

The majority of the today's business people as well as many other professionals belonging to a wide variety of different disciplines, have never heard of the so called Lean Six Sigma topic.

Some of you for sure will perfectly know what it is about, what it can imply, and how it can impact not only our businesses, and organizations but also our everyday lives.

Generally speaking, a majority of you might have a slight awareness about it, but what you will not probably be aware of, it what important role LS σ plays in your regular and normal daily activities. All of us have flown with any of the regular airlines, at a regular speed of 580 mph ~ 933 km/h and at altitude of 38.000 feet ~ 11.582 km next to the aircraft window, reading a book, working on our laptop or just sleeping.

Have you ever thought of what kind of quality tests this window close to you as well as all parts of the aircraft have gone through in order to guarantee safety for human life?

Lean Six Sigma and its pool of different tools make this possible.

As you can see, the range of different areas that Lean Six Sigma as a work philosophy can cover is really huge and proven.

On a general basis the Lean Six Sigma-Standard improvement approach:

- drives improvement projects based on business need
 - designs/redesigns processes, products, services, and experience
 - fixes customer and efficiency issues
 - enables rapid spread of proven solutions
- provides a strategic organization-wide approach to planning and managing improvement
 - Lean Six Sigma is used to drive faster, and better improvements.

A few key points about Lean Sigma are:

<i>Focuses on quality, waste reduction, and improved speed</i>	<i>Develops increased improvement capability within your organization</i>
<i>It is built on proven methods and tools</i>	<i>Results in lower costs and improved Customer loyalty and value</i>

What is "Industry" Lean Six Sigma?

Lean Six Sigma can be described using the following views:

- A statistic's tool for assessing capability
- A methodology for improving the organization
- A management philosophy

A statistic's tool for assessing capability

Lean Six Sigma is a statistic measurement that helps us assess what a process is capable of producing, compared to the specifications from a customer (internal or external). The specification limits provided by customers can and do change.

At a Six Sigma level (6 σ), a process is producing **3.4 defects per million opportunities** for that defect to occur (this is 99.9997% defect-free). As an example, if a company defines a defective

pager at customer receipt as the opportunity for a defect, then the company can predict that 3.4 pagers will fail in every group of one million pagers shipped to customers. This enables a significant opportunity to reduce or eliminate testing and inspection for that company.

A visual depiction of the Sigma definition

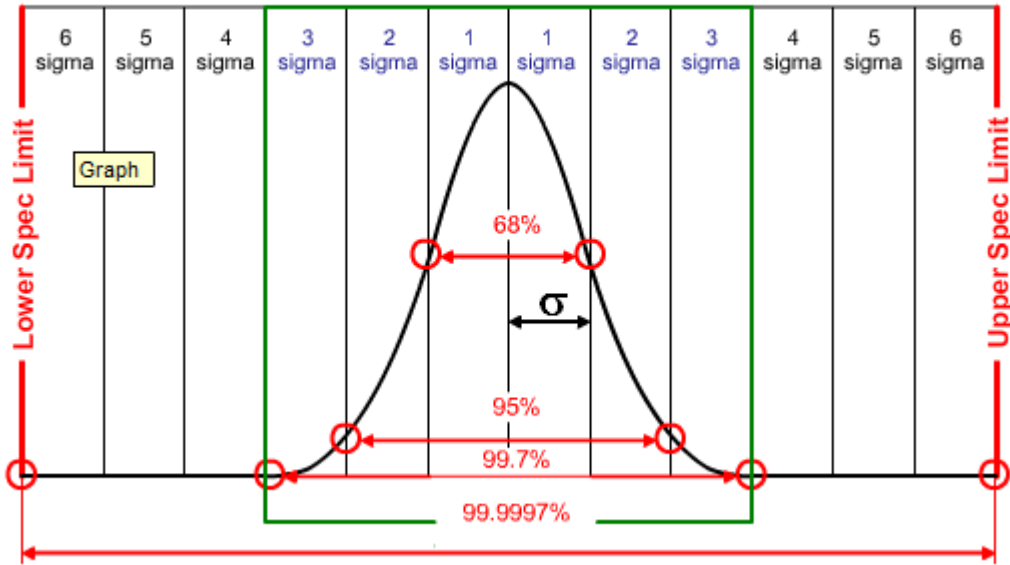


Figure 1

A methodology for improving your organization

Six Sigma is considered an approach or method for organizational improvement that uses:

