Lean Six Sigma applied to a Customer Services Process within a Commercial Finance Organisation – An Empirical Case Study

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Abstract

This study explores the use of Lean Six Sigma methodologies and tools as applied to supply chains within a services environment. The approach taken was to examine a L6S project as run within a large American financial services conglomerate to understand how this has been applied. The project not only demonstrated the results achievable but also the business thinking presented some compelling findings. Although there are differences between the Lean and Six Sigma approaches as well as the difference between a manufacturing and services environment, there were also some key learnings demonstrated. Certainly some of the key issues uncovered is that clear objectives combined with accurately set parameters and data gathering aligned with stakeholder buy-in is key to the success of a project of this nature. The implications and strategy adopted by the services company are borne out with the results as outlined in this study and further supports the deployment of a carefully thought through L6S programme within services supply chains.

1. Introduction

Lean Six Sigma (L6S) has been around in business as a form of quality programme for more than two decades now. Established by Motorola in the mid-Eighties, Six Sigma has since been adopted by a number of very high profile organisations including Boeing, Kodak and GE. Toyota then adapted this further into the complimentary Lean 6 Sigma methodology. What has sometimes been questioned by businesses is the tangible value that a programme such as L6S delivers. This is particularly true in services where there are many intangible processes and effects that require careful thought so that a true measure may be defined. Historically, the first firms to grasp L6S were mainly in the manufacturing sector. This was due to the fact that the core Six Sigma methodology revolved around the reduction of defects in a process.

As with Aircraft Engines, this might be a defect in the width of a piece of steel for use in the manufacture of a turbo fan engine. This might typically lead to a catastrophic failure, so a solid quantitative methodology lends itself well to the prevention of problems in this type of scenario. Services by its nature is very often bound by time in terms of the processes that are run and lead to the delivery of an outcome that then benefits a customer. This is where Lean comes in as a methodology that looks at how waste (in terms of time) may be taken out of a process and allows that process to become more efficient and, in turn, build capacity. This is where the focus of this paper will be, however to better outline the building blocks of Six Sigma we need to first look at the methodology behind the paper and its component parts.

2. Research Methodology

2.1 Secondary Research

The authors have performed extensive reading on supply chain management and on the application of Lean 6 Sigma methodologies, in order to provide a good theoretical background on the subject being studied. This has included books, academic journals, Newspaper and magazine articles, and Internet sources. Illustrations to support the theories can be found within the text of this paper. A list of all the literature and sources of information used for the outcome of this work can be found in the reference section at the end of this paper.

2.2 Primary Research

The main thrust of this paper revolves around a project run at GE within its customer services department with the objective of improving a process, eliminating waste and building capacity in the department.

3. A Case Study for Best Practice Deployment of L6S in a Services Environment

The case study that will be used for this paper centres around the National Grid, who as a client of GE Fleet Services in the UK, required renewal prompts for its vehicles to be issued to drivers in a timely and resource efficient manner. Please note that the case and the associated opinions as outlined in this paper in no way represents the opinions of either GE or the National Grid and are those of the authors of this paper only. Please also refer to Exhibit 1 onwards following the reference section. The first step in a L6S project is to define what is being undertaken and what represents success. Identifying the CTQ or what is 'Critical To Quality' is the first step and is ultimately what the customer wishes to gain from this exercise. The Big Y is the Yield that is expected to result and the little y represents a measure of this Big Y. In this case, the Voice of the Customer is expressed as: 'Need to reduce the amount of time taken to issue and manage order prompts. From the point that drivers are identified for a prompt to the point that it is issued by email is using too much resource capacity in terms of time' The Big Y is then defined as to 'Free up resource capacity when running renewal prompts'. The measure associated with this or the little y is then defined as, 'time spent running prompts'. This process of defining the CTQs is completed with the customer's approval and buy-in.

Exhibit 1

As a next step, the Project Charter is then drawn up and populated with relevant details covering the business case, objectives, scope, timelines and team involved in delivering on the customer's CTQs. The separate sections as outlined in the charter above are outlined below in more detail by way of an explanation:

3.1 Business Case (reason to run with this project)

The consistent and timely prompting of renewals followed by the subsequent placing of orders is a key service for this customer in the UK, National Grid (NG). The process was taking too long to issue prompts, leading to a lack of resource capacity within the NG customer services team.

3.2 Specific Problem Statement (clearly quantify what the problem is)

From 01/01/2006 to 22/03/2006, it was recorded:

- An order prompt number of 80 per month
- An order prompt process time median of 530 secs; P95 is 606 secs (8 mins 50 secs and 10 mins 6 secs respectively)

This has resulted in less time spent on other growth and value-add customer services activities by the National Grid customer services team.

3.3 Specific Goal Statement

This was defined as, 'reduce the time taken to process and issue an order prompt so that the P95 drops from 606 secs (10 mins 6 secs) to 240 secs (4mins) by Q2 2006. This should help to build resource capacity without creating more re-work loops or affecting the Yes/ No ratios at subsequent prompt steps'.

Note that the median is the mid-point of a set of data, not the mean or average. Whether to use the mean or the median is determined by the nature and spread of the data. So, for the numbers, 1, 20, 45, 100, 1000; the median is 45. The average would be all of the numbers added together and divided by 5.

As for the P95 reference, this relates to the percentile of a group of numbers. The P95 relates to the 95th percentile and means that in this case 95% of all prompts are issued within the time specified. So, the target of 240 secs or 4 mins is what we would like 95% of prompts to be processed within.

3.3.1 In Scope (what is the focus of this project)
All NG Renewals that require prompts and follow-up to achieve timely order placement

3.3.2 Out of Scope (what is not being included in the project)
Any other processes outside of NG Renewals within Customer Services

3.3.3 Project Team (who are the stakeholders who will work on this project)

Project Sponsor – typically a senior manager in the business
Quality Leader – the head of Lean in the business
BB Serve – the Black Belt for Customer Services
Customer Services Manager – functional managers for customer services
NG Account Manager – relationship manager with GE who's client is NG
NG Service Delivery Executives – the team who deliver the service for NG at GE

3.4 Define Process Map

A high-level process map was drawn up to highlight the areas of focus for the project. In this case:

1. Filter invoked and renewals identified

2. Check driver details and validate
3. Mail-merge letter and prepare email for issue
4. Dispatch email to driver

These are the areas that this project looked to improve that would in turn lead to the achievement of the specific goals as outlined above and in the appendices.

