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HIGH MATURITY IMPLEMENTATION FOR INTERNAL QUALITYMANAGEMENT

Dr. Bhargav Gangadhara,

[1]*Senior Technical lead/Director, Jack Henry and Associates, USA*
[1] *bhargavmtechmem@gmail.com, Mob no . 6514947376*

Abstract—CMMi (capability maturity model integration) high maturity process and practices help organization to achieve its business goals. Testing team is usually playing major role in improving quality in organization. High maturity practices help linking quality and business goals in the organization. There can be 2 types of process improvements in an organization. One is process improvement for existing organization's process. Another one is process improvement by technology innovation. Major task is to connect technology innovation with process improvement through statistical analysis, yields achievement of business objectives. Minitab can be used to check normality of data, to perform F test and 2T test to confirm 'Significant Improvement'. There needs to be linkage between productivity of the testing team and organization's business goal and interim QPPOs (Quality and Process Performance Objectives).

Keywords- ***CMMi (capability maturity model integration)***, ***Minitab, QPPOs (Quality and Process Performance Objectives).***

1. INTRODUCTION

In mobile field, time to market is critical as the competition isheavy. The builds are made whenever new patches are arrived and then delivered to validation, factory acceptance and field acceptance. In case of any rejections either by validation team or factory or field, many unplanned activities like building the binary, integration, review and re-release are triggered. This leads to delay in schedule and affecting organization's business goal (time to market). It is better to execute basic functionalities like sanity, flex settings, key press and key map as part of R&D testing before delivering to validation team.

In this paper, we are trying to explain how productivity improvement in R&D testing reduces the rejection by validation team or factory and in turn helps in achieving the schedule. These improvements are analyzed statistically for confirming significant improvement by using statistical tools and techniques. We have taken a very meaningful and practical data set and explained a complete coverage of key High Maturity practices.

2. Aligning Business Objective & Project objective.

Let's assume the business objective of a project could be "Deliver binary as per the schedule" and this translates into a interim objective as *"%Rejections by validation team/releases < 5%"*.

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Again this translates into project objective as "Automate Sanity/Flex/Key press/Key map test cases". [2][OPP (Organizational Process Performance) SP1.3 Establish Quality and Process Performance Objective].

To measure the process performance against the objectives, we have the number of schedule failures. On every week basis, the data is captured. Also rejection by validation team, factory, and Field test engineer are monitored and captured. On daily basis, executed automation/manual test cases are captured. Number of releases made on day to day basis is captured.

The data set used for analysis is shown in the Table 1 and 2 [Sample data set].

[2][QPM (Quantitative project management) SP2.1 SelectMeasures and Analytic Techniques].

Automation/manual productivity is calculated by using the formula "Automation/manual test cases executed/Automation or manual effort". Automation effort includes both development and deployment efforts.

3. PROBLEM STATEMENT WITH DETAILS

3.1 Define the problem

- Scheduling (Business Objective) is getting affected because of Rejections by Validation/factory.
- The majority of rejections are because of simple rejections (Sanity /flex setting / Key press / Key map)
- Internal testing is overloaded because of many releases (around 20 releases per day).
- Internal testing scope was doing sanity; flex setting, key press, Key Map.
- Covering all these things with existing resource is challenging task

3.2 Identify where the problem is appearing

Internal testing needs to test manually which requires lot of effort

3.2.1 Describe the size of the problem -

- Sanity – 4 hours
- Flex settings- ½ hours per profile, 270 profiles
- Key press – ½ hours per language, 35 languages
- Key Map- 1 hour per model

3.2.2 Describe the impact the problem is having on theorganization –

- Impact in schedule.
- Increase in Validation rejection

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- Increase in factory rejection

4. SCOPE FOR THE INITIATIVE PROPOSAL

4.1 To reduce Internal testing loading:

The time taken for manually test the test cases is replaced by automation testing. Basic understanding of the organization is required understand the process.

