Using the Thought Map to Guide DMAIC Project Completion

Reinforcing the "Questions Lead, Data & Tools Follow" Approach

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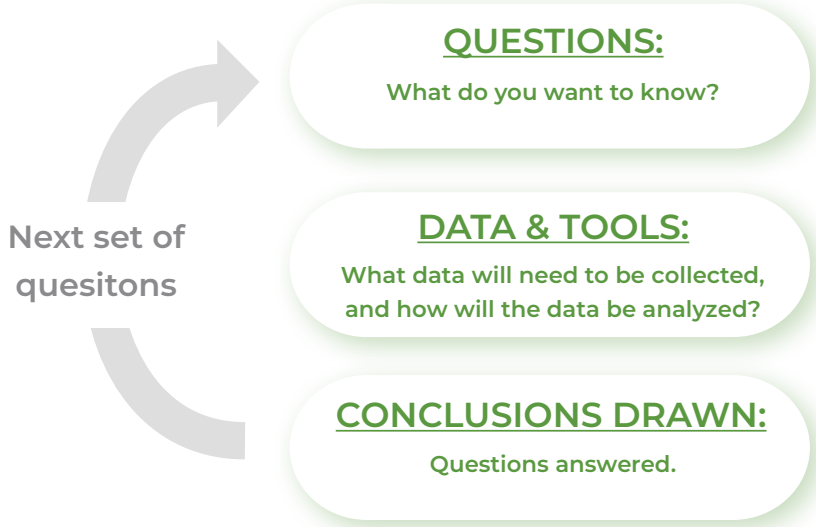
INTRODUCTION

The DMAIC framework is a series of critical thinking exercises, organized by phases, that follows a "formulate questions, collect information, draw conclusion, define next question" sequence. Unlike projects with known root causes and solutions, DMAIC projects focus first on uncovering the root causes then developing solutions. Unfortunately DMAIC candidates often approach problem solving with a "check the box" mindset. They focus on learning the tools, with the result being that many do not develop the critical thinking skills needed for successful project completion. Candidates also have the tendency to focus on the tools to analyze data, without first defining the questions that need to be answered. A valuable and often under-utilized graphical tool that captures the critical thinking and problem solving processes is the Thought Map.

The Thought Map is the "command center" for any DMAIC project. It is created in the Define phase with team input, and updated throughout the project. It allows for questions to be asked, data collected, and conclusions to be reached in an organized and logical manner. It is also important to understand that each project will have a unique set of questions that need to be answered.

Questions Determine Data Collection and Analysis Plans



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HOW TO CONSTRUCT A THOUGHT MAP

Here are the steps to construct a Thought Map:

1. State the problem statement and the project goal.
2. "Brain dump" initial questions that need to be answered and what you know about the project. Be sure to involve your team. This can be done on a flip chart or with Post-it notes. Frequently, at this stage, you will get a mix of questions, action items, and potential solutions. It is important not to be judgmental; as the project progress, the team will naturally eliminate some questions and add new ones, and some solutions may no longer apply.
3. Organize these questions according to the phases of the DMAIC Roadmap. If you know the answers to some of these questions, document them. Often the team has more questions and inputs in the Analyze phase, especially for technical projects. In these cases take the team back to the Define and Measure phases and brainstorm more. Projects often fail due to lack of work in the Define and Measure phases. Here are some basic questions to help the team get started:
    - **Define:** What is the problem? What is the scope of project? What are desired outcomes?
    - **Measure:** What is the baseline data? Do we have data? How accurate is it?
    - **Analyze:** What is the root cause of the problem and key driver of outcome? How sure am I?
    - **Improve:** What are solution ideas that address root cause?
    - **Control:** What can go wrong? How can we sustain the gain?

Figures 1a and 1b: A Thought Map in the Define and Measure phases for a team chartered to improve complaint resolution time.

Customer complaints were not resolved in a timely manner, damaging company reputation, and ultimately, resulted in lost sales. This team inventoried their questions and listed ways to answer questions. Note that the team already formulated solutions; you should still capture those ideas. As the team progresses, some of the solutions may no longer apply and will be replaced by better ones, all based on the work done in the Analyze phase.