3.5 Select CTQ (Critical to Quality) Characteristics

The CTQ characteristics are then outlined and this relates back to where the improvement is being made within the business, as previously described.

Exhibit 2

3.6 Define Performance Standards

This step is one of the most critical as it outlines very clearly what is being targeted for improvement and how the various processes may be defined to ensure that the desired performance is achieved. Starting with the left hand box and then working down the table to the right:

3.6.1 Voice of Customer (as previously stated)
Need to reduce the amount of time taken to issue and manage order prompts

3.6.2 Unit Definition – Processed Order Prompt (what unit are we measuring?)

3.6.3 Output Characteristics - Time Spent to Process Order Prompt

3.6.4 Output Operational Definition - Order Prompt from the time filter is applied to identify drivers to prompt to the time that the email prompt is issued to the driver

3.6.5 Customer Specification Limits - USL = 240 seconds (4 mins) – USL stand for the Upper Specification Limit and this is, as you may recall, within the P95 measure.
Target - 180 seconds (3 mins) = LSL – this is the ideal situation for the customer and is regarded as the Lower Specification Limit (LSL)

3.6.6 Defect – This is basically saying, what represents a defect in this process and the definition of a defect is if the time taken is greater than the Upper Spec Limit, > USL

3.6.7 Defect Opportunity Number per Unit – this is asking how many opportunities per prompt are there for a defect to occur. As the defect is defined as total time taken for prompt to be identified and then issued, this is 1.

Exhibit 3

3.7 Measurement System Analysis (MSA)

This step looks to identify how a particular measuring system may or may not affect the recording of processes or parts under investigation. For example, using a digital stopwatch for a sprint race will record a very accurate time with little bias added from the stopwatch itself in terms of +/ - fractions of a second. However, if a wall clock was used with no second hand, then the only unit that could be measured would be minutes and for a sprint race this would not be sensitive enough. Indeed even with a second hand, the clock may still not have the accuracy required to record a faithful time.
For this project, the following procedure was outlined and followed:

3.7.1 Operational Definition of the Measurement
Order Prompt from the time the filter is applied to identify drivers to prompt to the time that the email prompt is issued to the driver

3.7.2 Sampling Plan (what is measured to determine the bias of the gage)
The figures are based on 20 order renewal prompts identified during March 2006 as part of the National Grid order prompt process.

3.7.3 Measurement Procedure
The data was recorded by two people timing the prompts process from the point where the Customer Services Operator signalled they were starting the process to the point where they pressed the send button for the prompt to be issued via Outlook. The result being that two people checked the timings of 20 prompts one time each using the second hand on a wrist watch.
A short form gage R&R (this is simply a statistical tool that allows a user to measure the repeatability - the same measure being made by the same person - and the reproducibility – the same measure being made by two or more people and determine if there are any statistical differences between the measures made) was then run on the 20 observations and it was found that the gage would not be a bias beyond any reasonable level and that the project could be based around the measures as taken using the second hand of a watch.

Exhibit 4

3.8 Establishing the Process Capability

This step essentially quantifies where the process sits today. This is achieved in this case using a statistical tool to provide a measure. Looking at the bottom right hand table outlines the capability as follows, based on 20 observations:

N = 20 (observations) – N simply stand for, Number

Median = 530 seconds – median is the midpoint of a group of numbers

P95 = 606 seconds – P stands for Percentile and the definition is as above

DPMO = 1,000,000 – This stands for, Defects Per Million Opportunities

The above basically demonstrated that the process was completely defective and that not one of the prompts issued met with the customers desired Upper Specification Limit as previously defined.

3.9 Value Added Goals

This step allows a summary of the value added tasks that are key to this process happening. It also outlines the non-value added tasks that can occur within this process. The aim being to maximise the value added tasks and reduce or eliminate the non-value added tasks.

4. Mapping the Value Stream (VSM)

Moving into the Analyse phase, the objective here is to walk the process and ensure that it is fully representative of the process being measured. This involved sitting with the operator as they went through the process and recording each step with a description of the activity. The length of time that it took for each step was also measured as well as any waste in between those steps.

Colour coding was used to differentiate between one application as used and another (please note that a grey scale image was used for ease of printing for exhibits 5 & 6). In this case, all were MS office products but they had been used in a piecemeal manner and the process had evolved around these rather than being something that was carefully conceived and deployed. This mapping of the underlying process provided the framework for the subsequent phase of the analysis as outlined below.

Exhibit 5

4.1 The next stage is to look at Potential Causes

This allows an objective view of the process and highlights and isolates causes of wasted time. In this instance, a lot of manual intervention, re-keying, verification and manual mail-merging being the main issues.

Exhibit 6

4.2 Establish a New Process Flow

Through workouts and drilldowns on the various steps along with the input of stakeholders including IT, a new flow was developed that allowed a large number of the non-value added steps to be removed and a new process to be implemented that allowed for a more streamlined and accountable output. The key to the new flow was in allowing the various applications to operate more effectively by both optimising their performance individually and also in helping them to 'talk' more efficiently between each other. This was achieved by making the filtering process more automated within Excel, so that relevant data was pulled through to an appropriate template and also merging directly to an email message rather than merging to a word document to create a letter, The end result is that through all of this change and refinement, the process time for 20 prompts was reduced to 180 seconds combined, representing a time saving of 99% over what was achieved before.

4.3 Implementing the Pilot Solution

This step represents a workplan with roles and responsibilities for anyone looking at understanding how the new process will work from an operational perspective.

Exhibit 7

4.4 MSA (Measurement System Analysis) at Step 10

The key at this step is to measure the 'X' rather than the 'Y'. So, where the Y is the main yield or output, then the X is the variable that affects the Y. For example, $(X1 + X2 + X3 + X4) = Y$. There may be many variables that affect the Y. In this instance, the inputs in terms of the refining of the applications used and the efficiencies in the manner in which they talk to each other means that in this case the measurement of the Xs are closely matched with the Y. So a measure of the time taken to issue the prompts and a record is what is shown here. This is where the 180 seconds for 20 prompts can be clearly seen and the reduced file size is illustrated.

