Innovative Agile Project Based Learning

Problem Solving fundamentals

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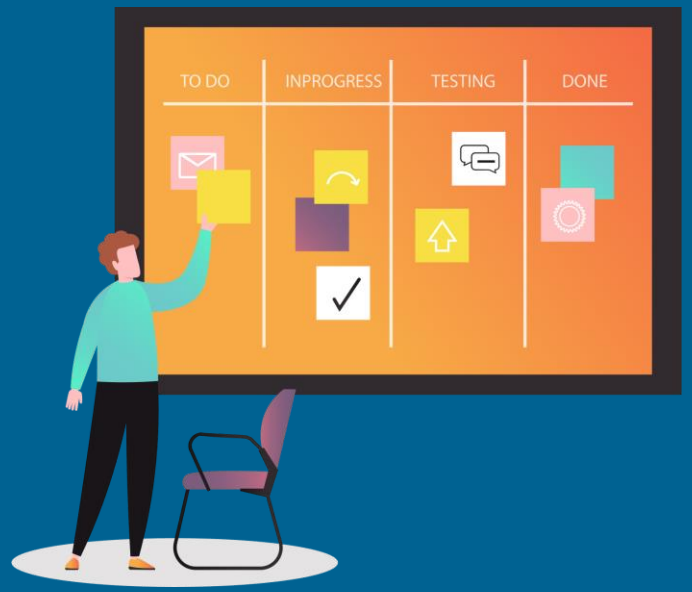
Agenda

- Definition of problem solving
- Problem solving principles
- Problem solving process steps/stages
- Skills for problem solving
- Class Activity

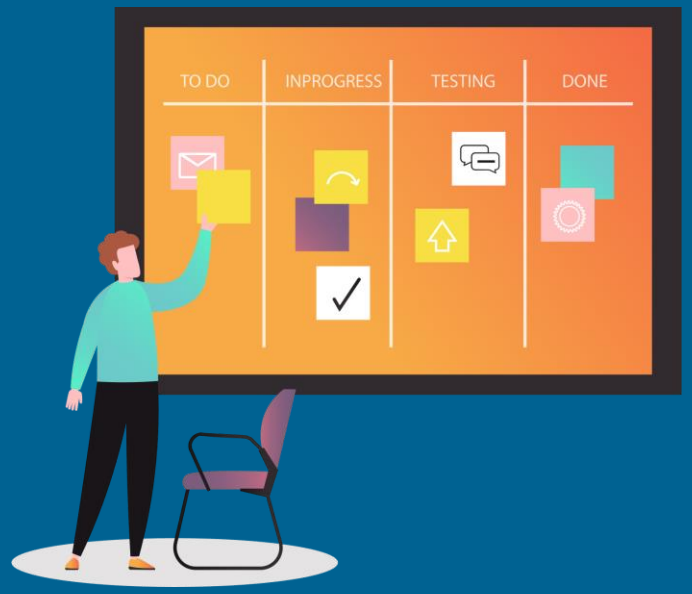
Problem solving definition

- Problem solving is a process aiming to remove an obstacle towards the achievement of an important goal.
- Problems can vary from simple to complex.
  - As simple are characterized problems that are related to simple tasks, there are sufficient knowledge about them and/or resources, and their solution involves generally simple actions.
  - As complex are characterized problems that are related to more complex task, have a lot of interdependencies with other factor of their environments, have lack of sufficient knowledge about them or resources and exist in an environment of uncertainty.



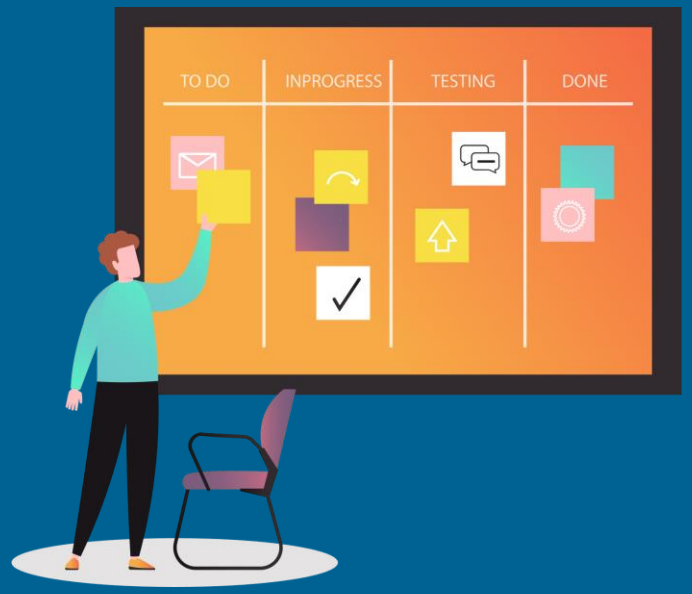
Preliminary of problem solving /1

- No problem solution should be caried out without substantial analysis, understanding and design no matter how complex it is.
- Otherwise, it is easy to reach to situation in which you may start wondering:
  - *If you solved the right problem*
  - *If you had selected a solution too quickly without study of its consequences or without having all the necessary information*
  - *The solution turned out to be too expensive and impractical.*



Preliminary of problem solving /2

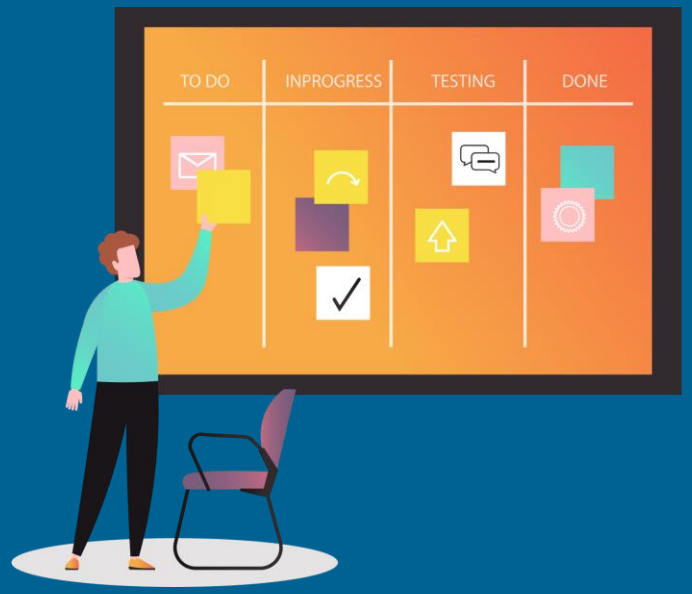
- Each problem requires a preliminary analysis in which will be evaluated if it is worth to be solved, the advantages from its solving and the cost of the solution.
  - This is the first step in effective problem solution.
- Other parameters that need to be considered is that:
  - Any problem-solving effort requires resources (time, money, etc.) that are not always available or unlimited.
  - If a problem is too simple or insignificant maybe it was not worth the effort or resources to solve it.



