TRADE FACILITATION/LOGISTICS
PERFORMANCE INDICATORS

JF ARVIS
INTERNATIONAL TRADE DEPARTMENT
Agenda

- What to measure: Categories of indicators
- Why we need indicators
- Comprehensive cross-country TFL indicators: LPI, DB.
- Measuring logistics costs?
- Gateway corridor monitoring.
- Before the border and connectivity.
What to measure?
The object = the International Supply Chain

**Partner Country**
- Logistics Operator
- Supply Chain in Partner Country
- International Shipping

**Country Being Assessed**
- Logistics Operator: Freight Forwarder
- Gateway
- Land Transport/Transit
- Warehouse/Factory

**Typical Participants:**
- Customs & Border Agencies
- Port Operators
- Customs Brokers
- Shipping Agents

**Typical Participants:**
- Customs & Border Agencies
- Transport Operator (Truck or Railroad Company)

**Incoterm:**
- Exports: FOB
- Imports: DES

- Exports: EXW
- Imports: CIF
The definitions.

- Trade related procedures
- Red tape
  - + services
  - + infrastructure
  - = logistics
  - = TTF

+ other « soft infrastructure »
(finance, standards...)
Different perspectives ...
Challenges

- **Dependent on:**
  - Gateway
  - Mode
  - Product
  - Asymmetry exports imports
  - Operator.

- **Multidimensional problem:**
  - Time
  - Cost
  - Reliability of the SC (quality of service)

- **Impact (competitiveness, welfare) dependent on product.**
- **Impact translation into meaningful $$$ metric.**
- **Before the border and connectivity (e.g. shipping)**
Trade off

- Cross country comparability vs. details.
- Country wide coarse grained indicators (e.g. Logistics Performance Index), vs. Project-Facility Specific tools.
- Aggregation vs. micro-significance

⇒ The concept of logistics costs would be most meaningful, with the desirable compromises. But robust methodology still to be developed.
All depends on the use

- Research is least demanding and can use coarse grained indicators irrespective of scale.
- Awareness raising, high level policy dialogue, requires synthetic tools with cross-country comparability (e.g. LPI)
- Implementation needs very specific tools with lot of details and time series for monitoring impact.
Comprehensive coarse grained indicators (LPI), available

Aggregated logistics costs. (concept)

Ad hoc TFL monitoring indicators. Better methodologies being available

Before the border and connectivity (air and sea).
Why we need indicators

What the Bank does in this area
Focus Areas include

- **Border management**: Improvement in border management in a broad sense: integration of customs, product standards, tax, rules of origin, etc.

- **Trade Infrastructure**: Improvement in the management of key trade related infrastructure, especially gateways and multimodal facilities

- **Logistics services**: Improvement of the quality/professionalism of private logistics services, through technical/economic regulation and capacity building

- **Regional**: Regional trade facilitation including transit systems

- **Indicators**: Performance monitoring and indicators: e.g., data on time, cost, and reliability along corridors

- **Action plan**: Implementation of comprehensive action plan addressing all of the above
Objective: Making Trade Logistics work for competitiveness through:
- *In-depth multidimensional assessment:* audits, surveys
- *Action plans:* inter-agency and private/public

Scope of work
- Components (= understand impediment to service delivery taking different perspectives):
  - **TTFAs** (performance of services and process)
  - **Value chain analysis** in key sectors, e.g. textile, automotive, agro and distribution
  - **User surveys**
  - **Thematic:** e.g. skills and training, regional logistics
- Strong client participation:
  - Inter-agency and private sector working group

From benchmarks to in-depth assessments

Trade and Transport Facilitation Audits (TTFA)
Initially proposed by Raven (2001)
Currently high demand for implementation

**Scope of work**
- Respond to new demand and put TTFA in a broader policy perspective (competitiveness);
- Current policy focus: beyond the initial focus on simplification of procedures to better cover service and transport infrastructure
- Take into account the experience of actually carrying out such audits
- Enhance the role of the toolkit as a pedagogical instrument and guidebook for policy makers and other practitioners

