THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL
(Case Study: PT. Garuda Indonesia Tbk. and Haryono Tours & Travel)

Author:
Siti Dara Sabrina
2510100046

Supervisor:
Dr. Eng. Erwin Widodo

Industrial Engineering Department
Institut Teknologi Sepuluh Nopember
INTRODUCTION
Research Background

THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL

(Yan and Pei, 2011)
Research Background

CHANNEL CONFLICT

IATA survey highlights 2013 (aviation, 2013)

Travelocity, Expedia, Orbitz (Koo et al., 2011)
Problem Identification

determine the best pricing scenario for airline ticket distribution channel, those are:

Scenario A:
Ticket sales structure through airlines own website only

Scenario B:
Ticket sales structure through airlines own website and traditional travel agents

Scenario C:
Ticket sales structure through airlines own website, traditional travel agents, and Online Travel Agents (OTA)
Research Objectives

✓ Develop three pricing scenarios for channel distribution in airlines ticket sales
✓ Determine the best financial performance between the scenarios

Research Benefits

✓ Provide a view of decision making in airlines ticket sales distribution for the future consideration
✓ Maintain cooperation between Garuda Indonesia and travel agents under DCSC structure
✓ Build a good relationship between Industrial Engineering Department with PT. Garuda Indonesia Tbk. and Haryono Tours & Travel

THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL | Siti Dara Sabrina 2510100046
Research Scope

LIMITATIONS

1. A study case in PT. Garuda Indonesia Tbk.
2. Ticket sales by Garuda Indonesia is only on website.
3. The travel agent used is Haryono Tours & Travel Head Office Surabaya
4. Ticket sales for route Surabaya-Jakarta

ASSUMPTIONS

1. The demand of airline ticket tends to be deterministic.
2. Profit will be taken based on each route
3. Dynamic pricing in airline ticket is negligible.
4. Airline website sells Garuda Airline ticket only
LITERATURE REVIEW

Industrial Engineering Department
Institut Teknologi Sepuluh Nopember
Literature Review

- Dual-Channel Supply Chain
- Airline Tickets Distribution
- Pricing Scheme
- Quadratic Programming
THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL | Siti Dara Sabrina 2510100046

RESEARCH METHODOLOGY

Industrial Engineering Department
Institut Teknologi Sepuluh Nopember
determine the best pricing scenario for ticket distribution channel:
A: Ticket sales through airline website only
B: Ticket sales through airline website + traditional travel agent
C: Ticket sales through airline website + traditional travel agent + OTA

• **Demand function** in DCSC: Do, Ds, Dso for each scenario
• **Objective function**: maximize Gtot, Gair, Gagent,
• **Constraint** for each scenario

• **Price** in airline website and travel agent
• **Demand** of ticket in airline website and travel agent
• Identification of **ratio in customer acceptance** to each channel
• **Value of demand elasticity** to price
• **Unit cost** of airline ticket
• **Profit sharing** percentage
THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL

Siti Dara Sabrina 2510100046

**Research Methodology**

- **Verification** will be done by checking “warning sign” on m-file script in MATLAB.
- **Validation** will be done by checking model behavior.

- **Optimization Process** using syntax `fmincon` in MATLAB:
  - The optimal result will be the one which give a better gain/profit performance than actual condition.

- **Output Analysis**:
  - Analysis output of the model: comparison scenario profit for each channel and the whole supply chain.
  - Sensitivity Analysis

- **Conclusion**:
  - Recommendation for the best airline ticket distribution channel.
MODEL DEVELOPMENT

Industrial Engineering Department
Institut Teknologi Sepuluh Nopember
System Description

1. Data of ticket sales is collected in the period of January-April 2014.

2. The variable costs used are unit cost of airline ticket, ticket price that travel agent needs to pay to the airline, and profit sharing from airline to travel agents.

LIMITATIONS

ASSUMPTIONS

1. Channel distribution of Garuda Indonesia ticket sales now is only on Garuda Indonesia’s website and traditional travel agent.

