Performance measurement for intermodal corridors: A methodological approach

Carlos Martner
OBJETIVE

- Given the increasing importance of intermodal transport in Mexico
- And the absence of indicators to understand the logistics performance of this sector
- It is proposed to construct a methodological framework for analyzing comprehensively and systematically the performance of intermodal corridors
- Using available data, currently produced in a dispersed, disconnected and disarticulated manner
GENERAL TRENDS IN INTERMODAL TRANSPORT IN MEXICO

- A PRIORITY IN THE NATIONAL DEVELOPMENT PLAN 2013-2018
  - ..., INFRASTRUCTURE AND TRANSPORT LOGISTICS SERVICES TIMELY, EFFICIENT AND SAFE
  - FOR ..., INCREASE COMPETITIVENESS AND PRODUCTIVITY OF ECONOMIC ACTIVITIES
  - REDUCE LOGISTICS COSTS

- BY DEVELOPING INTERMODAL LOGISTICS PLATFORMS AND INTERMODAL CORRIDORS
General trends in intermodal transport in Mexico (2)

- What are the recent trends in intermodal transport?

- A strong increase in participation of rail freight between 2000 and 2013
  - TONS from 2.9% to 7.4%
  - IN TON-KILOMETER from 3.3% to 8.1%

- In that period the intermodal freight transport quadrupled
  - FROM 2.1 TO 8.2 MILLION TONNES
  - 1.579 TO 6.306 MILLION TON-KM
GENERAL TRENDS IN INTERMODAL TRANSPORT IN MEXICO (3)

- Evolution of Intermodal - Average Annual Growth Rate, AAGR

- Despite the global economic crisis of 2009, this shows a high growth

  - 2000-2013 AAGR Tons = 10.8%
  - 2000-2013 AAGR Ton-km = 11.2%
  - AAGR 2000-2013 Ton-km by company: KCSM = 8.8% Ferromex = 15.3%, Ferrosur = 14.1%

- Much higher than the AAGR motor carrier and rail

  - Trucking Ton-km = 1.5%
  - Rail Ton-km = 3.7%
GROWTH OF RAIL-TRUCK INTERMODAL TRAFFIC IN TONNES AND TONNE-KM (AAGR 2000-2013)

Source: IMT’s own elaboration, with data from DGTFM-SCT
GROWTH OF INTERMODAL TRANSPORT BY RAILWAY COMPANY (AAGR Tonne-km)

Source: IMT’s own elaboration, with data from DGTFM-SCT
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- Recently, IMT an identified a number of useful data to develop indicators
  - Especially those related to traffic volumes

- With these data, can be modeled flows on a platform with geographical base (GIS) to identify
  - The main nodes and arcs of the intermodal network
  - Desire lines cargo
  - The intermodal corridors of higher density (in tons and ton-km)
Desire lines intermodal freight flows

Pares origen - destino mayores a 50,000 toneladas de carga contenerizada en 2012

SIMBOLOGÍA
(toneladas)
- 1,000,000 - 1,250,000
- 500,000 - 999,999
- 250,000 - 499,999
- 100,000 - 249,999
- 50,000 - 99,999
- Estaciones
- Vías férreas

Fuente: Elaboración propia, con base en los datos 2012 de la Dirección General de Transporte Ferroviario y Multimodal, SCT.
Volumes of containerized loads moved by rail, 2012

Source: IMT’s own elaboration, with data from DGTFM-SCT
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- However, it should develop a set of indicators on:
  - Operating,
  - Productivity
  - Efficiency, etc..

- ... to systematically measure the performance of intermodal corridors in Mexico

- Some sources of information are available
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- However, the data and indicators are presented in a dispersed and disarticulated manner.

- Lack of integrated vision, required for analyzing a chain or logistics corridor.

- Therefore, the proposal is to create a tool for:
  - Measure consistent and regular performance and efficiency.
  - Develop indicators covering the different links of the chain.

