Università di Pisa

Individual method evaluation: Five Whys

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1 Introduction

The purpose of this report is to introduce and describe the 5 Whys method, starting from its inception by *Sakichi Toyoda* and tracing its developments over the years.

When seeking a solution to a problem, starting with the outcome, examining its causes, and iteratively questioning the reasons proves beneficial. This fundamental and frequently successful problem-solving method encourages profound thinking via inquiry and is easily adaptable, and suitable for addressing a wide array of issues. This technique belongs to the class of qualitative methods and its application provides an organized approach to problem identification and fixing. As can be seen from figure 1, it is mainly used in the collection phase, but it can also be used to evaluate the severity of the problem by digging into its causes.

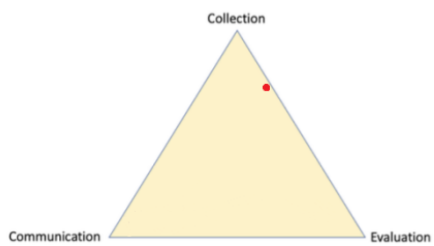

Figure 1: 5 Whys diagram position

The subsequent paragraphs will describe the different phases of the process that characterize its functioning and the various fields of application, along with their respective benefits and criticisms. In the concluding section, we will discuss the potential integration of quantitative approaches to bring improvements to the 5 Whys method.

2 Background Literature

Originally crafted by Sakichi Toyoda, this technique found its roots within the Toyota Motor Corporation during the developmental phases of its manufacturing methodologies. It constitutes a crucial part of the initiation into the Toyota Production System, standing as a pivotal element in problem-solving training. *Taiichi Ohno*, the architect behind the Toyota Production System, characterized the five whys method as "the cornerstone of Toyota's scientific approach," emphasizing that by iteratively asking "why" five times, both the essence of the problem and its solution become clearer (Serrat, 2009). This approach was initially designed not for root cause analysis[1] but to grasp the necessity for

[1] "RCA is an umbrella term for methodologies and tools for the retrospective and structured investigation of adverse incidents, near misses, and sentinel events." (Liepelt, 2023)

new product features or manufacturing techniques. However, the tool has transcended Toyota's sphere and is now integral within *Kaizen*, *lean manufacturing*, *lean construction*, and *Six Sigma* methodologies[2].

3 Description

The 5 Whys technique delves into the fundamental causes behind a problem through a series of iterative questions. Its goal is to target problem-solving efforts towards addressing the root cause rather than merely addressing the surface-level symptoms. By repeatedly asking "Why?" and using each subsequent answer as a basis for the next question, this method uncovers the underlying issues. While the conventional term suggests five questions, the actual number of iterations might be fewer or more, making it a flexible guideline rather than a strict rule. Typically, asking "Why" five times helps to systematically uncover layers of symptoms obscuring the core issue, yet sometimes, fewer or additional iterations are necessary for a comprehensive understanding.

The chapter *The Five Whys Technique* of the book *Knowledge Solutions* by Serrat describes the five basic steps (Figure 2) to conduct Five Whys in a company. The Five-Whys exercise is vastly improved when applied by a team and there are five basic steps to conducting it:

• The first step is of course to gather a team and craft a mutually agreed-upon problem statement. Once these steps are completed, it should be decided if additional individuals are necessary to solve the issue.

• Now that it's all settled, the next step is to engage the team in the first round of questioning by asking "why" the problem is occurring. Expect several plausible answers and document these responses either on a flip chart, whiteboard, or index cards affixed to a wall for visibility and discussion.

• The iterative cycle starts now: repeat the process again for each of the successibe "why" statements documenting on the flip chart, whiteboard, or index cards. Then associate each subsequent answer with its initial query, expanding the understanding of causation. Keep going on until the "why" statement ceases to yield new valuable insights. As told before, five is a rule of thumb, so in case the root cause remains elusive, persist with further questioning to get to the root cause.

• From the various responses obtained from the final "why," focus on identifying systemic causes underlying the problem. Now engage again the team to discuss and agree upon the most probable systemic cause among all the possibilities. After that, conduct a review session following the team's analysis and

[2] These approaches all share a common goal of continuous improvement and efficiency enhancement within different domains, be it manufacturing, construction, or overall process optimization in various industries.

show the findings to others involved, looking for validation and consensus on the logical analysis.

- Once the most probable root cause of the problem has been identified and the logic behind the analysis confirmed, developing suitable corrective actions aimed at eliminating this root cause from the system is the final step. Depending on the requirements, the actions may involve collaborations with others but it is extremely important to include the team in planning and applying these actions, based on their insights and inputs.