2. Unit cost of the airline ticket is IDR 530,000 based on Garuda Indonesia basic fare for V class.

3. \( P_w = C_u \)

4. Confidence level = 98%

5. Historical and questionnaire data are sufficient to represent the result.
Demand Function according to Widodo, et al. (2011)

**In store demand function**

\[ D_s = d_s^{\text{max}} - \frac{P_s - P_o}{1 - \rho}, \text{ for } \frac{P_o}{\rho} < P_s < d_s^{\text{max}} (1 - \rho) + P_o \]

Demand function above is developed from Chen and Simchi-Levi (2004) demand function, \( D_s = d_s^{\text{max}} - \beta P_s \)

**Online demand function**

\[ D_o = \frac{P_s - P_o}{\rho (1 - \rho)}, \text{ for } \frac{P_o}{\rho} < P_s < d_s^{\text{max}} (1 - \rho) + P_o \]
### Research Model

#### Demand Function

<table>
<thead>
<tr>
<th>Demand Function</th>
<th>Do</th>
<th>Ds</th>
<th>Dso</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario A</td>
<td>$d_o^{\text{max}} - \beta P_o$</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Scenario B</td>
<td>$\beta \left( \frac{\rho P_s - P_o}{\rho(1-\rho)} \right)$</td>
<td>$d_s^{\text{max}} - \beta \left( \frac{P_s - P_o}{1-\rho} \right)$</td>
<td>n/a</td>
</tr>
<tr>
<td>Scenario C</td>
<td>$\frac{\beta (P_o(\gamma - 1) + P_{so}(\rho - 1) + P_s(1 - \rho \gamma))}{\rho(1-\rho)(1-\gamma)}$</td>
<td>$d_s^{\text{max}} - \beta \left( \frac{P_s - P_o + P_s - P_{so}}{1-\rho + 1-\gamma} \right)$</td>
<td>$\beta \left( P_o(\gamma - 1) + P_{so}(\rho - 1) + P_s(1 - \rho \gamma) \right) \frac{1}{\gamma(1-\rho)(1-\gamma)}$</td>
</tr>
</tbody>
</table>

#### Notations

- $D_o$ = Online demand through Garuda Indonesia website
- $D_s$ = Store demand through Haryono tours and travel office
- $D_{so}$ = Online demand Haryono tours and travel website
- $d_o^{\text{max}}$ = Maximum value of $D_o$, when $P_o$ is set to a lower limit value
- $d_s^{\text{max}}$ = Maximum value of $D_s$, when $P_s$ is set to a lower limit value
- $\rho$ = customer acceptance ratio of Garuda Indonesia website compared to traditional travel agent
- $\gamma$ = customer acceptance ratio of Online Travel Agent (OTA) compared to traditional travel agent
- $\beta$ = demand elasticity ratio on price
- $P_o$ = Online price (ticket price on Garuda Indonesia website)
- $P_s$ = Store price (ticket price on Haryono tours and travel office)
- $P_{so}$ = Online price on travel agent website (ticket price on Haryono tours and travel website)
## Research Model

### Gain Function

**Demand Function**

<table>
<thead>
<tr>
<th>Channel Structure</th>
<th>Gair</th>
<th>Gagent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario A</td>
<td>( G_o = D_o (P_o - C_u) )</td>
<td>n/a</td>
</tr>
<tr>
<td>Scenario B</td>
<td>( G_o = D_o (P_o - C_u) - \theta C_u D_s )</td>
<td>( G_s = D_s (P_s - P_w) )</td>
</tr>
<tr>
<td>Scenario C</td>
<td>( G_o = D_o (P_o - C_u) - \theta C_u (D_s + D_{so}) )</td>
<td>( G_s + G_{so} = D_s (P_s - P_w) + D_{so} (P_{so} - P_w) )</td>
</tr>
</tbody>
</table>

**Notations**

- \( G_o \): Profit of ticket sales on Garuda Indonesia website
- \( G_s \): Profit of ticket sales on Haryono tours and travel office
- \( G_{so} \): Profit of ticket sales on Haryono tours and travel website
- \( D_o \): Online demand through Garuda Indonesia website
- \( D_s \): Store demand through Haryono tours and travel office
- \( D_{so} \): Online demand Haryono tours and travel website
- \( P_o \): Online price (ticket price on Garuda Indonesia website)
- \( P_s \): Store price (ticket price on Haryono tours and travel office)
- \( P_{so} \): Online price on travel agent website (ticket price on Haryono tours and travel website)
- \( \theta \): Profit sharing ratio of Garuda Indonesia to Haryono tours and travel
- \( C_u \): Unit cost of airline ticket
- \( P_w \): Travel agent cost to be paid to airline