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Figure 1a

Problem: Customer complaints not resolved in a timely manner

	QUESTIONS	INFORMATION NEEDED AND HOW
Define	What data do we have (or need) about this problem? Who are the customers? What is the process? Scope? What do customers want?	• Data showing % issues not resolved– **system log** • Data on amount of time it takes to resolve (log into system, time for external and internal communication)– **system log** • # of issues total – **system log** • Customer requirements - **VOC**
Measure	What is the process baseline – volume and touch time?	• % issues not resolved– **system log** • How much time is spent on managing issues for roles touching the process — **online survey** • Current state process — **interviews**

Figure 1b

Problem: Customer complaints not resolved in a timely manner

	QUESTIONS	INFORMATION NEEDED AND HOW
Analyze	Why are issues not resolved in a timely manner? Why are type x, y, and z issues often late? Why is there often rework?	• Potential causes — **Fishbone diagram, internal and external interviews** • Prioritized root causes — **multi-voting**
Improve		• Improve template instructions • Standardize templates • Training on the new process
Control	How to monitor improvement? What can go wrong?	• FMEA for future state • Mitigation for going back to old habits • Tracking response time, % unresolved with control charts

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HOW TO CONSTRUCT A THOUGHT MAP

4. Within each phase, determine which questions will be answered and in what order. After answering each question, succinctly summarize the result and provide reference links.
5. Use the Thought Map to guide the team progress. On the Thought Map there are many questions, but not all of them will be answered. Sometimes new information will lead to new questions, and making existing ones obsolete. Each answer obtained may lead to new questions that were not identified initially, potentially leading to new data collection requiring additional tools.
6. Update the content until project is completed. If a Thought Map is used properly, the project is considered complete when all necessary questions have been answered.

Figures 2a-2d: A Thought Map for a completed project that addressed "late study enrollment". There were wide variations in the time required for study sites to accrue sufficient numbers of subjects, resulting in delayed study completion.

