Six Sigma Step by Step Guide

UNIT 2: PROJECTS AND PROCESSES

CHAPTER 7 - WHAT IS A PROCESS?

Define -

- A process is a **collection of tasks, steps, or activities** that are performed, usually in a specific order, and result in an end product such as a tangible good or the provision of a service. In a business, multiple processes work together to achieve organisational goals.
- Four layers of process -
    - **The Steps -** Whether physical, digital, or ideological, every process is a series of some number of steps which can be in the form of instructions-often called a standard operating procedure in a formal business training or policy document or a visual diagram known as a process map.
    - **Processing Time -** Processes all take a certain amount of time, and processing time can change with a variety of factors. Process maps and documents can only record information such as the average time a process takes or measures of variation in the processing time.
    - **Interdependencies -** Almost any process in a business will be dependent upon one or more other processes. Sometimes, interdependencies are noted on processes maps. Other times, interdependencies are resource-related. When working with processes during a Six Sigma improvement project, teams must be aware of interdependencies.
    - **Resources and Assignment -** Processes require resources. Project teams must understand the resources involved, the cost of those resources, and the owners of the processes and resources in question so they can make appropriate requests about needing additional resources.

Major Components of Process -

- **Inputs -** Input refers to anything that enters a process or is required to enter a process to drive the creation of an output. Understanding all inputs to a process is important in Six Sigma because inputs are often causal- or related to causal - factors regarding a process. Inputs or the results of those inputs can cause errors or defects in the process.
- **Outputs -** The output of a process is the service or product that is used by the customer of the process. The process customer is not always the traditional end customer who purchases a product or service. Customers can be internal or external. From a Six Sigma perspective, an output is almost always of more value to the ultimate process than the input is.
- **Events -** Events are specific, predefined criteria or actions that cause a process to begin working. Six Sigma teams must determine what events trigger a process because it helps them understand why the process is being run when it isn't needed.
- **Tasks -** Tasks, or activities, are the heart of a process. Just as the heart pumps blood through your body, the tasks within a process pump the inputs through, turning them into the outputs. Tasks are the physical, automated, or computerised actions within a process.
- **Decisions -** Decisions are closely related to tasks and can be tasks themselves. Decisions within a process are typically governed by a set of rules. Sometimes those rules are formally documented; other times, decisions are made via informal rules along with staff knowledge and experience.
- **It can also be seen using SIPOC which stands for Suppliers, Inputs, Process, Outputs, and Customer.**

Process Owners & their Responsibility -

- As teams work to improve processes, they need to understand who the process owners are. Depending on the business organisation, **process owners can be the people with the power to approve changes**. In some organisations, the lowest-level owner might not have veto or decision power about all changes, but he or she is held responsible for the performance of the process.
- The responsibilities of a process owner are often defined by the infrastructure of a specific business, but commonly, a process owner will:
    - Monitor how the process performs, usually using one or more metrics or regularly reported data elements.
    - Understand how the process fits into the overall business, why the output of the process is critical to business goals, and what inputs feed the process.
    - Ensures the process is documented via standard operating procedures (SOPs) and that process documentation is kept current and accurate.
    - Ensures operators within the process have the resources and training they need to complete their jobs.
- In a Six Sigma environment, **process owners might also ensure a control plan is in place and regularly review the process** for possible improvement opportunities.

Defining Process Components: The SIPOC -

1. **SIPOC stands for Suppliers, Inputs, Processes, Outputs, and Customers**. Suppliers are the people, processes, and organisations that supply inputs to your process. Customers are the people, processes, and organisations that make use of the outputs of your process. The process itself is the series of steps that take the inputs and make them outputs.
2. The SIPOC diagram is one of the **most often used tools for understanding process components** and process relevance because it is so effective and simple.
3. **SIPOC diagrams are also infinitely scalable.** Teams can diagram processes at a very minute level, but they can also use SIPOC to diagram an entire business.
4. You can create a SIPOC diagram as an individual exercise or within a team environment. It can be created using a computer and software tool such as Word or Excel, but you can also draw them freehand on a whiteboard or piece of paper.

