Introducing the Tools for Continuous Improvement
The Concept

In today’s highly competitive business environment it has become a truism that only the fittest survive. Organisations invest in many different aspects of managing their business in order to remain competitive.

There is one single concept which can provide a competitive edge. A concept which will directly contribute to bottom line profit. And that is the concept of **Continuous Improvement**.

No matter whether you invest in business management systems or services they can always be improved. There is a saying that may well be true in your own organisation – “unless you can measure something then you won’t realise an improvement”

The Tools you will be exposed to in this presentation will provide you with an opportunity to measure almost anything. You will be learning how to use the **Tools for Continuous Improvement**. Each Tool is used for a particular purpose as you will see later. Make yourself familiar with the names of the Tools.
Principal Areas For Improvement

There are three key areas which contribute to the efficiency and effectiveness of an organisation. These involve

- the reduction of waste
- the way we do our job
- the way any process is undertaken.

To improve any one of these we need to:

- observe all our actions and the consequences
- record what we see in some detail
- analyse the results

FACILITATED GROUP OR REFLECTIVE EXERCISE

Discuss which areas in your organisation you feel would benefit from improvement.

Make a list of these for future reference.

What do you think you would need to measure?
INTRODUCTION
How would you go about helping to reduce waste? Or find ways to reduce the time taken to see a customer? Where do you start? How do you begin to break the task into manageable bite size pieces.

Whether you are providing a service manufactoring something, or simply trying to do a job better, there are a number of simple Tools that can help you understand and improve the way things are done.

This programme is an introduction to the Tools for Continuous Improvement. It will show in simple terms how each Tool is constructed, and outline when and why they are used.
Before exploring the specific Tools, let’s start by having a quick look at what’s involved in improving a process.

A process can be anything from a production line to serving a customer. To improve a process you need to have a clear picture of what’s actually happening not what you think is happening, or what’s happening in theory, but how the process is actually working.

You gather information about the process by talking to the people involved, watching, and recording. Then analyse the information, or, data to isolate the opportunity to improve the process.

For example, you might think that the greatest cause of waste in manufacturing buns is caused by product falling on the floor. However, after gathering and analysing information about the process, it turns out that there is much more wastage from buns being upside down.
Some of the Continuous Improvement Tools relate to how you look at the process, some at how you analyse and present the data. We’ll be looking at each Tool with examples of how they apply in two different work environments: a large bakery; and a hospital clinic.
The Tools

- Flow charts
- Cause and effect diagrams
- Check sheets
- Pareto charts
- Histograms
- Scatter diagrams
- Run charts
- Control charts
Areas for Improvement

- How do you reduce waste?
- How do you do a job better?
- How do you improve a process?

Watch ➔ Record ➔ Analyse
Things do not improve on their own! There is a mechanism for improvement. First you need to **Plan** carefully what you are going to do and the sequence in which you will do it. Next you **Do** it. Then you **Check** that what you intended to do is being done as you expected. Finally you **Act** on the results to improve your plan until you achieve what you set out to achieve.

The whole process is then repeated continuously; that’s what **Continuous Improvement** means.
ORGANISING THE STAFF

To ensure that there is commitment from everyone in your organisation to the process of Continuous Improvement they all need to be involved. Each person in the organisation has a role to play.

Senior Management are typically responsible for laying down the Policy on Continuous Improvement. They will certainly need to see that the process is resourced properly.

A Quality Improvement Team can be set up consisting of key managers and supervisors. Their role will be to agree and prioritise areas for improvement and decide on targets.

The Quality Action Teams, normally lead by one of the key managers, undertake the task of collecting and analysing the data, providing the solutions and implementing them.

FACILITATED GROUP OR REFLECTIVE EXERCISE

Decide who will be members of your teams. Don’t forget to take into account the areas you feel will benefit from improvement. Who are involved in these areas? These should be the people in the team to find the solution.

Draw up a list of the teams you will require.

