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Implementation of the Six Sigma Methodology to the Operation Processes between Customers and Server

1. Introduction

"Six Sigma quality program" originated as a result of Motorola investigations carried on during 1979–1987. The goal of Six Sigma is to elevation the client satisfaction degree by eliminating errors and deviations of quality of products. Name of Six Sigma was chosen to describe key program quality point as reduction errors and deviations. Six Sigma can be described as research, where most important thing is attainment constancy value services and products. Six Sigma is a strategy of leading activity and metho-dology which supports to get reality and constantly corrections of efficiency of operations. It is methodology support degree satisfaction of the customers in all ranges of conducting activities [1, 2, 6, 7].

Initiation of Six Sigma begins from measure the most essential values in most critical process. It has not control of values, which are most important, can not be improvement, there is not chance to change anything without measure it. Innovatory manners of maintenance of yields on the higher level of quality are research in all sectors of economies. That is the reason that Six Sigma has been implemented in many world corporations like Sony, Honda, Maytag, Raytheon, Cannon, Hitachi, Texas Instruments and many others. Furthers evolution of Six Sigma rise to aggregate two strategy: Lean Manufacturing and Six Sigma [7].

There are two different ideas to handle business – both rarely efficient. Lean Manufacturing strengthens firmly basis of organization – its production process, during the Six Sigma's projects attack all weakness sides of organization independent on place its appearance. Both treatment connecting common ground idea describing way of realization of tasks: continuous perfecting. This idea has in both cases affected different form. In front of simply Kaizen (little but daily rationalizations) stand complicated machines of DMAIC (Define, Measure, Analyse, Improvem, Control) [1, 2]. They based on the same basis cycle of Shewhart-Deming; it causes that this two ideas can cooperate superbly and interacts.

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2. Initiative of DMAIC of Process "Server Enrollment"

In the world corporations infrastructure for IT Departments is based on client server architecture. The servers are located physically in the sites and they act as data application servers. The foundation of exhibits of the server enrollment process was the quality which is major driver for investigating process in details.

Head Team and their customers recognized the requirements of approaching Six Sigma methodology to be applied to the process. Corporation management agreed upon, for performing Six Sigma investigations as a separate project and shares the results of it with key state holders. The business requirements of the DMAIC approach has been clearly defined based on voicing the customer and also Head Team, and it is described in details in Define Phase.

The Server Enrollment DMAIC process was conducted by corporation employers and the authors.

3. Survey – Voice of the Customers of Process "Server Enrollment"

Survey has been carried among 218 persons, which are authorized to fulfill request form about installing and configuring server. Forty nine of all persons responded. In it only twenty one of them ever fulfilled request.

Customers were informed about survey using electronic mail, which included link to web page where was bestead survey. Survey was written as electronic form to fill up in HTML language and it was avail for customer for a week. Survey included eight questions about process and its parts:

1. Have You ever fulfilled web based Server Enrollment request form?
2. How long, in your opinion does it take to fill the Server Request form (web based)?
3. How would you define acceptable period of time to have server enrolled (Published, in production)?
4. How long after publishing – enrollment, the server should be available for production?
5. How do You percept the Server Enrollment process takes now? [The server enrollment takes].
6. What is current communication efficiency in aspect of Server Enrollment? [Communication efficiency].
7. Would You like to be informed about the results from the steps taken during Server Enrollment process?
8. Would You like to be informed about the results from the steps taken during Server Enrollment process?

Detailed analyse of the survey results leading to the conclusions as listed below:

– according customers all process takes too long time,
– customers are unacquainted in how long process takes,

- fill Server Request form takes about 15–20 minutes and its depend on client, changing request form to be more easier and friendly for customers it can be shortened duration of fill up request,
- server should be available after publishing for production for two business days most any longer,
- all process should takes about 5 business most any longer,
- in ten points scale, customers have evaluated communication on five,
- customers definitely want to be inform about progress in during process by electronic mail.

4. Process "Server Enrollment"

Beginning of process is initiated based on of the customer request of server enrollment – customer fulfill web form, where must define type of server and its configuration. All process is doing on customer request. Goal of the process "Server Enrollment" is to satisfy a client and implement customer needs. There are different kinds of server as: DC (domain controller), EX (exchange server), FP (file and print server), MS (management server), AP (application server), BU (backup server), DB (data based server).

In the whole analysed process of server enrollment there are involved four teams, as presented on Figure 1.

