

CAN AI REPLACE A MASTER BLACK BELT?

A Look at Artificial Intelligence
and Continuous Process
Improvement

by Marshall Ariza

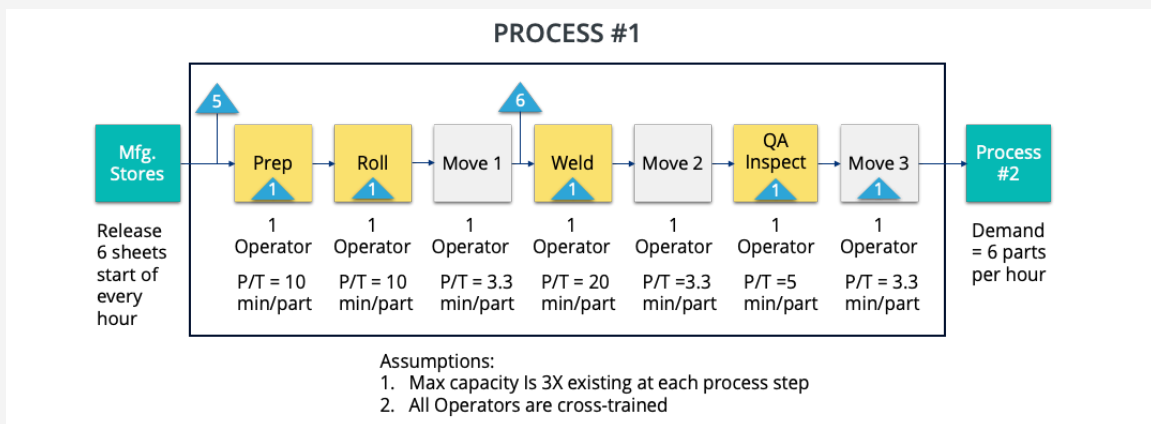


No matter where you look today, everyone is talking about Artificial Intelligence.

AI is touted as revolutionizing everything in modern life, making obsolete a number of human-performed functions. But what does that mean for continuous process improvement professionals? How will AI impact our work and our futures?

The Scenario

We're going to test-drive Microsoft Copilot, powered by OpenAI's GPT-4, and one of today's most widely available free AI platforms. It represents the type of integrated, text-based chatbot that is commonly referred to as "AI" in everyday discussions. I've constructed a simple manufacturing process as a case study and it will inform the questions and information I pose to the chatbot.



Here's my opening prompt to Copilot:

You're a Lean Six Sigma Black Belt with 20 years of experience and are employed as a Continuous Improvement consultant in a company that fabricates metal parts.

The company is having problems getting sufficient quality parts out of Process #1 to meet demand and management has asked you to trouble shoot and fix the problem. Your assignment is to form up a project team and use Lean Six Sigma tools and practices to solve the problem.

Project Planning, DMAIC, the Define Phase

To test Copilot's Project Planning capabilities I pose the following question:

Your first task is to organize and launch the project. What tools should you use, and steps should you take to ensure the project gets off to a successful start?

Copilot responds:

To ensure the project gets off to a successful start, you can follow these steps and use these Lean Six Sigma tools:

1. **Define the Problem:** Clearly define the problem that needs to be solved. Use the SIPOC (Suppliers, Inputs, Process, Outputs, Customers) tool to map out the existing process and identify where the issues might be.
2. **Assemble the Team:** Identify key stakeholders and subject matter experts within the organization who can contribute to solving the problem. This team should include representatives from all areas affected by the process.
3. **Develop the Project Charter:** The project charter should include the problem statement, project scope, project objectives, key stakeholders, and project timeline. This document serves as a reference point for the team throughout the project.
4. **Voice of the Customer (VOC):** Gather data on customer requirements and expectations. This could be internal (other departments that rely on the process) or external customers.
5. **Measure the Current State:** Use data collection and statistical analysis tools to measure the current state of the process. This could include tools like control charts, Pareto charts, and fishbone diagrams.
6. **Set Goals:** Based on the data collected, set improvement goals that are specific, measurable, achievable, relevant, and time-bound (SMART).
7. **Communication Plan:** Establish a communication plan to keep all stakeholders informed about the project's progress.
8. **Training:** Ensure all team members are trained in Lean Six Sigma methodologies and tools they will be using.
9. **Kick-off Meeting:** Hold a project kick-off meeting to communicate the project plan, roles and responsibilities, and expectations to all team members and stakeholders.