Steps to create SIPOC diagram -

1. **Step 1: Create Swim Lanes -** A SIPOC diagram is based on swim lanes. Swim lanes let you show how cross-functional activities and resources relate to your process. A SIPOC diagram gets five lanes: one each for Suppliers, Inputs, Process, Outputs, and Customers.
2. **Step 2: Set Boundaries and Name Your Process -** Before beginning a SIPOC session, set a definition and scope for where your process or responsibility begins and ends.
3. **Step 3: Complete Swim Lanes -** You can complete SIPOC swimlanes in any order, but best practices usually have teams enter data in the following order - Process, Outputs, Customer, Inputs & Suppliers.
4. Step 4: Validate the IInformation - Ensure that your understanding of the process at this high level is accurate by validating your diagram. If you've put together a comprehensive team that includes SMEs, the team can validate most of the information on its own.

CHAPTER 8 - QUALITY

Critical to Quality Characteristics -

- Critical to quality characteristics, or **CTQs, are the factors or parameters that are the major drivers of quality within an organisation or process**.
- Usually, **CTQs are key characteristics that can be measured**; where the performance of said metric provides information about whether or not the customer is going to be satisfied.
- CTQs are closely related to CTCs but they are **not the same thing**.
- In a process improvement environment, **CTQs are critical to narrowing work scope and understanding how to enact change**.
- To gain a better understanding of how to measure the quality of a process, teams must **convert VoC statements to CTQs**. One of the best ways to do this is through a diagramming process known as a CTQ tree.
- **A CTQ tree** begins with specific and critical customer needs, breaks that need down into drivers, and uses the drivers to create requirements. Specific requirements are easier to convert to measurable quality components. While each CTQ tree is unique, they begin with a common form.

How to Create CTQ tree -

1. **Identify Critical-to-Customer Needs -** Begin the CTQ tree process by creating a list of needs that are critical to the customer. Define needs in broad terms to help catch all drivers and requirements later in the diagramming process. The best way to define needs is to directly ask customers for feedback, data collected via recent surveys or feedback forms, which is the next-best thing. In the absence of customer feedback, brainstorm critical needs with a group of employees who have knowledge of and experience with the customer.
2. **Identify Drivers of Quality -** identify quality drivers that must be present or met for the customer to be fulfilled. Drivers for that need might include friendly service technicians, helpful and knowledgeable employees, and a timely response to service calls. Drivers are the transition point between customer needs and requirements; you don't necessarily have to be able to measure drivers, but you want them to be a bit more detailed than the broad customer needs you already identified and you want to be flowing in the direction of measurable factors when possible.
3. **List Requirements for Each Driver -** Requirements are the most detailed breakdown regarding critical to quality characteristics. These are the things that you can measure that lead you to understand whether drivers are performing appropriately so customer needs are met.
4. Relate them and summarise them in a CTQ tree diagram.

Define CoQ -

- **The cost of quality, or CoQ**, covers the expenses associated with maintaining good quality throughout an organisation or process. Sometimes, this is referred to as the **cost of good quality.**
- The cost of quality includes the cost of poor quality and the cost of good quality. In addition to internal and external failure costs.

CoQ = Cost of poor quality + Cost of good quality

- Other than CoPQ, it consists of Prevention Costs and Appraisal Costs.
- **Prevention Costs -** The costs of prevention are the expenses that are related to any activity meant to stop an error or defect from occurring.
- **Appraisal Costs -** Appraisal costs are those associated with any activity meant to ensure high levels of quality across a process or organisation. f a manufacturing plant hires a quality control specialist,

CoQ = CoPQ + Prevention Costs + Appraisal Costs

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- **The cost of poor quality or CoPQ** is defined as the costs or expenses associated with defects created by a process. It is usually broken into two major categories: costs associated with external failures and costs associated with internal failures.
    - **External Failures -** It usually occurs after products or services have been delivered, which means they are directly associated with customer dissatisfaction. External failures might include revenue losses associated with a reduction in sales because of the quality of products, services, systems, or information. Other types of external losses include expenses associated with repairs, returns, or rework associated with a customer complaint; expenses associated with warranties; or loss of revenue or sales because of customer ill will or bad word-of-mouth.
    - **Internal Failures -** It occurs when products, senvices, or processes don't conform to the requirements set by the company, and the product or service is provided to the customer in an unsatisfactory fashion. Internal failures are usually handled by scrapping the work, redoing the work, or repairing the work.

