Reduce Work Time Delivery, while Improving Quality and Customer Satisfaction

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Abstract *— A military production process currently being worked at a company has been delivered with defects to the customers and to prepare the final delivery package took around twenty four hours. The objectives of this project were to reduce the work time delivery, to develop quality inspectors, to create work instructions and to elevate customer satisfaction. Using the technique of Value Stream Process Management, the current state of the process was studied and analyzed. Through process automation, the current state of the process was modified and it was possible to reduce the work time delivery to twelve hours. Also, process automation helped to reduce user inputs mistakes throughout the different steps of the process. The implementation of self-inspection checklists guaranteed good quality packages before they were inspected. Standard work documents and instructions were created for the new state of the process, to ensure maximum quality, productivity and repeatability over time.*

Key Terms *— Inspection checklists, process automation, standard works, and value stream process management.*

INTRODUCTION

Background

Infotech Aerospace Services INC. serves as an Aerospace Technical Service Center. Infotech is a Joint Venture between Pratt & Whitney (world leader in the design, manufacture and service of aircraft engines) and India's Cyient (former Infotech Enterprises Ltd). The company began its operation in 2003 in the municipal city of Mayaguez and, after two years, the company moved its operations to the municipal city of Isabela. Its main purpose is to design, evaluate and support gas turbine engines mainly for Pratt & Whitney, but also for third parties companies. Since Puerto Rico is a United States territory, the company is allowed to work both military and commercial engines programs, at the Development, Production and Operational stages of each engines program.

Motivation

The production stage of any engine's program is the last phase of the program and the one that is most expected by the stakeholders or shareholders of the company. To reach the production phase, the engine program had to go through the design phase, the phase of learning using an assembled scale model, the phase of testing the first engine assembled using multiple instrumentations and the phase of engine development where the engine capabilities are tested and validated. It is in the production phase were all past efforts, investments, complications and lessons learned are joined for the same purpose, to sell the new engine. Only by selling the engines made, the company can see a return of investments and revenue, which is why this last stage is the most important one to the company.

Recently a few deliveries were sent out to the customers with defects and it takes around three shifts (~24 hours) for the task to be delivered. This task is crucial because the customers need the results in order to clear the engine and sell it to the new buyer. From that standpoint, the motivation is to work with a Military Engine Production Support Process that has the opportunity to be delivered faster, with improved quality and that will help maintain customer's loyalty.

Objectives

The four main goals of this project are: Reduce the work time delivery of the process; Regain

customers' loyalty and elevate customer satisfaction; Develop quality inspectors for the process, and; Create work instructions that will help to standardize the process in order to achieve great repetitiveness. As the project progressed, the objective of developing quality inspectors had to be modified because the decision to develop more quality inspectors is really a decision that top management has to make. Now, the objective is to create self-inspection checklists were the user can go and see whether he or she had followed the steps of the process correctly and see if anything is missing from the delivery before it goes out to the peer review or inspection process.

LITERATURE REVIEW

Different Techniques to Improve a Process

Different approaches could be considered to reduce the work time delivery of a business process. To reduce work time delivery, an analysis of the current state of the process is needed. Opportunities to improve the process need to be identified and wastes have to be eliminated. One of the techniques consists of using a Value Stream (Process) Management (VSM), where process effectiveness, efficiency and agility could be achieved. As the VSM, another technique is the Cycle Time Reduction (CTR). The CTR is a way of looking critically at the company business process, to find opportunities to get more efficiency out of them [1]. Making use of these techniques will help identify problems at an early stage and this is very important because these problems could trigger other problems down the process line. That's why a VSM should be applied to this project as it ensures that no steps of the process get overlooked.

Another important thought is to not think that just one idea will change the process structure and its end results. If that idea existed it would mean to take huge risks that nobody will be willing to take. Instead, you should plan to reach your goal with a combination of 10 or more actions [2].

Delighted Customers or Loyal Customers

To improve customer satisfaction, the deliveries should have accurate results and they should be delivered in a timely manner. Process standardization and standard works are needed to ensure repeatability over time, maximum quality and productivity. Customers' loyalty has a lot more to do with how good companies deliver, than on how delighted customer experience was. Delighting customers doesn't build loyalty; reducing their work effort (the work they must do to get their problem solved) does [3]. Loyal customers keep returning with more work, and this translates in more revenue. Another good way to maintain customer satisfaction is to reduce defects by debriefing; capturing both future success and failure and to applying those learning's to continuously improve the process.

ANALYSIS APPROACH

In order to start the analysis of a particular business process, it is necessary to do a complete review of the current process that is being followed. Only by doing this, it will be possible to understand what the intentions of doing this work are, which are the process requirements and what are the customers' needs or what are the customers' expectations from the final results delivery. Using the Value Stream Process Management, the current state of the process was studied and analyzed.

Value Stream Process Management

The Value Stream Management Process helps achieve process effectiveness, efficiency and agility through waste elimination and standardization. This process helps to identify the areas of opportunity were value can be added to the process. The use of the Value Stream Mapping helped discover and attack the different areas of opportunities where wastes could be eliminated from the Current State of the Process.

