Bożena Gajdzik, Michalene Grebski
Wieslaw Grebski, Radosław Wolniak

Human Factor Activity in Lean Management and Quality Management

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„DOM ORGANIZATORA"
87-100 Toruń, ul. Czerwona Droga 8
tel. (+ 48 56) 622 38 07, 622 28 98
http://www.tnoik.torun.pl; e-mail wydawnictwo@tnoik.torun.pl

Unikatowy identyfikator wydawnictwa
TNOiK – „Dom Organizatora" w Toruniu
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„Dom Organizatora"
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Recenzenci
Prof. dr hab. inż. Ryszard Barcik
Akademia Techniczno-Humanistyczna w Bielsku-Białej
Dr hab. inż. Andrzej Pacana, prof. PRz
Politechnika Rzeszowska

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Studio KROPKA dtp - Piotr Kabaciński
tel. kom. 602 303 814
e-mail: biuro@swk.com.pl

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Introduction

The study (book) contains introductory information which can be used in studying the following topics, *basics of management, human behavior in the organization, fundamentals of quality management and introduction to lean management.*

This information may be applicable for students of Economics, Humanities and Technical courses. This book was developed to provide introductory information and broaden the perspective of those studying Business, Economics and the Humanities. Businesses will find the information in this book especially helpful in expanding their knowledge of human behavior

The authors of the book hope that readers will develop the knowledge to build and enhance problem-solving skills as well as continue to improve organizational quality.

AUTHORS

Bożena Gajdzik
Silesian University of Technology, Gliwice, Poland

Michalene Grebski
Colorado Mesa University, Grand Junction, CO,USA

Wieslaw Grebski
The Pennsylvania State University,Hazleton, PA,USA

Radosław Wolniak
Silesian University of Technology, Gliwice, Poland

Chapter 1. **Problem-solving in an organization**

1.1. Practical and methodical ways of problem-solving

■ Viewing problems as an opportunity

In our professional and personal lives, each one of us encounters problems, failures and setbacks. Those life experiences often trigger a negative attitude. Often, we feel that our life is coming to an end and familiar pathways are closing. This is just a temporary fear of the unknown. Every end leads to a new beginning of something bigger, better and brighter. Every closing door leads to the opening of many other doors (opportunities). As soon as we let go of our fear, we begin to see the opportunities. Opportunities knock on our door daily, but often we are afraid to answer. Often the opportunities look like extra work, so we refuse to open the door. Often, we are under the influence of a negative attitude. It speaks to us in many ways: "Why is it me again?", "This is the end.", "There is no solution to my problem." Negative attitudes bring negative results. If you keep doing what you always did, you will get the same results you always got. Positive attitudes bring positive results. We need to use our energy to move forward instead of spinning wheels trying to live in the past. Life and the conditions we live in are changing. We have no choice but to embrace those changes. Often our lives are like a train leaving the station. We have a chance to either hop on the train or get run over by the train. Positive attitudes to life require us to do the following steps:

- Assess where you are.
- Determine where you want to be.
- Develop a plan to get there.

Presently we are living in challenging times. (Historically, every time was challenging).

- We are facing climate change due to the release of large amounts of carbon dioxide.
- We live in an economically divided society. (Rich get richer and the poor become poorer).
- We live in a politically divided society.

The problems we historically encountered created great challenges and opportunities for us. We need to be grateful for that because life gave us a chance to solve those problems and we will live up to those expectations. We will address energy problems by increasing energy efficiency and use sustainable energy. We will also address all the social aspects of our society. What a great opportunity for our generation. We can feel lucky for having the opportunity. A positive attitude can allow us to solve any problem. A negative attitude leads to self-destruction.

■ Seeking opportunities to innovate

Statistically speaking one in a thousand innovative ideas leads to success. It is important, therefore, to generate as many innovative ideas as possible. Often during our personal or professional life, we encounter the daydreaming mode with many innovative ideas crossing our mind. At the end of the day those ideas are forgotten. It is important to maintain and update daily an idea journal. All innovative ideas that crossing our mind need to be immediately written in the idea journal. The idea journal needs to be periodically reviewed. By reviewing the idea journal, new ideas are being generated combining the existing ideas. It is important to allow at least half-an-hour per day for daydreaming (lying in bed, looking out of a window or taking a leisurely shower). Routine is an enemy of innovation [1.1.1], [1.1.2], [1.1.3]. Routine makes us comforTable with the status quo. It also discourages us from making change. Challenging people around us (co-workers, supervisors, teachers, parents) is conducive toward the process of innovation. Obedience hinders innovativeness. Obedient people do not make history. It is critical to constantly add new individuals to our support network and circle of friends. To allow yourself to remain innovative, do the following: [1.1.3], [1.1.4].

- Associate yourself with energetic innovative individuals.
- Discuss with your friends your innovative ideas and dreams.
- Listen to feedback and also provide feedback to ideas.
- Always listen to opposite points-of-view.
- Do not sensor yourself and do everything that is expected from you.
- Rebel and periodically take bold steps of action.
- Always believe in your potential.
- Identify the driving forces keeping you going.
- Always be respectful, tolerant and accepting.
- Stay away from people having a toxic influence on you.
- Allow yourself time to regroup your thoughts and relax.
- Work intensely and play intensely.
- Do not try to find yourself but create the person who you want to be.
- Go to different workshops and presentations to meet other energetic people.
- Interact with people and do not be afraid to ask for help.

It is highly recommended to write our important wild dreams and create a roadmap leading to those dreams. (Fig. 1.1.1)

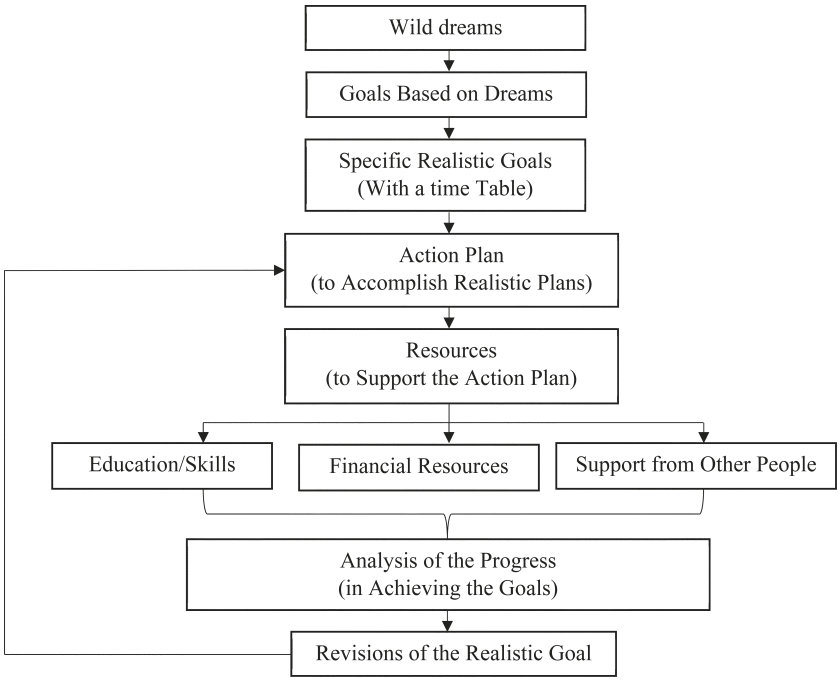

Fig. 1.1.1. Roadmap to your dreams.

It is highly recommended to prepare and constantly update the *rings of life* biographical sketch. The traditional resume is very limited in focus and lists our academic and professional accomplishments. The concept of the rings *of life* (Fig. 1.1.2) includes our dreams and accomplishments to a much greater extent than a traditional resume. The individual rings in Fig. 1.1.2 represent the following:

- **Ring 1 – Your life goals and dreams**
  (Life goals and dreams need to be periodically updated because they change as we go through our lives transformation process. Periodic review of the evolution of ours dreams allow us to understand ourselves better.)
- **Ring 2 – Internal motivational driving forces**
  (Our internal driving forces are also changing over time and they need to be periodically updated. A periodic review of these internal forces allows us to understand ourselves better.)
- **Ring 3 – Strengths and special skills**
  (Our strengths and special skills are also changing and need to be updated periodically. This periodic review is needed.)
- **Ring 4 – Education**
  (Education needs to be updated as well. Updating the education is straightforward.)
- **Ring 5 – Work experience**
  (Work experience is constantly changing and needs to be updated periodically.)
- **Ring 6 – Support system**
  (Our support system changes with our family situation and needs to be updated. This allows us to understand our live transformation process.)
- **Ring 7 – People who rely on our support**
  (The people relying on our support changes with age and family situation.)
- **Ring 8 – Weaknesses and shortcomings**
  (Weaknesses and shortcomings are also changing. Some of the weakn esses and short-comings can disappear.)

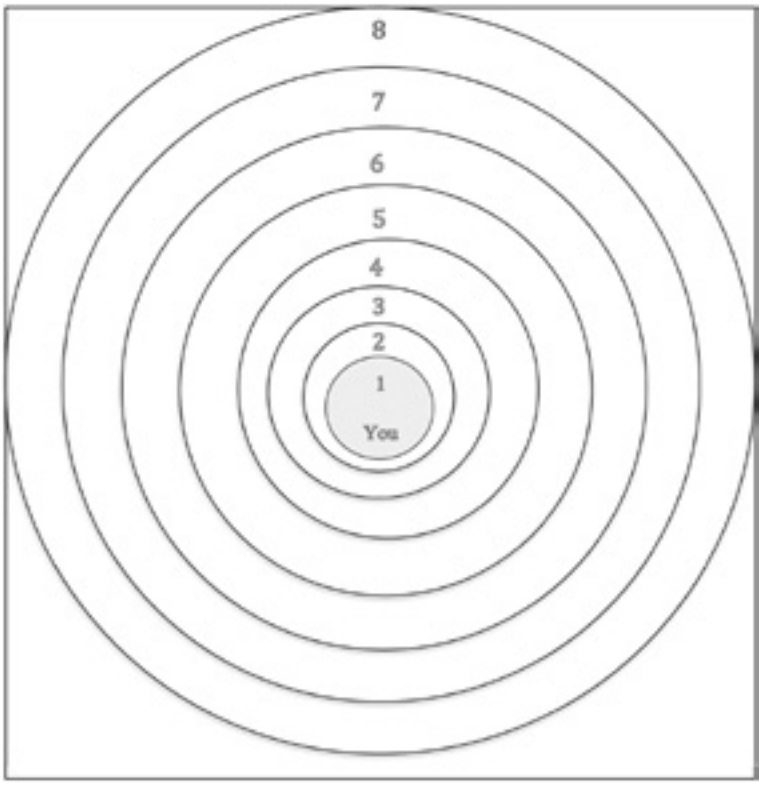

Fig.1.1.2. Rings of life
Source: Authors' compilation based on [1.1.1], [1.1.2], [1.1.3], [1.1.4], [1.1.5].

■ Innovativeness as a positive outlook for the future

Many innovative individuals are seeking opportunities to make a positive contribution to the world and humanity. This is not a new concept. In the 18th century (1793-1794) in Germany, Wilhelm van Humboldt introduced the Bildung Theory (*Theorie der Bildung des Menschen)*. During that time there was a division of labor and specialization [1.1.6]. Bildung Theory linked human development, skills, and knowledge. According to this theory, the most important part of human existence is to give as much as possible to humanity. [1.1.7] In this way, we will make an everlasting contribution to the world [1.1.8]. For over two hundred years, Bildung Theory was losing and gaining popularity because of various religious influences as well as nationalism. In the

21st Century, Bildung Theory has regained popularity among many young and energetic innovative people [1.1.9]. Bildung promoted equality and equity in education for everybody regardless of social and financial status. According to the Bildung Theory, education will create an inner force of responsibility. Education will also help to create responsible citizens. Bildung promoted an active lifestyle with the commitment of all our energy to make contributions to society. Bildung is an important model for thinking about our education as well as the purpose of our life. Creativity, innovativeness, and protecting our planet are more important than ever [1.1.10].

■ Intelligent Fast Failure Method for Innovative Problem-solving

Failure is always part of the innovative process. Albert Einstein stated that genius is making all possible mistakes in the shortest amount of time. Thomas Edison admitted that his invention of the lightbulb was preceded by about ten thousand failed attempts. The Intelligent Fast Failure Method was introduced by Dr. Jack Matson (Pennsylvania State University). [1.1.11], [1.1.12], [1.1.13] Intelligent Fast-Failure Method.was explained by Dr. Matson as a *rapid prototyping of innovative ideas*. Those innovative ideas can apply to either product or process. Dr. Matson explained this in his book *Innovate or Die: Personal Perspective on Innovation* [1.1.15]. The process of innovation is part of a cycle with the following components. [Fig. 1.1.3]

- Create.
- Experiment.
- Fail.
- Learn.

After a new idea is created, it should be subjected to an experiment. Most of the new ideas will fail. Every failure will provide us with a new experience (learning process). Based on the learning process, a new improved idea is generated and subjected to a new experiment. The cycle of the innovation process needs to be repeated as quickly as possible until there is ultimately a success. The intelligent Fast Failure Method allows us to try many different ideas within a short amount

of time. Ideas not working well are quickly eliminated and the search continues for better ideas. The intelligent Fast Failure Method needs to meet the criteria of being intelligent, fast and accepting failures.

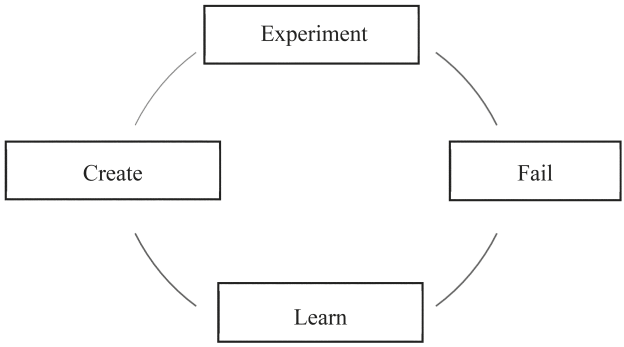

Fig. 1.1.3. Cyclical nature of the intelligent fast failure methodology.
Source: Based on [1.1.14].

- Intelligent [1.1.16], [1.1.17], [1.1.18]
  (Cyclical process of prototyping ideas needs to generate a learning experience. The process is a form of continuous quality improvement (CQI) of ideas.)
- Fast [1.1.19], [1.1.20], [1.1.21].
  (Because of the cyclical nature, the innovative process needs to be repeated at the fastest possible pace. The fast pace of the innovative process allows us to prototype more ideas.)
- Failures [1.1.22], [1.1.23], [1.1.24].
  (Failed attempts are not really failures as long as they provide a learning experience and are part of the continuous quality improvement process.)

■ A systematic approach for moving from problem to solution to commercialization

The designing process for a new product is a systematic procedure shown in Fig. 1.1.4.

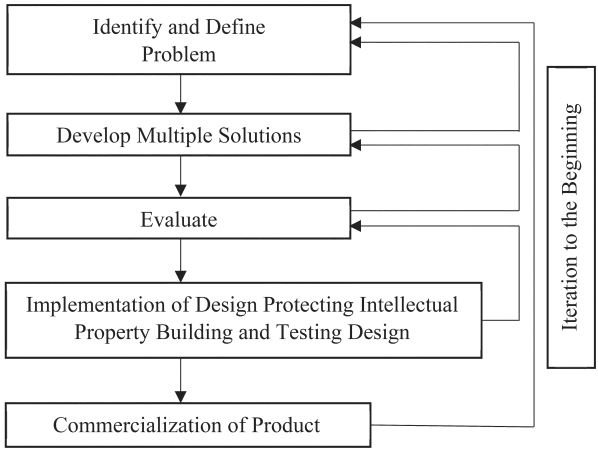

Fig. 1.1.4. Engineering design process
Source: Authors' compilation based on [1.1.25], [1.1.26]

The following seven steps describe a systematic approach for engineering design.

1. Define the problem as well as product specification and consumer expectations.
2. Conduct research related to consumer perception.
   (Contact prospective customers and talk with as many people as possible.)
3. Brainstorm and conceptualize the design.
   (It is necessary to generate as many ideas as possible and evaluated the design concepts.) [1.1.27], [1.1.28]
4. Build and test a prototype.
   (Apply for provisional patent pending status. The cycle needs to be repeated until the testing of the prototype is satisfactory.)
5. Develop and implement a marketing strategy.
6. Analyze the new product from the perspective of continuous quality improvement.
7. Improve the new product as a part of continuous quality improvement.

Commercialization of a new product requires overcoming internal and external resistance.

1.2. Strategic problem-solving

Strategic problem-solving in a company is one element of strategic management. A strategic approach to problem-solving may arise from the need to pay more attention to the key problems in the company. Problems are considered key when they threaten the implementation of the company's strategy. The structure of these problems is difficult, and its solution is important for the company. Strategic problem-solving is a set of advanced methods and tools for finding truly effective solutions to difficult problems. Strategic problem-solving, does not focus on identifying the person responsible for the problem but on solving the problem effectively. When solving complex problems, a company may need to engage in strategic dialogue (negotiation, consultation, discussion). The solution of complex problems involves many people. The understanding of the problem by many people allows alternative solutions to be developed simultaneously. Dialogue during problem-solving significantly reduces people's resistance. Resistance is always the biggest barrier to change, i.e., to effective problem- solving. Among the key problems are labour problems. The strategy of solving employee problems, e.g., radical reduction of staff for economic reasons by the company, falls into the category of social problems, which require a lot of discussions and agreements concluded with organizations representing employees (trade unions) [1.2.1].

Conflict in the workplace is a difficult topic in problem-solving. In a person's relationship with colleagues or management, there can be a difference of interests, values, views and emotions. This can be the start of conflict. Increasing conflict can result in employee frustration and stress, as well as increased absenteeism and even leaving the company. Many personal conflicts lead to poor communication or weakened cooperation. As a result of conflicts in the workplace, there can be a degeneration in the relationship among employees, redundancies, and the formation of informal groups of employees in the company [1.2.2].

In strategic problem-solving, you need

- people talking about the mistakes of the company,
- a deep analysis of the problem, and,
- the ability to measure the impact of changes.

Then there is the ability to learn lessons and improve the effectiveness of the company. Strategic problem management seeks to select methods of solving a problem that minimizes the negative aspects of the problem and maximizes the benefits leading to the development of the organization. Problem-solving involves many areas, a large problem is made up of many smaller ones [1.2.3−1.2.4].

To introduce the readers of the book to the topic, strategic problem-solving, it is necessary, at the outset of further considerations, to explain what strategy is. A strategy is a defined concept of systematic (comprehensive) action(s), in which long-term objectives are formulated and possibly modified, depending on changes in the environment. [1.2.5] Strategy is defined as "the determination of the basic long-term goals of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals." [1.2.6]· Strategies are established to set direction, focus effort, define or clarify the organization, and provide consistency or guidance in response to the environment. [1.2.7] When a company does not have a strategy then its business can be chaotic and is certainly unfocused, whereas when a company has a strategy then its business is goal-directed setting the stage for growth (Fig. 1.2.1). [1.2.8]

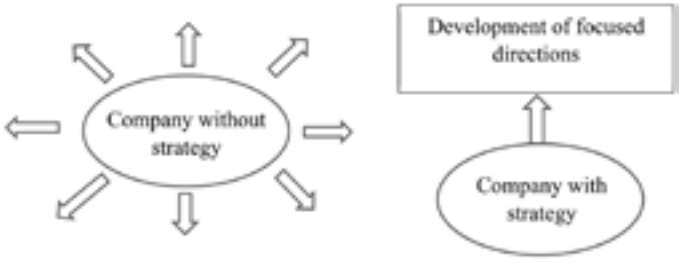

Fig. 1.2.1. A company without strategy and a company with strategy.
Source: Own concept.

In strategic management, it is important to be flexible in solving problems, which means that one cannot assume only that one side will win [1.2.9]. If a company is unable or unwilling to develop a critical assessment of the sources of a problem and apply the methods and techniques used to find the sources of problems and to solve the problem, it will be difficult for the company to eliminate problems in the nascent stage, because the growing problems may disrupt business efficiency [1.2.10]. Strategic problem-solvers need many skills and a high level of creativity [1.2.11].

Creative problem-solving (CPS) is a way of solving problems or identifying opportunities when conventional thinking has failed. It encourages you to find fresh perspectives and come up with innovative solutions, so that you can formulate a plan to overcome obstacles and reach your goals. Alex Osborn, founder of the Creative Education Foundation, first developed creative problem-solving in the 1940s. CPS has four core principles (Table 1.2.1) [1.2.12].

Table 1.2.1. Principles of CPS.

Divergent and convergent thinking must be balanced.	The key to creativity is learning how to identify and balance divergent and convergent thinking (done separately) and knowing when to practice each one.
Ask problems as questions.	Asking questions can generate valuable information.
Defer or suspend judgment.	Early evaluation of solutions leads to a halt in the idea generation process. Instead, there is adequate and necessary time to evaluate ideas in the convergence phase.
Focus on "Yes" rather than "No".	A „Yes" or "No" response," encourages people to expand their thoughts, which is necessary at certain stages of CPS. Using the word "but" – preceded by "Yes" or "No" – ends the conversation and often negates what came before it.

Source: Based on [1.2.12].

Today's businesses need to be agile when solving problems, which means that companies not only need to adapt to

- change,
- taking advantage of the organisational processes, and technological, opportunities,

but, above all, need to

- be different from other companies,
- differentiate themselves from other companies, with something
- reject the traditional way of thinking and,
- identify new way of doing business [1.2.13].

There are many methods of effective problem-solving. Most of them are based on Aristotle's classical logic and analysis of the causes of a given problem. Among the many methods of strategic problem-solving are the results of Professor Giorgio Nardone, an Italian psychologist, psychotherapist, and coach, who works in Arezzo, Italy, and who, in parallel to his therapeutic activity, Professor Nardone conducts research into processes of change. The result of his work is the Strategic Problem-Solving model. This model is related to the concept of the mechanism of self-deception. The analysis of this mechanism allows us to go beyond the traditional ways of analysing a problem, allowing us to access the resources of our mind, by blocking erroneous and ineffective attempts to solve the problem as well as unleashing creativity [1.2.14]. Problem-solving models consist of 3 or more steps. In Table 1 these particular steps are presented. The steps may have similarities and differences, even if the number is the same or different (Table 1.2.2).

Table 1.2.2 Steps in the models of problem-solving.

Steps		Example sources
3 steps	1. Understand. 2. Strategize. 3. Implement.	https://chapelhillmathcircle.org/2016/09/26/the-three-stages-of-the-problem-solving-cycle/
4 steps	1. Define the problem. 2. Determine the cause of the problem. 3. Identify, prioritize and select alternatives for a solution. 4. Implement a solution.	https://asq.org/quality-resources/problem-solving
5 steps	1. Define your root problem. 2. Break down the problem to its core components. 3. Prioritize solutions. 4. Conduct your analysis, and 5. Sell your recommendation internally.	https://www.inc.com/mike-figliuolo/decision-making-process.html

Steps		Example sources
6 steps	1. Identify and define the problem. 2. State the problem as clearly as possible. Generate possible solutions. 3. Evaluate alternatives. 4. Decide on a solution. 5. Implement the solution. 6. Evaluate the outcome.	https://www.healthywa.wa.gov.au/Articles/N_R/Problem-solving
6 steps	1. Identify the problem 2. Analyze the problem 3. Describe the problem 4. Look for root causes. 5. Develop alternate solutions. 6. Implement the solution. 7. Measure the results.	https://crestcom.com/blog/2016/09/01/7-steps-to-effective-problem-solving/
7 steps	1. Describe and define the problem, including agreement on the objective. 2. Recognize and evaluate all solutions used so far. 3. Identify a technique which will make the current situation worse. 4. Identify alternative technique scenarios beyond the problems. Develop the technique "small steps" 5. Develop a technique of "Alpinist". 6. Follow a technique of gradual guidance on the right path and gradual refinement of the new situation. 7. Follow a technique of gradual refinement to a new solution. that is gradual refinement the new situation.	https://psychologiawpraktyce.pl/artykul/7-krokow-strategicznego-rozwiazywania-problemow-w-organizacji (based on G. Nardone)
8 steps	1. Identify what the actual problem is. (This should be as specific as possible and include as many details and other information as is available.) 2. Break down the problem. (Breaking the problem down into different steps or parts is critical. This will make it possible to develop the right solutions for each aspect of the problem and help get things running as they should.) 3. Establish targets for the system on which you are working. (This will help guide you through the rest of the process.) 4. Look for the root cause. 5. Propose countermeasures. 6. Implement countermeasures. 7. Take the countermeasures that are proposed in the previous step and begin testing them. 8. Test the results. (Analyze the results by comparing the situation where the problem was found against your target results.) 9. Standardize. (Establishing new processes and procedures that will be followed by everyone in the facility is the last step in the problem-solving process.)	https://www.kaizen-news.com/effective-lean-problem-solving/ Effective Lean Problem-solving July 7, 2020 (by Mike Wilson)

Sources: Own elaboration (based on sources cited in Table 1.2.2).

The presented models cited in Table 1.2.2 are based on Michael E. Porter's 3 steps in competitive strategic planning (1979/1980) and Kurt Lewin 3 steps model of changes (1947). M. E. Porter in his work [1.2.15] presented the following steps.

1. Creating a „unique and valuable [market] position"
2. Making trade-offs by choosing „what not to do"
3. Creating „fit" by aligning company activities with one another to support the chosen strategy.

K. Lewin's model of changes consists of three steps. [1.2.16]:

1. Unfreezing
2. Changing
3. Refreezing

The following stages can be considered according to the models based on strategic problem-solving. [1.2.17–1.2.18]:

1. Identification/Description of the problem
2. Development of possible solutions/options
3. Evaluation of results
4. Solution selection
5. Implementation of plan
6. Evaluation of results.

A problem-solving strategy is helpful and very practical. It focuses on real problems that are happening here and now and that we can influence. A strategy is a clear plan of action. In strategic problem-solving, activities are directed towards understanding how a problem arises and functions. The problem-solving process must be analyzed and implemented 'here and now' and focus on 'how the problem works'. The question: How does the problem work? is the key strategic management question in the problem-solving phase. This question precedes the question: Why did the problem occur? This question is answered by looking for solutions rather than causes. [1.2.14] Figure 1.2.2 summarizes a strategic problem-solving diagram based on the 3xS: sources, structure and solution.

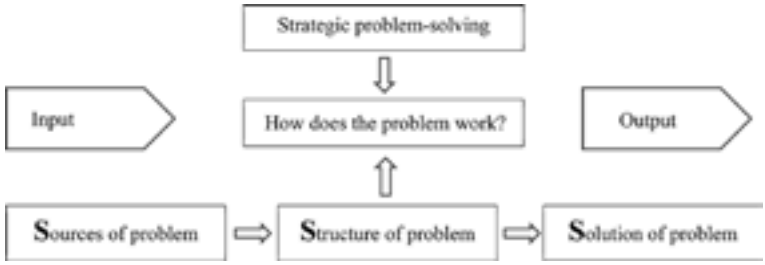

Fig. 1.2.2. Basic questions in the strategic problem-solving in organization.
Source: Own elaboration.