Which manager will head up which team?
The People

The Team Structure

Executive: Policy

Quality Improvement Team

Quality Action Team

Quality Action Team

Quality Action Team

Quality Action Team
FLOW CHARTS
Flow Charts

WHAT is a Flow Chart used for?

- Used to describe a process
- To see the different activities or tasks involved in a process
- To provide a clear picture of what is happening
- Allows for standardised practices
Flow Charts

*WHEN* are Flow Charts used?

- Can be used for any process
- Enables problem areas to be identified
- Used to identify unnecessary loops of activities
Flow Charts

HOW is a Flow Chart constructed?

- The following symbols are used for different parts of the process:
  - Each process has a start and end
  - Each activity is identified
  - Decision points are identified
  - Other complex processes may be involved
  - All records are identified
Flow Charts

1. Make dough
2. Record temperature
3. Weigh ingredients
4. Receive ingredients
5. Record ingredients
6. Stop
7. Pass inspection
8. Crumb or discard dough pieces into tray
9. Record weight
10. Proofed & baked
11. Buns cooled
12. Buns sliced
13. Packed and stored
14. Record slice height
To begin with, let’s have a look at a Tool for helping you see what’s happening within a process.

A Flow chart is a graphic Tool that shows how a process works. It can be applied to any process from manufacturing buns to the steps involved in admitting patients.

The Flow Chart helps us to illustrate and understand the different activities that make up a process.

For example, if you want to make sure that patients are given proper care without unnecessary delay, you’ll need to follow every activity that effects the patient from reception, through to when they leave the clinic.
To see how a Flow Chart works, let’s look at the process of making buns.

It’s important that you are clear on what the process is meant to achieve in this case: packaged buns. You can then define the boundaries of the process you will Flow Chart. We’ll begin with weighing the ingredients, and end with the finished buns packed and ready for distribution.

Flow Charts use a number of symbols to show different parts of a process.

An oval is used to show where the process begins and ends.
So we commence drawing the Flow Chart with the ‘Start’ oval. An arrow is then used to indicate the direction of the flow.

Each specific activity performed in the process is represented by a rectangle.

In our example, the first activity in producing buns is the weighing of the ingredients, so the words ‘Weighing Ingredients’ are placed in the first activity rectangle.

When a set of activities is too complex to be shown on the same chart, a circle is used. The process of ordering, receiving and storing the ingredients can therefore be represented by a circle linked to the first rectangle by an arrow.
What happens next? After being weighed, the ingredients are mixed into a dough. An arrow connects the activities, and ‘Make Dough’ is placed in the next rectangle.

Whenever a document is produced in the process, a rectangle with a wavy line is used.

As each dough is made, a record is kept of the temperature. The document recording the temperature is therefore represented by placing a rectangle with a wavy line next to the ‘Make Dough’ rectangle.

The Flow Charting continues in this way to cover the various activities in the process.
Where a decision is made in the process, a diamond is used. It usually indicates a simple ‘yes’ or ‘no’.

In this process as buns ‘Pass Inspection’, they move on to be ‘Sliced’, then ‘Packed and Stored’.

However, if they fail inspection they are either crumbed or disposed of, depending upon demand.

Once all the parts of the process have been included, the ‘Stop’ oval indicates the end of the Flow Chart.

Flow Charts can be simple or complex, depending upon the process involved.
In the case of our hospital example, a Flow Chart of the steps involved in a patient’s visit would look like this.

The Flow Chart enables us to pinpoint areas and unnecessary loops or activities, and to find opportunities for improvement.

It also enables us to identify activities that have a major effect on performance. For example, you might find that a particular task is causing unnecessary delays in the process.

Finally through creating the Flow Chart, and getting input from the people involved, you are able to standardise the way things are done.
Flow Charts

Exercise

Draw a Flow Chart for the process you are involved in at work.

What records (or Forms) have you identified?

Where does the process fail identify the actual activity involved?
CAUSE AND EFFECT DIAGRAMS
WHAT is a Cause and Effect diagram used for?

