UNESCAP Capacity Building Workshop, Bhutan

Air Transport Planning and Policy

Dr. Sanjay Gupta
Professor
School of Planning and Architecture,
New Delhi, India
April 2015
Air Transport enables easier access to markets, efficiency improvements & greater domestic & international competitiveness;
Factors Contributing to Air Traffic Growth

- **Economic Factors**
  - Economic liberalization
  - Expansion of Industries
  - GDP Growth
  - Expansion of higher income population
  - Emergence of LCC & apex fare system

- **Policy Factors**
  - Open sky policies
  - Liberal bi-lateral relations
  - Liberal permission for acquisition of new airports
  - Private investment in airlines & airport infrastructure
  - Permission of domestic airlines to operate on international sectors
Travel Markets at Different Stages of Development

Improvements in aviation productivity have raised productivity in almost every sector of the economy, from manufacturing to retail, tourism to agriculture.
Geographical scales of Airport

International/Global Network

National/Regional Network

Local (Airport City)
Stages in Air Network Development

Stage 1:
- Initial development (intermediate stops)

Stage 2:
- Bypassing effect

Stage 3:
- Proximity effect

Stage 4:
- Hubbing effect
Hub & Spoke Network

- Flights from multiple origin converge on airport (hubs) from which new flights start towards multiple destination (spokes);
- achieves regional market dominance and higher plane loads, while passengers benefit from better connectivity and lower costs
Hub airports may run into capacity limitations, both in terms of the number of gates and the availability of landing and takeoff windows.
Airport plays not only an important role as means of transport but also as a social connector & economic engine.
Typical Airport Layout
## Airport Classifications

<table>
<thead>
<tr>
<th>Primary</th>
<th>Yearly pax greater than 5 million</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E.U Classification</strong></td>
<td></td>
</tr>
<tr>
<td>Community Airports</td>
<td>if pax &gt; 10 million/year</td>
</tr>
<tr>
<td>National Airports</td>
<td>if pax 5-10 million/year</td>
</tr>
<tr>
<td>Large regional</td>
<td>if pax 1-5 million/year</td>
</tr>
<tr>
<td>Small regional</td>
<td>if pax &lt;1 million/year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ICAO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>Peak hr aircraft movements &lt; 15 for each runway or &lt; 20 for all runway</td>
</tr>
<tr>
<td>Medium</td>
<td>Peak hr movements 16-25 for each runway or 20-35 for all runway</td>
</tr>
<tr>
<td>Heavy</td>
<td>Peak hr movements &gt;25 for each runway or &gt;35 for all runway</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hub</td>
<td>Interchange mode for carriers that offers hub &amp; spoke service (Megahubs or Secondary Hubs)</td>
</tr>
<tr>
<td>Feeder</td>
<td>Supports hub as a spoke</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Routes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First level airports</td>
<td>Intercontinental &amp; international links &gt; 3000km</td>
</tr>
<tr>
<td>Second level airports</td>
<td>International links 2000-3000km</td>
</tr>
<tr>
<td>Third level airports</td>
<td>National &amp; International links 500-700km</td>
</tr>
</tbody>
</table>
Airport Catchment Area

- Catchment Area represents the possible demand & potential for airport development;
- **Primary catchment area**: Area where air travellers choosing an airport are captive
- **Secondary catchment area**: Area where air travellers may choose that airport but are not captive but elastic with respect to choice of another airport;
- Size of catchment area depends on:
  - population
  - income levels
  - Employment level
Airport Demand Assessment

Methods
- Trend Based approach
- Econometric Models
- Scenario Models
- Ratio Models
- Market Surveys
- Expert Judgment

Outputs
- The volumes & peaking characteristics of passenger & freight demand over the forecasting period.
- The number & types of aircraft serving the forecasted passenger & freight demand
- Performance & operating characteristics of the airport ground access systems

Approach
- Analyzing the past trends & estimating the future volumes of:
  - Aircraft movements
  - Passengers
  - Freight Shipments

Information needed:
- Region served by the airport
- Demographic or population data on airport catchment area.
- Economic characteristics of the area (GDP, Per Capita Income, Employment, Population etc.)
- The air travel market area
- Characteristics of the nearby areas providing the air transport services.