The 7 principles of problem solving /1

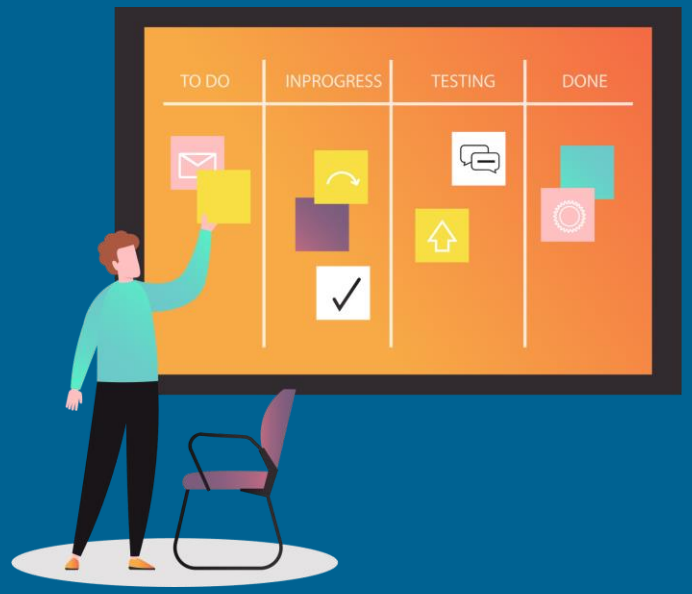
According to Nadler, G., & Hibino, S. (1998) there are 7 principles of effective problem solving. These are:

- **Each problem should be seen as unique.** Despite the similarities between problems, each problem has each own characteristics that differentiate it from others and make it unique. Its unique characteristics should be acknowledged before try to solve it.
- **Focus on the reasons to solve the problem.** By focusing on the purposes and benefits of a specific problem solving can be seen the larger picture and really assessed the value of the problem solving. As that, it is better to ask what we want to achieve from a problematic situation rather trying to identify what is wrong it. This approach will probably allow us to seek for a number of desired solutions.



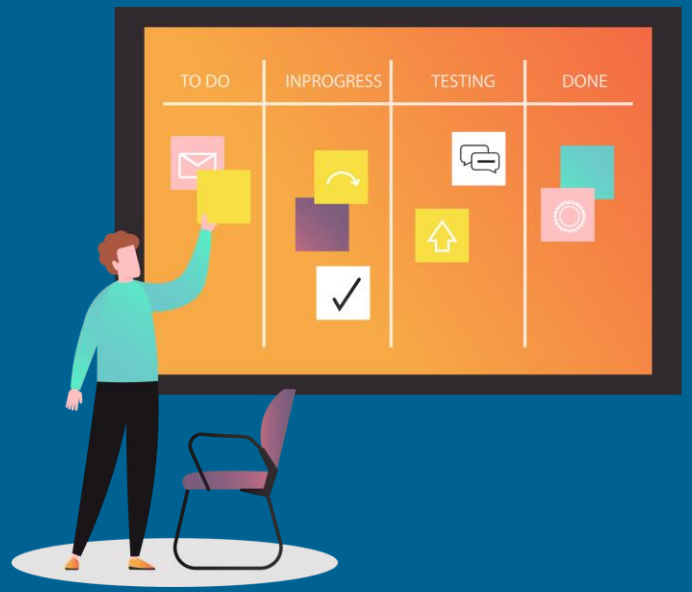
The 7 principles of problem solving /2

- **Seek solution using a long-term perspective.** To achieve that it is better sometimes to identify the ideal solution to a problem and in continuous working backwards to create a set of partial solutions that will server the ideal one.
- **View the problem from a systems approach.** To be achieved that each problem should be viewed as a part of a bigger system. This allows the better design and implementation of strategies and solutions that need to be applied in order to solve it.
- **Learn to work with minimal information.** Seeking for as much information as possible for problem is in many cases time-consuming or not feasible. On the other side, the existence of large amount of information may prevent from considering new or innovative solutions. However, a balance between to what is not enough information and what is enough information should be carefully evaluated.



The 7 principles of problem solving /3

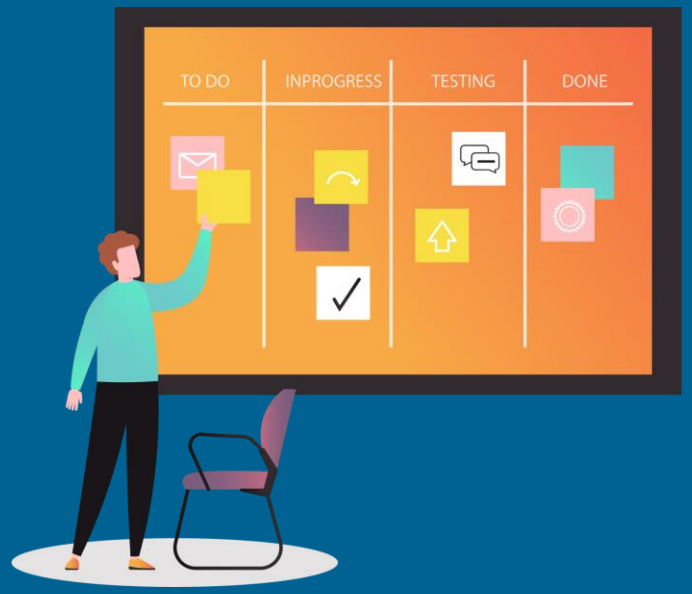
- **Keep the people factor in mind when developing solutions.** Each problem as well as its solution usually involves people that have a critical role to the overall success of the proposed solution. Therefore, any solution should take this factor into account and incorporate the necessary flexibility to deal with unexpected situations.
- **Incorporate the timeline principle.** Each problem solution consists of set of steps. The right sequence of these steps plays a critical role in successful problem solution and to the maximization of its results.