Remember, the key to a successful Lean Six Sigma project is a structured approach, active involvement of all team members, and open and regular communication. Good luck with your project!

This is a solid answer. Inclusions that would've made it stellar include: listing management meetings to ensure resources and alignment or using the DMAIC process to guide the project. But we're off to a promising start.

Next, I chat with Copilot about meeting with management to get a better understanding of the problem. Once I provide data, the chatbot properly structures it into a Problem Statement, Project Scope, and Project Objective. I'm especially impressed by how clearly it states the project goal of increasing output from 3 to 6 parts/hour.

The Measure Phase

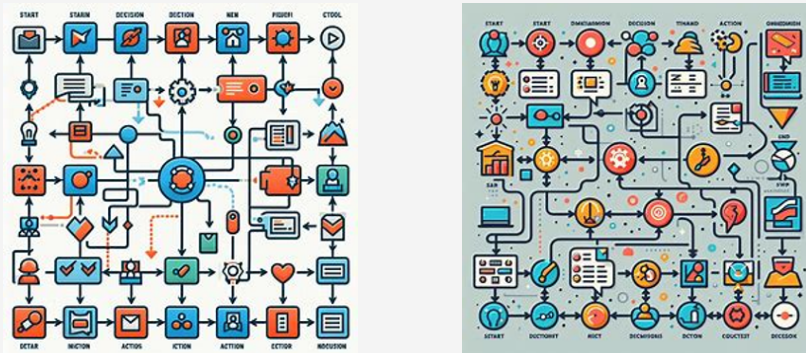
An essential part of the Measure phase is the documentation and understanding of the current state of the process. Curious if Copilot will recommend the use of a Value Stream Map to document the process, I ask:

I'd like to show management a visual representation of what Process #1 looks like and how well it is meeting Process #2's demand. What is a good tool to document how Process #1 currently looks that I can later use to identify and analyze the problem areas?

I get a pretty good generic answer about process maps and flowcharts, but not quite the what I'm looking for. I then provide data including sequential steps, processing times, number and locations of operators and demand rates. I ask Copilot to build me a process map.

Based on the information you've provided, I'll create a Process Map for Process #1. This map will visually represent each of the seven steps: Prep, Roll, Move 1, Weld, Move 2, QA Inspect, and Move 3, along with their respective processing times and the flow of parts through the process. Let's get started.

After this response, there's a long pause. And then Copilot produces:



Not even close to a Value Stream Map! I reply:

This isn't what I was expecting at all. I don't see where the Prep, Roll, Move 1, Weld, Move 2, QA Inspect, and Move 3 process steps are, along with their respective processing times and the flow of parts through the process, on these graphics at all. Want to take another try at it?

Copilot replies:

I apologize for the confusion. Unfortunately, as a text-based AI, I'm unable to create visual diagrams or process maps. However, I can guide you on how to create one.

Here's a textual representation of how your Process Map might look:

1. Prep (10 min/part): This is the first step where the initial preparation of the parts takes place.
2. Roll (10 min/part): After preparation, the parts go through the 'Roll' process.
3. Move 1 (3.3 min/part): The parts are then moved to the next process step.
4. Weld (20 min/part): Here, the parts are welded.
5. Move 2 (3.3 min/part): The parts are moved again to the next step.
6. QA Inspect (5 min/part): Quality Assurance inspection takes place in this step.
7. Move 3 (3.3 min/part): Finally, the parts are moved to Process #2.