Exhibit 8

5.5 New Process Capability

Once the new process has been established, the capability of the process may be measured. Due to the prompts being issued at a rate of 20 in 180 seconds, this represents a capability of 6 sigma and a defect rate of 0.

5.6 Implement Process Control

The aim of this step is to ensure that the new process does not lapse back to a previous state and the benefits of the new method are lost. The tool used here was a Failure Modes and Effects Analysis (FMEA) that basically looks at the severity, occurrence and detectibility of factors that may arise such as systems failure or different operators running the prompts that may then have an adverse affect on performance.

6.0 Conclusion

The project conclusions more or less speak for themselves in terms of the impact that a well structured project can have on a business, as follows:

- The time taken to issue National Grid order prompts reduced from a Median of 530 seconds for 1 prompt to a total time of 180 seconds for 20 prompts
- Capacity generated allowed for a new customer to be assimilated and managed – Rightmove PLC
- The size of the order prompts issued reduced from 3.5MB per prompt to 2KB as a result of the changes made
- Making the most of existing technologies that in turn increases capacity is a highly effective way in which to drive growth

One of the key aspects here is that a project with a relatively short timeframe (6 weeks) was able to achieve such significant improvements and in turn both meet the needs of the external customer and the GE business. This project subsequently received recognition from the business sponsor and quality leader in the form of an award. The citation from the business sponsor included the following:

"…We should not overlook the very positive motivational impact this project has had on the customer services employees directly involved in the National Grid account. Also note the future positive impact on the rest of the department given the project solution has universal application on the orders renewal process generally." Indeed, this project subsequently led to the building of a bespoke IT solution to manage the order prompts for other customers within the GE Fleet customer base.

Lean Six Sigma has had a great deal of practitioner and academic coverage over the past year or two as organisations such as the NHS (National Health Service in the UK) has embraced the methodologies to enhance and refine their processes. However, there has also been a great deal of scepticism shown by the industry at large as to the costs and timescales for delivery of such improvements. This GE project clearly demonstrates the value of a well-applied L6S method to solve a process problem within a services environment in a timely manner and create capacity in an over-stretched customer services department. There are lessons that can be learned here to benefit both the public and private sectors.

References from Secondary Research and Background Reading

Bendell, T (2000), Qualityworld – What is Six Sigma?, London: The Chartered Quality Institute

Brook, Q (2004), Six Sigma and Minitab – A Tool Box Guide for Managers, Black Belts and Green Belts QSB Consulting Ltd

