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Determining Optimum Number of Flight Deck Crew from HR Perspective

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Abstract: Airline companies are usually facing high flight deck crew (FDC) costs. They usually go through three different stages just to determine the FDC. First is the network and scheduling which translates customer demand into flying hours. Second, the manpower planning which convert flying hours in terms of FDC. The third is the crew scheduling, which is pairing, assignment, and recovery from irregular operations. This study aims to focus on helping the manpower planning department in an airlines company to find out the availability of new methods for determining the optimum FDC with minimum possible cost. One important function of HR is the Strategic Workforce Planning (SWP). In other words, the succession planning. SWP focuses on two types of positions; the critical, and the pivotal. Since FDC positions (Captains and First Officers) are very critical, so they are the most important positions in any aviation -airline- company. Three new theories have been developed and proposed in the literature. The results and findings showed that two of the three theories give better results, an airline company can save up to 75 million $ per annum.

Keywords: Optimizing costs, Flight Deck Crew, Human Resource, Workforce Planning.

I. INTRODUCTION

Strategic Workforce Planning focuses on critical and pivotal positions in organizations. Since the FDC positions are critical so it is the most important positions in any aviation -airline- company. The critical positions are driving the company to success. These positions are very sensitive and not easy to be filled. For example, a pilot may take three to four years on average to get a license [1]. The process of hiring a pilot may take from 18 months to 2 years [2]. Hence, the cost of each pilot may exceed 70,000$ up to 200,000$ SR [2]. All of what mentioned are just a few points that shows the importance and criticality of FDC determination process. Airline companies are usually facing high flight deck crew (FDC) costs. Usually they go through three different stages just to determine the FDC. First is the network and scheduling which translates customer demand into flying hours. Second, the manpower planning which convert flying hours in terms of FDC. The third one is the crew scheduling. The crew scheduling involves the optimal allocation of crews to flights and can be partitioned into three phases: crew pairing, crew assignment, and recovery from irregular operations. Crew pairing is a real challenge and it is complicated for two reasons. First, it is not practical to find the complete set of possible pairings which can cost millions to billions for major carriers for a problem. Second, the cost of a pairing usually includes linear combinations for hotel and per-diem charges and several nonlinear combinations based upon actual flying time, and total time away from the home. Crew assignment is also a complex problem, changing with organization rules, and doubled by additional rules including several rosters, language restrictions and married flight deck crew members preferring to fly together. The airline strives to make fair crew assignments in terms of equal flying time and number of days off. facing troubles such as unstable weather, sudden aircraft maintenance, air traffic overcrowding, security issues, cancelled flights or delays of passengers, and sickness or unlicensed crews on the day of operations; crew and passengers often incur airlines significant costs. In crew recovery, the objective is to reassign crew to scheduled flights. It is desirable to return to the original crew schedule as soon as possible. Crew recovery is a hard problem because of complex crew work rules, cost computations, changing objectives, and many other reasons. Often, airlines are forced to implement the first solution found due to time pressures [3]. Knowing this information about the crew scheduling give enough indicator about the complexity of this stage. Any mistake or any unprecise calculation or forecast will impact the whole process. So, this research focuses on helping the manpower planning department in an airline company to see if there is a better method of determining the optimum FDC with lower possible cost.

II. AIM AND SCOPE

The purpose of this study is to facilitate HR job in an airline company, specifically, manpower planning department by answering the question: is there a better method of calculating optimum FDC which gives lower cost? The importance and complexity of crew scheduling process and determining FDC can positively and negatively affect the performance of company. Flight deck crew is selected for the purpose of conducting this case-based research study. Four types of aircrafts will be considered in this study which are 787, 777, 330 and 320. All data have been collected of the year 2017.

III. METHODOLOGY

Three phases of meetings were conducted with manpower planning and crew scheduling experts and specialists. The first phase was conducted to understand the process of manpower planning and its impact on crew scheduling process and therefore identify the problem for determining the starting point. The second phase was conducted to identify the factors that impact the FDC costs. The third one was to identify the correlation between the factors. The flight deck crew costs were determined as the main problem due to the high variation of monthly expenses, where the causes are unknown. Then the parameters were determined, and data are gathered for flying hours, non-line hours, number of instructor pilots, instructor pilots' hours, leave etc. Monthly average cost of each parameter was calculated. Two main calculations were dealt with, the expected demand and the target. The expected demand is the net expected customer demand. And the target is our aim for the FDC. So, the target equals expected demand plus additional FDC for emergency cases.

IV. ANALYSIS

The data of the problem were analyzed starting with Cause and Effect Diagram for high flight deck crew costs variation. We found that the imprecision of calculation and lack of scientific approach are very important causes and further analysis is required to figure out the root cause/s of the problem. Analysis showed that based on aircraft type, we have two kinds of issues. Excess in flying hours inventory and shortage. Although the excess or idle is a problem, the shortage is much bigger problem. Analysis showed that in 777, 787, and 330 there are excess problems while the worst scenario is happened with 320, it has a shortage problem. We analyzed the impact of reflecting the flying hours on FDC as a cost and number. Analysis showed that with current method of calculation it will costs an airline company around 122.5 Million $ annum for 777, 72 Million $ annum for 787, 49.5 Million $ annum for 330, and 69 Million for 320. With a total of 313 Million $ annum.

V. MODELING

We came up with three theories. Based on the three theories, three methods have been built and followed to find the method with the optimum accepted costs. First Theory is the B&R Theory, which stands for Balancing and Rationing. The logic behind it is what if the relations between factors subjects to some constraints. In other words, it is an attempt to turn the problem into an OR problem as shown below in Fig. 1.

