Optimization of Drawing Redaction Tasks

Edwin Rosado Gracia
Masters in Engineering Management
Héctor J, Cruzado, PhD, PE
Graduate School
Polytechnic University of Puerto Rico

Abstract *— New services always provide new revenues for a company, but more often than not, these services need to be optimized. Utilizing tools from the Lean Manufacturing toolbox, like Lean Inventory and First-In First-Out queue structures, integrating teams to function as one unit as well as process simulation in the Arena® Simulation Software to analyze a new process in a company that involves the redaction of drawings. The turn-around time of a new service was reduced by at least 66.5% while improving the workload efficiency of the employees.*

Key Terms *— Continuous Flow, FIFO, Lean Inventory, Process Simulation*

INTRODUCTION

Infotech Aerospace Services (IAS) is an engineering company servicing the aerospace, defense, and industrial industries with focus on export sensitive areas [1]. It was founded in 2003 in Mayaguez, Puerto Rico and it is a joint venture between Infotech Enterprises Ltd., a global engineering services company, and Pratt and Whitney, one of the world's leading aircraft engine manufacturers and part of the United Technologies Corporation conglomerate [2].

This project deals with a new service being performed at IAS regarding the redaction of a drawing. A drawing, in the context of this project, is a document used to define the requirements of an engineered item, in this case an aircraft engine assembly tool. Because of the sensitive information contained in a typical tool drawing, the drawing needs to be redacted to make sure no proprietary information is contained on it such that it can then be exported to the aircraft engine customers. However, once the drawing is redacted, its classification might change and needs to be re-classified under the Export Administration Regulations (EAR) or the International Traffic in Arms Regulations (ITAR). This makes the drawing change hands inside the company, as the Classification Department takes care of the re-classification, whereas the Design Department works the redaction. This setup means one department works on all drawings first before the other department can perform their work. This creates, in a virtual way, an inventory of drawings and makes the process inefficient. Thus, to aid in the execution of this task at IAS, this project has the following objectives:

1. Increase efficiency of employee workload.
2. Reduce turn-around time to the client by at least 15%.

These objectives will optimize the service and ensure the company remains efficient while providing a top quality service to its customers.

LITERARY REVIEW

Lean concepts have been the backbone of manufacturing process improvements for quite a while. However, more and more companies utilize these concepts on services outside of manufacturing, in a straight sense, like construction [3]-[5]. However, basic concepts sometimes need to be modified to be relevant to the current service being analyzed, like changing classifying of activities from value-adding or non-value-adding activities to classify them as main and supportive activities and/or into normal and interactive activities [3]. Thus, while this project will use lean principles, they might not be as normally used in the manufacturing world. Moreover, the use of simulation analysis to improve processes can be

seen also outside of manufacturing [4], [6]. In today's technological-dependent world, it is no surprise simulations are used frequently in process improvement projects. A process simulation is a great tool that can provide management a clear view of how implementing key changes can impact the whole performance of a project.

METHODOLOGY AND IMPLEMENTATION

To achieve the objectives set for this project, a methodology was established to ensure the goals were achieved. Since the current process cycle takes place in two different departments, as shown in Figure 1, the flow of work is not continuous. Initial data for cycle times was acquired from the first batch of drawings completed at IAS. Since the times were correspondent to the complete batch, individual task times were calculated and are shown in Table 1.

To be able to achieve continuous workflow, a First-In First-Out (FIFO) queue system was implemented. A FIFO queue will make the first drawing completed at the redaction stage to move to the classification stage without waiting for other drawings to be completed. To achieve this queue system efficiently, an integrated product team (IPT) structure must be used to ensure that cohesion and communication is present while working this task.

Table 1
Individual task times

Task	*Total Time*	*Individual Time*
Drawing Redaction	160 hours per 100 drawings	1.6 hours or 96 minutes
Drawing Classification	80 hours per 100 drawings	.8 hours or 48 minutes
Drawing Upload	40 hours per 100 drawings	.4 hours or 24 minutes

The IPT structure will allow the process to minimize inventory, while at the same time reduce the turn-around time to the customer. However, the project needs to ensure that resources are kept busy since the company cannot have an employee idle. To ensure the elimination of idle employee time, a process simulation was generated in Arena® Simulation Software. Each step of the process was mapped in the software taking into account the time each tasks takes. Figure 2 shows an example of how the process was simulated in the software. Iterations of process were analyzed in the software by changing the amount of resources working at each step with the goal to achieve zero idle time for the classification step. The results of the simulation will be discussed in the next section.