More comprehensive, more policy oriented and more practical
www.worldbank.org/lpi

Ranking and component

- Logistics business environment and institutions
- Performance data

Available as rankings, maps, scorecards
Comprehensive Indicators
Summary messages

- Trade logistics performance is only as good as the weakest link
- Predictability and reliability are as important as cost and speed
- The LPI can assess your country’s bottlenecks and opportunities for reform – and where, if necessary, to direct “aid for trade”
- The LPI can mobilize broad constituencies for reform
Partnership with the private sector

Built on 5,500 country assessments by more than 800 logistics professionals worldwide:

- Assessments from professionals outside the country, trading with it
- Assessment of domestic business environment and institutions and time and cost data
- Questionnaire designed with input from trade and logistics professionals

Primary data gathered for 150 countries
The LPI measures seven dimensions of country performance:

- Efficiency of the clearance process
- Quality of trade and transport infrastructure
- Ease of arranging competitively priced shipments
- Logistics competence and quality of logistics services
- Tracking and tracing
- *Domestic costs*
- Timeliness
More than income: the “logistics gap”

Distribution of countries by income groups across LPI quintiles (%)

- Top quintile, highest performance
- Second quintile, high performance
- Third quintile, average performance
- Fourth quintile, low performance
- Bottom quintile, lowest performance
New survey: ongoing
- first results in November

New improved questionnaire
- balance between quantitative and perception data
- inclusion of a Customs module

Notoriety of pilot survey
- support participation of professional bodies
EXW
(Shipper)

FOB
(Free carrier at Port of loading or equivalent)

DDP
(Delivered duty paid)

Lead time export

Point of Origin
Seller’s Factory

Delivery to Dock

Alongside Vessel

Customs

Frontier/
Border

Exporting Country

Delivered to Buyer’s Warehouse

Delivering to Buyer’s Warehouse

Time and Cost Indicators
**Lead time import**

**EXW**
(Shipper)

- **Point of Origin**
  - Seller's Factory

**DES**
(Carriage paid to Port of discharge or equivalent)

- **Unloaded on Dock**
- **Customs**

**DDP**
(Delivered duty paid)

- **Delivered to Buyer's Warehouse**

**Importing Country**

**Frontier/Border**

**Time and Cost Indicators**
## Complementarities LPI/DB

<table>
<thead>
<tr>
<th></th>
<th>LPI</th>
<th>DB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source of data</strong></td>
<td>As many respondents as possible</td>
<td>Few by country</td>
</tr>
<tr>
<td><strong>Concept</strong></td>
<td>Performance outcomes</td>
<td>Analytic breakdown in component procedures</td>
</tr>
<tr>
<td><strong>Questionnaire</strong></td>
<td>Short online</td>
<td>Detailed</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>Several indices of performance</td>
<td>Metric of red tape applicable to trade operations (time export, import)</td>
</tr>
</tbody>
</table>

### Comparisons and overlaps

- Limited correlation (at least with stringent tests: rank, partial) of main indicators (LPI and DB time X/M)
- Different concepts of time to import and export, with huge discrepancies
LPI Ranking presents performance scores of all countries on the LPI index, as well as on the seven key dimensions, in a sortable format.

### International LPI ranking

By default, the table is sorted by the Logistics Performance Index (LPI). Click on the ▼ icons to sort by other categories in ascending order. Please click on the country name for the detailed information on the Country Scorecard.

