Journal of the Knowledge Economy
https://doi.org/10.1007/s13132-026-03420-w

ORIGINAL PAPER

Strategic Problem-Solving in the Knowledge Economy: Bias Mitigation, Knowledge Conversion, and Innovation

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Received: 21 September 2024 / Accepted: 7 July 2026
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Abstract
This article explores the role of cognitive biases and innovative problem-solving tools within the knowledge economy, focusing on how organizations can improve strategic decision-making in volatile, uncertain, complex, and ambiguous (VUCA) environments. Through a systematic literature review, we identify key methods, such as reframing, crowdsourcing, and TRIZ, that organizations can use to overcome cognitive biases and enhance their ability to solve complex problems. These tools enable firms to leverage external knowledge, foster innovation, and respond more effectively to market disruptions. By examining empirical studies and theoretical frameworks, this research highlights the importance of integrating knowledge-based strategies and external innovation mechanisms to improve organizational agility and resilience. The findings have broad applications at the firm, industry, and national levels, making significant contributions to the fields of technology management, entrepreneurship, and sustainable development. Our study underscores the potential for knowledge-based problem-solving approaches to drive breakthroughs in business strategy and enhance long-term competitiveness in an increasingly knowledge-driven global economy.

Keywords Problem-solving · Bias · Knowledge economy · Root-cause · Reframing · Brainstorming

Introduction

The increasing complexity of contemporary business environments has made problem-solving a central strategic capability. In volatile, uncertain, complex, and ambiguous contexts, firms are not only required to choose among alternative courses of action; they must first recognize, frame, and interpret problems whose causes,

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Published online: 21 July 2026

boundaries, and consequences are often unclear. This distinction is important because research on management decision-making has traditionally emphasized choice among alternatives, whereas strategic problem-solving requires managers to define the problem, gather and interpret information, identify possible solution paths, and only then decide how to act (Bhardwaj et al., 2018).

This issue is especially relevant in the knowledge economy, where competitive advantage increasingly depends on the ability of organizations to transform information, experience, and external inputs into actionable knowledge. From a knowledge-management perspective, problem-solving is not merely an operational activity but a process through which organizations acquire, create, combine, and apply knowledge to sustain adaptation and competitiveness (Gray, 2001). Therefore, the quality of problem formulation directly affects the quality of knowledge created inside the firm and the strategic value that can be extracted from that knowledge.

In this context, problem-solving tools such as reframing, crowdsourcing, text-mining, TRIZ, design thinking, and stakeholder-based approaches are relevant because they influence how knowledge is generated, selected, interpreted, and converted into innovation (Pinheiro et al., 2022). For example, crowdsourcing and text-mining allow organizations to access distributed external knowledge and convert unstructured information into a more structured understanding of unprecedented problems (Wahl et al., 2022). Similarly, open innovation perspectives show that organizations increasingly rely on knowledge flows that cross firm boundaries, requiring managerial capabilities to identify the right partners, interpret external contributions, and integrate them into internal innovation processes (Livieratos et al., 2025).

Accordingly, this paper does not treat the knowledge economy merely as a contextual background. Instead, it argues that problem-solving tools are knowledge-economy mechanisms: they help firms transform dispersed, uncertain, or ambiguous information into strategically useful knowledge. This is particularly important when firms face ill-defined problems, because such problems cannot be addressed only through routine decision-making or traditional strategic analysis. They require mechanisms that improve problem definition, reduce cognitive and organizational biases, integrate internal and external knowledge, and support the creation of new products, services, processes, and business models.

The aim of this study is therefore to systematize the literature on strategic problem-solving tools and to explain how these tools contribute to knowledge creation and innovation in the knowledge economy. More specifically, the paper addresses three research questions: (1) how do organizations define and understand complex or ill-defined problems?; (2) which problem-solving tools help organizations mitigate cognitive and organizational biases?; and (3) how do these tools support knowledge creation, external knowledge integration, and innovation in the knowledge economy?

Etymologically, the concept of problem has existed for thousands of years; originating from the Latin problēma, which means, among other meanings, to have before you, obstacle. In other words, people and organisations have always had problems to solve. Problem solving is, perhaps, a constant of everyday life for many people and companies.

However, the problems an organisation faces can have different degrees of complexity. They may have a more or less clear origin. They may require more or less

time to solve. They may imply more or less transformation in the organisational context. This list of characteristics, which is only an example, is intended to show that there are various types of problems with various types of scope and impact.

In addition to the variables presented, intrinsic to the concept of problem, today, probably more than ever, there are extrinsic factors of supreme relevance regarding the activity of organisations. The changes - some drastic - that have taken place in various aspects of society, namely technological, social and environmental, to which we can add a cycle of geopolitical instability. These changes have impacts on organisations at various levels: they alter consumer consumption patterns and preferences - which are increasingly characterised by instant needs, reducing the time-to-market period, or by being decided based on sustainability criteria -, they alter human resources and recruitment policies, impact on supply chains, require technological transformations in the means of production or work, influence the relationship with stakeholders or the way a company presents itself in the market.