4.1.1 The organization consists of four functional divisions.

- The development team release information regarding the time taken for start and end of a modeldevelopment.
- The internal testing group perform the various types of tests, here its sanity test and release the output to downstream users.
- The validation team then validates the tests performed and certain control measures are specified as feedback to development leads.
- Final factory check before the product is been delivered top the customer.
- So that the implementation of the automation will reduce the effort required for Internal testingloading.

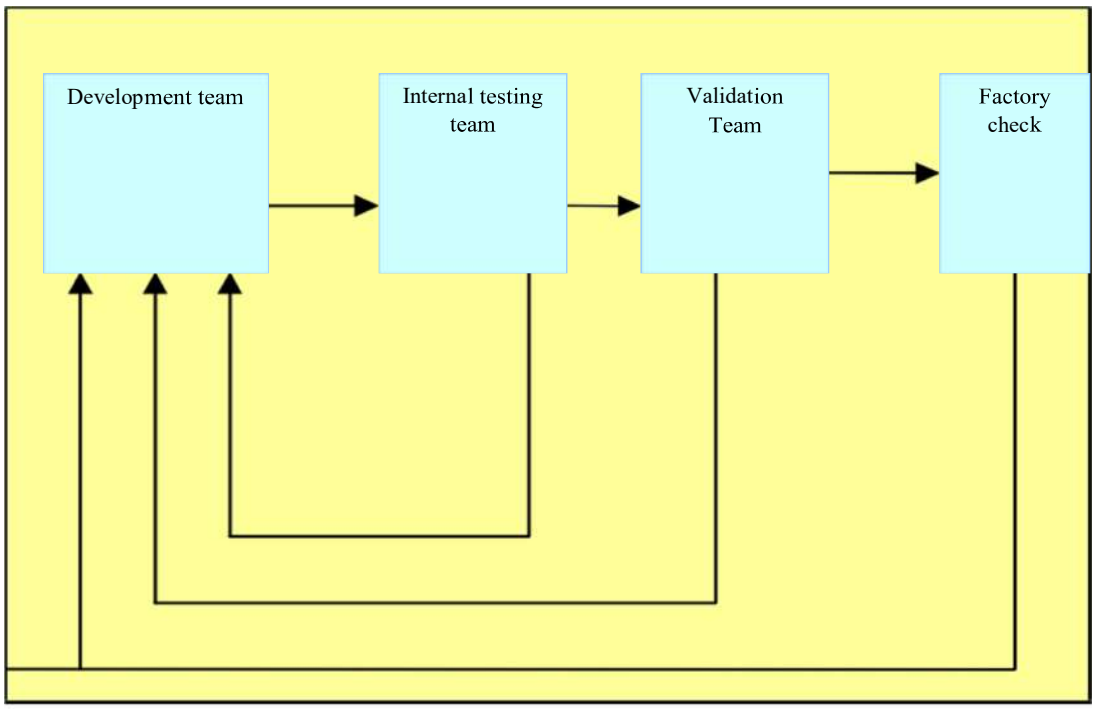

Figure 1: Basic structure of organization

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4.2 To reduce validation/factory rejection

The defects released to the validation/factory are reduced since the defect ratio is lowered.

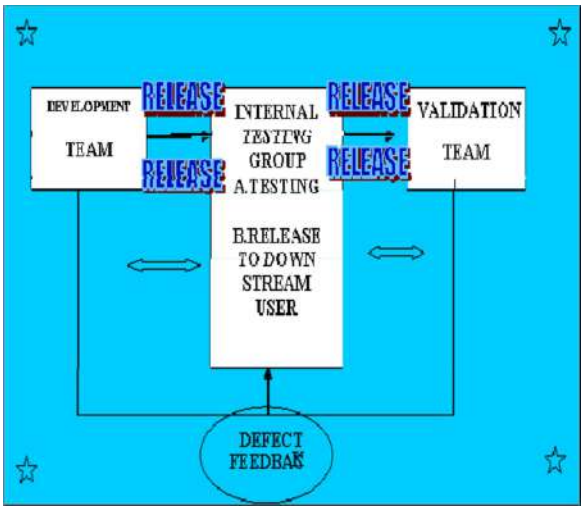

Fig 2: Defect rate released

4.3 To reduce factory rejection

Similarly the defects carried on to other sub processes are reduced. This will result to reduced factory rejections.