Each of these steps is sequential, and the output from one step becomes the input to the next. All steps are manned by one operator who is cross trained on all other process steps. The demand rate from Process #2 is 6 parts per hour, and Mfg. Stores releases a batch of 6 sheets to Process #1 every hour.

You can use any flowchart or process mapping software to create a visual representation of this process. Each step would be represented by a box (or other shape), and arrows would indicate the flow from one step to the next. The processing time for each step can be included in or below each box.

I hope this helps, and I apologize for any misunderstanding. If you have any other questions or need further clarification, feel free to ask! 😊

It's not a picture, but it is a good textual description of a Value Stream Map. Copilot says it's not optimized to respond back with graphics so now we know one of its limits. Calculating Process #1's cycle time leads to further unexpected answers, and it appears time to move on to the next phase.

The Analyze Phase

The following questions should help us locate areas to improve the performance of Process #1:

- Is Process #1 currently capable of meeting Process #2's demand? How do you know?
- At what process step is the bottleneck/constraint in Process #1?
- Using Taiichi Ohno's "Seven Deadly Wastes" as a guide, which of the process steps should be considered "Non Value Add"?

Copilot responds with:

Let's analyze Process #1 based on the information you've provided:

1. Is Process #1 currently capable of meeting Process #2's demand?
 - a. Process #1's total output time per part is the sum of the processing times for each step: 10 (Prep) + 10 (Roll) + 3.3 (Move 1) + 20 (Weld) + 3.3 (Move 2) + 5 (QA Inspect) + 3.3 (Move 3) = 55.2 minutes/part. This equates to an output rate of approximately 1.08 parts/hour (60/55.2).
 - b. Process #2's demand is 6 parts/hour.
 - c. Therefore, Process #1 is currently not capable of meeting Process #2's demand.

2. At what process step is the bottleneck/constraint in Process #1?
 - a. The bottleneck in a process is the step that has the longest processing time. In Process #1, the Weld step has the longest processing time (20 minutes/part), so it is the bottleneck.
3. Which of the process steps should be considered “Non Value Add”?
 - a. According to Taiichi Ohno’s “Seven Deadly Wastes”, any activity that does not add value to the product from the customer’s perspective is considered waste. In the context of Process #1, the Move 1, Move 2, and Move 3 steps could be considered non-value-adding activities, as they involve moving parts around without transforming or improving them.

Remember, the goal of Lean Six Sigma is to improve process efficiency by reducing waste and eliminating bottlenecks. I hope this analysis helps guide your improvement efforts! 😊

We’re getting back on track again. Here’s my assessment of the AI answers:

- Process Capability: Copilot correctly answers Process #1 is incapable of meeting Process #2’s demand, but its logic is flawed. Process #1’s output rate is 3 parts/hr., not 1.08 parts/hr.
- Bottleneck/Constraint: Copilot’s answer and logic are correct. “Weld” is the bottleneck because it has the slowest processing rate in the process.
- NVA Steps: Copilot is correct in stating that the three “Move” steps are Non-Value Add. But Copilot should have also included “QA Inspection” since it does not involve transforming or improving the parts.

Copilot has been helpful in the “Analyze” phase, but the responses aren’t as complete or reliable as I would like.

The Improve Phase

Now for recommendations and improvements. I pose the following:

- If I can make only one change, what should I do to make Process #1 capable of meeting Process #2’s demand?
- What additional changes should be taken to make Process #1 more efficient?

Here’s Copilot’s response:

1. If you can make only one change to meet Process #2’s demand:
 - a. The bottleneck in Process #1 is the “Weld” step, which has the longest processing time of 20 minutes per part. If you can reduce the time taken for this step, it would increase the overall output of Process #1, thereby helping to meet Process #2’s demand.
2. Additional changes to make Process #1 more efficient:
 - a. Eliminate Non-Value-Add Activities: The “Move 1”, “Move 2”, and “Move 3” steps could be considered non-value-adding activities as they involve moving parts around without transforming or improving them. If there’s a way to reduce these movements or combine them with other steps, it could lead to efficiency gains.
 - b. Cross-Training: You mentioned that all operators are cross-trained and know how to perform the other process steps. You could leverage this by

dynamically assigning operators to different steps based on demand and bottlenecks.