Therefore, organisations today must be more prepared than ever for the constantly changing universe that surrounds them. To this end, the use of tools related to strategy and foresight, which support anticipation and response to new challenges, are fundamental.

The present research thus aims to identify some of these tools, with a focus on problem-solving. Understanding, based on its etymology, that the concept of problem assumes the existence of an obstacle between a certain scenario or current situation and a scenario or situation that is intended to be reached, the concept of problem-solving should be called upon to respond to the challenges that organisations face, as these can in fact be an obstacle to their success and sustainability (namely financial and operational).

As mentioned above, this research is based on a systematic literature review of published literature on problem-solving. The reason for choosing this research problem is that low levels of systematisation have been identified in the published scientific literature on problem-solving, namely concerning management and business approaches, and its comparison with decision making.

Indeed, as stated for example by Bhardwaj et al. (2018) distinction between problem-solving and decision-making is also reflected in research. There is far more research on the latter than on the former are studies of choice, not problem-solving because subjects are not framing problems, gathering information to understand them, deciding how to attack the problem, and developing solution options.

On the other hand, see also Hurmelinna-Laukkanen and Heiman (2012), argue that further research is needed on when and why problem-identification processes are beneficial; how suitable processes can be selected efficiently; and whether various processes can coexist in an organisation.

In strategic problem-solving, the parallels between organizational challenges and individual cognitive barriers, such as mathematics anxiety, are notable. Zhu et al. (2024) found that external pressures, like parental expectations, negatively impact students' problem-solving abilities, a concept that can be extended to organizational settings where market volatility and internal stress hinder effective decision-making. Just as students struggle with applying problem-solving strategies despite understanding concepts, organizations often face similar difficulties in implementing solutions

due to biases and anxiety. Addressing these internal anxieties and fostering better metacognitive processes can enhance both educational outcomes and organizational agility in VUCA environments.

The importance of early skill development, particularly in mathematics, has clear implications for problem-solving capabilities later in life. Chen (2025) highlights a significant correlation between early mathematical competencies and later academic achievement, emphasizing the foundational role of early math education in cognitive development. This parallels organizational problem-solving, where early adoption of structured approaches and strategic tools can lead to long-term success. Just as early exposure to mathematical concepts fosters future success, organizations that cultivate problem-solving frameworks early are better equipped to tackle complex challenges effectively. This underscores the need for targeted interventions, both in educational and organizational contexts, to nurture problem-solving skills from the outset.

The role of collaboration and structured role-playing in knowledge construction is critical in both educational and organizational settings. Lin et al. (2025) demonstrate how distinct roles in a computer-supported collaborative learning (CSCL) environment foster deeper learning, paralleling how clearly defined roles in organizational problem-solving processes enhance group efficacy. Just as Elucidators and Rebutters contribute to connecting problems with relevant concepts in educational contexts, key team members in organizations link strategic challenges to effective solutions. The emphasis on collaboration and cognitive processes within CSCL echoes the importance of fostering a collaborative problem-solving culture in organizations to drive innovation and adapt to complex challenges, reinforcing the value of well-designed, role-based activities.

The strategic use of Open Innovation (OI) in organizations, particularly SMEs, highlights important parallels with broader problem-solving frameworks. As Livieratos et al. (2025) emphasize, success in OI requires not only managerial skills but also an open social attitude, framing innovation as a learning journey. This aligns with our research on strategic problem-solving, where the ability to reframe and redefine problems is critical. Just as SMEs must identify and collaborate with the right partners to succeed in OI, organizations need to deploy the right strategic tools and collaborative efforts to address complex challenges effectively. Starting with the goal of "solving a problem" and transitioning to "finding a problem worth solving" mirrors the iterative approach needed in complex problem-solving contexts.

Finally, we would highlight the recommendation of Mohaghegh and Furlan (2020) when they argue that despite the vast literature to encourage [systematic problem-solving] as a competitively superior behaviour mode little attention is placed to articulate its main supporting factors and an overview of the conditions that support its adoption is missing in the literature.

Following the systematic literature review carried out, this research will respond to two main challenges: (1) how to define, concretise or understand a problem; and (2) how to address and solve a problem. In other words, this research is divided into two phases, which obviously complement each other, but which do not overlap.

This division is adopted by several authors and has a reason for being: any problem-solving process that begins with the decision before understanding the problem runs a serious risk of being unsuccessful. For this reason, when possible, we will also

follow this division in presenting the conclusions of the systematic literature review performed: we will first present the conclusions regarding the definition and understanding of the problem and only afterwards the conclusions regarding its resolution.

We will also try to specify what type of problems are the main target of the problem-solving processes; there are problems that are more or less complex and more or less difficult to solve, so the present research will essentially focus on complex or poorly structured problems, as opposed to simple or well structured ones.

