



Measuring ROI in Low Maturity

Q:PIT Ltd

Reducing the Cost of Quality
through
Process Improvement,
Information Management
and Teamwork



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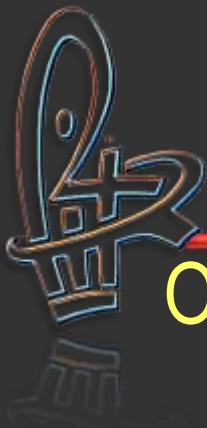
Process for Measurement

Putting into Practice



Causes for Failure

Why do so many fail in their improvement programme?



Five Reasons to Fail

Objectives

- Focus on the satisfying the model, not on the business

Budget

- Demonstrate return on investment within the year

Technical change

- Let the techies do this: it is their problem

We know what is needed

- Don't get the customer involved today, they will be happy that we improve

Do it quickly

- We can't afford to wait



Basics of Improvement

The Key Factors you Need to Implement First



Basics of Improvement: Business Focus

Focus on what you need to deliver to your market:

- Less defects, increased quality
- Reduced costs, better investment
- Quicker time to market
- Being Maturity Level X is rarely a business issue

Basics of Improvement: Culture

Process Improvement is not a technical activity:

- Focus on the cultural change that is needed
- Ensure that the cultural aspects are understood by management
- Generic goals are more important in the long-term than specific goals
- We need people to focus on quality and on improvement, not on compliance
- We need management to demonstrate what they want

Basics of Improvement: Leadership



Keep your eye on the horizon

- Lead by example
- Learn from mistakes
- Encourage the right attitude rather than the short-term result

Lead so that people can follow



Basics of Improvement: Quality Assurance

Assurance that people know what they are doing

Assurance that you know how they are doing

Assurance that they know why they are doing it

It is only by knowing what is really happening that we can learn and progress

Quality assurance needs to be seen as a proactive support, not just compliance audits and punishment



Basics of Improvement: Configuration Management

Configuration management gives us the foundations on which the rest can be built

- Every area, every process needs to ensure the integrity of the system
- This is more than just version control
- This does require investment in a tool

Basics of Improvement: Process Framework

Set up the framework for the future

- Consider what you are planning on doing
- Consider how you want to structure the processes
- Set up a process architecture
- Set up a process repository
- Set up a means for reporting processes and potential improvements
- Identify what and how you want to measure



Basics of Improvement: Measurement

If you don't know what you want to achieve, you will not achieve it

If you cannot measure your achievement, you will not achieve it

If you don't know how far you have come, you will not know if you have arrived

If you cannot demonstrate that you have improved, you will lose your support



Setting Up the Basics

Setting up all these things requires a significant investment

- How much should you invest?
- What will you get out of it?
- How to persuade management that this is an investment and not a cost?
- How to persuade the board / the shareholders that they are getting benefits out of this?
- How to ensure that this is improving quality of products and the life of the participants, not just creating more bureaucracy?



Principles of Measurement

What to measure, how to measure



Purpose of Measurement

Ensure that you are improving what needs to be improved

Demonstrate that the improvements are useful to the business

Demonstrate that progress is supporting the business

Demonstrate that this is an investment, not a cost



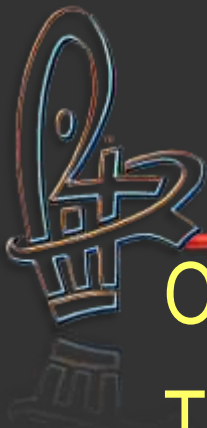
Principles Of Measurement ^{1/2}

Specifying the objectives of measurement and analysis such that they are aligned with identified information needs and objectives

Specifying the measures, data collection and storage mechanisms, analysis techniques, and reporting and feedback mechanisms

Implementing the collection, storage, analysis, and reporting of the data

Providing objective results that can be used in making informed decisions, and taking appropriate corrective actions



Principles Of Measurement ^{2/2}

Objective planning and estimating

Tracking actual performance against established plans and objectives

Identifying and resolving process-related issues

Providing a basis for incorporating measurement into additional processes in the future



What to Measure

There is not that much we can measure:

- Time
 - Elapsed
 - Effort
- Cost
- Quality (defects)
- Size



Progress and Baselines

Absence of measures is the key reason that organizations are ML1: if you knew the cost of quality, you would already have improved it

Absence of baselines is the key reason that ML1 organizations do not measure

We don't measure, because we have no measurements!

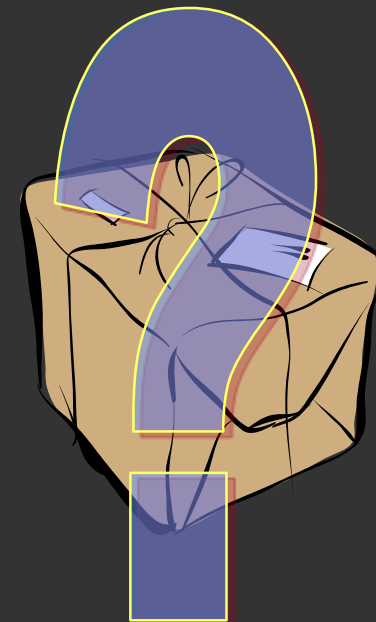
The time to establish the baselines is start measuring is now

But where to start?

Establishing Measures

Think outside the box:

- What do you need?
- What do you have?
- How long do you need to establish a baseline?





Quick Baselines

Think outside the box

- Establish a 1-week baseline

Could the productivity of the coming week be representative of your general productivity?



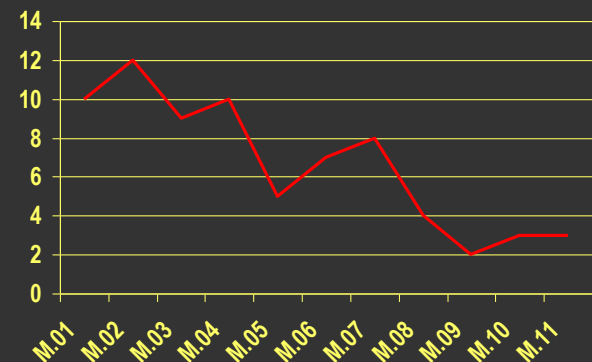
Measure the Trend



Start measuring the trend without a baseline:

- What is the change between two projects?
- What is the different with yesterday or last week?

