Joint UNESCAP – UIC seminar on:

Facilitation and Costing of Railway Services along the Trans-Asian Railway

Bangkok
9-11 December 2015
PART A: Traffic costing in railway planning environment

1. Relationship between railway costs and prices
2. Preparation of railway marketing and corporate plans
3. Railway capital investment appraisal
Relationship between railway costs and prices

- Most railways of region operate in competitive environment

  ➢ In competitive transport markets, competition determines level of railway prices

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Freight customer's premises  ➔  Station "A"  ➔  Rail Linehaul  ➔  Station "B"  ➔  Freight consignee's premises

Rail charges:
- Local delivery charge per tonne or per container
- Loading/unloading and other handling charges

Road charges:
- Linehaul transport charge

Total door-to-door charge (rail) = Local delivery charge + Loading/unloading and other handling charges + Linehaul transport charge + Local delivery charge per tonne or per container

Total door-to-door charge (road) = Linehaul transport charge
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3
Relationship between railway costs and prices

Example of comparative rail and road container haulage charges, Chennai-Bengaluru (2014)

Comparative haulage charges - container traffic Chennai-Whitefield-Chennai

<table>
<thead>
<tr>
<th>Route</th>
<th>Container size/load condition</th>
<th>Road</th>
<th>Rail</th>
<th>Ratio rail/road</th>
<th>Inverse ratio</th>
<th>Indicated modal shares</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rs per container</td>
<td>Rs per container km</td>
<td>Rs per container</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harbour of Madras - Whitefield</td>
<td>20ft loaded</td>
<td>36,000</td>
<td>11.80</td>
<td>10,200</td>
<td>30.54</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>20ft empty</td>
<td>12,000</td>
<td>3.27</td>
<td>7,000</td>
<td>20.95</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>40ft loaded</td>
<td>40,000</td>
<td>124.22</td>
<td>16,500</td>
<td>49.40</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>40ft empty</td>
<td>18,000</td>
<td>53.50</td>
<td>13,000</td>
<td>38.92</td>
<td>0.70</td>
</tr>
<tr>
<td>Whitefield - Harbour of Madras</td>
<td>20ft loaded</td>
<td>36,000</td>
<td>11.60</td>
<td>6,200</td>
<td>20.35</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>20ft empty</td>
<td>12,000</td>
<td>37.27</td>
<td>4,700</td>
<td>14.07</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>40ft loaded</td>
<td>40,000</td>
<td>124.22</td>
<td>10,850</td>
<td>32.49</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>40ft empty</td>
<td>18,000</td>
<td>55.00</td>
<td>8,600</td>
<td>25.75</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Sources: Rail charges - CONCOR website October 2014; Road charges, Freight Forwarder, Bengaluru October 2014

Assumptions:
1. Like for like comparison (haulage to/from Whitefield ICD by road vs. rail), on basis that road would have to call at Whitefield for customs inspection
2. Road rates apply irrespective of direction of travel
Relationship between railway costs and prices

- By contrast, railway O&M (Operating and Maintenance) costs are determined by the level of resources: human, physical and capital assigned to individual routes and services.

- The level of these resources can, and will to some extent, be varied in line with traffic volume - “to some extent” because railways are characterized by a high level of fixed costs, i.e. costs which do not vary with traffic volume.

  - Principal fixed cost items: fixed infrastructure (track, bridges, other structures) maintenance, station staffing and train control costs, but sometimes even train crew costs, are fixed.

- Fixed % of infrastructure O&M costs about 80% for low traffic railways and 50-60% for high traffic railways.

- Track inspection, fencing and vegetation control are fixed items of infrastructure maintenance. Re-railing, ballast renewal are main variable items of infra maintenance.

  - For ADB Multimodal project, 80% of Sri Lankan Railway infrastructure costs considered to be fixed.