Land Area Assessment
- Analyzing the past trends & estimating the future volumes of:
  - Aircraft movements
  - Passengers
  - Freight Shipments

Information needed:
- Region served by the airport
- Demographic or population data on airport catchment area.
- Economic characteristics of the area (GDP, Per Capita Income, Employment, Population etc.)
- The air travel market area
- Characteristics of the nearby areas providing the air transport services.
Factors affecting Airport Location

- Aviation activity
- Development of surrounding area
- Atmospheric conditions
- Accessibility to ground transport
- Availability of land for expansion
- Topography
- Presence of other airports
- Availability of utilities
Site Evaluation & Selection Process

1. Broad determination of the land area required;

2. Evaluation of factors affecting airport location;

3. Preliminary office study of possible sites;

4. Site inspection;

5. Environmental study;

6. Review of potential sites;

7. Preparation of outline plans & estimates of costs & revenues;

7. Final evaluation & selection; and

## Typical Land Area Distribution for an Airport

<table>
<thead>
<tr>
<th>Total Area</th>
<th>Area (Ha)</th>
<th>%</th>
<th>% of Airport Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRATEGIC RESERVE FOR NON AVIATION DEVELOPMENT/OTHER/MISCELLANEOUS</td>
<td>240</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>AIRPORT AREA</td>
<td>960</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>AIRSIDE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIRSIDE INFRASTRUCTURE</td>
<td>643.2</td>
<td>53.6</td>
<td>67</td>
</tr>
<tr>
<td>AIRCRAFT MAINTENANCE AREA</td>
<td>22.8</td>
<td>1.9</td>
<td>2</td>
</tr>
<tr>
<td>AIRPORT SUPPORT UTILITIES</td>
<td>22.8</td>
<td>1.9</td>
<td>2</td>
</tr>
<tr>
<td>CENTRAL TERMINAL AREA (PASSENGER)</td>
<td>63.6</td>
<td>5.3</td>
<td>7</td>
</tr>
<tr>
<td>AIR SUPPORT ELEMENTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIR CARGO TERMINAL</td>
<td>26.4</td>
<td>2.2</td>
<td>3</td>
</tr>
<tr>
<td>LANDSCAPE AND GREEN AREAS</td>
<td>14.4</td>
<td>1.2</td>
<td>2</td>
</tr>
<tr>
<td>AIRPORT COMMERCIAL DEVELOPMENT</td>
<td>166.8</td>
<td>13.9</td>
<td>17</td>
</tr>
</tbody>
</table>

**Source:** GMR

**Source:** Area distribution standards
Criteria for Airline Scheduling

- Routes to be served;
- Time-zone of each destination relative to the hub;
- Number of flights/week per route;
- Block time on each route;
- Number of aircraft in fleet;
- Turnaround time;
- Where aircraft will be overnight; and
- The time of the day when passengers will want to fly.
Case Studies

- Indian Airports and Aviation Policy
- Bhutan Aviation Policy
AIRPORTS AUTHORITY OF INDIA (AAI) WAS –
• Established in 1994 under the Airports Authority Act
• Responsible for developing, financing, operating, and maintaining all government airports
• The Aircraft Act (1934) governs remaining airports

FACTS ABOUT INDIAN AVIATION
• Third largest aviation market by 2020
• Travel & tourism to be a USD270.5 billion industry by 2023
• Business & leisure travel to boost growth
• By 2030, India’s working population to be thrice the total population in the US
• By 2016, India’s middle income class to be triple the total population in Germany
• India is the ninth largest civil aviation market in the world
• India ranks fourth1 in domestic passenger volumes (116.3 million)
Trends in India’s Aviation Sector

• In 2011-12, the Indian civil aviation sector provided the means for transporting 122 million domestic and 40 million international passengers as well as 807 million metric tonnes of domestic cargo and 1,460 million metric tonnes of international cargo.

• More passengers are flying more often than ever before.

• New airlines are inaugurating new routes.

• Service frequency on the most popular metropolitan routes is in excess of 30 flights per day.

• Airports are being modernised and expanded.

