Port Productivity vs Value of Port Functions

Professor Dr. Paul Tae-Woo Lee
Director, Maritime Logistics and Free Trade Islands Research Center
Ocean College, Zhejiang University
Zhoushan, China

Capacity building Workshop on Sustainable Port Development and Improving Port Productivity among ESCAP Member Countries, Bangkok, Thailand, 3-4 April 2019
My presentation aims

- To overview some issues of improving Port Productivity
- To revisit implications of Port Productivity, raising several questions
- To propose new perspectives, concepts, and arguments for Port Productivity in association with the Value of Port Functions.
Maritime Logistics Connectivity

- China’s Strategic Option with Logistics Distribution Centre (LDC) Development on the China-Africa-S. America (CASA) Trade Routes (Lee, 2016)
- China’s new exit strategy to Indian Ocean and Pacific Ocean thru East Sea

Main interlining ports:
- Northern Europe: Antwerp (mainly MSC), Le Havre (mainly CMA CGM), Rotterdam
- Straits of Gibraltar: Algeciras (mainly Maersk), Valencia (mainly MSC), Tanger Med, Sines (relation Portugal-Brazil only)
- Middle East: Salalah (mainly Maersk), Dubai, Jeddah

Source: Flynn Consulting (2011)
The 21st Century NEW Maritime Silk Road & Current Major Maritime Connectivity in the World

21st Century NEW Maritime Silk Road

Current major maritime connectivity in the world
Definition of Port Productivity

“Port productivity is defined as the number of container moves per port call divided by the total hours from when vessels arrive at port limits to the point of departure from the berth.”

* Source: https://www.joc.com Sep 26, 2016

“Port productivity can be defined differently between terminal operators and customers, there is a general consensus that productivity can be greatly improved with the help of certain tools and initiatives, such as carrier-terminal collaboration, which can be a win-win situation for ports and shipping lines if joint-planning is implemented as a way of optimising cargo flows from end-to-end.”

* Source: https://www.porttechnology.org 20 Aug 2015

Is the higher Port productivity good enough for the port, country, and port/city?
Factors Affecting Port Productivity (PP)

1. Quay and Crane Productivity

1) Quay Productivity
   - Containers handled over the quay / length of quay (period)

2) Ship Productivity
   - Gross Moves per Hour (GMPH): Containers moved to/from a ship / Hours between first and last lift (period)
   - Net Moves per Hour (NMPH): Containers moved to/from a ship / Hours between first and last lift minus idle time (period)

3) Crane Productivity
   - Gross Crane Rate: Containers moved over the quay per crane / Hours between first and last lift (period)
   - Net Crane Rate: Containers moved over the quay per crane / Hours between first and last lift minus idle time (period)

2. Yard Capacity / Productivity

1) (Factors affecting) Yard Capacity
   - Dwell time
   - Twenty Foot Ground Slots (TGS)
   - Storage Capacity TEU
   - Peaking Factor / Surge Factor
   - Maximum Stacking Height
   - Optimum Stacking Height

2) Number of inland transport units loaded (truck / rail / barge)

3. Gate Performance

1) Gross Truck Turnaround Time

2) Net Truck Turnaround Time

Global decline in Port Productivity in 2017 compared with 2016.

Definition of Port Productivity in this figure:

the number of container moves per hour of time spent by vessels in port.

Data from the JOC Port Productivity Database shows a 3 percent average drop in weighted port productivity globally in 2017 compared with 2016.

Africa leads global decline in port productivity

Change in number of container moves per hour of time spent by vessels in port in 2017

Source: IHS Markit

© 2018 IHS Markit

Environmental factors are NOT to be free from Port Productivity and it should be considered in port performance.

- Requirements to be a Green port
- Emission Control Areas (IMO)
- Sustainability

Do environmental factors affect negative impacts or positive impacts on improving port productivity?

Environmental performance of European Ports

1. Environmental management indicators

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Existence of a certified environmental management system</td>
</tr>
<tr>
<td>2</td>
<td>Existence of an environmental policy</td>
</tr>
<tr>
<td>3</td>
<td>Environmental policy makes reference to ESPO's guideline documents</td>
</tr>
<tr>
<td>4</td>
<td>Existence of an inventory of relevant environmental legislation</td>
</tr>
<tr>
<td>5</td>
<td>Existence of an inventory of Significant Environmental Aspects(SEA)</td>
</tr>
<tr>
<td>6</td>
<td>Definition of objectives and targets for environmental improvement</td>
</tr>
<tr>
<td>7</td>
<td>Existence of an environmental training program for port employees</td>
</tr>
<tr>
<td>8</td>
<td>Existence of an environmental monitoring program</td>
</tr>
<tr>
<td>9</td>
<td>Environmental responsibilities of key personnel are documented</td>
</tr>
<tr>
<td>10</td>
<td>Publicly available environmental report</td>
</tr>
</tbody>
</table>

2. Environmental monitoring indicators

1) Waste, 2) Energy consumption, 3) Water quality, 4) Water consumption, 5) Noise,
6) Air quality, 7) Sediment quality, 8) Carbon footprint, 9) Marine ecosystems,
10) Soil quality, 11) Terrestrial habitats

* Source: ESPO(2018), 'ESPO ENVIRONMENTAL REPORT - EcoPortsinSights 2018'
Environmental Evaluation Criteria vs Port Productivity

• If a port must abide by regulations of IMO and other organisations, how we can find evaluation criteria (APEC, IMO, Green Port Incentives) related to Port Productivity as well as Value of Port Functions?