Problem solving process steps /1

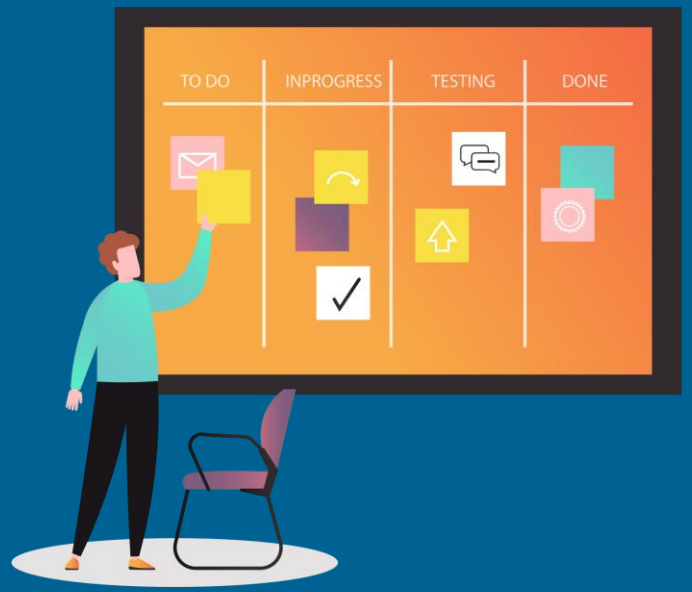
According to IOWA University of HR there are eight basic steps in problem solving process. These are:

1. **Define the problem**. To do that you must clearly identify what is the problem, how did you discover it, when it was started and for how long it is going on and if there is enough data to deal with it.
2. **Clarify the problem**. At this step should be identified the type/amount of data being available to understand the problem, the existence of additional resources to understand the problem, problem urgency and if it can or cannot affect the next stages of work.
3. **Define the goals**. At this step, the desired future state is considered along with the benefits of problem fixed state and the desired timeline for problem solving.



Problem solving process steps /2

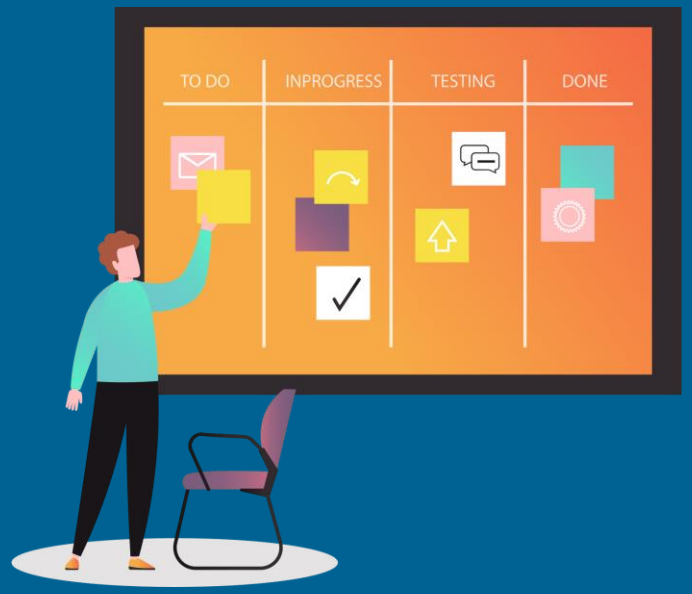
4. **Identify root cause of the problem.** At this step, possible causes of the problem are identified and prioritized. Also, the existence of necessary data for helping in problem root cause identification is examined.
5. **Develop action plan.** At this step, a list of actions required to address the root cause and prevent problem from getting to others is generated. Also, to each action for solving problem a timeline and a responsible person are assigned.
6. **Execute action plan.** At this step, the action plan created as a response to root causes of a problem is implemented and verify actions are completed.



Problem solving process steps /3

7. **Evaluate the results.** At tis step, the data collected from monitoring the action plan implementation are evaluated. Did projects goals defined in step 3 achieved? There were any unexpected or unforeseen consequences? If problem solved remove any problem-solving activities remaining. If problem is resolved, remove activities that were added previously to contain the problem.
8. **Continuously Improve.** At this step, reflect to problem solving design and implementation, look for possible alternative to solve problem and ensure that problem will not come back. Furthermore, communicate lessons learned to other stakeholders.

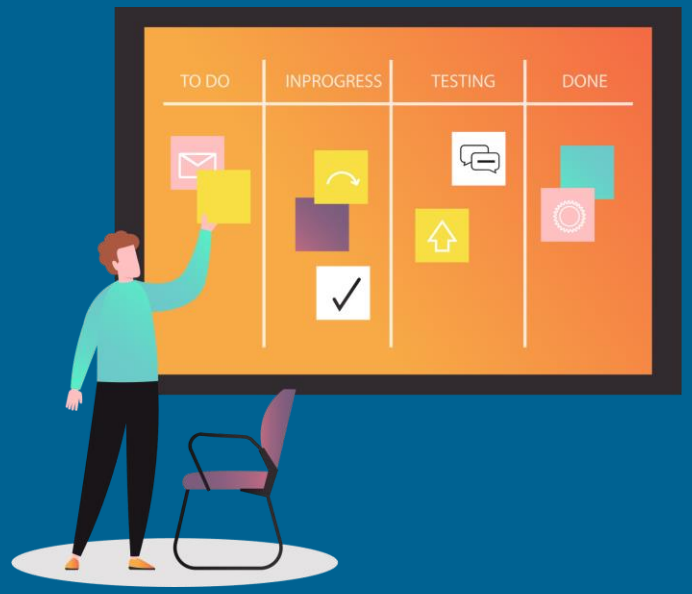
If needed, the 8-step problem solving process can be repeated for further improvement.