<table>
<thead>
<tr>
<th>Int. LPI Rank</th>
<th>Country</th>
<th>LPI</th>
<th>Customs</th>
<th>Infrastructure</th>
<th>International shipments</th>
<th>Logistics competence</th>
<th>Tracking &amp; tracing</th>
<th>Domestic logistics costs</th>
<th>Timeliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Singapore</td>
<td>4.19</td>
<td>3.90</td>
<td>4.27</td>
<td>4.04</td>
<td>4.21</td>
<td>4.25</td>
<td>2.70</td>
<td>4.53</td>
</tr>
<tr>
<td>2</td>
<td>Netherlands</td>
<td>4.18</td>
<td>3.99</td>
<td>4.29</td>
<td>4.05</td>
<td>4.25</td>
<td>4.14</td>
<td>2.65</td>
<td>4.38</td>
</tr>
<tr>
<td>3</td>
<td>Germany</td>
<td>4.10</td>
<td>3.88</td>
<td>4.19</td>
<td>3.91</td>
<td>4.21</td>
<td>4.12</td>
<td>2.34</td>
<td>4.33</td>
</tr>
<tr>
<td>4</td>
<td>Sweden</td>
<td>4.08</td>
<td>3.85</td>
<td>4.11</td>
<td>3.90</td>
<td>4.06</td>
<td>4.15</td>
<td>2.44</td>
<td>4.43</td>
</tr>
<tr>
<td>5</td>
<td>Austria</td>
<td>4.06</td>
<td>3.83</td>
<td>4.06</td>
<td>3.97</td>
<td>4.13</td>
<td>3.97</td>
<td>2.24</td>
<td>4.44</td>
</tr>
<tr>
<td>6</td>
<td>Japan</td>
<td>4.02</td>
<td>3.79</td>
<td>4.11</td>
<td>3.77</td>
<td>4.12</td>
<td>4.08</td>
<td>2.02</td>
<td>4.34</td>
</tr>
<tr>
<td>7</td>
<td>Switzerland</td>
<td>4.02</td>
<td>3.85</td>
<td>4.13</td>
<td>3.67</td>
<td>4.00</td>
<td>4.04</td>
<td>2.26</td>
<td>4.48</td>
</tr>
<tr>
<td>8</td>
<td>Hong Kong, China</td>
<td>4.00</td>
<td>3.84</td>
<td>4.06</td>
<td>3.78</td>
<td>3.99</td>
<td>4.06</td>
<td>2.66</td>
<td>4.33</td>
</tr>
<tr>
<td>9</td>
<td>United Kingdom</td>
<td>3.99</td>
<td>3.74</td>
<td>4.05</td>
<td>3.85</td>
<td>4.02</td>
<td>4.10</td>
<td>2.21</td>
<td>4.25</td>
</tr>
<tr>
<td>10</td>
<td>Canada</td>
<td>3.92</td>
<td>3.82</td>
<td>3.95</td>
<td>3.78</td>
<td>3.85</td>
<td>3.98</td>
<td>2.84</td>
<td>4.19</td>
</tr>
<tr>
<td>11</td>
<td>Ireland</td>
<td>3.91</td>
<td>3.82</td>
<td>3.72</td>
<td>3.76</td>
<td>3.93</td>
<td>3.96</td>
<td>2.65</td>
<td>4.32</td>
</tr>
<tr>
<td>12</td>
<td>Belgium</td>
<td>3.89</td>
<td>3.61</td>
<td>4.00</td>
<td>3.65</td>
<td>3.95</td>
<td>3.96</td>
<td>2.62</td>
<td>4.25</td>
</tr>
<tr>
<td>13</td>
<td>Denmark</td>
<td>3.86</td>
<td>3.97</td>
<td>3.82</td>
<td>3.67</td>
<td>3.83</td>
<td>3.76</td>
<td>2.52</td>
<td>4.11</td>
</tr>
<tr>
<td>14</td>
<td>United States</td>
<td>3.84</td>
<td>3.52</td>
<td>4.07</td>
<td>3.58</td>
<td>3.85</td>
<td>4.01</td>
<td>2.20</td>
<td>4.11</td>
</tr>
<tr>
<td>15</td>
<td>Finland</td>
<td>3.82</td>
<td>3.68</td>
<td>3.81</td>
<td>3.30</td>
<td>3.85</td>
<td>4.17</td>
<td>2.22</td>
<td>4.18</td>
</tr>
<tr>
<td>16</td>
<td>Norway</td>
<td>3.81</td>
<td>3.76</td>
<td>3.82</td>
<td>3.62</td>
<td>3.78</td>
<td>3.67</td>
<td>2.08</td>
<td>4.24</td>
</tr>
<tr>
<td>17</td>
<td>Australia</td>
<td>3.79</td>
<td>3.58</td>
<td>3.65</td>
<td>3.72</td>
<td>3.76</td>
<td>3.97</td>
<td>2.80</td>
<td>4.10</td>
</tr>
<tr>
<td>18</td>
<td>France</td>
<td>3.76</td>
<td>3.51</td>
<td>3.82</td>
<td>3.63</td>
<td>3.76</td>
<td>3.87</td>
<td>2.34</td>
<td>4.02</td>
</tr>
</tbody>
</table>
The LPI, on a 1 (worst) to 5 (best) scale) is aggregated by standard techniques (PCA), so as to reduce noise and improve confidence intervals.

