Accurate deliverables bookkeeping for quality audit compliance

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Abstract *— The inaccurate bookkeeping of deliverables can have a significant impact in a project's performance. It puts the project manager in a difficult position to track effectively and efficiently the project's progression and creates non-conformances in the company's project execution process which puts the company's quality standard at risk. To further understand this issue and reduce the number of non-conformances found by the Quality department audits, a Define-measure-analyze-improve-control (DMAIC) was performed. From the study performed, it was found that by adding a mistake proofing into the bookkeeping process, through the creation and implementation of an MS Outlook macro, the number of findings or non-compliances of inaccurate deliverables bookkeeping was drastically reduced.*

Key Terms *— Define-measure-analyze-improve-control (DMAIC) phases, Deliverable, Mistake proofing, Process Performance and Capability.*

INTRODUCTION

The company selected for this project is called Infotech Aerospace Services, Inc (IAS) and it is located in Isabela, PR. IAS provides engineering outsourcing and other professional services to the ITAR, military, defense, aerospace, and power generation industries for the disciplines of aerospace engineering, mechanical design, and software development engineering. IAS mission consists in providing exceptional engineering and business service value to the export-sensitive aerospace, defense, and industrial markets. For such reasons, quality plays an important role within the company and its business nature. The quality standards that IAS possesses are UTC ACE Gold, ISO9001 and AS9100c quality certifications. Due to company restrictions, disclosure of data is prohibited. For such reasons, the data and processes presented in this paper do not represent those of the company and are hypothetical ones.

One of the problems presented in the company lately has been the inaccurate tracking or bookkeeping of the deliverables evidence for the work performed. Since the company is an engineering services one and it focuses in the aerospace industry, the work that is delivered to the customer on a daily basis is in the form of files (engineering drawings, CAD models, finite element models, data entry, Excel spreadsheets, PowerPoint presentations, graphs, simulations, etc.) and the delivery method is through e-mails. The most common finding from the quality department is that the folder (for each project or contract) where the deliverable e-mails will be saved is not up to date or empty. This communication with the customer is the receipt that the work has been completed and delivered. For such reason, not keeping accurate bookkeeping of it creates a problem with the company's project execution process. Not having a proper bookkeeping of the deliveries of each project or contract makes it difficult to track the project's progression (# of deliveries sent vs total deliveries requested by the customer on the contract). Additionally to this, there is a big risk of losing the e-mail since the sent items folder in MS Outlook automatically deletes all e-mails that have a time span greater than three months. All these issues put the company's quality standards at risk since proper deliverables documentation is part of the company's project execution process which is one of the areas that is cover by the quality

standards. For such reasons, an action plan must be underlined to avoid this.

The objective set for this project is to reduce the findings of incorrect/inaccurate deliverables bookkeeping. The goal set for this objective is to achieve 100% deliverables bookkeeping compliance within the company's project execution process. This will be verified through audits performed by the Quality department once the improvements to the process are identified and implemented.

BACKGROUND

In project management there are several methods to keep track of a project. Often, this creates the dilemma of which technique is better to use in order to keep track and produce the best results project wise. This dilemma creates all sorts of problems within the project since the project manager or leader most of the time ends up tracking the tasks rather than the deliverables itself [1]. The problems presented while doing this can have a severe impact on the project's schedule since it may require re-planning and most often re-work. A deliverable is a project management term that represents the delivery of a service or product to a customer, either internal or external. Having a clear understanding of this term will give the project manager or lead a better view of the project's progression.

In the company, the projects are tracked by quantifying its outputs or deliverables. Not recording these on a timely manner represents the challenging task of not measuring the project's progression accurately. It is evident that the process of recording the deliverable within the company must be improved. To close this gap Six Sigma tools will be adopted and incorporated, along with the company's project execution process, in the same successful way it has been implemented in the manufacturing industry [2].