Simpler problem solving approaches

Several simplified approaches to previous problem-solving stages exist in the literature. These approaches combine two or more steps into one. A common model is the 4-stage approach. The stages identified in this model are:

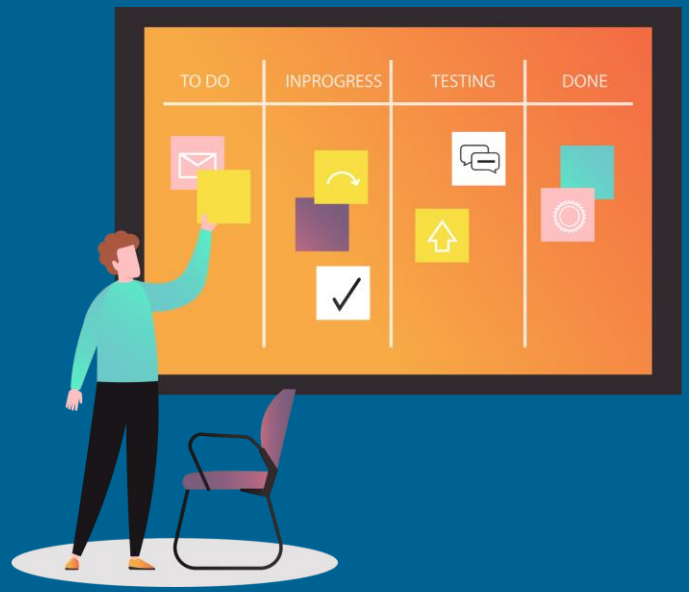
1. **Identifying problem.** Includes the definition of the problem, the identification of its root causes than its symptoms and the collection of relative problem data.
2. **Developing a solution.** Includes the stage of problem data analysis and the development of a set of problem solutions alternatives.
3. **Executing the solution.** Includes the selection of the best solution within the alternatives and the implementation of it.
4. **Assessing the solution.** Includes the stage of evaluation of problem solution implementation, and the improvement of the processes used for future reference.



Tools of problem solving process

There are several tools that can assist the various stages of problem-solving process. Problem solving tools fit into three basic categories:

- Visualizing Problem Structures,
- Displaying Data and Information, and
- Problem-Solving Techniques

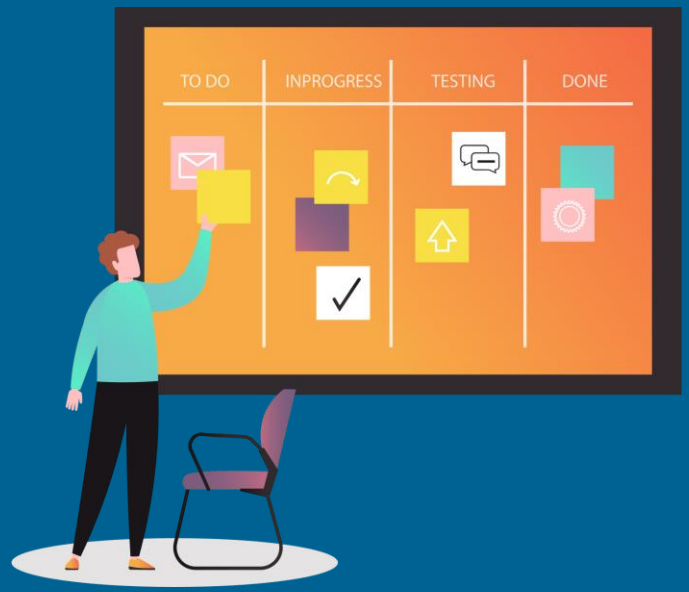


Tools of problem solving process

Table below presents tools of each category:

Diagrams for Visualizing Problem Structures	Tools for Capturing and Displaying Data and Information	Problem-Solving Techniques
• Affinity Diagrams • Fishbone or Ishikawa Diagrams • Flowcharts • Mindmaps • Relationship Diagrams • Tree Diagrams	• Check Sheet/Tally Sheet • Control Charts • Gantt Chart • Goals Grid • Histograms • Pareto Charts • Run Charts • Scatterplots • Standard Data Displays - bar graphs - line graphs - pie charts • Stratification	• Benchmarking • Brainstorming • Decision Trees • Five Whys • Force-Field Analysis • Nominal Group Technique (NGT) • Paired Comparisons • Weighted Selection

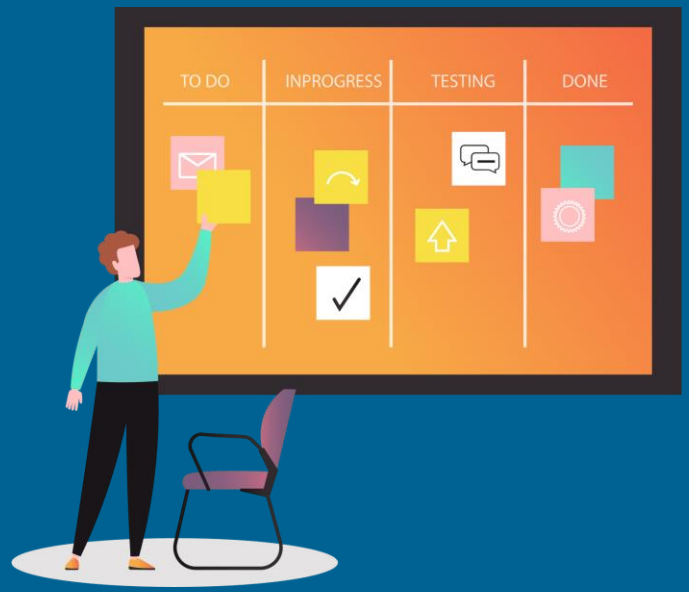
(Nickols F., 2020)