CoPQ = External Failure Costs + Internal Failure Costs

The Cost of Quality and Six Sigma -

- Six Sigma has also **reduced the cost of overall quality.** As the sigma level of processes is increased via the application of Six Sigma tools and methodology, the cost of both prevention and appraisal goes down as well.
- Six Sigma is one of the best methodologies for managing the cost of quality because it works to build quality into every process. While no organisation can remove quality costs 100 percent, the goal should be **zero costs of failure**, either internal or external, and minimal preventative and appraisal Costs.
- First, teams should concentrate on costs associated with failures. It's often easier and less expensive to detect costs associated with non-conformance, and improvements that seek to correct causes for a few critical failures can have a big impact on overall quality and total cost. Efficient Six Sigma processes are self-regulating. They have built in checks and balances that work to constantly reduce defects and rework.
- Second, identify Prevention and Appraisal Activities and then try to reduce it.

Quality is Critical for Success -

- When Six Sigma teams are expunging quality-related costs and unnecessary activities from processes, **it is critical that they don't actually remove quality.**
- It's almost always **best to remove any quality activity that does not provide additional value**.

CHAPTER 9 - SELECTING THE RIGHT PROJECTS

Why is selecting Right Project important and How?

- Six Sigma works best when it is implemented as a company-wide culture, project selection should work as an enterprise wide function. So it's important to choose the right project. A critical part of Six Sigma success tor organisations is knowing when teams reach maximum project load.
- Organisations should only launch projects they can:
    - **Fund -** Six Sigma projects take monetary resources, which means organisations must prioritise based on financial criteria.
    - **Support with people resources -** Six Sigma projects require work from employees at all levels. Companies shouldn't launch three projects at one time.
    - **Manage -** Project teams require leadership. Even so, organisations with limited Six Sigma experts on staff can't launch dozens of projects without putting a strain on those resources.

Five-step procedure for identifying viable Six Sigma improvement projects

1. **Data-Based Review of Current State of the Organisation -** Organisations can begin with a high-level look at internal and external sources of information about performance. Internal information might include complaints or issues raised by employees, existing performance metrics or reports, financial reports, and quality reports. External sources include all of the Voice of the Customer tools.
2. **Brainstorm and Describe Potential Projects -** Answers to the questions in step one become a brainstorming list for potential projects. What types of things are customers complaining about? Perhaps surveys and feedback forms show customers complaining about long shipment times, poor quality of products, or rude customer service. With just a single question, an organisation has a list of possible projects.
3. **Apply Some Basic Criteria to Shorten the List -** Once a list of possible projects is created, teams can apply some very basic criteria to remove projects that are inappropriate, could not work with Six Sigma methodology, are not property scoped, or have little likely return on investment.
    - First, teams can remove items from the list where there is no real pain point.
    - Second, teams can remove issues that have very obvious problems and/or solutions.
4. **Create Unique Business Criteria -** After removing project ideas that don't fit Six Sigma methodology, teams should create and apply business criteria to further filter the list. Business criteria usually come in the form of expenses, monetary gains, impact on customer satisfaction, and urgency. Some questions teams might ask include: How will the improvement impact revenue-facing measurements such as profit, orders, or income? What savings will the improvement create?
5. **Use Business Criteria to Prioritise Project Lists -** Using the business criteria, teams should prioritise projects and select projects from the top of the prioritised list for immediate work. One of the best ways to prioritise projects is to create a selection matrix with defined criteria and a numerical ranking system. One of the criterias can be - Savings, Costs, Revenue Model, Access to Resources.