You do not need to have a baseline in order to determine the difference between two or three points



Reverse Baseline

Measure your previous project to establish a baseline

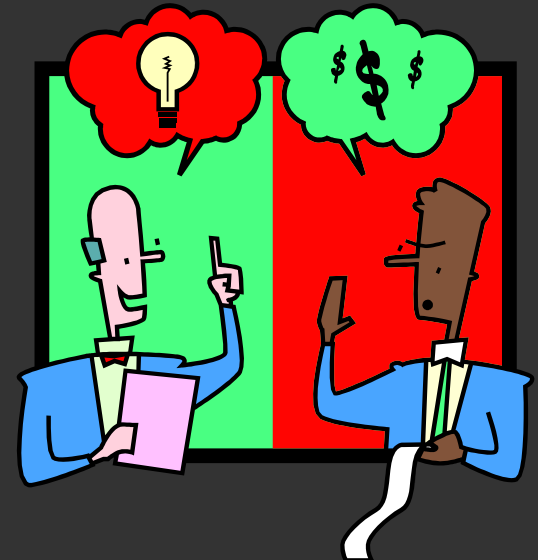
- What happened previously?
- What were the results?
- What went wrong?
- What needs to be changed?



Estimate the Opposite

Estimate the cost of not having done it:

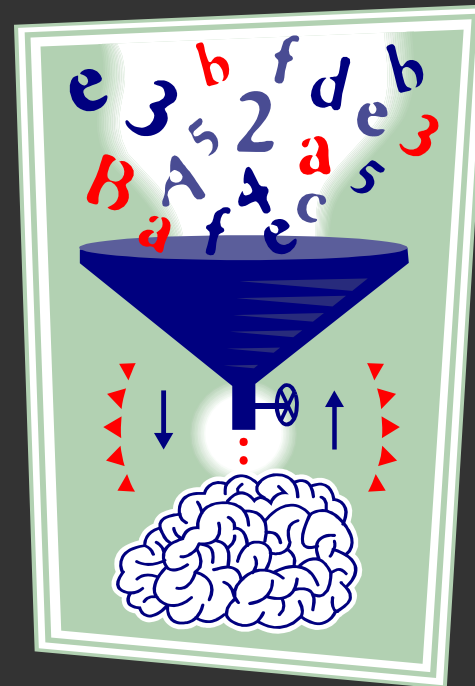
- What if you had not identified this risk?
- How long would it take if you had only identified this requirements defect in acceptance testing, not in the requirements review?
- What would have been the cost if QA had not identified this?



What Do You Have?

Consider what you already have

- Milestone slippages
- Defects reported
- Time in testing
- Budget
- Overtime





What is Required?

What do the models and theories require?



CMMI®

Align Measurement and Analysis Activities

- Establish Measurement Objectives
- Specify Measures
- Specify Data Collection and Storage Procedures
- Specify Analysis Procedures

Provide Measurement Results

- Collect Measurement Data
- Analyse Measurement Data
- Store Data and Results
- Communicate Results



FAA-ICMM

Goals

- Measures related to goals, objectives and major issues are established
- Measurement data are collected, analysed, and results are reported
- Measurement data and results are stored for use

Some general categories of measures:

- Schedule and progress
- Resources and cost
- Product size and stability
- Process performance
- Product/service quality
- Contractor performance
- Technology effectiveness



Trillium Measurement Map

Level 2

- Costs
- Product Measurement
- Project Measurement
- Process Measurement
- Process and Product Failures
- Customer Satisfaction

Level 3

- Measurement Planning
- Process Measurement
- Product Measurement
- Data Analysis
- Process and Product Failures
- Customer Satisfaction



Level 5

- Statistical Process Control

Level 4

- Process Measurement
- Quality Management





Trillium Level 2 Measurements ^{1/2}

Costs

- Project cost factors

Product Measurement

- Size, system resources, performance
- Additions, changes and deletions to requirements, design, code and test specifications
- Activities for managing requirements (e.g. status, change activity, cumulative number of changes)

Project Measurement

- Milestone completion, work completed, effort extended
- Effort and resources, change activity for the development plan



Trillium Level 2 Measurements ^{2/2}

Process Measurement

- Supplier costs and delivery date compared to plan
- Quality system costs and number of audits compared to plan
- Configuration management effort and funds, completion of milestones compared to plan