Root cause analysis tools /1

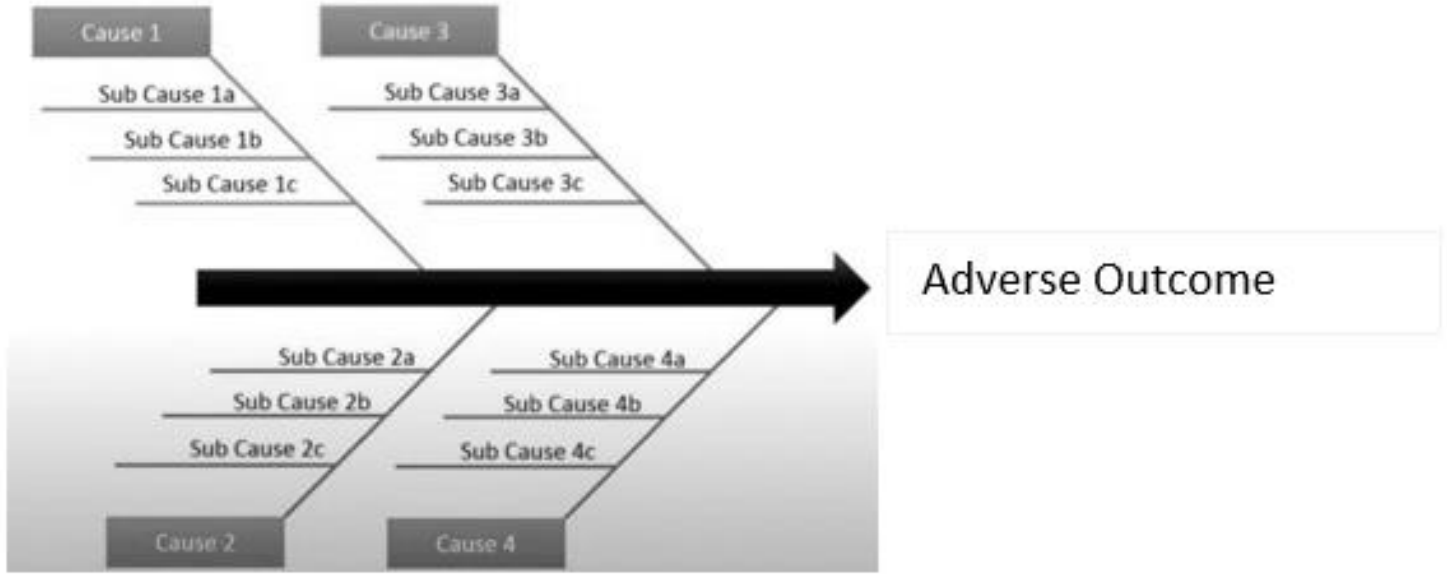
- **5 Whys.** In this model five whys were asked to find the root cause of the problem. However, problem solver can less or more questions according to its needs.

Figure Source: https://www.complianceonline.com/resources/7-powerful-problem-solving-root-cause-analysis-tools.html



Root cause analysis tools /2

- **The Ishikawa Fishbone Diagram (IFD).** This model uses the analysis/assessment of each cause for identifying the root cause of a problem.



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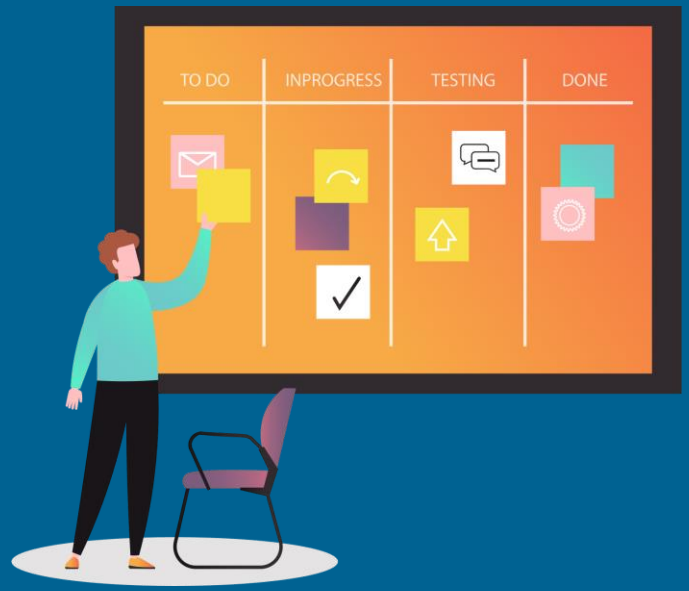
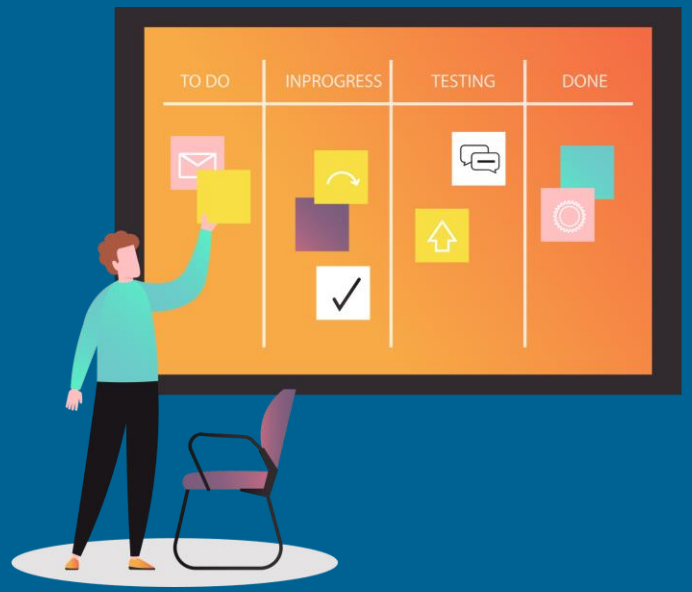


Tools for selecting best solution

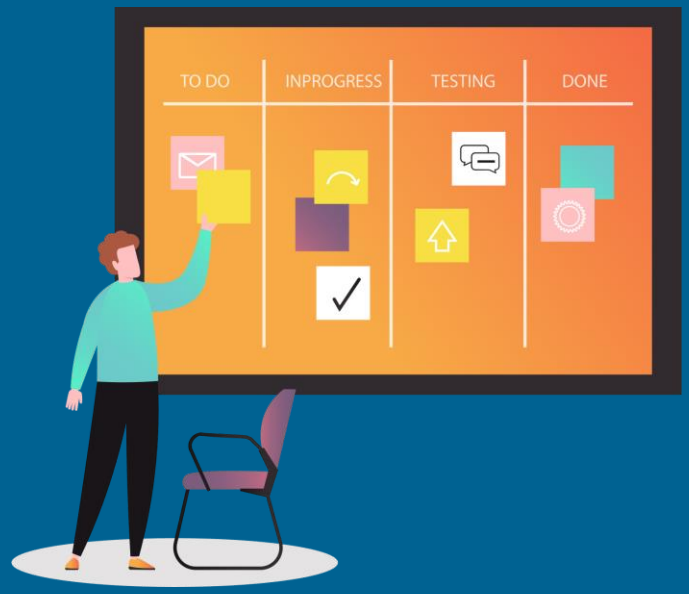
- When there is a set of alternative solution for a problem it usually selected the one that minimize the cost of solution and maximize the return.
- Usual methods that are used to select the most a appropriate solution are:
  - Pros and cons lists
  - Weighted Rubric
  - SWOT analysis (for more sophisticated analysis)