Confidence interval (+/- 10 %) provided, **on average 8 places in the ranking**.
Consistency & Robustness

- LPI consistent with intuitive knowledge of country performance, very specific ranking
- Homogeneous respondent population
  - LPI is aggregated as the first axis in a PCA
    - is a weighted average of the 7 components
    - weights based on the statistical properties of component variables
    - this technique gives higher weights to variables that contribute more to explain the variance across countries in the LPI data
  - +/- 10% confidence interval generated, on average the confidence interval equals 8 places out of 150
<table>
<thead>
<tr>
<th>Region</th>
<th>Customs clearance (days)</th>
<th>physical inspection (days)</th>
<th>Time export (days)</th>
<th>Time import (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Asia &amp; Pacific</td>
<td>2.1</td>
<td>18%</td>
<td>2.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>1.2</td>
<td>8%</td>
<td>1.7</td>
<td>4.5</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>2</td>
<td>14%</td>
<td>2.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>2.2</td>
<td>14%</td>
<td>2.1</td>
<td>7.2</td>
</tr>
<tr>
<td>South Asia</td>
<td>2</td>
<td>27%</td>
<td>4.4</td>
<td>7.2</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>3.3</td>
<td>29%</td>
<td>4.8</td>
<td>13.3</td>
</tr>
<tr>
<td>High income: OECD</td>
<td>0.9</td>
<td>3%</td>
<td>1.8</td>
<td>4.6</td>
</tr>
</tbody>
</table>
Respondents from 14 countries evaluated Indonesia

| Number of international assessments (hits) | 22 |
| Confidence Interval = 0.13 |
| Number of Indonesian respondents (from 16 companies) | 20 |
Respondents answering high/very high competences in the domestic logistics industry include:

- Air transport service providers
- Freight forwarders
- Warehousing and distribution operators
- Customs agencies
- Road transport service providers
- Consignees or shippers
- Trade and transport related associations
- Customs brokers
- Rail transport service providers
- Other border crossing-related government agencies

Indonesia and East Asia and Pacific regions are highlighted in the chart.
Logistics Costs
The three components of logistics costs at firm level

1. Freight costs
2. Administrative costs...
3. Induced costs: storage, inventory, ...

- **Direct costs**: e.g., Fees paid to transport operator
- **Overheads**: Fixed costs per shipments
- **Delay and predictability**: Inventory in motion + Induced costs of non service (e.g., express services...)

**LPI**
- Value of time $\approx 0.1\%$ (= accounting concept $\approx 1/10$ of Hummels’ estimate)
- Mean delays in days or weeks.
- Much or Most time is not spent in motion, notably initiation of transit, borders…
- Significant variance. (CV$\sim$1) (universal)
- Asymmetric long tailed lead time distribution curve (log-normal shape)

$\Rightarrow$ multiplier (3-5 or more) for inventories over mean delay.
Inventory model (Baumol 70). Reference: a truckload or 40’ container

Total transit cost = Administrative costs
+(fixed truck cost) × (truck use in days per shipment) → efficient
or \( \frac{\text{fixed truck cost}}{(\text{rotations allocated per truck per unit time}) \times \text{load factor}} \) → cartel_or_syndicate.
+ \( \frac{\text{variable truck cost}}{\text{load factor}} \) × Distance
+(value of time) × \( T(\gamma) \) × (Value of shipment)