Process and Product Failures

- Failures and statistics throughout the life-cycle of the product



Establishing a Measurement Process

Making it happen



The 6-Sigma Approach: DMAIC

Define

- Understand what are the key processes

Measure

- Identify and collect measurements of success

Analyse

- See what are the issues

Improve

- Make useful improvements

Control

- Manage the process



DMAIC : Define

Charter

Customer needs and requirements

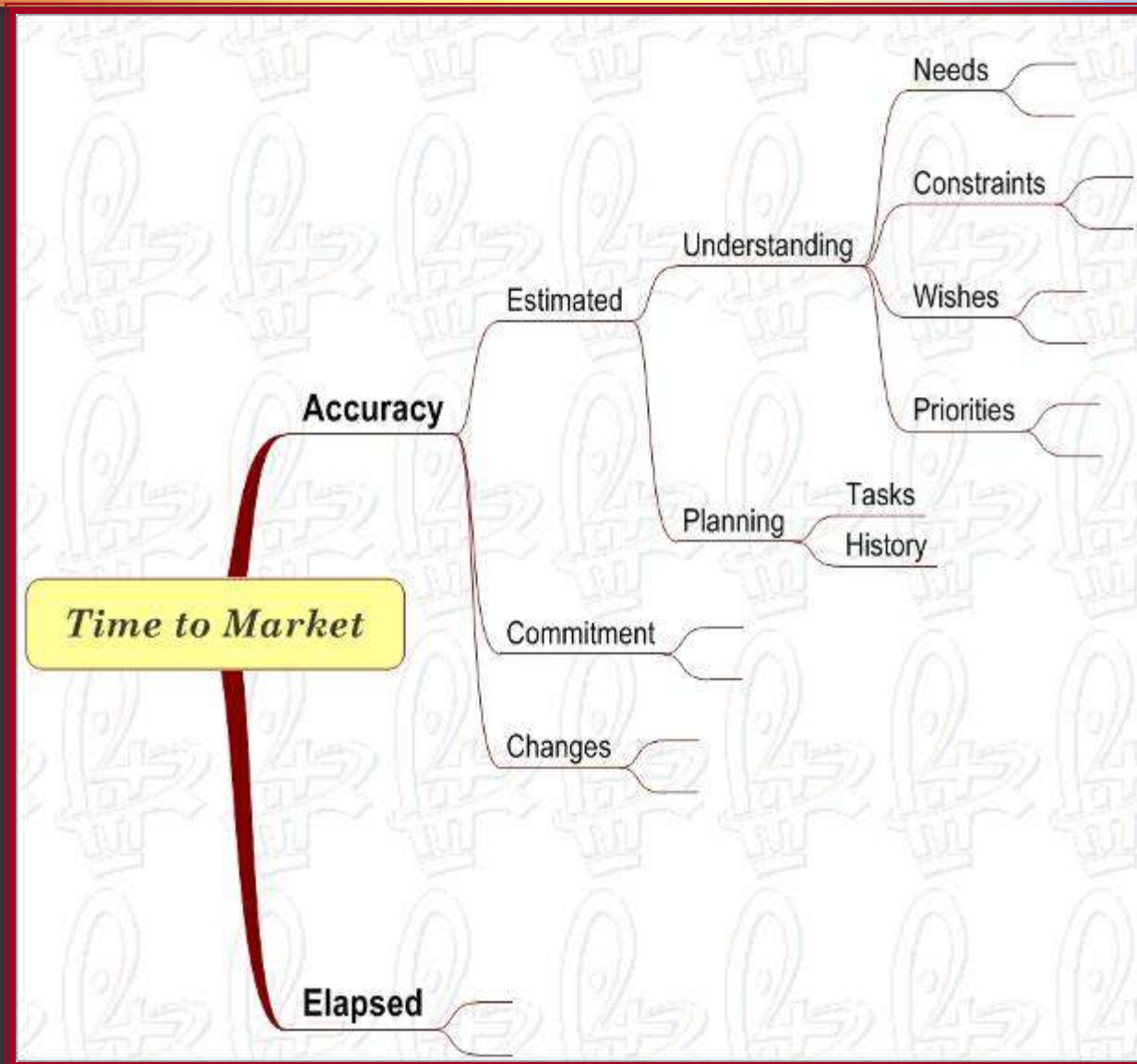
High-level process map

Agree on the high-level steps

DMAIC : Define Charter

Business case	Why do we want to change anything? What is the business reason for spending time on this?
Problem statement	A detailed description of what is the problem Possibly include a quantitative description of the expected benefits and targets
Project scope	What is the scope of this project, what is included, where are the limits?
Goals and objectives	Description of what we hope to achieve through this approach
Milestones	Dates and deliverables for each of the main phases
Roles and responsibilities	Who is taking responsibility for this problem? Who is the sponsor? Who are the process improvement team members?

DMAIC : Define Customer needs and requirements

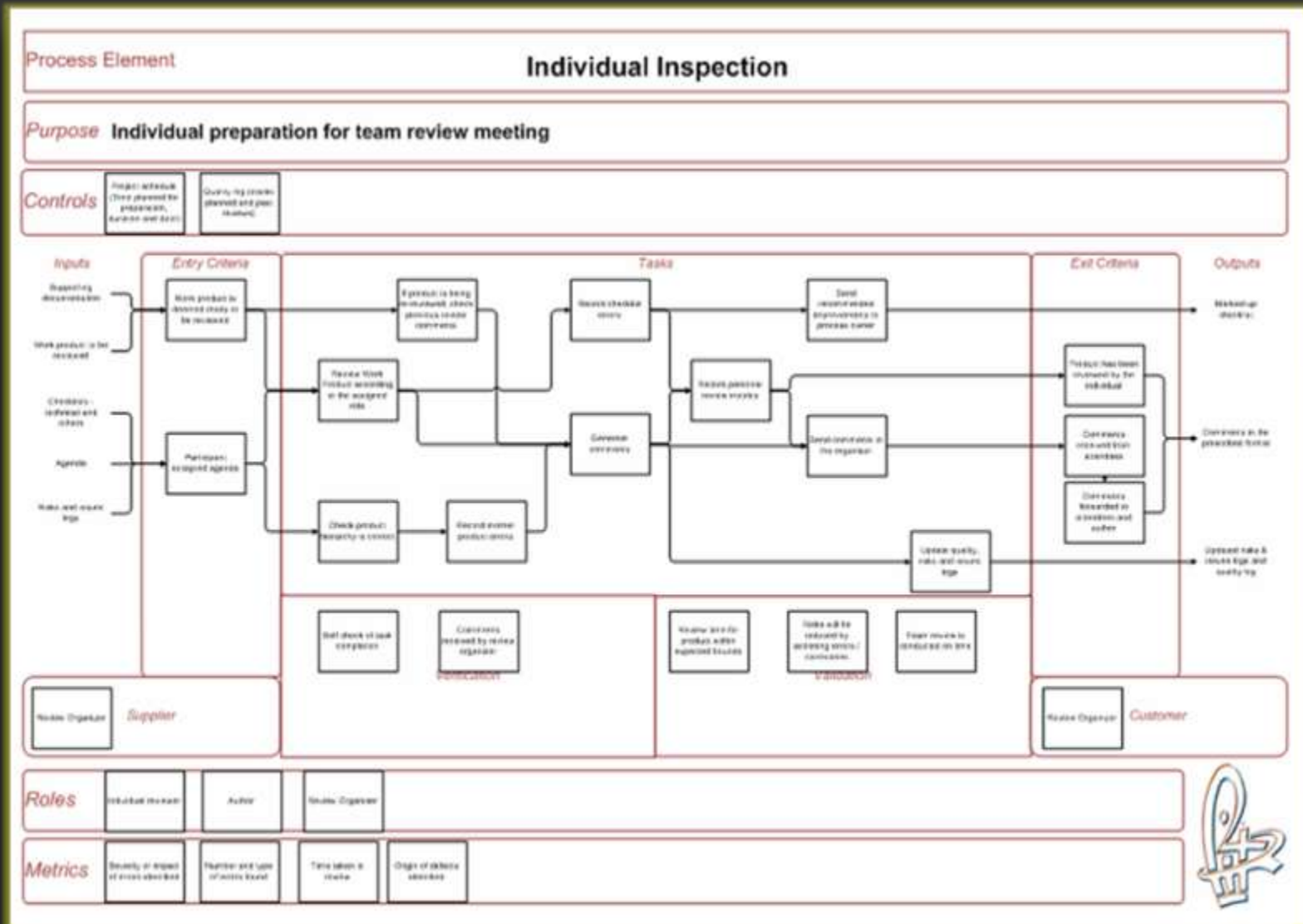




DMAIC : Define High-level process map ^{1/2}

- Name the process
- Establish the start and stop points of the process
- Determine the output(s) of the process
- Determine the customer(s) of the process
- Determine the supplier(s) of the process
- Determine the input(s) of the process