The Project Viability Model

- Teams can choose to create their own criteria for a project selection matrix, or they can use a 15-point viability model as defined below. One benefit of the project viability model is that it provides some weighting, letting teams make some criteria more important than others.
- This model is based on 15 criteria, which are -
    - **Sponsorship -** The project is likely to be sponsored at a high level. Sponsorship increases the chance that teams will have access to the funds and resources required for a successful potential project.
    - **Corporate alignment -** The goals of the project are aligned with the goals of the business. Working on potential projects that aren't aligned with business goals can reduce business effectiveness.
    - **Data -** Data is available or can be accessed so the team can design project metrics. Without access to data, a Six Sigma methodology can't be applied. If data is excessively time-consuming and expensive to collect, then the potential project is usually not the best choice.
    - **Definition of defect -** There is a specific, well-defined defect or problem. Without a well-defined defect potential projects run the risk of scope creep.
    - **Stability -** The potential process is stable and there are no expectations that the process is going to be overhauled, redesigned, or changed in the near future. There is usually no reason to spend time and money improving a process that will drastically change soon anyway.
    - **Customer -** The planned goal of the potential project would create a substantial and positive impact on customer satisfaction or perception of quality.
    - **Benefits -** The potential project has a strong cost-benefit ratio.
    - **Timeline -** The timeline for a potential project is relatively short. Timelines for most Six Sigma improvement projects are around 6 months, though some do run longer. Longer timelines decrease the chance that an improvement fits within the DMAIC methodology.
    - **Solution -** The potential project purpose is to find a solution that is not already known or defined. As we previously stated, if a solution is obvious, you don't need to run a project to find it.
    - **Implementation -** A solution identified and verified by the potential project is likely to be implemented. If, for any reason, change is very unlikely within a process, then going through Six SIgma improvement work is a waste of resources.
    - **Required investment -** The potential project requires a large investment of cash. Generally, the greater the cash or capital investment required, the less likely a project will be selected or a solution will be implemented due to cost-benefit analysis.
    - **Available Six Sigma -** The Black and Green Belts required for the projects are available.
    - **Resources -** Inputs can be For a Six Sigma process improvement project to be successful, at least some of the inputs must be within control of the team or organisation.
    - **Redesign -** The process can be improved as is and doesn't need a complete redesign.
    - **Process quality is improved/maintained -** The improvement doesn't negatively impact the quality of service or products along the value chain.

CHAPTER 10 - BASIC SIX SIGMA TEAM MANAGEMENT

To Note -

- Six Sigma is typically managed on **two levels within an organisation**.
- First, the **culture of Six Sigma must be managed at an enterprise-wide level,** usually by a group or council of senior managers, such as executives, with the guidance of a Master Black Belt or Black Belt. Ultimately, this group sets the tone for Six Sigma within an organisation, provides final approval on projects, and holds others accountable for metrics, performance, and success.
- Six Sigma must also be **managed at the team level**. Team should discuss managing a team with timelines and schedules, milestones, budgets, and a defined measure of success.

Building a Six Sigma Team

- **Executive leadership groups working with Six Sigma leaders and experts usually put teams together.** Any process improvement team should have, at minimum:
    - A Six Sigma leader
    - A process owner
    - An expert on the process
    - Someone to manage budgeting and accounting
- When putting teams together, organisations should remember that three basic team member types exist with relation to a Six Sigma project.
    - **First, there are the regular team members that include project leaders, process owners and experts**, and identified subject matter experts who the team or executives feel would be critical components of their group.
    - **Second, ad hoc team members provide expertise on an as-needed basis**. Usually, these are subject matter experts or employees who work directly with the process.
    - **Finally, resource team members** are only included when the project team leader feels they are needed in a meeting or team event to provide expert information, counsel, or help in accessing resources.
- **Most Six Sigma process improvement teams are relatively small**: five regular team members is considered a good number on average.
- Other tips for selecting team members include:
    - Choosing employees who are knowledgeable about the customer, product, or process related to the project.
    - Choosing employees who have shown a willingness and ability to work toward improvement in a team environment.
    - Selecting employees who have access to and an understanding of the data required to learn about and measure the process or problem.
    - Picking employees who can provide at least five hours of work per week to the team.
    - Matching the skills of employees to the projects at hand; if a project is likely to include all technical improvements, you would be less likely to add a team member who is skilled in marketing.
    - Removing political obstacles through team selection; if a specific person in an organisation is likely to be an obstacle to a team, sometimes putting that person on the team can increase the chance that they will buy into the process.