George, M (2000), The Six Sigma Way, McGraw-Hill

Geroge, M (2003), Lean Six Sigma For Service, McGraw-Hill

Appendices

Exhibit 1

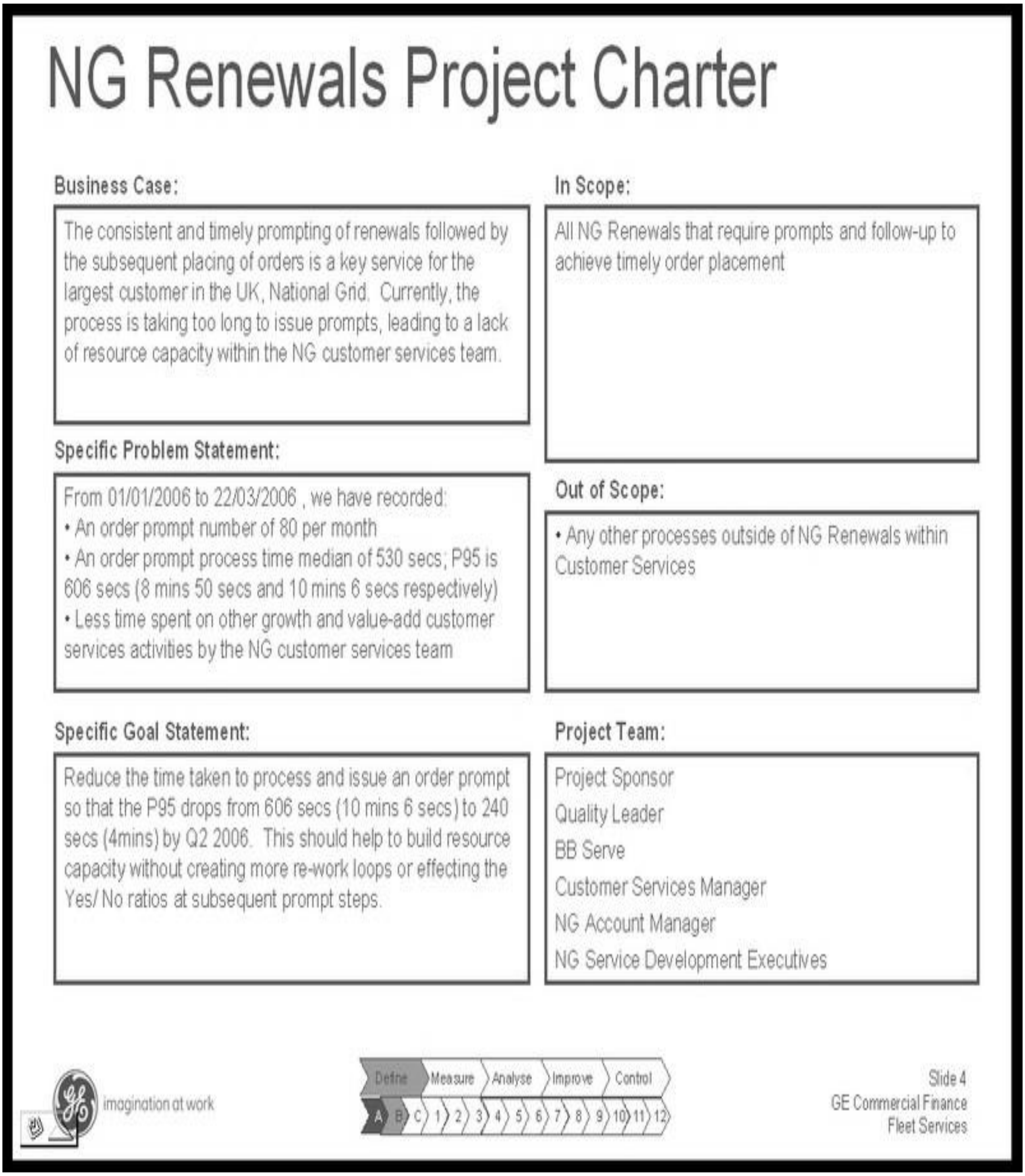


Exhibit 2

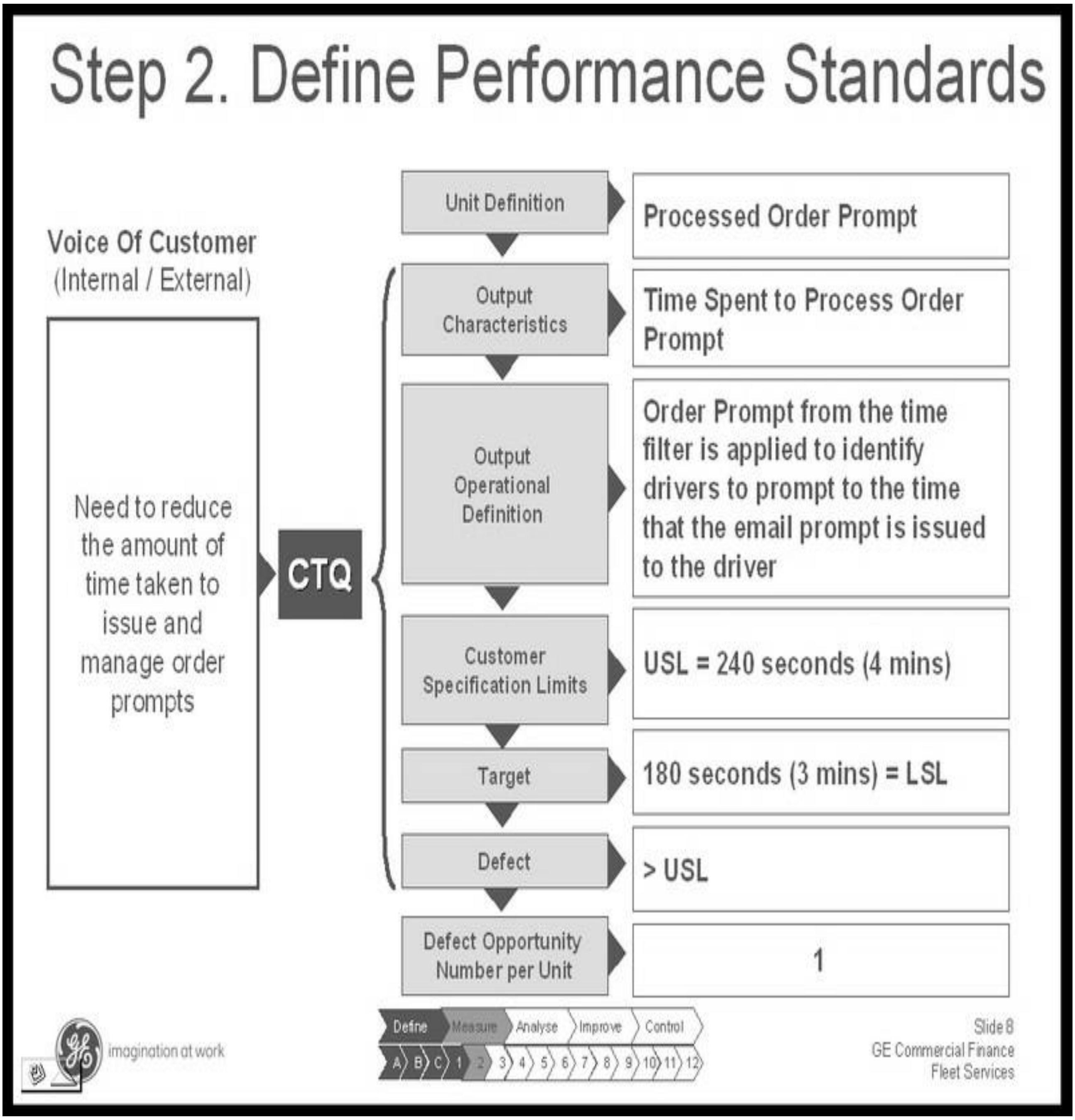

Step 2. Define Performance Standards
Voice Of Customer
(Internal / External)
Need to reduce the amount of time taken to issue and manage order prompts
CTQ
Unit Definition
Processed Order Prompt
Output Characteristics
Time Spent to Process Order Prompt
Output Operational Definition
Order Prompt from the time filter is applied to identify drivers to prompt to the time that the email prompt is issued to the driver
Customer Specification Limits
USL = 240 seconds (4 mins)
Target
180 seconds (3 mins) = LSL
Defect
> USL
Defect Opportunity Number per Unit
1
imagination at work
Define
Measure
Analyse
Improve
Control
A B C 1 2 3 4 5 6 7 8 9 10 11 12
Slide 8
GE Commercial Finance
Fleet Services

Exhibit 3

Step 3. Measurement System Analysis

Continuous GR&R – Short Form

Part	Operator 1	Operator 2	Range
1	607	606	1
2	523	523	0
3	604	604	0
4	408	407	1
5	532	532	0
6	602	601	1
7	582	582	0
8	607	608	1
9	421	422	1
10	458	458	0
11	574	575	1
12	527	528	1
13	472	472	0
14	563	564	1
15	511	512	1
16	584	585	1
17	563	562	1
18	528	527	1
19	458	458	0
20	475	476	1
		Average Range:	0.65

d* # of parts	# of Operators 2	3	4
1	1.41	1.91	2.24
2	1.28	1.81	2.15
3	1.23	1.77	2.12
4	1.21	1.75	2.11
5	1.19	1.74	2.10
6	1.18	1.73	2.09
7	1.17	1.73	2.09
8	1.17	1.72	2.08
9	1.16	1.72	2.08
10	1.16	1.72	2.08