Where
\[ \gamma = \left( \frac{\text{cost stockout}}{\text{inventory cost}} \right) > 1 \]
\[ T(\gamma) = \frac{1}{\gamma} \int_0^\infty tP(t)dt \]
where \( \text{Prob}(t>T) = \int_T^\infty tP(t)dt = \frac{1}{\gamma} \)

and \( P \) is the distribution of lead time \( t \).
In practice

- Not so easy to measure (availability of data)
- Definition not universal (where you start and stop on the supply chain…)
- Micro-level Model feasible based on supply chain model using shipment level data (Arvis 2007).
- Evidence from survey or corridor analysis point that the third category of costs is the primary problem in developing countries in the form of: loss shipments or excessive inventory. (transport = 1/3)
In practice (2)

- No yet generally agreed methodology to aggregate at the country level: requires combination of survey data and national account...

- Indication from different researchers
  - 10% in high income OECD
  - 15%-20% in MICs (mostly LAC and MNA)
  - Above 30% in some LDCs

- Series of logistics costs/gdp would be ideal and very interesting for policy makers.

=> WORK IN PROGRESS.
Project Specific indicators
Narrow objectives

- Monitor performance over time (not necessarily compare with other) for a specific gateway (port) or corridor.
- Focus on time, and increasingly variability of time at shipment level.
- Provide a breakdown of the time: e.g. dwell time in ports.
Trade « simplified »

- Vessel arrival
- Manifest
- Submission of an accepted declaration
- Clearance
- Exit Delivery
- Port
  - Forwarder
  - Shipper
  - Bank
- Customs control agencies
  - Forwarder
- Port Forwarder
- Shipping agents
  - Forwarder
  - Transit
- Handling Transit
- Clearance
- Removal

Handling Transit → Clearance → Removal
WCO TRS methodology (ports)
Bank Trade and Transport Facilitation in Eastern Europe (TTFSE) methodology
USAID, Nathan FastPath (for corridor)
=> World Bank Nathan FastPath Lite.
Exemple (Rades Tunisie)
FastPath Lite Graphic Model
Connectivity indicators
Intuitive concept of connectivity

- Capture the quality of the connection to global market by air or sea (“before the border”)
- Along with domestic logistics performance may influence the overall supply chain performance, hence reliability
- Important to measure given the potential high impact of hub and spoke structure of international transportation
- Non entirely exogenous (transport service policies)
UNCTAD’s liner shipping connectivity index

- Based on individual country aggregated traffic and line information, corrected for country size. Essentially a simple average of the following indicators (normalized to 100 for the highest connectivity country), available for 162 countries:
  - Ships per mio capita
  - TEU per 1000 capita
  - Liner companies
  - Liner services
  - Ship size average
  - Ship size maximum
  - Ships per line
<table>
<thead>
<tr>
<th>Year</th>
<th>LSCI</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>100.00</td>
<td>1</td>
</tr>
<tr>
<td>Hong Kong, China</td>
<td>94.42</td>
<td>2</td>
</tr>
<tr>
<td>Germany</td>
<td>76.59</td>
<td>7</td>
</tr>
<tr>
<td>Singapore</td>
<td>81.87</td>
<td>4</td>
</tr>
<tr>
<td>Netherlands</td>
<td>78.81</td>
<td>6</td>
</tr>
<tr>
<td>United States</td>
<td>83.30</td>
<td>3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>62.83</td>
<td>12</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>68.68</td>
<td>10</td>
</tr>
</tbody>
</table>
Challenges

- Strong Demand for connectivity indicators
- Theoretically complex: topology of the network essential
- Current indices (UNCTAD, IATA) useful but not yet consistent with network picture.
- World Bank Air Connectivity Index being developed as pilot.
Contact Us

The World Bank Group
International Trade Department

www.worldbank.org/lpi
www.worldbank.org/trade
www.worldbank.org/tradefacilitation
www.worldbank.org/tradelogistics

Washington Office
1818 H Street NW
Washington DC 20433

Contact: tradefacilitation@worldbank.org