4.4 To achieve scheduling.

The software which was supposed to be delivered before two weeks to the factory is delivered within the specified time.

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5. SCHEDULING

"Predict before implementing any process"-The Pareto analysis was carried out to know whether the achievement is cumulative and the innovation deployed is fruitful.

5.1 Pareto analysis for schedule Achievement Jan to Jul –2010

The fig 3 below shows the number of failures versus categories (such as simple rejection, late detection, and field issue, others).

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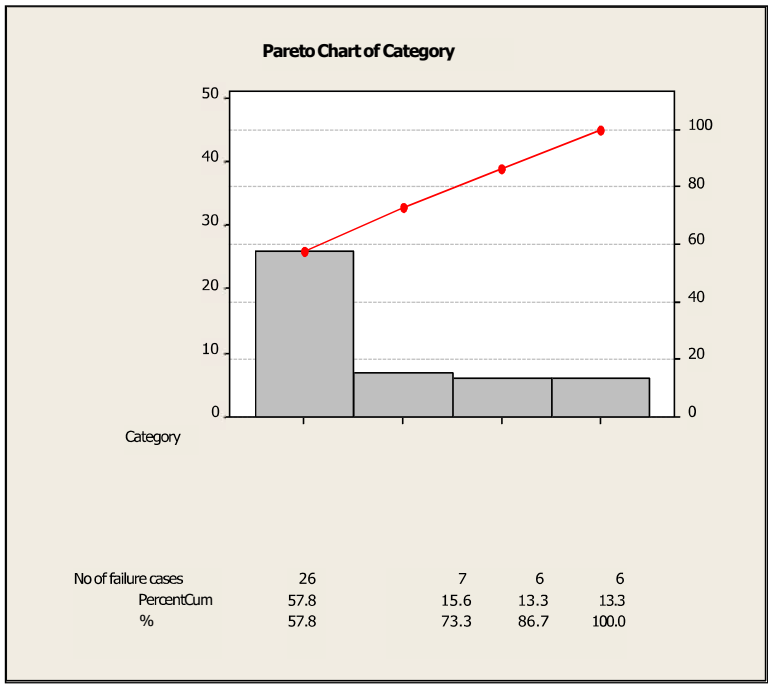

Figure 3: Pareto analysis for schedule achievement Jan to July

- The Pareto chart shows the major contribution isbecause of simple rejections (57.8%).
- This clearly shows that the rejections per release are more and should be considered as a primary aspect.
- The table below shows the number of failures percategory.

Category	**No of failure cases**
Field issue	6
Late detection	7
Simple rejections	26
Others	5
Total	**44**

Table 1: Number of failures per category

As shown in the Pareto chart, the rejection per release per month is targeted as shown in fig 4 .The fig 4 explains about the rejections at validation /factory during 2009, before the

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implementation of automation.