Weighted Rubric example

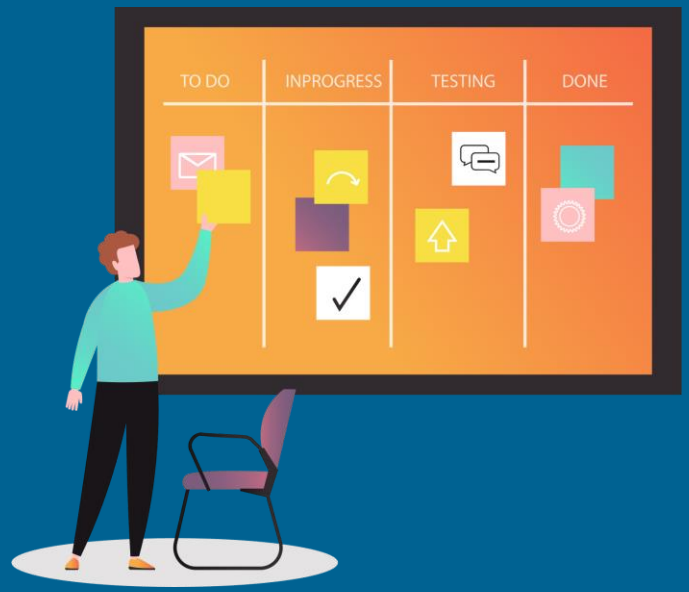
Qualities/ Skills	Weight	Malcolm	Anna	Kai	Malik	Questions
Communication	20%	5	4	1	3	**Tell me about a time you disagreed with your boss. How did you discuss this with them?**
Organization	20%	4	2	2	5	**How do you stay organized when you have multiple projects at once?**
Relevant Experience	40%	3	5	4	5	**Tell me about your experience in the Marketing Industry.**
Motivation	20%	5	3	1	3	**What is your biggest motivation?**
Weighted Average	**100%**	4	3.8	2.4	4.2	

Figure source: https://www.firstproinc.com/wp-content/uploads/2021/09/Table.jpg



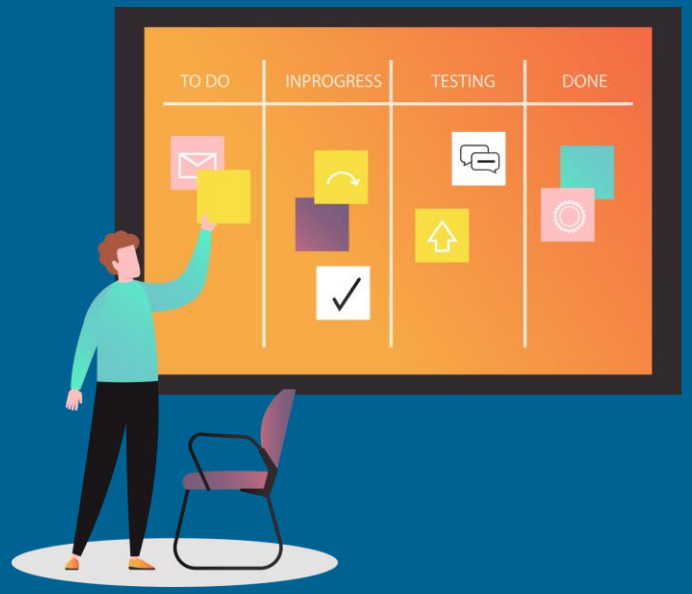
Tools for assessing solution

- Examples of tools that can be used assess a solution are:
  - Tests
  - Surveys
  - Focus groups



Problem solving skills - Intro

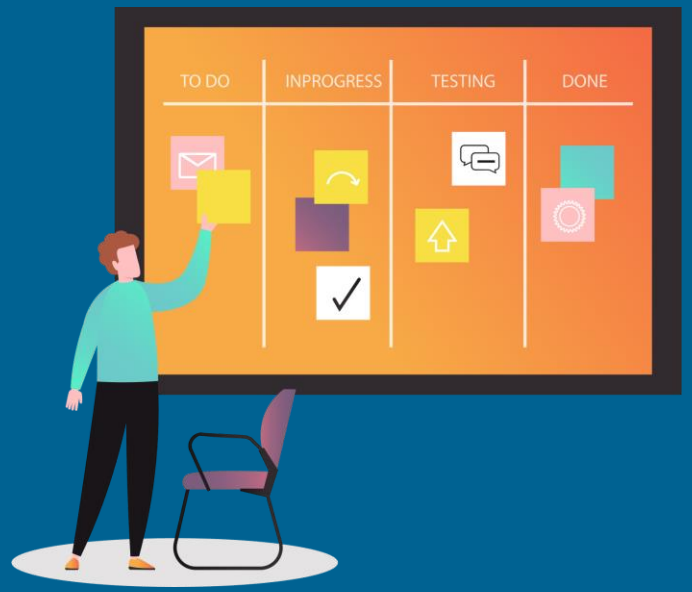
- In the literature can be found several definitions of problem solving. However, all are focusing on the ability to accurately assess a situation, design and implement an effective and accurate solution.
- In fact, problem solving is a multifaceted skill that require a set of transversal and technical skills.
  - Technical skills are domain depended and refer to the knowledge of the domain in order to be able to solve problems related to technical aspects of that domain.
  - Transversal skills are more general skills that someone has to have in order to be able to solve problems.