Maximize \( G_{tot} = G_{air} + G_{agent} \)
## Constraints

### Scenario B

<table>
<thead>
<tr>
<th>No</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower bound of price</td>
</tr>
<tr>
<td>2</td>
<td>Demand interplay</td>
</tr>
<tr>
<td>3</td>
<td>Demand must be positive</td>
</tr>
<tr>
<td>4</td>
<td>Price deviation bound</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

### Scenario A

<table>
<thead>
<tr>
<th>No</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower bound of Price</td>
</tr>
<tr>
<td>2</td>
<td>Demand must be positive</td>
</tr>
</tbody>
</table>

### Scenario C

<table>
<thead>
<tr>
<th>No</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower limit of price</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Demand interplay</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Demand must be positive</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Price deviation limit</td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
# Parameter Data Collection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer acceptance ratio of Garuda Indonesia website compared to traditional travel agent</td>
<td>ρ</td>
<td>0.9</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>Customer acceptance ratio of Online Travel Agent (OTA) compared to traditional travel agent</td>
<td>γ</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Maximum value of Do when Po is set to a lower limit value</td>
<td>$d_o^{\text{max}}$</td>
<td>2</td>
<td>Historical Data</td>
</tr>
<tr>
<td>Maximum value of Ds when Ps is set to a lower limit value</td>
<td>$d_s^{\text{max}}$</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ticket unit cost/ticket price travel agent needs to pay to Garuda Indonesia</td>
<td>Cu/Pw</td>
<td>530000</td>
<td>Basic fare of V class by Garuda Indonesia</td>
</tr>
<tr>
<td>Profit sharing percentage</td>
<td>θ</td>
<td>5%</td>
<td>Interview to Haryono tours and travel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demand elasticity ratio on price</th>
<th>β Scenario A</th>
<th>β Scenario B</th>
<th>β Scenario C</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>$\beta_o$ 0.0000000685</td>
<td>$\beta_o$ 0.000000155</td>
<td>$\beta_o$ 0.00000006</td>
</tr>
<tr>
<td></td>
<td>$\beta_s$ 0.000000065</td>
<td>$\beta_s$ 0.00000025</td>
<td>$\beta_{so}$ 0.00000035</td>
</tr>
</tbody>
</table>

**THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL**

Siti Dara Sabrina 2510100046
THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL | Siti Dara Sabrina 2510100046

NUMERICAL EXPERIMENT AND ANALYSIS

Industrial Engineering Department
Institut Teknologi Sepuluh Nopember
\[ P = 1.7249 \times 10^6 \]

\[ G = -9.7796 \times 10^5 \]

\[ \text{exitflag} = 1 \]

\[ P = 1.0 \times 10^6 * \]

\[ \begin{bmatrix} 1.7194 & 1.9894 \\ -2.6370 \times 10^6 \end{bmatrix} \]

\[ \text{exitflag} = 1 \]
THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL

Siti Dara Sabrina 2510100046
Validation

Each model represents real condition where the **increasing value of ticket unit cost** impacts the **decreasing value of total gain**.
### Numerical Experiment

