MAPIC - A new comprehensive methodology for process improvement

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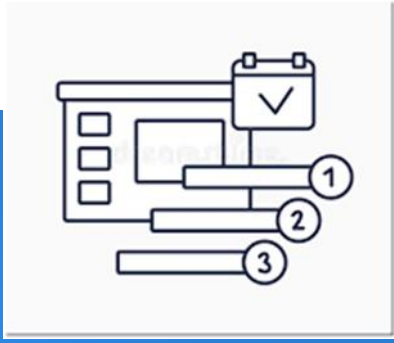


PRESENTATION STRUCTURE

- The concept of Process Improvement (PI)
- Context of the work
- Work goals
- Revision of PI methodologies
- Research gaps
- The Methodology MAPIC
- Main conclusions and further work

The concept of PI

- Process improvement (PI) is a widely practiced strategy in manufacturing and service companies around the world to improve products or services quality, reduce lead times, optimize costs, and improve delivery reliability, in order to achieve performance excellence and customer satisfaction (Aichouni et al., 2021).

- According to Sousa et al. (2020) there are two types of PI: (i) Systematic problem solving and (ii) improvement projects. The difference between these two types occurs from the identification of the need for improvement. Improvement projects are linked to the strategic objectives of the company (clients, competitors, etc.) and systematic problem solving refers to a set of activities that will be executed in a reactive or preventive way to a problem.

The concept of PI

Other designations for PI are:

Problem solving, Work improvement, Continuous improvement

However, the latter designation presupposes that there is a culture of continuous improvement within the organization, possibly supported by organizational management practices and models that encourage employees to regularly identify and formulate improvement proposals. Despite the difference between the two designations, in both cases, when it is decided to improve something related to the production process, there is a need for process improvement.

CONTEXT OF THE WORK

Do we need PI?

Modern production challenges:

- Increasingly shorter product life cycles;
- Rapid technological developments, particularly in information and communication technologies;
- Frequent changes in demand, requiring companies' strategic plans to be more carefully designed and with shorter planning horizons;
- Social and political changes, such as the phenomenon of globalization and the expansion of the European Union to Eastern European countries;
- Greater competition;
- Products becoming increasingly customized, complex, and intelligent;
- Digitalization of products;
- Geopolitical uncertainty;
- Climate change.

CONTEXT OF THE WORK

Do we need PI?

Real short story:

A few years ago, on a television program about road safety, the interviewer asked a road safety expert the following question:

"Don't you think that the high accident rate in Portugal is due to the fact that all drivers consider themselves to be good drivers?"

Personally, I was expecting the expert to agree with the interviewer, but to my surprise, he replied that this was not the problem! I was astonished!

The expert's answer was:

"The problem is that no driver makes an effort to keep improving their driving."

Since then, I have understood the need for process improvement, or, if we prefer, continuous improvement.

CONTEXT OF THE WORK

Do we need PI methodologies?

Independently of the Interpretations of PI meaning, there is a widespread consensus that the application of PI methodologies can bring internal and external benefits for the organizations.

- At the internal level, the application of process improvement methodologies promotes the definition of a work structure, with clear stages and guidance in the form of objectives, with tasks to lead improvement efforts most efficiently.
- At the external level, process improvement methodologies are widely recognized in the market, attributing credibility to companies that adopt them correctly (Hoang, 2014).

WORK GOALS

The research questions of this work can be formulated as the following two hypotheses:

H1: There are differences between the major PI methodologies and gaps not covered by them;

H2: A new PI methodology may mitigate the gaps identified in the existing PI methodologies.

Revision of PI methodologies

The most common and referenced methodologies in the literature:

- PDCA cycle - Plan-do-check-act, whose authorship is attributed to Shewhart and later developed by Deming (Shewhart, 1939; Deming, 2000);
- Six Sigma - Define, Measure, Analyze, Improve, and Control, associated with Smith at Motorola (Smith, 1993),
- DMAIC;
- QC Story - Quality Control Story, attributed to Ishikawa (Ishikawa, 1985);
- 8D - Eight Disciplines, attributed to Ford Motor Company (Ford Motor Company, 2002);
- TOC - Theory of Constraints, authored by Goldratt (Goldratt, 1994); and the
- Lean Thinking, credited to Womack and Jones (Womack and Jones, 1996), in short Lean.

