Boeing 787 Financial Approach

Final Report

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Abstract

The Boeing 787 Dreamliner is one of the largest aircrafts in Boeing Company. The Boeing's newest project has caused company with many problems. The biggest problem of Boeing 787 is over-outsourcing. In fact, Boeing 787 launched global outsourcing strategy by focusing on the components that were outsourced by foreign suppliers such as China, India, and Italy and so on. Boeing 787 planned to build the fuel-efficient new aircraft and cut off some costs of production from outsourcing.

However, because of too much out sourcing, Boeing has faced with 3-years-delay construction since the first delivery schedule in 2007. As a result, Boeing has already been charged with 12 billion of penalty cost. Boeing still needs more managing plan in order to fix the technical problem and avoid the cause of further delay. The purpose of this paper is to discover the mistake in business strategy of Boeing 787 and propose an alternative solution by comparing with Boeing 777 project which had no history of penalty payment as a benchmark in order to prove whether Boeing 787 would be a better project if it reduces outsourcing scale as in Boeing 777.

1. Background

The air travel industry has been growing over the last few decades; the IATA predicts that by 2014, there will be 3.3 billion passengers travelling around the globe by air. There were 2.5 billion air passengers in 2009 and this was projected to increase by about 40% in 5 years [1].

As a response to this growth in the air travel industry, Boeing started the "Dreamliner 787" Project which is efficient relative to other aircraft on the market. The 787-8 variant carries 210-250 passengers on routes of 7,650 to 8,200 nautical miles, and the 787-9 variant carries 250 - 290 passengers on routes of 8,000 to 8,500 nautical miles. The 787 family also utilizes 20% less fuel than today's similarly sized airplanes [2].

Besides the new materials used in this plane, Boeing employed a new approach to development and that was to outsource the manufacture much more of the aircraft's parts relative to previous projects. Boeing, has had projects before the 787 Dreamliner where about 50% of the budget went to contractors but in this project outsourcing goes far beyond that and the production of large, complicated subassemblies were handled by contractors [3].

787-8 Dreamliner is priced at $185.2M and 787-9 Dreamliner is priced at $218.1M [4]. Boeing has more than 800 orders on the 787 Dreamliner family even though the project has been delayed by about 3 years so far [5].

The competitive advantage that the Boeing 787 (B-787) family provides is derived from

Plastic Composites: Use of relatively more plastic composites in the Boeing 787 Dreamliner reduces weight and allows new design concepts [6].

Fuel Efficiency: Having used the composite material in Boeing 787 Dreamliner, makes it one of the most fuel efficient planes [7].

Production and Delivery Delay

The B-787 Dreamliner delivery was scheduled for May 2008. It was a very ambitious delivery schedule considering the tremendous barriers involved:

> Carbon-reinforced plastic structures are thermoset materials with significantly slower processing times than thermoplastics. The critical tooling for such large sections was in the development stage and on top of all, the new coatings had to be developed to deal with the crack propagations [8].

> On the previous airplanes, Boeing had outsourced only the manufacturing and maintained control over the design. They provided very detailed specifications to the customers as to what the final product should be. For the B-787 Dreamliner, Boeing also outsourced the design which caused a lot of delays in the development process [9].

2. Problem Statement

As we researched the reasons for the delays of the B-787 Dreamliner project, we found that the major problem of the project was the excessive amount of outsourcing.

Having considered the above, we came up with the following problems for analysis:

1. How would the project be financially different if Boeing had not outsourced to this extent?
2. How much would Boeing gain if they had not outsourced the project?
3. What delays could have been avoided?

We decided to make a comparison between Boeing 777 (B-777) and B-787 to illustrate the difference in the manufacturing approach and processes. These two alternatives are analyzed financially in this paper. It is later explained in the paper why B-777 was a good choice for a benchmark.

For the purpose of this paper, we will analyze the Boeing 787 family as a whole. This means that the unit prices in our calculations are an average of the 787-8 and 787-9 variants. The number of orders, number of cancellations, development costs and penalty costs are totals of the 787 family.

3. Explanation of Alternatives

Boeing 777 as a Benchmark for Boeing 787

There are two main reasons why we chose Boeing 777 to compare with Boeing 787.

Boeing 777 is comparatively the closest model to Boeing 787 in terms of digital production and materials. Both models were designed by computer. Furthermore, the main materials that both models used were composites and aluminum, albeit in different proportions [10].

