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ЕКОНОМІЧНІ, ПРАВОВІ ТА СОЦІАЛЬНО-ПСИХОЛОГІЧНІ
АСПЕКТИ ЗАБЕЗПЕЧЕННЯ ЯКОСТІ ТА ЕФЕКТИВНОСТІ
ПРОЦЕСІВ І СИСТЕМ. СУЧАСНА ОСВІТА

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**Serhii Prystynskyi, PhD, Head of the production process support and optimization
department,**
KOSTAL Ukraine LLC, s.prystynskyi@kostal.com

**EFFECTIVENESS OF USING ARTIFICIAL INTELLIGENCE (AI) IN
TECHNOLOGICAL PROBLEM SOLVING**

In the modern world, it is difficult to imagine the functioning of technological processes and systems without the emergence of problems, which have various factors such as technical as well as economic. The complexity of managing problems and finding solutions encourages the modification of existing ones and the search for new approaches.

The *PDCA (Plan, Do, Check, Act)* methodology is known as the Deming's cycle and the manifestation of excellence leadership demonstrate a high level of effectiveness in solving technological and other problems. [1].

Despite being quite effective, the right approach to solving problems, in particular finding root causes, the employing of *PDCA* requires a number of meetings involving team resources. This leads to time costs that vary depending on the complexity of the problem.

Recently, the use of *artificial intelligence (AI)* as an assistant to solve various tasks and problems has become increasingly popular. The process of using *AI* involves interaction between humans and machines, which is noted as a potential for significantly increasing the efficiency of problem solving [2].

During the experiment, 27 rounds of root cause searches for a complex problem were conducted using the *5 Why* methodology and the *Ishikawa's diagram*. These tools are an integral part of the *Plan* phase in the *PDCA* methodology. As a result, it was established that the average time spent by the team on finding the root cause for the *5 Why* was 8 min (from 3 to 12 min) (confidence level $p = 0.88 > 0.05$) and using the *Ishikawa diagram* – 19 min (from 17 to 25 min) (confidence level $p = 0.88 > 0.05$). The high value of p indicates that it is impossible to reliably predict the duration of the root cause identification process, and the processing time can vary significantly, depending on many factors, such as the motivation of the participants, the level of knowledge and qualifications, etc. That is, the total duration of problem solving is on average 743 min or 12.38 h. In this case, one round takes 0.45 h. Thus, *FTE (Full Time Equivalent)* could be 0.08 per month with a working week of 40 h. Depending on the number of problems, it is possible to determine the resource that needs to be used to find the root causes, which can be calculated by formula 1:

$$N = FTE * n, \quad (1)$$

where *FTE* - Full Time Equivalent, which is calculated by formula 2 [3]:

$$FTE = \frac{\text{Total activity time}}{\text{Total available time}}; \quad (2)$$

n – number of problems per month.

Understanding the number of problems, it is possible to calculate the required resource N using formula 1. Thus, assuming that 10 problems arise each month, you need to allocate a resource of 0.8*FTE*, which might be equivalent to one employee each month.

Thus, in trying to properly solve problems, organizations waste personnel resources on non-value added activities.

Subsequently, an experiment was conducted using the integrated *AI* assistant in the ZOOM software. A Whiteboard was created, where in turn a request was made to form an Ishikawa diagram and identify possible root causes for the technical problem “Appearance of flash in a molded polymer part”. Fragments of the formed answers are shown in Figures 1 and 2.