An alternative scenario should be added to the diagram thus presented to provide flexibility in the problem-solving trajectory. The overarching goal of strategic problem-solving is change. Change is defined, most commonly, as the replacement of an existing solution with a new one. The simplest synonyms for the term 'change' are: "replacement", "modification", "innovation", "design". It is possible to speak of change in general and change in a specific area of a company's activity. Several definitions of the word "change" are given in management textbooks (Table 1.2.3).

Table 1.2.3. Definitions of change in improving of organization.

Source/Author	Definition	Characteristics based on source. (Own interpretation)
D.K. Carr, K. J Hard, W.J. Trahant	Change is the only sure thing in modern business.	– Change is necessary., – Change must be monitored., – The process of change cannot be stopped.
Source:	Carr, D. K., Hard, K. J., & Trahant, W. J. (1996). Managing the change process: field book for change agents, consultants, team leaders, and engineering managers. New York Publisher: McGraw-Hill, 1st edition. (October 1, 1995). [1.2.19]	
L. Clarke	Change should be treated as something ineviTable and should not be resisted.	– Change must be embraced. – You cannot run away from change. – Change is necessary in a turbulent environment.
Source:	Clarke, L. (1997). Zarządzanie zmianą, Warszawa, Poland: Gebethner & Ska. [1.2.20]	
P.F. Drucker	In turbulent times, managers cannot assume that tomorrow will be an extension of today	– Change is dynamic., – Instability is in the modern world.
Source:	Drucker, P.F. (1993). Zarządzanie w czasach burzliwych, AE, Kraków, Poland: AE, p. 4 [1.2.21]	

Source/Author	Definition	Characteristics based on source. (Own interpretation)
R.W. Griffin	Change is any significant modification of some part of an organisation., Change affects many aspects of an organisation's functioning and its environment, which are undoubtedly affected by the transformations taking place in the organisation., Change may entail effects beyond the area of change.	– Change induced in an organisation changes the organisation itself., – Change has an unlimited scope., – Change affects other areas of human life and existence., – Change is unpredicTable., – The extent of the impact of the change introduced cannot be determined.
Source:	Griffin, R.W. (2007). Fundamentals of management. New York: Houghton Mifflin, 4th Ed. edition (October 1, 2007) [1.2.22]	
Ch. Handy	Change today is not what it used to be. Maintaining the status quo today is no longer the best way to for the future.	– Change is ineviTable., – Change is dynamic.
Source:	Handy, C. (1996). Wiek paradoksu. W poszukiwaniu sensu przyszłości. Warszawa, Poland: Dom Wydawniczy ABC. [1.2.23]	
G. Nizard	Change is a process, a constatation of the difference between one state and another, without indicating its causes, methods, procedures forms or effects.	– Change is inscribed in the process., – Results of change are new things, new forms, new processes etc., – Changes in the environment are dynamic.
Source:	Nizard, G. (1998). Metamorfozy przedsiębiorstwa - zarządzanie w zmienionym otoczeniu organizacji. Warszawa, Poland: PWN, p. 107 [1.2.24]	
J.A.F. Stoner	„ [...] planned change is a systematic effort to redesign an organisation in such a way as to make it easier to adapt to radical changes in its environment and to achieve new goals". Change is – a new challenge for the company.	– Change can be planned., – Change requires systematic action., – Change modifies or transforms changes the organisation, – Change is an opportunity for the organisation itself., – The organisation has to adapts to changes in its environment, not the other way around., – Change is radical., – Change is ineviTable..
Source:	JStoner, J.A.F. (1986). Management. Publisher: Longman Higher Education, ; 3rd Ed. 3rd Revised edition (1 lutego 1986) [1.2.25].	

In modern strategic problem-solving, change agents must leave (abandon) a rigid mental schema for a more flexible and functional perspective, with more choices. For there is not one 'unique and true' reality, but there are as many as there are interactions in relationships

with oneself, others and the world. Each of us builds a reality for ourselves, to which we then surrender and succumb. Strategic management is not static in nature; the models can include a feedback loop to monitor execution and to inform the next round of problem-solving [1.2.13]. Strategic problem-solving combines the theoretical methods of strategic management with the practical possibilities of solving problems under the conditions that are in the company and with the possibilities available to the company.

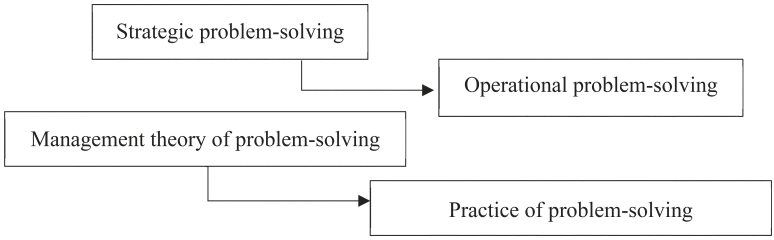

Fig. 1.2.3. Strategic management theory and practical with operational management in strategic problem-solving.
Source: Own elaboration.

According to Henry Mintzberg and James Brian Quinn, strategic problem-solving involves the related concepts of strategic methods with plan about the solution of problem and strategic thinking. Strategic methods are formalized procedures to solve the problem and analysis used as inputs for strategic thinking, which synthesize the data resulting in the strategy. Strategic planning and methods may also refer to control mechanisms used to implement the strategy once it is determined. A strategic path happens around the strategic thinking in strategic problem-solving [1.2.27] (Fig. 1.2.4).

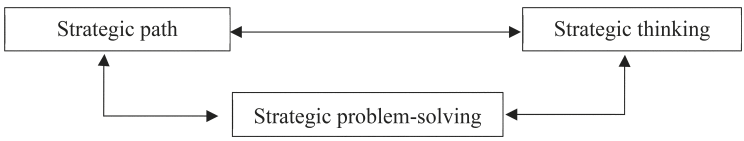

Fig. 1.2.4. Strategic thinking in strategic problem-solving.
Source: Own elaboration.

Strategic problem-solving is based on strategic questions about the problem as shown in Fig. 1.2.5:

- What?
  - What is the problem?
- Who?
  - Who is involved?
  - Who is affected by the problem
- Where?
  - Where is the problem happening?
- When?
  - When does it occur?
- How?
  - How does it act?
  - How does it manifest itself?

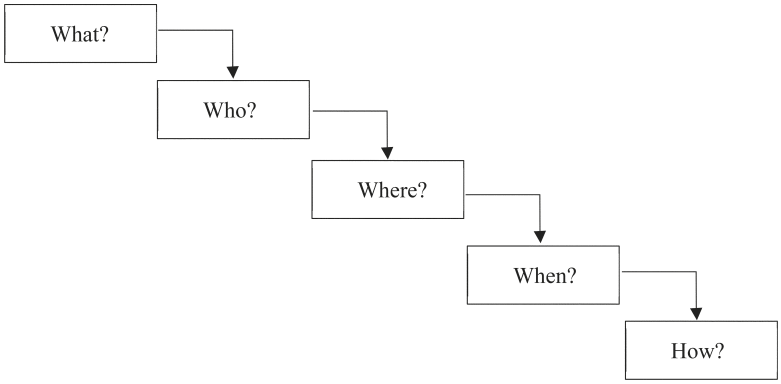

Fig. 1.2.5. Structure of questions in strategic problem-solving.
Source: Own elaboration.

In addition to general questions, there are guiding questions. Examples of guiding questions are:

1. What would have to change in the organization for the problem to be considered solved?
2. What do we need to know in order to understand how problems work?
3. What can you tell if a problem no longer exists?
4. What has been done so far to solve the problem?

5. Who has done what?
6. What should you think about or know about in order to recognize (know) the problem?
7. What should be the first step to start solving the problem?
8. What point should we reach to be able to say that the problem has been solved?
9. What should be the steps in solving the problem?
10. What should be the stage immediately preceding the complete solution of the problem?

In strategic problem-solving, a main objective and micro-objectives are set. Overly general objectives are useless in strategic problem-solving. The main objective must be based on the SMART principle (Table 1.2.4). In strategic problem-solving we need to reach a general target to define micro-targets. (Fig. 1.2.6):

S – Specific
M – Measurable
A – Achievable
R – Relevant
T – Time-bound

Table 1.2.4. SMART principle for strategic problem-solving.

Principle	Description	Questions
S – Specific	We need to be clear about the target. (What we want to achieve.)	• Who? What? When? How? Why? • Who needs to be involved in solving the problem? • What do we want to achieve? • When do we need to make a change? • When do we need to solve the problem? • What obstacles do we need to overcome to solve the problem? • What requirements do we need to meet when solving the problem? • Why do we need to solve the problem?
M – Measurable	We need to define criteria for measuring progress in strategic problem-solving.	• What criteria do we use to measure of progress in problem-solving? • What indicators do we want to use to assess problem--solving? • What are the milestones in strategic problem-solving?

Principle	Description	Questions
A— Achievable	We need to consider if the target is achievable. At this stage we should analyze: time, effort, costs of strategic problem-solving.	• Does solving the problem require financial resources? • Do we have the resources available to solve the problem? • Do we have the tools available to solve the problem? • Do we have the skills to solve the problem ourselves? • Do we need to ask others for help?
R— Relevant	Is the target relevant to the company?	• Is the solution to the problem consistent with the strategic long-range plans of the company?
T—Time-bound	We need to set a deadline for solving the problem, but with time reserves.	• What time do we have available to solve the problem? • Do we have time constraints associated with solving the problem? • What barriers might arise while trying to solve the problem?

Source: Own elaboration based on the construction of SMART. (https://focus.admin.ox.ac.uk/files/smartpdf) [1.2.28].

Fig. 1.2.6. Targets in strategic problem-solving.
Source: Own elaboration.

In addition to the SMART technique in target setting of strategic problem-solving, the SMARTER technique is possible with the addition of: E – evaluation and R –Readjust. Adding these two letters means revising and improving the objectives in case of recurring problems. (Table 1.2.5).

Strategic problem-solving is a key element of change management. Furthermore, change management is part of the overall business management system (Fig. 1.2.7).

Table 1.2.5. SMARTER in the strategic problem-solving.

Principle	Description	Questions
E – Evaluation	We need to constantly observe (analyse) the situation that initiated the problem., Constantly observe the sources of the problem and ways of solving the problem.	• Has the problem been solved definitively? • Has the problem not been solved? • Is the problem increasing? • Has the problem perhaps arisen again?
R – Readjust	We must remember that the company is constantly changing, as is its environment, so the problem will evolve. The problem may change with changes within the enterprise and in its environment.	• Do we need to look again at the situation that started the problem? • Does the problem have the conditions to reoccur? • Do we need to take more radical measures to prevent similar problems in the future?

Source: Own elaboration based on the construction of SMARTER.

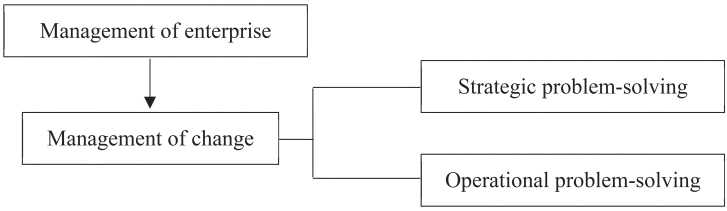

Fig. 1.2.7. Strategic problem-solving in the management of change.
Source: Own elaboration.

Problem-solving have resulted because of business practices under the influence of the dynamic environment, in the company. Over the years, a number of models have been developed for the strategy of problem-solving in the business change system. Many models have three basic steps.

Step 1: Perception – awareness of the problem and recognition of the need for change, including:

- reporting the problem to management,
- appointment of a problem-solving team and other teams, already at the stage of introducing the change, e.g., steering team, research and design team, as well as implementation team,

- analysis and diagnosis of the problem, including:
- development of a change program (strategy),
- identification of several options for action – alternative scenarios,
- selection of a solution to the problem in accordance with the adopted objective,
- deciding on changes that will eliminate the problem.

Step 2: Implementation – development of a detailed program to solve the problem, including:

- preparing the company to solve the problem,
- choosing the way of solving the problem,
- piloting the activities that make up the solution to the problem,
- removing barriers that arise in the course of solving the problem.

Step 3: Evaluate the effects of the implemented activities in the problem-solving in the company.

A number of company problem-solving models have been developed over the years. One of these was Kurt Lewin's model (Fig. 1.2.8). This model distinguishes between three basic process ethos: preparation of the organization to solve the problem and thus change, implementation of the activities that make up the problem-solving-change or change, and consolidation of the new situation in the company.

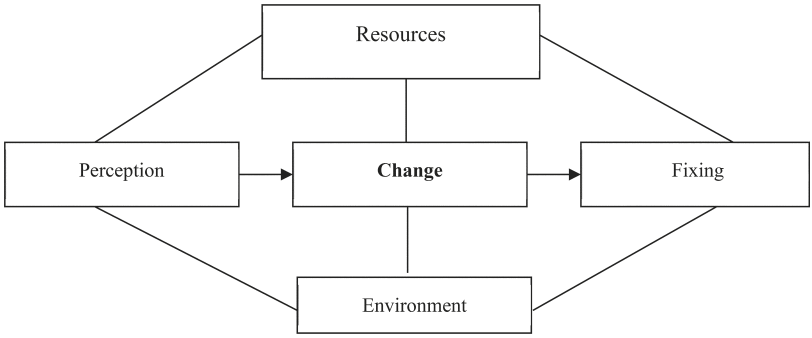

Fig. 1.2.8. Lewin's model in the problem-solving

Source: Inspiration on: K. Lewin: *Frontiers in Group Dynamics. Concept Method and Reality in Social Science*, Human Relations No 6/1947, p. 5–41 [1.2.16].

According to this model, during strategic problem-solving, the company must be prepared for change. The company must have staff, organizational structures, finances, etc. In addition, the enterprise at the important problem-solving stage can make use of expert knowledge and commission external companies to carry out additional analyses of the problem and impact assessments of the problem. The next step is to solve the problem with the changes. The last is to fix the new situation introduced. The success of strategic problem-solving can be ensured by a well-thought-out path (route) for solving the company's problem, including: a realistic assessment of the possibility of solving the problem without the involvement of third parties, a thorough analysis of the problem, an assessment of the availability of resources for solving the problem, an assessment of the employee motivation system (change orientation) and an assessment of the work of the staff through innovative initiatives (Fig. 1.2.9).

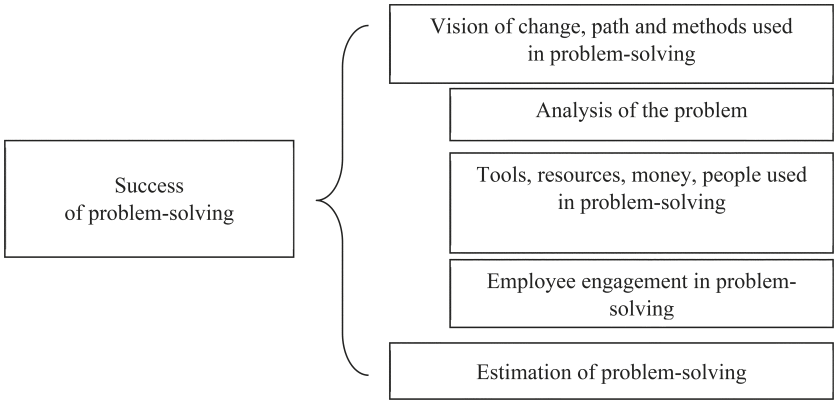

Fig. 1.2.9. Conditions for a success in problem-solving.
Source: Own elaboration.

Strategic problem-solving should be well planned, problem-solving should be implemented cross-sectionally and in accordance with the law and accepted procedures and business rules, e.g. communication, negotiation. Throughout the process, the company should consider the many factors necessary to achieve a successful problem-solving. It is also important to overcome the resistance of problem-solving participants to the need to face the problem and to gradually remove barriers blocking

problem recognition. It is accepted that companies that want to solve strategic problems must think comprehensively, innovatively, flexibly.

The most frequent mistakes in problem-solving:

- performing activities that we know should not be performed,
- not performing actions that should be performed,
- unconsciously introducing wrong solutions,
- failing to go into the essence of the problem,
- taking too quick an approach to solving a problem,
- setting unattainable goals,
- being quickly discouraged from solving the problem.

1.3. Lean problem-solving

In dynamic environment, companies want to lean the business (eliminating activities that are not worthless to customers). In Lean problem-solving, the company focuses on the customer - the customers' values (Fig. 1.3.1).

Fig. 1.3.1. Key direction in Lean Problem-solving.
Source: Own elaboration based on the concept of Lean in TPS.

In the Lean concept, changes implemented in companies should benefit them by eliminating all activities that are not of value to customers. In customer orientation, companies apply Lean Manufacturing or Lean Management (abbreviation: LM) methods and techniques. The Lean concept looks for ways to make savings at the job and process levels. Companies aim to reduce the cost of operations and production. Processes are improved to better adapt products to customer needs.

The term "Lean" was first used in the book entitled: "The machine that changed the world" by author: J.P. Womack, in 1992 [1.3.1]. A team led by J.P. Womack popularized the Lean concept, which was initiated

at Toyota plants in the 1940s and created the Toyota Production System in the 1970s and beyond.

Currently, Lean is one of the best known and most widely used management concept in manufacturing. The Lean concept is an abbreviated form of Lean Management or Lean Manufacturing (LM) or Lean Production (LP) [1.3.2–1.3.4]. Lean solving problem is the concept that maximizes value while minimizing waste (Muda in TPS) – Fig. 1.3.2.

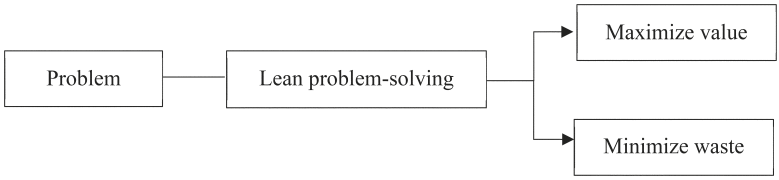

Fig. 1.3.2. Two key directions in Lean Problem-solving
Source: own elaboration based on the concept of Lean in TPS.

Lean problem-solving is a way of approaching organizational problems that is characterized by continuous improvement and the use of proven, problem-solving methodologies. The goals of Lean problem-solving include identifying and solving problems in less time and achievement of measurable results. What is Lean problem-solving? The answer – it is about finding the cause of the problem and eliminating it in order to maximize value and minimize waste. The point of Lean problem-solving is to effectively reduce the number of errors at work – on the job – by applying problem-solving techniques. We can use the 7 principles in the Lean problem-solving according to the lean business (Table 1.3.1):

1. Optimize the whole
2. Eliminate waste
3. Build in quality
4. Deliver fast
5. Create knowledge
6. Defer commitment
7. Respect people

Table 1.3.1. Seven principles in lean business

Principle	Characterize
Optimize the whole	Every business operates through a value stream, in order to deliver the end result to the customer. A Lean business identifies those value streams and optimize them as a whole.
Eliminate waste	Waste can mean too much work in process, or time spent manually completing a task that could be automated, too much materials in product, too much time on work etc. In Lean problem-solving we eliminate any activity that does not result in value for the customer.
Build in quality	Quality is very important in Lean. Quality is built in process. Quality is controlled at every stage of the process.
Deliver fast	A Lean business focuses on delivering value fast, and in increments, so that customer feedback can be included in development. This allows for giving the customer exactly what they want, and ultimately saving time in the overall process.
Create knowledge	Learning is a top priority in a Lean business environment and can be done through small, incremental experiments throughout a process. It is crucial to create an infrastructure to document and share these learnings across teams and organizations.
Defer commitment	This Lean business principle, similar to a just-in-time system, encourages waiting until the last responsible minute to make a decision. Doing so allows for agility to make decisions with the most up-to-date and relevant information.
Respect people	A Lean business shows respect to their customers by delivering maximum value, it shows also respects for its employees who are doing the work to create that value.

Source: https://www.planview.com/resources/articles/lean-business/. R. Lynn: What is a Lean business? [1.3.5].

The Kaizen method is strongly linked to Lean problem-solving (Fig. 1.3.3). Kaizen focuses on improvement in small steps and very often with little or no money spent. The specificity of Kaizen is the continuous improvement of processes in the direction of increasing process efficiency through gradual and continuous action. Kaizen introduces changes that are not revolutionary as in the case of Business Process Reengineering (BPR) by authors M. Hammer and J. Champy.

Popularized by J.P. Womack, since the 1990s the concept of Lean has required new thinking, which J.P. Womack calls “Lean Thinking”, or thinking based on delivering value to customers through continuous improvement. J. P. Womack moves from Lean Thinking and ‘Lean production’ over time to ‘Lean enterprise’. When one puts the publications

of J. P. Womack and team in historical order, one gets the genesis of the Lean concept (Fig. 1.3.4.). In this historical view, Lean problem-solving is the key philosophy for solving problems in the enterprise.

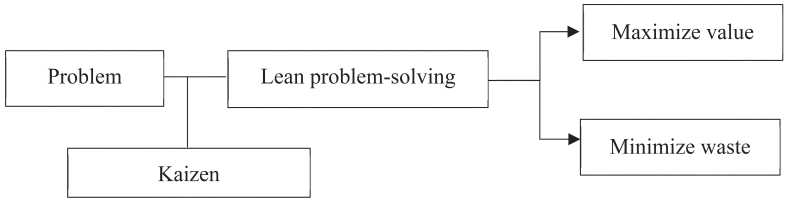

Fig. 1.3.3. Kaizen and Lean problem-solving
Source: Own elaboration based on TPS.

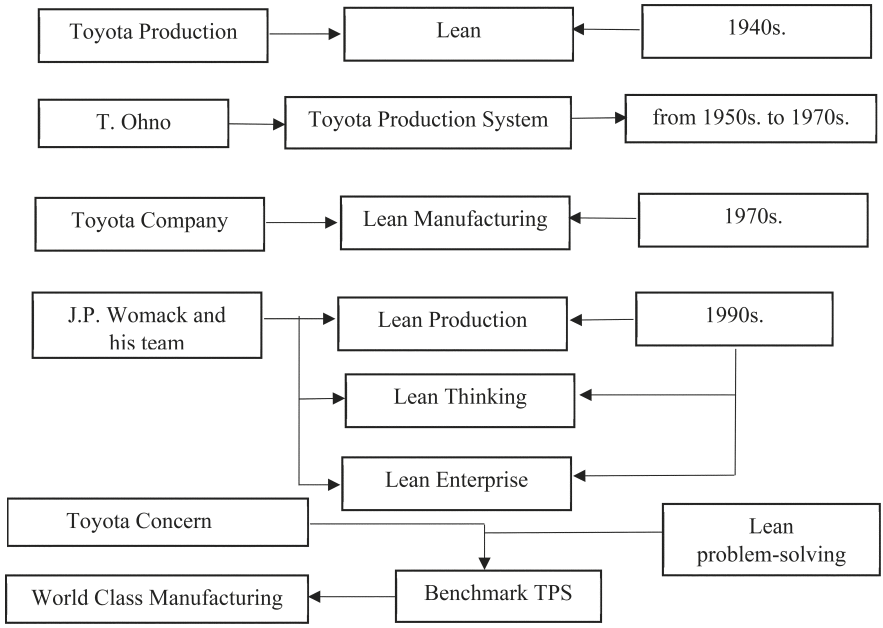

Fig. 1.3.4. History of Lean problem-solving
Source: own elaboration based on TPS.

Lean problem-solving belongs to the methods of effective problem-solving. Lean problem-solving is used to solve problems using such methods as (examples): PDCA, A3 method, Global 8 Disciplines [8D], Kepner-Tregoe [PSDM]. Those methods are intended to prevent us from

moving too quickly from diagnosis of problem to its solution. These methods are based on the foundations of effective problem-solving:

- in analysis of problem, we move from the general to the specific (helped by, among others, the 5xWhy method);
- facts are important in the problem-solving, not opinions, we collect facts and data about the problem;
- we don't blame each other or other employees, but we look for faults in the process and the standards of work;
- we must understand of the causes of the problem before we propose solutions of the problem;
- we must effectively eliminate the causes of the problem through new standards of work (new procedures, new instructions etc.).

According to D. Powell et al. (2021) modern Lean manufacturing that is based on participation and standardized practices can take advantage of the collaborative environment and structured data collection and analysis offered by Industrial Internet of Things (IoT) and Cyber-Physical System (CPS) technologies" [1.3.6]. "A philosophy of production that emphasizes the minimization of the amount of all the resources (including time) used in the various activities of the company. It involves identifying and eliminating non-value-adding activities in design, production, supply chain management and dealing with the customers" [1.3.7].

The main objectives of the Lean Manufacturing concept are often referred to by the acronym CQD. It stands for reducing costs (C – Cost), improving the quality of manufactured products (Q – Quality) and reducing the time from order to delivery to the customer (D – Delivery). To these objectives is also often added the requirement to ensure decent working and safety conditions for employees (international and national occupational safety standards). To the abbreviation: CQD is added S – Security. Abbreviation: SQDC (Security, Quality, Delivery, Cost) are the goals of Lean. In the Japanese philosophy, lean companies aim to eliminate irregularities and losses referred to as: "3 Mu" – Mura – non-rhythmicity, Muri – overload and Muda wastefulness [1.3.10]. Figure 1.3.5 shows the listed LM goals.

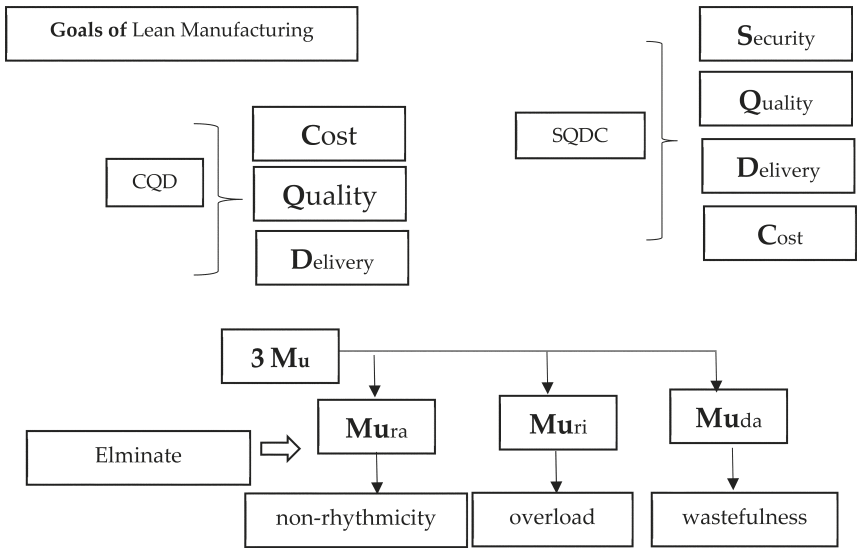

Fig. 1.3.5. Goals in the Lean Manufacturing concept
Source: Own elaboration based on TPS.

The basic 7 types of Muda in manufacturing operations were discovered and first identified by Taiichi Ohno. An additional, eighth type of Muda, was presented by Womack and Jones. Currently, the eight types of Muda include: overproduction, production bumps, unnecessary (excessive) inventory, waiting (downtime, start-up) – lack of time synchronization, unnecessary processing (unnecessary work), transport, unnecessary movement (unnecessary activities). To these seven losses an eighth loss is often added, which is lost employee engagement (employee reluctance to change, employee passivity towards the organization's tasks, etc.). Table 1.3.2 presents some of waste.