Revision of PI methodologies

In addition to the mentioned methodologies, there are other methodologies:

- Sometimes defined within the organizations themselves, mainly in larger organizations, such as 4Q improvement methodology from ABB company;
- Variants of the mentioned methodologies, such as DMAIV - Define, Measure, Analyze, Design, and Validate, derived from DMAIC, but applied to new processes/products;
- And methodologies that result from the combination of them, such as Lean – Six Sigma. However, these cases will not be addressed in this work because either they do not assume significance in the bibliographic context.

Comparision between PI methodologies

	Process Improvemnt Methodologies						
	PDCA	**Six Sigma**	**DMAIC**	**QC Story**	**8D**	**TOC**	**Lean**
Phases	*1- Plan* *2- Do* *3- Check* *4- Act*	*1- Define* *2- Measure* *3- Analyze* *4- Improve* *5- Control*	*1- Define* *2- Measure* *3- Analyze* *4- Improve* *5- Control*	*1- Identify the Problem* *2- Observe* *3- Analyze* *4- Plan the Action* *5- Act* *6- Check* *7-Standardize* *8- Conclude*	*1- Create a team* *2- Define and describe the problema* *3- Contain the problema* *4- Identify root causes* *5- Choose corrective actions* *6- Implement and validate corrective actions* *7- Take preventive Measures* *8- Congratualate your team*	*1- Identify constrain* *2- Exploit constrain* *3-Subordinate processes* *4- Elevate constrain* *5- Repeat cycle*	*1- Identify the product's value* *2- Identify the value stream* *3- Create flow* *4- Establish pull control* *5- Seek perfection*
Goal	Minimize the process problems	Reduce variation	Minimize the process problems	Minimize the process problems	Minimize the process problems	Manage constrain	Remove waste
Focus on	Any process Problem (Comprehensive methodology)	Quality variation	Any process Problem (Comprehensive methodology)	Any process Problem (Comprehensiv e methodology)	Any process Problem (Comprehensive methodology)	System constrains	Process flow
Main effects	Depends on the problem, but minimize recursive problems; Create dynamics of continuous improvement.	Uniform process output; Less waste; Improved quality. Create dynamics of continuous improvement	Depends on the problem, but minimize recursive problems; Create dynamics of continuous improvement.	Depends of the problem, but minimize recursive problems; Create dynamics of continuous improvement.	Depends on the problem, but minimize recursive problems; Create dynamics of continuous improvement.	Increased production rate; Less waste; Improved quality; Create dynamics of continuous improvement.	Reduced flow time; Less waste; Improved quality; Create dynamics of continuous improvement.
Aplication dificulty	Low	Hight	Medium	Medium	Hight	Hight	Medium
Improvement management	Operators	Top managers	Middle managers; Operators.	Middle managers; Operators.	Middle managers	Top managers	Middle managers
known case studies	Very high	High	Very high	Medium	Medium	Low	Very high
Limitations	Limited for simple problems; Requires discipline to maintain the multiple cycles.	Time and resources consuming; Trained collaborators; Rigid methodology.	Little detailed; Dependent of the tools employed.	Time consuming; Bureaucratic.	Time consuming; Bureaucratic; Trained collaborators.	Little operator intervention; Trained collaborators; Rigid methodology.	Cultural change; Trained collaborators; Rigid methodology.