2. IMPLEMENTATION

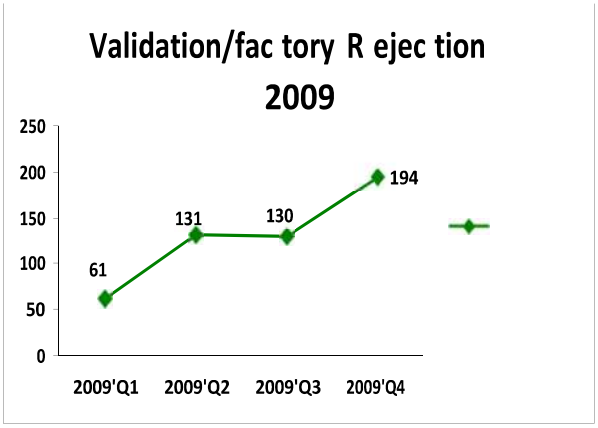

Fig 4: Validation/factory rejection as per 2009

6.1 Validation rejection trend 2010

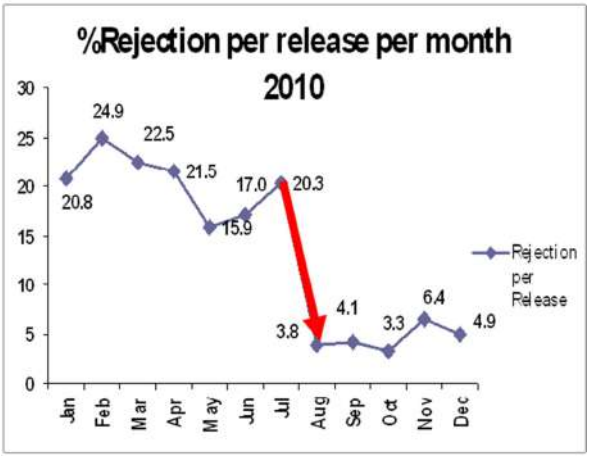

Fig 5: Validation/factory rejections as per 2010

The Fig 5 is a simple line chart which explains about the month wise percentage of rejections per release for the year 2010. This clearly indicates the reduced trend of the rejection.

The red line specifies about the introduction of automation during July 2010 led to drastic decrease in the rejection per release.

The chart also clearly shows that the mean value did not increase more than 4.3 which is reduction of 75% of release rejection.

6.2 Categorized % rejections per release

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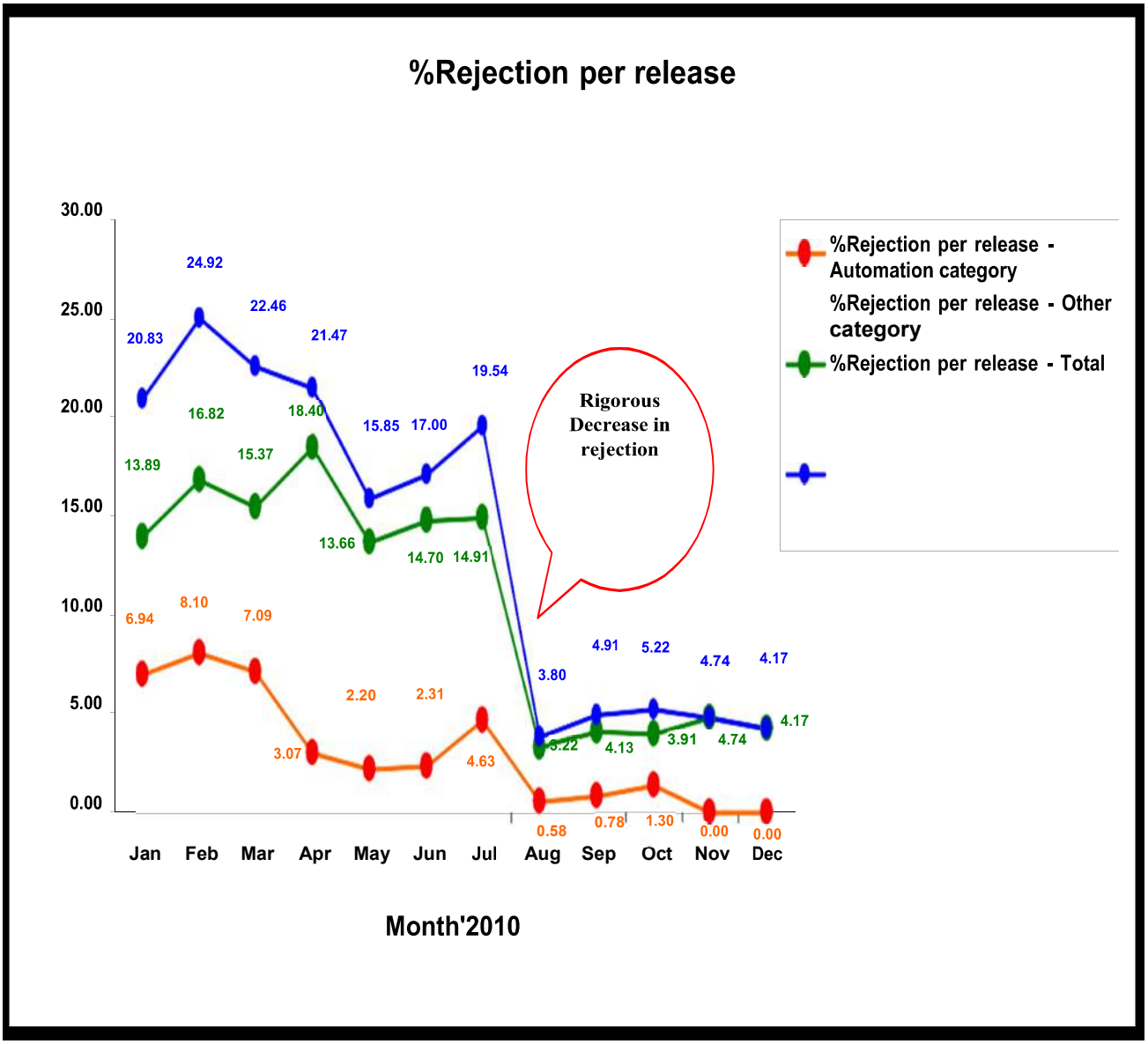

