The Implementation of Dual-Channel Supply Chain (DCSC) in Airline Ticket Channel Distribution

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Abstract — Airline ticket channel distribution became a big issue to be discussed since conflict between channels is unavoidable. Airlines desire to do e-business as a centralized channel in selling tickets because it helps them to save costs using their own website by eliminate intermediaries. However, some of the customers prefer to travel agents because they provide different choices of flights, even some hotel booking for group tour customers segment. Yet, they need a different channel distribution to reach a broader customer segmentation. This research propose three different scenarios in airline ticket distribution: ticket sales through airline website only, ticket sales through both airline website and traditional travel agent, also ticket sales through their own website, traditional travel agent with online travel agent (OTA), to see the best financial performance among them. Mathematical model development is done to represent each structure of the scenario proposed. Numerical experiment by MATLAB also done to find the optimal price should offer to customers in each channel distributions. The result shows that airline ticket distribution channel under airline website together with traditional travel agent and OTA give the best financial performance.

Key Words — airline ticket distribution, dual-channel supply chain, optimization, quadratic programming

1. INTRODUCTION

The internet is undeniable to be something important to our life. It has a special role to expose something new which never exists before. We can find any information from the internet about weather, news, entertainment, tourism, even social media which brings us to communicate easier without distance as a limitation. E-commerce is one of the new systems which is an internet application in increasing a competitive advantage to companies [10]. E-commerce has become a strategic tool for some companies selling products or services to reach their objectives of the business to enable the customers shop using the electronic channel [12].

The development of e-commerce gives an opportunity for supply chain concept to expand its channel in practice. The business nowadays is not only doing the sell-and-buy process by face-to-face, but also using the online channel [6]. When a company sells its product using both channel, offline (conventional store) and online (website) simultaneously, it is called as Dual-Channel Supply Chain (DCSC). It means that the company has a retailer which is the conventional store to sell its product beside its own website as the direct channel to the customers. The DCSC can be applied in some business area, such as food, fashion stuff, home appliances, airplane tickets, computers, and many other things [7]. On these days, many manufacturers who already use DCSC as their strategy in selling products are DELL, Panasonic, Mattel, Cisco System, and Estee Lauder [13].

In earlier years, the common concept of supply chain is about the relationship between suppliers and retailers before a product reaches the end customer. Since the concept of DCSC came up, supply chain’s problem is not only the relationship between suppliers to their retailers, but also to its direct customers. The rapid development of e-commerce provides easier way for people to do transactions compared to the conventional store. Using internet facilities, customers may do transactions wherever and whenever they want so that they can save their money and time. This condition makes some companies release their direct channel in selling products/services beside their retailers.

Doing a business with DCSC as one of the strategy means that the preference of customers toward a channel in doing a transaction became a big issue. Based on the easiness and cheapness of the online channel, some customers will shifted to prefer buying products from this channel and mitigate the customer acceptance of the offline channel. The imbalance of the customers preference between two channels leads a conflict between both channels [7].

The airlines ticket is one sample of a DCSC application. Nowadays, airline companies have started to open direct channel using their own website to sell tickets beside the travel agents. Conflict issue between airlines and travel agents is about channel distribution of ticket selling. From the airlines view, e-commerce’s growth can be a good prospect to be developed for future, while on the other side travel agents want to keep their existence as one of the tickets channel distribution. Somehow, the development of e-commerce can also give an opportunity for travel agents to have their own website for selling airlines ticket. There are some online travel agents already exist, such as Travelocity, Expedia, and Orbitz [5].

II. MODEL DEVELOPMENT

A. System Description

The case study of this research belongs to the airline ticket sales of Garuda Indonesia through DCSC structure. The system of airline ticket distribution observed in this research pictures the relationship between Garuda Indonesia’s online channel (ticket sales through its own website) and particular travel agent (Haryono tours and
travels) as the offline channel. Garuda Indonesia is the leader of full service airline in Indonesia. It currently operates 82 aircrafts to serve 33 domestic routes and 18 international routes to South East Asian, Middle East Asian, China, Japan, South Korea, Australia, and Amsterdam. Garuda Indonesia’s vision is “We seek to become a strong and distinguished airline; therefore, our journey is to provide quality service for our passengers and freight around the world with genuine Indonesian hospitality” and its mission is “The flag carrier of Indonesia that promotes Indonesia to the world, supports national economic development by delivering professional air travel services.”

As a leader in full service airline in Indonesia, some awards have been achieved by Garuda Indonesia, such as “Four Star Airline” and “The World’s Most Improved Airline” by Skytrax, “Airline Turnaround of the Year” in 2010 by Sydney-based Centre for Asia Aviation (CAPA), also received “Best Regional Airline in Asia” and “World’s Best Regional Airline” in 2012.