- c. Continuous Improvement: Implement a culture of continuous improvement where operators are encouraged to suggest improvements to the process. Small incremental improvements over time can lead to significant efficiency gains.

Remember, the goal of Lean Six Sigma is not just to improve efficiency but also to maintain or improve quality. Any changes should be monitored to ensure they do not negatively impact the quality of the output. Good luck with your project! 😊

Copilot correctly identifies increasing output at “Weld” as the most effective change to make to meet Process #2’s demand. Cross-training appears, but without an explicit recommendation to move workers from other steps to Weld.

I agree with improving Process #1’s efficiency by eliminating non-value adding “Move” steps, however Copilot doesn’t take the step of calculating the capacity of the three steps to conclude that the cut won’t impacting productivity.

It’s also noteworthy that the chatbot only obliquely mentioned improving process quality (i.e., increasing Prep, Roll, Weld Cpk) as a way of making the process more efficient by reducing or eliminating the QA Inspection step. There was no mention of using single piece flow for efficiency, but I’ll give this a pass since the benefit of reduced WIP has to be greater than the increased handling cost from implementation.

The Control Phase

Finally, we arrive at Control:

- What other tools or controls should the team implement to ensure the new process continues to operate as expected?
- What final steps should management, the stakeholders, and the team take to wrap up this project and recognize its success?

Copilot’s response:

Here are some tools and controls the team can implement to ensure the new process continues to operate as expected:

1. Statistical Process Control (SPC) Charts: These can help monitor the process performance over time and detect any variations that could indicate a problem.
2. Control Plan: This is a detailed plan that outlines the steps necessary to maintain the improvements, including who is responsible for each step, what actions they should take, and how often.
3. Standard Operating Procedures (SOPs): Update the SOPs to reflect the changes made to the process. This will ensure everyone knows the correct procedures to follow.
4. Training: Ensure all operators are trained on the new process and understand the importance of maintaining the improvements.
5. As for wrapping up the project and recognizing its success, here are some final steps:

6. **Project Review:** Conduct a final project review meeting to discuss the project's successes, challenges, and lessons learned. This is also a good time to compare the project's outcomes with the original goals set in the Project Charter.
7. **Documentation:** Document all changes made, results achieved, and lessons learned. This will be useful for future projects and for anyone who might work on this process in the future.
8. **Communication:** Communicate the project's success to all stakeholders. This could be in the form of a project report, a presentation, or a company-wide announcement.
9. **Recognition:** Recognize and celebrate the team's hard work and the success of the project. This could be a simple thank you, a team lunch, or formal recognition in front of the company.

Remember, the goal of the Control phase is to ensure the improvements are sustained over time. Regular monitoring and continuous improvement are key. Congratulations on your successful project! 😊

Can't argue here. Copilot has given us a great checklist to use in Control as we take the final steps to wrap up our project.

Summary

So, how well did Copilot do compared to a Black Belt with 20 years of experience? When it comes to retrieving checklists, definitions, and basic textbook information: Great. It's fast, easy and provides an enjoyable conversational experience. However, as of writing, I wouldn't rely on it for creating technical graphics or making autonomous decisions. Of course, this is a small snapshot of where Artificial Intelligence is now, today. At the rate AI is advancing, I won't be surprised when this or other applications handle more demanding functions soon. And in many ways, the question misses an important point. AI is a great research tool right now and it will likely eventually be able to do all of the analysis. What it's never going to be able to do is the implementation of the improvements or working with the team and business to create a successful and meaningful change. For that, you'll still need to rely on your hard earned Black Belt skills and experience.



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