- data and statistics to systematically reduce defects and variation.
- a structured project roadmap called *Design, Measure, Analyze, Improve, and Control (DMAIC)*¹, into which the project work is organized. If your customer wants you to use a roadmap, you will find that DMAIC can easily fit with the model for improvement

A management philosophy

Six Sigma is also a management philosophy that focuses on business excellence and customer satisfaction. Its aim is to reduce process variation, defects and cost.

As you will have probably already noticed, it is that L6σ is composed of 2 parts –

¹ DMAIC is one of the several commonly used Six Sigma roadmaps to improve an existing process.

Lean

6σ

What is **Lean**?

Lean is a way of thinking and a set of principles, methods, and tools that create **process velocity**² (by reducing cycle time) and **process efficiency**³ (by ensuring minimal cost). In other words, the goal of **Lean** is to accelerate the velocity of a process by focusing on reducing:

- waste (also known as “muda” is anything that adds no value to the customer)
- cycle time (or accelerating flow)
- non-value-add activities

What is **Six Sigma**?

Six Sigma is also a set of principles, methods, and tools that improve the output of a process by identifying and removing the causes of defects and minimizing variability in the processes leading to the output.

Lean	Six Sigma
Emphasis on eliminating waste and improving flow	Emphasis on reducing defects and variation
Focus: <ul style="list-style-type: none"> • Minimize waste and non-value-add • Improve speed 	Focus: <ul style="list-style-type: none"> • Meeting customer’s requirements • Delivering predictable, consistent outcomes
Analysis technique used to study Lean <ul style="list-style-type: none"> • Value Stream Map (VSM) 	Analysis technique used to study 6σ <ul style="list-style-type: none"> • Run & Control Charts • Histograms • Pareto charts

Many companies and consultants have brought Lean and Six Sigma together and named them Lean Six Sigma or Lean Sigma. The methods and tools complement each other and facilitate the improvement of quality, speed, and customer satisfaction in addition to simultaneous cost reduction. By bringing Lean and Six Sigma together, organizations get the advantage of:

- having an eye for both:
 - customer and quality problems
 - waste, non-value add work, and speed
- building the capability to use methodology and tools in an integrated, flexible fashion
- focusing on both effectiveness and efficiency and thus amplifying the improvement effects

At a deeper stage, we can also find **Design for Six Sigma**

Design for Six Sigma (**DFSS**) is the design or creation of a process by incorporating the efficiencies of Six Sigma methodology into the process **before** implementation. DFSS is applied at the stage when a process is designed or when a product or service is created, as opposed to

² Process velocity: Defined as the speed, flow, or volume of a process

³ Process efficiency = $\frac{\text{Value add time}}{\text{Total cycle time}}$ Where Value add time is defined as the time spent in doing work that adds value for the Customer.

attempts to improve an existing process. Design for Six Sigma incorporates a number of tools, most typically **FMEA** (failure mode and effects analysis), **VOC** (voice of the customer), and **QFD** (quality function deployment)..

The premise for such an approach is that applying DFSS will result in products and services that provide greater customer satisfaction and business results.