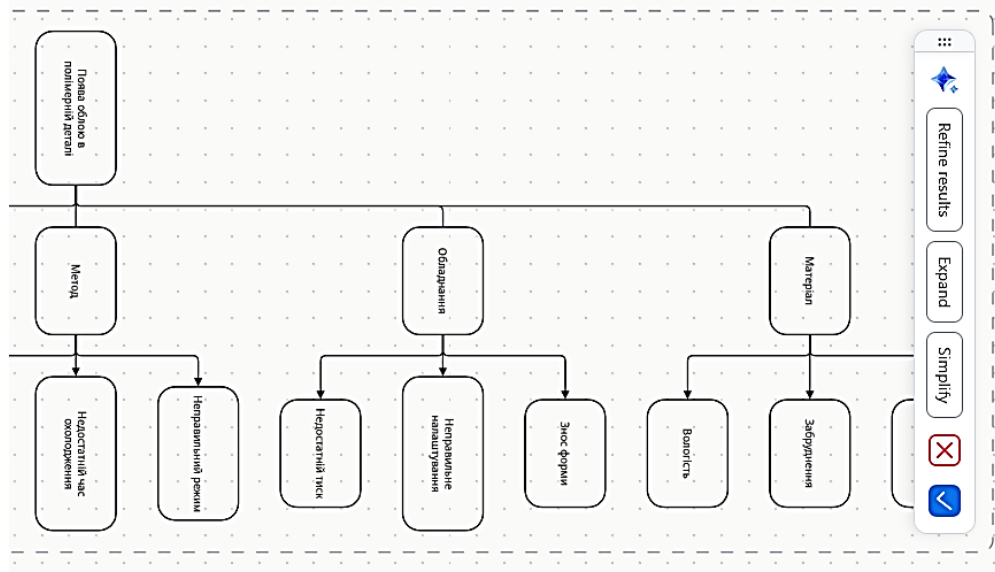


Fig. 1 – Fragment of an Ishikawa Diagram generated by AI

Therefore, Figure 1 shows the formed Ishikawa diagram by basic categories. The time spent on formation, taking into account the interaction between human and machine, was 2 min.

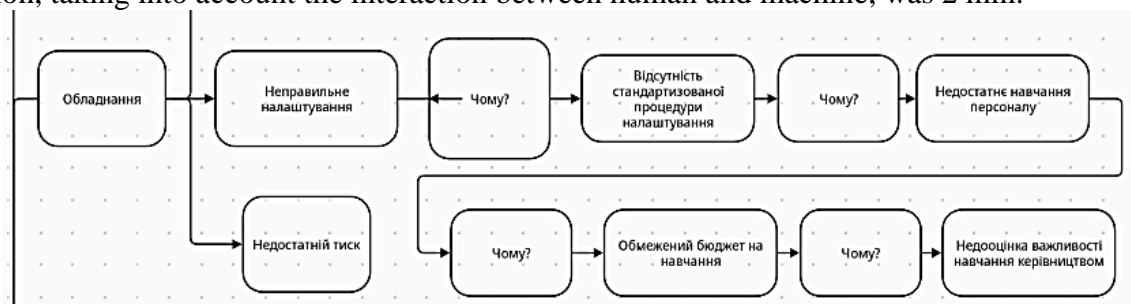


Fig. 2 – Fragment of 5 Why generated by AI

The time spent by AI on forming the root cause for 5 *Why* (Fig. 2) was 1 min.

Thus, the estimated duration of the root cause round can be 3 min. At the same time, 15 min are spent on discussion. Therefore, the total duration is 18 min, or 0.3 hours. For the entire complex of 27 rounds, the time spent is 8.1 hours, which is 53% less than in the standard approach without the use of *AI*. It is worth noting that the proper level of quality during the search for root causes can only be achieved with sufficiently qualified and motivated personnel, because a person makes the very choice of solution to be based on additional aspects, technologies, local law etc.

References

1. Prystynskiy, S., Palyvoda, O., Plavan, V., Lozovyi, O., Hrytsenko, A. (2024). Devising an innovative method for improving decision-making efficiency at polymers processing companies in automotive industry. *Eastern-European Journal of Enterprise Technologies*, 6 (13 (132)), 6–18. <https://doi.org/10.15587/1729-4061.2024.317462>
2. Joksimovic, S., Ifenthaler, D., Marrone, R., De Laat, M., & Siemens, G. (2023). Opportunities of artificial intelligence for supporting complex problem-solving: Findings from a scoping review. *Computers and Education: Artificial Intelligence*, 4, 100138. <https://doi.org/10.1016/j.caeai.2023.100138>
3. Amri, A. (2023). Workforce design and employee workload using the full-time equivalent method at PT XZY. *International Journal of Engineering, Science and Information Technology*, 3(2), 60-65. <https://doi.org/10.52088/ijesty.v1i4.445>