

Six Sigma aims to maximise customer satisfaction and minimise defects.

### WHAT IS SIX SIGMA?

In statistical terms, the purpose of Six Sigma is to reduce process variation so that virtually all the products or services provided meet or exceed customer expectations. This is defined as being only 3.4 defects per million occurrences.

Six Sigma was developed by Motorola in the 1980s but has its roots in Statistical Process Control (SPC), which first appeared in 1920s.

### HOW DOES SIX SIGMA WORK?

There are three basic elements to Six Sigma:

- Process improvement
- Process design/re-design
- Process management

Each of the above three elements is examined in more detail below.

#### Process improvement

The purpose of process improvement is to eliminate the root causes of performance deficiencies in processes that already exist in the organisation. These performance deficiencies may be causing real problems for the organisation, or may be preventing it from working as efficiently and effectively as it could.

To eliminate these deficiencies a five-step approach is used. DEFINE – a serious problem is identified and a project team is formed and given the responsibility and resources for solving the problem.

MEASURE – data that describes accurately how the process is working currently is gathered and analysed in order to produce some preliminary ideas about what might be causing the problem.

ANALYSE – based upon these preliminary ideas, theories are generated as to what might be causing the problem and, by testing these theories, root causes are identified.

IMPROVE – root causes are removed by means of designing and implementing changes to the offending process.

CONTROL – new controls are designed and implemented to prevent the original problem from returning and to hold the gains made by the improvement.

More details of these five steps are given later in this document.

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### Process design/re-design

Sometimes simply improving existing processes is not enough, and, therefore, new processes will need to be designed, or existing processes will need to be re-designed. There are several reasons why this could be necessary:

- An organisation may choose to replace, rather than repair, one or more of its core processes.
- An organisation discovers, during an improvement project, that simply improving an existing process will never deliver the level of quality its customers are demanding.
- An organisation identifies an opportunity to offer an entirely new product or service.

As with process improvement, a five-step approach is used to design/re-design a process:

**DEFINE** – identify the goals for the new process, taking into account the customer requirements.

**MATCH** – develop a set of performance requirements for the new process that match these goals.

**ANALYSE** – carry out an analysis of these performance requirements for the new process, and based upon this produce an outline design for the new process.

**DESIGN & IMPLEMENT** – work this outline design up into a detailed design for the new process, and then implement it.

**VERIFY** – make sure the new process performs as required and introduce controls to ensure it keeps performing that way.

### Process management

Because it requires a fundamental change in the way an organisation is structured and managed, process management is often the most challenging and time-consuming part of Six Sigma.

In general, process management consists of:

- Defining processes, key customer requirements, and process “owners”.
- Measuring performance against customer requirements and key performance indicators.
- Analysing data to enhance measures and refine the process management mechanisms.
- Controlling process performance by monitoring process inputs, process operation, and process outputs, and responding quickly to problems and process variations.



### PROCESS IMPROVEMENT IN DETAIL

Since process improvement is the most frequently used aspect of Six Sigma, this section looks at part one – Process Improvement – in more detail.

#### Step 1 – Define

Having identified the improvement project to be carried out, the project needs to be established by carrying out the following activities:

- **PREPARE A PROBLEM STATEMENT** - this statement must describe the problem in specific terms that identify: what is wrong; what is the visible evidence of the problem – the symptoms; how serious is the problem, expressed in quantifiable and measurable terms; how large is the problem – can it be addressed by a single, manageable size improvement project or will it need to be sub-divided into several smaller, manageable projects.
- **PREPARE A MISSION STATEMENT** - this statement must describe what is going to be done about the problem, ie, the objective of the improvement project. The mission statement should contain the same variable and unit of measure as does the problem statement.
- **SELECT A PROJECT TEAM** - the project team selected should be a cross-functional team that spans all functions upon which the improvement project will have an impact, both direct and indirect.

#### Step 2 – Measure

During this Measure step, symptoms of the problem that exists are identified and a baseline measurement of current and recent performance is established. Also, a map of how the process that is producing the problem operates is developed.

However, the real purpose of this step is to analyse the symptoms and then to confirm, or modify, the mission statement based upon the results of this analysis. In Six Sigma a symptom is defined as the outward, observable evidence of a problem. It is an output of the process that is producing the problem.

If a symptom like this occurs on an ongoing basis, it signals a chronic, underlying quality problem that needs to be addressed. To address such a problem, first of all, the symptom needs to be analysed in the following manner:



- Develop operational definitions
- Measure the symptom
- Define the boundaries – that is, the scope of the improvement project
- Concentrate on the vital few – those sources of error thought to be largely responsible for the problem. It is time consuming to attempt to tackle all possible sources, and the result may not justify the effort.

Once the above analysis of the symptoms has been completed, the mission statement should be revisited to confirm that it is still applicable, or to modify it to make it applicable. The results of the analysis may reveal that the problem is somewhat different from the one that was originally described; or that the improvement project is too large and needs to be broken down into more manageable parts.

### Step 3 – Analyse

During this Analyse step, theories about the causes of the problem are formulated, these theories are tested, and, finally the root causes of the problem are identified.

- FORMULATING THE THEORIES – the project team brainstorms possible theories, documents them, and then organises them in the form of a cause-and-effect diagram.
- TESTING THE THEORIES – before any theory can be accepted as true, it must be systematically tested. Any data required to test a particular theory, that is not available, must first be collected. If the data collected demonstrates that a particular theory is clearly not important, then that theory can be eliminated.
- IDENTIFYING THE ROOT CAUSE(S) – once testing has been completed, the root cause(s) of the problem should be able to be determined.

Once found, the removal of the real root cause(s) will sharply reduce or eliminate the problem/deficiency.

### Step 4 – Improve

During this Improve step, several sequential activities are performed and these are described below.

- EVALUATION OF ALTERNATIVES – alternative improvement methods are evaluated to determine which method will best remove, or reduce the effect of, the root cause(s) of the



problem. This evaluation is carried out using a set of evaluation criteria such as cost, impact, cost/benefit ratio, cultural impact etc

- DESIGN OF THE IMPROVEMENT – an improvement method has been selected, the improvement process is designed by confirm that the improvement achieves the project goals; determining the required resources; specify the procedures and the other changes required; assessing human resource requirements to determine whether any training/re-training is required.
- PLAN FOR “CULTURAL RESISTANCE” – by their very nature, improvement efforts create change in an organisation and “cultural resistance” is a natural consequence of change. Therefore, dealing with this potential cultural resistance needs to be factored into the improvement project plan.
- PROVE EFFECTIVENESS – before an improvement is finally adopted, it must be proven effective under operating conditions. This could be done with a pilot test; a dry run, which doesn't involve delivery to the customer; an acceptance test; a simulation
- IMPLEMENT – this involves introducing the proposed change to the people that will make it work. This demands: a clear plan; a description of the change; an explanation indicating why the change is necessary; involvement of those affected; the change.

The most important parts of implementation, though, are good planning, good preparation, and good cooperation between all of the individuals concerned.

### Step 5 – Control

During this Control step, controls are put in place to ensure that the gains that have been achieved will continue and the problem will not recur. To do this the following activities need to be carried out.

- Design effective quality controls
- Foolproof the improvement
- Audit the controls.

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