Microsoft Excel Worksheet

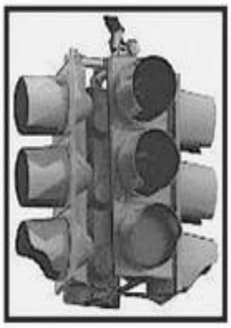
This Excel Short Form tool was used to calculate the GR&R for the timed data gathered during the MSA

Gage Error:

$$GRR = \frac{5.15 \times \text{Average Range}}{d^*}$$

% GR&R = GRR x 100 / Tolerance

$$GRR = \frac{5.15 \times 0.65}{1.13} = 2.97$$



2.97 x 100%/60 = 4.95% Gage R&R Error

Tolerance = USL (240 secs) – Target (180 secs) = 60 secs

The Gage R&R for the process is 4.95% and passes the test for gage variation

imagination at work

Define | Measure | Analyse | Improve | Control

A | B | C | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12

Slide 10
GE Commercial Finance
Fleet Services

Exhibit 4

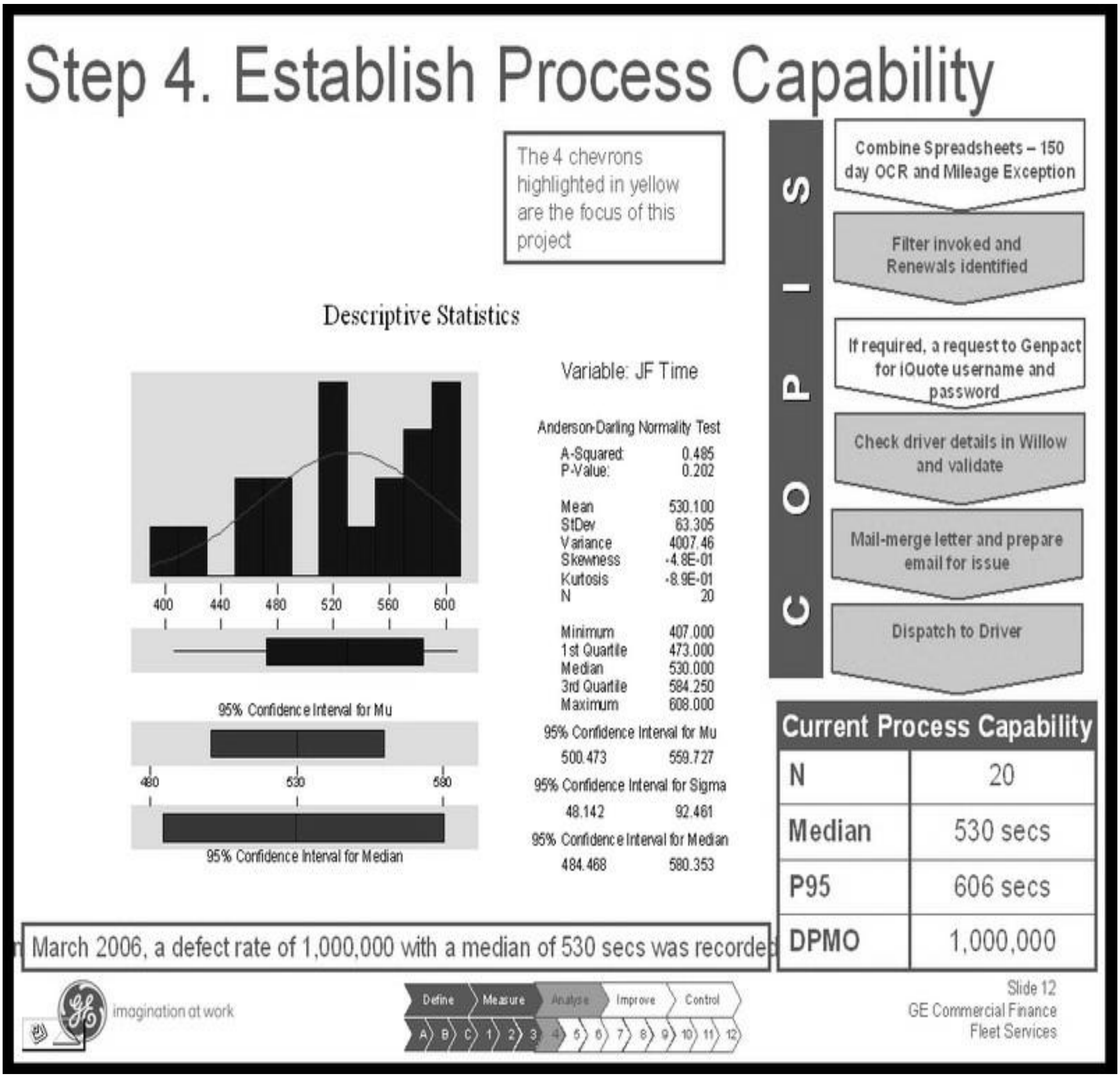
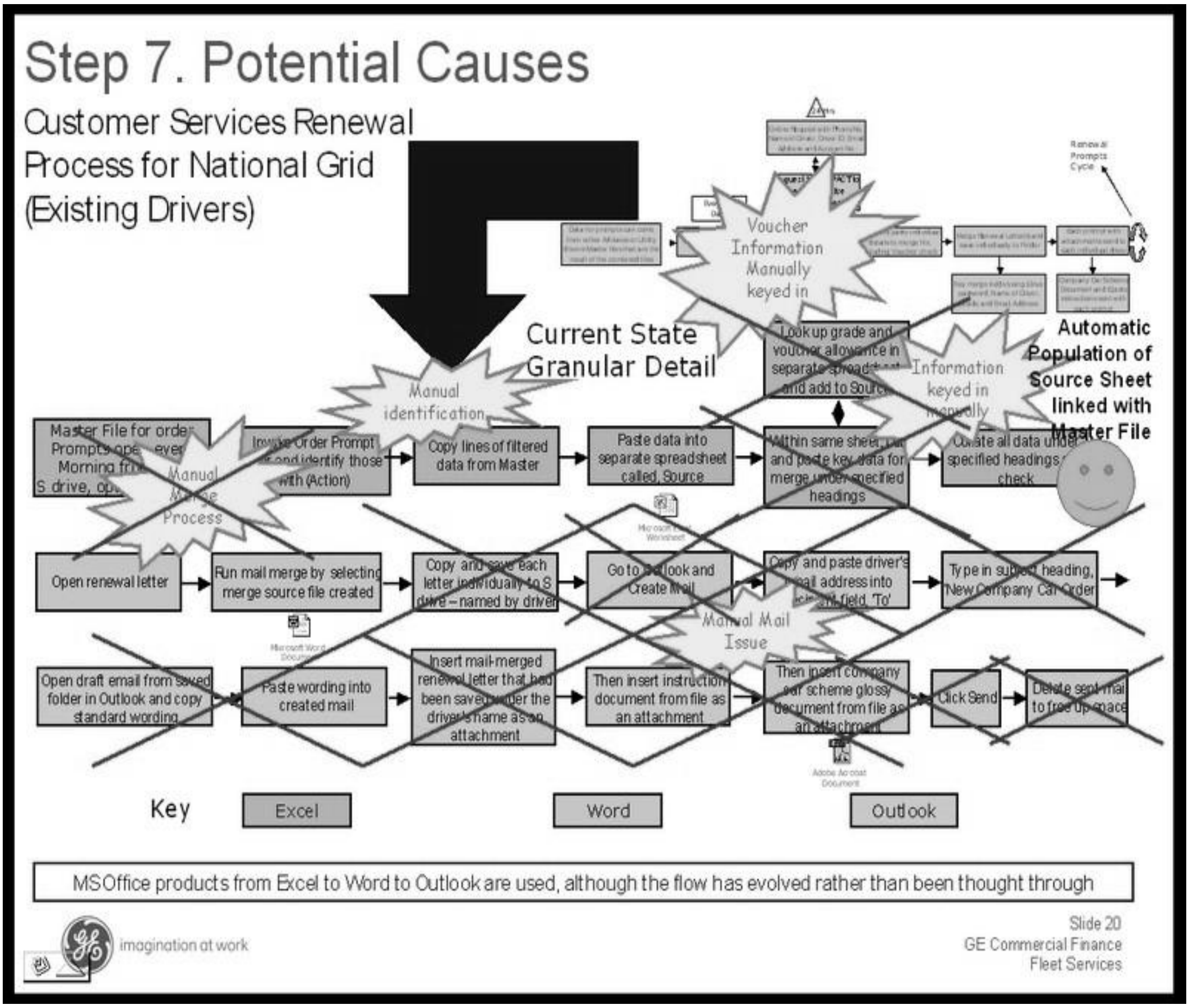