Table 1.3.2. Waste – 7 (8) Muda – causes of problem

Description	Causes of problem	Impacts	Indications, methods, techniques, actions, recommendations
• Overproduction			
production in excess of customer demand	• incorrectly balanced workstations in the process, • lack of cooperation between the orders department and the production department (no information on the actual level of demand), • lack of an IT-computer support system that integrates orders with production schedules)	• additional logistics and storage costs, • risk of destruction - loss of value of the product, • risk of withdrawal of the manufactured product (processing, other utilisation) when another customer is not interested in it	• suction system, • JiT • integration of the company's IT and computer process systems areas, • computerised system for measuring the number of pieces of product, components, parts made (identification by digital codes) – intelligent products • process tracking
• Defects			
the product or service does not meet customer requirements and/ or standards	• lack of a quality control system, • lack of a system to warn of technology failures resulting in a decline in product quality	• the need to make adjustments, • scrapping of parts of products • costs of complaints, returns of products to producers	• TQM and Quality System Control
• Unnecessary stocks			
too much material in the company, too much raw material in the production process, too much in-process material, etc.	• lack of an IT/ computer support system to control stock levels, • lack of cooperation between the purchasing department and the production and storage department (lack of information on actual stock levels at different levels of technological processing) • imbalance of material flow in processes	• increased costs, • frozen capital, • taking up production and storage space	• JiT • FIFO • Kanban • stock control – minimum stock to ensure continuity of production, risk of interruption in the supply chain must also be considered • inf.-com systems to track stock levels, at various stages of the process, • reporting of stock levels – ongoing • One Piece Flow • rhythmic production

• Waiting			
waste of time	• material shortages, • machine breakdowns • unbalanced work between operations	• loss of working time, • paying for what ? downtime, • loss of energy utilities, • unnecessary production	• TPM • SMED • sensor controlled machines • pull manufacturing
• Unnecessary processing			
performing activities that the customer is not willing to pay for	• excessive control, • production of unnecessary reports and documentation • repetitive operations	• additional production costs • increase in product costs • loss of customers	• process mapping • identification of value-adding and non-value-adding activities • identification of customer needs and expectations - customer value research
• Transport/movement			
the movement of products, intermediate products or tools	• wrong location of objects • lack of an optimal transport path, • inappropriate choice of means of transfer, transmission of materials, documents, etc. • lack of marking of transport routes	• additional transport costs, • unnecessary involvement of people, • inefficient time	• JIT • Kanban • visualisation • rhythmic production
• Unnecessary movement, operations			
unnecessary movement of workers	• lack of job instructions, • lack of cooperation between workplaces • lack of good communication • lack of work quality standards	• increase in production costs - paying for unneeded operations	• 5S • improvements in communication systems • measurement of working time based on efficient operations
• Unused ideas of employees			
ignoring employees' ideas (improvements)	• no Kaizen system • no continuous improvement • no measurement of the level of employee engagement • no system of rewarding implemented employee improvements	• decline in staff engagement	• Kaizen

Source: Own elaboration based on [1.3.8] and [1.3.9].

Lean problem-solving is driven by the need for continuous process optimization in companies (Fig.1.3.6). During Lean thinking important is the creation of value stream map(s) – VSM. The technique of VSM is very important because its application in a company only provides the basis for Lean implementations and enables measurable process results. If a company starts its development with the Lean concept by mapping the value stream (VSM), such an action is considered appropriate because the journey towards Lean then starts from the right point, i.e. values. The company asks: Where are we and where are we going? By analyzing the value stream map, an accurate picture of all process steps is obtained, together with the identification of so-called bottlenecks – i.e. process locations that specifically require improvement. The map of VS covers all activities, from the placing of the order by the customer to the delivery of the finished product. It uncovers all the problems and distinguishes between those activities that add value and those that do not. It clearly defines the links between the various processes, showing the flow of materials and information. The map (VSM) provides a unique opportunity to understand the process, and this is crucial in undertaking other improvement processes [1.3.10].

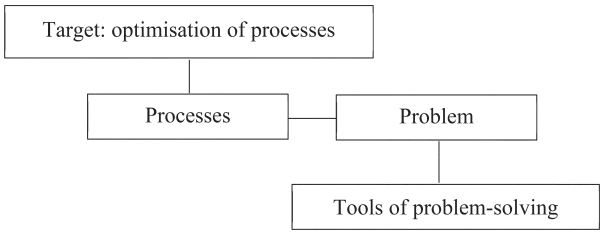

Fig. 1.3.6. Processes in Lean problem-solving
Source: Own elaboration.

When building a map (VSM), it is important to look at the organization of workstations: Kanban, FIFO, so one seeks to achieve one piece flow (one piece flow), between workstations, to harmonize the pace of manufacturing and facilitate process management. The work cell – the workstation – is a fundamental element of the value stream map. Work place needs to be appropriately organized with the aim of producing the product as easily as possible and with reduced effort for the operators

and ensuring job safety. The operational management is carried out according to the principles of optimal working conditions, ergonomics of movements, full equipment and optimal handling of workers. Workstations require improvement over time, which in the Lean concept comes down to the use of 5S [1.3.10]. In mapping of processes the following types of VSMs are realized – Fig. 1.3.7.

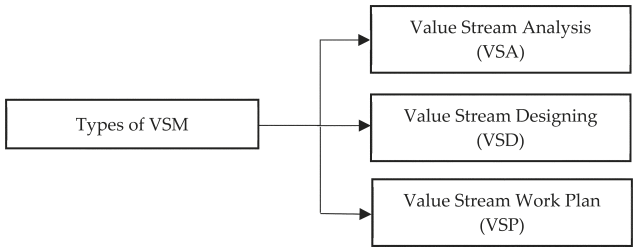

Fig.1.3.7. Typology of value stream maps in Lean problem-solving
Source: Own elaboration based on [1.3.11].

When drawing up a value map, some basic questions should be formulated:

- Why does the customer buy this product?
- Why does he/she buy products from your company?
- What makes him/her (the customer) buy?
- What does he/she pay special attention to?
- What are his/her preferences and expectations?
- What are his/her characteristics in the purchase transaction?
- Is it the quality of the product?
- Is it: competitive price?
- Is it: short delivery time?
- Is it: on-time delivery?
- Is it: speed of implementation of changes in product design?
- Is it: production of any product variety?

Prior to the pilot stage of implementing the Lean concept, it is necessary to conduct in-depth research on customer needs (analysis based on previous orders, product (assortment) analysis, complaints analysis, market research, marketing research, benchmarking analysis, etc.).

Management and employees must learn to look at the company through value stream maps [1.3.12−1.3.13]. VSM analysis is used on five of levels of process improvement (Table 1.3.3).

Table 1.3.3. Level of VSM analysis in Lean problem-solving

Level	Field of analysis	Description
1	Identify what is of value to the customer	Description product features which create added value to customer, i.e. what the customer is willing to pay for. The added value is determined from the point of view of the end user of product – a customer.
2	Indication of operations defined as a value stream	Once the value for the customer has been identified, those activities (operations) that contribute to the value are determined. The sequence of activities (operations) is called a value stream. A customer is not interested in tidying up in warehouses, keeping extensive records of operations in processes, etc.
3	Creation of the flow of operations	Once it has been identified which activities do not add value and which need to be realized from non-value adding, it is important to try to improve the flow of operations. Flow is the uninterrupted movement of products (elements of product) through the production system towards the end user (a customer). The main factors interfering with the continuity and rhythmicity of flow are work-in-progress queues – buffers. Buffers increase the production cycle - the time between the initiation of production and delivery a product to the customer. Buffers consume resources that could be used elsewhere in the company.
4	Activity of customer "pulling" useful products from process	Once redundant items have been removed and the flow stabilized, the focus is on enabling the customer to control the fulfilment of their needs, ‚pulling' useful products or services from the process. The company must streamline the process so that it is sensitive to customer expectations, delivering products only when the customer orders them.
5	Process improvement	This activity is carried out continuously so that non-value-adding activities are removed, the flow is improved, and customer needs are met more efficiently. In addition - the results achieved are an improvement in production quality. The product is shorter in the production process, reducing the possibility of damage or products being manufactured according to outdated documentation. There is a simplification of the process, as well as a reduction in deviations from normative value production standards. As all activities in the process are verified, the result is that constraints, usually bottlenecks, are removed and process throughput is increased.

Source: [1.3.14], pp. 61–62.

At this stage of change in Lean improvement, it is important to replace the push system with a pull system. The push system uses a top-down production schedule with starting points for each operation. The schedule applies to each workstation, but in this approach there may be a lack of flow and exchange of information, as individual cells do not work together. In contrast, in a suction (pull) system, which is the gold standard of Lean Manufacturing, operations are only performed when there is a signal that a particular part, material or document is needed. Information is passed upstream in the process and material is reversed downstream. The suction (pull)system eliminates waste, including the key one of overproduction, which is the cause of much waste [1.3.15]. Kanban and Just in Time (JiT) are needed in the improvement of work operations. A production Kanban takes the form of a card, although it can also be in another form, such as a demand signal for a particular part and transmitted to a upstream station in the manufacturing process. A transport Kanban is needed, ordering the movement of material to a specific location, or a signalling Kanban, forcing a certain action to be taken. In a production system, the principle of "first in, first out" must be followed. – FIFO [1.3.16–1.3.17]. Rother & Shook (1999) presented the FIFO lane. FIFO lane means a specific quantity of inventory located between supply process and customer process. This quantity is limited by a maximum that when reached this stops production of the supply process until customer process consumes material (Fig. 1.3.8). The maximum is a way to control because when it is achieve the production of that product has to stop.

Fig. 1.3.8. FIFO lane representation
Source: Rother & Shook, 1999 [1.3.12]

Problem-solving according to Lean involves continuous improvement, waste elimination, production oriented to customer satisfaction, mistakes

prevention practices (Poka-Yoke) and pull system among others. The success of this model has been mainly based in methods and tools that was developed by Toyota sustaining on Just-In-Time (JIT) and Jidoka pillars (Fig. 1.3.9) [1.3.9 and 1.318−1.3.19]. In the JIT pillar most important concept is the Pull system. This system assumes that each process inside the company is a customer driven and therefore it should receive parts (material, final product, assembly parts and others) in the right quantity and at required time (Liker, 2004). This system allows reducing stocks of final product because it only produces the quantity required. Production pulled from the customer and production orders are released into the production when the customer wants. The coordination of production and internal logistics between different processes is very important with pull system to prevent the break or oversupply of parts/components [1.3.20].

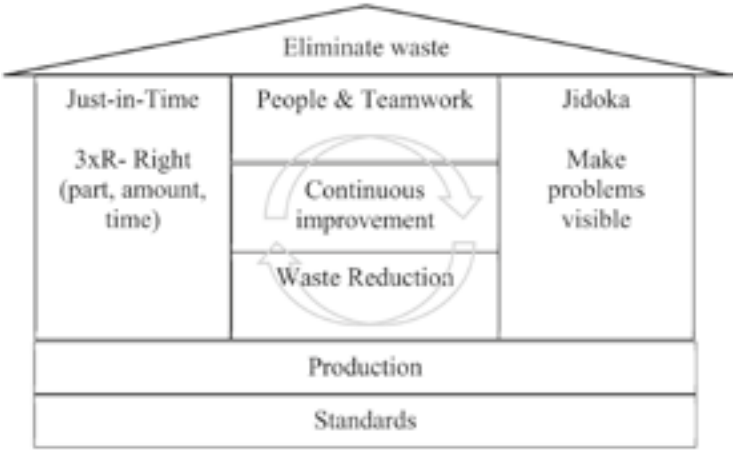

Fig. 1.3.9. TPS house
Source: Likert & Morgan (2006) [1.3.15]

Lean is a set of techniques used in the broad sense of improving production and minimizing waste [1.3.21]. The following techniques should be added to those already mentioned (PDCA, A3 method, Global 8 Disciplines [8D], Kepner-Tregoe [PSDM): Just in T ime, Pull, FIFO, Kanban, One Piece Flow, 5S, TPM, SMED, heijunka, Andon, Jidoka, Poka Yoke, Genchi Genbutsu, Fish Bone (Ishikawa), 5 x Why, VSM and

heuristic techniques, e g. brainstorming. The list of techniques cited is not exhaustive. Lean practitioners are constantly adding new techniques and methods to solve problems. Lean problem-solving techniques and methods can be organized and grouped. S. Taj and C. Morosan (2001) [1.3.22] grouped Lean tools into three areas:

1. The area of minimum waste of time, materials, labor (JIT), continuous flow, machine maintenance – *Total Productive Maintenance* (TPM).
2. The area of Total Quality System (TQM).
3. The area of Human Relation Management (HRM).

Together, these areas form Lean as a multidimensional approach to problem-solving, resulting in the application of improvement instruments for better quality, lower costs, speed of response to the problem and flexibility in solving the problem. The key areas of toolbox of Lean problem-solving are presented in Fig. 1.3.10. In Lean problem-solving, human resources and their orientation towards total reduction of unnecessary costs and activities are important. Employees should be familiar with lean methods, quality control tools, logistical methods and other forms of process improvement. During Lean problem-solving, meetings or internal training the focused should be on Lean methods and techniques used and the results obtained. Any analysis of the results may indicate the need to reapply the chosen Lean tool due to lack of results. Analyzing after the application of each tool allows for continuous improvement and thus brings the enterprise closer to the Lean goals.

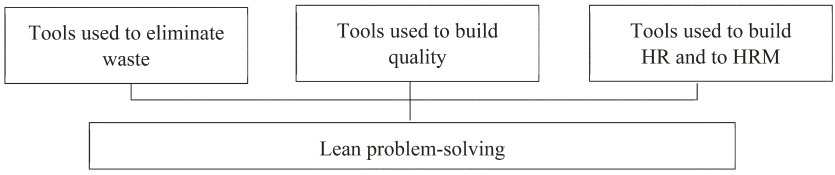

Fig. 1.3.10. Key areas of tools used in Lean problem-solving
Source: own elaboration based on [1.3.22].

Lean methods and techniques can be grouped into 'hard' and 'soft' methods. The division is conventional and was created on the basis of the criterion

of the object or subject of influence. If the Lean method or technique concerns process technology then it is classified as a hard method, and if the human factor then it is classified as a soft method [1.3.23] (tab. 1.3.4).

Table 1.3.4. Grouping of Lean methods and techniques

Hard	Soft
• Pull	• VSM
• JiT	• Visualisation
• Kanban	• Standard operation
• 5S	• Load levelling
• Supermarket	• Kaizen
• Sockets and subject lines	• Suggestion system
• One pice flow	• Teamwork
• Takt time	• Empowerment
• Production leveling	• 3A report
• Andon	• Hoshin Kanri
• Jidoka	• Genbutsu Gemba
• SMED	• PDCA
• TPM	• Brainstorming
• Poka-Yoke	• 6/3/5 method
• Lean Logistics	• One lesson

Source: Walentynowicz P. (2013, p. 414) [1.3.23] based on TPS.

The described above Lean methods and techniques can assist the enterprise in implementing Lean and adding methods from one group to another. In lean problem-solving, the group of hard methods must be complemented by soft methods, and vice versa. It would be good for the company to introduce in parallel the methods and techniques belonging to the groups listed (in Table 1.3.4). Other classification present authors: E. Pawłowski, K. Pawłowski and S. Trzcieliński (2010, pp. 27-28) [1.3.24]. They grouped methods and tools of Lean into the following categories:

- product development and marketing: Concurrent Engineering, Simultaneous Engineering, Mass Customisation, Modularity, Designing for Manufacturing, Developing the Quality Function, Designing for Manufacturing, Quality Function Deployment, TRIZ/ /TIPS (Russian: Теория решения изобретательских задач, Theory of Inventor's Problem-Solving),

- system analysis and mapping: Takt Time, Systems Dynamics, Product Contribution Analysis, Muda Map, Value Stream Mapping, Soft Systems Analysis,
- continuous improvement and management: 5S (Sort, Straighten, Shine, Systematize, Sustain, Shingo version) or CANDO (Cleanup, Arranging, Neatness, Discipline, Ongoing Improvement), western version: selection, systematics, cleaning, standardization, self-improvement, kaikaku, standardization (Standards), value engineering (Value Stream Mapping), soft systems analysis, value engineering (Soft Systems Analysis), Value Engineering and Value Analysis, Kaizen, TPM: Total Productive Maintenance, OEE: Overall Equipment Effectiveness, 5 x Why, Business Process Reengineering, Kanban, Batch Sizing, Changeover Reduction or SMED (Single Minute Exchanges or Dies), heijunka, Cellular Manufacturing, Visual and Audio Management, Point of Production Control, Bottlenecks,
- quality: Kano Model, yidoka, poka yoke (Failsafing), Short Run Statistical Production Control (SPC), Sigma, Precontrol,
- supply and distribution - Supplier Partnership, Supplier Associations, Integrated Supply, People (human resources) Open Book Management, Change Management.

Each Lean implementation activity must conclude with a results analysis consisting of:

- comparison of the results achieved with the objectives,
- identification of errors and shortcomings committed,
- guidelines for further action (in terms of applying new tools and educating employees).

The implementation of Lean methods and techniques ends with a thorough analysis of the assumptions made at the beginning of the company's transition and the presentation of the results obtained – measurable benefits (outcomes). When the enterprise detects discrepancies, an analysis of the reasons for their creation is required, with a consequent backtracking to the phase that caused the discrepancies. The compliance of the results with the objectives allows

the company to move to the next stage of the Lean transformation. In addition to loss elimination analysis, quality analysis is also important. It is worthwhile at this stage of introduce and evaluate the change and also integrate the analyses of the system: Lean and Quality. The final stage of implementing the Lean concept is improvement. The stages of improvement never end in a functioning enterprise, it is a continuous process in line with the Deming PDCA cycle (Fig. 1.3.11−1.3.12].

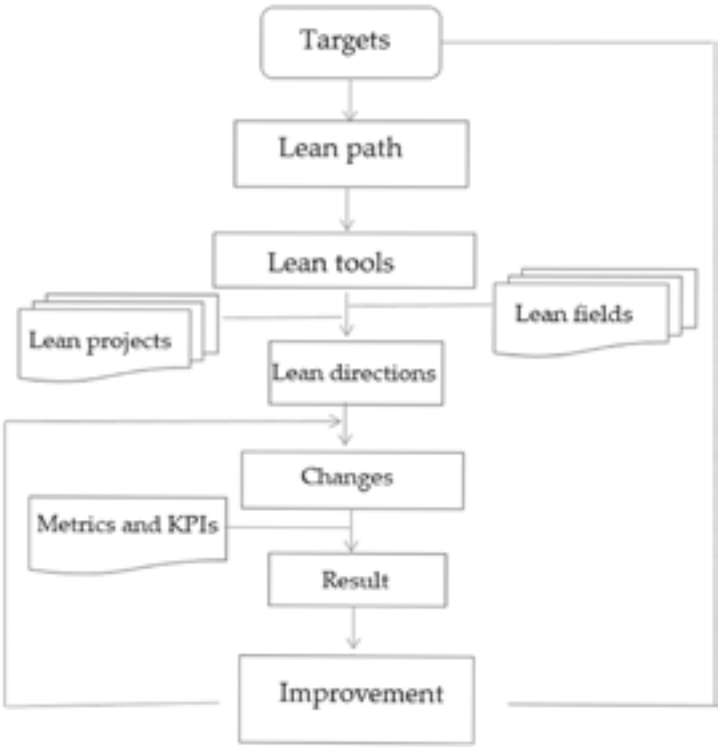

Fig. 1.3.11. The way in Lean
Source: Own elaboration based on [1.3.11].

Fig. 1.3.12. Scopes of improvement in Lean – levels of reference to facts
Source: Own elaboration based on [1.3.11].

To summarize the chapter about Lean problem-solving, I would like to quote two definitions. The first for A. Sandersa (2016) "Lean revolution caused considerable decrease of resources' wastes and in-creased productivity efficiency" [1.3.25], the second for Beifert (1.3.26] "Lean principles focusing on dynamic production variation inside the larger volumes are seen as more efficient than traditional manufacturing)". In my opinion these definitions fully reflect the meaning of Lean in organization.

Lean problem-solving is characterized by:

- planning the company's tasks and activities in joint discussion with employees - involving employees in process management,
- educing process costs by increasing the productivity,
- proposing a large number of simple improvement solutions,
- elimination of defects and waste,
- immediate removal of errors (rejection of errors at source),
- dynamic planning and organization of processes (depending on developments of change),
- employee responsibility for activities (processes)
- employees 'awareness of business costs
- continuous training about techniques and methods problem-solving,
- group work and job crossing in production line,
- decentralization of decisions on the operational level of the business,
- employee responsibility towards the company,
- direct contact managers and employees,
- partnership with suppliers,
- product diversification (production flexibility)- high production flexibility
- highest quality,
- Just in Time,
- continuous material flow,
- continuous improvement of work standards,
- continuous improvement of productivity (broadly defined, e.g. productivity of people, productivity of equipment, material intensity, energy intensity),

- building the engagement of all employees in the continuous improvement process of the production system and organization.

There are many ways to integrate Lean practices into your business at a team or organizational level. The Lean concept we can describe by such feathers (Fig. 1.3.13.)

- continuous improvement
- Value stream mapping
- Metrics and KPIs – *Key Performance Indicators* (There are several metrics that can be used to measure quality and efficiency of a Lean business, such as lead time, throughput, and cycle time. These metrics are meant to be shared real-time with all employees and stakeholders, so that key performance indicators are visible at all times. This level of transparency helps to encourage shared responsibility of process improvement and customer value)[1]

Fig. 1.3.13. Triple of keys in problem-solving
Source: Own elaboration.

Customer's value and Lean thinking are foundational parts of any Lean problem-solving. A commonly used model of continuous improvement is the PDCA model, which stands for Plan, Do, Check, Act. This model encourages teams to perform incremental tests and document learnings throughout a process in order to be constantly improving and building quality. Value stream mapping helps teams visualize the steps of

[1] The topic was presented in the chapter about effectiveness of Lean

a process so that the steps can be evaluated and improved over time. This practice is commonly used to improve any process where there are repeatable steps and multiple handoffs. Through analyzing the steps and handoffs, inefficiencies are identified and improved upon.

1.4. Improvement in Quality Management

A quality improvement process presents a series of steps to think about and work through. Quality improvement (QI) is a systematic, formal approach to the analysis of practice performance and efforts to improve performance. These steps help you ask questions, gather information, and take actions effectively and efficiently [1.4.10; 1.4.19; 1.4.20]. Thus, a quality improvement process provides a framework that guides you from the initial improvement challenge to successful completion of the effort. quality improvement process's biggest benefit is to prevent you from skipping important steps along the way [1.4.13; 1.4.14].

Quality improvement should be the objective of all companies and individuals. It improves the rate of return or profitability through increased productivity and by cost reduction. It is consistent with the philosophy that a company should continually seek to expand its competitive edge [1.4.4].

There are many models of quality improvement used in various quality approaches. In the Table 1.4.1 we presented the generis ten-step quality improvement process comparing the common terminology with the terminology used in quality management.

The main goals if continuous quality improvement are connected with following problems [1.4.5]:

- guide quality operations,
- ensure safe environment and high quality of services,
- meet external standards and regulations,
- assist agency programs and services to meet annual goals and objectives.

Table 1.4.1. Generic ten-step quality improvement process

Common Terminology	Quality Terminology
What do I or we want to accomplish?	Identify charter and make initial plans.
Who cares and what do they care about?	Identify customers and requirements.
What are we doing now and how well are we doing it?	Assess current state
What can we do better?	Define preferred state, gaps between current and preferred state, and improvement opportunities.
What prevents us from doing better? What are the underlying problems?	Identify barriers and root causes.
What changes could we make to do better?	Develop improvement solutions and plans.
Do it.	Implement plans.
How did we do? If it didn't work, try again.	Monitor results; recycle if necessary.
If it worked, how can we do it every time?	Standardize.
What did we learn? Let's celebrate!	Conclude project, identify lessons learned, and recognize accomplishment.

Source: [1.4.1].

A variety of approaches – or quality improvement models – exist to help you collect and analyze data and test change. While it's important to choose a repuTable quality improvement model to guide your efforts, it's more important that you fully commit to using the quality improvement process and good quality improvement practices. We can distinguish many benefits of implementing quality improvement in organization. We characterized them in the Table 1.4.2.

Table 1.4.2. Benefits of implementing quality improvement within organization

Benefit	Characteristic
Error Reduction	Continuous quality improvement can reduce the number errors your business makes. Defective products and mistakes made when providing services are examples of errors that can be costly. Because small companies cannot produce goods and services in mass like larger companies, errors can be especially costly. Focusing on continuously identifying potential sources of errors and fixing them can avoid problems that might otherwise crop up over time.
Increased Adaptability	A philosophy of continuous quality improvement can make a business better equipped to adapt to changes in an industry, take advantage of opportunities and avoid threats. Processes in a company pursuing continuous quality improvement continually undergo incremental changes. Companies used to continually implementing changes are better equipped to adapt their businesses to changing markets than those that employ rigid processes, such companies engaged in mass production.

Benefit	Characteristic
Increased Productivity	Continuous quality improvement can result in hiccups in productivity in the short term as businesses implement better processes, but it can lead to increased productivity in the long term. For example, a small business that revises its production processes might have to shut down production for a day to implement the improvements, resulting in a day of lost production. After the changes take effect, though, the company might have fewer production slowdowns and higher productivity.
Improved Morale	Continuous quality improvement focuses on improving business processes as a means to improve a company rather than blaming workers for sources of inefficiency. According to the Louisiana Department of Children & Family Services, one of the main benefits of continuous quality improvement is that it can improve staff morale. Workers with high morale tend to be more productive and less likely to quit their jobs than workers with low morale. Reducing turnover is especially important for small business because owners must often recruit and train new workers themselves.
Greater employee engagement	Continuous improvement gives staff the basis they need to solve the problems they encounter in their work themselves. This not only improves efficiency, but also sends the signal to your staff that you appreciate and value them and their vision.
Improved customer service	Continuous improvement creates a framework that gives you better insights into your customers' needs and requirements. What are your customers looking for? What problems are they encountering? And which products or services create the most value for your customers? Armed with the answers to these questions, you can anticipate customers' needs and requirements more quickly and accurately.
A more proactive learning culture	Knowledge rapidly becomes outdated in this fast-paced digital era. But continuous improvement forces you to constantly investigate what could be different, better, more efficient.
Higher-quality of products and services	Because continuous improvement focuses on making small, incremental improvements to your processes, it also boosts your products and services' market value.
Faster delivery	if you're producing more products faster, then your time to market is shorter. This gives you a competitive edge over your competitors who take longer to get their products to market.
Safer workplace	Continuous improvement also involves paying attention to the quality of the workplace. Is everything neat and tidy? Are processes, machinery, and workspaces safe to use? Continuous improvement should also provide answers to this type of question and make safety in the workplace a top priority.
Better insight into objectives and strategies	Continuous improvement also raises knowledge levels among employees about your organization's objectives. Terms such as 'strategy' and 'core values' then take on greater meaning for your entire workforce.
Greater focus on innovation	In the current economic climate, change is the only constant. Today's innovations may be totally outdated in six months' time. Continuous improvement encourages agility and increases adaptability. Vital for any company looking to remain relevant in the future!