• How can we add new criteria to contribute to improving PP and Port Value?

Some points to ponder: “Single eye” vs “Compound eyes” (ommatidia)

1. Is it free of charge to improve Port Productivity (PP)?
   ✓ Trade-off between PP and value of port functions
   ✓ Increase of PP vs increase of Port Investment (extra costs)

2. How to share the improved PP gains?

3. Are port performance indicators which have been developed for major ports and world terminal operators suitable for little ports?

4. How to consider PP in association with value of port functions for the country and port/cities as well as in the context of port sustainability?

5. Is the only panacea for little players (ports) to improve PP?
   ✓ Port productivity vs Diversification/Rearrangement of port functions (5th Generation Port [Lee et al. (2018) vs 4th Generation Ports by UNCTAD (1999)]

6. How can we integrate a port into welfare maximization of developing countries?
   ✓ Dynamic Customer-Centric Community Ports (Lee and Flynn, 2010; Lee, 2014-2017, modified version)

How can we see our ports? With “Single eye” or “Compound eyes” (ommatidia)?
How to share the improved port (terminal) productivity gains?

Stakeholders to share the improved PP gains

1) SHIPPING LINES
   - Vessel turn around time (savings operation costs and capital costs)
   - Offering better schedule service to their customers

2) PORT AUTHORITY / TERMINAL OPERATOR
   - Equipment optimization
   - Higher number of boxes moved (Increased earnings)
   - Operational savings (e.g. Labour)

3) LOGISTICS PROVIDER
   - Better organisation of supply chains
   - Lower transportation and logistics costs

4) COUNTRY/COMMUNITY
   - Terminal efficiency for a country’s competitiveness and economic development
   - Lower congestion and pollution on the roads and in port
Two Main Streams in Port Development (Bennathan & Walters, 1979)

» Anglo-Saxon Doctrine

- Port, . . ., should stand on its own bottom.
- Port construction costs transfers to port service users.
- As a result, no container hub port in UK.

» European (Continental) Doctrine

- Port as part of the social infrastructure of a whole region.
- Port construction with port (End) user’s investment and local and central governments subsidy
- A couple of container hub ports in Europe

Developing “Asian (Port) Doctrine” to explain Asian port success. 

*Transport Reviews, Vol.31, No.6*

➢ Anglo-Saxon Model and European (Continental) Doctrine by Bennathan & Walters (1979) cannot explain the Asian success of container port developments.

---

**Transport Reviews**

Publication details, including instructions for authors and subscription information:  
[http://www.tandfonline.com/loi/ttrv20](http://www.tandfonline.com/loi/ttrv20)

**Charting a New Paradigm of Container Hub Port Development Policy: The Asian Doctrine**

Paul Tae-Woo Lee \(^a\) & Matthew Flynn \(^b\)

\(^a\) Department of Logistics and Shipping Management, Kainan University, 33857, Taiwan, Republic of China

\(^b\) Flynn Consulting Ltd, Hong Kong Special, Administration Region

Available online: 19 Oct 2011
Developing “Asian (Port) Doctrine” to explain Asian port success

Ideology, Rationale & Strategy
- Gerschenkron model
- Infant industry argument
- Public enterprise approach
- Administered pricing
- Cross-subsidization
- National economic security
- SOC and Infrastructure
- National welfare

A New Paradigm for Port Development Policy

Globalization: Manufacturing centre

Geo-political factor

Economic theory: policy alignment

Economic actor: State as port Operator & Economic facilitator

Asian port pricing

Source: Lee & Flynn (2011)
How will we (policy-makers) see a port?

- “Single eye” approach vs “Compound eyes” (*ommatidia*) approach (Lee & Lam, 2017)

- **Compound eyes approach**: Port development should be considered in the context of overall economic policy and socio-economic-geopolitical system.
## Comparison of Key Features of the Fourth and the Fifth Generation Ports (1/2)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service quality</strong></td>
<td>Meeting regulations and general levels of standards</td>
<td>Finding dynamic incentives to perform beyond basic standards and to meet customers’ satisfaction</td>
</tr>
<tr>
<td><strong>Information Technology</strong></td>
<td>Cargo clearance &amp; tracking</td>
<td>IT is not only based on tracking and tracing of both cargoes and information via a ‘single window’ system but also on performance measurement including gas emission information</td>
</tr>
<tr>
<td><strong>Community environmental impact</strong></td>
<td>Regulatory compliance with environmental impact and planning statutes</td>
<td>Active outreach to community stakeholders in port-city interface, planning and decision making process, in particular waterfront development. Active green port policy with rewarding system is envisaged.</td>
</tr>
<tr>
<td><strong>Port cluster</strong></td>
<td>Handled through land-use planning</td>
<td>Port leaders have role as “port cluster managers” in tandem with maritime cluster contributing to generating value-added in in the context of logistics hub.</td>
</tr>
</tbody>
</table>