Head Team applies to all local servers as installing software and configure the servers agreeably by customer according to the procedure, step by step. Process is global, therefore operators can use remote desktops to connect to the servers. Installation packages are begun downloaded then starting installation of the server. When installation and configuration are completed, operators send request of server enrollment to Head Team and this is the end of its role. After submitting of the request to the Head Team COG SMC Team performs request controlling of the server.

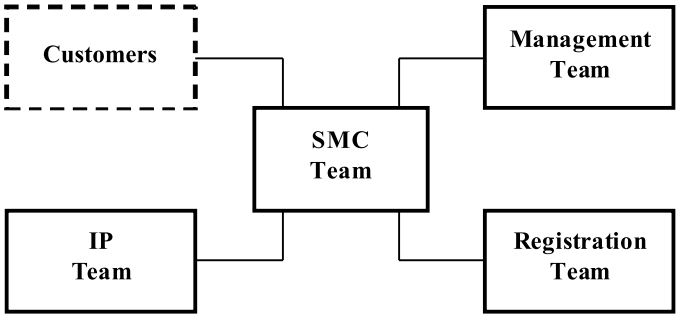


Fig. 1. Cooperation teams which have been involved in the server enrollment process

5. Define Phase

Process of choosing and defining of project Six Sigma is a key goal of all concepts. Project is a problem to be solved based on constrains. Problem is a non acceptable different between present and desirable condition. In case process "Server Enrollment" problem is a time which is need to configuration and installation of the software. In present time whole process takes about ten days. According the survey executed among customers, process should be last about three to five working days. This is a challenge for Six Sigma, which demands deeply analyze, exploration of causes and study and plans alternative solutions. Describe the most important elements, which consist on definition of project, then begin problem formulation which is "Server Enrollment" process is quality in function of time. Conduction of in-depth analysis has allowed learning and describing approximately its strong and weak points. On this base have been defined borders of activity during realization of process. Range of the scope concerns only operators' work – installation software and configuration it.

Important element of process is possible metric and factors. Measure is time, it describes problem and phenomena coherent as operators break or speed of link, which is using by operator to connect to the servers. Measuring time within steps of the process informs about present level of process and as process runs away form customer's expectations.

The most important elements compose on project Six Sigma:

- Problem of duration of all process.
- Process "Server Enrollment" within which is a problem to solve.
- Acceptable measure of time in [sec.], which describe analyzing problem, process and its progress in project.

Chosen this project it was used funnel's rule – gathered and elaborated few different concepts and next analyze them, next choose one form them – process "Server Enrollment". Realization funnel's rule means necessity continuously gathering information about all projects in organization.

Definition of problem rest on gathering information describes the problem and its environment:

- Problem is a process "Server Enrollment", which is a process of configuration and installation software in definite time.
- Problem concern duration of time need to configured and installed software and make server production.
- Surveyor's made measurement at use digital stopper.
- All thirty one steps were measure on the operator sign of start and stop of step.
- Currently process takes to long twice (according survey) as customers accepted.
- Goal of the project is to reduce time of process and increase quality.
- Project team contains – two persons. First make a measurement, and second will supervise all project. There is need to open fast information channel this cause fast, precise and transparent exchange of information between person who measure and supervisor.

Tasks performed by Head Team can not be measured and analyzed out appliance of time difference and technological constraints. From customer perspective these tasks are much important as value of the time spent on their completion. It is important that the whole process and measuring path should include Head Team. Regional Team and the customer very often emphasize that tasks exposed on Central Team are not completed timely manner.

6. Measure Phase

It is a process map to perform measurement on CTQ factors on the process steps in case of the process "Server Enrollment" an algorithm was developed to build new process. Describes the undesirable effects. This part involves describing the current state of various metrics. Before trusting the information, it is important to verify that it is reliable and valid. We will say that information is reliable if we obtain essentially the same information from more than one trusted source. We will say that information is valid if it covers the area of interest sufficiently well to accurately represent the area of interest. And when the problem – time – is defined, then we decided to measure thirty one steps of process "Server Enrollment" to quantify this problem. Fifteen measured samples supposed to be sufficient and representative for decisions and results about the process.

To evaluate the reliability and validity of dimensional measurement systems such as gauges, conduct a gauges repeatability and reproducibility (GR&R) study. Gauge R&R studies are scientifically designed to quantify gauges error from a variety of source.

Repeatability is the consistency of measurement obtained when one person measures the same parts or items multiple times using the same instruments and techniques. Reproducibility is the consistency of average measurements obtained when two or more people measure the same part or items using the same measuring technique.