<table>
<thead>
<tr>
<th></th>
<th>Historical Data</th>
<th>Scenario B</th>
<th>Scenario A</th>
<th>Scenario C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Po</td>
<td>1,232,732</td>
<td>1,719,400</td>
<td>1,724,900</td>
<td>1,262,800</td>
</tr>
<tr>
<td>Ps</td>
<td>2,364,287</td>
<td>1,989,400</td>
<td></td>
<td>2,313,200</td>
</tr>
<tr>
<td>Pso</td>
<td></td>
<td></td>
<td></td>
<td>1,966,300</td>
</tr>
<tr>
<td>Do</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Ds</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Dso</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Go</td>
<td>968,142</td>
<td>1,455,601</td>
<td>1,194,900</td>
<td>6,414,117</td>
</tr>
<tr>
<td>Gs</td>
<td>1,834,287</td>
<td>1,459,400</td>
<td></td>
<td>1,783,200</td>
</tr>
<tr>
<td>Gso</td>
<td></td>
<td></td>
<td></td>
<td>6,211,936</td>
</tr>
<tr>
<td>Gair</td>
<td>941,642</td>
<td>1,429,101</td>
<td>1,194,900</td>
<td>6,273,006</td>
</tr>
<tr>
<td>Gagent</td>
<td>1,834,287</td>
<td>1,459,400</td>
<td></td>
<td>7,995,136</td>
</tr>
<tr>
<td>Gtot</td>
<td>2,775,929</td>
<td>2,888,501</td>
<td>1,194,900</td>
<td>14,268,141</td>
</tr>
</tbody>
</table>

Ticket sales under 3 channels; Garuda Indonesia website together with Haryono tours & travel office and website shows the best financial performance.
Sensitivity Analysis of scenario A

Each 5% increasing value of Cu impacts decreasing value of total gain IDR 17,786 (2%) on average.
Sensitivity Analysis of scenario B

- Do exists when $\rho > 0.8$
- At $\rho > 0.945$, Gagent will decrease to the extinction of travel agent.

- Each 5% increasing value of Cu impacts 3% decreasing value of total gain
- When Cu = IDR 500,000, Gair will significantly declining than Gagent
Sensitivity Analysis of scenario C

- Decreasing value of Cu will impacts 0.036% decreasing value of Po on average → decreasing Gair
- Decreasing value of Cu will impacts increasing value of 0.7239% Ps and 0.7241% Pso → demand still high → Gagent increased.
Sensitivity Analysis of scenario C

- Increasing 0.01 value of $\rho$ impacts $P_0$ to be **19% higher**.
- When $\rho > 0.91$ demand decreased up to **36%** $\rightarrow$ Gair decreased

- As $\gamma$ increased, travel agent tends to increase $P_s$ 0.9% and $P_{so}$ 2.1%. $\rightarrow$ **decreasing value of demand** $\rightarrow$ Gagent decreased
- At $\gamma = 0.875$, Gagent=Gair
Managerial Implication

1. The implementation of ticket sales under 3 channels would impact to increasing Po 2%, decreasing Ps 2% than historical data, and Pso should 15% cheaper than Ps. This channel distribution gain more demand, so that total gain would increase significantly than historical data.

2. Garuda Indonesia with travel agent would keep DCSC when $0.81 \leq \rho \leq 0.945$, so that both will have win-win solution.

3. Garuda Indonesia would have best profit with single channel distribution (Garuda Indonesia website) when $\rho \geq 0.99$, as the travel agent would be extinct.
CONCLUSION AND RECOMMENDATION

Industrial Engineering Department
Institut Teknologi Sepuluh Nopember
Conclusions

1. Three pricing scenarios of airline ticket distribution channel are developed to maximize total profit for each channel structure.

2. The best financial performance showed by multiple channel supply chain (scenario C).

3. This study shows that multiple channels distribution (scenario C) reach wider customer segmentation and gain more profit than single channel. The optimal total gain of scenario C gives significantly better profit than scenario B.

4. The expansion of OTA will result a better profit for both Garuda Indonesia and Haryono tours & travel, as the demand for travel agent will increase with respect to customer acceptance ratio of OTA.

5. When customer acceptance ratio of OTA reach its threshold of 0.875, travel agent tends to increase its price and have a willing to turn customer preference to buy ticket from Garuda Indonesia website with its lower price than travel agent.
Recommendations

1. On the research model development should consider the dynamic pricing and stochastic demand of airline ticket.

2. Input parameter gathering data should be more precisely close enough to represent the actual condition.

3. Marketing cost of each channels should be considered for a better comparison between channels.

4. Correlation ratio between OTA and airline website should be considered in multiple channel distribution.


THANK YOU

THE IMPLEMENTATION OF DUAL-CHANNEL SUPPLY CHAIN IN AIRLINE TICKET DISTRIBUTION CHANNEL

Siti Dara Sabrina 2510100046