Figure 2a

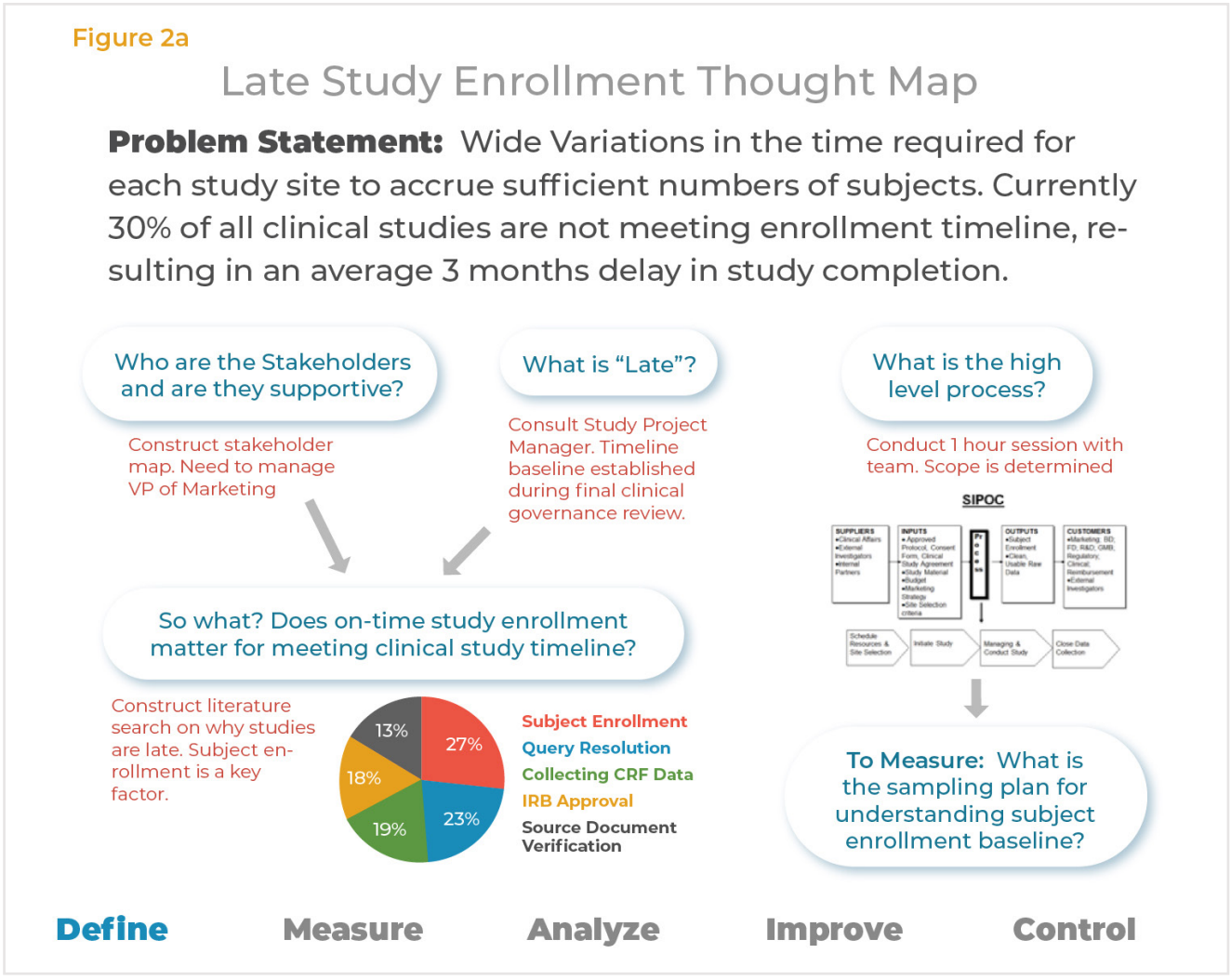

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Figure 2b

Late Study Enrollment Thought Map

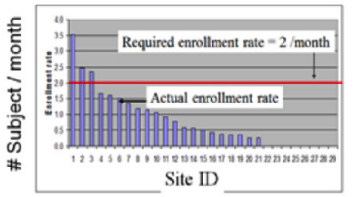
What is the sampling plan?

Select a recent study with 50 sites:
- Good documentation
- Multi-center study
- Recent

What do we know about the enrollment rate for each site?

Source: Study initiation form

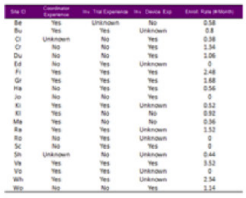
Overall Subject Enrollment Rate



What do we know about these sites?

Source: Study initiation form

Site Infrastructure Information



Which of these factors affect enrollment rate?

Define **Measure** Analyze Improve Control

Figure 2c

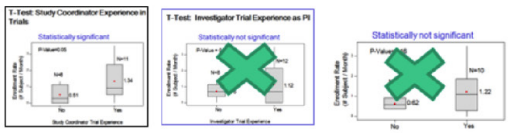
Late Study Enrollment Thought Map

What are the potential factors to investigate?

- Factors were selected based on study SME feedback, external benchmarking, and publications
- Study staff experience, investigator experience, institution experience

Are any of these factors significant?

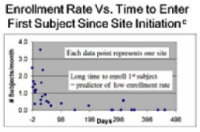
t-tests



Study staff experience seems important → To Improve

Can "time to enroll first subject" be a predictor of enrollment rate?