Fig 6: Categorized % rejection per release

The Fig 6 is categorized % rejection per release

- % Rejection per release-automation category
- %Rejection per release-other category
- %Rejection per release-Total

Graphical method of displaying the process performance

7.1 Control chart for Manual Productivity

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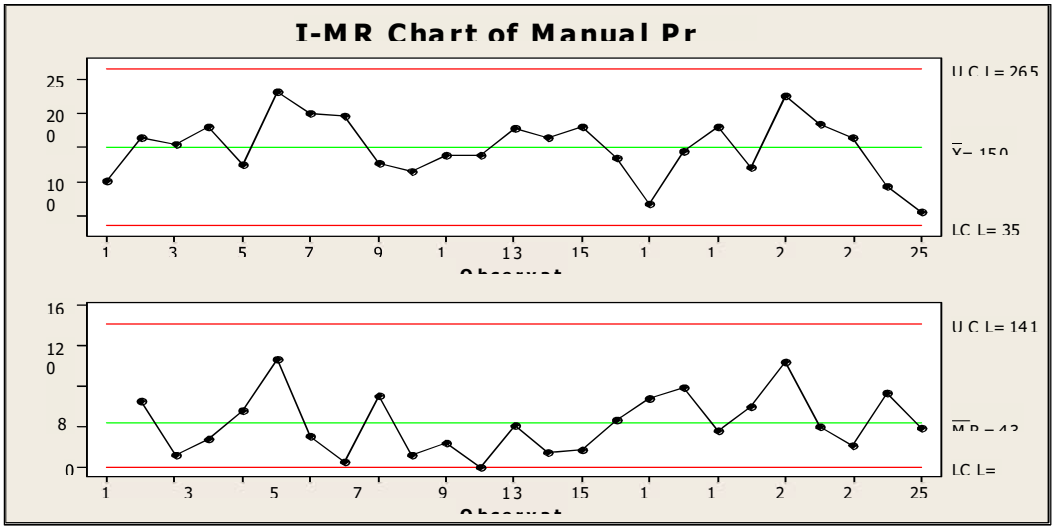

Fig 7: I-MR chart for productivity

The Fig 7 shows the Graphical method of displaying the process performance of manual productivity using I-MR (Individuals (I) chart and Moving Range (MR) chart.) graphical method of displaying the process performance. Means of individual and moving average are 150.6 and 43.3 respectively. (Productivity is a measure of output from a production process, per unit of input).

I-MR chart is mostly used for 2 purposes.

II-

- To see if the process is in control and to detect signs of special causes that might take the process out of control.