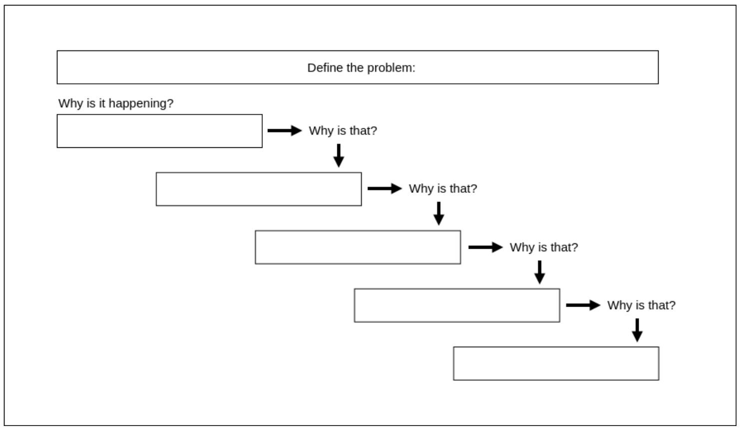

Figure 2: 5 Whys Template [Serrat 2009]

4 Application

Using the 5 Why Analysis as a brainstorming tool to drive further investigations proves to be highly effective across diverse disciplines and industries, showing its nearly universal applicability.

4.1 Case study - 5 Whys in engineering education

In this sub-section, a case study taken from the *Journal of STEM Education* is briefly explained. In this article, the five whys technique effectiveness was tested in five upper-level civil engineering classes at Northwestern University from 2012 to 2015. In the beginning, it was highlighted how problem-solving skills are extremely important, especially in engineering practice. Indeed when a product is defective or does not meet the design standards, the engineers involved in product design should fix the issue. Therefore they need to switch back, discover what the problem was, and finally adjust it. Given this premise, the issue posed by the article was as follows: instructors, in their role as teachers, correct projects, assignments, and quizzes for students, yet they do not ask them to go back and inquire and understand on their own what they have done wrong. On the other hand, students, in most cases, focus on the grade received, giving less importance to the teacher's comments on their mistakes, risking not fully understanding them and potentially falling into the same errors in the future. The task of this experiment was to prepare students to become better problem solvers by applying the five whys techniques in order to find their own mistakes and correct them. The instructor in the course acted as the customer who was sad with the performance of the product (the homework assignment). The assessment of this method took place through the analysis of written surveys and interviews with students and the results suggested that The Five Whys method proved effective for many of them, especially in preventing repeated mistakes. Analyzing the students' comments also revealed their tendency to halt at symptoms without delving into the root cause.

4.2 Advantages and Limitations

Regarding the advantages, they have been thoroughly discussed during the explanation of this method and refer to its ability to identify root causes, promote teamwork, and prevent the repetition of the same mistakes in the future. But despite its widespread use, Five Whys technique has faced several criticisms over the years. Among these are:

Simplicity: This aspect can be seen as both a pro and a con. Its accessibility makes it easy to use; however, its simplicity might not ensure a deep enough analysis of the causes to effectively solve the problem.

Scarcity of quantitative data: This method is predominantly qualitative, and the lack of data support could pose a problem in the accuracy of conclusions.

Bias occurrence: During the process, the team can be influenced by the subjectivity of its members, driven by their knowledge and expertise, in analyzing the questions and their respective answers, thereby affecting the accuracy of the conclusions.

5 Quantitative Improvements

Given the qualitative nature of this method, to improve the results of the Five Whys and make it more concrete and data-driven, it could be integrated with some quantitative methods.

Pareto Diagram: it is the primary tool for visually displaying essential information in root cause analysis. As can be seen from figure 3a, bar graphs are used to display problems in order of importance (frequency). The application of the five whys method could be to dig into the results highlighted by the Pareto analysis ensuring greater consistency[3].

[3] Retrieved from https://www.ease.io/5-root-cause-analysis-tools-for-more-effective-problem-solving/

Scatter Plot diagram: a scatter plot or scatter diagram (figure 3b) utilizes pairs of data points to reveal relationships between variables. It serves as a quantitative approach to ascertain the correlation between two variables, a useful method to test potential causes identified in the five whys method.

(a) Pareto Chart example

(b) Scatter Plot example

Figure 3: Diagrams

References

Card, A. J. (2016). The problem with '5 whys'. *BMJ quality & safety*.

Foster, P. (2018). *5 root cause analysis tools for more effective problem-solving.* Retrieved from `https://www.ease.io/5-root-cause-analysis-tools-for-more-effective-problem-solving/`

Key, B. A. (2019). Five whys root cause system effectiveness: A two factor quantitative review.

Liepelt, S. H. . K. R., S. (2023). Team experiences of the root cause analysis process after a sentinel event: a qualitative case study. *BMC Health Services Research*, *23*.

Moaveni, S., & Chou, K. (2017). Using the five whys methods in the classroom: How to turn students into problem solvers. *Journal of STEM education*, *17*(4).

Murugaiah, U., Benjamin, S. J., Marathamuthu, M. S., & Muthaiyah, S. (2010). Scrap loss reduction using the 5-whys analysis. *International Journal of Quality & Reliability Management*, *27*(5), 527–540.

Serrat, O. (2009). The five whys technique. *Knowledge Solutions*.

Voehl, F. (2016). 5 whys. In *The innovation tools handbook, volume 2* (pp. 1–10). Productivity Press.