Step 4. Establish Process Capability
The 4 chevrons highlighted in yellow are the focus of this project
Descriptive Statistics
Variable: JF Time
Anderson-Darling Normality Test
A-Squared: 0.485
P-Value: 0.202
Mean 530.100
StDev 63.305
Variance 4007.46
Skewness -4.8E-01
Kurtosis -8.9E-01
N 20
Minimum 407.000
1st Quartile 473.000
Median 530.000
3rd Quartile 584.250
Maximum 608.000
95% Confidence Interval for Mu
500.473 559.727
95% Confidence Interval for Sigma
48.142 92.461
95% Confidence Interval for Median
484.468 580.353
400 440 480 520 560 600
95% Confidence Interval for Mu
480 530 580
95% Confidence Interval for Median
S I P O C
Combine Spreadsheets – 150 day OCR and Mileage Exception
Filter invoked and Renewals identified
If required, a request to Genpact for iQuote username and password
Check driver details in Willow and validate
Mail-merge letter and prepare email for issue
Dispatch to Driver
Current Process Capability
N 20
Median 530 secs
P95 606 secs
DPMO 1,000,000
March 2006, a defect rate of 1,000,000 with a median of 530 secs was recorde
imagination at work
Define Measure Analyse Improve Control
A B C 1 2 3 4 5 6 7 8 9 10 11 12
Slide 12
GE Commercial Finance
Fleet Services

Exhibit 5


Step 7. Potential Causes
Customer Services Renewal Process for National Grid (Existing Drivers)
Current State Granular Detail
Voucher Information Manually keyed in
Manual identification
Manual Merge Process
Information keyed in manually
Manual Mail Issue
Automatic Population of Source Sheet linked with Master File
Copy lines of filtered data from Master
Paste data into separate spreadsheet called, Source
Open renewal letter
Run mail merge by selecting merge source file created
Then insert instruction document from file as an attachment
Click Send
Key
Excel
Word
Outlook
MS Office products from Excel to Word to Outlook are used, although the flow has evolved rather than been thought through
imagination at work
Slide 20
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Fleet Services