Since Boeing 777 is the most recent model before Boeing 787, it is our opinion that if Boeing had not taken the option of extensive outsourcing, it is most likely that it would have taken the B-777 approach. In this case, Boeing had learnt what went right and wrong from the B-777 model before it started working on building the 787 model. Therefore, we could see what strategies Boeing continued to use on the 787 model, what strategies Boeing discontinued to use on the 787 model, or what strategies Boeing added to the 787 model.

On the face of it, the Boeing 777 approach may be a better option economically since no penalty costs were incurred for Boeing 777. In contrast, the Boeing 787 project has incurred a lot of penalty costs as

described in the previous section. There are four main reasons why B- 777 could avoid the penalty costs while Boeing 787 could not.

1. Boeing outsourced 50% of the design and manufacture on the 777 project while it outsourced 60% of the design and manufacture on the 787 project [11] [12].

For 777, Boeing had done a great job on outsourcing since Boeing managed to get its suppliers to deliver on time and with no delays. The reason was that most of the companies that worked in this project had worked with Boeing for a while in the past and they got experiences. Some of them had worked with Boeing for more than 30 years [11]. As a result, Boeing and those suppliers had formed working relationships.

However, for 787, Boeing believed that outsourcing could save their money because it already spent much on other things such as design, engineering, and materials. But it was not what Boeing anticipated since Boeing outsourced too much to some companies who had not proven to be reliable [12]. Some of them were inexperienced in working with a big company like Boeing. Plus, Boeing spread the design and manufacturing of crucial components out to suppliers in foreign countries such as Italy, Sweden, China, and South Korea [13]. Occasionally these suppliers failed to meet the Boeing's requirement which led to the supply chain problem. As a result, Boeing had to pay a lot of penalty costs due to the delivery delay.

Actually the idea of outsourcing is excellent since a company can reduce costs and let suppliers pay design and manufacturing costs by themselves. But in case of 787, outsourcing was excessive for Boeing to manage.

1. Boeing provided enough information to the suppliers on the 777 project while it did not on the 787 project.

For 777, Boeing provided enough information to their suppliers. For example, Boeing gave the information of designing, manufacturing. So their suppliers perfectly understood how to do things

However, for 787, Boeing let its suppliers do everything by their own from the start until the end. Rather than follow its old model of providing parts subcontractors with detailed blueprints created at home, Boeing gave suppliers less detailed specifications and required them to create their own blueprints [13]. Unfortunately, some of the suppliers failed to meet the Boeing's requirement and failed to deliver their parts on time because of the lack of understanding.

2. The 777 project concentrated on working together while the 787 project concentrated on reducing costs by outsourcing.

For 777, the program focused on two simple but powerful strategies: working together and reducing change, error, and rework [14]. With the good communication between Boeing and their suppliers, they could reduce unnecessary change and Boeing could finally save money.

However, for 787, because there were a number of suppliers, Boeing could not focus on any particular supplier so Boeing let its suppliers deliver and manage key portions of production and see the result at the end [15]. Sometimes it was too late. As a result, Boeing had to correct by itself or let its suppliers rework. It was a cause of delay.

3. The 777 project had a better problem solving than the 787 project.

For 777, according to S. Sorscher (personal communication, February 24, 2011), Boeing encouraged all major stakeholders to involve in the early design phase of the project. If there were a problem, it would be shared and discussed earlier before it was too late. Even though it was somewhat expensive in coordination cost, the airplanes were delivered on time and at the end Boeing could avoid the penalty costs.

However, for 787, Boeing paid less attention on problem solving issue. They wanted to spend as little as they could. As a result, most of the design and build processes were shifted to the suppliers. Boeing's

major concern was the assembling process. When the problem occurred, most of the time Boeing was unable to deal with it and it cost them a lot of money.

