Ethiopia	3,5	1,4	41,4	22,4
Qatar	5,5	4,5	90,1	73,0
Croatia	4,6	3,3	72,4	55,3
Turkey	4,5	3,1	67,1	51,3
Italy	4,4	3,1	65,1	50,7
South Africa	4,9	4,4	78,3	71,7
Israel	2,8	2,3	23	34,2
Romania	3,4	3,1	37,5	49,3
Brazil	2,9	2,7	25,7	43,4
Switzerland	4,4	5,4	62,5	85,5
Tunisia	3,3	4,8	34,2	78,3

*Source: World Economic Forum, Global Competitiveness Report (2016-2017)*

These rankings do show that some developing countries have managed to substantially improve their quality of port infrastructure, while some of the developed economies have fallen behind. Countries as Argentina and Romania are now actually below the global average.

Box 1.7: Some observations from the WEF rankings on quality of port infrastructure

First, the BRIC countries, whose economic performance is crucial for global economic growth, overall do not score high, with substantial differences between them. Brazil ranks 114th of 137, with a score of just 2.9. Russia is somewhat better off with a score of 4, India even a bit better (4.5), whereas China scores a 4.6. Overall, these results suggest a huge unlocked potential for international trade.

Second, the performance of the only fully private port sector (the UK) is improving. The UK scores a 5.6, good enough to reach the 12th position. In the last five years, the UK's score has gone up year by year. So even though some observers have voiced concerns over the lack of public control over a vital sector, this WEF ranking suggests the UK ports industry is performing well.

Third, port reform does not immediately lead to a better score. Ireland pursued port reform in the late 1990s but only started to score better since 2007. France's score in 2012, after the port reform that was finalised in 2011, suggests that the effects are still to come. After scores around 6 in the period 2004-2010, France was in 2012 down to 5.4.

Finally, some island economies have potential to improve. Ports are especially important for island economies. Most countries actually trade more overland than by sea. For instance, the US trades more (in value terms) overland with Mexico and Canada than overseas. Island countries are fully dependent on efficient and effective ports for trade. Iceland is the first ranked island (5.9), followed by the UK. But even somewhat below the OECD average we find large islands or island groups such as New Zealand (5.3), Japan (5.3) and Australia (4.9). These scores perhaps should be a reason for rethinking regulations and public policies regarding seaports.

*World Bank survey data on ports*

WEF is not the only institution to publish user perception based indicators. The World Bank (WB) has publicly available data that is expert based, i.e. generated through user surveys. The WB separately assesses the quality of port infrastructure and the level of port charges. Conceptually the WB approach is more appealing: while WEF only asks for an assessment of quality, WB asks for an assessment of quality and price. This is in line with standard economics where port users would be interested in the most attractive port in terms of price and quality, instead of being focused on quality alone. Indeed one could argue price is the more important component, since empirical work on the price elasticity of long distance freight transport suggests that for the bulk of the transported volumes, this elasticity is low.

### *The validity of the WEF & WB survey based indicators<sup>1</sup>*

As a test of the validity of the WB and WEF indicators, they are compared. For this comparison, we have taken the judgment on the quality of ports from both surveys.