Exhibit 6

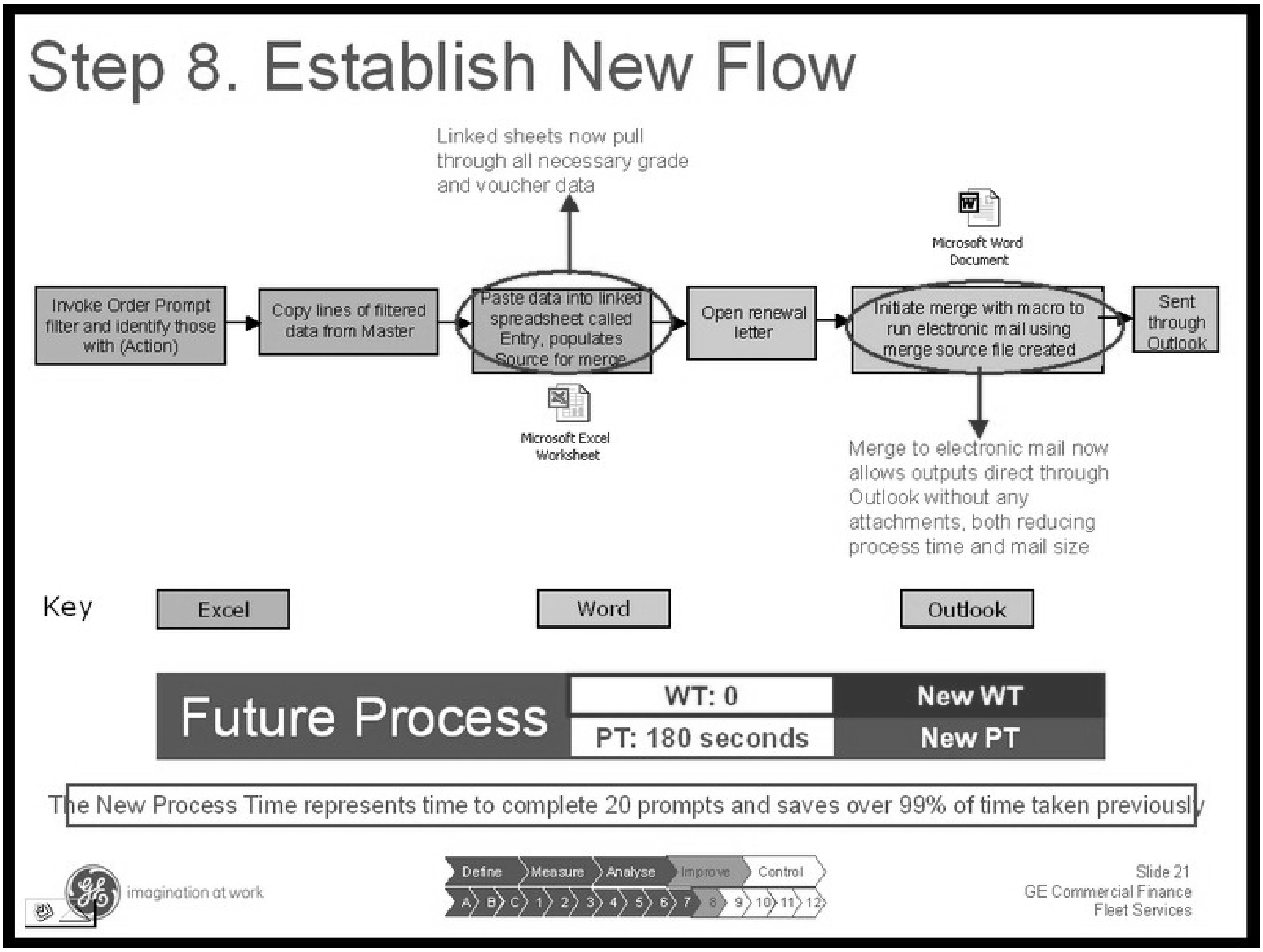

Step 8. Establish New Flow
Linked sheets now pull through all necessary grade and voucher data
Microsoft Word Document
Invoke Order Prompt filter and identify those with (Action)
Copy lines of filtered data from Master
Paste data into linked spreadsheet called Entry, populates Source for merge
Open renewal letter
Initiate merge with macro to run electronic mail using merge source file created
Sent through Outlook
Microsoft Excel Worksheet
Merge to electronic mail now allows outputs direct through Outlook without any attachments, both reducing process time and mail size
Key
Excel
Word
Outlook
Future Process
WT: 0
PT: 180 seconds
New WT
New PT
The New Process Time represents time to complete 20 prompts and saves over 99% of time taken previously
imagination at work
Define
Measure
Analyse
Improve
Control
A B C 1 2 3 4 5 6 7 8 9 10 11 12
Slide 21
GE Commercial Finance
Fleet Services