The methodology that will be used is the Six Sigma Define-Measure-Analyze-Improve-Control (DMAIC) technique. Through this methodology, the company or organization identifies a problem, which will be later solved by applying a set of quality tools or techniques in a logical fashion [3]-[5]. The DMAIC is composed of 5 phases:

- Define – The problem statement is defined along with the potential resources, project timeline and scope.
- Measure – The data of the problem is collected and as well is the phase where the gaps between the current and required performance are identified. A process baseline or sigma must be defined.
- Analyze – Root cause analysis is performed on the data collected and a root cause is selected.
- Improve – This is the phase in which a solution to the problem is implemented. Mistake proofing implementation.
- Control – In order to control, the processes, trainings, work flow maps, etc., must be updated. This phase will ensure through a control plan that the solution implemented is successful and provides consistent and accurate results.

METHODOLOGY

In order to tackle this problem properly, a methodology or course of action must be underlined in order to ensure that the project's objectives will be met by the end of the same. Given the nature of the problem, and as mentioned earlier, the best way to attack it is by using DMAIC (Define, Measure, Analyze, Improve and Control) improvement cycle tool. The first step is to outline the problem statement and project scope (Define). The following step is to collect the data (Measure) from the quality department and identify the current process sigma. The subsequent step will be to understand the reasons for the quality findings by performing and selecting a root cause (Analyze). The next step will be to list the possible solutions (Improve) towards attacking this problem. In order to ensure that the implemented solution or mistake proofing procedure will be followed, the processes must be updated to reflect the new standard for

submitting a deliverable to the customer. For this, an updated workflow map must be created. Once these steps are established, data will be collected again by the Quality department through the audits performed after the new process is set (Control). This data will be analyzed and it will be determined afterwards if the steps taken worked or not towards achieving the defined objective.

The sampling size for this project will consist on selecting and inspecting 30 random projects or contracts each month to determine if each meets the established compliance criteria. The quality department, through random audits, will collect the data from different projects or contracts of each department throughout the company. The study will gather the data (a hypothetical one since the company didn't authorized the release of data) of three months prior to any process improvement implementations and of three months after the mistake proofing techniques or process improvement implementations have been made.

There are two types of data that can be categorized throughout an inspection process; these can be either variable data or discrete data. Discrete data can be separated into two forms: attribute data or count data [4]. For this project, the type of data that will be used and analyzed is the attribute data. This data form has qualitative characteristics and it is typically used to represent decisions regarding a product or procedure specification. These decisions can be a pass/fail, good/bad, accept/reject, etc. [4].

RESULTS

A DMAIC was performed and the following results were found.

Definition phase

In this phase, the problem statement was defined. Deliverables have not been tracked properly triggering findings or defects in the company's project execution process. These were found while performing aleatory quality audits throughout the company. Every time a deliverable is sent, it must be recorded real time in its corresponding project or contract folder. Not complying with such procedure will result in a non-conformance for the department's metrics. To better understand the process, a work flow map has been developed to represent the baseline process of documenting deliverables as shown in Figure 1.