Team Member Roles -

- **Sponsors and Champions -**
    - These are the senior-level leaders who oversee projects at the highest level.
    - The senior leader is usually responsible for the final result of a project, which means he or she usually wants regular reports about progress.
    - Coaching the team, particularly at the project charter stage. The sponsor often provides input into what is in scope on a project and who might be included on a team.
    - Locating resources for the team, including support from other departments, money, equipment, time, and labour hours.
    - Handling matters of politics within a corporate structure so the team doesn't have to.
    - Working with other managers within the organisation to help the team succeed in improving a process and transitioning improvements to a daily work environment.
- **Business or Process Owners -**
    - The business or process owner is usually someone who is directly responsible for the process in a leadership capacity.
    - Usually, the process owner is the person who is going to "receive" a solution implemented by a Six Sigma team once that solution is ready to be rolled out to all team members or used on a daily basis.
    - The process owner must also be familiar with methods of control that are created by the Six Sigma team.
    - A process owner usually also acts as a process expert on a Six Sigma team. The process owner has insight into the existing process, understands the needs of the customers and employees related to the process, and might already have access to data regarding the process.
- **Six Sigma Leaders -**
    - Six Sigma projects are usually led by certified Black Belts, although some organisations do allow Green Belts to act as leaders on small initiatives with occasional feedback and guidance from Black Belts.
    - In most organisations, the Black Belt holds primary responsibility for the regular work performed by a team and usually only works with one team or project at a time.
    - Most certified Black Belts can bring Six Sigma methods to process improvements even in areas they aren't closely familiar with.
- **Project Managers -**
    - Some organisations use traditional project management techniques alongside Six Sigma improvement methodologies. In these organisations, a project manager is usually assigned to a Six Sigma project.
    - While structures vary by organisation, the project manager does not usually lead the team. Instead, the PM offers leader support to the Black Belt by keeping up with documentation and timelines, helping keep meetings on track, and ensuring items are followed up on after meetings.
    - With a PM worrying about timelines or whether the meeting is getting too far off track, a Six Sigma expert is free to concentrate on the brainstorming session or statistical analysis at hand.

- **Timekeeper -**
    - Not all Six Sigma teams use timekeepers, but they can help keep meetings on track, reduce the chance of scope creep, and increase overall productivity.
    - The timekeeper can be any person on the team who is not regularly engaged in leading meetings, brainstorming activities or recording team activities and notes.
    - The timekeeper shouldn't police time in such a rigid fashion that the benefits of fluid discussion and brainstorming are lost, but he or she should gently steer teams toward following agenda schedules or provide the project leader with an indication that time is up for the topic at hand.
    - Keep an eye on the agenda and the time.
    - Let team members know when the time for a certain agenda is almost up, teams might want to set up a five-minute warning rule so they have a few minutes to wrap up a discussion.
    - Signal that the time is up for a certain discussion or item

- **Scribes or Minute-Takers -**
    - Notes are important because they help team members review what was discussed, create lists of folloW-ups and actions from a discussion, and record charts, graphs, and diagrams that were created during brainstorming processes.
    - While everyone can take notes, the team leader should appoint one person as the official scribe for the team.
    - The scribe should create notes or minutes of the meeting in typed format and disseminate those notes to all team members as soon as possible following a meeting. Team members can review the notes and add any missing information if desired.

- **Team Members -**
    - Participate in brainstorming sessions, discussions, and other team activities.
    - Collect data and perform analysis under the direction of the Black Belt. Often, team members performing these functions are Green Belts.
    - Perform work between meetings as required by the project leader.
    - Report the results of and progress on individual assignments to the team.

Timelines, Scheduling, and Milestones -

- Scheduling and maintaining that schedule is an integral part of the Six Sigma project process.
- Organisational leaders need to understand how long a project will take, when results can be expected, and when team resources will be freed up for other endeavours.
- **Phase-Based Timeline -**
    - DMAIC breaks a project up into five phases: Define, Measure, Analyse, Improve, and Controls.
    - Experienced Six Sigma experts with some data and information about a project and process can usually provide a very basic and raw estimate of time by assigning a certain number of weeks to each phase.
    - It's also worth noting that most of the phases are likely to overlap.
    - To create a raw timeline for a project, a Black Belt or other Six Sigma leader usually starts with an overall time requirement. He or she either estimates the total time required for an improvement or works with a deadline imposed by the leadership group.