- **Minimize**

$$Constant + Cl \cdot \boldsymbol{L} - Cout \cdot \boldsymbol{Out} + Cin \cdot \boldsymbol{In}$$

- **Subject to:**

For Excess Problem	For Shortage Problem
OUT >= a	IN >= e
L <= b	L <= b
2 OUT – 3 IN >= 0	2 IN – 3 OUT >= 0
L – c OUT >= 0	f IN – L >= 0

Fig. 1 The Mathematical Model of the B&R Theory

Where, the constant is determined by the type of the aircraft and other factors. The expected demand will be calculated as:

Expected Demand = Constant / Minimum Guarantee Time (1)

Minimum Guarantee Time is the minimum flying time required for each FDC member. The target will be calculated as:

Target = Constant + Cl . L – Cout . Out + Cin . In / Minimum Guarantee Time (2)

Where, Cl is the cost related to FDC who leaves for annual vacation. C_{out} is cost related to FDC who upgrade or downgrade from the aircraft to another unlicensed. C_{in} is cost related to FDC who upgrade or downgrade to the aircraft from another one or got recently licensed.

The Second Theory is the simplicity theory. The logic behind it is: simplifying the old formula and focus on the factors with direct impact as much as possible. So, the expected demand will be calculated as:

Expected Demand = Expected Flying Hours / Minimum Guarantee Time (3)

Then, the target will be calculated as:

Target = Expected Demand + L + Out – In (4)

The third theory is the Couple Theory. The logic behind the Couple Theory is that GACA regulations considering captains and first officers the same and referring to them as PILOTs. (Male and Female) they have different gender, but both are humans. So, we have couples of (C, FO) they have different grades, but both are (PILOTs), and couples of (Augmented and Un-Augmented Flying Hours) they have different durations, but both are (FLIGHTs Hours). We did not distinguish between FDC for augmented hours and un-augmented hours. One captain may fly certain augmented hours and certain un-augmented hours. The mathematical model of the Couple Theory is shown below in Fig. 2.

- **Minimize**

$$Cca\,.\,Ca + Cfo\,.\,FO$$

- **Subject to:**

$$0.56\text{ Ca} + 0.44\text{ FO} \geq \frac{Total\ Flying\ hours}{MGT}$$

$$\text{Ca} \leq \text{available captains}$$

$$\text{FO} \leq \text{available first officers}$$

Fig. 2 The Mathematical Model of the Couple Theory

Where, Cca cost related to captains, Ca is the number of captains, Cfo cost related to First officers, and FO is the number of first officers. as a couple, we have a percentage of Captains plus percentage of first officers out of 100%. So, the expected demand is calculated as shown below:

Expected Demand = Cca . Ca + Cfo . FO / Minimum Guarantee Time (MGT) (5)

The target is calculated as shown below:

Target = Expected Demand * % of factors (6)

% of factors determined by specialists and professionals depending on aircraft type.

VI. RESULTS AND FINDINGS

We found that using the Simplicity theory method, an airline company could save around 75 Million $ annum with least possible cost, as shown below in Fig. 3.

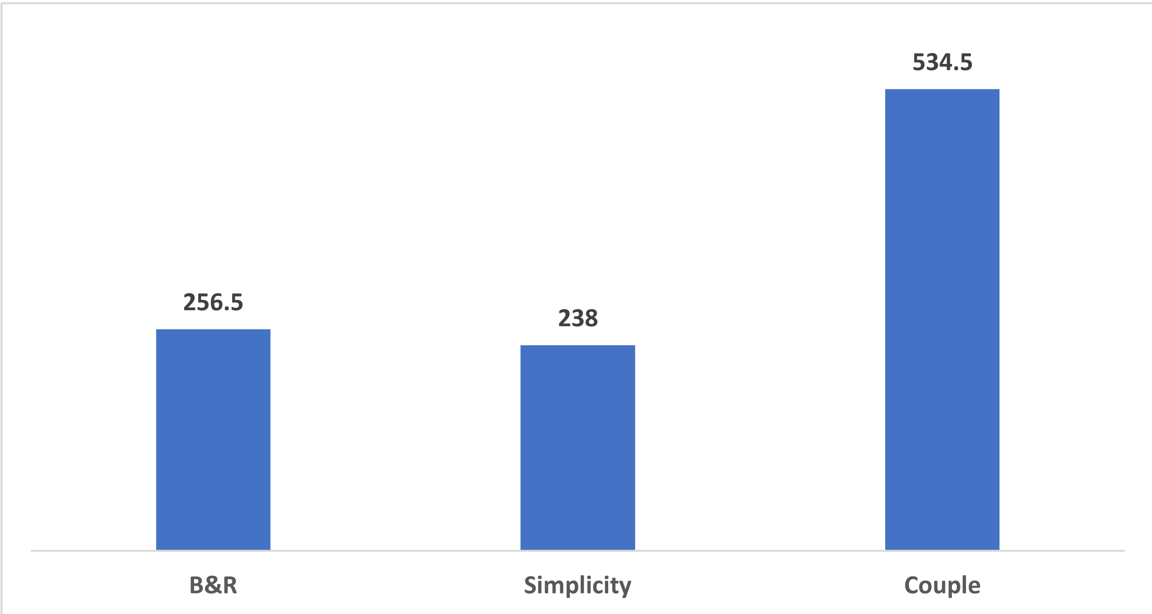

Fig. 3 Simplicity theory has the lowest cost

Conflict of interest: The authors have no conflict of interest.

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