Today, Garuda Indonesia has different types of channel distribution to sell the airline’s tickets. Garuda Indonesia has its own website, corporate partners, Garuda Frequent Flyers (GFF), and travel agents. One of the travel agents who sell Garuda Indonesia’s ticket is Haryono tours and travel.

Haryono tours and travel is one of Indonesian incorporated company as a travel agent. Haryono is also registered as a member of ASITA (Association of The Indonesia Tour & Travel Agencies) and IATA (The International Air Transport Association). It currently operates seven offices located in Surabaya, Jakarta, Semarang, and Malang. Haryono serves airline ticketing, hotel reservation and travel package.

The DCSC model development used in this research is limited and assumed to:

1. System Limitation:
   a. Online channel for Garuda Indonesia’s ticket is the website of Garuda Indonesia (www.garudaindonesia.com).
   b. Offline channel (store) for Garuda Indonesia’s ticket is the head office of Haryono tours and travel (Jl. Sulawesi 27-29 Surabaya).
   c. The observed ticket sales is only for Surabaya-Jakarta route.
   d. The data of ticket sales used in this research is collected in the period of January-April 2014.
   e. The variable costs used in this research are only unit cost of the airline ticket, ticket price that travel agent needs to pay to the airline, and profit sharing from airline to travel agents.

2. System Assumptions:
   a. Channel distribution of Garuda Indonesia ticket sales now is only two channels, Garuda Indonesia’s website and traditional travel agent.
   b. Unit cost of the airline ticket is Rp 530,000.00 based on Garuda Indonesia basic fare for V class.
   c. Ps = C0.
   d. Confidence level = 98%.
   e. Historical and questionnaire data are sufficient to represent the result.

B. Research Model

There are three scenarios developed in this research, first scenario captures Garuda Indonesia ticket sales through Garuda Indonesia website only, as Garuda Indonesia expects to have a better profit by minimizing its cost of profit sharing to travel agents. So that for this scenario, there will be only a demand function for Do.

\[
D_o = d_o^{max} - \beta P_o
\]

Another scenario is develop, where it captures the existing channel distribution of Garuda Indonesia ticket. As assumed in the system description above, Garuda Indonesia only sell its ticket through the Garuda Indonesia website and traditional travel agent. At this point, there will be two demand functions for this scenario, those are Ds (demand in traditional travel agent) and Ds (demand in airline website) which are more likely to the model reference of Widodo et al. (2011).

\[
D_s = d_s^{max} - \beta \left( \frac{P_s - P_o}{1 - \rho} \right) - \beta \rho P_o
\]

Last scenario proposed because based on the IATA survey highlight in 2013, travel agents still give the opportunity for airlines to reach a wider customer segmentation. While on the other side, the growth of e-commerce shown a prospective development. So that the existing of online travel agent can be a solution to this contradictory situation. On this scenario functions, γ is inserted to be a parameter of customer acceptance ratio of the online travel agent to the traditional travel agent.

\[
D_s = \beta \left( \frac{\rho P_o - P_s}{\rho (1 - \rho)} \right)
\]

The objective of this research is to maximize profit/gain (G) for the supply chain system. Each scenario has different profitability functions depends on the intermediary demand function. There would be gain for airline, gain for travel agent, and total gain for supply chain system. Basically, G represents the multiplication of demand to price subtracted to ticket unit cost. However, gain for airline has another cost which if profit sharing. Profit sharing determine 5% of total demand agent multiplied to ticket unit cost.

C. Constraints

Aside from the objective function, the constraints will be used on this research is shown as follow:

1. Ps, Po, Pso ≥ C0; ticket price in each channel should higher than unit cost or wholesale price of the ticket.
2. \( Ps \geq Po/\rho \); demand interplay between traditional travel agent and airline’s website can happen only if \( Ps \geq Po/\rho \) (threshold of Ps).
3. \( Ps \geq Pso/\gamma \); demand interplay between traditional travel agent and OTA can happen only if \( Ps \geq Pso/\gamma \) (threshold of Ps).
4. \( Ds, Do, Dso \geq 0 \); demand of each channel should be positive.
5. \( Ps-Po \leq \text{Price} \); price deviation between channels bound.
6. \( Po \leq Pso \leq Ps \); price leadership between channels.

Those constraints above are used in different scenarios depends on the need of variable used in each scenario.

### III. NUMERICAL EXPERIMENT

#### A. Existing Condition

First optimization was done by second scenario which represent the existing condition of ticket distribution channel. The optimization process for second scenario used \( \beta \) trial and constraints relaxation to approach the closest result to real condition of channel distributions. The closest iteration was number 12, which has both demand positive. However, it still has no better total gain than the historical data. So, another iterations were done to seek a bit higher profit than historical data to prevent too much higher price than historical data.

Final optimization resulted best optimal gain on iteration number 16 with total gain equal to IDR 2,888,501 with Po equal to 1,719,400 and Ps equal IDR 2,313,300, where the total gain of historical data was IDR 2,775,929.