- **Critical Path Method -**
    - The critical path method is a more detailed way of defining timelines for various elements of a project, but it does require more information and input from a project team.
    - This means you probably won't be able to provide a detailed timeline until the project is underway; a critical path diagram could be one of the activities the team undertakes as part of the Define phase.
- **Milestone Meetings -**
    - Once a timeline is established, set up milestone meetings and dates to help keep the team on track and notify the sponsor or champion of progress.
    - In a DMAIC project, milestones are usually set at the end of each phase (Define, Measure, Analyse, Improve, and Control).
    - However, teams can set custom milestones, and sponsors might require specific milestones if they are approving large resourcing or funding requests for a project.
    - You can also set up milestones within a team environment to manage goals and tasks; these milestones can be kept within the team..

- **Budgets -**
    - Teams, and especially team leaders, must always be concerned with project budgets.
    - For leaders, success is also measured in terms of time and budget. A strong timeline and good milestones help you meet time requirements, and an understanding of financial drivers, strong communication, and financial oversight help you keep a project within budget.
    - One of the challenges when dealing with budgets in a Six Sigma project is that all team members are not always completely aware of financial drivers.
    - Some information and analysis might need to be performed solely by a project-leading Black Belt in such cases, especially if data is critical or sensitive.

- **Defined Measures of Success -**
    - Finally, Six Sigma teams must create a well-defined measure of success.
    - To best manage a Six Sigma project and team, leaders have to ensure all team members, leaders, and sponsors agree on what success means.
    - If success isn't defined at all, the team risks scope creep and getting lost in a project that never seems to end.

CHAPTER 11 - INTRODUCTION TO DMAIC AND DMADV

DMAIC -

- **Define -**
    - Teams create what is known as a project charter and a basic plan for work and also team members. A charter is a synopsis of the project.
    - It provides some common information and a summary of what the team hopes to accomplish.
    - Some charters also include a rough timeline estimate for the project.
    - Teams create or list measurable customer requirements and create high-level documents about the process (including process maps).

- **Measure -**
    - During the Measure phase, the team is concerned with creating a baseline metric for the process and refining problem statements and other outputs of the Define stage.
    - Creating a baseline metric lets teams understand how a process should be measured and how the process is really performing before improvements begin.
    - It also provides a comparison point so teams can show how much improvement they've brought to a project at the end of the DMAIC method.
    - A successful measure phase requires strong observation skills, an understanding of the reasons behind measure, knowledge of data types such as discrete and continuous, tools for measurement assessment, and a strong background in statistical analysis.

- **Analyse -**
    - Analyse phases are when teams perform detective work on the process. Using the clues gathered during the Define and Measure phases, along with information provided by the sponsor, process owner, and subject matter experts, teams attempt to identify root causes for a problem.
    - They also use statistical analysis and other tools to verify causes before turning to the work of identifying possible solutions.
    - Tools common in the analysis phase include Pareto charts, run charts, histograms, cause-and-effect diagrams, scatter diagrams, process maps, and value analysis.
    - During analysis, teams might begin working on possible solutions and selecting solutions, developing improvement plans, and preparing some basic documentation about improvement work.

- **Improve -**
    - Team selects a final solution and begins to put it in place. Sometimes, teams will select more than one solution, especially if a few smaller solutions are highly related and work together for an overall solution.
    - Usually a best practice is to implement one change at a time and verify that change before moving on to something else.
    - Teams should use a solutions selection matrix to evaluate solutions, choosing only the few best solutions.
    - During Improve, Six Sigma teams must continue to keep the project definitions in mind.
    - The solution must addresS a root cause verified in the analysis phase.
    - After selecting solutions, teams must test them using statistical tools and real-world sampling to ensure effectiveness before deploying solutions to a live work environment.

- **Control -**
    - Teams usually handle four tasks: creating the foundation for process discipline, finalising documents regarding the improvement, establishing ongoing metrics to evaluate the process, and building a process management plan that lets the team transition the improvement to the process owner.
    - Tools used by a team during the Control phase include documentation checklists, control charts, response plans, process maps, and process dashboards.
    - In a well-run DMAIC process, the Control phase is a time of wrapping up loose ends and arriving at the end of a project.