Site enrollment rates vs days to first subject



important to monitor how long it takes to enroll first subject. may be a lagging indicator we can track and intervene

Define Measure **Analyze** Improve Control

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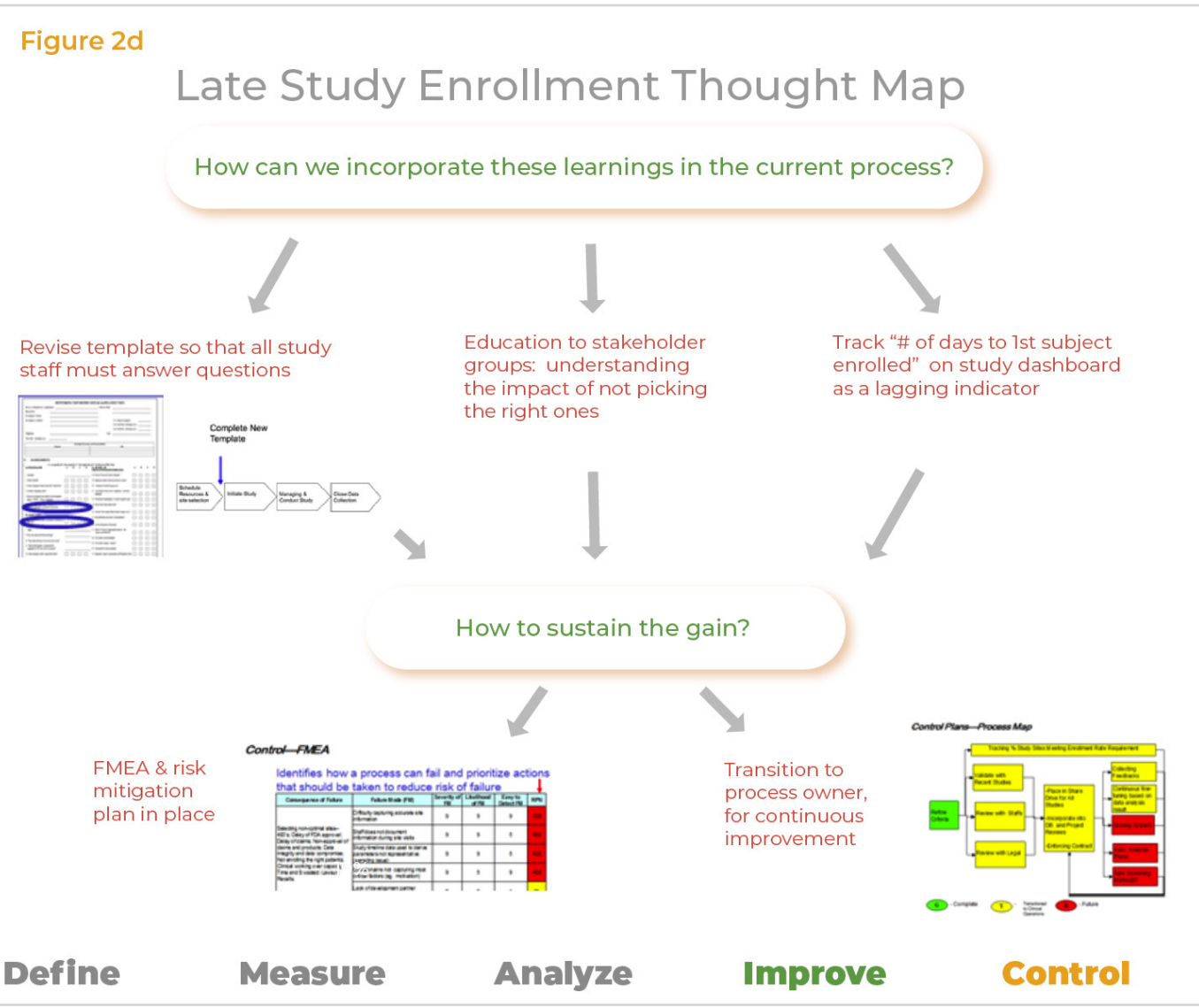
Figure 2d



At times, properly constructing and updating a Thought Map may change the project trajectory significantly. Shown in **Figure 3** is a project addressing lack of interest to a training program. Initially, the problem statement was "low enrollment", and the immediate solutions were "getting better trainers", and "better promotion". While constructing the Thought Map, the team added questions in the Define and Measure phases that were not thought of previously, changing the problem statement to "it is not clear what benefit this program brings to the company". In this case, the Thought Map tool facilitated the critical problem solving approach that really helped the team identify what truly mattered! The team was able to make decisions on what data was collected, even though only 50% of the initial questions were answered.