Source: Own elaboration based on: [1.4.2; 1.4.3; 1.4.11].

The first and most widespread model of quality management continuous improvement is so called PDCA model popularized by E. Deming. PDCA (plan–do–check–act or plan–do–check–adjust) is an iterative design and management method used in business for the control and continual improvement of processes and products [1.4.1]. We presented the model on Figure 1.4.1 and described four it's stages in Table 1.4.3.

Fig. 1.4.1. Deming's PDCA Cycle
Source: Own elaboration based on: [1.4.7].

Table 1.4.3. PDCA Cycle

Stage	Characteristic
Plan	Establish objectives and processes required to deliver the desired results. • Understand your definition of quality • How do you know if a change is an improvement? • Can you predict your outcomes? In this stage you will want to test and analyze for what is currently wrong with the product or how it can be improved. You will also attempt to understand what changes you can make to tackle these problems or to make something better. You will look to map out operationally how this improvement can be managed and achieved. Finally, you will hope to be able to predict the outcomes of your process improvement efforts.
Do	Carry out the objectives from the previous step. • Start with small scale testing • Implement iterative changes to your experiments to test variables • Document every step Instead of simply deciding to make a change and suddenly overhauling all operations, it is vital to bring change about slowly and iteratively while testing hypotheses. Using studies which can be measured against control groups helps you better understand the data you receive, allowing you to not just improve your output but to understand exactly why your output was improved by the changes you enacted.

Stage	Characteristic
Check	During the check phase, the data and results gathered from the do phase are evaluated. Data is compared to the expected outcomes to see many similarities and differences. The testing process is also evaluated to see if there were any changes from the original test created during the planning phase. If the data is placed in a chart it can make it easier to see any trends if the PDCA cycle is conducted multiple times. This helps to see what changes work better than others and if said changes can be improved as well. • Did your outcomes match with your predictions? • In what ways did the outcomes differ and why? • How could you test variables which were previously unaccounted for?
Act	Also called "Adjust", this act phase is where a process is improved. Records from the "do" and "check" phases help identify issues with the process. These issues may include problems, non-conformities, opportunities for improvement, inefficiencies, and other issues that result in outcomes that are evidently less-than-optimal. Root causes of such issues are investigated, found, and eliminated by modifying the process. Risk is re-evaluated. At the end of the actions in this phase, the process has better instructions, standards, or goals. Planning for the next cycle can proceed with a better baseline. Work in the next do phase should not create a recurrence of the identified issues; if it does, then the action was not effective. • Implement your recommended changes • Track performance and data over time • Provide all documentation to the company to improve internal theory The Act stage is both the implementation of improvements into the company and the implementation of new knowledge into our theory of our own company. The Act stage should attempt to synthesize the new information gleaned in the Study stage with our broader understanding of how our business operates.

Source: Own work based on: [1.4.1; 1.4.7; 1.4.15; 1.4.16].

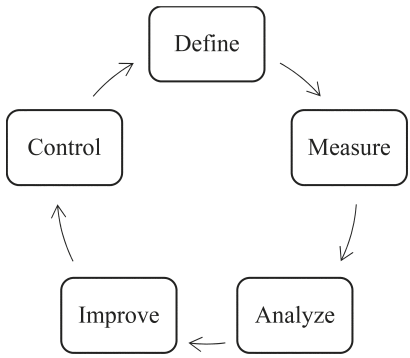

Fig. 1.4.2. DMAIC continuous improvement cycle
Source: Own elaboration based on: [1.4.6].

Another model of continuous improvement very useful in quality management especially in Six Sigma implementation is so called DMAIC model. DMAIC (an acronym for Define, Measure, Analyze, Improve and Control). The DMAIC improvement cycle is the core tool used to drive Six Sigma projects. However, DMAIC is not exclusive to Six Sigma and can be used as the framework for other improvement applications [1.4.6]. We presented the model on Figure 1.4.2 and described four it's stages in Table 1.4.4.

Table 1.4.4. DMAIC Cycle

Stage	Characteristic
Define	The purpose of this step is to clearly pronounce the business problem, goal, potential resources, project scope and high-level project timeline. This information is typically captured within project charter document. Write down what you currently know. Seek to clarify facts, set objectives and form the project team.
Measure	The purpose of this step is to measure the specification of problem/goal. This is a data collection step, the purpose of which is to establish process performance baselines. The performance metric baseline(s) from the Measure phase will be compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement has been made. The team decides on what should be measured and how to measure it. It is usual for teams to invest a lot of effort into assessing the suitability of the proposed measurement systems. Good data is at the heart of the DMAIC process.
Analyze	The purpose of this step is to identify, validate and select root cause for elimination. A large number of potential root causes (process inputs, X) of the project problem are identified via root cause analysis (for example a fishbone diagram). The top 3-4 potential root causes are selected using multi-voting or other consensus tool for further validation. A data collection plan is created and data are collected to establish the relative contribution of each root causes to the project metric, Y. This process is repeated until "valid" root causes can be identified. Within Six Sigma, often complex analysis tools are used. However, it is accepTable to use basic tools if these are appropriate.
Improve	The purpose of this step is to identify, test and implement a solution to the problem; in part or in free of all whole. This depends on the situation. Identify creative solutions to eliminate the key root causes in order to fix and prevent process problems. Use brainstorming or techniques like Six Thinking Hats and Random Word. Some projects can utilize complex analysis tools like DOE (Design of Experiments), but try to focus on obvious solutions if these are apparent.
Control	he purpose of this step is to embed the changes and ensure sustainability, this is sometimes referred to as making the change ‚stick'. Control is the final stage within the DMAIC improvement method. In this step; Amend ways of working; Quantify and sign-off benefits; Track improvement; Officially close the project; Gain approval to release resources. [

Source: Own elaboration based on: [1.4.6; 1.4.17; 1.4.18].

Next model of continuous improvement is model used in Kaizen tool. Kaizen is a tool that improves quality, productivity, safety, and workplace culture. Kaizen focuses on applying small, daily changes that result in major improvements over time [1.4.12]. The Kaizen philosophy states that our way of life – be it our working life, our social life, our home life – deserves to be constantly improved. Kaizen is about achieving improvements by taking small steps instead of drastic, rigorous changes. Although improvements under Kaizen are small and incremental, the process brings about dramatic results over time. Additionally, Kaizen is a low-risk and an inexpensive approach. It involves process improvements that do not require a large capital investment. As a result, Kaizen encourages workers to experiment and try out new ideas. If an idea does not work, they can always revert the changes without incurring large costs. We presented the model on Figure 1.4.3.

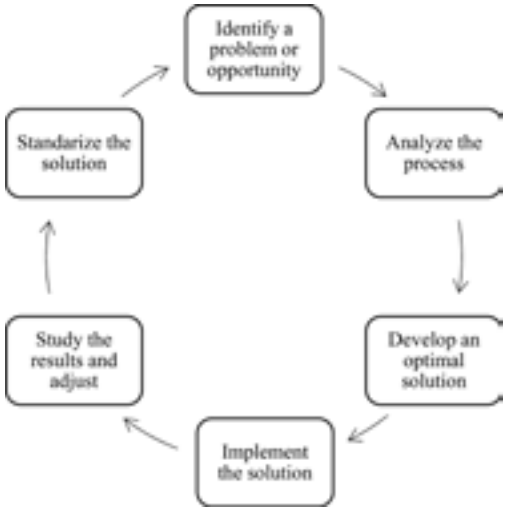

Fig. 1.4.3. Kaizen continuous improvement cycle
Source: Own elaboration based on: [1.4.9].

All presented models of continuous improvement should be implemented in appropriate way to achieve success within organization. The continuous improvement model reflects the idea that organization should undertake improvements in all its activities. Presented models can be applied to every industry regardless the size of the business. But to achieve

the appropriate effectiveness of model's implementation we should concentrate on principles described in the Table 1.4.5.

Table 1.4.5. Main principles of continuous improvements models

Principle	Characteristic
Improvements are based on small changes rather than major paradigm shifts or new inventions	This concept is essential because significant changes often feel frightening and destabilizing to organizations. By approaching change in small, incremental steps, the continuous improvement model reduces the fear factor and increases speed to improvement. When following this principle, the organization does not need to wait for a strategic shift or a new product release to begin to advance. Any idea that eliminates waste speeds production times, reduces defects, or allows employees to develop new skills, is worth exploring. In addition, this approach opens the door to consider small-scale proposals to improve processes and enable employees to do their best work.
Employee ideas are valuable	The continuous improvement model relies greatly on employees, not only top management, to identify opportunities for improvement. This bottom-up improvement is effective because employees are closest to the problems and thus better equipped to solve them. Ask people what improvement they could make to save them 5 minutes a day. Then empower them to implement that improvement, and spread it to everyone else in the organization doing the same process. In this way, you can take a small idea that anyone could come up with and drive a significant impact. For example, say you get one idea from ten employees, each of which saves them five minutes per day. That's ten ideas. Share all ten of those improvements with one hundred other employees so that every one of them is now saving fifty minutes per day (10 ideas x 5 minutes each).
Incremental improvements are typically inexpensive to implement	Employees tend to focus on small changes that can be accomplished without a lot of expense. In fact, many ideas from employees involve eliminating process steps rather than adding them, which is an excellent way to ensure that every activity adds some value to the customer and reduces wasted effort.
Employees take ownership and are Involved in improvement	Getting people to change the way they've always done things is hard. Do you know what makes it easier? Rolling out changes that originated from the front lines. When people come up with ideas to improve their own work, they intrinsically see the value of the changes. Knowing that improvements come from their peers inspires faith in the necessity of the changes. By engaging your staff in the continuous improvement model, you empower them to take charge of their own work (but you help them as leaders). As a result, they're able to identify problems or opportunities for improvement, follow through on implementing their ideas, take credit for the work, and see a measurable impact from their efforts. In this way, the sole burden of improvement and process management is lifted from managers, who can spend their time more effectively coaching staff on improvement techniques and removing barriers to implementing changes.

Principle	Characteristic
Improvement is reflective	Constant feedback is an essential aspect of the continuous improvement model. During every phase of executing an improvement, open communication is critical to both the final results of the improvement and the maintenance of employee engagement. Admittedly, this is tough to pull off in a traditional improvement culture. Coaches don't have the visibility they need to keep up with everyone doing the improvement work. Senior leaders can't engage without a major time commitment, meetings are tough to schedule, and communication gets buried in inboxes.
Improvement is measurable and potentially repeatable	It is not enough to simply make a change and call it an improvement. To achieve real success, the impact of change must be measured. This makes it possible to determine if the change can be applied successfully to other problems. Proving positive ROI also helps keep the organization aligned around improvement. Improvement can be measured (most easily with software) in terms of cost savings, revenue, time to market, customer satisfaction, safety incidents, collections, defect reduction, or almost any other key performance indicator for your organization.

Source: Own elaboration based on: [1.4.8].

Chapter 2. **Leadership in an organizational improvement.**

2.1. The Leader's role in improving an organization

Leadership inspires people to live the vision, mission and values of an organization. Leaders do not just tell people what to do. Great leaders empower people to make decisions that support the goals and vision of the community, ultimately developing smarter solutions and increasing the performance of the organization. Their job is to inspire and coach. Leadership abilities and especially social abilities are key factors for team management and organizational performance. Successful leaders can increase the performance of an organization. Leadership training and its applications are essential to the development of organizations [2.1.1], [2.1.2], [2.1.3], [2.1.4].

■ Introduction

Leaders and managers may have many different characteristics. These characteristics may be innate or developed through various training programs. Howard Gardener [2.1.5] and many other researchers have defined multiple intelligences as important traits needed by those in a leadership role. Some researchers focus specifically on the emotional intelligence of those in leadership roles. This specific aspect can affect the performance of the workgroups.

Many methods can be used to define the leadership role within organizations. Depending on the methods of data collection and statistical analysis, the results may differ. The purpose of this section is to focus on how the leader's training and characteristics will improve organization. Leadership training programs [2.1.4] as well as leadership and worker performance within an organization [2.1.5]

will also be discussed. Improvement in the organization will be the main consideration. Leaders of an organization are instrumental in the process of development and improving of the organization.

■ Leadership Styles

Traditionally the leadership style can be divided into 6 different styles based on the personality of the leader and the historical tradition within the company [2.1.6], [2.1.7], [2.1.8].

1) Commanding Leadership Style
   This is an older and obsolete style of leadership. The leader exercises full authority and enforces the chain of command within the organization. This can be counterproductive in a knowledge-based organization. The lack of autonomy of the employees decreases creativity and innovativeness in an organization. The decisions of the leader are being enforced by disciplinary actions. Often the employees feel intimidated and do not have respect for the leader. This was the popular leadership style a century ago during the time when the economy was based in manufacturing. School systems and company training were promoting values like obedience and respect for authority. Commanding leadership style still exists in some countries but by hindering creativity, innovativeness and progress is not appealing to a modern workforce. This management style has some advantages during a crisis situation for the organization. During a crisis situation, obedience and a sense of strong authority in charge may have advantages.

2) Visionary leadership style
   A visionary leader has a future vision of an organization and shares that vision with employees. The future vision of the organization needs to be realistic (achievable) and supported by the plan to follow. The leader must be an expert in the field and have trust of employees. This leadership style provides workers with some autonomy and builds up a sense of ownership. Visionary

leadership style is conducive towards creativity and innovativeness and is suiTable for a modern style knowledge-based organization.

3) Affiliative leadership style
This type of leadership prioritizes people and human relationships before the organizational tasks. This leadership style nurtures human capital. Good work is being rewarded but at the same time some mediocre performance is being tolerated. Affiliative leadership can rapidly build a positive working environment. This type of leadership does not work well in a crisis situation. This leadership style can be effective if employees have a sense of commitment and respond well to the leader.

4) Democratic Leadership Style
Democratic leaders provide everyone in the organization a voice in the decision-making process. Democratic leadership increases the sense of employee ownership within the organization.
Employees, therefore, are more committed to the success of the organization.
This leadership style is not appropriate in a crisis type of situation when a decision needs to be made quickly.

5) Pacesetting Leadership Style
Pacesetting Leadership Style relies on setting high-performance examples for the employee. A pacesetting leader is willing to help underperforming workers. This leadership style can be effective only if employees are motivated and competent. A pacesetting leader needs to be a good communicator to clearly define the expectations.

6) Coaching Leadership Style
Coaching leaders invest their time and effort into the professional development of employees within the organization. This leadership style can be effective in the development of future leaders. Coaching leadership is not popular due to the time-consuming process of mentoring and coaching.

7) Servant Leadership Style
   The Servant Leadership Style is focused on helping and supporting project teams. Servant Leader is focused on removing roadblocks to success for employees of an organization so they can be more productive and effective. Servant Leadership Style focuses on an agile culture and leading by example.

Robert K. Greenleaf is considered the modern servant leadership theorist. In a 1970 essay, [2.1.7] The *Servant as Leader* (revised in 2008), [2.1.8] Greenleaf defined the term servant leadership as different from other forms of leadership. "The difference manifests itself in the care taken by the servant-first to make sure that other people's highest priority needs are being served. Do they, while being served, become healthier, wiser, freer, more autonomous, and more likely themselves to become servants? And what is the effect on the least privileged in society? Will they benefit or at least not be further deprived?" An institution or organization can also be a servant. Awareness, foresight, and listening are some of the characteristics of a servant leader.

■ Traditional and Modern Leadership Style

Historically traditional leadership was based on rules, obedience, control, and was enforced by disciplinary action. Traditional leadership was hindering creativity and innovativeness. Psychological safety was low, and workers were intimidated by the leader. The focus was on punishing or firing poor workers rather than rewarding good workers. Any kind of failure was criticized and punished.

Modern leadership involves building a sense of ownership as well as inclusion and trust within the organization. Modern leadership is built on psychological safety and is conducive to creativity and innovativeness. Modern leaders motivate employees, delegate authority, and also provide direction, inspiration, and guidance. Modern leaders of an organization are servants to their employees. "They serve you because you serve them."

Good Leaders need to possess 15 essential leadership skills.

These are as follows: [2.1.9], [2.1.10], [2.1.11]

- Integrity
- Delegation
- Communication
- Self-Awareness
- Gratitude
- Learning Agility
- Influence
- Empathy
- Responsibility
- Courage
- Humility
- Vision
- Agility

A good leader needs to exhibit passion, confidence, ambition, commitment, and transparency. They also need to be open to constructive criticism and appreciate the agility of employees. Good leaders focus on the vision of the organization and customer satisfaction. They support agile teams to be as effective as possible and do not micromanage agile team activities. Modern leaders of an organization are always open minded, accept failures, and enjoy the process. Modern leaders adapt to rapidly changing environments and promote organizational change according to a well-known expression "If changes outside of the organization are happening faster than changes inside of the organization, that is the beginning of the end for the organization." Good Leaders lead by example by modeling desired behaviors [2.1.11], [2.1.12], [2.1.13].

■ The Making of a Successful Leader

Self-help books (approximately 82,000 published in 2019) [2.1.6] are one of the largest categories of published books. It is estimated that there are approximately fifteen thousand leadership books in print [2.1.7]. UNESCO data indicates that two million books are published each year. In the online UNESDOC Digital Library lists there

are approximately nineteen thousand leadership-titled world-wide publications. [2.1.8] In addition, a non-comprehensive list of journals contains thirty-nine periodicals related to leadership available in the United States. [2.1.9] The Library of Congress (United States) has catalogued approximately two hundred twenty-five thousand various types of publications related to leadership. With so many titles and publications, it is hard for potential leaders choose what to read and what guidelines to follow.

- **How can an effective leader be identified?**

The Society of Human Resources Management (SHRM) has three hundred thousand business leaders who influence the lives of one hundred fifteen million workers and their families in one hundred sixty-five countries. Specific characteristics of a successful leader and a competency model were developed [2.1.11]. Key leadership skills, abilities, and diversified experience identified by SHRM are as follows:

- Identify and define the problem
- Generate alternative solutions
- Evaluate the alternative solutions
- Determine the "best" solution
- Take actions to "mitigate" the disadvantages of the best solution
- Implement the decision
- Follow up to evaluate the success of the solution
- Take corrective action, when necessary

The SHRM Competency Model focuses on the following six characteristics [2.1.11].

1. Expertise and knowledge in the area of work
2. Ethical behavior
3. "People" skills/Social interaction skills
4. Critical thinking skills
5. Communication skills
6. Global and cultural awareness

Effective leadership can be also identified based on seven changes in organizational behavior [2.1.13], [2.1.14], [2,1,15] [2.1.16], [2.1.17].

1. Workers have become effective leaders
2. There are higher levels of job satisfaction
3. There are increased levels of worker performance
4. Workers demonstrate greater commitment to their jobs
5. Workers demonstrate greater commitment to the organization's goals, mission and values
6. Workers feel more comfortable making decisions
7. There is an increase in teamwork.

■ Assessment of leadership based on performance and climate within an organization

Leadership leading to positive performance within an organization can be assessed in many ways. Effective leadership supports effective implementation of evidenced-based practices (EBPs). The Implementation Leadership Scale (ILS) measures the development, factor structure, initial reliability as well as convergent and discriminant validity related to positive performance leadership. The characteristics of transformation and characteristic of leaders can overlap. Those characteristics are as follows: [2.1.18], [2.1.19], [2.1.20]

- Creative
  - (How does a leader encourage their followers?
- Interactive
  - Does the leader have a reward system in place? Is the leader one of the team?
- Visionary
  - Is the leader able to see beyond the present situation?
- Empowering
  - How does the leader build their team?
- Passionate
  - Does the leader believe that their work and the work of the team will bring positive outcomes?
- Relationship builders
  - Does the leader communicate frequently with the team members, so that the leader and the team members understand their perspective?

- Influence agents
  - Is the leader a positive mentor to their mentees?

A shorter Portuguese version of the effective leadership attributes was developed in 2017 [2.1.17]. The shorter version of attributes list the following characteristics:

- Strong interpersonal communication skills
- Supportive personality
- Recognition of work performance (Rewards and/or encouragement)
- Shares responsibility
- Encourages new ideas
- Respectful
- Establishes consistent values.

These characteristics help to lead the organization to successful performance and outcomes. The goal of evaluating leadership traits is to enhance success of the leader, organization and the workforce [2.1.21], [2.1.22]. [2.1.23].

During the 20th and 21st centuries many scholarly articles have been written using different terminology related to the leader's role in improving an organization. There are other terminologies which has been used in scholarly articles. The terminology includes, but are not limited to the following:

- Authentic Leadership
- Collective Leadership
- Distributed Leadership
- Ethical Leadership
- Knowledgeable Leadership
- Perseverant Leadership
- Shared Leadership
- Supportive Leadership
- Team Leadership
- Transformative Leadership
- Transactional Leadership.

Besides the behaviors of effective leaders cited historically, there are many hard and soft skills allowing a leader to become effective [2.1.24], [2.1.25], [2.1.26].

2.2. Agile and learning teams in an organization

■ What is an agile organization?

All enterprises and organizations try to constantly find more effective methods of conducting business as well as more effective forms of organizational structure. Their objectives are to enter new markets and stay ahead of the competition. Today the organizational structure of most companies is to optimize company efficiency. Focusing on efficiency is important but this usually happens at the expense of agility. The conditions of the business world are changing. New realities emerging from Industry 4.0. and applying artificial intelligence makes agility a higher priority than efficiency. The most proactive and state-of-the-art companies are already restructuring themselves to be more competitive in this new business environment. The main objectives of those companies are to become: [2.2.1]

- Learning organizations
  (Challenging the status quo as well as emphasizing professional growth and sharing the company's vision.)
- Agile organizations
  (Rapidly adapting to change and not being afraid of unknown territories as well as risky initiatives.)
- Organizations adapting to change rather than following a set process

  Each of those three attributes are contributing to the company's success. All three of them applied simultaneously can be very powerful tools allowing the organization to adapt to disruptions swiftly. This requires a major cultural change within the organization. The leadership of the organization needs to be an agile leadership [2.2.2]. A good agile leader removes roadblocks to success for their employees, so that they can be productive

and effective. Agile leadership is more effective in bringing better outcomes to the organization. Typically, agile leadership team includes all members of the executive committee.

■ Agile verses waterfall approach

There is a big difference in the approach between the traditional *waterfall method* and the *agile team method.* The waterfall method is a lineal approach that requires the team to complete one phase of the project before moving to the next phase [2.2.3]. The waterfall approach method is still being used in manufacturing and construction industries, where changes are difficult, costly, or even not possible to implement after the project is completed. An agile team environment encourages the team to work simultaneously on different phases of the project. Agile teams are often working very intensely on two-week deadlines. Implementation of an agile team environment takes time and requires major adjustments in the organizational culture [2.2.4]. There is no one size fits all approach. Agile teams follow agile principles. Some of those principles may vary, but they have a common denominator.

- Team is communicating with customers to collect necessary information.
- Team is defining work plans and milestones.
- Team is delivering a usable output.
- Team members are collaborating constantly.

■ What is an agile team?

An agile team is normally small with no more than nine members. Individuals serving on an agile team can consist of employees or contractors hired just to serve on the team [2.2.5]. The average size of an agile team is four to seven individuals based on the size of the project. Employees working on an agile team do not have responsibilities for other projects. The roles of the team members are as follows:

- Product owner
  (Often this is the executive or major stockholder.)
- Scrum Master

(This person has a vision of the end product and how the product fits into the company's goals.)
- Two-to-five developers depending on the size of the project

An agile team can be defined as a group of individuals working together as a multidisciplinary team to deliver a new product or service to the customers and stockholders. This multidisciplinary team working together generates synergy. (The total positive results are more than the sum of the individual contributions of the team members.) Agile teams must be empowered to decide how to organize their work and how to approach the task. Agile teams increase their output over time based on a continuous learning process as well as organizational improvements [2.2.6]. An agile team operates within a framework of the project activity workflow and the role of the team members. Agile teams organize their own operating procedures.

There are four criteria to determine whether a team is truly agile [2.2.7].
1. Is the team self-organizing?
2. Does the team improve the methodology and objective of their work constantly?
3. Is the team effective in producing value for the clients or stockholders?
4. Does the team validate the accomplishments?

■ Managing agile teams/Social support

In a traditional company, employees have a designated mentor. Periodic meetings with this mentor (once a month) are not very productive. In the past, a slow methodical process was the norm. In agile organizations, members of the team are able to access many experts (globally) using search engines and available social networks. [2.2.8] Agile organizations can access knowledge by developing the infrastructure for sharing the knowledge. People often want to share knowledge, but they do not know how to do it. Rapid methodologies for sharing knowledge can be as follows:
- Development of toolkits
- Video guides prepared by experts

There is a need for full transparency in sharing knowledge within the company. This transparency allows for trust building and a sense of ownership. Direct communication between employees needs to be encouraged. Employees can try, fail early, learn and try again. This methodology is called the *rapid control failure method.* This is a methodology for the rapid prototyping of ideas [2.2.9], [2.2.10]. The company's policy should promote the culture of accepting failures and celebrating successes. Hiding failures can lead to very costly bigger failures. The company's policy needs to integrate people with technology and allow people to develop their human potential and values. In Industry 4.0 learning is taking place between the interaction of people and technology.

- **Agile versus scrum teams**

In addition to agile teams, there are also scrum teams. The role of the scrum team is very similar to the role of an agile team. Scrum teams are solving shorter tasks with smaller deliverables. Normally agile teams are working on longer tasks for an extended period of time. Agile teams present their results at the end of the task [2.2.11]. Agile teams do not require external management because they are:

- self-contained and self-organized,
- understanding the procedure and have an agile mindset,
- holding each other accountable for contributing to the task,
- using feedback to assess progress of the work and
- mentoring each other constantly and sharing their skills and knowledge.

To effectively build agile teams the organization needs to make a commitment to permanently change and to maintain the stability of that change. The individual characteristics associated with that change [2.2.12] are to:

- build optimism among the employees,
- reassure people to make them secure,
- breakdown barriers between the departments as well as management and employees,

- optimize failures so they happen early in the process,
- provide resources,
- provide detailed plans for recovery and
- allow employees to focus on their task.

An agile organizational environment consists of a number of small teams. Small teams allow for face-to-face communication, dialogue and collaboration. A small team environment is conducive towards accountability and a sense of ownership. The main characteristics of an agile team environment are [2.2.13]:

- a multidisciplinary unified outlook,
- accountability and ownership at the highest level,
- a culture of excellence and high emotional intelligence,
- a focus on performance objectives with a high passion for work and
- an inspiring and supportive leaders.

Scrum teams are normally a subset of agile teams and are often used as a transition to agile teams. Normally agile teams focus on the highest priority items in the organization. The leader of the agile team needs to be a servant leader and agile coach. The leader needs to create all the conditions for the team to be successful and deliver the expected outcomes and commitments [2.2.14].