To compare the performance of the process at various stages. E.g. before and after implementing a change

6.1.1 Calculation of manual productivity:

Manual productivity=No of Test cases / manual test effort

6.3.1.2 Summary of manual productivity

Fig 8: Explains about the summary of manual productivity

P-value=0.870(probability value)Mean=150.61
Std dev=44

Considering 95% confidence interval

- Mean=132.10-169.13
- Median=127.82-179.94

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- Std dev=35.03-62.41

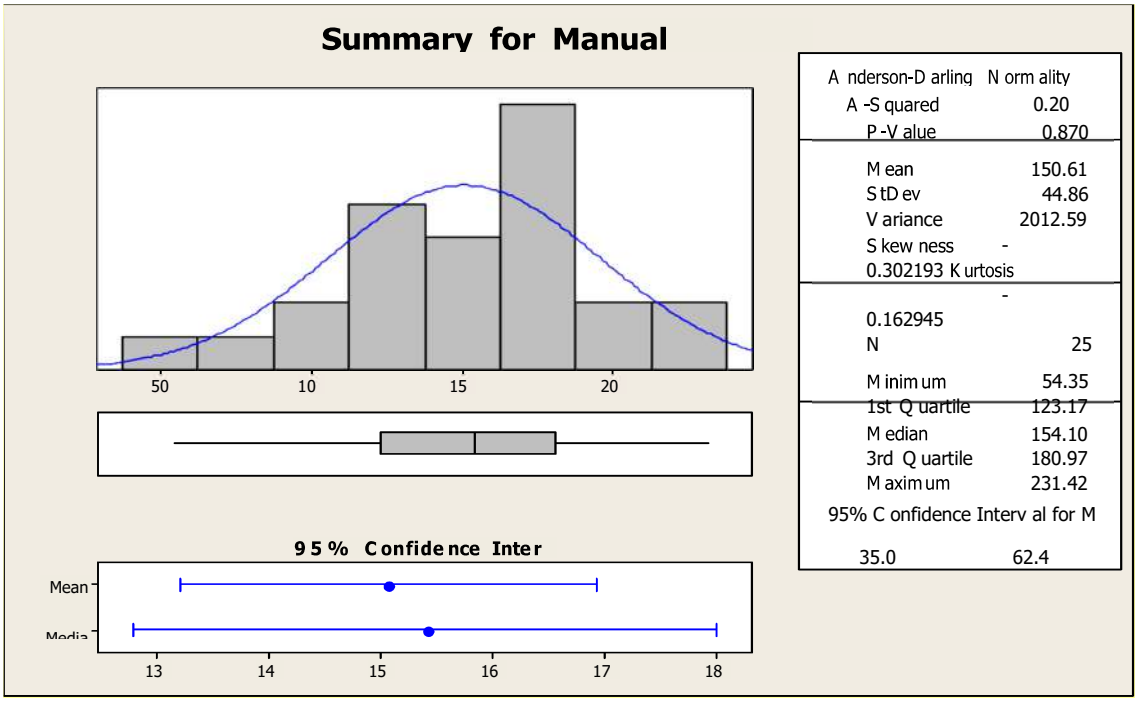

Fig 8: Summary of manual productivity

7.2.Automation contribution for validation rejections

Even though the internal testing team works in different shifts , manual deployment of test cases takes more time the remedy for such bottle necks is to automate a tool which helps the testing of functional like sanity testing and non- functional like setting alarm, deleting messages, stress checking the contact capacity which may be limited to nearly 250 contacts only. Here the automation is essential in non- functional test cases where the test engineer can test certain applications such as stress checking any application for more the one day ,even if he's not in working place he can run the automation tool which helps him to stress check that particular application If there is any critical issue related to test cases then the development lead can be intimated which helps the development leads to know the error well in advance and control measures can be taken to overcome this problems.But in case of manual testing for functional applications like the sanity test companies prefer manual testing itself as knowledge of different domain is essential for a tester which cannot be updated in an automation tool. This untouched area wherein manual testing was essential, an automation tool is developed which reduces the burden of the tester and also manual vigilance is applicable.

