Application of Tools in Six Sigma

(Stephen Halliday; wdp consulting)

Training within Six Sigma provides a comprehensive set of tools to help an individual or team achieve significant advances in process improvement. Although most of the tools are not new, they have been brought together to provide a well-stocked toolbox.

However, like the toolbox in your garage, the tools are to be used in particular situations and if the tools are used for the wrong application then the required objective may not be achieved successfully, even though we have probably all been guilty of using a screwdriver as a chisel or lever.

It is the intention of this article to look at the main tools and their appropriate use. It is not the intention to explain each tool in detail but rather focus on their application.

Tool Set

The set of tools taught within Six Sigma may vary from course to course but there are a number of common tools.

Some people advocate that all the tools should be used during a Six Sigma project, whilst others advocate a pick and mix approach. It is interesting that it was reported that Allied Signal during the first two years of Six Sigma found that 80% of their projects only used ‘basic’ tools. This would align itself with Ishikawa’s view that the ‘simple’ methods would suffice for 90 – 95% of process improvements.

What is clear is that the further the processes have been developed the more complex the tools become. The leap from 5 Sigma to 6 Sigma requires an enormous effort and further tools from the Black Belt set often taught in Design for Six Sigma. However, if a process has not been developed then the ‘simple’ tools will be sufficient.

Define

The key requirement of this step is to ensure that the project is clearly defined and understood, identifying the specific objectives and expected outcomes. A **Project Charter** ensures that the project is thought through before committing people and resources. One difficultly, sometimes encountered, is the release of people to be part of the team. This should be resolved by the Champion, but some companies have found it useful to create a **Team Charter** which is signed

off by departmental managers and details when the team will meet and how much time an individual will be expected to be release from their day-to-day job.

At this stage, an understanding of the customer requirements (Voice of the Customer) and a **Critical to Quality (CTQ)** tree or matrix is vital in helping the team understand the requirements of the output of the process and translate these into measures that can be monitored to ensure that the customer needs are achieved. The CTQs must represent the customers' view but they can be too easily based on the team's opinion, thus leading to a focus on the wrong things. For example a group of hotel managers thought that the key requirements for room service were Speed, Quality and Cost and so ensured that simple low cost meals were supplied. However, the customers who used room service said that their key requirements were Speed, Quality and Variety. Cost came very low on their list. Why, because room service was put on their company's bill. If cost was an issue, the customer ate in the restaurant or went out to eat.

Six Sigma is about improving processes so it is essential that a **Process Map** of the intended area be created. For some teams creating this map can be a revelation as to why there had been little consistency in the past. Some significant improvements can be achieved by agreeing what the best flow of the process should be an implementing it. One company recognised the inconsistency in a major process and estimated that by creating one agreed method of running the process would save them tens of thousands of pounds.

For the project leader, whether a Black Belt or Green Belt the use of project tools such as **Milestone Planning** and / or **Gantt Charts** can help in the planning and delivery of the project.

Measure

The emphasis within Six Sigma has brought people beck to the need for fact-based decisions.

In this stage it is important that the tools used to measure the process are up to the job. For this reason a **Gauge Repeatability and Reproducibility study** (Gauge R&R) is required. This works very well for variable measurements but has difficulty when considering subjective measurements. In one company the method of assessing a semi-finished product revealed that not only did inspectors disagree with each other but also they didn't agree with themselves when repeatedly shown the same material.

One issue that has come up with Gauge R&R is a failure to use parts that represent the true variability of the process. It is very easy to take ten consecutive parts from a process but these will have little variability and give the result that the measurement system is poor. Once parts representing the

process variation are used then the measurement system is often seen to be acceptable.

If data is to collected then a **Data Collection Plan** will ensure everyone knows what is to be collected, by whom and when.

It can be that during the collection of the data that reasons for variation might be spotted or additional useful measurements might be identified.

Analyse

You have the data, so the next step is to find out what it is telling you.