  - For Chennai-Bengaluru Industrial Corridor (CBIC) project, 50% of Indian Railways infrastructure costs considered to be fixed.
Relationship between railway costs and prices

- Monitoring profitability of individual railway traffics
  - Desire to improve profitability of railways necessarily requires assessment of profit (or financial contribution) at a disaggregated level, i.e. at level of individual OD traffics or trains, routes and traffic segments
  - Profit for individual traffic segments can be assessed as the difference between unit revenue (revenue per net tonne-km or per passenger-km) and unit operating cost (O&M cost per net tonne-km or per passenger-km)
Preparation of railway marketing and corporate plans

- Marketing plan provides foundation for other functional department plans and for corporate plan

- Essential element of Marketing Plan is SWOT analysis at the market, or traffic, segment level
  - Assessment of financial contribution by individual traffic and market segment is an input for SWOT analysis
Preparation of railway marketing and corporate plans

- Assessment of traffic financial contributions

![Graph showing unit revenue vs operating cost by traffic segment in Bengaluru-Chennai rail corridor, India]

- Example: Analysis of container, bulk freight and passenger traffic on the Bengaluru-Chennai route shows different levels of profit (loss) for 3 different traffic segments.

- In a competitive environment, unit revenue (or price) determined by forces of competition, but unit costs may be varied by changing level of resource inputs.

- Financial contribution of individual routes, trains or traffic segments can be improved by increasing train sizes, reducing cycle times, or by a variety of different operating interventions.

- Marketing plan should drive the development of strategies designed to improve the financial contributions of individual traffic segments.
Railway capital investment appraisal

- Financial and economic appraisal techniques used to evaluate railway capital investment proposals

- Typical types of railway capital investment projects in UNESCAP region:
  - New track construction
  - Track capacity expansion
  - Track renewal
  - Track re-gauging
  - Electrification
  - Signalling system modernization
  - Station/terminal re-development
  - Locomotive fleet expansion and/or upgrading
  - Passenger rolling stock fleet expansion and/or upgrading
  - Freight rolling stock fleet expansion and/or upgrading
Railway capital investment appraisal

- **Financial appraisals** involve Discounted Cash Flow (DCF) analysis of project inflows and outflows:

<table>
<thead>
<tr>
<th>CASH FLOWS</th>
<th>Construction period</th>
<th>Operating period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure CAPEX - initial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure CAPEX - replacement</td>
<td></td>
<td></td>
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<tr>
<td>OPEX</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ Project income (train operations) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
+ Project income (other)            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

= NET CASH FLOW | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |

- **Outflows**: Land acquisition; Capital expenditures (infrastructure, motive power and rolling stock); Operating and Maintenance (O&M) expenditures (train crews, energy consumption, motive power and rolling stock maintenance, fixed cost of infrastructure maintenance, variable cost of infrastructure maintenance, station and train control operating costs, shunting costs, signalling operating costs)

- **Inflows**: Income (revenue) from train operations; income from station retail franchises; income from advertising
### Railway capital investment appraisal

- **Economic appraisals** involve calculation and analysis of the discounted **net** benefits to the economy of a railway capital investment project:

<table>
<thead>
<tr>
<th>ECONOMIC COST AND BENEFIT FLOWS</th>
<th>Construction period</th>
<th>Operating period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Infrastructure CAPEX - initial</td>
<td>![Arrow pointing left]</td>
<td>![Arrow pointing right]</td>
</tr>
<tr>
<td>Economic Infrastructure CAPEX - replacement</td>
<td>![Arrow pointing left]</td>
<td>![Arrow pointing right]</td>
</tr>
<tr>
<td>Economic OPEX</td>
<td>![Arrow pointing left]</td>
<td>![Arrow pointing right]</td>
</tr>
</tbody>
</table>

| Economic benefits | ![Arrow pointing right] |

| NET ECONOMIC BENEFIT FLOW | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |

- **Economic costs:** Conversion of financial costs (CAPEX and OPEX) to economic costs by application of Shadow Pricing Factors (to exclude taxes, government charges and market distortions)

- **Economic benefits:** Induced economic growth; induced traffic growth; VOT (Value of Time) savings to existing road and railway users; VOC (Vehicle Operating Cost) savings to the economy; reduced Greenhouse and noxious gas emissions; reduced transport accident costs; reduced road maintenance costs
Thank you

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