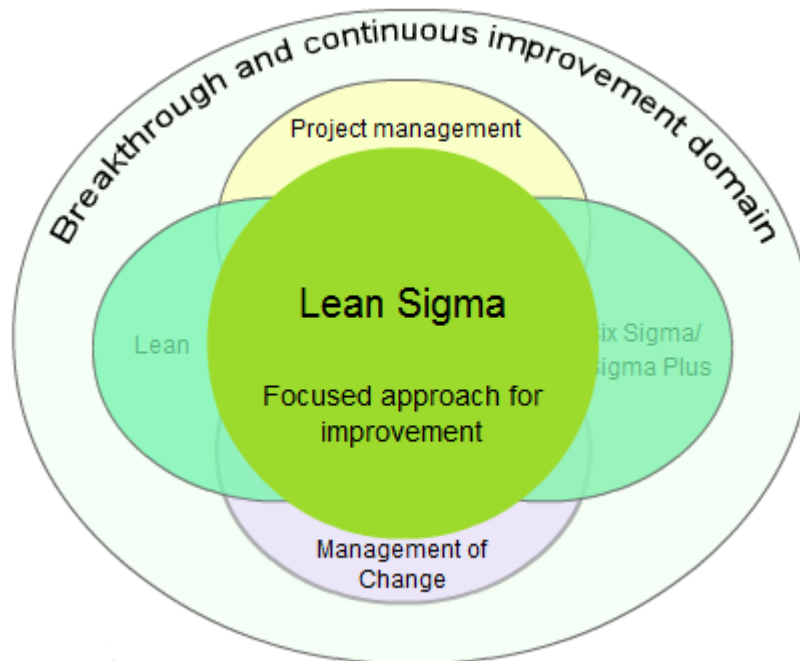


Figure 2

Should you think of changing the mindset of your company or organization, start by considering the following:

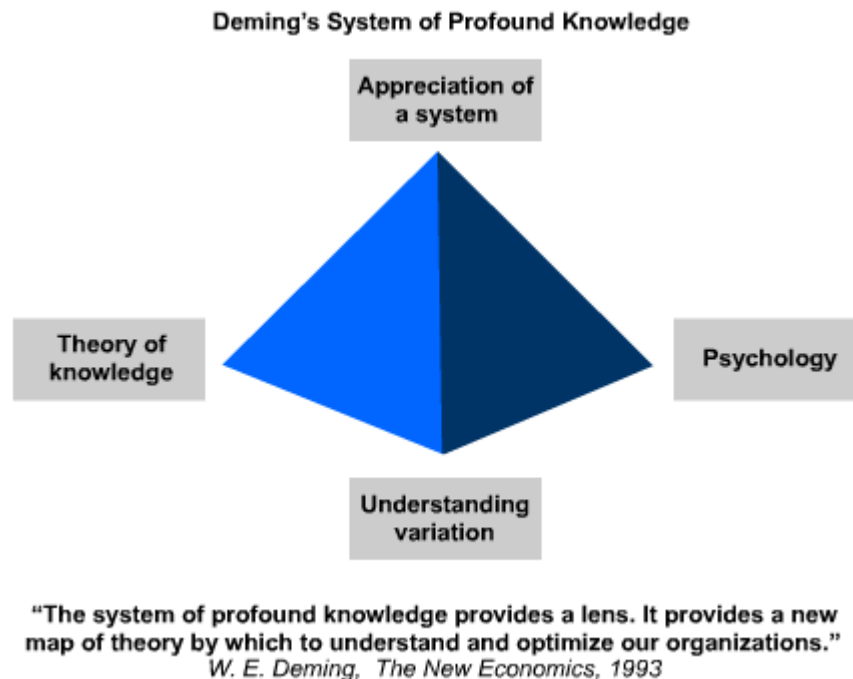


Figure 3

The four streams of theory provide a lens to view how the world operates as well as a rich foundation that supports the methods and tools for improvement.

Appreciation of a System

The management's role is to strive towards optimization of the system (their Organization) as a whole. Every organization has different groups, functions, and departments. When driving improvement, do not maximize one of the parts of the organization to the detriment of the overall system. The performance of a system depends more on how its parts interact than how its parts act independently.

Psychology

Successful leaders understand that people react differently when facing change. Knowledge of individual and group psychology is needed to nurture and preserve the innate desires of people to learn, create, contribute and therefore take pride in their work. Attention to management of change is very important.

Understanding variation

Variation is always present. The key is not in measuring it, but understanding what is causing variation. Are the causes common to the system or are they specific to a certain employee or task?. Understanding this will guide our improvement strategy.