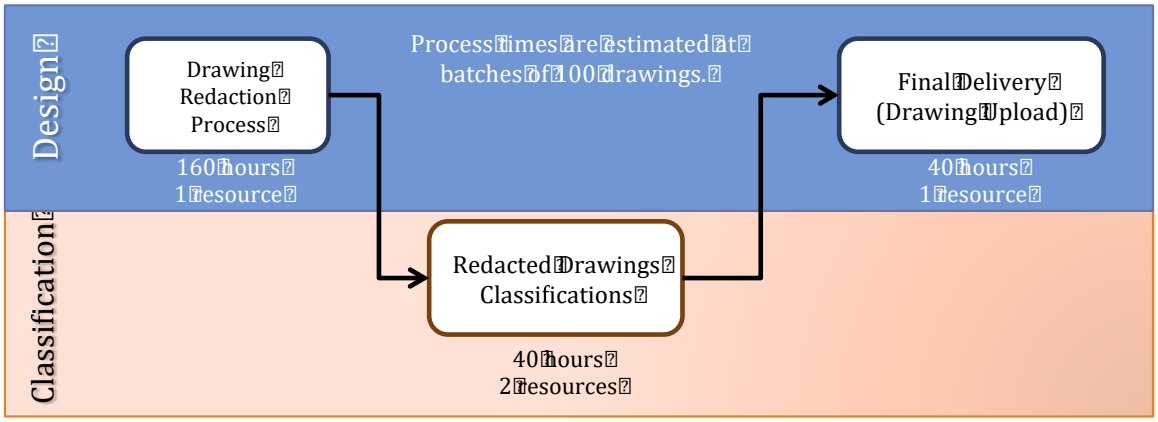

Figure 1
Current Process Map

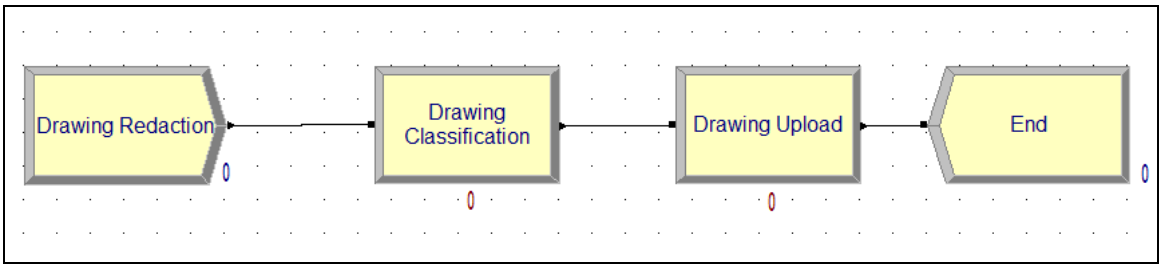

Figure 2
Process Simulation Example

RESULTS

As mentioned in the previous section, a series of simulations were completed to quantify the benefits of the methodologies implemented for this project. The first simulation that was completed was just looking at the flow of the new process with just one practitioner per step or task. This, while providing a time reduction as seen in Table 2, is not a viable solution because, as it was previously discussed, employees cannot be idle and the step times are different at each step, making the utilization percentage on the second employee approximately 50%. From this point forward, different scenarios were utilized, like 2 employees working the first task, Drawing Redaction, and 1 employee working the second, Drawing Classification. These scenarios were changed until a utilization percentage of approximately 99.5% was achieved, as shown on Table 2.

Table 2
Simulation Results

	Scenario	*Time*	*Utilization %*	*Reduction %*
1	Baseline	240 hours	N/A	0
2	1 Designer and 1 Classifier	161.2 hours	50.13%	32.83%
3	2 Designers and 1 Classifier	80.4 hours	99.50%	66.50%
4	4 Designers and 2 Classifiers	40.4 hours	99.01%	83.17%

After all the runs were analyzed, another scenario was completed to see how the process could scale. This scenario was using 4 Designers and 2 Classifiers. This results in a reduction of 83% of the original time while maintaining a similar utilization percentage. This setup could be utilized when there is a very urgent deadline as the only drawback is being able to get the manpower to perform the task. Although the main optimization of the process did not take into account step 3, this step can be worked in batches, as it is the quickest task of the process. An additional designer would be used for this task. But since this task is so quick, it would require too many employees for a task of this magnitude, which could be difficult to achieve.

CONCLUSION

Lean inventory is one the most used tools from the lean manufacturing toolbox in today's world. This provides a continuous flow of production and reduces costs and waste. While this project is not related to manufacturing, it can be seen how the principles can be applied to other industries and processes with the same excellent results.

In this project both objectives were achieved, as more than 15% turn-around time reduction was reached as well as more efficient employee workload by designing a scenario where the employee is virtually 100% of the time working and not idle. This also will help management understand how many employees are needed to meet a deadline, which helps their workload assessments.

The recommendation of this project is to use Scenarios 3 and 4 as needed. Scenario 3 presents the best scenario as less manpower is needed to complete and provides great results. Any further improvements would need to take into consideration continuous flow at the last stage of

the process, which is the Drawing Upload. But as it was discussed in the results section, that approach might not be the most practical one.

REFERENCES

[1] “About.” *http://infotechpr.net/about.htm*. Infotech Aerospace Services, Inc. 2016. Web. 8 Oct. 2016.

[2] “Infotech.” *http://www.pridco.com/why-puerto-rico/Pages/InfoTech.aspx*. PRIDCO. 2013. Web. 8 Oct. 2016.

[3] Agbulos, Albert, et al. "Application of Lean Concepts and Simulation Analysis to Improve Efficiency of Drainage Operations Maintenance Crews." *Journal Of Construction Engineering & Management*, 132 no. 3, March 2006, 291-299.

[4] Mao, Xiaoming, et al. "Construction Process Reengineering by Integrating Lean Principles and Computer Simulation Techniques." *Journal Of Construction Engineering & Management*, 134 no. 5, May 2008, 371-381.

[5] Song, Lingguang, et al. "Lean construction implementation and its implication on sustainability: a contractor's case study." *Canadian Journal Of Civil Engineering*, 38 no. 3, March 2011, 350-359.

[6] Choong-Yeun, Liong, et al. "A Simulation Study on Garment Manufacturing Process." *AIP Conference Proceedings*, 1643 no. 1, February 3, 2015, 460-466.