Key metrics for the process "Server Enrollment" are 31 steps of installation software by operators according to proper procedure. This steps are must not doing one by one, usually software is installing in sequence of downloading data. It sometimes happened that there are few servers installed parallel, and this situation could case mistakes. Operators have break between 11.30 till 12.15 during process. All of these reasons could cause negative influence to the results. It could be performed a correction into schedule of the process to eliminate future mistakes.

Gathered data is representative by fifteen samples which are and discreet and they represent fifteen separate processes.

7. Analyse Phase

Analyze is the process of finding a solution to a problem. This involves two distinct steps. First is divergent thinking about as many possible solutions candidates as one can. Second is convergent thinking to identify the best solution. In the analyze phase of Six

Sigma project cycle, must be quantify the process improvement goals. Tools and techniques useful during the analyze phase include: descriptive statistical analysis as central tendency, distribution; exploratory data analysis as box plot comparison and process capability analysis. Exploratory date analysis is conducted to collect evidence that will form the basis of theories of cause and effects. Descriptive data analysis is conducted to determine what sort of distributions process produce. Statistics are computed and graphical displays are created to explore the central tendency, spread, shape. This information is used to help from theories of cause and effect that can then be examined more carefully or designed experiments. The results are used to plan fact-based future process improvement activities. Data often indicate that the capability of the existing process for exceeds its actual performance level.

Before preparing a project plan, the Six Sigma team should perform a detailed, physical audit of the process. To accomplish this is to form a process audit team. Six Sigma project team members who have in-depth knowledge of the proper way to operate the process should be members of the team, however, it is also helpful to have team members who are less familiar with the project of the team. Process owners should be notified in advance of the audit, they should be kept informed during the audit, and they should be the first to receive the audit findings. After receiving the response from the process owner, the audit should prepare a written audit report [1].

In this project the analysis of Pareto was developed , normality test and histogram with fit to Gauss's curve of thirty one process steps and analyze GR&R of 5^{th}, 6^{th} and 1^{st} steps [3, 4, 5].

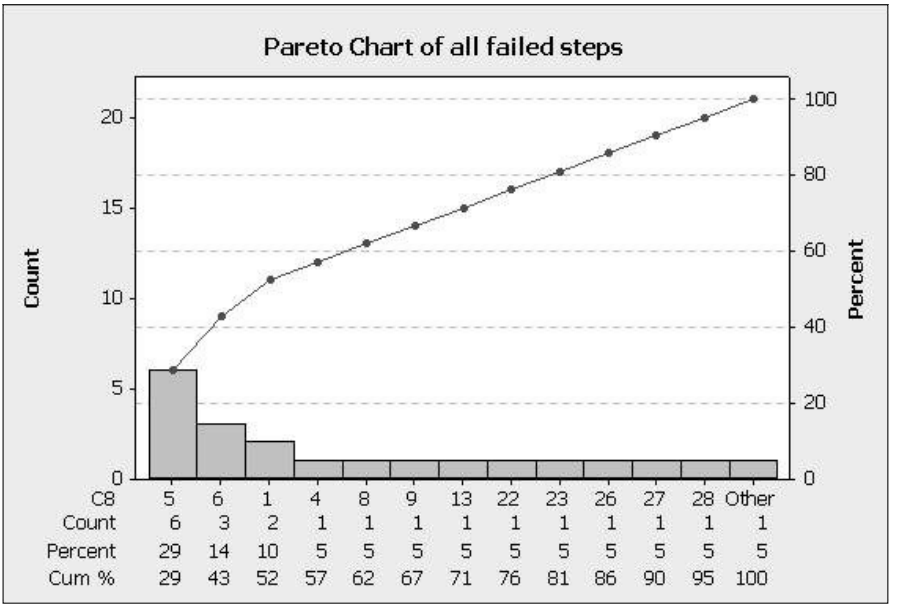


Fig. 2. Pareto Chart of all failed steps

Rule of Pareto 80/20 (Fig. 2) says that in the heterogeneous population 20% elements are represent by 80% accumulative value of feature. So rule 80/20 says that occur a lot of types of events can be observe in little fragment of possible circumstances. Identification of causes permit to meet direction of operations, which particularly effectively may cause do improve of process. Pareto analyze of process "Server Enrollment" show that 5^{th} step of process cause 29% of all errors. These 29% errors are representing by: suspense of operation system, broken connection with server or shortage information about configuration of array. This are weak point must be eliminated in first.