Theory of knowledge

The management’s job is also to predict. Prediction is based on knowledge. Knowledge is built on theory and experience, and hence, knowledge without theory teaches less or nothing. So, the practical steps for increasing knowledge are the “PDSA” cycles – Plan/Do/Study/Act cycles.

Model for improvement

Let’s think for a moment, of the proposed Model for improvement

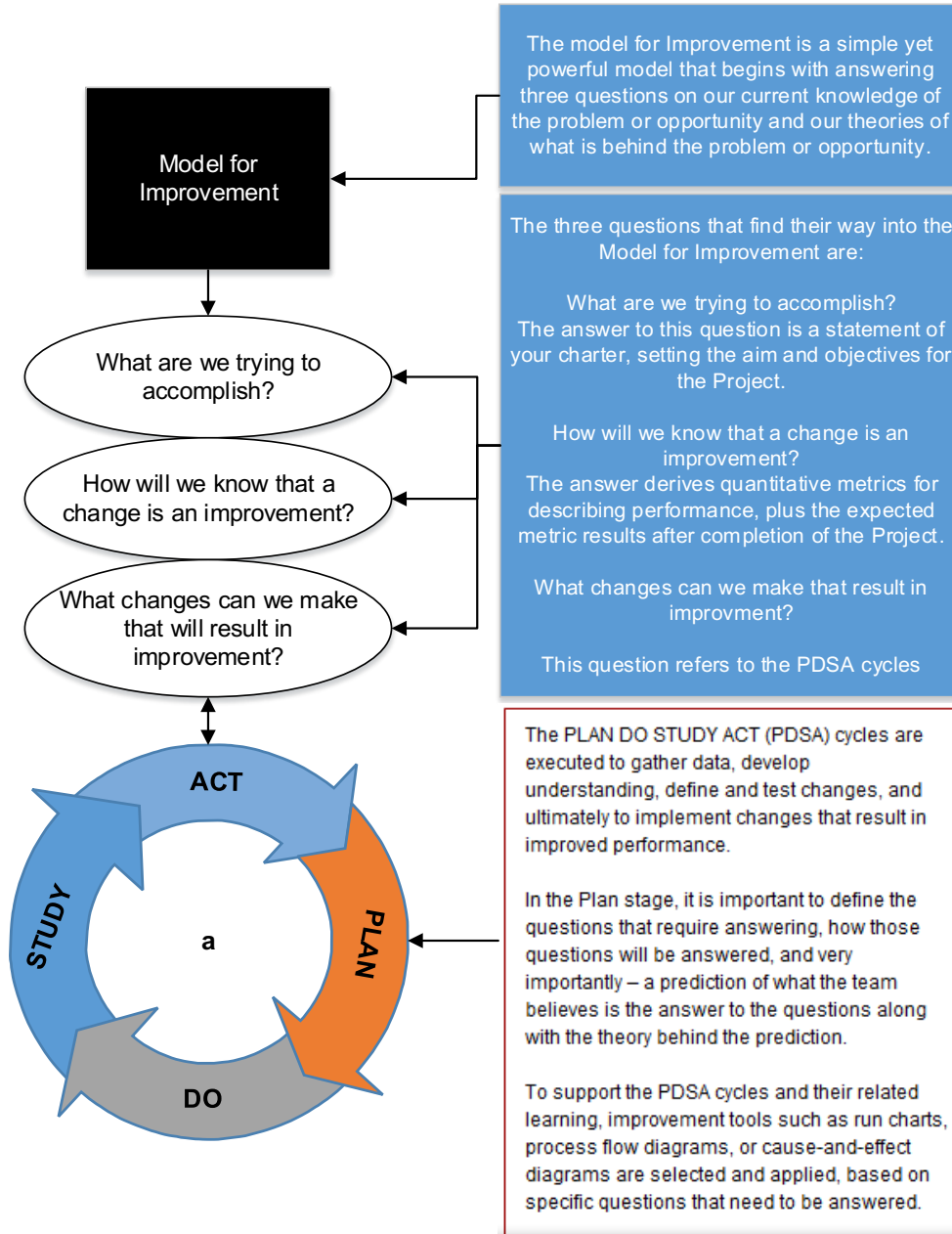


Figure 4

Definitions of Green and Black Belts

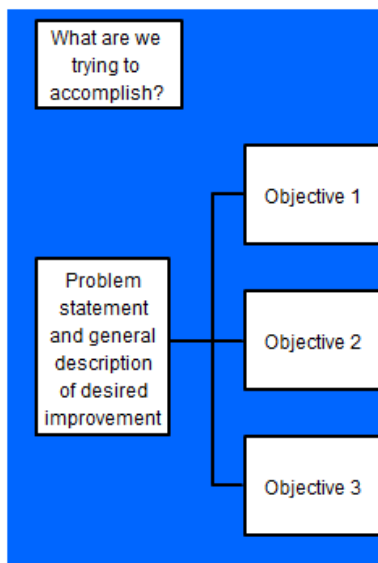
Green Belts and Black Belts are individuals who lead and/or facilitate improvement projects. Green Belts facilitate moderately complex improvement projects. Black Belts facilitate very complex improvement projects.

An improvement project is a project where the solution is not known. You will know what your goals are, but you don't know what needs to be done to achieve the project goals most effectively. The Lean Six Sigma methodology and tools will lead you to an effective solution.

Building a Project with the Model

Before drafting the improvement plan and starting the project, many teams find it helpful to draw out a tree diagram to frame thinking about the project by helping us determine what needs to be improved, the desired outcome, the measurements, and the initial PDSA cycles. The tree diagram helps us build the required project knowledge by means of the three questions displayed in the diagram. The tree is sometimes referred to as AMI (Accelerated Model for Improvement).