Exhibit 7

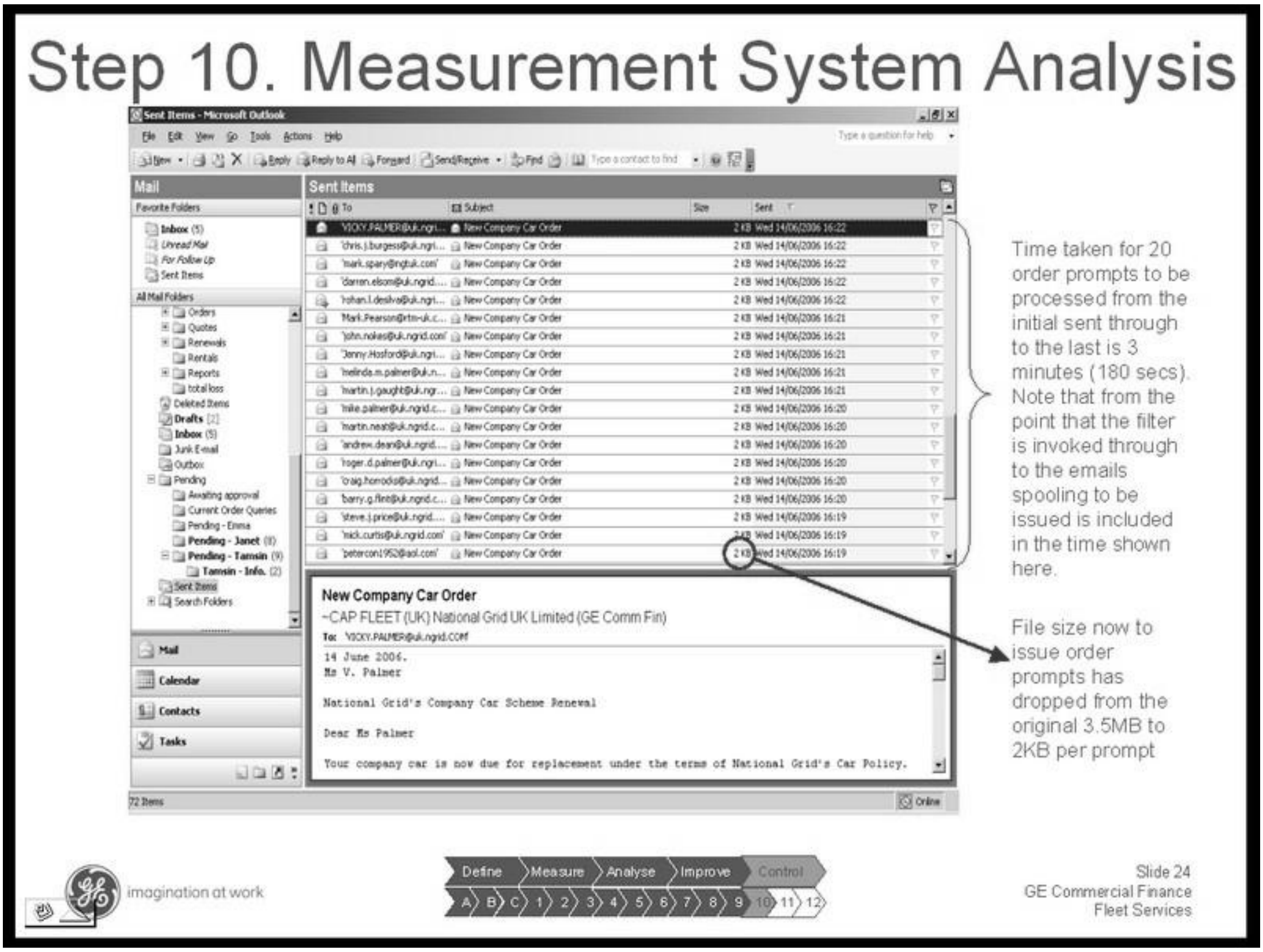
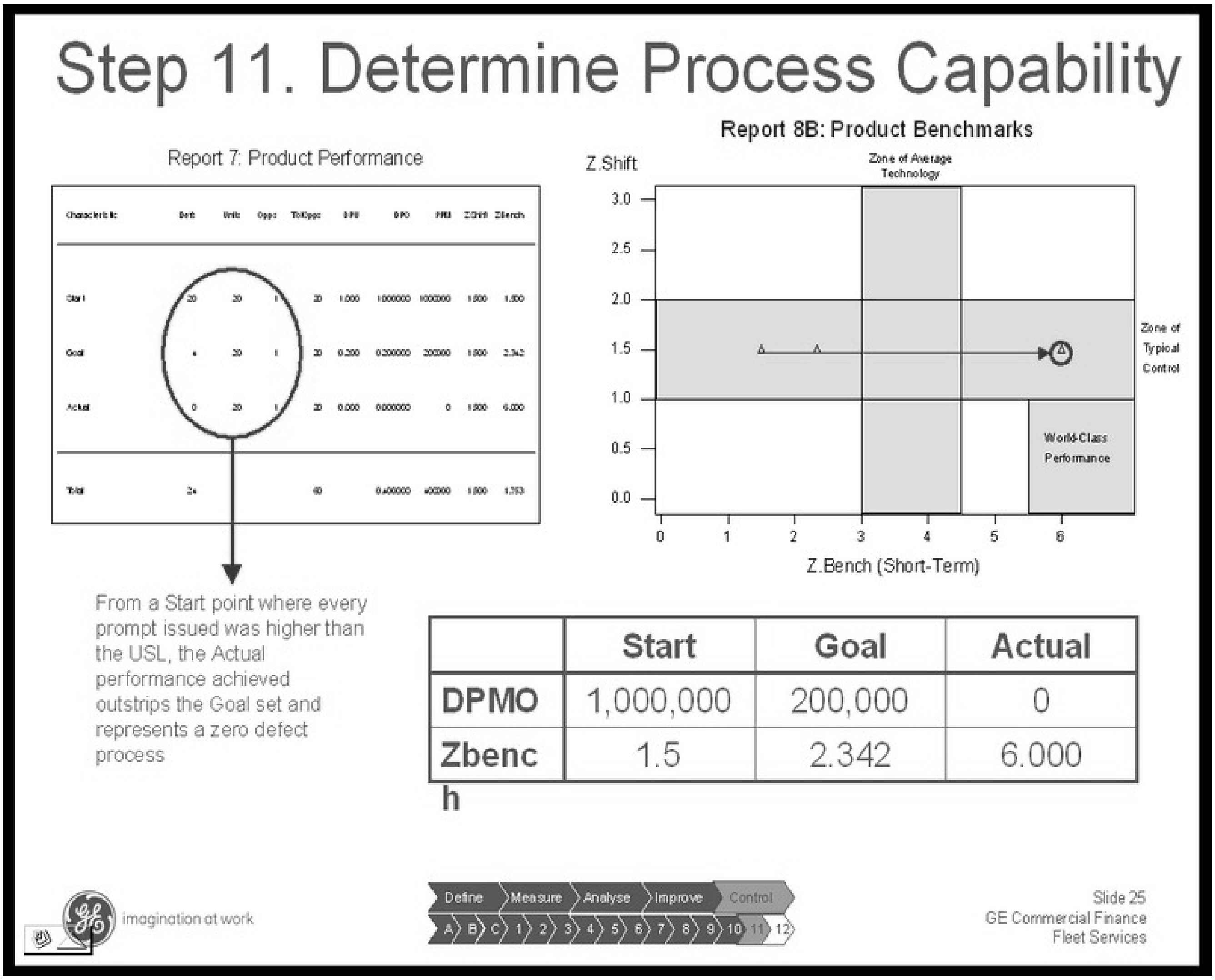

Step 10. Measurement System Analysis
Sent Items - Microsoft Outlook
Mail
Sent Items
New Company Car Order
~CAP FLEET (UK) National Grid UK Limited (GE Comm Fin)
14 June 2006.
Ms V. Palmer
National Grid's Company Car Scheme Renewal
Dear Ms Palmer
Your company car is now due for replacement under the terms of National Grid's Car Policy.
Time taken for 20 order prompts to be processed from the initial sent through to the last is 3 minutes (180 secs). Note that from the point that the filter is invoked through to the emails spooling to be issued is included in the time shown here.
File size now to issue order prompts has dropped from the original 3.5MB to 2KB per prompt
imagination at work
Define
Measure
Analyse
Improve
Control
A B C 1 2 3 4 5 6 7 8 9 10 11 12
Slide 24
GE Commercial Finance
Fleet Services

Exhibit 8


Step 11. Determine Process Capability
Report 7: Product Performance
Report 8B: Product Benchmarks
Z.Shift
Zone of Average Technology
Zone of Typical Control
World-Class Performance
Z.Bench (Short-Term)
From a Start point where every prompt issued was higher than the USL, the Actual performance achieved outstrips the Goal set and represents a zero defect process
Start | Goal | Actual
DPMO | 1,000,000 | 200,000 | 0
Zbench | 1.5 | 2.342 | 6.000
imagination at work
Define Measure Analyse Improve Control
A B C 1 2 3 4 5 6 7 8 9 10 11 12
Slide 25
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Fleet Services