DMAIC : Define High-level process map 2/2





DMAIC : Measure

Define how you are going to measure:

- Create a data collection map
- Create data collection forms

Implement your data collection plan

Start making some statistics:

- Calculate baseline sigma
- Establish a basic control chart



DMAIC : Measure Data collection map creation

What to measure

Type of measure

Type of data

Operational definitions

Targets / specifications

Data collection forms

Sampling



DMAIC : Measure Data collection plan

Data collection forms

- Determine what a defect is
- Determine reason codes for defects
- Determine the time frame for data collection
- Determine a grid for data collection



DMAIC : Measure Calculating Baseline

Standard Sigma Baseline:

- $1000000 * (\text{number of defects} / (\text{number of units} * \text{number of opportunities}))$

The Sigma baseline is not a requirement but a possibility

- Once you have made a few measurements, establish a baseline
- This does not have to be based on a statistically representative sample, but it does need to be understood for what it is



DMAIC : Analyse

Data Analysis

- Discrete
- Continuous

Process analysis

- Sub-process mapping
- Nature of work

DMAIC : Analyse Data Analysis ^{1/2}

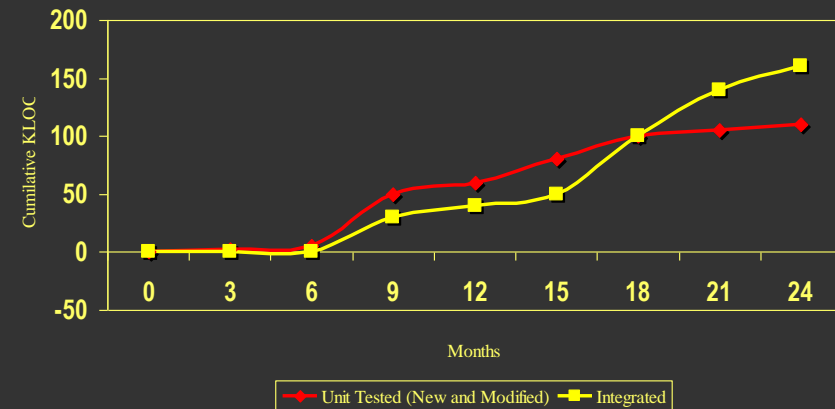
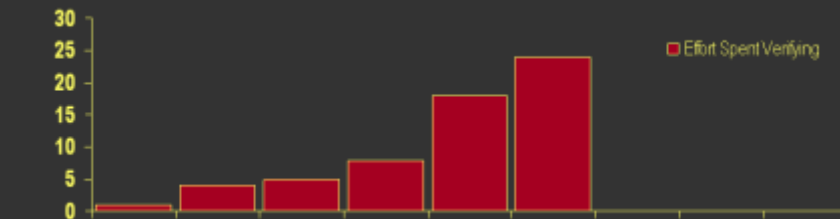
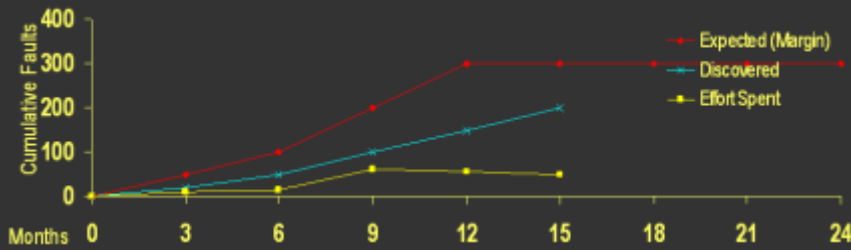
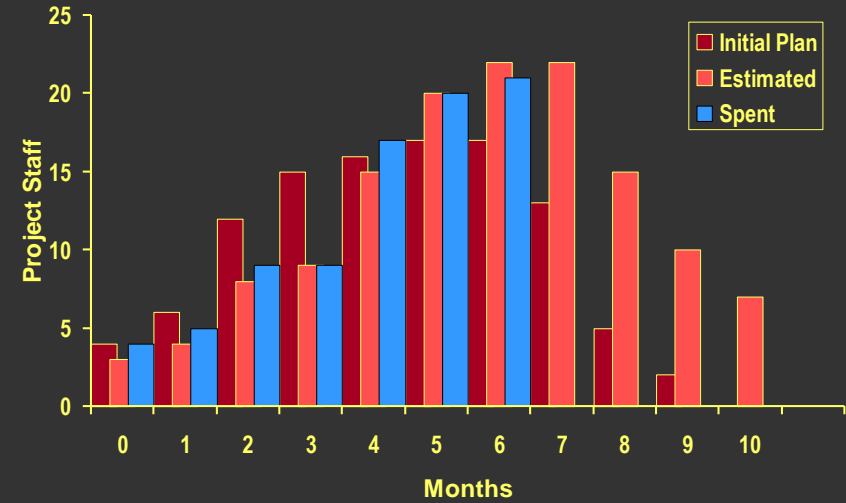
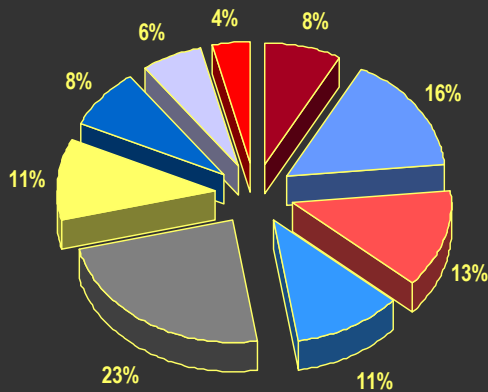
Discrete

- Pareto
- Pie chart

Continuous

- Frequency distribution check sheet
 - Machines in the process
 - Materials used in the process
 - Methods in the process
 - Nature or environment
 - The measurement itself
 - People
- Run chart