For example,…
## Time Anchoring of Ships in the Port of Veracruz, January-August, 2014

<table>
<thead>
<tr>
<th>TIPO DE CARGA</th>
<th>SHIP AT ANCHOR</th>
<th>% OF SHIPS AT ANCHOR</th>
<th>TIME ANCHORING (HOURS)</th>
<th>ANCHORING PER VESSEL (DAYS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAIN BULK</td>
<td>50</td>
<td>38%</td>
<td>4,958.00</td>
<td>4.13</td>
</tr>
<tr>
<td>GENERAL CARGO</td>
<td>47</td>
<td>17%</td>
<td>1,648.00</td>
<td>1.46</td>
</tr>
<tr>
<td>CONTAINERS</td>
<td>38</td>
<td>8%</td>
<td>790.00</td>
<td>0.87</td>
</tr>
<tr>
<td>AUTOMOBILES (CARS)</td>
<td>17</td>
<td>14%</td>
<td>866.00</td>
<td>2.12</td>
</tr>
<tr>
<td>OTHERS</td>
<td>21</td>
<td>26%</td>
<td>527.00</td>
<td>1.05</td>
</tr>
<tr>
<td>TOTAL</td>
<td>173</td>
<td>15%</td>
<td>8,789.00</td>
<td>2.12</td>
</tr>
</tbody>
</table>

Fuente: Elaboración propia con base en datos de API Veracruz
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- High efficiency in the First Maneuver (vessel to yard and vice versa)
  - Container/hour/crane
    - Puerto Lázaro Cárdenas = 38 CHC (2014 - First half)
    - Puerto Progreso = 30 CHC (2014 - First half)
  - Container/hour/vessel in operation
    - Puerto Lázaro Cárdenas = 113 CHVO (2014 - First half)
    - Puerto de Veracruz = 80 CHVO (2014 - First half)

Favorable evolution of performance indices of loading/unloading and transport.
Source: Author’s own elaboration with data from CGPMM
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- However, there is a critical fact: The container clearance time at port terminal

- Time spent in the container terminal
  - Σ stay time in container yards / Σ Total operated container
  - Port of Manzanillo 2013 = 5.77 días
  - Port of Manzanillo 2014 = 6.88 días
  - SSA Manzanillo 2014 = 6.42 días

- Dynamics Capacity (DC) in the maritime terminals
  - DC = (365 / Average stay) * Static capacity
  - Port of Manzanillo 2014 = 2.90 Million TEUs
  - SSA Manzanillo 2014 = 1.42 Million TEUs
Average stay of containers in the terminal SSA Manzanillo, 2014

Fuente: Elaboración propia con base en datos de API Manzanillo.
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- % OCCUPANCY CONTAINER TERMINALS
  - TEUS moved / Dynamic Capacity * 100
  - PORT OF MANZANILLO 2014 = 82 %
  - SSA MANZANILLO 2014 = 112 %

- EFFICIENCY INDICATORS OF THE INTERNATIONAL LOGISTICS CONNECTION
  - Efficiency of Border Crossings
  - Efficiency of Customs Clearance at Port
TEUs moved vs Dynamic Capacity
SSA Manzanillo, 2014

Fuente: Elaboración propia con base en datos de API Manzanillo
PERFORMANCE OF INTERMODAL CORRIDORS IN MEXICO

- Moreover, it is important to measure the evolution of the efficiency and competitiveness of hinterland connections.

- Indicators of the intermodal chain:
  - Competitiveness of Intermodal vs Truck
  - (A favorable Breakeven Point for intermodal transport)
  - Inland transport costs
  - Travel Time Indicators (Truck-FFCC)
  - Frequency and Reliability of Service
Tarifas del Transporte de contenedores por Autotransporte y Ferrocarril ($/contenedor)

<table>
<thead>
<tr>
<th>Kilómetros</th>
<th>$/contenedor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5,000</td>
<td>100</td>
</tr>
<tr>
<td>10,000</td>
<td>200</td>
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<tr>
<td>15,000</td>
<td>300</td>
</tr>
<tr>
<td>20,000</td>
<td>400</td>
</tr>
<tr>
<td>25,000</td>
<td>500</td>
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<tr>
<td>30,000</td>
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<td>700</td>
</tr>
<tr>
<td>40,000</td>
<td>800</td>
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<tr>
<td>45,000</td>
<td>900</td>
</tr>
<tr>
<td>50,000</td>
<td>1,000</td>
</tr>
<tr>
<td>55,000</td>
<td>1,100</td>
</tr>
<tr>
<td>60,000</td>
<td>1,200</td>
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<td>70,000</td>
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<td>75,000</td>
<td>1,500</td>
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<td>85,000</td>
<td>1,700</td>
</tr>
<tr>
<td>90,000</td>
<td>1,800</td>
</tr>
<tr>
<td>95,000</td>
<td>1,900</td>
</tr>
<tr>
<td>100,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

**Breakeven Distance**
- Distancia (km): 338
- Tarifa (Pesos Mex): $6,862

Source: IMT’s own elaboration, with field gathering data and logistic operators information, 2009.
Cost per kilometer: Truck and rail containers, 2010