Following the current process, it takes from seven to twenty four hours for the final package to be delivered, twenty four hours being the worst

case scenario. Worst case scenario takes into consideration possible rework time due to errors in the process such as wrong inputs, wrong equations for data corrections and errors found by the inspector. Errors found in the inspection process need to be avoided because after they get corrected, the deliveries have to be submitted for inspection again and takes a considerable amount of time. The process time starts from the moment that the customers notify that the new engine was tested and that the data is available in the database. The process time ends after the engine's data is analyzed, validated and the standard plot package created and delivered.

To help understand this better, it was necessary to separate the times into three categories. The first category is the Process Time; this is the actual time that takes the user to interact with the computer. The process time takes around 35% of the total current process time. The second category is the Waiting Time, this is the time that takes the computer to process the inputted information, plus the time that takes for every tool used in the process to load and run. The Waiting Time takes around 24% of the total current process time. The third category is the Peer Reviews or the delivery inspections. The current process has two peer reviews and they showed to take 41% percent of total process time and that's a lot. The overall reason for this is the lack of quality inspectors for the process. Figure 1 helps to visualize this better.

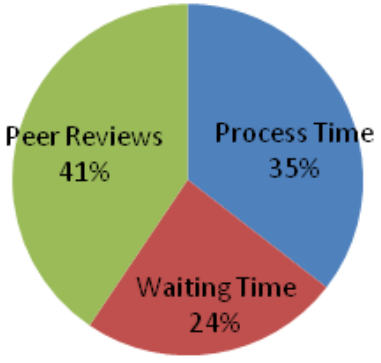

Figure 1
Time Consumption of Current State of Process in Percentages

The Peer Reviews are still part of the Waiting Time, but taking into consideration the lack of quality inspectors and that those reviews cannot be automated, they were separated into their own category.

Approaches for Waste Removal

When trying to eliminate waste from a process, the best approach is to try to automate as much as possible. There are many coding languages and programs that help to achieve process automations. For this project the use of Excel spreadsheets, PowerPoint macros and different coding programs will help achieve to remove the wastes that were seen as opportunities. Creating or updating command files codes will help reduce the Process and Waiting times. PowerPoint macros will help create the final presentation with the touch of a button, after the basic template is created. As for the Peer Reviews, since no automation is possible here and the decision to add quality inspectors to this process falls on top managements, a work around is needed. Excels spreadsheets will be used to create Self-Inspections checklists.

RESULTS AND DISCUSSION

Future State of the Process

The Future State of the Process resulted in simplified version of the Current State and more robust as it ensures the capability to meet the customer's requirement. To reduce the Process Time, lines of code were added to the first command file of the process, where now instead of manually inserting the new engine information on a command file, the programing tool will ask for the inputs as it runs. This guarantees that the inputs are entered correctly because if the computer cannot find an input, the program will not run. If this happens then the inputs can be modified right there and not further ahead in the process. Also, a PowerPoint macro was created, this macro builds the final presentation in 20 minutes instead of the 1.5 hours that the Current Process took.

To attack the Waiting Time, instead of running the plotting tool on an 8GB RAM computer, where it takes around 1.5 hours to create the plots, the tool was ran in an 24GB RAM (high memory) computer and the waiting time was reduced to around 18 and 24 minutes. The 24GB RAM computer will be used throughout the whole process, as it speeds up the process, reducing significantly the Waiting Time. After the modifications were implemented to the Current Process it now takes, from start to finish, four to twelve hours to deliver the final package.

Standard work documents for the Future Process were created. This is the method by which work is simplified and structured to ensure maximum quality, productivity and repeatability over time. All changes have been documented and communicated to all who perform the work.

Self-Inspection Checklists

As it was seen earlier, the Peer Reviews take around 41% of the total process time due to the lack of certified quality inspectors for the process. If the inspectors find errors when reviewing the deliveries, rework is needed to correct the deliveries and again they have to be submitted for reviews. To avoid this scenario self-inspection checklists were created and are going to be required before every task gets submitted for inspection. These checklists serve as a self-evaluation prior the peer reviews. These list include a detailed description of every step of the process, where the user can check what he or she has accomplish and see what is missing prior the peer reviews. This will help guarantee that when an inspector reviews the package it won't have any flaws.

CONCLUSIONS

The Future State of the Process shows that all objectives were met and process requirement comply with what the customers are expecting. The work time delivery was significantly reduced, before the modifications it took around 24 hours to deliver the package to the customers. Now, with the modifications in place, it takes around 12 hours to deliver the product to the customers. The development of self-inspections checklists helped achieve this process time reduction, they guarantee that the deliveries are almost flawless when the inspectors review them. The creation of work instruction simplifies and gives structure to the process and this ensures maximum quality, productivity and repeatability over time. All this improvements help achieve the final objective, that is customer satisfaction. The work is delivered faster and quality is impeccable, this helps build and maintain customers' loyalty.

Additional process improvements might be added, as process keep maturing and as new eyes and more experienced people review or work with this process. New people might bring new ideas for improvements and/or lessons learned from other engine programs might be useful and could be also applied to this process.

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