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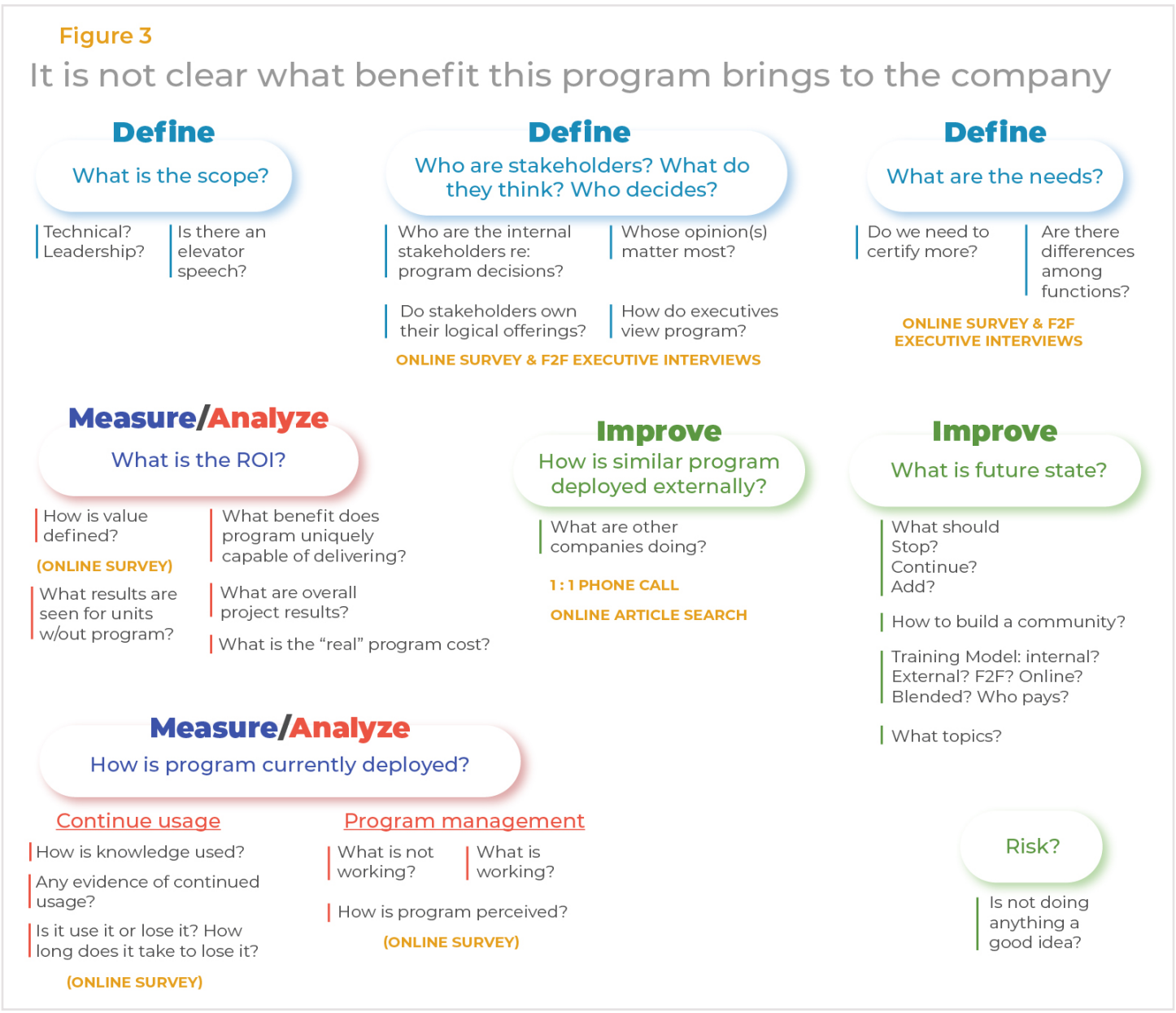
Figure 3