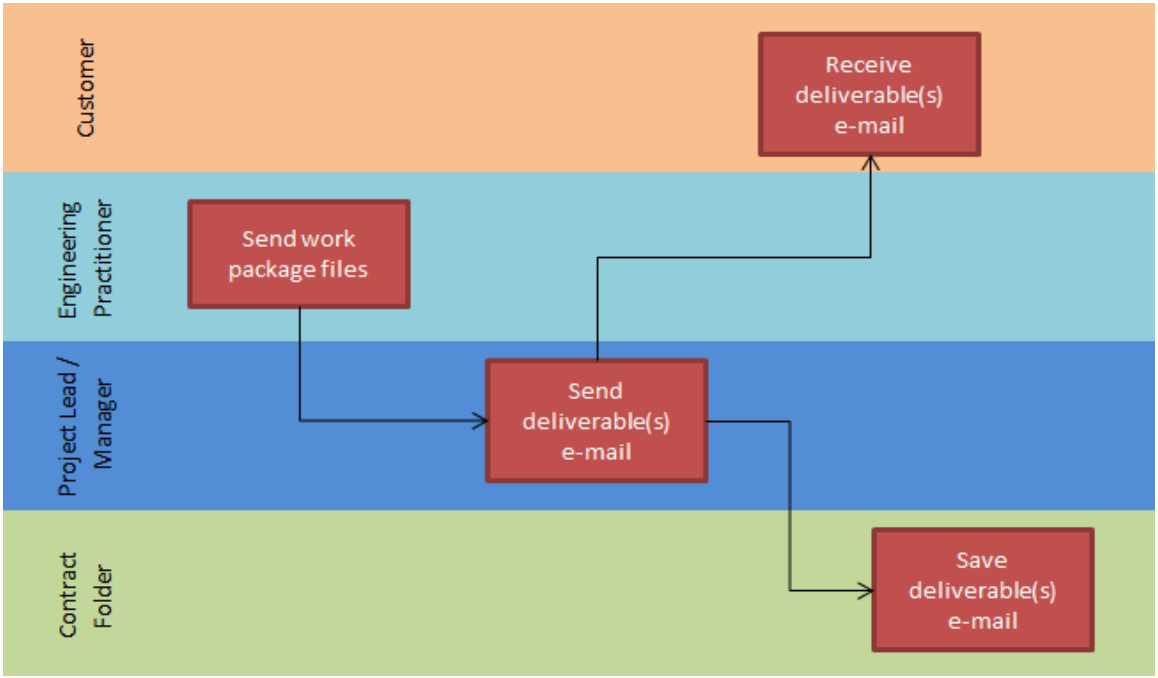

Figure 1
Baseline work flow map

Measuring phase

Samples of 30 random projects through the whole company were audited each month, during a three months period. From the data collected, it can be seen that the company is not at 100% compliance documenting its deliverables. Figure 2 shows the audit findings during a three month period.

With the obtained data, the baseline process performance and capability was calculated. The baseline process capability or process sigma calculated was 2.4. This performance represented that per every million opportunities the process will yield 188,889 defects.

Table 1 shows the data used to calculate the baseline process performance & capability, where number of defects is the number of projects inspected that obtained failed result during the month, the number of units is the sample audited each month, opportunities per unit is the type of finding that will produce a failed result or defect and finally the defects per million of opportunities.

Table 1
Baseline Process Performance & Capability

Process Sigma using Attribute Data				
	Apr-16	*May-16*	*Jun-16*	*Total*
Number of Defects:	12	6	16	34
Number of Units:	30	30	30	90
Number of Opportunities Per Unit:	2	2	2	2
Defects Per Million Opportunities	200,000	100,000	266,667	188,889

Sigma Level	2.4

Analysis Phase

Root cause for the problem presented has been identified and confirmed. From the results of the measure phase, one of the action items identified by the process improvement team was the implementation of mistake proofing prior to sending the deliverables e-mail to the customer. From the statistical analysis performed of the process with mistake proofing vs. the process without it, was found that the process with mistake proofing provided positive results towards reducing the defect numbers.