(adapted from Nave, 2002, and Aichioni et al., 2021)

Main results of the comparison and research gaps

1- The presented methodologies do not have the same phases and are characterized by different outcomes;

2- Three of the methodologies, namely Six Sigma, TOC, and Lean, have specific focuses, while the others are flexible for any process improvement;

3- All of them present, as one of their main effects, the creation of continuous improvement dynamics, which suggests that process improvement in a company should follow a certain methodology. However, this continuous improvement is reactive for all because do not consider a phase that open the possibility for improvements without the existence of a problem (gap);

4- Concerning the application difficulty, PDCA methodology has the lowest degree of difficulty, and it seems to have a positive correlation between the difficulty and the methodologies that have specific focuses, Six Sigma, TOC, and Lean;

Main results of the comparison and research gaps

5- For the improvement management, it varies from the worker level to the top manager level, and it is linked with the application difficulty of the methodology;

6- Known case studies are higher for the less difficult methodologies;

7- All of them have been validated to some extent because case studies with their implementation are reported in the literature;

8- None of the methodologies include validation of the proposed improvement before its implementation in their phases, which could be considered a limitation for all of them (gap).

Hypothesis H1 is validated and opens space for the creation of a new one.

The Methodology MAPIC - Methodology of Analysis and Process Improvement Completed

In short, completed, in the sense that mitigates the gaps of the other ones. MAPIC is supported by the following eight main steps:

1. Selection of the process aspect to improve;
2. Selection of the products or processes to analyze;
3. Record, synthesis, and analysis of the aspect to improve;
4. Formulation of the improvement plan;
5. Validation of the improvement plan;
6. Scheduling the implementation of the improvement plan;
7. Implementation and control;
8. Final validation of the implementation.

Special remarks of the MAPIC

(1) Selection of the process aspect to improve

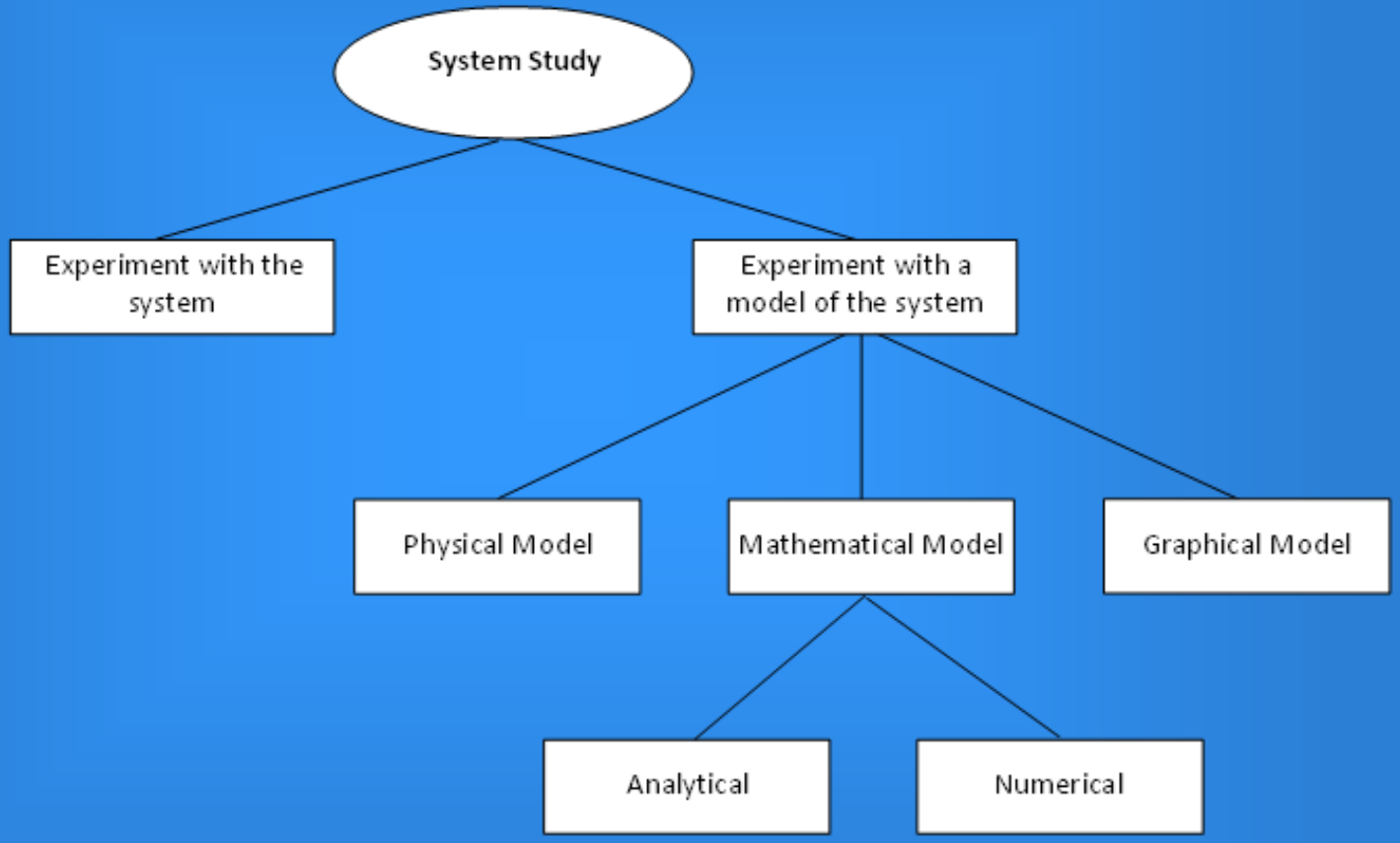
This phase emphasizes the need, before starting any study on process improvement, to first identify which aspect of the process one intends to improve. This activity fits into a proactive philosophy of continuous improvement, where problems are not necessarily identified when starting an improvement process. In summary, the start of an improvement process does not necessarily have to begin with the existence of a problem, as is the case with the methodologies reviewed in the previous section.