HOW THE THOUGHT MAP IMPROVES THE EFFICIENCY OF PROBLEM SOLVING

The Thought Map is an excellent framework that you can leverage to mitigate the following issues that any mentor or leader of DMAIC projects will likely experience at some point:

- **Thought process is not clear:** This happens frequently especially for candidates who are new to the DMAIC methodology. The Thought Map re-enforces the "Questions Lead, Data & Tools Follow" approach that helps the candidate apply critical thinking skills throughout the project completion. In addition, a well-constructed Thought Map will have a series of questions answered sequentially, in a logical manner that, in turn, helps the candidate "tell the story".

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- **Using the tools because data is available:** Very often when candidates first learn new analysis tools in classes, they are very eager to apply new learning. In addition, statistical software such as Minitab generates impressive outputs that bring candidates great satisfaction. However, upon reviewing the outputs, candidates often cannot articulate what they learned from the analysis or why they used a particular tool. Using the Thought Map makes candidates think about the "Why".
- **Jumping to conclusions:** Most of us formulate solution ideas at some point well before Analyze phase is complete. The Thought Map can capture those ideas initially as action items in the Improve phase, so that they are not lost. After the Analyze phase is completed, the team can better evaluate whether these initial ideas can effectively address the root causes.

WHO BENEFITS FROM THE THOUGHT MAP TOOL

A completed Thought Map has three elements: 1. questions asked, 2. actions taken, and 3. conclusions drawn. The Thought Map greatly benefits many project stakeholders. Examples are:

- **Project leads** can better encourage team participation, including the problem solving journey, while better documenting the thought process.
- **Team members** feel more engaged, since their ideas are captured and investigated as appropriate.
- **Mentors**, especially those with multiple mentees, can quickly pick up mentee's thought process, and re-enforce the DMAIC framework as needed.
- **Management** can quickly understand the journey, know what is explored, not explored, and why. To communicate to this audience group, the Thought Map can serve as the project summary page with supporting materials in the reference section. Management can choose whether or not to see more details. Presenting in the Thought Map format also increases clarity and flexibility.

MAKE THE MOST OUT OF THOUGHT MAP TOOL

A Thought Map can be done in PowerPoint, Mind Map, Visio, or on Flip Charts and Poster Boards, as long as the team follows the "Questions Lead, Data & Tools Follow" format. Here are some final tips on how to make the most out of this tool:

- Revise and update, construct it as you go. Like a Project Charter, Thought Map is a living document. Use it to facilitate team discussion, not only for capturing the thought process after the fact.

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- Capture investigations that lead to a dead end and show why the team chose not to pursue a certain route. It will be very important for those who wish to learn more, long after the project has been completed.
- Incorporate the Thought Map in the DMAIC training curriculum and make it a requirement for all projects. It has to be used consistently and broadly to be most effective. After all, for DMAIC projects the adage is “Questions Lead, Data and Tools Follow”, and not the other way around.

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REFERENCES

- J. DeLayne Stroud. *Use a Thought Map to Increase Efficiency*. Retrieved from URL https://www.isixsigma.com/implementation/project-selection-tracking/use-thought-map-increase-efficiency/
- Chris Schweighardt. *Thought Process Map for Six Sigma: What, Why and How*. Retried from URL https://www.isixsigma.com/methodology/project-management/thought-process-map-six-sigma-what-why-and-how/
- *Thought Process Map - Project Management and Six Sigma*. Retrieved from URL http://patrick-life.blogspot.com/2007/06/thought-process-map.html
- Cheryl Hild, Doug Sanders, and Bill Ross. *The Thought Map*. Retrieved from URL http://160592857366.free.fr/joe/ebooks/ShareData/Sigma%20Science%20Thought%20Maps.pdf
- University of Leicester Student Learning Development. *Thought Mapping*. Retrieved from URL https://www2.le.ac.uk/offices/ld/resources/study/thought-mapping
- Moresteam.com. *Lean Six Sigma Black Belt – A Path to Improvement Online Course Reference Text Volume 1*.

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