- **Agile learning organizations / / Promoting a culture of learning and knowledge-sharing**

Institutional culture and an agile learning strategy as well as sharing the resources need to be embedded in the operation of agile teams. Everybody is a teacher and student at the same time. Offering formal courses and providing a course calendar does not meet the needs of agile teams. Learning needs to be based on intelligent rapid failure [2.2.9], [2.2.10]. The failures need to happen early enough so that the search for a better solution can move on. Agile teams are leveraging the new technologies as well as expanding the limits of human capital capability [2.2.15]. During the activities of agile teams, different data from unexpected sources are synthesized rather than waiting

for data from formal business reports. In the business environment disruptions are happening quicker than ever. If the organization is not sufficiently agile to respond quickly, it will lose its position on the market. Sometimes it is necessary to disassemble the existing structure to respond rapidly to market disruptions. Many organizations are still functioning in centralized structures with different functions being in separate departments within the organization. These types of structures optimize the efficiency but slow down the process of reactions to disruptions. Slow reactions to disruptions put the organization at risk of losing their market share.

A hierarchy in decision-making hinders agility in any organization. A more agile model needs to be developed to empower multidisciplinary teams to make decisions as well as incorporate learning into the workflow. The presence of agile teams that are able to assemble and disassemble rapidly (as needed) make an agile learning organization [2.2.16].

A formal learning process by offering courses to the employees is too slow, ineffective and does not meet the learning requirements of the agile teams. The learning process needs to be embedded into the work of the agile team. The members of the team can access the knowledge as needed and acquire the knowledge while working on the task. In an agile organization the delivery of the necessary training has changed entirely. The objectives of the training did not change. The employees need to be able to access the information and the knowledge at the time that it is needed.

■ Building an agile learning culture

The knowledge-based economy requires organizations and businesses to become learning organizations. Learning organizations are constantly prioritizing learning for the employees and the transitioning the learned methodology as needed. This leads to a company culture of system thinking, understanding the company's vision and challenging the status quo. Every agile team needs to be a self-learning team as well. At the first meeting the team needs to decide the following: [2.2.17]

- What knowledge does the team have already?
- What knowledge does the team need to acquire?
- What processes and practices will be used?
- What technology will be used?

There can be knowledge-sharing groups already. Learning can be organized around technology, interest or common ground. The agile methodology was originally introduced by companies specializing in software development. The methodology uses the technique of adapting to change rather than focusing on the process [2.2.18]. The success of the method allows for its application in other fields. It is always up to the team to solve the problem and decide on the solution without "an external manager" interfering in the team's activities. Organizations adapting to a culture of agile learning are more responsive to changes and disruptions. Implementing agile methodology is associated with meeting resistance and distrust from the employees. This can be a time-consuming process. Agile learning methodology has been used in the software industry for a number of years. Agile methodology is also widely adapted in the project management industry. Therefore, there is already sufficient experience in implementing agile learning methodology. Agile learning is defined as the process of adapting an agile concept into learning a design process. Learning agility is defined as an adaptation to an unfamiliar situation by associating previous experiences with a current problem. Many companies using agile learning are also promoting "just-in-time learning" to allow employees to access information and knowledge as needed. Agile learning needs to be mobile learning available through online multiple devices. It is highly recommended to divide agile online learning into *microlearning*. The benefit of microlearning are as follows: [2.2.19]

- Learners may only need one-or-two specific skills.
- Learners may only have a limited amount of time (5 to 10 minutes).
- Microlearning courses are sufficient to provide the knowledge needed by agile teams.

Microlearning courses are becoming more popular due to their benefits.

2.3. Human factor in Lean problem-solving

Lean problem-solving must involve people. G. R. Salancik states that employee engagement is a state in which the employee supports the activities of the enterprise and participates in problem-solving [2.3.1]. Employee engagement is a true commitment to the enterprise. An engaged employee has a positive attitude towards work and performs his or her work diligently. Such an employee has a strong desire to do more than the obligatory scope of the tasks (going beyond the duties, looking for ways to solve the company's problems, improving working conditions, improving work organization, etc.) For A.M. Saks [2.3.2], commitment is a form of intellectual and emotional dedication to the organization and is measured by the amount of effort the employee puts into the work. An employee's activity during problem-solving can be measured by ideas submitted, attendance at meetings in problem teams, number of technical patents submitted, etc. Engagement is a state in which the employee contributes to the work and is positive towards it. An active employee is satisfied with the achievements of his work and the development of the company [2.3.3].

Problem-solving can involve both frontline workers and management representatives. Employees participating in the organization's problem-solving are: Front Line Employees, Supervisor and Managers (Table 2.3.1). In addition to the company's employees, consumers can also be invited to actively solve problems, which in the case of Lean is particularly important because a way (way) of improving customer value is being sought. Employees participating in problem-solving can be organized according to the structure of the organization. (Table 2.3.2) Employees at different levels of the organization differ in their problem-solving activity. Top management is particularly involved in strategic problem-solving. Employees at lower levels of the organization are involved in solving operational problems.

Table 2.3.1. People involved in problem-solving

Front Line Employees	These are typically the people who will deal with the problem on a regular basis. Nobody will have greater insights into the root cause, and potential solutions, than these employees. Having one or more people from this level helping to solve a problem is critical.
Supervisor	A supervisor or department manager will be able to provide additional insights into how the problem is impacting the business. They will also be the ones to help coordinate the implementation of any potential solutions so they should be involved.
Appropriate Management	If a problem, or the expected solutions, will require upper-level management approval, someone from that team should be included in the process. It is easier to have someone from the leadership partnering with you from the beginning than to try to bring them up to speed for approval down the road.
Customers	When appropriate, having a customer available to discuss the problem can be very helpful. Customers are sometimes the ones who have the most information about the symptoms of the problem, which can make them very helpful.

Source: [2.3.4].

Table 2.3.2. Hierarchy of employee involvement in problem-solving

Top management	– determination to make problem-solving part of organizational improvement, – realization of the problem-solving objectives (goals) through company development, – introduction of problem-solving methods in all departments of the company, – support for problem-solving and give direction to the activities by allocating resources, – building systems, procedures and structures to support the functioning of problem--solving teams
Middle management	– development and implementation of problem-solving objectives (main and micro goals), – dissemination of knowledge of problem-solving tools to employees through intensive training programs, – application of problem-solving techniques in individual plants and departments of the company, – implementation, maintenance and improvement of problem-solving methods in the plants, departments/divisions of the company, – assist employees in developing problem-solving skills and tools.
Supervising staff	– the application of problem- solving in each workplace, – creating standards for problem-solving leaders and providing guidance to employees, – improving communication with employees and maintaining high morale among employees, – supporting the activities of problem-solving teams, – supporting individual employee suggestions (suggestions for improvement), – building a structure of problem-solving culture in the workplace, reacting to irregularities in the process, execution of activities, etc., – inspiring (prompting) improvement activities of employees.

Workstation staff	– involving in problem-solving through a system of suggestions and small staff team activities, – work with workplace standards (self-monitoring), – continuous self-development aimed at better problem-solving (making suggestions for change), – development of employee skills and competences (multifaceted education) at the problem recognition and problem-solving stages.

Source: [2.3.5].

It would be good for problem-solving teams to have leaders. The leaders of such teams are important employees of the company. Leader influences others, inspire, motivate and direct the activities to achieve the organizational goals and to be active in problem-solving [2.3.6]. Leader should be flexible, smart, mobile etc. Leader must be authentic during proposing of changes in organization [2.3.7]. Leaders should be mainly focused on problem and on managing of people. Leaders should be agile and helpfully for others. Leaders should be agile and adaptive in terms of learning, working cross-culturally and cross-generationally, etc. The list of features is unlimited, and is still being built and lengthened. The features of leaders are changed according to new condition of business. The list consists of intellectual competencies, managerial competencies and socio-emotional competencies [2.3.8].

A continuous improvement system does not exist without standardization of the processes. However, there is only one branch of standardization applied at Toyota. Managers also need to have certain working standards developed, without which the company's improvement culture cannot survive on its own.

Leader Standard Work (LSW) is about much more than standardized work for leaders. It entails a shift in leadership philosophy; a move away from traditional leadership activities to critical work that leaders must do to reinforce and sustain improvements in culture, performance and practices [2.3.9].

LSW entails a fundamental change to a leader's routines. Leaders mimic the behavior they would like to see, setting the example for

best practice. Furthermore, they move away from an 'audit' mentality towards one of structured coaching. In this way, LSW as a management philosophy instils a sense of ownership, responsibility, accountability and empowerment across all levels of the organization [2.3.9]. The Lean Leader Work Standardization (LSW) is a series of planned activities within the Continuous Improvement (CD) Program for which every leader in the organization from the CEO to the leader on the production line is responsible (Fig. 2.3.1).

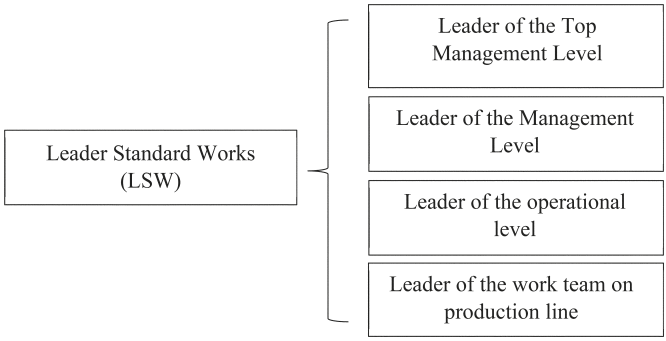

Fig. 2.3.1. Levels of leaders in organization with LSW
Source: Own elaboration

Leaders have many tasks in organization. Table 2.3.3. summarizes the specific responsibilities of each level of leader.

Table 2.3.3. Tasks of leaders in problem-solving

Plant Manager	• walk through the plant at least twice a month, paying particular attention to 5S, visual system of processes, A3 designs and talking to workers on the line about operational problems; • participate once a month as an observer at daily production meetings, • take part in discussion with leaders or managers about problems, once a quarter.
Production Manager	• walk around the plant paying particular attention to 5S, visual system of processes, A3 designs and exchange a word with the leader on the production line, • participate as an observer in daily shift meetings at KPI boards. • take part in production meetings, as a leader or as a participant of team. • be an observer at changeovers, e.g., preparation phase, or completion phase. • inform leaders and line managers on company problems. • arrange meetings with a group of operators and leaders where the topic is dictated by the employees (it is a good idea if there is a meal at this meeting at the same time, such as a second breakfast or lunch, provided by the employer of course).

Shift leader	• take part in daily meetings at the KPI boards • present results or targets, communicate important information, remind the team of the rules including safety in the workplace and to engage the team to focus on their work and when the meeting is at the end of the shift, to thank them for their cooperation. • visiting production lines, paying particular attention to 5S and control the check sheets and visuals, A3 projects or quality system. • talking to leaders, talking to operators about problems on lines.
Line leader	• walking-through production lines daily before and after shift, • paying particular attention to 5S and Kaizen cards. • observing the maintenance of standards work machine/line changeovers. • talking to the operators to build relationships with the workers (use open questions about problems, listen to employees' ideas, etc.)

Source: [2.3.10].

Standardization of the leader's work is a tool by which the Lean Leader can teach the employee something new, e.g. adherence to safety at work, quality, standardization, attitude (from Situational Lean Leadership, to a teachable moment). If the leader conducts the entire conversation in the right way, it will influence the relationship between the employee and the leader, reflecting the work culture that needs to be built daily in the company as part of the continuous improvement program.

The main intention of using the LSW approach is to supervise certain standards of work in others and – at the same time – to enter into our own standard of work as a good example for others. LSW is not form of control others, rather it is an activity that supports others. Leader in problem-solving can remind, help, verify, ask, talk, thank, compliment, etc. LSW is a method to engage and encourage employees to maintain certain standardized processes and build the right relationships, within the principles and method of continuous improvement.

2.4. Team problem-solving techniques in Quality Management

According to literature we can define the problem-solving as an act consisting from following steps:

- definition of the problem,
- determination of the cause of the problem,

- identifying, prioritizing and selective alternative solutions,
- implementing a solution.

It could be describe briefly as in Figure 2.4.1 or particular four steps can be fully characterized as in Table 2.4.1.

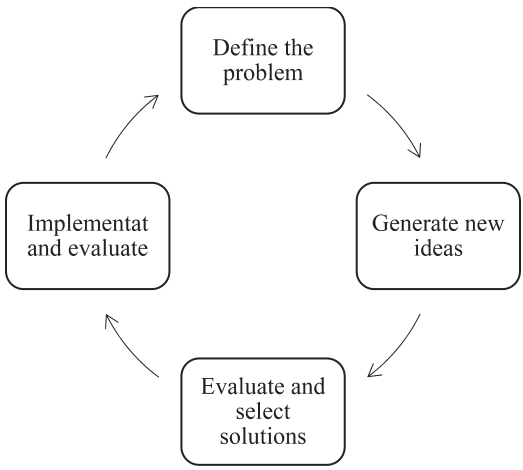

Fig. 2.4.1. Steps of problem-solving process
Source: [2.4.1].

Table 2.4.1. Steps of problem-solving process

Step	Characteristic
Define the problem	Diagnose the situation so that your focus is on the problem, not just its symptoms. Helpful problem-solving techniques include using flowcharts to identify the expected steps of a process and cause-and-effect diagrams to define and analyze root causes. • Differentiate fact from opinion • Specify underlying causes • Consult each faction involved for information • State the problem specifically • Identify what standard or expectation is violated • Determine in which process the problem lies • Avoid trying to solve the problem without data
Generate alternative solutions	Postpone the selection of one solution until several problem-solving alternatives have been proposed. Considering multiple alternatives can significantly enhance the value of your ideal solution. Once you have decided on the "what should be" model, this target standard becomes the basis for developing a road map for investigating alternatives. Brainstorming and team problem-solving techniques are both useful tools in this stage of problem-solving. Many alternative solutions to the problem should be generated before final evaluation. A common mistake in problem-solving is that alternatives are evaluated as they are proposed, so the first accepTable solution is chosen, even if it's not the best fit. If we focus on trying to get the results we want, we miss the potential for learning something new that will allow for real improvement in the problem-solving process. • Postpone evaluating alternatives initially • Include all involved individuals in the generating of alternatives • Specify alternatives consistent with organizational goals • Specify short- and long-term alternatives • Brainstorm on others' ideas • Seek alternatives that may solve the problem
Evaluate and select an alternative	Skilled problem solvers use a series of considerations when selecting the best alternative. • Evaluate alternatives relative to a target standard • Evaluate all alternatives without bias • Evaluate alternatives relative to established goals • Evaluate both proven and possible outcomes • State the selected alternative explicitly
Implement and follow up on the solution	Leaders may be called upon to direct others to implement the solution, "sell" the solution, or facilitate the implementation with the help of others. Involving others in the implementation is an effective way to gain buy-in and support and minimize resistance to subsequent changes. • Plan and implement a pilot test of the chosen alternative • Gather feedback from all affected parties • Seek acceptance or consensus by all those affected • Establish ongoing measures and monitoring • Evaluate long-term results based on final solution

Source: Own elaboration based on: [2.4.1].

In the Table 2.4.2 we described the 4 steps how to make the team solving process better to achieve competitive advantage.

Table 2.4.2. Steps to improve team's problem-solving strategy

Step	Characteristic
Align yourself, and each of your team members with one of the 6 problem-solving strengths	• Ability to get into the detail of a problem and evaluate all components & perspectives to understand it and determine what's missing. • Ability to continuously collect detail and put it into sequence, see the big picture, evaluate where the problem exists and why. • Ability to take information that is available and make assumptions based on that information, deducting the most optimal solution based on personal perspective. • Ability to see a problem as black or white and a solution as right or wrong by seeking authoritative approval & consensus. • Ability to envision several outcomes, make assumptions as to what needs to be done to achieve an outcome & is willing to take risks because they have confidence in their own judgment. • Ability to compartmentalize a problem as an individual event and seek solutions with an open mind.
Align yourself and your team with one or more of the 6 problem-solving weaknesses	• Difficulty moving quickly enough to a solution without all the facts. • Difficulty developing a unique solution when comparative situations from the past do not exist. • Difficulty seeing things from perspectives other than their own. • Difficulty making decisions to move past a problem, without affirmation that they are moving forward with an accepted approach. • Difficulty focusing when faced with a deadline or budget constraint, losing sight of more obvious solutions. • Difficulty being pragmatic enough to solve the issues, allowing problems to reoccur several times before a solution is put in place.
Discuss the Problem-Solving Evaluation Process, Strengths & Weaknesses with your team as a whole	• Train your team on each of the problem-solving mindsets, making it an open discussion amongst them. This will help you tackle problems more strategically when they do indeed occur. • Work with each individual to overcome their weaknesses by leaning on other team members who can use their strengths to assist. • Once you meet with everyone individually, it is up to you whether or not to share the conclusions with the entire team. Personally, I believe this is an important step, but it really depends on your team and if you think they are ready to share the information. You may choose to wait until positive steps have been taken to improve weaknesses, then share. Team members may also decide to share the information on their own.
You are now ready to tackle your next business problem	• Assign the problem to one team member to lead the solution process based on their strengths. • Assign other team members as support based on leader's weaknesses.

Source: Own elaboration based on: [2.4.2].

In the quality management there are many existing models of problem-solving. We described main of them in the Table 2.4.3.

Table 2.4.3. Main problem-solving models

Model	Characteristic
The ISO 9001 Corrective Action Process	A corrective action procedure is what most organizations provide for employees who must perform root cause analysis and take corrective action. Unfortunately, the procedure tends to mimic the ISO standard by requiring the following: • problems are identified and documented, • causes are determined, • corrective action is taken, • effectiveness of the action is evaluated. While the procedure typically includes a bit more information about who is to oversee and sign off on corrective actions, what forms and databases are to be used to document the diagnosis/actions/results, and the required reporting channels and timing, the procedure usually does not provide any help for how to go about finding causes.
Six Sigma DMAIC	The Define-Measure-Analyze-Improve-Control (DMAIC) model used for Six Sigma process improvement is certainly a good one. It helps an organization make sure that it is working on the right problems, has the right people involved, is considering critical-to-customer measures, is evaluating reliability/stability/capability of the process data, is identifying the most important factors contributing to performance, is changing the process to reduce the impact of those factors, and is maintaining the gains. The three steps of define, measure, and analyze are excellent for identifying root causes, but a Six Sigma Black Belt who guides project teams through such an analysis typically receives four weeks of training on how to apply the model and the various tools that support it. So just providing such a high level model to assist the corrective action process would not be adequate, since untrained personnel would have insufficient knowledge of how to follow it.
Other Models	There are, many other problem-solving models available. Plan-Do-Check-Act (PDCA), developed by Dr. Walter Shewhart and communicated and modified by Deming to PDSA (Plan-Do-Study-Act), has been widely used but provides little detail on how to find a root cause. The 8-Discipline (8-D) model, developed by the Ford Motor Company in the 1980s, has been widely adopted by many organizations, and the recent enhanced Global 8-D version is quite good. But again, the raw form (for example, just the list of 8-Ds) does not provide much cognitive guidance.

Source: Own elaboration based on: [2.4.4; 2.4.10; 2.4.11; 2.4.12].

One of the best methodologies used in quality management to team problem-solving is so called 8D Problem-Solving Methodology. 8D stands for eight discipline problem-solving methodology. The 8Ds are:

1. Select an appropriate team
2. Formulate the problem definition
3. Activate interim containment
4. Find root cause(s)
5. Select and verify correction(s)
6. Implement and validate corrective action(s)
7. Take preventive steps
8. Congratulate the team

We characterized all those disciplines in the Table 2.4.4.

Table 2.4.4. 8D problem-solving methodology

Discipline	Characteristic
D01 Initiation	We call this step D0 because it precedes the formal steps D1–D8. In this phase, a customer or internal management indicates they have a specific problem that needs to be addressed. At this time a quality alert is generated and vigorous containment effort is started to isolate the problem from the customer(s). Management will decide whether this problem is simple and can be handled by an individual, or whether it is significant enough to launch an 8D problem-solving team. The 8D effort requires significant time and resources, management support allocating time, and team authorization, all of which are essential for the success of the team.
D1 A Team Approach	Management is responsible for assembling a team that has relevant knowledge and experience to address the issue. Management needs to allow time for the team to go through the four phases of team development – forming, norming, storming, and performing – to be effective. In some organizations a senior manager is assigned as champion for the team to provide additional support and remove barriers for the team. It is very important that management assign a team leader for the project. The team leader should be experienced (subject matter expert) and should have completed a few 8D projects. The team leader must have the authority as needed to allocate time and acquire other resources needed for the team. In manufacturing cases, the team members could be from production, industrial engineering, design engineering, purchasing, programming, human resources, quality, and so forth. In retail cases, the team members could be retail associates, shift supervisors, marketing representatives, maintenance workers, delivery persons, and so forth. For healthcare, the team members could be nurses, nurse supervisors, programmers, doctors, and so forth. In the food industry the team members could include hostesses, servers, bus people, cooks, bartenders, shift supervisors, dietitians, accountants, and so forth.

Discipline	Characteristic
continued: D1 A Team Approach	Depending on the team's level of experience, the team leader might facilitate some root cause analysis training (which we discuss in the next chapter) with the team members. It is the team leader's responsibility to keep the team on track and provide an open line of communication among all stakeholders. It is also the team leader's responsibility to ensure that all team meeting minutes are kept, including team progress, action plan, and individual assignments and dates.
D2 Define and Explain the Problem	The team will precisely detail the problem. It is extremely important that the problem be described in measurable terms. It is important to remember that it is difficult to improve something that can't be measured. A nice tool available to define the problem is called the 5W & 2H. It is defined as follows: • Who? Who is complaining? • What? What are they complaining about? • When? When did it start? • Where? Where is the problem occurring? • Why? Why is this problem occurring (an educated guess)? • How? How did this problem occur (an educated guess)? • How? How many problems (measurable and magnitude)?
D3 Interim Containment Action	All nonconforming material must be isolated from the customer. This step is typically already in progress as discussed in step D0. An open and honest line of communication is required in this step between producer and recipient of the problem. Every effort is taken to isolate the problem from the customer. It may involve 100% inspection of the product in house and in the customer's warehouse and additional steps in the process to ensure that the integrity of the product being produced is maintained. It is the team's responsibility to review whether the containment action taken already is appropriate and to modify the action plan if needed. Containment action is not a substitute for a permanent solution. Most containment actions are inspection in nature, are temporary Band-Aids, add cost, and are no substitute for a permanent solution. The containment action plan must be documented on the 8D form and reviewed periodically.
D4 Root Cause Analysis	Finding the root cause is the most difficult part of the 8D process. If this problem were simple and easily solved, it would be resolved already. Two types of variability exist that should be considered: special cause and random cause. Naturally, we are interested in finding the special cause that is deeply hidden in the process. The main reason teams with subject matter experts are formed is to find the special cause. Problem-solving tools are sometimes categorized as soft or hard. The term "hard" here refers to those using statistical analysis. In this book we concentrate on the following soft tools: • Team brainstorming event • Five whys process • Flowchart • Checklists and check sheets • Fishbone diagram

Discipline	Characteristic
D5 Develop Permanent Corrective Action	Once the root cause of the problem has been identified, a number of corrections may be discussed. Scientific methods should be utilized to screen for the best solution. It is essential that the correction(s) be realistic, practical, cost-effective, and robust against process variability. Error proofing the process is a preferred method. The team must ensure that the correction does not create unintended consequences. At this stage, the correction should be implemented on a small scale to verify its effectiveness.
D6 Implémente Permanent Corrective Actions	At this stage a permanent correction has been verified. The next step is to validate the correction on a large production scale. Again the team needs to ensure the correction does not create other issues. All changes need to be documented and all procedures updated. As the team implements the permanent solution, other people will be affected and need to be made aware and trained. An environment needs to be created so that the user(s) of the new method will have an opportunity to participate and be encouraged to do so. All suggestions from other groups need to be reviewed and, if valid, be incorporated into the total change process.
D7 Prevent Future Reoccurrence	For a reasonable time, the team should monitor whether the improved process is meeting all team goals set at the onset, and should ensure that the ongoing performance metrics are not negatively affected and are meeting all requirements. The lessons learned from this effort should now be leveraged on similar processes. All quality control systems should now be in place and validated.
D8 Recognizing the Team	Once the team task is completed and results meet all customer requirements, the team needs to be formally recognized and thanked by the management. The team members should thank all others who helped them to succeed, and they should complete all relevant paperwork and publish their work for future use. Team focus should especially be on lessons learned and application to similar processes.

Source: Own elaboration based on: [2.4.3; 2.4.8; 2.4.9].

Another interesting approach to team problem-solving solution is approach based on root cause analysis. Root cause analysis (RCA) is the process of discovering the root causes of problems in order to identify appropriate solutions. RCA assumes that it is much more effective to systematically prevent and solve for underlying issues rather than just treating ad hoc symptoms and putting out fires. Root cause analysis can be performed with a collection of principles, techniques, and methodologies that can all be leveraged to identify the root causes of an event or trend. Looking beyond superficial cause and effect, RCA can show where processes or systems failed or caused an issue in the

first place. Using this approach we should concentrate on following core principles that guide effective root cause analysis [2.4.5]:

- Focus on correcting and remedying root causes rather than just symptoms.
- Don't ignore the importance of treating symptoms for short term relief.
- Realize there can be, and often are, multiple root causes.
- Focus on HOW and WHY something happened, not WHO was responsible.
- Be methodical and find concrete cause-effect evidence to back up root cause claims.
- Provide enough information to inform a corrective course of action.
- Consider how a root cause can be prevented (or replicated) in the future

A typical root cause analysis consists of following steeps [2.4.7]:

- A decision is made to form a small team to conduct the root cause analysis.
- Team members are selected from the business process/area of the organization that experiences the problem. The team might be supplemented by:
  - A line manager with decision authority to implement solutions.
  - An internal customer from the process with problems.
  - A quality improvement expert in the case where the other team members have little experience with this kind of work.
- The analysis lasts about two months. During the analysis, equal emphasis is placed on defining and understanding the problem, brainstorming its possible causes, analyzing causes and effects, and devising a solution to the problem.
- During the analysis period, the team meets at least weekly, sometimes two or three times a week. The meetings are always kept short, at maximum two hours, and since they are meant to be creative in nature, the agenda is quite loose.
- One person in the team is assigned the role of making sure the analysis progresses, or tasks are assigned to various members of the team.

- Once the solution has been designed and the decision to implement has been taken, it can take anywhere from a day to several months before the change is complete, depending on what is involved in the implementation process.

In the root and cause analysis we can use many quality management methods. Some of them we characterized in the Table 2.4.5.