* Source: Modified key features of the Fifth Generation Ports in Table 2 taken from Flynn et al. (2011, p. 503).
## Comparison of Key Features of the Fourth and the Fifth Generation Ports (2/2)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maritime cluster</strong></td>
<td>Treated as separate from port function</td>
<td>Subject to clustering, functional interrelated with creative financial incentives to attract shipowner and cargo by creating jobs and added value</td>
</tr>
<tr>
<td><strong>Logistics hub</strong></td>
<td>Logistics developed as a back of port function; and Physical Free Trade Zones and Logistics Parks</td>
<td>Logistics as part of a maritime logistics chain, which is interrelated to the feature of ‘inland’ to maximise its synergy effect, considering airport interface for high-value added flexibility, Advanced FTZ and Logistic Park functions.</td>
</tr>
<tr>
<td><strong>Inland</strong></td>
<td>Inland connections develop through natural evolution</td>
<td>Ports develop hinterland strategies through pricing &amp; incentive policies ensuring that evolution does advantage interest of cargo owners and generates efficiency of intermodal system with possible reduction of total transportation costs.</td>
</tr>
<tr>
<td><strong>Waterside</strong></td>
<td>Port marketing as two dimensional price and quantity approach</td>
<td>Ports developing foreland strategies to capture transshipment cargoes in tandem with SCM through pricing and other incentive policies</td>
</tr>
</tbody>
</table>

* Source: Modified key features of the Fifth Generation Ports in Table 2 taken from Flynn et al. (2011, p. 503).
Evolution Path to the Fifth Generation Port (5GP) as “Dynamic Customer-Centric Community Ports”

- Market growth
- Port competition

- Cargo ports
  - Logistics ports
    - SCM ports
      - Globalised e-ports
        - 2-way flow of information
  - Economic Value Creation

- Big Port - multiple services (warehouse, etc.)
- Complexity
  - Government support
  - Locational restriction
  - Environment, Security & Safety concerns
  - Resilient system
  - Sustainability

Source: Flynn and Lee (2010); Modified by Lee (2015)
Dynamic Customer-Centric Community Ports


- Vol. 1: Applying Theory to Practice in Maritime Logistics
  - Ch. 3 China’s Growing Engagement in Emerging Maritime Logistics Markets in Africa
  - Ch. 9 Proposing New Concepts of Economies of Flow, Connexion, and Fusion Technology in Maritime Logistics

- Vol. 2: Emerging Trends in Ports
  - Ch. 8 Developing the Fifth Generation Ports Model
Traditional Concepts of Economies

• Economies of Scale
• Economies Scope
• Economies of Density
• Economies of Speed

Are they enough to improve productivity and efficiency in economic activities?
Proposing new economies concepts for Logistics and SCM?

A New Paradigm to Improve Efficiencies and Competitive Edge in LOGISTICS & SCM

1. Economies of Flow

2. Economies of Connexion (networking)

3. Economies of Fusion technology

Note: These concepts were coined by Paul T-W Lee (2009) and published in Lee (2015).
Priority Issue between Port Productivity and Sustainability

Port Productivity > Sustainability

VS

Port Productivity < Sustainability

How can we reflect PP in Sustainability?
A Way Ahead Towards Port Productivity (PP)

- Stakeholder’s Priority & Different perspective in PP.
  - Central government
  - Local government
  - Port authority
  - Terminal operator
  - Port users’ needs and responses---Shipping liners, land transport sector, logistics providers, shippers
  - Port/City relationship (Community issue)

Who will bear the costs to improve PP and how will the stakeholders share its fruits?
Concluding Remarks

Improving port (terminal) productivity is not free of charge.
- Capital, Advance technology, labor training program, and fusion technology are required to improve port productivity.

Is it a panacea for the port/country/port-city to improve PP?
- Is PP the ultimate goal of a port?
Concluding Remarks and Discussion Points

- How will we (policy-makers) see a port?
  - Asian Port Doctrine vs Anglo-San & European Doctrine (Lee & Flynn, 2011)
  - “Single eye” approach vs “Compound eyes” (ommatidia) approach (Lee & Lam, 2017)
  - Compound eyes approach: port development should be considered in the context of overall economic policy and socio-economic-geopolitical system.

- Can we reflect new concepts proposed in this speech to improve PP as well as Value of Port Functions?
  - Economies of flow, connection and fusion of technology.
  - 5th Generation Port, Dynamic Customer-Centric Community Ports,

- Can we think trade-off between PP and the Value of Port Functions?
  - How can we maximize the value of port functions for its community and country at a marginal expense of PP?


Thank You

谢谢
감사합니다
cảm ơn
Terima Kasih
Vinaka
ขอบคุณครับ / ขอบคุณค่ะ
ありがとうございます。

Contact point: Professor Paul Tae-Woo Lee, Ocean College, Zhejiang University
Email add: paultaewoo.lee@zju.edu.cn; ptwl2030@qq.com