Pareto analyze approved that 29% of all mistakes depend on step five. It is accumulated value of feature, which is a criterion of evaluation this step five and its influence on all process.

During the analyse normality test was done for all measured steps, but below in Figure 3 there are only tests for step one, five and six have been presented because of they significant influence to the process.

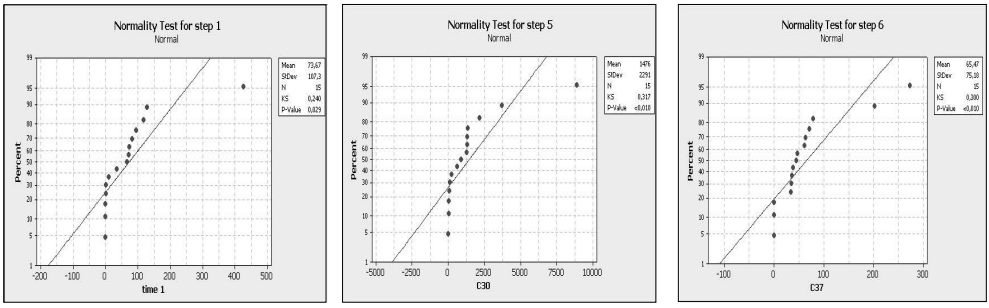


Fig. 3. Normality test of steps one, five and six respectively

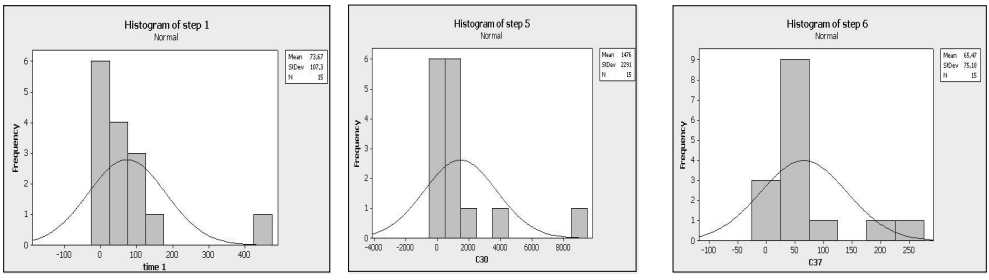
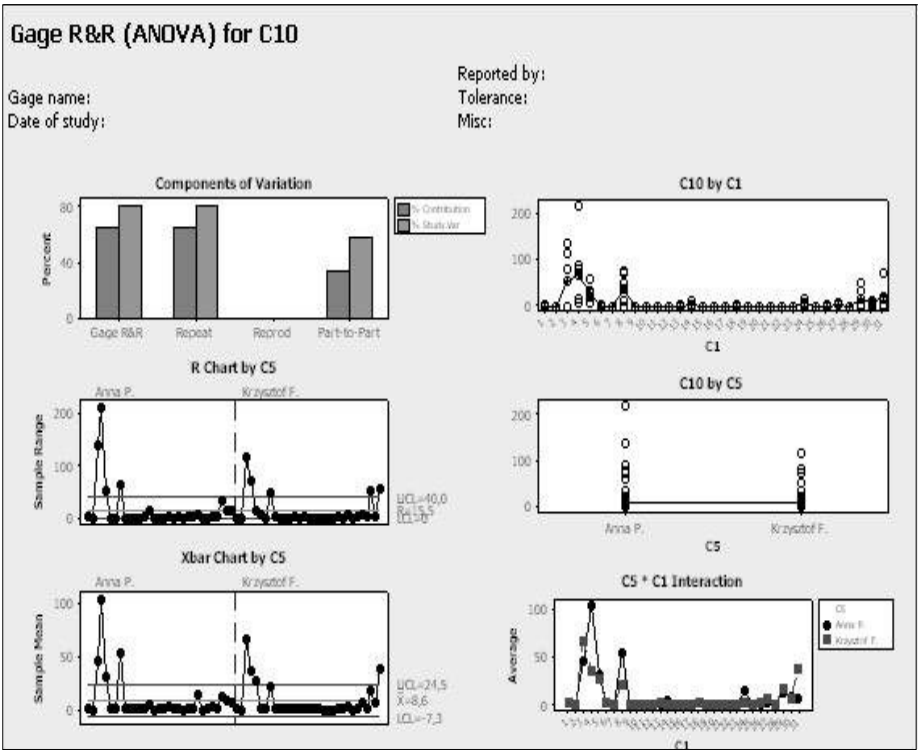


Fig. 4. Histograms of step one, five and six respectively

All of these have not normal distribution, as shown also on the histograms (Fig. 4). It can be cause defective measuring gauge depend on physical limitations of surveyor's.