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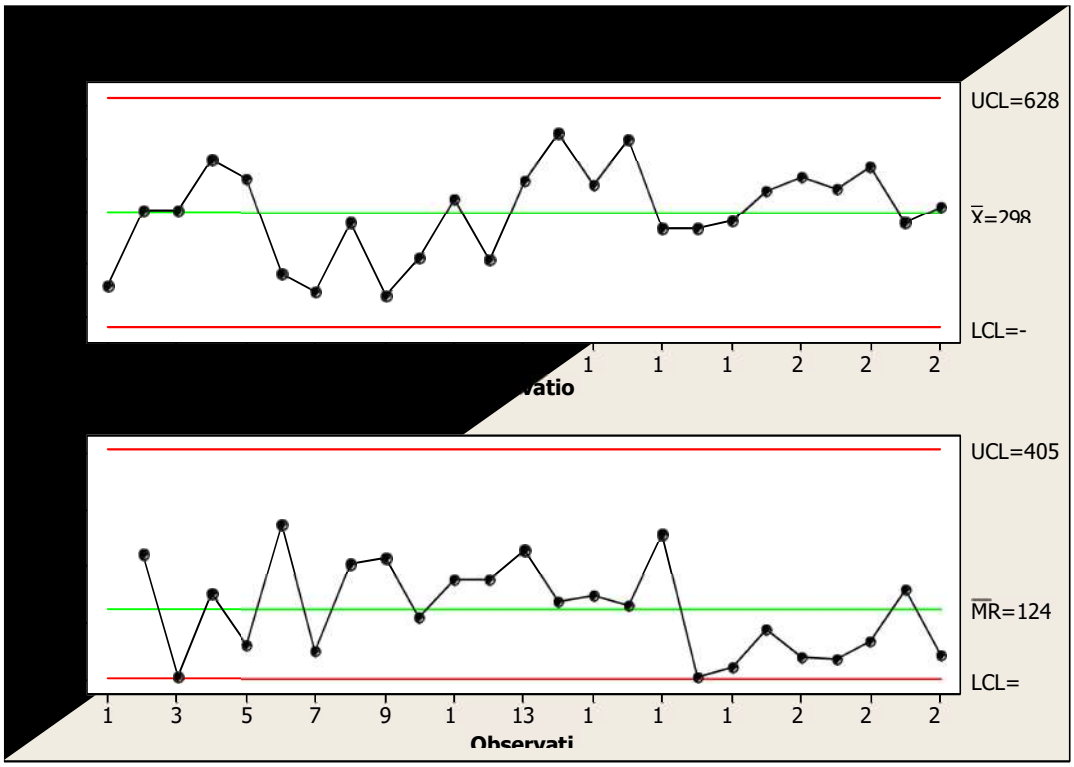
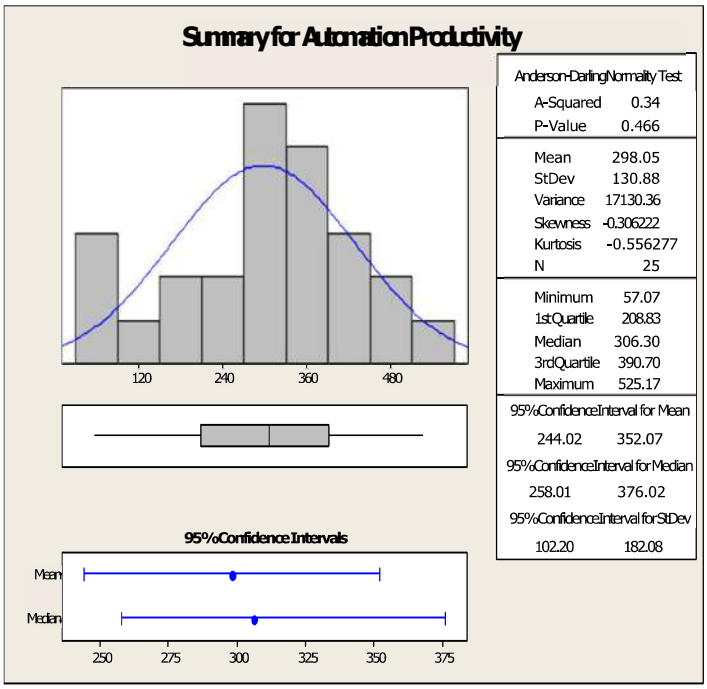