- Used to identify all the Causes which contribute to a particular Effect
- Used to aid Brainstorming
Cause and Effect Diagram

WHEN are Cause and Effect diagrams used?

- Used to identify things which combine to give a Problem
  or
- Used to look at the various factors which contribute to produce a Desired Outcome
Cause and Effect Diagram

**HOW is a Cause and Effect diagram constructed?**

- The following steps are taken:
  - The Problem or Desired Outcome is placed at the head of a Fishbone skeleton
  - The main categories of Causes are identified
  - The categories are Brainstormed to identify specific contributory Causes
Cause and Effect Diagram

- Patient Enquiries
- Internal Enquiries
- Assisting Doctor
- Medical students
- Booking-in location
- Interruption of admissions
Tools like the Flow Chart can help describe a process. But how do you identify opportunities for improvement? What are the contributing factors? Which do you tackle first? And once a change has been made, how can you tell if it has in fact been an improvement?

Information from people is important, but it needs to be backed up by objective data - measuring things to get the facts about a process.

By comparing measurements made before and after a change, it's possible to gauge the effect of the change on the process.

There are a number of Tools that enable us to clearly present and analyse the data.
The Cause and Effect Diagram is a Tool that enables you to identify all the causes that contribute to a particular effect.

It's used to look at the different things that combine to cause a given problem, or the various factors that are necessary to produce a desired outcome.

Brainstorming can be a useful aid when using continuous improvement tools particularly when constructing a Cause and Effect Diagram. Working together, a group of people involved in a process are able to think more freely, building on each other's ideas to identify and explore all the possible causes behind the effect you are studying.

In our example, we'll be identifying the causes that upset the smooth flow of patients through the clinic - causes like the interruptions created by phone enquiries.
Because it’s reminiscent of a fish skeleton, the Cause and Effect Diagram is sometimes called a Fish Bone Diagram. You begin by placing the effect (the problem, or desired outcome) in a box at the ‘head’ of the diagram.

In our example, the effect we are analysing is interruptions to Admissions.

You next need to work out the main categories of causes that contribute to interrupting the flow.

In our examples, these would be Patient Phone Enquiries, Internal Enquiries, Assisting Doctors, Medical Students, and the Booking-In Location.
Having decided on the categories, further brainstorming will allow you to be more specific about the contributing causes. These are then included under the appropriate category.

For example, under Patient Phone Enquiries, delays are caused by advising other patients over the phone, and waiting for doctors to answer their pagers.

Under Internal Enquiries, there are general phone calls, ward enquiries, Registered Nurse enquiries, and so on.

You’ll have to use common sense to know when to stop adding causes to the chart. It’s usually when you’ve covered each category and the ideas start to slow down.
The bakery ‘Cause and Effect’ Diagram was helpful in working out the causes responsible for waste in the making of buns. In this case, the causes fell under the headings; people, methods, machines, materials and environment. These general headings are often used as they can help guide you to the contributing causes.

‘Cause and Effect’ Diagrams can be used whenever you need to trace a problem back to its root causes. They also allow you to work out the things that need to be looked at to achieve a desired result.
Cause and Effect Diagram

Exercise

Draw a Cause and Effect diagram for any Problem you have experienced at work.

Which is the most probable specific Cause of the Problem?

What is the solution to the Problem?
CHECK SHEETS
Check Sheets

WHAT is a Check Sheet used for?

Used to collect Data about an activity in a way that is easy to use and analyse
Check Sheets

**WHEN is a Check Sheet used?**

- Used to count the number of times something happens
- Used in many different ways to collect data
- Each type serves a different function
Check Sheets

HOW is a Check Sheet constructed?