Main Origin-Destination
(Mex Pesos / Container / km)

Source: IMT's own elaboration, with field gathering data and logistic operators information, 2009.
INLAND TRANSPORT PER CONTAINER 40 FEET (FEU)
INTERMODAL VS TRUCK

Manzanillo-México D.F. - USD 950 –USD 0.99 FEU/Km
Travel time 48 hours - Vel. 20 Km/hours

Manzanillo - México D.F.-USD 1150 –USD 1.33 FEU/Km
Travel time 17-18 hours - Vel. 50 Km/hours

Fuente: International World Cargo Co., Ltd. Shanghai, China
INLAND TRANSPORT PER CONTAINER 40 FEET (FEU)
INTERMODAL VS TRUCK

Lázaro Cárdenas-México D.F. - USD 875 –USD 1.01 FEU/Km
Travel time 36 hours   - Vel. 23 Km/hours

Lázaro Cárdenas-México D.F.- USD 1350 –USD 1.63 FEU/Km
Travel time 15-16 hours   - 50 Km/hours

Fuente: International World Cargo Co., Ltd. Shanghai, China
Final Reflections

- In a scenario of high growth of intermodal transport

- It is desirable to develop a set of indicators to measure the performance of intermodal corridors in Mexico

- Currently there are some isolated data useful for the establishment of indicators

- Many others are not collected systematically or consistently

- It requires a mechanism and rules to ensure the periodic lifting of travel information:

- That would be the role of the National Observatory of Transport and Logistics
THANK YOU FOR YOUR ATTENTION

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Carga contenedorizada transportada por ferrocarril en toneladas - kilómetro, 2011

Simbología (Toneladas - kilómetro)
- 2,000,000,000 - 2,700,000,000
- 1,000,000,000 - 1,999,999,999
- 500,000,000 - 999,999,999
- 100,000,000 - 499,999,999
- 50,000,000 - 99,999,999
- Menos de 49,999,999

Vías férreas
Estaciones

Fuente: Elaborado por el IMT, con base en datos de la DGTFM de SCT
# Mexico Inland Charges in US Dollar

<table>
<thead>
<tr>
<th>Inland City</th>
<th>VIA</th>
<th>Truck Camión</th>
<th>Rail+Truck Intermodal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20’ / 40’ / 40’ HC</td>
<td>20’ / 40’ / 40’ HC</td>
</tr>
<tr>
<td>Mexico City</td>
<td>Manzanillo</td>
<td>1150 / 1150 / 1150</td>
<td>800 / 950 / 950</td>
</tr>
<tr>
<td>Monterrey</td>
<td></td>
<td>1400 / 1400 / 1400</td>
<td>1050 / 1050 / 1050</td>
</tr>
<tr>
<td>Guadalajara</td>
<td></td>
<td>750 / 750 / 750</td>
<td>600 / 650 / 650</td>
</tr>
<tr>
<td>Mexico City</td>
<td>Lázaro Cárdenas</td>
<td>1350 / 1350 / 1350</td>
<td>725 / 875 / 875</td>
</tr>
<tr>
<td>Monterrey</td>
<td></td>
<td>1600 / 1600 / 1600</td>
<td>900 / 1050 / 1050</td>
</tr>
</tbody>
</table>

Fuente: International World Cargo Co., Ltd. Shanghai, China
E斯塔 mejorando.
Mejora competitividad en costo vs autotransportistas.

**Corredor Intermodal**

<table>
<thead>
<tr>
<th>Costo</th>
<th>USD 250</th>
<th>USD 700</th>
<th>USD 150</th>
<th>Total $1,100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puerto de Manzanillo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal Pantaco</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destino Final México DF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tiempo</th>
<th>3.5 días</th>
<th>2 días Tiempo Recorrido</th>
<th>2 días desde Terminal Interior</th>
<th>Total 7.5 días</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estadía en Puerto</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Corredor Unimodal - Truck**

<table>
<thead>
<tr>
<th>Costo</th>
<th>USD 250</th>
<th>USD 1,100</th>
<th>Total $1,350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puerto de Manzanillo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destino Final México DF</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tiempo</th>
<th>6.4 días</th>
<th>0.7 días Tiempo de Recorrido</th>
<th>Total 7.1 días</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estadía en puerto</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fuente: Elaboración IMT, con base en datos de levantamiento de campo y de operadores logísticos,