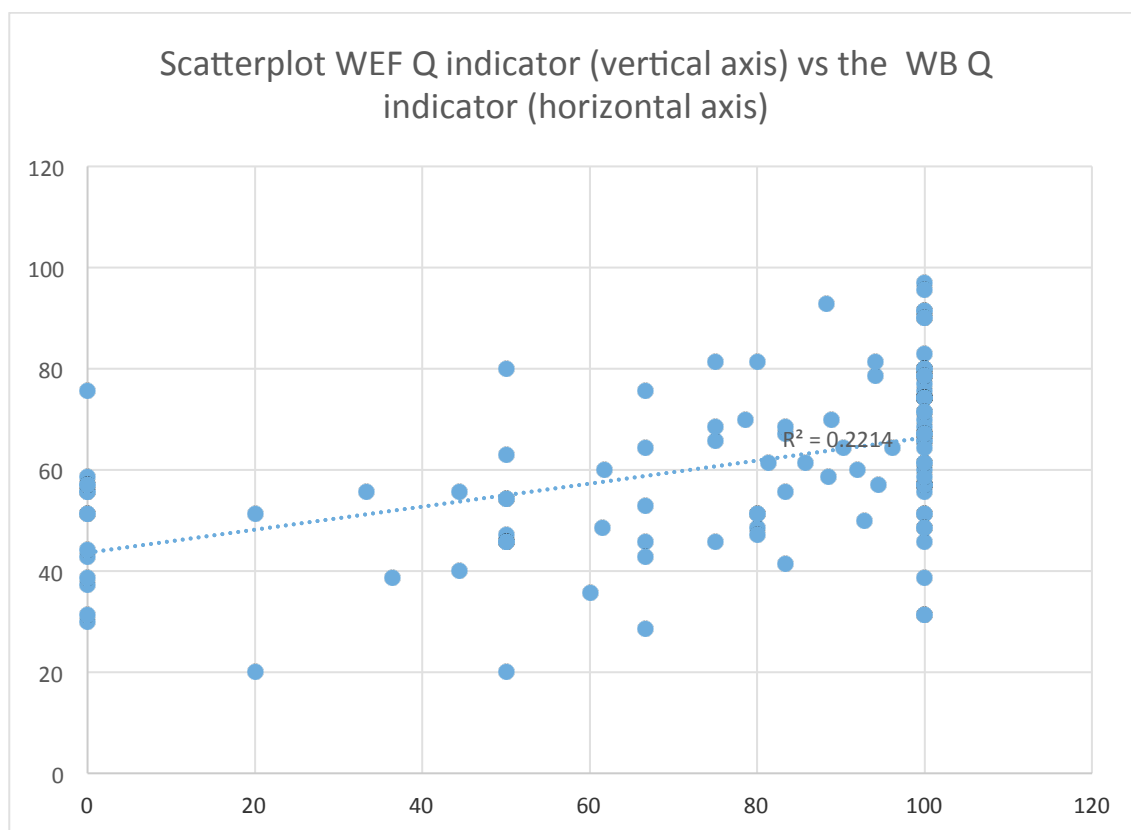


Figure 1: Scatterplot WEF Q indicator vs. the WB Q indicator

These results show a very limited correlation between the two different user satisfaction measurements that are available on a country level. This means at least one of those does not accurately reflect user perceptions. Given the huge number of 'boundary scores' (scores of either 0 or 100) of the WB indicator, the number of respondents seems to be limited. Furthermore, the WEF forum results (Singapore, the Netherlands on top) are more in line with industry perceptions. Thus, in our view the validity of the WB results is limited and not further included in this WP.

### **3.2 The UNCTAD Liner Shipping Connectivity Index (LSCI).**

The LSCI is a well-established index, published by UNCTAD and World Bank each year from 2004 onwards (see <http://unctadstat.unctad.org/TableViewer/dimView.aspx>). It is developed to measure countries' competitiveness in terms of access to regular and

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<sup>1</sup> This issue is also addressed in D 4.4 it is relevant for both deliverables.

frequent liner services<sup>2</sup>. The LSCI is developed under the umbrella of the United Nations Conference on Trade and Development (UNCTAD). This index is the normalized average of five components that reflect the availability of container services to/from the assessed country:

- 1) The number of container ships on the liner services from and to country's ports,
- 2) The TEU carrying capacity of these ships,
- 3) Maximum vessel size,
- 4) The number of services,
- 5) The number of companies that deploy container ships on services from and to a country's ports.

#### *Are WEF and LSCI correlated?*

The LSCI is developed according to the five facts described above, while WEF indicators are based on survey results from industry leaders' opinions. For instance, in the WEF Quality of port infrastructure indicator, industry leaders rate the quality of port infrastructure in their countries from 1 (extremely underdeveloped – among the worst in the world) to 7 (extensive and efficient – among the best in the world) based on their executive opinion. So LSCI is objective, while WEF indicators are subjective.

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<sup>2</sup> Recently, several additional connectivity indices have been developed for maritime connectivity, that build upon the LSCI. Bartholdi et al. (2014) use LSCI's components to develop a container connectivity indicator at the port level; Bang et al. (2014) add information on ship size and number of competing shipping lines per string (whereas LSCI 'just' uses the number of shipping lines that provide services to/from a country, regardless of the trade). Jiang et al. (2015) add a method to include 'indirect connectivity' through transshipment of containers in intermediate ports. These additions clearly show the interest in further advancing maritime connectivity indicators.

Table 3 shows the top-15 countries with the best LSCI scores in 2016 and compares it to WEF Quality of port infrastructure world ranking. Among the top-15 LSCI countries we find the 5 countries with highest WEF Quality of port infrastructure score, and only Korea and China are not in top-25. Figure 2: Scatterplot scores LSCI per country and WEF indicator on quality of ports infrastructure shows there is virtually no correlation between the WEF and LSCI scores.