6.3 Control chart for Automation Productivity

Fig 9: I-MR chart for Automaton Productivity



7.2. 2T test for internal testing productivity 2010

As shown in figure Fig 8 and Fig 11, we can draw a conclusion about the internal testing productivity. The table below shows the difference achieved between manualproductivity and automation productivity

Mean	298	150.6
Std Dev	131	44.9

P value = 0.000

2T test passed .significant improvement found

7.2.2T test for Schedule Achievement 2010

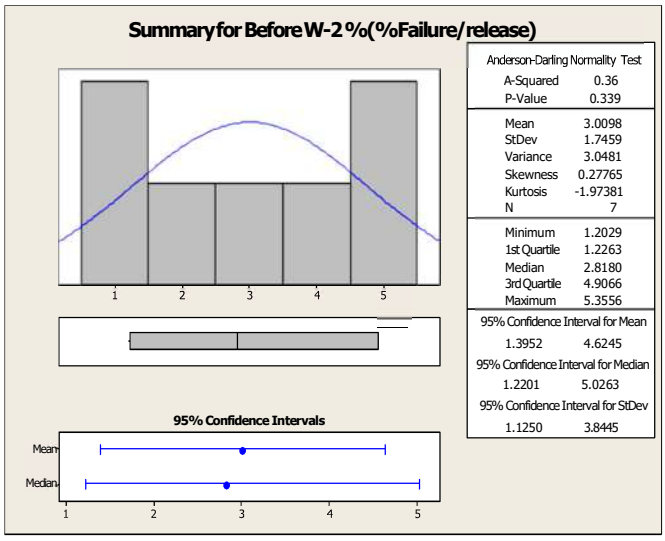


Figure 10: Summary for Before Schedule Achievement 2010

Before W-2 %(%Failure/release)	**After W-2 %(%Failure/release)**
2.818035427	0
1.639613051	0
4.906552478	0.443655723

1.202935162	0.49741345
3.919860627	0
1.226316758	
5.355612682	

Mean	20.41	4.51
Std Dev	3.12	1.22

Mean	3.01	0.188
Std Dev	1.75	0.258

P value = 0.006

2T test passed. Significant Improvement is found

7.5 2T test for Validation/Factory rejections

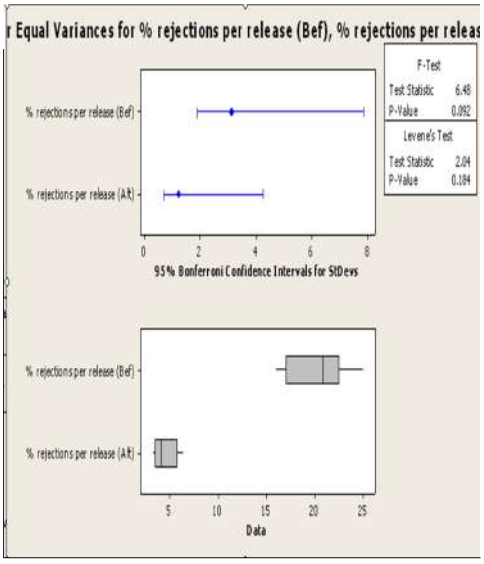


Fig 11: Equal variance for % rejection per release (before/after)

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P value = 0.00

2T test passed. Significant Improvement is found.

CONCLUSION

Successful implementation and execution of the processes helped in significant reduction of efforts in terms of Defect triaging. This extra effort was utilized by the team in undertaking late requirement changes. The automation which was deployed between June–July showed rigorous decrease in rejection per release.

Also with the reduction in the Rejected Defects percentage Customer satisfaction also significantly increased as the product was delivered to the customer well within time.

So overall the high maturity techniques, processes and methodology followed in the execution of this project can be utilized in any similar projects.

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