Special remarks of the MAPIC

(5) Validation of the improvement plan

This phase emphasizes the need to validate the improvement plan before its implementation. Validation should first validate the intended performance and subsequently, if necessary, the financial performance. In the initial validation, the aim is to assess whether the proposed plan will bring improvements to performance, and if confirmed, financial validation will evaluate whether the investment mainly ensures a payback aligned with the estimated life cycle for the processes under study..

How can be performed this validation



(Adapted of Law & Kelton, 1991)

Summary of the methodology MAPIC

The hypothesis H2 (A new PI methodology may mitigate the gaps identified in the existing PI methodologies) is considered theoretically validated, because, MAPIC presents differentiating elements from other methodologies and adds new functionalities to mitigate the existed gaps.

	MAPIC Methodology
Phases	*1- Selection of the process aspect to improve* *2- Selection of the products or processes to analyze* *3- Record, synthesis, and analysis of the aspect to improve* *4- Formulation of the improvement plan* *5- Validation of the improvement plan* *6- Scheduling the implementation of the improvement plan* *7- Implementation and control* *8- Final validation of the implementation*
Goal	Improve the process Performance or Minimize the process problems
Focus on	Any process feature to improve or any process problem (Comprehensive methodology)
Main effects	Depends of the problem, but can: - Improve critical activities for the process performance; - Improve the use of resources; - Improve the production layout; - Improve the control of the production flows; - Create dynamics of continuous improvement in a proactive way
Aplication dificulty	Medium
Improvement management	Middle managers
known case studies	Not known in this final version, but few in the initial version
Limitations	Time and resources consuming; Cultural change; Trained collaborators.

Conclusion

- (1) MAPIC is a methodology that will join the group of comprehensive methodologies, without a specific focus on the process characteristic to be addressed;
- (2) MAPIC demonstrates, from its first phase, a proactive continuous improvement approach, different from those analyzed, which are based on a reactive continuous improvement approach;
- (3) MAPIC validates the improvement proposal before its implementation, while the other methodologies are silent on this matter.

Further work

- it is intended to allocate a set of tools/techniques to support the various phases of MAPIC and
- present the results of its implementation in several case studies, which will validate the methodology to some extent in practical terms.

Thanks for your attention!

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