DMAIC : Analyse Data Analysis ^{2/2}



DMAIC : Analyse Process Analysis

Sub-process mapping

Nature of work

- Sub-process selection
 - Customer considers the sub-process important
 - There is a physical change
 - It is done right the first time
- Non-value-added activities
 - Internal failure
 - External failure
 - Delays
 - Controls and inspections
 - Preparation and set up
 - Moves
 - Value enabling
- Micro-problem statement



Putting into Practice

Giving it a try



Define Objective

Basic objectives for process improvement:

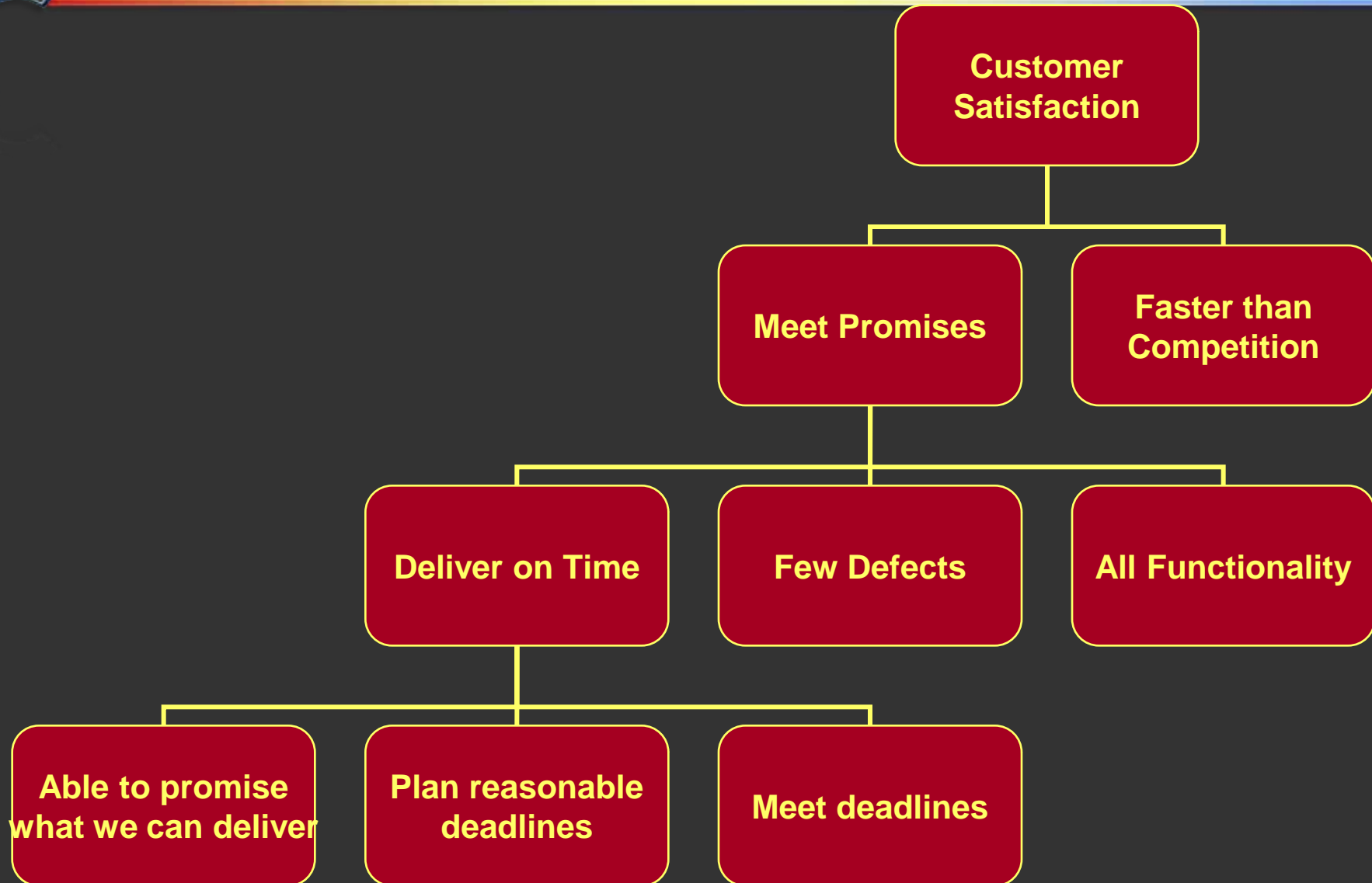
- Cycle time (efficiency)
- Cycle time slippage (repeatability)
- Effort to find and fix defects
- Effort slip rate (predictability)
- Customer reported defects (quality)
- Feature slip rate