- The following steps are taken:

- Identify the types of Fault or Occurrence

- Record each time a Fault or Occurrence is observed

<table>
<thead>
<tr>
<th>Fault</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upside down</td>
<td></td>
</tr>
<tr>
<td>Slip in tray</td>
<td></td>
</tr>
<tr>
<td>Squashed</td>
<td></td>
</tr>
<tr>
<td>Fell on floor</td>
<td></td>
</tr>
<tr>
<td>On side</td>
<td></td>
</tr>
</tbody>
</table>

[Table continued]
**Check Sheets**

*Incorrect Bun Positions*

<table>
<thead>
<tr>
<th>Fault</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upside down</td>
<td>#####</td>
</tr>
<tr>
<td>Stay in tray</td>
<td>####</td>
</tr>
<tr>
<td>Squashed crown</td>
<td>####</td>
</tr>
<tr>
<td>Fall on floor</td>
<td>####</td>
</tr>
<tr>
<td>On side</td>
<td>####</td>
</tr>
</tbody>
</table>
A check sheet is a simple Tool for collecting data about an activity in a way that is easy to use and to analyse.

There are many different types of check sheets. Each serves a different function, but they all basically involve making checkmarks on a sheet to count the number of times something happens - as it happens.

For example, a check sheet is used to keep a running tally of how many buns are incorrectly positioned on the production line.
Check Sheets

Exercise

Prepare a Check Sheet for something which you would like to collect data for in your work.

Identify the likely faults.

Which do you think will occur most?

Go and confirm your beliefs!
PARETO CHARTS
Pareto Charts

WHAT is a Pareto Chart used for?

Used to assess the relative importance of different causes of problems
Pareto Charts

WHEN is a Pareto Chart used?

- Used to identify the cause of a problem which occurs most often
- Used to rank causes from most occurrences to least occurrences
- Pareto contended that 80% of problems were the result of 20% of causes
The following steps are taken:

1. Choose the comparison unit.
2. Record the comparison unit on the vertical axis.
3. Place Causes on the horizontal axis, from most occurrences on the left, to least occurrences on the right.
Pareto Charts

Bun Waste

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number of Buns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upside down</td>
<td>200</td>
</tr>
<tr>
<td>On side</td>
<td>150</td>
</tr>
<tr>
<td>Too small</td>
<td>100</td>
</tr>
<tr>
<td>Squashed crown</td>
<td>50</td>
</tr>
<tr>
<td>Fall on floor</td>
<td>20</td>
</tr>
</tbody>
</table>
As we have seen with the Cause and Effect Diagram, there are usually a number of causes contributing to a particular effect. In our hospital example, there were patients phone enquiries, interruptions by staff, and so on.

So when it comes to improving the process, where do you start? Which of the different causes do you tackle first? A simple Tool for assessing the relative importance of a number of different causes is the Pareto Chart.

This Chart is designed to present the causes in order, from most important to least. Based on the 80/20 Rule (80% of the problem comes from 20% of the causes), the Pareto Chart will show that the problem usually stems from a few major causes.

Let’s return to the bakery and look at the different causes of waste on the production line. The first step in using this Tool is to choose a unit of comparison such as cost or frequency. How much does it cost? How often does it happen? In this example, the appropriate unit would be ‘Number of Buns’. Data about the process can then be presented in a simple bar chart.
With a Pareto Chart the units are placed on the left hand vertical axis. The different causes are then placed on the horizontal axis. From our data we find that the greatest cause of waste was Buns Being Upside Down - a total of 248. This cause is represented by the first bar on the Chart.

The next greatest cause of waste was Buns On Their Side – 120 then Buns Too Small, and so on.

In this way the relative importance of the different causes can be seen at a glance. It’s clear from looking at the Chart that, in keeping with the 80/20 Rule, the majority of the waste stems from just one or two causes.

Pareto can be used whenever you need to sort out which causes need to be addressed first to improve a process.
Pareto Charts

Exercise

Prepare a Pareto Chart for something which you would like to collect data for in your work.

Identify the most important cause.

Are 80% of the problems due to 20% of the causes?

Go and confirm your beliefs!
HISTOGRAMS
Histograms

*WHAT is a Histogram used for?*

- Used to look at data that can be arranged into groups
Histograms

WHEN is a Histogram used?