The first question is captured by defining the overall aim of the project and identifying the process, product, service, or system to be improved. Next, the objectives are linked to the overall aim and begin to break down how the project will be approached.



Determine what needs to be improved:
Q1 – What are we trying to accomplish?

The question begins to scope the project by defining the following:

- problem or opportunity to be addressed
- overall aim of the project, identifying the process, product, service or system to be improved.
- importance of the project and how it links to the organization's priorities or the strategic plan, objectives, business, and customer impact

Figure 5

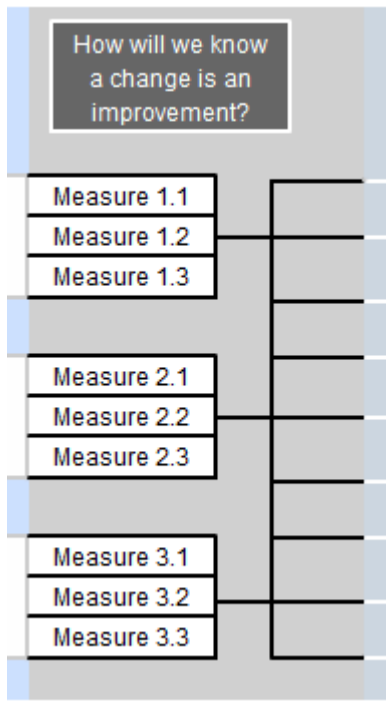


Figure 6

Determine the desired outcome

Q2 - How will we know that a change is an improvement?

The answer to this question is determined by linking the measures with objectives and by performing the following steps:

Define the appropriate project measurements, such as success factors and counter balancing measurements.

Collecting data to determine the baselines. This allows us to evaluate any differences of the result, after a change is implemented. Collecting existing data may also identify any casual factors associated with the process. Our recommended changes may target some of these factors. Note that collecting baseline data may require PDSA cycle.

Setting project goals on the basis of actual performance, benchmarks, and customer or stakeholder needs.

Evaluating if the outcome is directly linked to the objectives established in Q1. Every target derived from Q1, should have a corresponding measure.