Charter

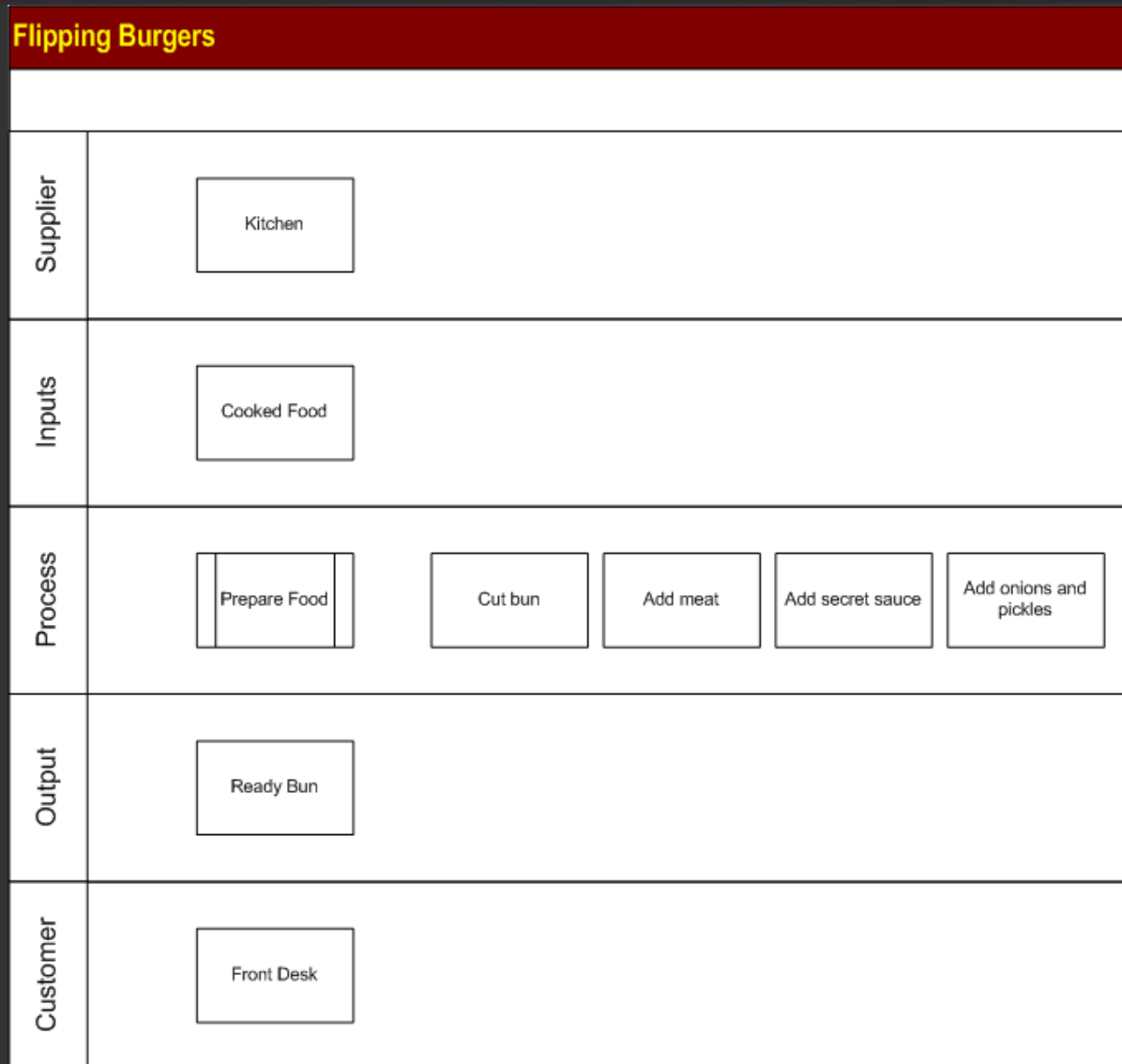
Business case	Improving the satisfaction of existing customers will directly impact repeat business
Problem statement	Customers are currently not satisfied because we regularly deliver late
Project scope	All projects within the local development centre
Goals and objectives	Identify how we can reduce the time to deliver
Milestones	Define: 1 week from now Measure: 3 weeks from now Analyse: 4 weeks from now Improve: 2 months from now Control: 6 months from now
Roles and responsibilities	Manager to provide data Measurement specialist to provide analysis

Define Customer Needs





Define High-Level Process Map





Define Data Collection Map

What to measure

- Cycle time

Type of measure

- Time

Type of data

- Minutes

Operational definitions

- Time between moment customer enters the restaurant and first bite into product
- Time taken to complain and respond is added to value