- Used to look at one particular set of results
- Allows us to see any patterns in a process
- Used to examine a large amount of data
The following steps are taken:

- Choose the measurement: bun weight
- Select an appropriate range: 0.1g
- Plot the measurement ranges on the horizontal axis
- Plot the number in each range on the vertical axis
Histograms

Bun Weight (g)

Number of Buns

(g)
The Histogram is a Tool for looking at data in groups, rather than representing all the individual scores. It looks at one set of measurements in the process like the weight of a dozen buns in groups such as 601 to 605 grams, 606 to 610 grams, and so on.

It is designed as a simple way of looking at data collected with Tools like a check sheet.

The Histogram is useful when dealing with a large amount of data, or when data has been collected in groups or classes. The units of measurement would be things like minutes, dollars, kilograms, and so on.

Let’s have a look at an example of the time it takes to record patient histories in the clinic.
On the horizontal axis of the Histogram, the different times taken can be presented in groups of five minutes.

The vertical axis is for frequency - the number of times the data falls into each particular group. In this case the unit would be 'Number of Patients'.

From our research we found that two patients had their histories taken within 6 to 10 minutes.

So in the 6 to 10 minute class we place a bar that indicates two patients. In the 11 to 15 minute class, there were five patients, and so on.

It is important to choose the groups or classes that will give you a meaningful result.
For example, if the groups were 6 to 25, and 26 to 45 minutes, it wouldn’t tell us much about how long it takes to record patient histories.

Histograms allow us to see patterns in large amounts of data. For example, this histogram show us that the bun weights centre around two different peaks. This might mean that the two bun making machines produce a slightly different result. The Histogram shows us that the ages of patients in this hospital are skewed towards the elderly.
Histograms

Exercise

Prepare a Histogram for something which you would like to collect data for in your work.

Do any patterns show up?

If there is a pattern, what is it telling us?

Go and confirm your beliefs!
SCATTER
DIAGRAMS
Scatter Diagrams

WHAT is a Scatter Diagram used for?

- Used to see if there is a relationship between two different things
Scatter Diagrams

**WHEN is a Scatter Diagram used?**

- Used to see if as one measurement changes the other one increases or decreases
- Used to see if there is no relationship between two measurements

![Scatter Diagrams](image)

No Relationship  Decreasing  Increasing
Scatter Diagrams

HOW is a Scatter Diagram constructed?

The following steps are taken:

- Choose the two measurements that you think are related: weight & height

- Plot one measure on the vertical axis

- Plot the other measure related to the first on the horizontal axis as a Data Pair
Scatter Diagrams

Weight of Buns vs Height of Buns
The Scatter Diagram is a way of seeing if there’s a relationship between two different things.

For example, is there a relationship between oven temperature and bun colour? Or patient waiting time and the number of nurses on duty?

Let’s see if there’s a connection between the weight of a bun and its height.

To construct a Scatter Diagram, we begin by placing one measurement on the vertical axis, and the other measurement on the horizontal axis. In our example, we’ll place Bun Weight on the vertical, and Height of Bun on the horizontal. Now we can start to fill in the data.
A bun 42 millimetres high weighed 54 grams, so we place a dot on the chart where 42 and 54 meet. A 47 millimetre bun weighed 58 grams, and so on.

As you’d expect, you can see by the pattern of the dots that the weight of the buns increases as the height increases. This is the sort of connection that a scatter diagram helps us to see.

However, in this next example, you can see that there’s no connection between the Oven Temperature and Bun Weight.

Scatter Diagrams can be used whenever you are trying to see if there’s a relationship between two different sets of variables.
Scatter Diagrams

Exercise

Prepare a Scatter Diagram for something which you would like to collect data for in your work.

Is there a relationship?

If there is, does one measure increase or decrease with respect to the other?

Go and confirm your beliefs!
RUN CHARTS
Run Charts

WHAT is a Run Chart used for?

Used to see how something varies with time or to record a sequence of events
Run Charts

WHEN is a Run Chart used?

- Used to record data in the order in which it was taken
- Used to observe trends and cycles
- Useful to compare performance after changing a process
Run Charts

HOW is a Run Chart constructed?