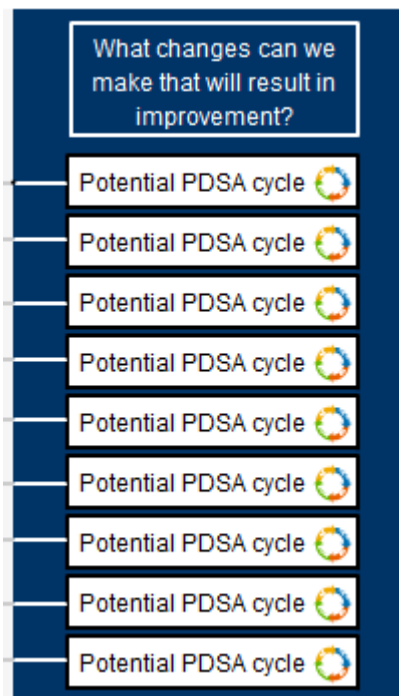


Figure 7

Determine the action plan

Q3 - What changes can we make that will result in improvement?

The answer to the third question from the tree diagram is determined by identifying the initial questions to be answered and then grouping them into the initial PDSA cycles. This is also the best source for determining what the initial cycles will be. As learning is derived from these initial cycles, the need for additional cycles becomes clear.

Some of the key steps to perform when determining the response for the third question are:

Developing a list of questions that need to be answered to get the project started (initial PDSA cycles) and will generate learning and action by the team. Note that the questions should be grouped where they are targeting the same aspect.

Using critical and creative thinking methods to develop changes to be tested.

Consulting and working with SMEs to help define potential quick wins, testing theories and proposed solutions to determine the number of cycles to be run in a project - the more you learn, more questions and cycles will develop.

Using PDSA cycles within the DMAIC roadmap

The Lean Six Sigma approach is complementary to using the DMAIC roadmap (or any other roadmap), as depicted below. With any roadmap you may choose to use, the three questions and PDSA cycles are still applied. The following figure depicts that while using the DMAIC roadmap, the PDSA cycles are applied within each section of that roadmap.