General skills for problem solving /1

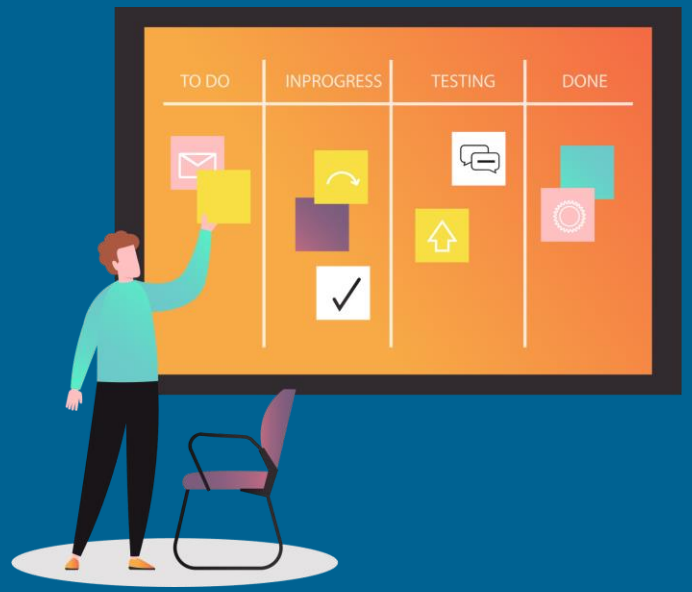
There are 5 general problem-solving skills that someone should have for problem solving :

- **Ability to manage time effectively.** A problem solver should be able to manage time wisely, meaning that should be able to do effective scheduling (planning, prioritizing, etc.), complete tasks on-time and stay engaged. This will lead to better resources allocation and utilization and improvement of decision-making process.
- **Ability to execute strategies.** A problem solver should be able to set o problem solution within the context of the general strategic design of the organization or the overall aim set.



General skills for problem solving /2

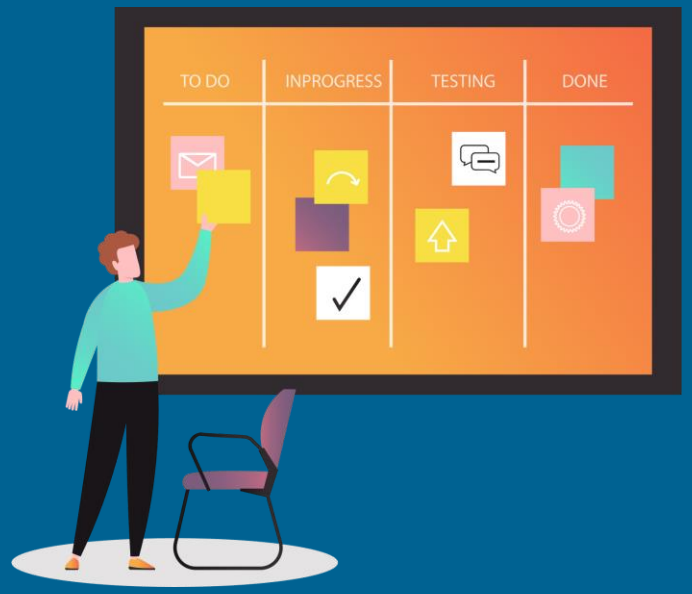
- **Ability to think outside the box.** A problem solver, in many cases, should be able to think beyond profound and trivial solutions in order to be able to identify new opportunities in problems and reach to better outcomes that was not obvious initially.
- **Ability to work under pressure.** Many times, problem solving requires quick and immediate actions and decisions which cause great pressure to problem solver. Therefore, the ability to act effectively under such circumstances is important.
- **Ability to address risk.** Each problem and problem solution generate risks during their implementation. A problem solver should be able to evaluate risks occur and consider this parameter to its decisions.



Transversal skills for problem solving /1

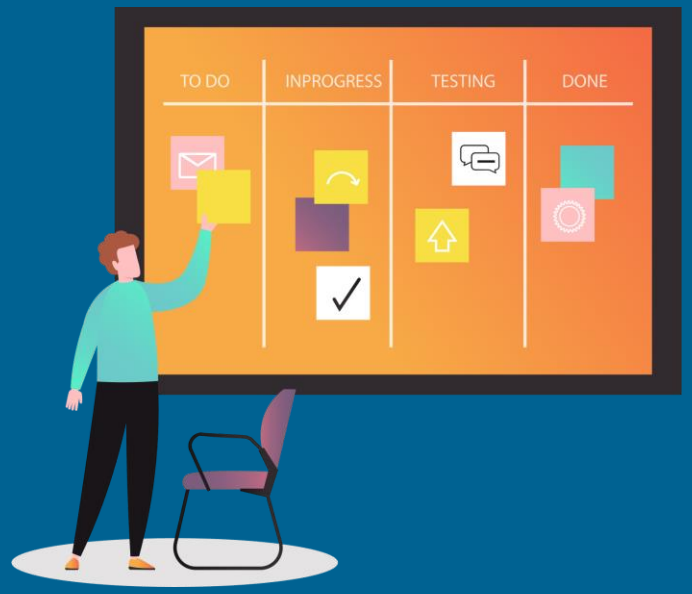
To obtain the previous general skills on problem solving a problem solver should have set of basic transversal skills such as:

- **Active Listening.** This will allow them to gather the necessary information to solve the problem. It will also help them to identify and understand the root caused of the problem and the value of other stakeholders in problem solving process.
- **Analytical thinking**. With analytical thinking problem solvers can identify the reasoning behind a problem, identify easier the root cause of it and select the most effective solution from a set of alternatives.
- **Creative thinking.** Creative thinking allows problem solvers to provide new perspectives and uncover innovative solution to problems.