Targets / specifications

- Bring total time below 4 minutes

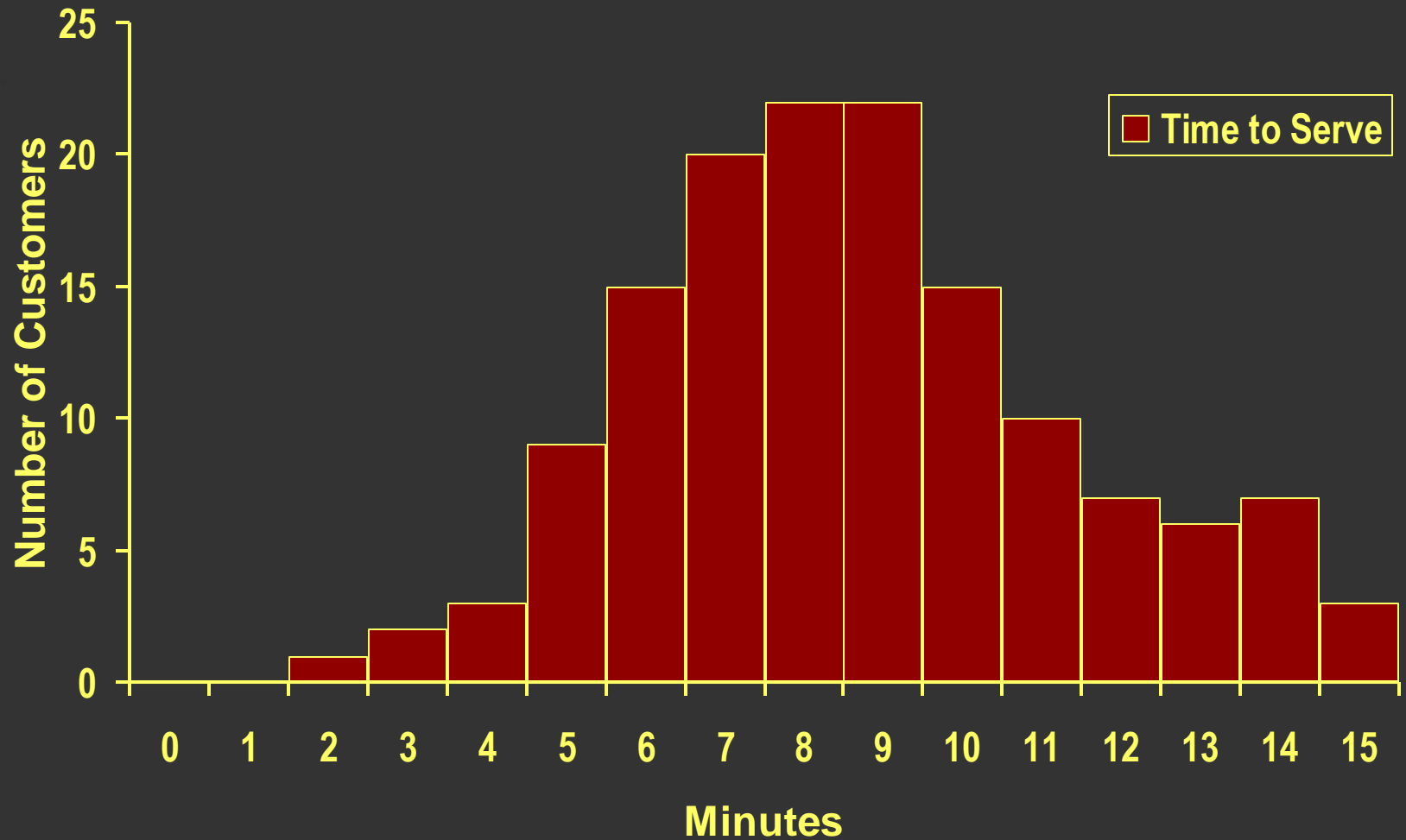
Data collection forms

- See attached

Sampling

- Measure the time for every 20th customer

Variation



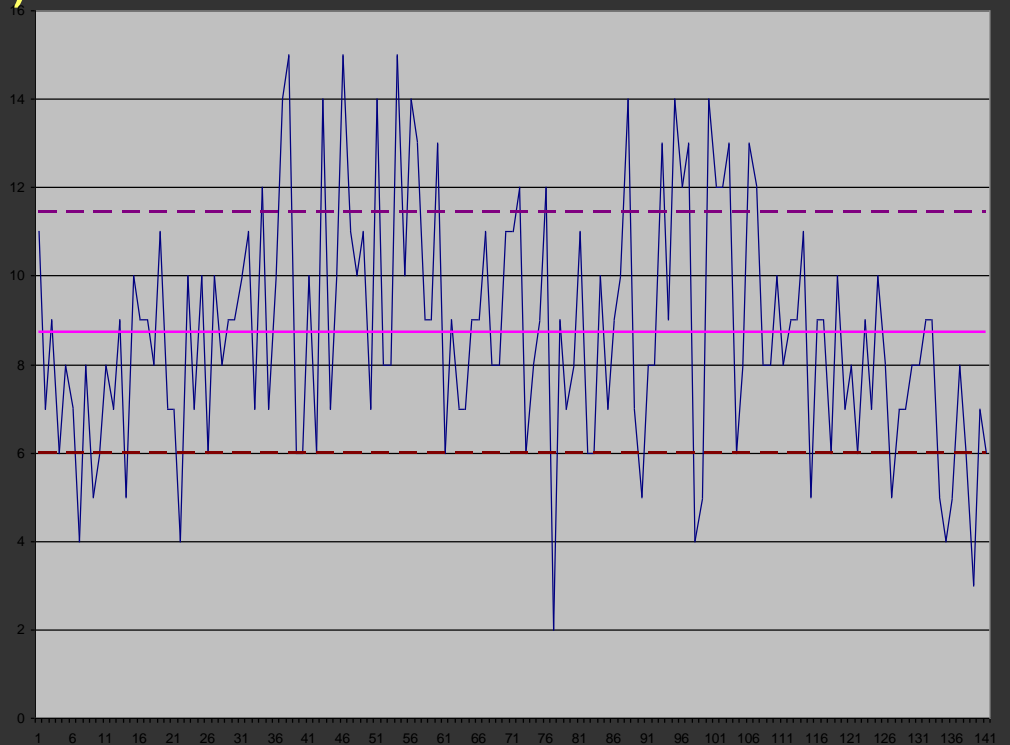


Trend

$$\text{Mean} = \Sigma x / N$$

$$\text{Std Deviation} = (\Sigma x^2 / N) - M^2$$

$$\text{Control Limit} = \pm(3 \text{ SD})$$





Identify Sub-Processes

Sub-Processes:

- Queuing
- Choosing
- Waiting for selection
 - Sandwich
 - Fries
 - Drink
 - Deserts
- Paying

Identify the detailed measurements



Now Do It

Define your improvements

Keep on measuring

Demonstrate that you are doing the right thing

Because, if you cannot measure it, you cannot improve it



Appendix

Some Measurement Tools



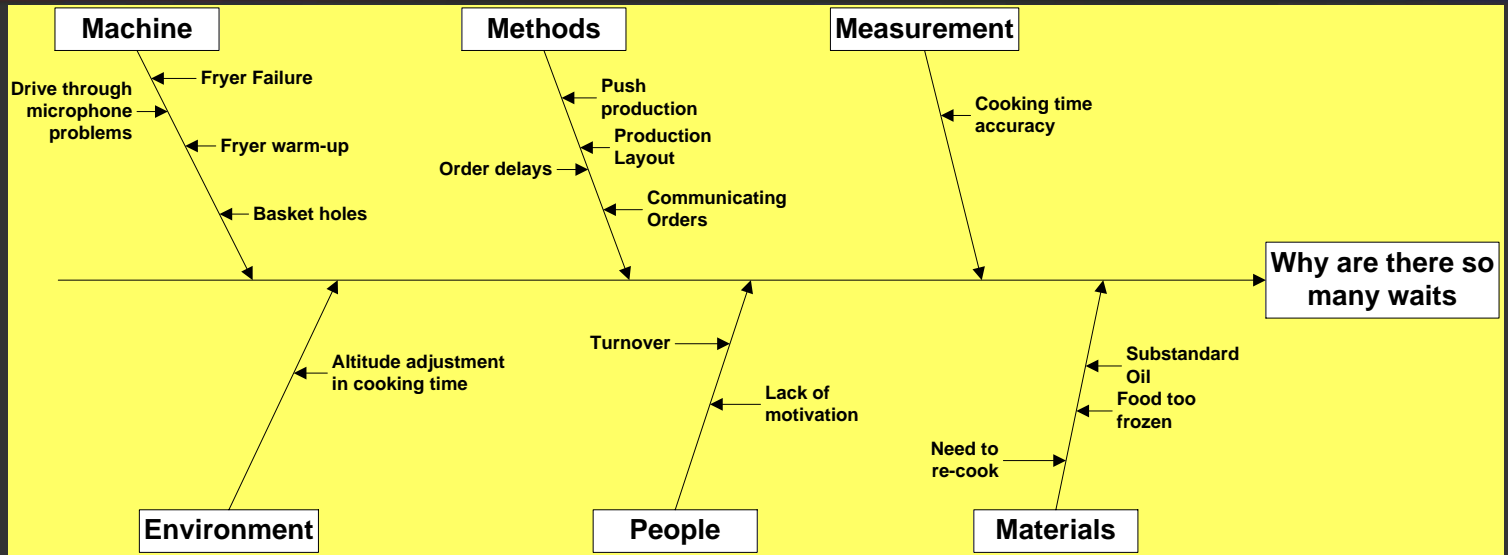
Measurement Chart

Define what you need to measure

Define what are the added-value elements

Step	Value Added	Non VA	Time
Request bid	X		24
Bids are reviewed		X wait	48
Finalists contacted	X		1
Re-negotiate bid		X error	24
Try alternative vendor		X prep.	48
Wait for final submission		X wait	48
Award contract	X		1
Contact vendor	X		1
Total			196