Table 3: Top 15 countries with best LSCI scores and WEF Quality of port infrastructure world ranking for year 2016

Country	LSCI world ranking	LSCI score (maximum 2004=100)	WEF Quality of port infrastructure score	WEF Quality of port infrastructure world ranking
<b>China</b>	1	167,48	4,6	41
<b>Singapore</b>	2	122,70	6,7	2
<b>Korea, Republic of</b>	3	115,61	5,2	27
<b>Malaysia</b>	4	106,79	5,4	17
<b>Hong Kong SAR</b>	5	101,02	6,4	4
<b>United States</b>	6	98,70	5,7	9
<b>Germany</b>	7	97,75	5,6	14
<b>United Kingdom</b>	8	97,23	5,6	13
<b>Netherlands</b>	9	95,73	6,8	1
<b>Belgium</b>	10	88,64	6,3	5
<b>Spain</b>	11	86,13	5,5	16
<b>France</b>	12	83,90	5,3	23
<b>Japan</b>	13	78,90	5,3	20
<b>Taiwan, China</b>	14	75,75	5,3	21
<b>United Arab Emirates</b>	15	70,57	6,4	3

Source: World Economic Forum, Global Competitiveness Report (2016-2017) and UNCTAD



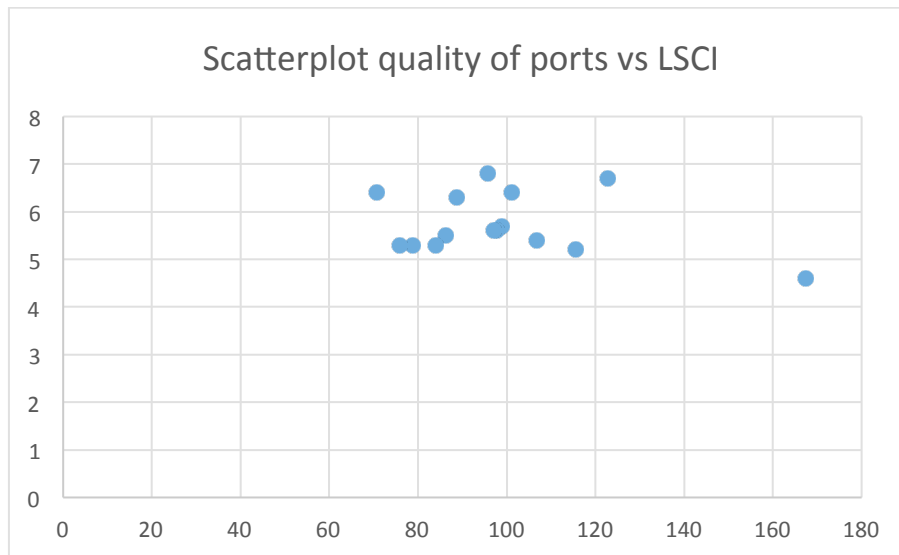


Figure 2: Scatterplot scores LSCI per country and WEF indicator on quality of ports infrastructure

Northern European countries such as Finland, Iceland, Denmark, Sweden, and Estonia are not in top-15 of LSCI world ranking; however, these countries are top-15 of WEF Quality of port infrastructure. Overall there is no correlation between both.

### 3.3 The World Bank’s Logistics Performance Index.

The World Bank has developed a Logistics Performance Index (LPI), based partly on quantitative data and partly on user perceptions of the quality of logistics services in a country. The LPI is split in two different scores: international LPI and a domestic LPI. This difference is not crystal clear, as some of the ‘domestic’ issues deal with customs, port and airports.

The components analyzed in the International LPI were chosen based on recent theoretical and empirical research and on the practical experience of logistics professionals involved in international freight forwarding. They are:

- The efficiency of customs and border management clearance (“Customs”).
- The quality of trade and transport infrastructure (Infrastructure”).
- The ease of arranging competitively priced shipments (“Ease of arranging shipments”).
- The competence and quality of logistics services—trucking, forwarding, and customs brokerage (“Quality of logistics services”).
- The ability to track and trace consignments (“Tracking and tracing”).

- The frequency with which shipments reach consignees within scheduled or expected delivery times (“Timeliness”).

The LPI uses standard statistical techniques to aggregate the data into a single indicator that can be used for cross-country comparisons.

The domestic LPI has detailed information, for instance on costs, lead times and number of inspections per shipment. In addition, the domestic LPI has detailed information on the quality of the environment and institutions. The most relevant information for this WP is the evaluation (a qualitative assessment) of costs and quality of various components in a supply chain, including ports. The scores of the components of the international LPI are publicly available on a country level.

### *The LPI scores & some insights*

Since LPI is composed by several components, countries with highest overall LPI score have high scores in most of LPI components. Table 4: Top 20 overall LPI countries with their scores of all LPI components shows top-20 countries with highest Overall LPI score and their scores in all LPI components.