4. Calculations

In analyzing the B-787 project, we employed the Annual Worth method as illustrated below:

$$AW\ (i) = -\ D\ (A/P\ i,\ n) – P\ [(F/A\ i,\ n\text{-}k)\ (A/F\ i,\ n)] + R$$

This translates to:

$$AW\ (33\%) = -\ D\ (A/P\ 33\%,\ 8) – P\ [(F/A\ 33\%,\ 3)\ (A/F\ 33\%,\ 8)] + R$$

Where:

D = Development costs; the total cost of the project from initiation to implementation

P = Penalty Costs; the total costs accrued from delivery delays

R = Revenue, annual progress payments received from customers for the purchase of planes

i = is Boeing's MARR (Minimum Acceptable Rate of Return)

n = the study period of the project

k = the number of years before penalty costs were incurred

Assumptions

i. The delivery date is the same for all customers

ii. Boeing's latest press release for the delivery target date will hold

iii. Boeing does not offer discounts to any of its customers

iv. The Boeing 787 aircraft has no variants

v. There will be no more order cancellations after the date stated in Boeing latest Press release of (the third quarter of 2011 – 31 December 2011) [16]

vi. The only reason for order cancellations is delivery delays

vii. Cancelled orders did not accrue penalty costs

viii. Progress revenue payments continued despite delays and are uniformly distributed over the life of the project.

ix. Development costs are invested at the beginning of the project

x. Complexity for the new technology will not lead to delays

xi. The delivery date is the same for all customers

First Alternative – The Current Case

The justification for Boeing taking the approach it did towards the B-787 project was reduction of development costs by 55 percent. The initial budgeted cost was $10 billion [18]. Consequently, the estimated development costs for this project amounted to $4.5 billion.

Due to delays associated with this project, Boeing was charged 5 percent of its total sales revenue per year of delay. The unit price per plane is $201.65 million and with orders of 843 planes (factoring in cancellations) [17], the penalty cost amounts to approximately $8,499.55 million.

According to S. Sorscher (personal communication, February 24, 2011), revenue is received in the form of progress payments. We assumed that, despite delays, these are uniformly distributed over the life of the project. With the orders at 843 planes, unit price at $201.65 (the average of the unit price of B-787-8 and B-787-9) and the study period being 8 years, annual revenue progress payments amount to $21, 248.87.

Plus, MARR is derived from a payback period of three years and is approximately 33%. The study period of this analysis is eight years based on a start date of December 2003, when the board approved the sale of B-787, and an end date of December 2011, the next delivery date based on Boeing's press release of Jan 18, 2011. We assumed that Boeing will delay one more quarter.

Furthermore, the delays have been ongoing for three years and so the penalty costs are based on 5 percent of the total sales revenue per year of delay. This has been annualized over the entire eight year period by converting it to a future value with a three year period and then an annuity over eight years.

Second Alternative – B-777 Case

Employing this alternative means that Boeing does not benefit from the development cost savings and so development costs amount to the initially budgeted $ 10 billion. Nevertheless, there are no penalty costs associated with this approach and the revenue received is much higher because, it is based on the same unit price of $201.65 million and a greater number of orders (975 airplanes) since there are no cancellations associated with this approach; based on our assumptions: since there are no delays, there are no cancellations. Therefore, annual revenue amounts to $24,576.09. The two alternatives' annual worth based on their annual revenue and costs are illustrated in table 1 below.

ANNUAL WORTH OF PROJECT ALTERNATIVES					
		ALTERNATIVE 1 (B-787 case)		**ALTERNATIVE 2 (B-777 case)**	
DESCRIPTION	**DISCOUNTING FACTOR**	**AMOUNT (millions)**	**AW (millions)**	**AMOUNT (millions)**	**AW (millions)**
Revenue	n/a	$21,248.87	$21,248.87	$24,576.09	$24,576.09
Development Cost	(A/P 33%, 8)	-$4,500.00	-$1,653.75	-$10,000.00	-$3,675
Penalty Cost	(F/A 33%, 3) (F/A 33%, 8)	-$8,499.55	-$1,306.45	$0.00	$0.00
Total AW (33%)			**$18, 288.66**		**$20,901.09**

Table 1: Annual Worth of project alternatives

Therefore, the AW(33%) of Alternative 2 (B-777) is relatively greater than Alternative 1 (B-787) and it is the better option with a difference of Annual Worth about $3million.

5. Conclusion

The second alternative is the better option since it has a higher annual worth value. This means that from a purely financial point of view, Boeing would have been better off conducting the B-787 project the same way it did the B-777 project.

In addition to losing company core competencies because of outsourcing development, this case study also can be a reminder to companies that it might be too risky to outsource 60% of a new technology based project (e.g., BOEING 787 project) without an integrated approach of effective problem solving and global logistics management.

Despite the fact that the annual worth of the first alternative is also positive, the cost from loss of credibility due to three years of continuous delays has not been quantified. The loss of credibility would impact to reduce the company revenue and the value of annual worth. Therefore, further work in this area would enhance this paper's accuracy.

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