Reduction in lead times of manufacturing Product X

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Abstract *— The project takes place in an Aerospace Company in Puerto Rico. The purpose of it was to reduce the lead times of a specific product called Product X, the product that will benefit the company the most. Qualitative (interviews) and quantitative (actual lead times) data were gathered and analyzed in four phases. After choosing Product X, its bottleneck in production was pinpointed in the assembly stage and modified to get the lead times of Product X closer or equal to its historical data, the lead times the product should have.*

Key Terms *— Airplane parts, manufacturing times , qualitative, quantitative, SRR*[2]

INTRODUCTION

Many aerospace companies can be found to have their own facilities in Puerto Rico. Some of these are Honeywell Aerospace, Pratt and Whitney, Collins Aerospace, Lufthansa Technik and more [1]. There had been an increase of 36.4% in the job numbers created by this companies. This implies a growth in the quantity of different aerospace companies on the island [1]. Most of this companies specialize in the manufacturing of airplane parts and some of them have a military division [1]. The military division of a manufacturing company often concentrates in the creation of airplane parts for the USA military section specifically, like rotors and motors [2].

One of the primary jobs of some of the employee inside this companies, specifically engineers, is the reduction of the lead times (or manufacturing times) of the interoperations of the manufacturing process of the different products this company creates. Primarily, this reduction in time is achieved by using quantitative data such as time, the different time a product take in each of the steps of the manufacturing process [3], and compare it with the historical data for the same product, to pin point the process step that is taking more time than it should and reduce it. In some cases, a reduction in production time can lead to a reduction in production costs [4] because if the process takes less time, the company can use that extra time to start the next product or reduce the cost in manpower. The time data is often gathered by the engineer directly or through surveys answered by the operators [1].

Gathering the time data is a type of quantitative research method which responds to the question "what is happening" in the process of production of that product that is making it take more time than it needs to [5]. This method does not take into consideration the human interaction in the process of production [6]. For this purpose, there are qualitative research methods, such as meetings and interviews with the employees, that answer the "why is this happening" in the production line [6]. In this type of methodology, the human interaction is taken into consideration and could be the answer to a problem that, otherwise, cannot be explained or could be misinterpreted from the data [6].

Utilizing both types of methodology can help provide a creative approach tied up with a technical approach, the qualitative research helps create the ideas while the quantitative research test the validity of the ideas [5].

The project is developed in the military division of one of those aerospace companies, for which the name cannot be revealed, as well as the names of the parts that will be involved in the project. This is why the parts will be referred to X, Y or Z. The purpose is to reduce the time of an interoperation for an airplane part. Quantitative,

time, and qualitative, interviews and meetings, data is gathered to generate the best allocation of production time possible for that product.

METHODOLOGY

This project was divided in four phases. The phases were identified as: Phase 1 – Gathering the data, Phase 2 – Choosing Product X, Phase 3 – Gathering and analyzing the data for Product X and Phase 4 – Lead times modifications. The phases had the purpose of identifying the product that will benefit the most to the company because it has the highest SRR^2 (Scrap, Rework and Repair). This product chosen to undergo the lead time modification will be called Product X. These phases took around 2 weeks per phase to complete.

Phase 1 consisted in gathering qualitative and quantitative data of the products from the company to choose Product X. The qualitative data was gathered by meetings and interviews with some of the employees and the quantitative data was gathered through data bases. Six of the products of this company will be chosen to undergo more data analysis and choose from them product X.

Phase 2 consisted in analyzing the data recorded for the six products that will be chosen from Phase 1. Their data is analyzed to locate Product X, the product that will benefit the most to the company if its lead times are fixed. After this Product X is chosen.

Once Product X is chosen Phase 3 can be started. In this phase the bottleneck in where the product is getting delayed has to be pinpointed. For these all the lead times from the different phases will be collected and compared with the historical data.

After the bottleneck is pinpointed, Phase 4 can start. This phase consists in modifying the bottleneck process and the lead time for that process to reduce it and get the product as close as possible to its historical data.

RESULTS

In Phase 1 six products were chosen because they had the highest SRR^2. From these six products, one was chosen in Phase 2. This is Product X; the product that will benefit the company the most economically if its lead times get fixed.

The data gathered in Phase 3 is presented in Table 1. The lead times historical data is 5.32 hours. This means that Product X should take in average 5.32 hours to be produced. As observed in Table 1, all of the Product X manufactured during the week Phase 3 was conducted have higher lead times than they should. While gathering that information and comparing the different stages of the manufacturing process, the bottleneck in which Product X was getting delayed was pinpointed. This bottleneck was found in the assembly part of the process.

Table 1
Actual Lead Times of Unit X in hours, September 2020

Unit	Time (HR)
X1	6.14
X2	6.03
X3	5.72
X4	5.45
X5	5.61

Once the bottleneck was found, Phase 4 was launched. The modifications to the process for Product X were made in the assembly stage of the manufacturing process. This assembly was divided into sub-assemblies for a better organization of the process of assembly resulting in lower lead times. The data for the new lead times for Product X is represented in Table 2. As seen on the table, there was a reduction in lead times.

Table 2
Lead Times of Unit X in hours after bottleneck modification, September 2020

Unit	Time (HR)
X1	5.37
X2	5.31
X3	5.35
X4	5.30
X5	5.61

DISCUSSION

During this project, some issues were encountered. The biggest difficulty encountered was finding the time for the meetings in between the normal activities of the employees. Because of this most of the meetings ended up been rescheduled. Another difficulty encountered was the access to the data. Waiting on the clearance to have access to the data for Phase 1 took some time. Lastly, because of the COVID-19 regulations, meetings are restricted and are mostly held virtually which hinders the management of the information discussed in them. Even though all these difficulties were encountered, the project was completed inside the time limits and the results were positive. After all the phases of the project were carried out, the lead times for product X were modified to achieve lead times closer to their historical data.

CONCLUSION

This project had as a purpose to reduce the manufacturing or lead times of the interoperations of Product X, an airplane part. This purpose was achieved, and the lead times were modified to get close of equal to the historical data. The advantages this can represent in the company is a reduction in cost and production times for the company. Companies should undergo this type of data analysis more often to review their lead times a resolve the different issues in them.

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