#### B. Proposed Scenario

First proposed scenario represent ticket sales through one channel only, which is the airline website. Numerical experiment shows total gain for this scenario obtained from calculation of Do multiplied by profit, which is price subtracted by unit cost of the ticket. However, on Do calculation by demand function was previously rounded to have integer demand. Based on the optimization done for this scenario, iteration result of total gain for this structure showed by iteration 6, which is IDR 1,163,600 with Po equal to IDR 1,693,600. This gain has the least deviation to the historical gain. However, to have fair comparison total gain in each scenario, the optimal iteration chosen is number 11, which has Po higher than the optimal result of existing condition, IDR 1,724,900 and total gain equal to IDR 1,194,900. At this point, even if Po of proposed scenario is higher than Po of existing scenario, either total gain or airline gain of proposed scenario are still lower than existing scenario, which can be concluded that maintaining the existing scenario would be better than this scenario.

Another proposed scenario is third scenario, where based on the IATA survey highlight in 2013, travel agents still give the opportunity for airlines to reach a wider customer segmentation. While on the other side, the growth of e-commerce shown a prospective development. So that the existing of online travel agent can be a solution to this contradictory situation.

Based on optimization process for third scenario, the optimal solution showed on iteration number 34 which has Po and Ps closest to the historical price. Moreover, the solution on this iteration represent the intended channel structure, which has Po < Pso < Ps because price in travel agent should higher than price in airline website, yet OTA still serve a cheaper price (Pso) than traditional travel agent. Total gain of optimal this scenario result is IDR 14,268,141 with Po equal to IDR 1,262,800, Pso equal to IDR 1,966,300, and Ps equal to IDR 2,313,200. Beside this optimal result shows the closest price to historical data, this result is chosen due to its price are much lower than the optimal price chosen on existing scenario to have an equal comparison between existing scenario and third scenario to existing scenario to first scenario, where lower ticket fare offered can give a better gain performance with wider channel structures.

### IV. SENSITIVITY ANALYSIS

Sensitivity analysis is done for chosen scenario which is third scenario with three channels distribution of ticket sales. This sensitivity shown below.

![Figure 1. The impact of \( \rho \) value change to scenario C gain](image)

Based on figure above, increasing value of \( \rho \) impacts the increasing value of airline gain and decreasing value of travel agent gain together with total gain. There is a threshold value of \( \rho \) equal to 0.91 where the increasing value of \( \rho \) impacts higher Po offered, yet the Ps and Pso tries to decrease their value to reach back their customer. So that figure above shows airline gain tends to get lower with
ρ more than 0.91 due to this competition. On the other side, sensitivity value of γ also done to seek its impact to scenario C gain as shown below.

The increasing value of γ tends to decrease travel agent gain. This behaviour came up due to the competition between each channels. As OTA tries to offer higher Ps to customer since γ increased, Ps and Po will also gets higher. However, due to the price leadership constraint of Ps≤Pso≤Ps, customer with high expectation to OTA will turn back to buy tickets from airline website to get a lower fare of the ticket. This is caused travel agent will have a decreasing gain and airline website has an escalation of gain. On the other side, threshold value of ρ equal to 0.875 will give the same proportion of gain between airline and travel agent. Sensitivity analysis of Cu value change continued below.

The behavior of this scenario model shows that the increasing value of Cu will impacts 0.032%-0.04% decreasing value of Po. However, Po and Pso shows higher value to be offered. This caused Do gets higher, while Ds and Dso remain the same, yet airline gain would still get lower due to its cost and travel agent will gain more profit as it has more likely constant demand with Ps and Pso keep increased.

V. MANAGERIAL IMPLICATION

Considering value change of price and gain for each structure, there are some aspects that can be consideration for both airline and travel agent, those are: 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, Garuda Indonesia with travel agent would keep DCSC when 0.81 ≤ ρ ≤ 0.945, so that both will have win-win solution, also Garuda Indonesia would have best profit with single channel distribution (Garuda Indonesia website) when ρ ≥ 0.99, as the travel agent would be extinct.

VI. CONCLUSION

Three pricing scenarios of airline ticket distribution channel are developed to maximize total profit for each channel structure. First is ticket sales through airline website only, second is ticket sales through airline website and traditional travel agent, and last is ticket sales through airline website and traditional travel agent together with Online Travel Agent (OTA). The best financial performance showed by multiple channel supply chain, where airline ticket sales is under three different channels. Those are airline website (Garuda Indonesia website), traditional travel agent (Haryono tours&travel), and Online Travel Agent (OTA). This study shows that multiple channels distribution with Garuda Indonesia website, Haryono tours & travel, together with OTA developed, reach wider customer segmentation and gain more profit than single channel. Chosen scenario perform total gain for supply chain equal to IDR 14,268,141, where ticket sales under single channel and DCSC structure only shows profit equal to IDR 1,194,900 and IDR 2,888,501. 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. However, when this ratio 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.

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