• Airlines - foreign and domestic, allowed to operate cargo services to or from any Indian airport with customs facilities (Air Cargo Open Sky Policy).

• The entry of low-cost carriers into the market marked a watershed moment. (60.3% share in 2012-13)

• Private sector investment is expected to increase to USD 9.3 billion during the Twelfth Five Year Plan from USD 5.5 billion in the previous plan.
# Facilities at Various Major Airports in India

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>NORMS ( /PHP/DAY)</th>
<th>KIA, BENGALURU</th>
<th>RGIA. HYDERABAD</th>
<th>IGIA, NEW DELHI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landside Facilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pax Handled per annum</td>
<td>&gt; 10 Million</td>
<td>12.8 Million</td>
<td>8.6 Million</td>
<td>36 Million</td>
</tr>
<tr>
<td>Average Daily Traffic ( ADT)</td>
<td></td>
<td>35257</td>
<td>23,307</td>
<td>1.01 Lakh</td>
</tr>
<tr>
<td>Peak Hour Pax</td>
<td>0.1725( ADT)</td>
<td>6082</td>
<td>4090</td>
<td>17428</td>
</tr>
<tr>
<td>Designed Peak Hr Capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Terminal Area</td>
<td>25 Sq.m</td>
<td>28 Sq.m</td>
<td>26.6 Sq.m</td>
<td>30.8 Sq.m</td>
</tr>
<tr>
<td>Check-in Counters</td>
<td>1 per 68 PHP</td>
<td>1 per 31 PHP</td>
<td>1 per 233 PHP</td>
<td></td>
</tr>
<tr>
<td>Self Check-in Kiosks</td>
<td>1 per 240 PHP</td>
<td>1 per 136 PHP</td>
<td>1 per 560 PHP</td>
<td></td>
</tr>
<tr>
<td>Escalators</td>
<td>1 per 136 PHP</td>
<td>1 per 127 PHP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevators</td>
<td>1 per 127 PHP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immigration Counters</td>
<td>1 Sq.m</td>
<td>1 per 250 PHP</td>
<td>1 per 90 PHP</td>
<td>1 per 190 PHP</td>
</tr>
<tr>
<td>Parking</td>
<td>1.5-2 Spaces/PHP</td>
<td>0.3 Space/ PHP</td>
<td>1.4 spaces/ PHP</td>
<td>4 Spaces/ PHP</td>
</tr>
<tr>
<td>Security channels</td>
<td></td>
<td></td>
<td>1 Per 380 PHP</td>
<td></td>
</tr>
<tr>
<td>Baggage reclaim belts</td>
<td>2.6 Sqm/pax</td>
<td>1 per 400 PHP</td>
<td></td>
<td>1 per 1500 PHP</td>
</tr>
<tr>
<td>Customs Counters</td>
<td>3 Sq.m</td>
<td>20% of terminal building area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Airside Facilities** | | | | |
| Contracting Bridges/Aero Bridges | 1 per 17 ATM/day | 1 per 28 ATM/Day | 1 Aero Bridge/10 ATM/Day |
| Remote Stands | 1 per 18 ATM/day | 1 per 11 ATM/Day | 1 Stand/14 ATM/Day |
| Parking Bays for Aircrafts | 1 per 7 ATM/day | 1 Bay/8 ATM/Day | 1 per 15 ATM/Day |
| Taxiways | 1 per 28 ATM/Day | | | |
| Apron Area | 1064.55 Sq.m/ATM/Day | 415 Sq.m/ATM/Day | 840 Sq.m/1 ATM/Day |
Broad NTDPC Policy Recommendations

• Airport capacity sufficient to process 1150 million passengers per annum (mmpa) required by 2031-32

• Airport-specific investment plans should be dynamic in their response to changing traffic patterns and demand.

• A National Master Plan should be devised and maintained which identifies clear economic reasons for building airports in generally specified locations.

• DGCA should be replaced with a Civil Aviation Authority responsible for the operational regulation of airlines and aircraft covering areas such as air-worthiness, safety and licensing.