Cause and Effect Diagram



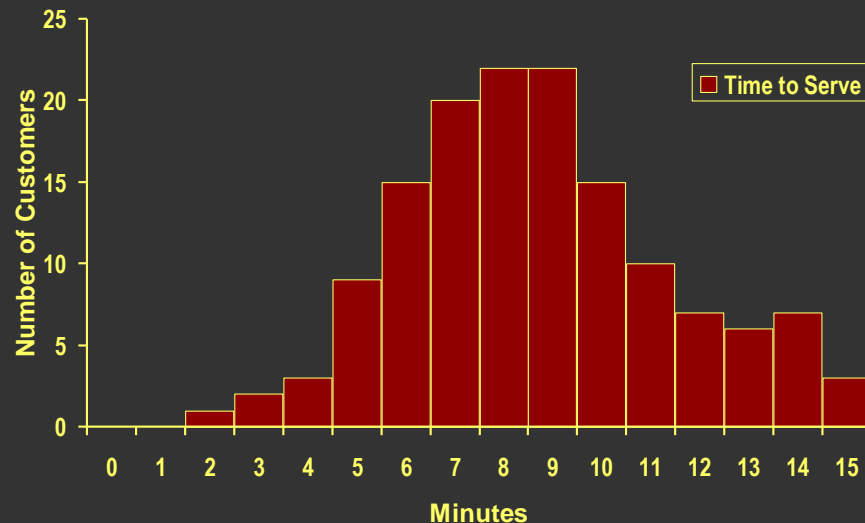
Identify the root causes of problems, classify them into general categories

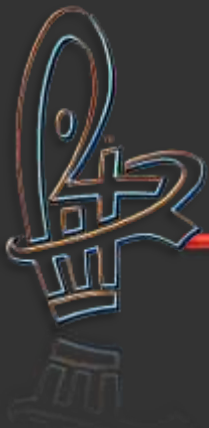
Suggested general categories are Machine, Methods, Measurement, Materials, People and Environment, but others are possible



Histogram

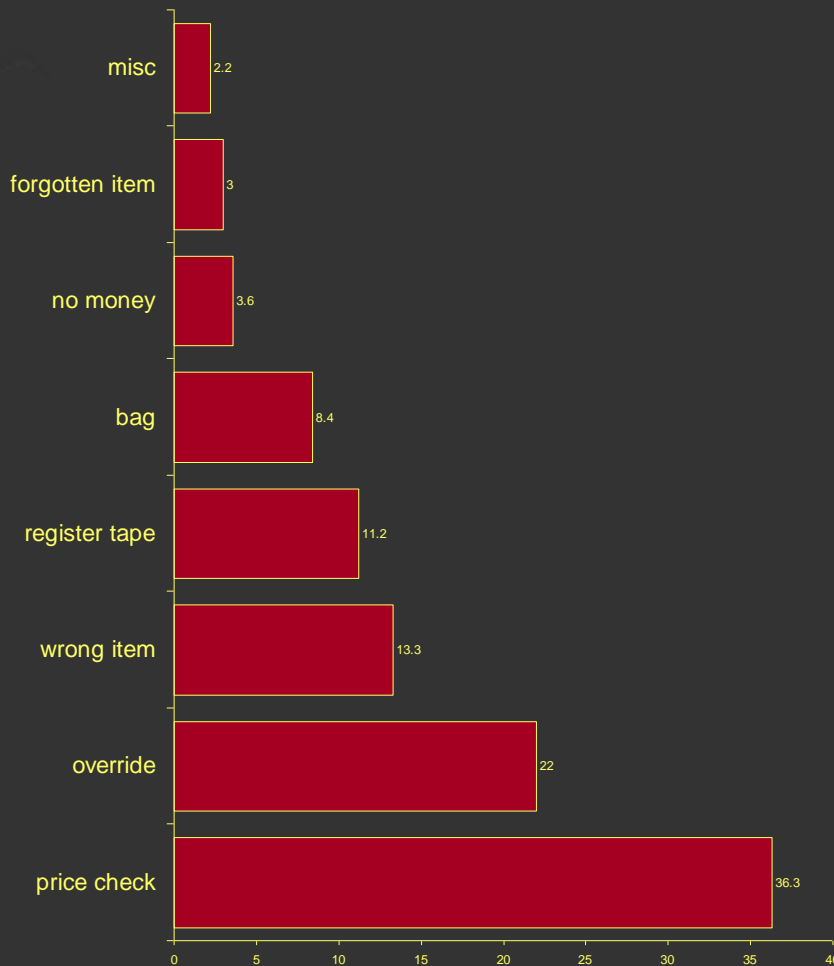
Classify sequential events, see the “bell-curve”, in which the most frequent case is bound by examples of lesser frequency tapering off in both directions





Pareto Chart

Group elements based on frequency of a problem occurring, allows to rapidly identify the biggest issue.





Some Additional Reading

Six-Sigma for Everyone

- George Eckes, 2003
- John Wiley and Sons, Editor
- ISBN 0-471-28156-5

Application of the Indicator Template for Measurement and Analysis

- Woflhart Goethert and Jeannine Siviyy, 2004
- Software Engineering Measurement and Analysis Initiative
- SEI Technical Note CMU/SEI-2004-TN-024

Metrics and Models in Software Quality Engineering

- Stephen H. Kan 2003
- Addison Wesley / Pearson Education
- ISBN 0-201-72915-6



Contact Information

Peter Leeson

- Q:PIT Ltd
1 Harby Close
Emerson Valley
Milton Keynes
MK4 2BB
United Kingdom
- Direct Line: +44 (0)20 8433 4120
- Tel / Fax: +44 (0)1 908 506 908
- Mobile/Cell: +44 (0)773 998 98 67
- E Mail: Peter@qpit.ltd.uk
- Internet: <http://www.qpit.ltd.uk>