Transversal skills for problem solving /2

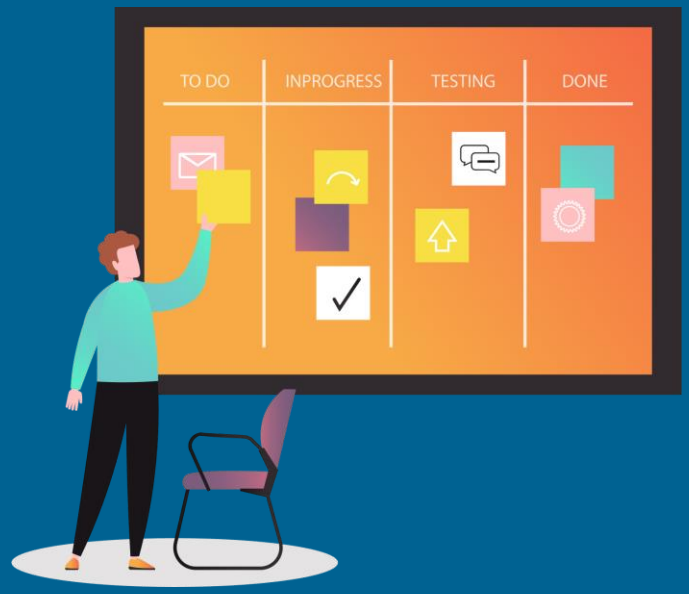
- **Communication.** Problem solvers should have communication skills in order to able from one hand to retrieve important information about the problem and from the other hand communicate information about problem solution to other stakeholders especially if they have to relay complex information in fast changing or pacing environments.
- **Decision-making.** This skill allows problem solvers to make decisions and be confident about them as soon as they have all the relative information and consider the alternatives.
- **Teamworking.** Problem solving often requires collaboration with other partners so its is important for a problem solver to be able to operate as team member. Furthermore, maybe he will need to motivate other team members to get the best out of them in order to achieve the best possible solution.



Characteristics of best problem solving teams

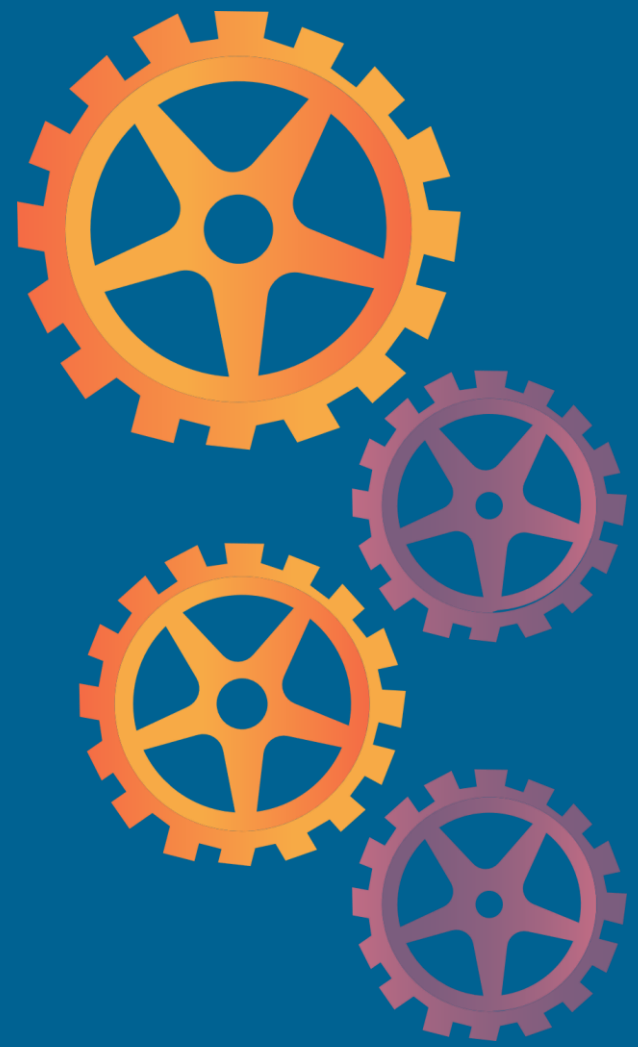
- Considering the characteristics that teams within an organization should have to be able to solve problems effectively it was found that highly effective teams typically have a pair of common features. These are:
  - They are **cognitively diverse.** This is a confirmation that problem solving is a multifaceted process that requires a variety of skills and knowledge.
  - They are **psychologically safe.** This indicates that members of problem-solving teams should feel safe, secure, and comfortable in their work in order to be able to effectively contribute to problem-solving process.

Reynolds, A. & Lewis, D., (2018)



Activity

- Select a problem concerning the students of your class.
  a) Follow problem solving steps presented earlier in this file to solve the problem.
  b) Record for each step the inputs, the tools you used and the outputs.



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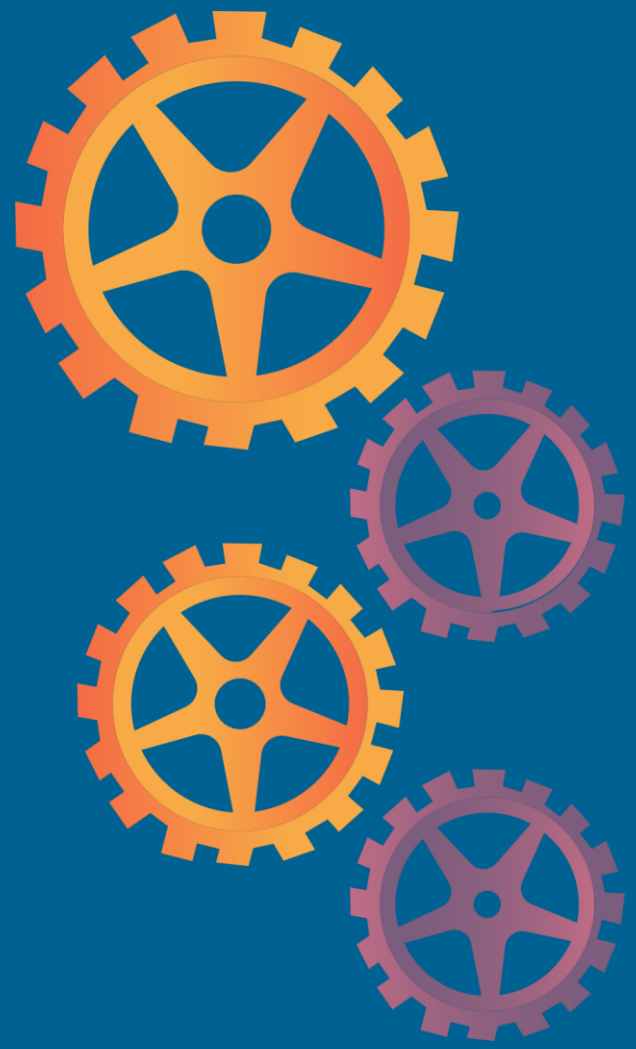

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