• Centre should progressively withdraw from airport operations where feasible and commercially sustainable

• Need to create off airport cargo facilities similar to ICD to reduce congestion at airports

• Need to build Heliports to support growth of aviation sector
• The taxation regime should be revised in view of the distortionary nature.
• The government must decide clear and stable rules governing the foreign ownership and operation of domestic airlines.
• Financial strength and stability of airlines important criteria for permitting entry and also continuing operations.
• There is substantial scope for airports to ensure that their pricing regimes are fairly determined and transparently applied.
• Institutions that regulate civil aviation will need to be strengthened.
• Need to set up fully autonomous Accident Investigation and Safety Board.
Bhutan Aviation Policy
The national airline Drukair and the country’s first privately owned airline Tashi Air, together carried 296,422 international air passengers in 2014, an increase of 38.5% compared to 2013.
Domestic air passenger flow

- Domestic Air Service in Bhutan started on 17th December, 2011 with flights to Bumthang and Yonphula followed by Gelephu on 25th October, 2012.
- Drukair and Tashi Air are currently the two domestic air service operators.
- The total number of domestic air passengers increased by 10.3% in 2014 compared to 2013.

### Domestic Passenger Flow, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>International passengers</th>
<th>Local passengers</th>
<th>Total Passengers</th>
<th>Number of Flights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paro-Bumthang</td>
<td>919</td>
<td>444</td>
<td>1,363</td>
<td>131</td>
</tr>
<tr>
<td>Bumthang-Paro</td>
<td>1,217</td>
<td>427</td>
<td>1,644</td>
<td>132</td>
</tr>
<tr>
<td>Total</td>
<td>2,136</td>
<td>871</td>
<td>3,007</td>
<td>263</td>
</tr>
</tbody>
</table>

Source: Drukair
Civil Aviation Policy - Objectives

The overall policy objective of the air transport sector is to develop domestic air services through the establishment of regional airports and improve external air links with full Instrument Landing System facility.

Specific objectives are to:

a) Enhance safety and security of air services;
b) Develop domestic air services;
c) Promote and expand international air services;
d) Expand, upgrade and maintain international airport infrastructure and facilities;
e) Strengthen legal and institutional framework, and improve service delivery system;
f) Address environmental issues and gender disparity.
Civil Aviation Policy - Strategies

1. **Enhance safety and security of air services**

   a) Continuously ensure high levels of safety and security of commercial air transport
   
b) Establish an effective emergency and disaster management system;
   
c) Develop search and rescue capabilities;
   
d) Separate regulatory, provider and development functions;
   
e) Consolidate all security responsibilities at the airports;
   
f) Management of Bhutanese airspace, including the establishment of Flight Information Region through required infrastructure and facilities.
2. **Develop domestic air services**
   
a) Facilitate the introduction of domestic air services within the tenth plan;

b) Up-grade heliports/helipads and develop regional airports;

c) Encourage private sector participation and foreign direct investment.

3. **Develop domestic air services**
   
a) Develop international airport with Instrument Landing System capability;

b) Facilitate the growth of trade and tourism;

c) Foster bilateral, regional and international cooperation;

d) Enhance cooperation and collaboration among stakeholders;

e) Regulate traffic and tariff until such time the market dictates otherwise.
4. **Expand, upgrade and maintain airport infrastructure and facilities at par with international standard**

   a) Enhance security surveillance system and emergency response capabilities;

   b) Up-grade and modernize communication and navigation aid, meteorological services and the Air Traffic Control facilities; and

   c) Develop and expand infrastructure and associated facilities.

5. **Strengthen legal and institutional capacity, and improve service delivery system**

   a) Develop institutional capacity and professionalism at all levels for efficient delivery of services;

   b) Promote the use of Information and Communication Technology to enhance productivity and reduce cost;

   c) Improve airport services and public service delivery system
Air travel is vital in improving connectivity particularly to remote regions with challenging geography or topography.

Airport investment plans should be dynamic in response to changing traffic patterns and demand.

Air transport should be seen as a component of multi-modal transport system.

Network centric thinking is necessary in planning air transport infrastructure.

Good land transport networks should be available for quick distribution of traffic.

Economic impacts of air connectivity needs to be assessed along with feasible business models for air.

Bhutan

Air transport policies proposed are comprehensive and need to highlight explicitly the integration of air transport development with land transport—roads and transport system.