Table 2.4.5. Selected methods used in Root Cause Analysis

Method	Characteristic
Quality function deployment (QFD)	Quality function deployment (QFD) is a structured process for planning the design of a new product or service or for redesigning an existing one. QFD first emphasizes thoroughly understanding what the customer wants or needs. Then those customer wants are translated into characteristics of the product or service. Finally, those characteristics are translated into details about the processes within the organization that will generate the product or service. QFD shortens the design time and reduces the costs of achieving product or service introduction. The planning stage may take longer than without QFD, but expensive corrections and redesigns are eliminated. Eventually, fewer customer complaints, greater customer satisfaction, increased market share, and higher profits are achieved.
Affinity diagram	The affinity diagram organizes a large number of ideas into their natural relationships. This method taps the team's creativity and intuition. It was created in the 1960s by Japanese anthropologist Jiro Kawakita. The affinity diagram process lets a group move beyond its habitual thinking and preconceived categories. This technique accesses the great knowledge and understanding residing untapped in our intuition. Very important "Do nots": Do not place the notes in any order. Do not determine categories or headings in advance. Do not talk during step 2. (This is hard for some individuals!)
Cause and effect Fishbone diagram	This can help identify possible causes for a problem by encouraging us to follow categorical branched paths to potential causes until we end up at the right one. It's similar to the 5 Whys but much more visual. Typically, we start with the problem in the middle of the diagram (the spine of the fish skeleton), then brainstorm several categories of causes, which are then placed in off-shooting branches from the main line (the rib bones of the fish skeleton). Categories are very broad and might include things like "People" or "Environment." After grouping the categories, we break those down into the smaller parts. For example, under "People" we might consider potential root cause factors like "leadership," "staffing," or "training." As we dig deeper into potential causes and sub-causes, questioning each branch, we get closer to the sources of the issue. We can use this method eliminate unrelated categories and identify correlated factors and likely root causes. For the sake of simplicity, carefully consider the categories before creating a diagram. Common categories to consider in a Fishbone diagram:

Method	Characteristic
continued: Cause and effect Fishbone diagram	• Machine (equipment, technology) • Method (process) • Material (includes raw material, consumables, and information) • Man/mind power (physical or knowledge work) • Measurement (inspection) • Mission (purpose, expectation) • Management / money power (leadership) • Maintenance • Product (or service) • Price • Promotion (marketing) • Process (systems) • People (personnel) • Physical evidence • Performance • Surroundings (place, environment) • Suppliers • Skills
Change Analysis/ Event Analysis	This method is especially handy when there are a large number of potential causes. Instead of looking at the specific day or hour that something went wrong, we look at a longer period of time and gain a historical context. • First, we'd list out every potential cause leading up to an event. These should be any time a change occurred for better or worse or benign. Example: Let's say the event we're going to analyze is an uncharacteristically successful day of sales in New York City, and we wanted to know why it was so great so we can try to replicate it. First, we'd list out every touch point with each of the major customers, every event, every possibly relevant change. • Second, we'd categorize each change or event by how much influence we had over it. We can categorize as Internal/External, Owned/Unowned, or something similar. Example: In our great Sales day example, we'd start to sort out things like "Sales representative presented new slide deck on social impact" (Internal) and other events like "Last day of the quarter" (External) or "First day of Spring" (External). • Third, we'd go event by event and decide whether or not that event was an unrelated factor, a correlated factor, a contributing factor, or a likely root cause. This is where the bulk of the analysis happens and this is where other techniques like the 5 Whys can be used.
5 Whys	One of the more common techniques in performing a root cause analysis is the 5 Whys approach. We may also think of this as the annoying toddler approach. For every answer to a WHY question, follow it up with an additional, deeper "Ok, but WHY?" question. Children are surprisingly effective at root cause analysis. Common wisdom suggests that about five WHY questions can lead us to most root causes – but we could need as few as two or as many as 50 WHYs.

Method	Characteristic
Balanced scorecard	The balanced scorecard is a set of measures that gives a quick overall view of the performance of an organization or business unit. Measures are grouped into four perspectives: customer, internal business, innovation and learning, and financial. Within each perspective, measures chosen by the organization reflect its business strategy. At every level of the organization, measures, targets, and actions are chosen that support the overall organization scorecard. Thus, the balanced scorecard allows everyone to plan for and monitor improvement on the issues most important to the organization's success.

Source: Own elaboration based on: [2.4.5; 2.4.6; 2.4.13; 2.4.14; 2.4.15; 2.4.16].

Chapter 3. **Decision-making and creativity**

3.1. Creativity in decision-making

Creative thinking involved breaking down and restructuring our knowledge in order to gain new insight into its nature. It is something which occurs when we are able to organize our thoughts in such a way that readily leads to a different and even better understanding of the situation we are considering [3.1.2; 3.1.22]. According to Sternberg and Lubart creativity requires a coming together of six clear-cut yet interconnected assets: intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment [3.1.3; 3.1.11].

Other authors thinks that there is no dearth of alternative definitions of creativity. These various definitions seem to agree that creativity involves an ability to come up with new, different, and even useful viewpoints. However, any definition of creativity is complicated because the concept is multi-faceted [3.1.4].

In the literature there are many theories connected with the term of creativity. We can think that origins of creativity are connected with: grace, accident, association, cognitive and personality. We described those conception in the Table 3.1.1.

Table 3.1.1. Early theories of creative thinking

Theory	Characteristic
Grace	Creativity is something of a mystery, drawing forth images of wonderful insights, imaginative efforts, illumination, and intuitions that come from nowhere. It seems the work of magic. The idea of genius may add force to this notion since creative artists, musicians, etc. seemed to be endowed with superhuman potential. Creativity, in this sense, is seen as a divine gift.
Accident	This is the opposite of it being a divine gift. It rises by chance. Holders of this view offer various types of accidental discoveries such as those of immunization arising from an interruption in work, radioactivity from the wrong hypothesis, and the smallpox vaccination from observation.

Theory	Characteristic
Association	This is the most popular and suggests that applying procedures from one area to another gives rise to novel associations, and that such associations form the bedrock of creative ideas. The notion was popularized by Koestler (1964) under the term 'bisociation,' and it underlies the justification for many divergent thinking techniques, such as lateral thinking and brainstorming.
Cognitive	Creativity is a normal human activity. It uses cognitive processes like recognition, reasoning, and understanding. Many inventors work at a problem for years. Research has concluded that ten years of intense preparation is needed for significant creative contributions. Deep thinking about an area over a long period leaves the discoverer informed enough to notice anomalies that might be significant. Highly creative people are strongly motivated and seem able to concentrate over a long period.
Personality	Creativity is a state of mind which can be learnt. Some people seem to have a facility for it while others do not, but they can improve with practice. Mental barriers to creativity have to be removed to allow innate spontaneity to flourish. Creative acts are not isolated acts of perception, they require an emotional disposition, too, for any new idea replaces and in effect destroys the previous order. It takes courage and persistence to brave the resistance that any change seems to engender.

Source: Own elaboration based on: [3.1.1; 3.1.5; 3.1.6].

When we think about creativity it is need to distinguish differences between so called convergent and divergent thinking. We have described the characteristic and differences between them in the Table 3.1.2.

Table 3.1.2. Convergent and divergent thinking

Convergent thinking	Divergent thinking
Convergent thinking focuses on reaching one, well-defined solution to a problem.	Divergent thinking involves more creativity and accepts multiple solution to a problem.
This type of thinking is best suited for tasks that involve logic as opposed to creativity, such as answering multiple-choice tests or solving a problem where you know there are no other possible solutions.	Divergent thinking is the opposite of convergent thinking and involves more creativity. With this type of thinking, you can generate ideas and develop multiple solutions to a problem. While divergent thinking often involves brainstorming for many possible answers to a question, the goal is the same as convergent thinking – to arrive at the best solution.
It's a straight forward process that focuses on figuring out the most effective answer to a problem.	In contrast, divergent thinking refers to opening the mind in various directions and trying out multiple solutions for a problem.
Its characteristics include • Speed • Accuracy • Logic	Its characteristics include • Spontaneous • Free-flowing • Non-linear

Convergent thinking	Divergent thinking
If the copy machine breaks at work, a convergent thinker would call a technician right away to fix the copy machine.	If the copy machine breaks at work, a divergent thinker would try to determine the cause of the copy machine's malfunction and assess various ways to fix the problem.
Methods involved in convergent thinking also involve recognizing the previously tried out techniques and reapplying them along with the readily stored information.	Divergent thinking relates to figuring out new procedures to solve a problem despite existing solutions.
In mathematics, convergent refers to approaching a definite limit in a series.	Divergent thinking generates its name from the idea that there are limitless number of solutions for any given problem, however unrelated they might be, which are then spread on the Table to pick out the best one.
Examples: • Variety of tests, such as multiple choice tests, standardized tests, quizzes, spelling tests and similar other tests require convergent thinking, because only one answer can be 100% correct. • A convergent thinker would only regard a person be either sick or healthy. • A medical student can be either a doctor or nothing.	Examples: • Divergent thinking wouldn't be applicable in multiple choice tests or standardized tests, which require a single absolute answer. • A person can be both sick and healthy. For instance, a man can be under great stress mentally but perfectly fit physically. • A medical student doesn't always have to be either a doctor or nothing. She could very well make a career switch in the future and be a writer, or a painter, and varieties of other possibilities.
Convergent thinking helps to find out the best possible answer to any problem, which are accurate most of the time, and no room for ambiguity is left.	Although Divergent thinking keeps the options open, a completely accurate answer isn't identified.
The answer procured by such type of thinking is either completely right or 100% wrong, which might not always be the best possible way to go about. Convergent thinking only considers the world as Black and/or White, with no other possibilities.	The world isn't always Black and/or White, and a divergent thinker keeps the options open.
A convergent thinker is exactly what the circumstances demand in various situations, such as standardized tests.	Divergent thinker isn't always able to pin-point the right answer. For instance, in a standardized aptitude test, a convergent thinker might be able to decide the right answer, but the contemplating mind of a divergent thinker might work against him in the situation.

Source: Own elaboration based on: [3.1.7; 3.1.8].

The more creative is divergent thinking. We can distinguish following benefits of the divergent thinking [3.1.7]:

- identify new opportunities,
- find creative ways to solve problems,
- assess ideas from multiple perspectives,
- understand and learn from others.

To improve the personal ability to think in more creative way person should try to think in more divergent way. To become a more divergent thinker can help exercise both sides of the brain and ensure that you can see the problem you want to find solution from various angles. We can distinguish five main strategies to improve the personal diverged thinking ability described in the Table 3.1.3.

Table 3.1.3. Strategies of divergent thinking improvement

Strategy	Characteristic
Think about your thinking process	Sometimes the best strategy is the simplest one. When you're mindful about thinking divergently, it becomes easier to do. Try putting notes up in your office or adding steps in your processes that encourage divergent thinking. Steps that encourage divergent thinking may include: • Require at least a one-hour break before sending emails regarding big decisions. • Before making a big decision, put yourself in the shoes of other team members and consider their perspectives. • Don't make big decisions without vetting your decision with at least two people.
Try brainstorming and mind mapping	Brainstorming and mind mapping are two strategies that inspire divergent thinking because they help you think outside the box and generate new ideas. Mind mapping is a form of brainstorming in which you diagram tasks, words, concepts, or items that link to a central concept. This diagram helps you visualize your thoughts and generate ideas without worrying about structure.
Free yourself from time constraints	Everyone has deadlines they must meet. But if you're making an important decision or trying to solve a crucial problem, try to get rid of those strict time constraints so you don't feel pressured to skip straight to a convergent thinking approach. Some techniques you can use to relieve pressure caused by deadlines include: • Request a meeting agenda in advance so you have time to prepare. • Use timeboxing to come up with multiple ideas in 5-10 minute intervals. • Set personal deadlines before official deadlines to give yourself some wiggle room.

Strategy	Characteristic
Use work management software	Work management is an approach to organizing projects, processes, and routine tasks in order to provide clarity to your team so they can hit their goals faster. Work management software, like Asana, can benefit both types of thinking. If you're having trouble with divergent thinking in particular, there are certain features of the software you may find most useful. Work management software can stimulate divergent thinking by allowing you to: • Collaborate with others on projects. • Share ideas and feedback quickly. • Make changes at the click of a button.
Get curious and take risks	Sometimes team members settle into convergent thinking habits because they're afraid of taking risks. While it's important to prevent project risks when possible, you shouldn't be afraid to steer away from traditional processes and think outside of the box.

Source: Own elaboration based on: [3.1.7].

There is also the so-called cognitive theory of creativity. Cognitive processes have been a much-disputed topic for many years. Various schools of psychology – the psychoanalytical, gestalt, and associative – all have their various perspectives on the subject. The process of thinking effectively means accessing very large volumes of information in long-term memory via a bottleneck memory space, which takes the form of short-term memory. While the speed of access to long-term memory is extremely rapid, it appears possible to consider only small amounts of information at a time. Bottlenecks are symptomatic of inefficient operation and usually result in a slowdown or cessation of operation if they become overloaded or choked. Creative problem-solving aids need to help us circumvent these difficulties if they are to be useful aids to thinking [3.1.1].

It is not easy to implement creative thinking methods within organization. Creative thinking and problem-solving do not necessarily come naturally to people. In the case of individuals, there are blocks to creative thinking and creative problem-solving. The blocks are essentially of two varieties – individual and organizational. Jones identified four main typologies of block in creative thinking [3.1.9]:

- Strategic blocks: 'one-right-answer approaches', inflexibility in thinking.

- Value blocks: 'over-generalized rigidity influenced by personal values'.
- Perceptual blocks: 'over-narrow focus of attention and interest'.
- Self-image blocks: poor effectiveness through fear of failure, timidity in expressing ideas, etc.

We can distinguish following main problems connected to creative thinking methods implementation in practice [3.1.1]:

- Emphasis on managerial control – control can stifle creativity since autonomy and a degree of freedom are critical ingredients of creative thinking. Moreover, traditional financial controls are not appropriate for long-term innovation efforts.
- Short-range thinking – there is a tendency to give priority to quick returns with financially measurable results.
- Analysis paralysis – ideas are often over-analyzed, and time is lost along with any competitive advantage.
- Rigid hierarchical structures – an unpredictable environment requires a responsive organizational structure, and this is not characteristic of most organizations.
- Tendency to look for one project that is likely to generate a big payoff – rather than a number of smaller projects with small-to-medium payoffs. Good small projects can often be overlooked.
- Market – versus technology-driven product planning – there tends to be an over-emphasis on market research, in line with the marketing orientation adopted by many companies. While the marketing orientation is very important, it is often implemented at the expense of good ideas which come out of R&D and which never get off the ground.
- Pressure to achieve and do more with fewer resources – R&D departments are often penalized for cutting costs; the more the department saves one year, the less it has to play with the next. Paradoxically, the more companies have to cut back on expenditure, the more creative they must become.
- Lack of a systematic approach to innovation – a lack of real ideas about how to innovate
- Belief that some people are creative – others are not.

There are some approaches how to deal with mentioned problems [3.1.1]:

- Encouraging prudent risk-taking
- Freedom of thought – some degree of autonomy
- Linking rewards with specific performance
- Encouraging different viewpoints on problems
- Positive involvement of top management
- Continual flow of ideas
- Responding positively to new ideas

The ability to consider all perspectives and solve problems using creative decision-making is a very useful skill. Linking creative decision-making with an analytical outlook can help organizations to consider all potential option of solving problems or carrying the tasks. We can distinguish many benefits of creative decision-making which are described and characterized in the Table 3.3.4.

Table 3.1.4. Benefits of creative decision-making

Benefit	Characteristic
Fostering collaboration and partnerships	Creative thinking as a team can generate even more ideas, particularly when one person's thought prompts someone else to think of a solution. It encourages the entire group to collaborate and innovate, strengthening team building while exploring creative solutions.
Driving progress and originality	Creative decision-making promotes productivity, progress and innovation. In environments where leaders encourage creativity, employees are free to utilize more than just the standard or previous problem-solving methods. Having the ability to explore new ways to accomplish a task or find a solution can bring about ideas that also improve efficiency.
Encouraging positivity	Those who approach a challenge with positivity often view it as an opportunity for growth rather than a problem, and this outlook can lead to creative ideas. Fostering an environment of creative decision-making establishes the idea that every proposed solution is worth exploring. This can improve company morale, as it can make team members feel valued.
Strengthening commitment	Employees trust a process, leader or company when they have clarity and a sense of contribution. Knowing that creative decision-making influenced an outcome and that the teams explored all options in a logical way can help garner employee support.
Improving the quality of decisions	Most problems have more than a single solution, and creative decision-making can generate more options to choose from. When there are more alternatives to choose from, this can increase the quality of the decisions your team makes.

Benefit	Characteristic
Developing logical reasoning and critical thinking	Creative decision-making can prevent overthinking by inviting productive ways to explore the situation. When you feel free to examine a topic from multiple perspectives, this can reinforce the logic and reasoning behind your final decision.
Increasing company growth	Companies that foster creative decision-making may see improved clarity regarding roles, purpose and processes. This clarity can help guide priorities, which can later lead to improved sales, revenue or hiring growth.
Building a positive reputation	An employee or leader who promotes creative thinking can build a reputation for being an inclusive, thoughtful contributor who generates ideas. As you practice creative decision-making, continue to develop concepts for solutions and share them with team members and stakeholders. This can help you develop and maintain a reputation as a creative helper.
Creativity Promotes Clarity	It's proven that when your mind isn't busy trying to work through a problem, relive the past, or ponder the future, you are in the creative sweet spot.
Creativity Strengthens Critical Thinking	Mentally reviewing experiences and determining what warrants retelling hones your ability to think critically about your daily actions
Creativity Helps See the Big Picture	The act of being artistic requires your brain to maintain a view of the big picture throughout the process. For any leader, seeing the big picture is an essential quality.
Creativity Cranks Up Productivity	A well-rested mind becomes more creative, spawning ideas for efficiency and more effective process.
Creativity Promotes Logical Reasoning	The key to creativity is a clear mind, still focused (barely) on another stimulation. Turning off the tendency to overthink and analyze inevitably makes room for creative thought.

Source: Own elaboration based on: [3.1.13; 3.1.15; 3.1.14; 3.1.16].

The implementation of creativity in business needs leaders which are creative and creative atmosphere within the organization [3.1.18; 3.1.19; 3.1.20]. The main factors of building the creative atmosphere are characterized in the Table 3.1.5. The characteristics of creative leaders are as follows [3.1.12]:

- Perseverance in the face of obstacles and adversity,
- Willingness to take risks,
- Willingness to grow and openness to experience,
- Tolerance of ambiguity,
- Effective use of analogy to apply a known situation to an unknown situation.

In general, so far, computers have not been specifically harnessed to produce creative ideas and insights for managers by themselves. Rather it has been through the interaction of people and computers that ideas have been produced. There is now a range of computer software which can be used to assist creative problem-solving. Computer-aided creative-thinking and problem-solving mechanisms began to appear in XX century [3.1.1; 3.1.10].

Table 3.1.5. Factors to achieve creative atmosphere within organization

Factor	Characteristic
Questioning attitude	Organizations that don't invite the questioning of values, assumptions or norms are not likely to be very creative. Organizations need to continually question the long-held beliefs of their industry if they're going to stay ahead of the curve and come up with creative ways to bring services and products to their customers.
Culture	Our traditional values are sometimes at odds with the creative solutions we might come up with to solve organizational problems. If an organization's culture puts too much emphasis on tradition, they're likely to stifle creativity around problem-solving.
Leadership	Similar to culture, leaders who are bound to traditional characteristics of the leader-follower relationship, who don't promote questioning attitudes or invite their employees to challenge the status quo, will not do much to foster a creative environment.
Attitude toward risk	Finally, employees who are afraid to try something new will never put their creative solutions into action! Just as one of the characteristics of a creative leader is a willingness to take risks, so must employees feel comforTable doing so in an organization.

Source: Own elaboration based on: [3.1.12; 3.1.17].

In the process of creative thinking, we can spot some biases connected with cognitive thinking which can be harmful for the creativity in business environment. We can distinguish following cognitive biases in cognitive thinking decision-making [3.1.17]:

- Confirmation bias: we believe what we want to believe by favoring information that confirms preexisting beliefs or preconceptions. This results in looking for creative solutions that confirm our beliefs rather than challenge them, making us closed to new possibilities.
- Conformity bias: choices of mass populations influence how we think, even if against independent personal judgments. This can

result in poor decision-making and lead to groupthink which is particularly detrimental to creativity as outside opinions can become suppressed leading to self-censorship and loss of independent thought.

- Authority bias: favoring authority Figure opinions ideas within innovation teams. This means that innovative ideas coming from senior team members trump or better all others, even if other concepts, ideas, and inputs could be more creative and relevant to problem-solving.
- Loss-aversion bias: once a decision has been made, sticking to it rather than taking risks due to the fear of losing what you gained in starting something and wishing to see it finished. We also attach more value to something once we have made an emotional investment in it. A consequence of effort, time and energy put into creative thinking, team members can become biased and become emotionally attached to their outcomes. To remedy this, the 11th commandment: "thou shalt not fall in love with thy solutions".
- False causality bias: citing sequential events as evidence the first caused the second. This can occur within the Design Thinking empathize phase where you are intentionally seeking confirmation of causality between what people say vs. what they do, leading to taking the wrong problems or needs forward to solve.
- Action bias: when faced with ambiguity (creative fuzzy-front end) favoring doing something or anything without any prior analysis even if it is counterproductive: "I have to do something, even if I don't know what to do". Team members can feel that they need to take action regardless of whether it is a good idea or not. This can be an issue when under time pressure in strict design sprint workshops for example.
- Self-serving bias: favoring decisions that enhance self-esteem. This results in attributing positive events to oneself and conversely negative events as blame on oneself. Within innovation workshops, this can mean that decisions made can be loaded with personal agendas rather than customer and business logic for the company.
- Framing bias: being influenced by the way in which information is presented rather than the information itself. We see this one

all the time, particularly when developing prototypes for pitching as well as in presenting polished slides. People will avoid risk if presented well and seek risk if presented poorly meaning that decision-making logic can easily be skewed.

- Ambiguity bias: favoring options where the outcome is more knowable over those which it is not. This bias has dire impacts innovation outcomes because the process is fundamentally risky and unknown process. If team members sub consciously favors known known's, you will most likely follow know knowns and previously trodden paths.
- Strategic misrepresentation: knowingly understating the costs and overstating the benefits. When developing innovative concepts, ballpark Figures and business model prototypes, teams are prone to understating the true costs and overstating the likely benefits in order to get a project approved (which happens all the time in large governmental contracting). Over-optimism is then spotted and challenged by managers assessing how truly innovative team outcomes are.
- Bandwagon bias: a commonly known bias favoring ideas already adopted by others. This is especially influential when linked to authority bias. The bandwagon effect is a common occurrence we see in workshops. The rate and speed at which ideas are adopted by others (through discussion, the rate of silent dot voting etc.) can significantly influence the likelihood of those ideas and concepts being selected by the group and taken forward.
- Projection bias: from behavioral economics, over-predicting future tastes or preferences will match current tastes or preferences. This bias has particular influence as new innovations are conceived in the now and are projected into the future when they enter markets resulting in over value-appreciation of consumer preferences.
- Pro-innovation bias: new innovations should be adopted by all members society (regardless of the wider needs) and are pushed-out and accepted regardless. Novelty and 'newness' are seen as inherently good, regardless of potential negative impacts (inequality, elitism, environmental damage etc.) resulting in new ideas and concepts generated being judged through somewhat rose tinted spectacles.

- Anchoring bias: being influenced by information that is already known or that is first shown. This causes pre-loaded and determined tunnel vision and influences final decision-making. We deliberately manipulate team members' minds by 'pre-loading' them one of our warm-up exercises to demonstrate this bias at play. The impact is highly-significant on creative thinking and outcomes.
- Status-quo bias: favoring the current situation or status quo and maintaining it due to loss aversion (or fear of losing it) and do nothing as a result. This is a subtle bias on an emotional level that makes us reduce risk and prefer what is familiar or "the way we do things around here" as it is known. It has severe consequences when seeking out new ways to creatively solve needs and problems.
- Feature positive effect (close links with optimism bias): due to limited time or resources, people tend to focus on the 'good' benefits whilst ignoring negative effects even when the negative effects are significant. This is influential when deep-diving into specific new feature sets for new concepts (especially when coupled with loss aversion bias) because it means that teams will overlook missing information especially when it is outside expertise resulting taking ideas forward with critical flaws.

In the Table 3.1.6. we put some examples of using creative problem-solving methods in practice. Studying those description, you can think how to use those conceptions in real business solutions. On the basis of presented examples organization can adjust the way is trying to resolve problems in its firm in creative way.

Table 3.1.6. Examples of creativity in decision-making

Example	Characteristic
Staying in business	A storm damages the dining area of a well-known neighborhood restaurant, and customers aren't able to enjoy a dine-in experience, though the kitchen remains fully operational. The restaurant owner encourages the staff to brainstorm creative solutions that can keep revenue coming in and allow employees to continue working during repairs.

Example	Characteristic
continued Staying in business	The employees develop several solutions, including: • Creating new lunch and dinner specials • Expanding takeout hours • Offering free delivery and more drivers • Updating the restaurant's website with service information • Using social media accounts to advertise the changes This application of creative decision-making strengthens the commitment of employees, allowing them to feel invested in the outcome and motivated to find thoughtful solutions. Additionally, some of these ideas might later prove to be good business practices to continue using even after the restaurant's repairs and renovations are complete.
Saving money or increasing revenue	An airline wants to increase profits without raising the cost of airfare or investing in more airplanes to operate. Leaders across multiple departments ask teams to collaborate, run organizational efficiency studies and find areas of improvement that can affect cost savings or increase revenue. Teams explore a variety of creative ways to save money, increase revenue and improve efficiencies, including: • Operating larger airplanes on the most popular routes to generate more ticket sales • Conducting analysis for service level agreements with business partners • Adding ancillary revenue opportunities from goods or services other than airfare • Sourcing alternative partnerships for onboard products, like beverages and snacks • Running a time study of how long an airplane stays on the ground between flights • Preventing common reasons for mechanical delays • Performing analysis on the weight of various equipment and finding lighter options • Reviewing the organizational structure of the company to eliminate position redundancies • Discovering excess materials or supplies and improving ordering processes With this interdepartmental research and creative decision-making, the airline is able to increase revenue while saving on costs.
Developing a documentation system to increase efficiency	A small proprietorship has several employees who work in different time zones, often working on the same project or tasks. The team expresses an overlap in production, with difficulty knowing who is working on what task and at which time others are working on similar tasks. The business owner wants to find a solution that is accessible across time zones and allows for productive collaboration. The business owner researches affordable software and invests in one that safely and securely allows teams to: • Have authorized access to separate projects • Track project deadlines and milestones • Update a task completion spreadsheet • Edit documents or presentations remotely • Organize vacation time or days off • Message colleagues on internal platform • Access a library of documents and records The solution applies creative decision-making, improves efficiencies, promotes collaboration and improves employee morale.

Source: Own elaboration based on: [3.1.13; 3.1.21].

3.2. Creative problem-solving methods

Problem can be defined in management sciences as any situation in which a gap is perceived to exist between what is and what should be [3.1.3]. Problem-solving process is one whereby a situation that is not as it should be is changed into one that is as it should be [3.1.2].

Alex Osborn, founder of the Creative Education Foundation, first developed creative problem-solving in the 1940s, along with the term "brainstorming." And, together with Sid Parnes, he developed the Osborn-Parnes Creative Problem-Solving Process. Despite its age, this model remains a valuable approach to problem-solving [3.2.6].

When we think about solving problems we can divide problems into three main types [3.1.2]:

- Well-structured – straightforward, familiar to the decision maker, and the goal is clear, the information about it is complete
- Il-structured – new/and information about such is ambiguous or incomplete.
- Programmed – solution is a repetitive decision that can be handled by a routine approach (Procedure, rule, policy).