*Table 4: Top 20 overall LPI countries with their scores of all LPI components*

Country	Overall LPI score	Customs score	Infrastructure score	International shipments score	Logistics quality and competence score	Tracking and tracing score	Timeliness score
Germany	4,23	4,12	4,44	3,86	4,28	4,27	4,45
Luxembourg	4,22	3,90	4,24	4,24	4,01	4,12	4,80
Sweden	4,20	3,92	4,27	4,00	4,25	4,38	4,45
Netherlands	4,19	4,12	4,29	3,94	4,22	4,17	4,41
Singapore	4,14	4,18	4,20	3,96	4,09	4,05	4,40
Belgium	4,11	3,83	4,05	4,05	4,07	4,22	4,43
Austria	4,10	3,79	4,08	3,85	4,18	4,36	4,37
United Kingdom	4,07	3,98	4,21	3,77	4,05	4,13	4,33
Hong Kong SAR	4,07	3,94	4,10	4,05	4,00	4,03	4,29
United States	3,99	3,75	4,15	3,65	4,01	4,20	4,25
Switzerland	3,99	3,88	4,19	3,69	3,95	4,04	4,24
Japan	3,97	3,85	4,10	3,69	3,99	4,03	4,21
United Arab Emirates	3,94	3,84	4,07	3,89	3,82	3,91	4,13
Canada	3,93	3,95	4,14	3,56	3,90	4,10	4,01
Finland	3,92	4,01	4,01	3,51	3,88	4,04	4,14
France	3,90	3,71	4,01	3,64	3,82	4,02	4,25

<b>Denmark</b>	3,82	3,82	3,75	3,66	4,01	3,74	3,92
<b>Ireland</b>	3,79	3,47	3,77	3,83	3,79	3,98	3,94
<b>Australia</b>	3,79	3,54	3,82	3,63	3,87	3,87	4,04
<b>South Africa</b>	3,78	3,60	3,78	3,62	3,75	3,92	4,02

Source: World Bank LPI database

### **3.4 The JOC container terminal productivity indicator**

The JOC indicator measures hourly moves based on shipping line data on arrival time, departure time and number of lifts. Data are collected at the level of terminals, and can be aggregated to ports. Only deep-sea terminals are included. JOC makes a distinction between calls of ships with a capacity below 8,000 TEU and ships with a capacity of more than 8,000 TEU. Even though some disclaimers can be made, this indicator is relevant and broadly accepted in the industry. However, the terminal productivity data are not publicly available.

### **3.5 The Drewry Shipping Consultants Carrier Performance Insight.**

Drewry provides a schedule reliability benchmark within the container shipping industry that enables service levels to be assessed. The data are collected first hand based on publicly available Actual Arrival Time data and the published schedules by the carriers. The data are updated each month. The data shows the carrier performance but at the same time may be considered a port performance indicator, since reliability may differ between ports, However, the Drewry data is focused on the carriers – not the ports.

## 4 CONCLUSIONS AND IMPLEMENTATION ISSUES

Three external indicators provide valuable insights for port performance and are thus relevant to include in a port performance dashboard. These three indicators are:

1. The World Economic Forum (WEF) 'quality of port infrastructure' indicator, as well as other components of the WEF Global Competitiveness Report. Some of these indicators also appear in other WEF publications such as the Enabling Trade Report.
2. The UNCTAD Liner Shipping Connectivity Index (LSCI).
3. The World Bank's Logistics Performance index and other World Development Indicators.

### *Implementation in a dashboard*

The implementation of these indicators is straightforward. As these indicators are publicly available and can be downloaded in MS Excel format, inclusion in a dashboard requires downloading the data and developing a dashboard to visually show these indicators. All the three indicators are provided yearly. The WEF indicator is provided Q4, the LSCI and LPI in Q2. As these indicators are not strongly interrelated they are best presented separately.

### *Context indicators*

These three country level indicators complement the PORTOPIA efforts to develop port specific PPIs. As argued elsewhere, the port is analytically a better unit of analysis than a country, for PPIs as the country is an institutional spatial unit that may consist of many or a few ports (or even no ports – this does not prevent the WEF to present scores), so that comparing countries with other countries is not comparing like with like. Thus, the three indicators are best regarded as context indicators that help understand PPIs for specific ports.