Below on the Figure 5 the analyse GR&R of one, five and six steps has been presented in detail.



Source	VarComp	%Contribution (of VarComp)
Total Gage R&R	441,508	65,79
Repeatability	441,508	65,79
Reproducibility	0,000	0,00
C5	0,000	0,00
Part-To-Part	229,602	34,21
Total Variation	671,110	100,00

Source	StdDev (SD)	Study Var (6 * SD)	%Study Var (%SV)
Total Gage R&R	21,0121	126,073	81,11
Repeatability	21,0121	126,073	81,11
Reproducibility	0,0000	0,000	0,00
C5	0,0000	0,000	0,00
Part-To-Part	15,1526	90,916	58,49
Total Variation	25,9058	155,435	100,00

Fig. 5. Gage R&R of one of the operators

As can be seen in the both cases measurement system is not adequate to process Server Enrolment because contribution is more than 8%. In the case of first operator is equal

71.18% and in the case of second operator is 63.18%. Study variation is more than 30% in the case of both operators.

Conclusion is that whole measurement system was defective.

8. Improve and Control Phases

The Analyse and Improve phases are conducted simultaneously. In fact there is Improvement in every phase of the project. The work done in the Define, Measure and Analyze phases all help better determine what the customer wants, how to measure it, and what the existing process can do provide it. It is possible that by the time the Improve phase has been reached, so much improvement will have already been made that the project goals have been met. However if the process performance still falls short of the project's goals, then additional activities in the improvement phase must be undertaken. The project without an extensive process or product redesign – optimization, which involves a rigorous, detailed study of the existing process to determine if there is any way to operate it such that the requirements are met at level near six sigma. Statistical Design Of Experiment can help determine the optimal performance level. It is important that before we experiment with process, we first determine its capability if it is operated consistently in accordance with established procedures, as we did in the Analyze phase.

Failure Mode and Effect Analysis (FMEA) is conducted to help develop control plans that prevent problems with the new process – Control phase. This is the last battle against creeping disorder, against entropy, the battle to ensure the gains are permanent.

9. Conclusions

These measurements are direct key points in the process, which have an influence on its run of the process. These key points are steps 5, 6, 1, which have not a normality distribution. 29% of all errors are cause by step 5, and this step as the first must be undertaken to eliminate these errors.

Normality test of Kolmogorov-Smirnov shows that majority of steps have not normality distribution. This is cause of insufficient measuring gauge. Some of the steps ware doing parallel, what causes errors in measurement. Limitations of measuring gauge are causes of physical capabilities of person who was make a measurement.

Measurement is not correct because of failed measuring gauge. These mistakes of measurements are strictly coherent with the person's physical capabilities and inaccuracy in saying stop and start at each step by the operator. The next mistake is caused by doing a few actions parallel by operator what causes an inaccurate measurement.

Though a lack in the hardware specification for analyzed cases of installation, the operators performing these types of installation point out that one of the reasons for these processes taking place considerably long is the hardware configuration of servers (array subsystem, memory, remote access card).

In each analyzed case the configuration of the hardware varied somehow from that specified by the producer manufacturer. Setting up the system to specified standards took up a lot of additional time that was not taken into consideration of measurement.

Nevertheless the process will shorten once the hardware configuration parameters are maintained such that no necessity arises from the side of the operator to intervene prior to the installation.

According to the feedback from the client, an important role in making the process effective is rendering accurate communication to the end user. Nevertheless, there is a limit to the amount of information accepted by the client – about 84.62% of questionnaire require to be informed about the result from the steps taken during process and about 74.49% want to be informed by e-mail – that was defined in the beginning and at the end of the process.

Because of delays there are violation taken to allow access to the servers by regular users and/or local administrators that must perform day to day activity. As Head Team must reboot the servers several times during the part of the process under the tasks exposed on them when servers are treated by the customer as production – these reboots must be treated as outages then. This is then another quality factor which has not been analyzed in this thesis.

Measuring phase of DMAIC process was performed based on the tools which are freely available and therefore they had their limitations. The only way for ensuring reliability of the gathered data is possible, but by building special tool, which could have capability implemented like: count mouse click, count the distance of mouse movements, capture of time snapshots related to server enrollment process steps, capture failures/successes, store all captured data in SQL data base and insensitivity of the operators influence to the captured data.

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