Another conception is the division of problems solving into six following categories, characterized in the Table 2.1.1:

- analytical problem-solving,
- logical problem-solving,
- rational problem-solving,
- absolute problem-solving,
- creative problem-solving,
- positive problem-solving.

Table 3.2.1. Types of problem-solving

Stage	Characteristic
Analytical Problem-Solving	An analytical thinker has the ability to get into the detail of a problem, evaluate all components & perspectives to understand it and determine what's missing. Analytical thinkers ask questions to fill in any gaps they see in order to foresee next steps. They have confidence in their ability and make assumptions & decisions because of their constructive fact finding process. Although their assumptions are credible & decisions well supported, they may not move quickly enough to a solution if they do not have all the facts. Because their fact-finding process takes time, they may not offer any opinions unless specifically asked.
Logical Problem-Solving	A logical thinker has the ability to continuously collect detail and put it into sequence, allowing them to see the big picture & evaluate where the problem exists and why. Then using historical data, they infer solutions based on similar situations. If this worked before in a similar situation, it will work again in this one. The problem with inferring solutions based on past situations occurs when past situations do not exist. When the search for past situations has been exhausted or a new solution is required, the logical problem solver may be at a loss.
Rational Problem-Solving	A rational problem solver has the ability to take information that is available & make assumptions based on that information, deducting the most optimal solution given their personal perspective. A rational person may use the words "From my perspective here is the problem and the best approach to solve it is xyz in order to achieve what I believe to be the best solution." The problem is that although the approach may be rational for that individual, the starting point of that reasoning may be completely unjust to another. Rational problem solvers often do not see the world from perspectives other than their own.
Absolute Problem-Solving	An absolute problem solver has the ability to see a problem as black or white and a solution as right or wrong. Absolute thinkers believe there is a right way of doing something and if there is a problem it is because those involved were unaware of the solution that exists. They try to find that solution by seeking an authoritative source that can confirm the answer. These individuals often have difficulty moving past a problem, they do not like making decisions without affirmation that they are moving forward with an accepted approach. Absolute thinkers also tend to group their thoughts based on information that they have confidence in; inferring a solution that worked elsewhere must work in a parallel situation.
Creative Problem-Solving	A creative problem solver has the ability to envision several outcomes, make assumptions as to what needs to be done to achieve an outcome & is willing to take risks because they have confidence in their own judgment. Creative thinkers start from scratch and are not limited by steps or processes; instead they create unique paths and new solutions. The limitation of creative problem-solving is often that there is no limit to the creative process. If a problem has a deadline or budget constraint, creative thinkers may struggle because they have difficulty focusing and can lose sight of more obvious solutions.

Stage	Characteristic
Positive Problem-Solving	A positive problem solver has the ability to compartmentalize a problem as an individual event and seek solutions with an open mind. Positive thinkers are not restricted by fears or past results, instead they predict improvement and are more open to finding ways of achieving it. Thus they listen for opportunities to improve and collaborate. The limitation of positive thinkers is that they may not hold situations or individuals accounTable when they are required to do so. This makes it possible that problems reoccur several times before solutions are put in place because they are not pragmatic enough to solve the issues.

Source: Own elaboration based on: [3.2.4].

In the process of creative problem-solving we are trying to generate alternatives. In this process we can use three main types of heuristic: representativeness, availability and anchoring. We characterize them in the Table 3.2.2.

Table 3.2.2. Major heuristics used in creative problem-solving

Heuristic	Characteristic
Representativeness	The more object X is similar to class Y, the more likely we think X belongs to Y. People predict future performance mainly by similarity of description to future results. For example, when seeking to appoint a new employee, predicting future performance as a manager based on a single reference or interview with the person concerned.
Availability	The frequency of a class or event is often assessed by the ease with which instances of it can be brought to mind. For example, when reviewing the number of expense claims and looking for ways to reduce them, one may more easily recall large claims when these are very much in the minority and have little impact on the overall total of expenses claimed.
Anchoring	People often estimate by adjusting an initial value until a final value is reached. The approach may characterize wage settlements. The next steps in the process are to judge the most satisfactory solution to the problem, implement it, and monitor how well it serves to provide a solution to the problem. If a satisfactory solution cannot be identified, then a further search has to be undertaken and the latter part of the process repeated

Source: Own elaboration based on: [3.2.2; 3.2.5].

We can distinguish following main principles of creative problem-solving [3.2.6]:

- Divergent and convergent thinking must be balanced. The key to creativity is learning how to identify and balance divergent and convergent thinking (done separately), and knowing when to practice each one.
- Ask problems as questions. When you rephrase problems and challenges as open-ended questions with multiple possibilities, it's easier to come up with solutions. Asking these types of questions generates lots of rich information, while asking closed questions tends to elicit short answers, such as confirmations or disagreements. Problem statements tend to generate limited responses, or none at all.
- Defer or suspend judgment. As Alex Osborn learned from his work on brainstorming, judging solutions early on tends to shut down idea generation. Instead, there's an appropriate and necessary time to judge ideas during the convergence stage.
- Focus on "Yes, and," rather than "No, but." Language matters when you're generating information and ideas. "Yes, and" encourages people to expand their thoughts, which is necessary during certain stages of CPS. Using the word "but" – preceded by "yes" or "no" – ends conversation, and often negates what's come before it.

One of the useful approaches to the creative problem-solving is so called CPS Learner's Model (Figure 3.2.1). the particular stages of the model are described in the Table 3.2.3.

Fig. 3.2.1. CPS Learner's Model of creative problem-solving.
Source: On basis: [3.2.6].

Table 3.2.3. CPS Learner's Model of creative problem-solving.

Stage	Characteristic
Clarify	Explore the Vision identify your goal, desire or challenge. This is a crucial first step because it's easy to assume, incorrectly, that you know what the problem is. However, you may have missed something or have failed to understand the issue fully, and defining your objective can provide clarity. Gather Data Once you've identified and understood the problem, you can collect information about it and develop a clear understanding of it. Make a note of details such as who and what is involved, all the relevant facts, and everyone's feelings and opinions. Formulate Questions When you've increased your awareness of the challenge or problem you've identified, ask questions that will generate solutions. Think about the obstacles you might face and the opportunities they could present.
Ideate	Explore Ideas Generate ideas that answer the challenge questions you identified in step 1. It can be tempting to consider solutions that you've tried before, as our minds tend to return to habitual thinking patterns that stop us from producing new ideas. However, this is a chance to use your creativity Brainstorming and Mind Maps are great ways to explore ideas during this divergent stage of CPS.
Develop	Formulate Solutions This is the convergent stage of CPS, where you begin to focus on evaluating all of your possible options and come up with solutions. Analyze whether potential solutions meet your needs and criteria, and decide whether you can implement them successfully. Next, consider how you can strengthen them and determine which ones are the best „fit."
Implement	Formulate a Plan Once you've chosen the best solution, it's time to develop a plan of action. Start by identifying resources and actions that will allow you to implement your chosen solution. Next, communicate your plan and make sure that everyone involved understands and accepts it.

Source: Own elaboration based on: [3.2.1].

In the creative problem-solving we can use convergent and divergent problem-solving methods respectively. When we divide the creative cycle into four stage: discover, define, deduce, determine we can link each of the stages with convergent or divergent problem-solving approach. It is good solution because we can in this way can mix those two approaches using benefits of them all. In the Table 3.2.4 we present the full characteristic of the four stages of creative cycle from convergent and divergent solving point of view.

Table 3.2.4. The creative cycle from convergent and divergent thinking point of view

Stage	Characteristic
Discover	The first stage of creative problem-solving is discovery, and in this stage, you'll need to use divergent thinking. When you have a problem at work, the first step is to discover the cause of the problem by considering all of the possibilities.
Define	Use convergent thinking when narrowing down the potential causes of your problem. While it's possible that more than one cause led to your budget overruns, convergent thinking requires a focused approach to solving your problem, so you'll need to choose the cause you think is most problematic.
Deduce	In stage three, you'll switch back to divergent thinking as you work to find a solution for your problem.
Determine	The last stage of problem-solving is when you'll use convergent thinking once again to determine which solution will most effectively eliminate your problem. While all the solutions you came up with in stage three may solve your problem to some degree, you should begin with one action item to address. In some instances, you may focus on more than one action item, but only do so if these items are related.

Source: Own elaboration based on: [3.2.1].

One of the main useful methods of creative problem-solving is brainstorming. Brainstorming it's an approach taken by an individual or team to solve a problem or generate new ideas for the improvement of a product, organization, or strategy. most brainstorming techniques involve three steps [3.2.9]:

- capture ideas,
- discuss and critique the ideas,
- choose which ideas to execute.

The golden rule of all brainstorming sessions is quantity over quality. The more ideas you have, the better your chances are that one will be worthy of execution. For these reasons, especially in group brainstorming sessions, be sure all team members check their criticisms at the door and let it be known that the only bad ideas are no ideas. There are in the literature many types of barnstorming. We try to characterize main of them in the Table 3.2.5.

Table 3.2.5. The methods of brainstorming

Method	Characteristic
Brainwriting	In this nonverbal brainstorming method, everyone writes down three ideas that relate to the topic of the brainstorm. Allow about four to six minutes for this process. Then everyone passes their ideas to the person on their right (or left, whichever you prefer), who will then build off of the ideas, adding bullet points or creative strategies. If your team is remote, they can use a communications platform like Slack to share ideas. After another few minutes, everyone will pass the piece of paper again until it makes it all the way around the Table. Once the ideas have made it around the circle, the group discusses them and decides which ideas are best to pursue. This technique can alleviate two of the biggest brainstorm pitfalls – unbalanced conversation and the anchoring effect – by ensuring that everyone has the opportunity to contribute and eliminating the bias toward the first idea. Best for: group brainstorms and introverted team members
Collaborative brainwriting	oftentimes a brainstorming facilitator will kick off this technique by posting a large piece of paper, sticky notes, or sharing a cloud-based document to jot down a few brainstorming ideas. From there, team members can build off of those ideas on their own time and anonymously provide feedback. Be sure to set a clear deadline of when the brainstorming session closes to ensure all brainstormers have an opportunity to chime in. Best for: individual brainstorming.
Rapid ideation	In rapid ideation, everyone writes down as many ideas as possible in a set amount of time before any ideas are discussed, critiqued, or fleshed out. For this brainstorming technique, you will need to set (and stick to) a time constraint, otherwise you'll risk losing the sense of urgency. This brainstorming exercise can be helpful to avoid the all-too-common scenario when an idea is shot down before it has time to grow, transform, and develop. By allowing everyone to capture their ideas before the critique begins, rapid ideation avoids the ineviTable, premature shooting down of ideas. The time constraint can also prevent people from talking themselves out of an idea before they share it with a group a common brainstorming mishap. Best for: extroverted team members, tight deadlines.
Figure storming	In Figure storming, the group picks a well-known Figure who is not in the room – it could be a boss, a fictional character, or a well-known public Figure – and discusses how that person would approach the problem or think about this idea.
Eidetic image method	This visualization-based method recommended by author and psychologist Jacqueline Sussman employs vivid images stored in our minds from all of our life experiences. Begin with intention-setting: Have the group close their eyes and clearly set an intention for what they will create – for example, an innovative smartphone. Each person in the group sets the intention in their mind that they will come up with a new phone design unlike previous ones.

Method	Characteristic
Continued Eidetic image method	This method works best when the goal isn't to reinvent the wheel but rather to enhance it. While the group should not focus on costs, their ideas should remain in the realm of possibility. Best for: visual thinkers, creating an idea anew.
Online brainstorming	For this group brainstorming technique, all you need is a central location for team members to write down their ideas. If all of your employees are in the same time zone, you can host real-time brainstorms over Slack to develop ideas together. If your team is distributed, you can put together a running Google doc that allows team members to write down their ideas whenever inspiration hits, allowing for busy schedules and time differences. After everyone writes down their ideas, it's important to follow up to decide which ideas to pursue, so this technique is best used for idea capture, with separate meetings for critique, planning, and execution. This technique encourages remote employees to participate and puts everyone on the same playing field. You can also keep everyone's identity anonymous if that helps the team contribute more freely. Best for: group brainstorms, introverted team members, remote teams.
Round-robin brainstorming	In a round-robin brainstorm, every member of the meeting participates, contributing one idea to the brainstorm. The first rule is that the group has to make it around the whole room at least once before anyone can contribute a second idea or criticize, elaborate on, or discuss any of the ideas. The second rule is that no one can say, "My idea was already said." You can come back to that person at the end when they've had more time to think. It's also a good idea to give the team some time to prepare ideas before the brainstorm meeting. Like rapid ideation, this technique encourages (read: requires) everyone to participate and allows the team members to get all of their ideas out before moving on to the critique phase of the brainstorm. Best for: introverted team members and developing a surplus of ideas.
Step-ladder technique	The step-ladder technique, while a bit complex, is a great way to make sure the group isn't heavily influenced by the first few ideas or by the loudest people in the room. To use the step-ladder technique, a facilitator first introduces the brainstorming topic and then everyone leaves the room except for two people. If you're working with remote team members, you can use breakout rooms in a videoconferencing app to facilitate this. Those two brainstorm together for a few minutes before a third person comes back into the room. The third person shares some of their ideas, before discussing the ideas that the first two discussed. Individuals return to the room one by one, sharing their ideas before learning about the other ideas that have been discussed. Outside the room, the other teammates can either continue to brainstorm and write down ideas or go back to individual work, but they should not discuss their ideas with anyone until they are inside the room. Best for: introverted team members, vetting ideas thoroughly, honing in on an execuTable solution

Method	Characteristic
Mind mapping	Sometimes, the first idea shared with the group isn't the right idea, but it sparks three better ideas—that's where mind mapping comes in. In this technique, the group starts with one idea and then draws lines connecting sub-ideas to the first one. Mind mapping is a visual way to approach brainstorms and can be helpful for those who think visually. You'll need a large piece of paper or whiteboard to do this. Begin by writing down a topic and then drawing lines connecting tangential ideas to it. This essentially helps you paint a picture of your topic at hand and what might impact its execution or even expedite it. Best for: individual and group brainstorms, visual thinkers.
Starbursting	Star bursting is a later-stage brainstorming technique that can be implemented when a group has already selected an idea to elaborate upon and potentially execute. In a starburst brainstorming session, your team will start with an idea or challenge at the center and then create a six-point star around it. Each point represents a question: who, what, when, where, why, and how. Because it focuses on questions rather than answers, star bursting encourages the group to examine an idea from every angle. Presenting an idea in this way frees the person who generated the idea from having to defend it or Figure out how to execute it on their own. Instead, the team works on solutions together. Best for: large group brainstorms, vetting ideas thoroughly.
Change of scenery	If your team is all in the same space, moving your brainstorm outside to a casual lunch place or even a different floor in your building can help get new ideas flowing. Physical space plays a big part in how employees work, think, and feel. When a team is constantly brainstorming together in the same room, with the same group of people, the brainstorms may feel repetitive and uninspiring. The change of scenery provided by a brand-new space, even for a short period of time, can help people think differently and devise new ideas. Best for: individual and group brainstorms, creating an idea anew.
S.C.A.M.P.E.R.	his helpful acronym allows you to improve ideas by poking at them from different angles. It works great when combined with a brain writing session. S.C.A.M.P.E.R. stands for: • Substitute (What would happen if we swapped X for Y?) • Combine (What would happen if we combined X and Y?) • Adapt (How could we adapt this thing to a different context?) • Modify (How could we modify this product to add more value?) • Put to Another Use (What other uses might this project have?) • Eliminate (What could we remove from this project?) • Reverse (How might we reorganize this project to make it more effective?). Utilize the templates to track everyone's responses. When used in a group brainstorming session, you might want to use templates to track responses or pair the SCAMPER method with a brainwriting session to encourage all brainstormers to evaluate ideas from every angle. Best for: individual and group brainstorms, vetting ideas thoroughly.

Method	Characteristic
Lightning Decision Jam	Instead of never-ending discussions, "you can use this simple exercise to encourage creativity and foster innovation." For example, they use it for: • The conversion flow of checkout on their site • An internal design process • Organizing events • Keeping up with the competition • Improving sales flow It only takes about 40 minutes to run and always leaves you and your team feeling involved, energized, productive – and it gives you tangible, actionable results. Best for: group brainstorms, remote workforces, tight deadlines, honing in on an execuTable solution.
Random Word Picker	Also called "free association," you draw random words from a bank. You then go around the group and invite team members to draw associations between those words at the topic at hand. Use the template to keep track of all the associations. To further organize your thoughts, consider pairing this brainstorming technique with word banking, meaning categorizing random words together and then drawing associations between their category and the brainstorming topic. Best for: group brainstorms, creating an idea anew.
The Idea Napkin	Created by the UX design team at ORBIT, The Idea Napkin method "encourages a vast variety – as well as diverging quality – of ideas." It allows brainstorming participants to enrich and enhance their ideas by applying a structured approach, allowing for better assessment and comparison of ideas. The idea napkin also includes a column for who the idea is targeting—meaning who you're solving a problem for (customers, teammates, etc.)—and a column noting what problems your idea addresses. Brainstormers can fill out their napkins ahead of or during a brainstorming session, each is expected to present or share them. The final ideas will be placed on an impact and effort matrix to determine which are worth pursuing. Best for: group brainstorms, honing in on an execuTable solution.
Reverse Brainstorming	The concept behind reverse brainstorming is simple. Instead of brainstorming solutions to one problem, you brainstorm actual problems. This allows a different perspective: humans have a natural ability to see problems more easily than solutions, so you can use this to identify hurdles your team might face when working on a project. Think of it as a way to tap a group to brainstorm all the ways a plan could fail. Then you can start problem-solving. Best for: group brainstorms, idea generation, problem-solving.
How Now Wow	The How Now Wow matrix is a tool you can use to brainstorm ideas and organize them based on their originality and ease of implementation. "How" is used to describe ideas that are innovative but not yet feasible, "Now" refers to ideas that are familiar, easy to implement, and proven to work well, and "Wow" describes ideas that are new but still easy to implement. The goal of using the matrix is to come up with as many "Wow" ideas as possible.

Method	Characteristic
Continued How Now Wow	Obviously, you want as many "Wow" ideas as possible since these are execuTable but also because they might set you apart from competitors or dispel monotony in a company. To help organize your ideas, consider using a matrix of four squares with difficulty weighted on the Y-axis and innovation on the X-axis. Best for: individual and group brainstorms, homing in on an execuTable solution
Storyboarding	A storyboard is a sequence of illustrations that are used to develop a story. Many businesses use storyboarding to understand and map customer experiences. The technique is instrumental for aligning your team, pitching an idea, understanding the customer journey, and much more. Best for: individual or group brainstorms, problem-solving, vetting ideas thoroughly.
Six Thinking Hats	This method encourages you to wear different "hats" and think about a problem from various angles: thinking about the available data, using your intuition, looking at potentially negative outcomes, thinking about positive outcomes, looking at a problem creatively, and thinking about how to control a process. A template can be useful here because it helps you keep track of everyone's "hats" for a particular problem. You can pick and choose which angles are most important to your organization. And by the end of the group discussion, the whole brainstorming group should be able to hang their hats feeling confident about the ideas you'll pursue. Here's what each of the Six Thinking Hats represents: • Blue Hat: "the Conductor's Hat". When you or your team are in blue hat mode, you focus on controlling your thinking and managing the decision--making process. You have an agenda, ask for summaries, and reach conclusions. • Green Hat: "the Creative Hat". The green hat represents creative thinking. When you're "wearing" this hat, you explore a range of ideas and possible ways forward. • Red Hat: "the Hat for the Heart". This hat represents feelings and instincts. When you're engaged in this type of thinking, you can express your feelings without having to justify them logically. • Yellow Hat: "the Optimist's Hat". With yellow hat thinking, you look at issues in the most positive light possible. You accentuate the benefits and the added value that could come from your ideas. • Black Hat: "the Judge's Hat". This hat is about being cautious and assessing risks. You employ critical judgment and explain exactly why you have concerns. By „wearing" each of the Six Thinking Hats in turn, you can gain a rich understanding of the issues you face – and the best ways forward. You also encourage everyone to be fully involved in the decision-making process. Best for: group brainstorms (six or more people), introverted team members, vetting ideas thoroughly

Method	Characteristic
SWOT Analysis	The SWOT in SWOT analysis stands for Strengths, Weaknesses, Opportunities, and Threats. It allows you to consider all angles when planning your business's strategy. Discuss the following aspects of your topic to determine whether it's worth executing: • Strengths: how does the idea dominate or stand out from competitors? • Weakness: are there any flaws in the idea that could jeopardize its execution? • Opportunities: what else can you capitalize on based on this idea? • Threats: what are potential downfalls that could arise if the idea is launched? Best for: individual and group brainstorms, vetting ideas thoroughly
Wishing	Wishing is exactly what it sounds like! Think about your ideals: features, products, or plans that you wish you could build. What makes them unattainable? Why aren't they possible? Thinking about the impossible might help you unlock some creative possibilities. Best for: individual or group brainstorms, creating an idea anew.
Five Whys	The Five Whys is a framework for brainstorming the root of a problem. Fundamentally, the approach is simple: you ask why a given problem happened, and then you ask "why" four more times. It allows you to have a focused discussion so you don't get distracted by other topics. Start with a problem statement, examine why that problem exists, then continue moving through each problem until you identify a core issue that you can act upon. Best for: individual and group brainstorms, vetting ideas thoroughly
Word Banking	A way to ideate creative solutions to a problem, Crazy Eights involved giving each participant a template that has eight boxes. You set a timer for eight minutes, then ask each person to sketch eight quick ideas. Once time is up, go around and share. Repeat this process to allow folks to build off of each other's ideas.
Drivers analysis	Just as the name implies, driver analysis is a brainstorming technique that analyzes the drivers or "causes" of a problem. To use this brainstorming technique, simply keep asking yourself or your team of brainstormers: "What's driving [insert problem]?" and then, "What's driving [insert answer to the previous question]?" Similar to why analysis, the deeper you dig into a problem, the more well-vetted it will be and the more confident you will be in executing solutions for those problems. Best for: individual and group brainstorms, vetting ideas thoroughly.
Gap filling	When you're struggling with how to execute an idea, that's where gap filling comes in – to address the obstacles standing in your way. Begin by starting with a statement of where you are and then a statement of where you want to be. For example, "Our company creates smart watches; we want to expand our portfolio to also include fitness trackers." It's worth writing these out on a large piece of paper or a whiteboard for all of your brainstormers to see, perhaps using a flowchart or mind map to do so. Then, list obstacles that are preventing you from getting where you want to be and work through solutions for each of them. By the end of your brainstorming session, you should have a clearer plan of how to get where you want to be. Best for: individual and group brainstorms, visual thinkers, honing in on an execuTable solution.

Method	Characteristic
Figure storming	Brainstorming technique in that brainstormers take on the identity of a famous or prominent Figure, whether that's a leader or celebrity, and put themselves in their brain space and how they'd approach an idea. This helps teams look at a topic through a different lens and, in the case of group brainstorms, alleviates any nervousness that brainstormers will put out bad ideas. Because they're not putting out their ideas – they're sharing someone else's. So go on and give yourself a new job title for the day. Best for: individual and group brainstorms, extroverted team members.
Role storming	Role storming is similar to Figure storming in that brainstormers take on different personalities to dream up ideas, but with one dramatic twist—brainstormers act out those ideas. Generally, brainstormers are asked to take on the role of an average person who will be affected by the idea or solution in question, whether that's an employee, client, or another party, and they act out a scenario that could stem from the idea to help them decipher what problems might arise from it. Consider this brainstorming technique for more extroverted teams. Best for: group brainstorms, extroverted team members.
Reverse thinking	Reverse thinking is a bit of a mashup of the Figure storming and six thinking hats brainstorming techniques. It encourages brainstormers to merely ask themselves, "What would someone else do in this situation?" Then, it prompts them to think through why that person's solution would work or not and if your current solution is more effective. Best for: group brainstorms, extroverted team members, vetting ideas thoroughly.
Charrette	The charette brainstorming technique helps break up a problem into smaller chunks and also breaks up your brainstormers into separate teams to address them. For instance, you might reserve three rooms, write a topic or problem on a whiteboard, and have three sets of brainstormers walk into those rooms to jot down their ideas. Then, the sets of brainstormers rotate rooms and build off of the ideas of the group that was there before them. Consider it effective teamwork at its best. Best for: vetting ideas thoroughly, honing in on an execuTable solution.
'What if' brainstorming	A very off-the-cuff brainstorming technique, "what if" brainstorming is as simple as throwing out as many "what if" questions surrounding a topic as possible, similar to the rapid ideation brainstorming technique. For instance, "what if this problem occurred in a different country," or, "what if this problem occurred in the 1800s?" Walking through the scenarios might help spur new obstacles pertaining to your problem. Essentially, the "what if" brainstorming technique helps your team evaluate all the possibilities. Best for: individual and group brainstorms, creating an idea anew, vetting ideas thoroughly.

Method	Characteristic
Crazy eights	A short and fun brainstorming technique, crazy eights delivers on quantity by encouraging brainstormers to think quickly using a template that has eight boxes and only eight minutes on the clock to sketch out eight ideas. Once the timer stops, the group discusses their ideas. For a larger group, consider having each brainstormer narrow in on only three ideas and give them a longer time limit of six minutes to sketch them out in more detail. Best for: group brainstorms, visual thinkers, developing a surplus of idea

Source: Own elaboration based on: [3.2.7; 3.2.8; 3.2.9; 3.2.11; 3.2.13; 3.2.14; 3.2.15; 3.2.16; 3.2.17; 3.2.18; 3.2.19; 3.2.20].

We can also point out five main advices how to use the brainstorming method in effective way [3.2.7; 3.2.9]:

- Allow people to prep. On-the-spot creativity is hard to spark, so factor in some prep time. Make sure to email your team the prompt, topic, or problem you are trying to solve as early as possible so the team can start to come up with ideas on their own. This means at least one full day before the brainstorm, if not two – 10 minutes before the meeting is not quite enough time to get those creative juices flowing.
- Set a clear intention. Are you looking for very feasible, we-can-make-this-happen-this-month ideas, or are you looking for never-been-done-before ideas? Make sure your desired outcome is clear before the meeting begins.
- Invite new people. If the same team brainstorms together each week or month, the ideas can get stale and the group can start to converge on the same few ideas each time. Inviting a fresh perspective shakes things up, so make sure that you invite people from different backgrounds and teams.
- Foster an inclusive, supportive environment. "No bad ideas" has become a brainstorming cliché, but if someone's idea gets shot down quickly, they're less likely to have the confidence to share their next idea.
- Follow up. Recognize that a brainstorm serves a purpose – to foster new ideas, solutions, products, etc. – but you need to follow up in order to bring these ideas to life. Make sure to set aside ample

time to narrow down your ideas and pursue a few in a structured manner.