## **5 APPENDIX 1: INTERNATIONAL INITIATIVES NOT REVIEWED ABOVE.**

### *Indicators in OECD reports*

The OECD published a series of reports on ports, often with the support of academic researchers. These reports include performance indicators but none of these indicators are developed structurally and made publicly available. The most substantial effort is probably an OECD publication on the time efficiency of ports worldwide (<http://www.itf-oecd.org/sites/default/files/docs/dp201408.pdf>) by Ducruet and Merk. However, this analysis has not been replicated and the source data are not publicly available.

### *GIL terminal quality indicator*

The Global Institute of Logistics (GIL) developed a The Container Terminal Quality System (CTQS) that uses 80 Container Terminal Performance Measures (CTPM's) and common metrics developed for the CTQS. Participating ports may benchmark their own performance against others. The CTQS was developed as the result of a collaborative effort by a group of TOCs. However, none of the metrics is published and no reports have been made available to show some of the findings of the collaborative exercise and overall news items related to CTQS are scarce.

### *ECLAC energy use in ports*

United Nations Economic Commission for Latin America and the Caribbean (ECLAC)'s energy consumption survey in ports and terminals is the most comprehensive analysis examining the evolution and detailed structure of energy consumption and efficiency measures in cooperation with the public and private sector. It provides the scientific fact base that will be used in the LAC region to formulate energy efficiency strategies and policies in the future. The dataset includes 41 container terminals around the world of which 30 are located in Latin America and the Caribbean. These 30 represent 1/3 of the regional annual container throughput in 2014. The data are not publicly available.

### *ASEAN customs procedures work*

The Association of Southeast Asian Nations (ASEAN) countries customs are cooperating, amongst others with the aim to enhance the transparency of Customs Administrations of ASEAN Member States. To increase transparency, the member states have agreed to compile the key performance indicators (KPIs) of individual countries to provide information on the service standards for the various customs procedures. The initiative has not (yet) led to a harmonised set of customs KPIs, but includes in many countries such KPIs as the average time it takes to clear customs in different 'lanes' or similar regimes.

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## 7 APPENDIX 2: NOTEWORTHY NATIONAL/REGIONAL INITIATIVES

### *Canada*

Canada embarked on an ambitious project to develop port performance indicators around 2008. Transport Canada is leading this project to develop performance indicators from a supply chain perspective. The project has resulted in much better KPIs for ports and supply chains. These KPIs are not publicly available at an open platform (website) but the annual Transport Canada publication does show the main KPIs that were developed. These include the End-to-End Transit Times from Shanghai to Toronto via British Columbia Ports Using a Direct Rail Model.

### *Australia*

In Australia, a detailed analysis of port performance is undertaken by the Bureau of Infrastructure, Transport and Regional Economics (BITRE). The results are publicly available (in a report called 'Waterline'<sup>3</sup>) and provides information on container movements of five Australian major port terminals: Brisbane, Sydney, Melbourne, Adelaide and Fremantle. Waterline reports on trends in container handling productivity on the waterfront in Australia as well as the cost of importing and exporting containers. It covers both the unloading of container ships and the transport of containers from container terminals. Performance indicators include modal split, port costs, terminal productivity and truck handling times.

### *Kenya & Northern African Corridor*

Efforts regarding performance measurement in Kenya and East Africa in general do not focus on ports but on corridors. The core corridor is the Northern Corridor, the governance of this corridor is organised in a multi country Northern Corridor Transit and Transport Co-ordination Authority (NCTTCA). This authority focuses on performance measurement and measures such items as ship waiting time, terminal productivity, container dwell time, customs handling time and port costs. The data is publicly available in a user-friendly platform<sup>4</sup>.

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<sup>3</sup> See [http://bitre.gov.au/publications/2015/water\\_057.aspx](http://bitre.gov.au/publications/2015/water_057.aspx)

<sup>4</sup> See <http://top.ttcanc.org/index.php>

### *West Africa (PMA-WCA)*

The port association of West & Central Africa (PMA-WCA) has embarked on a port performance measurement process, by selecting the most relevant indicators and defining calculation methods. The focus is on operational efficiency indicators including port productivity and ship waiting times. There is no uniform measurement yet and the data is not publicly available

### *Spain*

In Spain the government department 'Puertos del Estado' collects and makes available various indicators of the ports industry. These include throughput, modal split, and, albeit not publicly available, data on port costs.

### *South Africa*

In South Africa, the ports regulator is leading in assessing port performance, as part of their regulatory role in port pricing decisions. The Ports Regulator analyses port performance and benchmarks internationally, albeit not (yet) in a structured sample and a multi-year approach. The indicators developed by the Ports Regulator include container moves per ship working hour, ship turnaround time, and container dwell times. The regulator also analyses terminal utilisation of bulk and RoRo terminals.