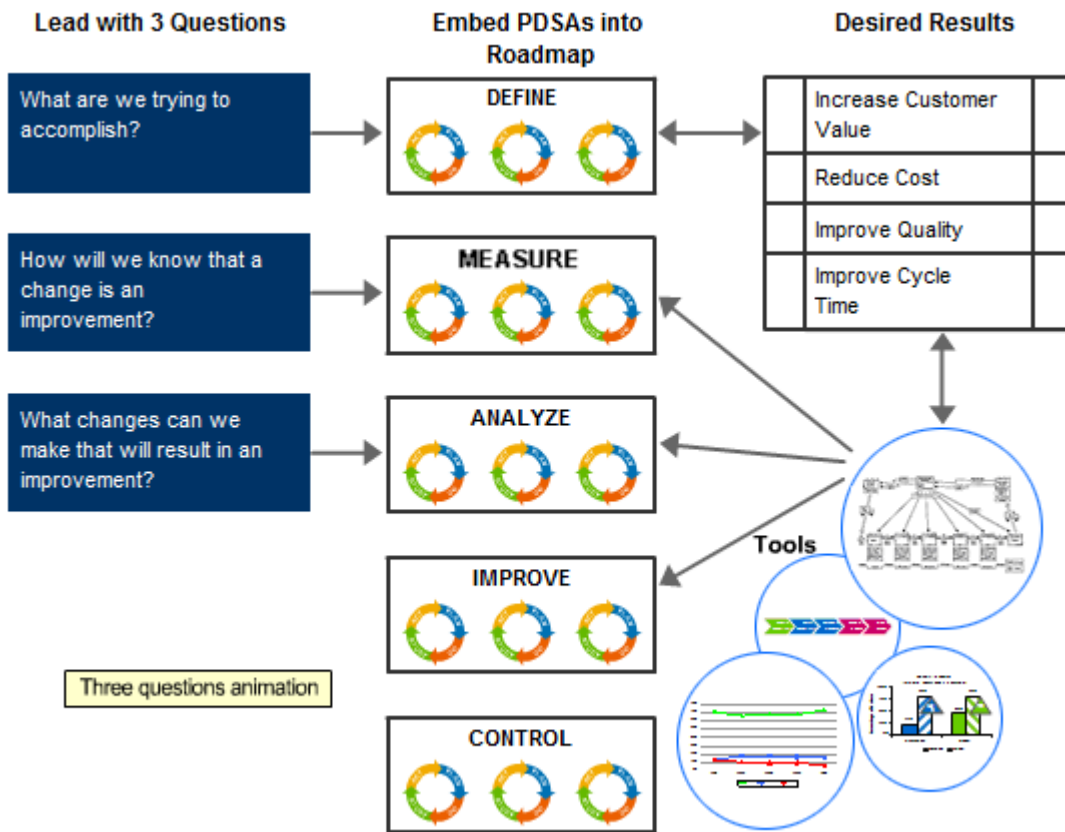


Figure 8

You can begin by using the three basic questions to frame the problem or opportunity and draft the improvement plan accordingly. If you choose to use a roadmap when using Lean Six Sigma, you can insert the PLAN DO STUDY ACT (PDSA) cycles into DMAIC. This helps generate learning and actions that will ultimately result in sustainable improvement.

As you conduct PDSA cycles, you can select appropriate tools to assist with the learning. These tools can be analysis or planning tools or tools to help people work together and manage change.

PDSA cycle for learning and improvement

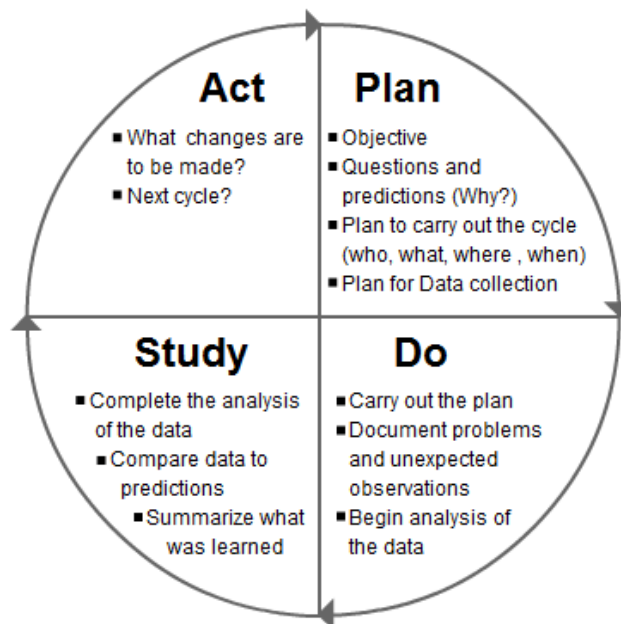
The Plan-Do-Study-Act (PDSA) cycle is a continuous cycle starting with Plan and ending with Act, which sets up the new cycle plan. Simply put, the PDSA cycle is a common building block where the steps are common, every time the cycle is run.

Finally, in the Act step, the learning is put into action, generating the next PDSA cycle and moving the project towards implementation.

In the Plan step, the specific objective of the PDSA is stated. That objective is typically aimed at doing **one** of the following:

- Understand and collect data
- Develop a change
- Test a change
- Implement a change

It is important to identify the questions your team will be answering during the cycle, and it is just as important to predict what you expect the answers/outcome will be. The plan will then be defined so that its clear who is doing what steps, and when.



In the Study step, a comparison is drawn between the actual and the predictions to generate new learning.

In the Do step, plans are carried out and problems and real-time learning are documented. In addition, data is collected and analyzed.

Figure 9

Improvement tools are only used when they help advance learning and support questions that need to be answered. In other words, questions drive the selection and use of tools. It might be that you do not require any specific tool to be used in a project phase or that you require all tools to be used during a project.

At this point, it may be useful to mention that any given tool might be used at various times in a project and in different phases of DMAIC.