DMADV -

- **Define -** Same as above
- **Measure -** Same as above
- **Analyse -** Same as above
- **Design -**
    - Teams create a new process or develop a new product.
    - A Six Sigma team would have previously done all the work to lay the foundation for development, which means most of the design phase is taken up with the actual work involved in creating the process or project.
    - Using the plans, instructions, or maps created in earlier phases, the team either creates a product themselves or works with vendors, manufacturers, or other employees to create the product.
    - During Design, a team will also test the product, process, or service. Testing can be done in testing environments, in limited production environments, or via Beta testing. Usually, the team rolls out the new process or product to a limited number of internal or external customers; those customers provide feedback and the team uses the feedback to troubleshoot the new process or product as needed. Seeking feedback and troubleshooting the new process.

- **Verify -**
    - The Verify phase of a DMADV or DMADOV project is very similar to the Control phase of a DMAIC project.
    - The new process, product, or service is transitioned out of project mode and handed off to a process owner or employees who work daily with the process or product in question.
    - Control plans, including control charts, might be put in place by the team to track ongoing results, and almost all of the tools used in a DMAIC Control phase are relevant to Verify.
    - One of the differences between Verify and Control is that DMADV teams might take time to complete further CTQ analysis at the end of a project so they can identify new critical-to quality factors. This is done because the process or product is different than it was when the team first started working.
    - At the end of the Verify phase, a team delivers a final product or process that meets the needs first identified in the Define stage. The process or product should be free of known problems and defects wherever possible, and teams should have provided a way to manage and control the process through statistical control charts, Lean templates, and policies.
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DMAIC versus DMADV -

- **Phase 1 - Define**
  - DMAIC - Identifying the problem, defining requirements for the project, and setting goals for success. Requirements and goal setting might relate to a variety of factors and are dependent somewhat on guidance from the leadership team and expected budgets.
  - DMADV - Define stage is slightly more rigid. Teams also have to identify a problem and begin defining requirements, but requirements must be made within a change management environment. Six Sigma teams must incorporate all requirements of that program and also work to define customer requirements to create a measuring stick to which the process development can be compared.
- **Phase 2 - Measure**
  - DMAIC - The bulk of the measure phase is occupied with actually gathering data and formatting it in a way that can be analysed. Measuring can be one of the most difficult tasks in a Six Sigma project if data isn't already being captured.
  - DMADV - Team might do some of the same things during the measure phase, but activities are typically more targeted. Teams will likely collect data and measurements that help them define performance requirements for the new process.
- **Phase 3 - Analyse**
  - DMAIC - Teams develop hypotheses about causal relationships between inputs and outputs and between Xs and Ys, they narrow causation down to the vital few (using methods such as the Pareto principle), and they use statistical analysis and data to validate the hypotheses and assumptions they've made so far. **It includes hypothesis testing to validate assumptions.**
  - DMADV - Identify cause and effect relationships, but they are usually more concerned with identifying best practices and benchmarks by which to measure and design the new process. Teams might also begin process design work by identifying value and non value-added activities, locating areas where bottlenecks or errors are likely, and refining requirements to better meet the needs and goals of the project.
- **Phase 4 - Improve or Design**
  - Six Sigma teams start developing the ideas that began in the analysis phase during the Improve phase of a project. They use statistics and real-world observation to test hypotheses and solutions.
  - Hypothesis testing actually begins in the analysis phase, but is continued during the improvement phase as teams select solutions and begin to implement them.
  - The fourth phase is where DMADV projects begin to diverge substantially from DMAIC projects. The team actually works to design a new process, which does involve some of the solutions testing mentioned above, but also involves mapping, workflow principles, and actively building new infrastructures.

- **Phase 5 - Control or Verify**
    - For DMAIC and DMADV teams, the control or verify phase is where loose ends are tied and the project is transitioned to a daily work environment. Controls and standards are established so that improvements can be maintained, but the responsibility for those improvements is transitioned to the process owner.
    - During the transition, the Six Sigma team might work with the process owner and his or her department to troubleshoot any problems with the improvement.

Glossary -

1. **Process Map -** Using process mapping software, process maps show a series of events that produce an end result. A process map is also called a flowchart, process flowchart, process chart, functional process chart, functional flowchart, process model, workflow diagram, business flow diagram or process flow diagram.

2. **Change Management -** Change management refers to a closely-managed process of making changes in an organisation. Often, companies use change management policies and rules to govern how changes are made to software, infrastructure, or processes that have compliance or audit elements. During change management, teams must document all activity in keeping with corporate policies and report changes and results to an oversight committee.