- Think out of the box. Creative thinking begins with not taking ourselves too seriously. Just as you encourage inclusivity, encourage imperfections and out-of-the-box thinking, too. This could include anything from fun team building games to unique icebreaker questions. Hey, even a bevy of silly ideas to build off of is better than no ideas at all. Brainstorming techniques like wishing can encourage team members to open up.
- Amplify creativity with music. Similar to how a change of scenery can inspire new ideas, even a little background music can promote creativity. Consider putting some on for your brainstorming session, and for the best results ensure it's: instrumental, in a major key, on a fixed tempo and volume.
- Mix and match brainstorming techniques. Just as brainstorming techniques aren't necessarily one-size-fits-all, they also aren't all one-type-fits-every-session. Be prepared to pivot your brainstorming technique depending on what your group of brainstormers is most receptive to and also how many ideas you're juggling.
- Execute your ideas. Coming up with bright ideas is great. But they're pretty useless unless you effectively execute them. While some brainstorming techniques build the execution process into them, others might require you to follow up with brainstormers using project templates to map out a plan using creative solutions.

The using of brainstorming techniques brings organization many benefits but also have many challenges to overcome. In the Table 3.2.6 we compare the benefits and challenges of brainstorming usage in business environment.

Table 3.2.6. Benefits and challenges of brainstorming

Benefits	Challenges
• Provides a quick and easy class activity. Brainstorming sessions can be effectively used in the classroom. However, they do require meaningful planning time for ultimate success. • Contributes to classroom collective power. Brainstorming sessions allow individual students' voices to become one with the group's voice. The final ideas are generally identified through consensus. • Creates a student-centered activity. Students direct the group in which they generate their own ideas, develop rating criteria, and are responsible for group dynamics. • Supports learning in a relaxed environment. Students can collaborate in a comforTable, informal learning environment. • Strengthens problem-based learning. Brainstorming is a problem-solving activity where students build on or develop higher order thinking skills. • Encourages creative thought. Brainstorming encourages students to think creatively (out of the box), encouraging all students to share their ideas, no matter how far "out there" they may seem.	• Becoming just a chat session. The instructor should direct the session to keep students on task. • Students in a group setting compete with one another rather than collaborate when generating ideas. The instructor can walk around the room and listen for inappropriate group behavior. • Staying surface-level. The instructor can prompt for deeper, higher order thinking. • Getting "buy-in" or acceptance from those who have participated in brainstorming who have never seen their ideas brought forth and acted upon. The instructor can work with any student who may be in this category and remark on their contribution to them personally, their group, and to the whole class. • Getting quiet or independent students to actively participate. The instructor can explain that as part of this course all students are expected to bend a little which may have them participating in activities that might make them uncomforTable. It is best to avoid forcing. • Helping groups to move forward if they are "stuck" and not able to generate ideas. The instructor can reconvene the group to review the problem or issue or provide an example of a possible solution. • Reaching consensus. Getting students to reach consensus becomes less of a problem if all students are given equal time to provide input, feel like they are a valued member of the group, and are respected for their points-of-view.

Source: Own elaboration based on: [3.1.10].

To use the brainstorming methods described in this chapter people in organization should have appropriate problem-solving skills. In the Table 3.2.7 we distinguished main skills especially useful in the problem-solving process with some examples.

Table 3.2.7. Problem-solving skills

Skill	Examples
Active listening	A consultant will need active listening and communication skills when interacting with clients and will also need relevant domain knowledge related to the problem in hand. A consultant will also need to know when to bring in someone with more specialized knowledge relating to a client's problem.
Research	Research skills refer to the ability to gather information about a problem. Some research will need to be undertaken in order to define and solve problems. A search of the World Wide Web may suffice or it may be necessary to conduct field research or an extensive review of the literature relating to the problem. Having research skills is essential when having undertaken problem-solving. It will be necessary to identify the cause of the problem and be knowledgeable about the various factors that relate to it. It may also be possible to obtain more information about a problem through discussions with other team members and consulting experts in the field.
Communication	Knowing how to communicate the nature of the problem and possible solutions to others is of paramount importance. It is also essential to know the appropriate communication channels when assistance is required.
Creativity	Many problems require creative insights in order to solve them. If a person has a flair for finding creative solutions then that is a valuable asset. However, skills in creative problem-solving and using its techniques may compensate for any deficiency in natural creativity.
Analysis	Analysis involves examining a problem from all angles. It may include recreating the problem to understand the steps that caused it, and reviewing data that may provide additional details about the problem. Analytical skills help understanding of problems and effectively develop solutions. It will also be necessary to have analytical skills to help distinguish between effective and ineffective solution
Reasoning	Reasoning is the ability to use information that has been obtained by research, analysis, and experience to identify steps and draw conclusions. It includes deductive reasoning, which is working backwards from a known conclusion to identify what happened, and inductive reasoning, which is applying evidence that has been obtained to reach conclusions about possible solutions.
Decision-making	It is necessary to reach a decision about how to solve problems that arise. Such decisions may have to be made quickly, so it useful to have a well-rehearsed set of procedures to follow. Having good research and analytical skills can be of enormous help when there is a shortage of experience in those trying to grapple with a problem. One has also to consider that it may be necessary to pass the problem over to someone more capable of solving it.
Dependability	Solving problems in a timely manner is essential. Individuals who can be trusted to both identify and then implement solutions as fast and effectively as possible are highly valued assets.

Source: Own work based on: [3.2.2; 3.2.12; 3.2.12].

3.3. Psychology of decision-making

Decision-making is a cognitive process. To make a decision a person relies on their attention, sensations, perception, memory, thinking, and problem-solving. An important part of the decision-making process is collecting all the necessary background information. By analyzing the background information, we can come to a conclusion or decision that seems to be the best at that time.

It can be difficult to predict what the potential outcome of the decision might be. Sometimes the decision can be straightforward, and other times we need to be creative and accept the significant risk associated with making the decision. Risk mitigation need to be considered. The process of decision-making begins with a thought (following the data analysis). Thought is how we use our memories and, background knowledge to assess our present status,or situation, and make choices based upon that assessment.

3.3.1. Basis of decision-making

We think using mental images and concepts. Mental images often refer to pictures that we see in our mind and can manipulate, but we can think to ourselves in many different ways. An example of how mental images help us make decisions would be if we are deciding whether we want to jump over a puddle of water or go around it. We can see the puddle of water in our mind and manipulate the image to judge if we have jumped over similar puddles, or how large the splash might be if we do not succeed. A concept is being formed from mental images we have in our mind. A concept can be a prototype (the most common occurrence of the concept) or an exemplar (an example from the memory of the concept). For example, dogs come in all shapes and sizes. All of the images of a dog we can recall from our mind would be the exemplar (for example, our own dog). The prototype of a dog may be an amalgamation of the most common traits of a dog(for

example, a dog that looks similar to a golden retriever). Concepts and mental images are building blocks that are being used in the process of decision-making [3.3.1].

3.3.2. Problem-solving

To make a decision we must first identify the problem, the different options to correct the problem, and the background information we have related to the problem. If there is only one factor or option to consider, the Single-Feature Model may be the model to follow. To evaluate many factors or options, the additive model may be most effective. The Elimination-by-Aspects Model creates a system where a person ranks choices based on certain criteria. Once a Model is chosen, a decision can be made. [3.3.1] It can be more difficult to make a decision if there are many factors or options available to us [3.3.2] [3.3.3] [3.3.4] [3.3.5] [3.3.6].

Based on the information available to them, the leaders of an organization need to make many difficult decisions using problem-solving strategies. These strategies can be as follows:

- Trial and error
  This problem-solving strategy is helpful when some of the information we need is missing, but there is sufficient time to finalize the decision. This method also requires more time and resources at our disposal.
  - *For example:* You are trying to decide on what ingredients to use to make a dish taste good. The first time you make the dish it may not taste good, but next time you make it you will be able to change the ingredients to improve the taste.
- Algorithms
  Algorithms are more precise by nature. If we know that a certain problem can be solved by following an algorithm or procedure, we can derive a decision by following appropriate procedure or formula.
  - *For example:* You are looking for a video to watch on YouTube. There is an algorithm that shows videos on your homepage based on data they have collected using the information on the

videos you watched before. If you have search previously for psychology and dog videos, those types of videos will be more likely to end up on your recommended list. This is accomplished by using algorithm.

- Heuristics

  This is a method of problem-solving that occurs when a choice has to be made quickly. It can be a useful tool but also inaccurate. The *Representativeness Heuristic* can lead to faulty decision-making based on a person's prototype. *Availability Heuristic* can also create problems in decision-making as a person may overestimate or underestimate based on what is remembered. We may form a Mental Set influencing our decision A Mental Set is the tendency to make a decision based on something that has or has not worked in the past. This can be helpful in making decision quickly but can also lead a person to overlook potentially better solutions (or even functional fixedness).
  - *For example:* You may see a picture of a shark and cow. You immediately assume that shark is more dangerous than a cow, even though cows kill more people per year (*availability heuristic*).
- Insight and Intuition
  - Both of these methods of problem-solving seem to come without much thought. Insight is a sudden understanding of how to solve a problem. Intuition is a conscious and unconscious feeling a person may have about which choice is more appropriate. (without any analysis or justification)
    - *For example:* Someone has a bad feeling about heading into work today, and so they do not go into work. The decision happened on an unconscious level.Though the person may or may not realize that under the similar weather circumstances a friend was injured previously on the way to work. [3.3.1]

3.3.3. Bias and cognitive errors

Even though a decision is being made using one of the above scientific problem-solving strategies, that does not mean it will be free from bias. We all have our own mindsets and theory of mind. We understand that

other's think differently from us, but sometimes we try to predict what others consciously or unconsciously are thinking. We know that they have a different way of perceiving a problem, decision, and solution. Our minds unconsciously can create many forms of bias, for example:

- Confirmation bias
  Confirmation bias is looking only for information that supports our belief.
  - *For example:* You may be wondering how many cups of coffee is healthy to consume in a day, so you look it up online. You may consciously or unconsciously look only at sources that confirm your belief.
- Belief-bias effect
  Belief-bias effect is a false logic that seems logical because the results confirm our belief.
  - *For example:* If a conclusion supports our belief we will do all we can to work backward and find justification for our beliefs.
- Overestimation effect
  Overestimation effect is when a person overestimate how common something is (often times because of the environment we live in and people we interact with).
  - *For example:* We may belong a certain pollical party, and our friends and family may overwhelmingly have the same affiliation. So, we may believe that more people share our political views than what is actually a true representation of the population.
- Fallacy of positive instances
  This is the tendency to remember uncommon events because it supports our beliefs and expectations.
  - *For example:* If we are in traffic and the lane is moving slowly, we may move to the other lane that seems to be moving faster. But now from that new lane, the lane we were in before looks to be moving faster [3.3.1].
- Etc.
  Other forms of bias also exist; therefore, it is important for us to remain mindful of where our thoughts and behaviors are coming from. These will be discussed further below.

Our minds are a powerful tool that can sometimes mislead us. We always attempt to make decisions based on the information we know

about a problem We need to be mindful of our bias and be aware that it can affect our decisions making and problem-solving process.

3.3.4. Memory

Decision-making can also be difficult due to emotional factors. Memory can also impact our decision-making process. It is sometimes easier to see the past than it is to see the current events. We remember the past and have the tendency make decisions based only on the past experience and not the current situation. Making decisions based on the past experience can sometimes lead to incorrect decision, less applicable to the current problem [3.3.7]. It can also lead to a fear of making a decision.

People can have a fear of decision-making, and this can potentially be link to a fear of the unknown. There is a saying “the devil you know, is better than the devil you do not know”. Decisions making process works in the same way. It is always easier and safer to make the same or similar decisions multiple times, but it is more difficult and riskier to make a new decision. A new decision which is not yet tested is associated with higher risk factor. Even though the old decisions and problem-solving strategy may no longer work for the problem at hand, we have a tendency to use methodology we know. Change for anyone can be difficult, but past experiences and predispositions can make it even more difficult to accept and promote change [3.3.1] [3.3.8] [3.3.9].

Fear of consequences and risk factor link to our decision can result in certain anxiety disorders, stress-related disorders, and mood disorders (as well as other disorders). Anxiety can come from analyzing and speculating about past decisions and future potential decisions as well as outcomes of those decisions. Sometimes we feel shame or regret for decisions we made [3.3.10].

Throughout difficult decision-making processes, many outlets and strategies are available. Therapy from both psychiatric and psychological professional can be utilized as needed. Eventually, the anxiety will fade, and it will become easier to make decisions based on current

circumstances and evidence. This takes time and effort, potentially with the help of a psychologist or psychiatrist.

Once a decision is reached, a person may also contemplate their decision further. There is a term known as 'buyer's remorse' where a person who has decided to buy a product is now regretting the decision. This happens daily with purchases. Maybe a product did not meet a buyer's needs, or the buyer decided they did not like or need the product as much as they believed they would. Companies take account of this in their return policy [3.3.11].

3.4. Effective Lean problem-solving

A company that wants to achieve efficiency in problem-solving should use change planning. Change planning can be based on the Coopers and Lybrand model, the basic stages of which are [3.4.1]:

1. Assessing (analyzing the current situation, defining the purpose and nature of the change),
2. Change planning (resources needed to implement the change, areas of change, staff training).
3. Implementation of change (observing the situation after the change, measuring the effects).
4. Renewal (improvement of the organization through continuous change).

Success of the introduced change is a sum of several components, i.e.:vision, need, means, rewards and team evaluation. Based on the model – Coopers and Lybrand and other scientists [3.4.2−3.4.4] propose such stages:

- diagnosis phase- definition of the problem through diagnosis,
- search phase – proposals of various solution variants,
- decision phase, i.e. evaluation of solutions according to the assumed criteria (selection of an optimal solution), introduction of changes under author supervision,
- evaluation phase – assessment of effects of the change introduced in the enterprise.

The success of change can be illustrated using the diagram in Figure 3.4.1. In addition to the above-mentioned stages of change, which need to be well prepared, there is a need to involve and reward employees for their active attitudes and participation in organizational improvement.

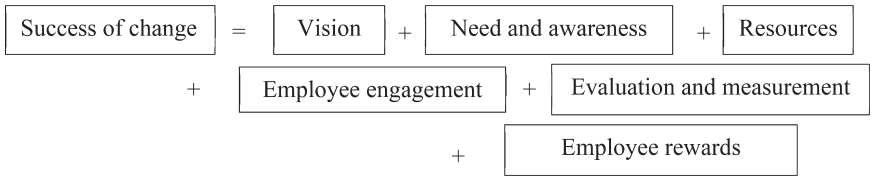

Fig. 3.4.1. Components of change success
Source: own elaboration.

Changes implemented in the company should be well planned and the implementation of the change should follow established procedures (assessment, plan, implementation, renewal) The company should take into account the many factors necessary for success (internal and external factors) throughout the process. It is also important to overcome resistance to change through frequent communication with employees, removing barriers blocking change, rewarding employees' positive attitudes towards change, staff training, encouraging employees' cooperation in implementing change in the enterprise and other measures. Only a learning enterprise is able to ensure its success during problem-solving [3.4.5–3.5.6].

Using lean in solving the problems, and in-depth analysis according to the next 5G is needed (Table 3.4.1). A good understanding of the problem is a determinant of future success. Without knowing the essence of the problem, we may not be successful.

Table 3.4.1 5G and effective problem-solving

GENBA	actual place
GENBUTSU	actual objects
GENJITSU	data and facts
GENRI	operating principles
GENSOKU	standards and parameters

Source: [3.4.7].

When we think about EPS stands for Effective Proble- Solving we must go where the process is going, we must check machines, tools, programs, we must verify what has happened, we must understand the rules that govern the process, we must review the standards in place.

The results of problem-solving should be:

- up to date, i.e. measured with appropriate frequency,
- overseen by the board – decisions are taken directly by senior management,
- simple – everyone in the organization knows how they are achieved and what influences them,
- team-based – they carry information about the performance of individual teams in the company,
- relevant – they have a direct impact on the implementation of the company's strategy,
- clear – they are designed in such a way that teams have as little influence as possible over their control.

There are no universal methods for achieving efficiency in problem-solving that can be copied and applied unreflectively in different organizations. It is always necessary to start from the realized essence of the problem and, at the problem-solving stage, establish metrics for evaluating the results. Some examples of measures belonging to KPIs (Table 3.4.2) in different areas of the company are summarized below. When we want to concentrate more on customers we can use also the indexes presented in Table 3.4.3.

Table 3.4.2. Examples of measuring problem-solving results through KPIs

Product quality	■ PPM (parts per milion), ■ number of errors in processes, in transactions etc. ■ number of wrong (damaged) products ■ COPQ cost of poor quality
Operational management	■ Overall Equipment Effectiveness, OEE ■ labor productivity (value of products or services produced per employee) ■ production waste (value or percentage) ■ average lead time for customer orders - lead time ■ consumption of electricity, water, natural gas and other utilities ■ mean time to repair, MTTR ■ mean time between failures, MTBF ■ % of employees participating in the employee suggestion scheme ■ % of implemented ideas submitted by employees,savings generated from implemented ideas to the value of sales/1 employee ■ results of 5S audits ■ average time to start a new project
Human resources management and health and safety	■ employee sickness absence (e.g. number of hours missed/total number of scheduled hours worked in the period) ■ staff turnover (voluntary departure) ■ employee satisfaction levels from work conditions ■ number of training hours per employee per year ■ number of overtime hours per employee per year ■ working time effectiveness (ECP) ■ average duration of the recruitment process (filling a job position in the company) in days ■ average time to reach target productivity, quality level, etc. ■ number of hours lost due to accidents at work to the number of hours worked in the company in the year ■ number of so-called near miss accidents (total or per employee in year) ■ % of employees trained in first aid in year ■ results of health and safety audits ■ number of hours worked by employees for the local community ■ number of employee-reported defects (red tags)
Customers and service	■ customer acquisition cost, CAC ■ churn rate ■ duration of an operation or transaction (e.g. opening a bank account, customer waiting time) ■ level of customer satisfaction in scale ■ % on time delivery to customers (OTD) ■ % on-time or complete deliveries to customers (On-Time In-Full, OTIF) ■ number of complaints/total number of completed shipments to customers ■ daily/weekly/monthly number of active users (e.g. app, social network)

Marketing	■ number of new customers acquired ■ number of logins on company FB ■ number of customers served remotely (EDI, e-invoice) ■ size of customer base with consent for business contact ■ number of emails sent in newsletters per month ■ average number of emails to 1 customer per month ■ newsletter Open Rate ■ newsletter click-through ratio (CTR) ■ price competitiveness - average price of products vs competitors ■ number of enquiries from the website ■ number of completed contact forms ■ NPS ■ return on investment (ROI) for individual sales channels ■ average number of transactions made by 1 customer per year ■ share of transactions with discount codes/vouchers ■ number of newsletter sign-ups ■ number of newsletter unsubscribes
Sale	■ average net margin in the period from… to… ■ average transaction (order value) ■ average number of products from different categories per order ■ average time from lead acquisition to finalization of contract ■ average level of product discounting ■ pipeline (sales tunnel) by sales stage ■ average revenue per salesperson ■ value of lost sales opportunities ■ share of transactions finalized to orders or offers sent (in number and value) ■ share of orders made by new customers vs. those made by customers in the CRM database ■ Top 10 best-selling goods (by number or value) ■ average payment period ■ number of lost orders
Customer service	■ number of FTEs in the call center and customer service department ■ number of calls answered at the call center ■ average customer service rating ■ share of calls handled to all incoming calls ■ average after-call work time (after-call work time) ■ average number of calls handled by an Agent in 1 RBH ■ average waiting time for an agent to take a call ■ average cost of 1 RBH of hotline work ■ number of emails in backlog (i.e. waiting for response) ■ number of orders accepted by call center ■ number of calls answered up to 15 sec. ■ number of goods/services 're-sold' by call center agents ■ number of customer service emails received ■ number of complaints reported ■ average time from receipt of enquiry/complaint to response (more about the indicators used in the call center in a separate post)

Logistics	■ contribution of different types of consignments (courier, postal consignment, parcel post, collection in shop) ■ average cost of goods shipment ■ average warehouse labor cost per transaction ■ value of goods in stock (stock value) ■ average cost of storing goods per month ■ efficiency - monthly turnover in PLN net divided by the average stock value of the last 2 months ■ stock turnover ■ number of days needed to sell out of stock (Average Days to Sell Inventory) ■ share of products in stock with no sales for 3, 6 and 12 months ■ share of damaged / incomplete / lost products ■ breakdown of returns by reason (damaged goods, incomplete, not as expected, etc.) ■ average time from receipt of payment to dispatch of goods ■ share of late deliveries to customers

Source: [3.4.8]

Table 3.4.3. KPI in Lean problem-solving (examples)

Logistics	Number of complete and on-time deliveries to key customers	Number of complete and on-time deliveries to all customers	Number of delayed shipments Number of missing items delaying shipments
Lean	Lead time of key products	Average Lead time	Number of VSM workshops Number of employee training sessions
Maintenance	Number and time of breakdowns of key machines	Number and time of breakdowns of all machines	Number of employee hours spent on preventive maintenance Number of breakdowns longer than... min
Production	On-time implementation of the production plan	Number of total complaints	Level of machine fleet utilization Results of 5S audits
Quality	Number of complaints from key customers	Number of total complaints	Number of shortages retained in production
Customer service	NPS of key customers	Average NPS	Average customer service time

Source: [3.4.9].

Lean problem-solving efficiency adopts to a customer orientation, so Table 3.4.4. shows examples of customer measurement indicators.

Table 3.4.4. Control sheet in measurement of customer value

Customer	Customer Average Daily Demand (ADD)
Frequency of shipments	How often are supplies of finished goods shipped to the customer? Infrequent shipments increase finished goods inventory - the more often you ship finished goods, the smaller finished goods inventory you can maintain.
Delivery time	This is the time when the delivery of the product to the customer's premises is included in the lead time.
Required stock	The stock you need to maintain according to the contracts you have agreed with your customers.
Minimum lot size	Put this data on the map (VSM) if the customer has specific requirements in this regard or your company prefers a certain minimum size
Maximum lot size	Place on the map if the client has specific requirements or your company prefers a maximum lot size
Optimal lot size	Place on the map if the customer has specific requirements or your company prefers a certain optimal size
Carrier capacity	This information will allow you to see how the capacity of your carrier compares compare to the size of the component batch to be delivered, and therefore find out how many days' supply fits into the carrier's capacity.
The relevance of the customer's orders	This data should be related to the changes the customer makes to the order before shipment; it is important to make a note of how long before the orders are shipped the changes can be made.
Frequency, period, relevance of customer forecasts	Provide this data if the customer sends order forecasts to your stream..
Means of transport product to customer	Cars: what kind, capacity...
Method of communication with the customer	e-mail, fax, telephone, direct communication system.
Penalties for late delivery	Penalties paid by the company (per year)

Source: [3.4.10].

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Authors' biographies

Dsc Phd in Economics and (hab.) in Technical Sciences, Eng. Bożena GAJDZIK, Associate Professor, Silesian University of Technology, Poland, EU

She specializes in theoretical and practical issues relating to the management. She analyzes changes in steel industry from 90s until now. In last time she describes and analyses changes in enterprises towards Industry 4.0. She is the author of more 600 publications including 14 books about different aspects of management in an organization and 7 monographs about restructuring of steel industry in Poland with econometric models of steel production and own research about industrial transformation in the sector. She is the expert for steel industry market in Poland. Her scientific books mainly are about changes in steel industry in Poland, including using statistic models in the research of the sector. Now she realizes research about Industry 4.0 in steel industry. She is a reviewer and an editor both a member in scientific journals.

✉ bozena.gajdzik@polsl.pl
■ Researcher ID: S-8265-2018.
■ Scopus ID: 24173392600.
✍ ORCID: 0000-0002-0408-1691

Michalene Eva Grebski PhD

Michalene Eva Grebski has a multidisciplinary background combining Masters' degrees in Psychology and Business Administration as well as a Doctorate in Management. From 2016 through 2020, she was a faculty member at Northampton Community College (Pennsylvania USA). Presently she is a faculty member at Colorado Mesa University (Colorado USA). Michalene Eva Grebski has co-authored ten books and sixty-one scholarly articles. Her research interest is innovativeness and creativity in education and entrepreneurial networks. She has conducted research related to the development of innovativeness skills and attributes as well as a multidisciplinary holistic approach for enhancing

innovative behavior. Dr. Michalene Grebski is a member of many professional societies (American Counseling Association, American Psychological Association, American Association of University Professors, The International Honor Society in Psychology/PSI CHI).

▪ Wieslaw Grebski PhD

Wieslaw Grebski is Professor Emeritus at The Pennsylvania State University. He was an Engineering faculty and Coordinator of the Engineering Program at Penn State Hazleton. His research interests evolved from computer-aided manufacturing to sustainable forms of energy. Professor Grebski was always promoting a close cooperation between university and industry. Under his leadership a new Engineering program focusing on renewable energy was developed. He has coauthored two hundred publications and nine books. Professor Grebski promoted different unconventional methods for teaching and learning. He was the recipient of the Milton S. Eisenhower Award. (This is one of the highest recognitions at The Pennsylvania State University.) He has also received eleven other awards for teaching and advising. He has also taught the dual enrollment class, Introduction to Engineering Design, as a form of promoting the Engineering profession and recruiting students for the Engineering program. He was a member of the Pennsylvania Academy of Science, American Society of University Professors, American Society of Mechanical Engineers and American Association of Engineering Educators.

▪ Prof. dr hab. inż. Radosław Wolniak

Prof. Radosław Wolniak, PhD, is a professor of social sciences. He works at the Department of Economics and Computer Science, Faculty of Organisation and Management, Silesian University of Technology. He is the author of more than 550 articles and 22 books in the field of management and quality sciences. He has promoted 4 doctorates. He deals with the following issues: quality management, management methods and tools, Smart City, Industry 4.0, internationalisation of management, CSR. He is President of the Silesian Branch of the Society of Organisation and Management and editor of many national and international journals. He is vice-chairman of the Council of Management and Quality Sciences at the Silesian University of Technology.

✉ Mail: rwolniak@polsl.pl
✍ ORCID: 0000-0003-0317-9811

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The book is very much needed on the publishing market. The traditional way of management is based on assigning tasks, coordinating works, supervising and accounting for them by a manager is giving way to the human factor activities in organization in enterprises. Modern enterprises will not achieve market success if they do not activate the human factor. Employees of enterprises have to be engaged in problem solving in order to improve business processes and working methods. I particularly recommend the book to companies that are improving their quality management systems and applying Lean methods and techniques. The human factor activity in Lean and Quality Management can be a source of improvement and development shaping directions of change in companies.

Prof. dr hab. Ryszard Barcik
Akademia Techniczno-Humanistyczna w Bielsku-Białej

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The areas of human factor activity mentioned in the title of the book are particularly important for improving organisations. In a dynamic environment, organisational improvement is a requirement (necessity) for an organisation to survive in this environment. Modern organisational improvement is carried out with the strong involvement of the people (employees) who make up the organisation. Every organisation has to solve problems. Every manager has to make decisions. Every employee knows best where the problems are in their workplace. Employees, especially those with many years of service, know their organisation (enterprise) well and it is worth trusting them, allowing them to solve problems, the small ones that arise on the job and the big ones that can jeopardise the organisation's development strategy. Every employee in an organisation, whether old or young, has knowledge that must be used to solve problems. There is no organisation (enterprise) today without problems in the market.

Dr hab. inż. Andrzej Pacana, prof. PRz
Politechnika Rzeszowska

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