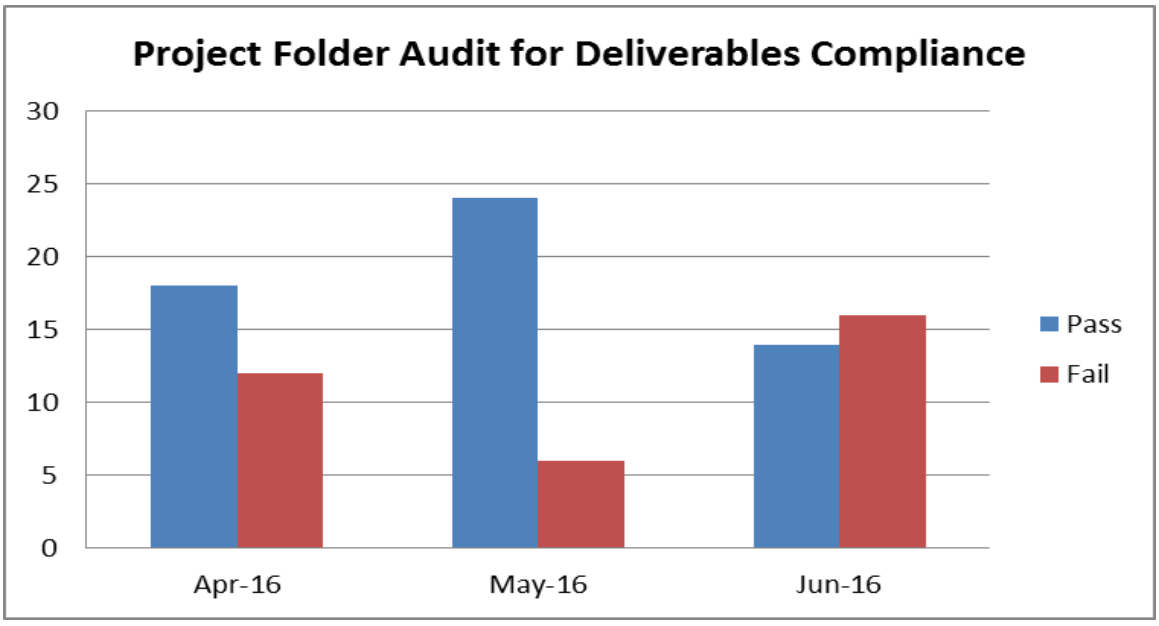

Figure 2
Project Folder Audit Findings

Improvement phase

Once it was identified that the root cause of the problem presented was the lack of mistake proofing prior to sending a deliverable e-mail to the customer, a MS Outlook macro was created to serve this purpose and works as follows. When the project manager sends the customer an e-mail, it will bring a pop-up that it will ask if the e-mail is a deliverable. If yes is selected on the check box, it would enable a drop down list that will let the project manager select the contract to which the deliverable will be made. When sent to the customer it will automatically save the e-mail into the selected contract or project folder in real time, leaving the option of manually saving the e-mail out of the equation.

Control phase

After implementing the mistake proofing MS Outlook macro, data was collected to calculate the new process performance and capability. From the results obtained, listed in Table 2, it can be seen that the process capability is now at 4.0. Also, it can be noted that the defects per million opportunities has been reduced drastically.

Also, it can be seen that the defect obtained during the month of September was due to incorrect selection of contract while sending the deliverables e-mail, thus it was saved on the incorrect folder.

Table 2
New Process Performance & Capability

Process Sigma using Attribute Data				
	Aug-16	***Sep-16***	***Oct-16***	***Total***
Number of Defects:	0	1	0	1
Number of Units:	30	30	30	90
Number of Opportunities Per Unit:	2	2	2	2
Defects Per Million Opportunities:	-	16,667	-	5,556
Sigma Level				4.0

CONCLUSIONS AND RECOMMENDATIONS

From the study made, it has been found that the implementation of mistake proofing within the process has yield positive results towards reaching the objective's goal, which was set at 100% deliverables bookkeeping compliance. Although the established goal hasn't been met completely, it has been demonstrated that by using the DMAIC process improvement methodology, the process has matured and its capability has increased from a Sigma level of 2.4 to a Sigma level of 4.0.

Due to time constraints, further data collection and analysis could not be performed. In order to help the process improvement team to achieve zero defects, it was recommended to include in the MS Outlook macro's drop down list a brief description of the contract next to the contract number. This way it will help the project manager identify the contract that will be selected to save the deliverable e-mail, thus avoiding a potential incorrect contract selection.

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