- The following steps are taken:

  - Plot time or sequence along the horizontal axis

  - Plot the corresponding measurement on the vertical axis
Run Charts

Bun Weight

Bun Weight

Time
When you want to see how something you are measuring varies over time, a Tool called a Run Chart can be used.

The Run Chart is a record of data plotted on a graph in the order in which it is taken. For example, it could be used to see how the number of patients waiting in the clinic varies throughout the day.

We’ll have a look at how bun weights vary during the course of production.

To produce the Run Chart, the thing being measured is placed on the vertical axis, with time or sequence on the horizontal axis. In our example, the weight per dozen buns is placed on the vertical, with the time the weight is recorded on the horizontal.
At 7 am the buns weighed 655 grams, so a dot is placed at the intersection of 7 o’clock and 655 grams. At 7:15, the weight was 660 grams, and so on. Once all the data is marked on the chart, the dots are then joined.

The Run Chart is used to see how something you are measuring varies over time. As well as recording time itself on the horizontal axis, we could also record a sequence of things eg Patient One, Patient Two, and so on - in the order in which they visit the clinic.

For example, this Run Chart records the Number of Interruptions to admitting each patient over the course of a day. We can see that Patient Six, Seven and Eight experienced more interruptions than the others.

With Run Charts it is possible to see trends and cycles in data at a glance. They are also helpful in comparing how a performance measure varies after implementing a change to the process.
Run Charts

Exercise

Prepare a Run Chart for something which you would like to collect data for in your work.

Identify the trend.

Do you think the trend will continue?

Go and confirm your beliefs!
CONTROL CHARTS
Control Charts

**WHAT is a Control Chart used for?**

Used to identify acceptable variation of a measure
WHEN is a Control Chart used?

- Used to help determine if there is a problem with a process
- Measures outside the limits show there is a problem with a process
Control Charts

**HOW is a Control Chart constructed?**

- The following steps are taken:

  - Draw a line to represent the upper limit above which measurements will not be acceptable

  ![Upper Limit Diagram]

  - Draw a line to represent the lower limit below which measurements will not be acceptable

  ![Lower Limit Diagram]
Control Charts

Bun Weight

![Diagram of control chart with time on the x-axis and bun weight on the y-axis. The chart includes upper limit, target, and lower limit lines.]
Within any process there will be a degree of acceptable variation in products and service.

For example, the height to which buns rise will vary. But what heights are unacceptable? To help determine when there is a problem, we use a Control Chart.

This is our Run Chart of how bun weights vary during the day. To create a Control Chart, we simply draw two lines that allow us to see if the process is performing as it should. These lines are called Upper and Lower Control Limits, and their positions are worked out using complex calculations. However, we'll leave the calculations to the experts, and concentrate on how to use and interpret the Control Chart.

The bun weights vary from 662 to 668 grams, which falls comfortably within the Control Limits of 650 and 670 grams.

However, if any measurements fall above or below the lines on the Control Chart, it is a clear indication that there is a problem. And that problem will have a ‘Special Cause’ - a cause which falls outside of acceptable variations.
Control Charts

Exercise

Prepare a Control Chart for something which you would like to collect data for in your work.

How do you decide on the Limits?

What kinds of things would cause the measurements to go outside the Limits?

Go and confirm your beliefs!
CHOOSING
THE RIGHT TOOL
Choosing the Correct Tool

*HOW do we choose the Correct Tool?*

- What do we want to measure?
- What do we want to achieve?
- What form does the data take?
- What do we want to do with the results?
Choosing the Correct Tool

WHICH Tool do we use?

- Flow Charts
- Cause and Effect Diagrams
- Check Sheets
- Pareto Charts
- Histograms
- Scatter Diagrams
- Run Charts
- Control Charts
There are various ways of processing and presenting the different Tools. The data can be worked on manually, and the Tools drawn by hand.

Or you can use a computer to help with your presentation.

This presentation has provided a basic introduction to the Tools for Continuous Improvement.