The first important question is whether you are dealing with **Common Cause** or **Special Cause** variation. This is one issue that is not dealt with very well by many Six Sigma courses. The tools for each are different, but many courses although teaching about the two causes of variation do not teach how to deal with them. For Special cause some teach the **Five Whys** and **Cause & Effect diagram**. These may well lead to the root cause very quickly but in some cases the answer to 'Why?' Is 'Don't know' and the tools of **Special Cause Problem Solving** are required. These tools use **Problem Profiling**, **Differences and Changes** and **Test Matrix** as taught by **Kepner Tregoe**, **Ford's G8D** and wdp consul ting's **R.I.S.E.** (www.wdpc.co.uk)

Statistical Process Control (SPC) can be used to identify whether the process is exhibiting Special Cause or Common Cause variation. Special Cause variation, if present, must be removed before dealing with Common Cause variation.

For common cause variation then the 'simple' tools such as **Pareto chart**, **Histogram**, **Check Sheet**, **Scatter diagram** and **Cause & Effect diagram** along with SPC can be very powerful in guiding towards an understanding of the process. As already mentioned it is these tools that are particularly powerful in the early stages of process improvement.

Some teaching focuses on **Hypothesis Testing** at this point. In most early improvements the change should be so dramatic that it does not require a statistical test to demonstrate improvement. If an SPC chart has been used then this will certainly show an improvement. It does raise the question as to whether the time spent in some Six Sigma training on Hypothesis Testing and **Statistical Tests** is time well spent.

Another set of tools increasingly becoming part of the Six Sigma toolbox are those used in Lean manufacturing. In particular, understanding **Value-added** and **Non-Value-Added** steps of a process. It is sometimes very uncomfortable for many people to learn that most of what they do during the working day is

Non-Value-Adding, especially for those in non-manufacturing processes. This leads to a recognition and removal of the **Eight Deadly Wastes**. (Transportation, Inventory, Motion, Waiting, Over-production, Over-processing, Correction and Not Utilising Human resources).

Improve

Perhaps the most difficult part of the Six Sigma process is this stage. There are few tools that can point out the obvious way forward and it relies on the knowledge and creativity of the team.

5S Housekeeping can help clear clutter and make it easier to see what is happening in the process and ensure a consistent approach with minimum waste.

Poke Yoke (Mistake proofing) is one method to ensure human error is avoided in the future. This methodology is best used by seeing what others have done and learning from their creativity.

Design of Experiments is a powerful tool to identify which factors have a key influence on the process and how best to optimise them. These techniques can be taken further by using **Parameter Design (Taguchi)** to make the process robust to Noise i.e. factors that affect variation that are difficult, impossible or expensive to control. (e.g. external temperature).

Failure Mode and Effects Analysis (F.M.E.A.) or **Risk Analysis** is useful to identify potential risks and this may lead to further improvement.

Control

This is probably the most important part of the DMAIC process. If the improvements, which should have been Verified during the Improve stage, are not control then all the work becomes in vain. In addition this is the opportunity to transfer the knowledge to similar areas and so the benefits flow wider than simply the original project.

At this stage SPC can be used once more to ensure that the process is stable and continuing to deliver the improvement. To help maintain the improvement then implementing **Standardised Work** and **Control Plans** will ensure a consistent approach to the process.

It may be at this stage it is recognised that further improvements are required to meet the customer needs and a new project may be started.

Summary

The Tool Set taught in Six Sigma is an important part of equipping a Black or Green Belt to set about process improvement.

Knowing the tools is only one part of the Six Sigma process. Committed leaders and Champions who are actively creating the environment for Six Sigma to be successful must support the tools. In addition, it is vital that the projects are run through effective teamwork. Six Sigma projects can easily die due to poor teamwork or lack of support from leadership.

Good teamwork, supportive management and a few tools will achieve more than poor teamwork, distracted management and a full toolbox.

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