The main conclusions of the systematic literature review will be addressed, which include suggestions to address and understand the problem through mechanisms of analysis and re-analysis (e.g. reframing) and organisational processes, either collective or individual; in the latter, the advantages or disadvantages of collective (e.g. brainstorming) and individual processes will be addressed, as well as their results according to experiments carried out. This research also alludes to solutions based on resources external to organisations (open creativity and crowdsourcing).

In the problem-solving section, innovative tools such as text-mining for information and data processing will be addressed. The tools and theories identified in the systematic literature review, including some used in other contexts, such as the Teoriya Resheniya Izobretatelskikh Zadatch (TRIZ), will be discussed. As part of the literature review, we will also address suggestions regarding the involvement of stakeholders in problem solving.

Methodology

The present research was based on the realisation of a SLR, and the methodology adopted is described below. For the purpose of defining the sample of the present SLR, certain criteria were selected based on the question to be answered: what is the relevance of strategy in problem-solving processes?

An initial sample of 78 articles was selected, which met the general criterion of addressing the issue of problem-solving. In order to select this initial sample, a search was made in the Science Direct database, using the following terms: search for the expression problem-solving, filtering so that the results were only related to scientific papers (therefore excluding books and conferences), written in English and related to the areas of business and management.

Subsequently, in order to reduce the universe of 78 articles to the desired 20, additional criteria were defined. These criteria were established in a positive and negative way, i.e. inclusion and exclusion criteria were set. The criteria corresponded to the following: (1) that the article should directly address problem-solving, even if from a problem-interpretation perspective; (2) that the article should be of a business nature; (3) that the article should not address only the strategy perspective without reference to problem-solving; (4) the article should have a broad business and organisational vision and not only focus on the top management of the organisations or on a psychological, relational or mindset perspective; (5) the article should have been published after the year 2000; (6) the article should be related to business and not to other areas.

In addition, other articles were excluded which, despite fulfilling the above criteria, were not really useful for this SLR, namely because they focused on a specific

perspective of a business area (e.g. biotech), because they dealt with too specific social considerations (e.g. behavioural analysis due to the lack of diversity in companies) or because they dealt with horizontal matters such as the effects on the economic development of society. On the other hand, two articles were included due to their relevance related to the subject under analysis: one concerns the TRIZ and the other the relationship with stakeholders.

Some challenges should be highlighted. The terms problem, problem-solving and strategy have such breadth that they are used by various authors to classify diverse realities. Some of these realities, dealt with in articles on problem-solving, do not have a direct relationship with tools associated with decision or management mechanisms, nor with the definition or interpretation of problems. Instead, they are often used to title articles that aim to respond to a problem (and not a problem-solving process). On the other hand, many articles focus on the topic of decision-making and not so much on the problem of identifying, concretising and framing the problem. These factors hampered the process of defining the final sample, to the extent that many of the articles in the initial sample were not related to the specific question that was intended to be answered within the scope of this research.

After the screening process, the final sample of 20 publications was analyzed through a structured qualitative coding procedure. The purpose of the coding was not only to summarize each article, but also to identify patterns across the literature regarding problem definition, problem classification, cognitive and organizational biases, knowledge sources, problem-solving tools, and strategic implications. Each article was read in full and coded according to five analytical dimensions: (1) the stage of the problem-solving process emphasized by the article, namely problem identification, problem framing, problem structuring, solution generation, implementation, or evaluation; (2) the type of problem addressed, such as ill-defined, wicked, unfamiliar, complex, or service-related problems; (3) the main knowledge mechanism involved, such as internal knowledge creation, external knowledge acquisition, stakeholder knowledge, crowdsourcing, text-mining, or codified inventive knowledge; (4) the organizational level of analysis, namely individual, team, firm, stakeholder network, or market level; and (5) the main strategic implication, such as bias mitigation, innovation generation, dynamic capability development, open innovation, or value creation.

The coding process followed an iterative logic. First, descriptive codes were assigned to each publication based on the concepts, tools, and problem-solving processes explicitly discussed in the article. Second, these codes were compared across the 20 publications to identify recurring themes and conceptual overlaps. Third, the themes were consolidated into broader analytical clusters that organize the results section. When an article addressed more than one theme, it was assigned to the cluster corresponding to its primary analytical contribution, while secondary themes were noted in the interpretation. This procedure was adopted to avoid double counting and to make the clustering more transparent.

Because the final sample is relatively focused, the review should be understood as a concept-driven SLR rather than a broad bibliometric mapping of the problem-solving field. The objective was to examine publications that directly contribute to understanding strategic problem-solving in business and management contexts, par-

ticularly when the literature connects problem definition, cognitive or organizational bias, knowledge management, open innovation, and strategic decision-making. This focus makes the sample suitable for conceptual integration, although it also limits the generalizability of the findings. This limitation is acknowledged in the Discussion and in the future research agenda.

Artificial intelligence tools were not used to select the articles, code the sample, extract data, or generate the findings of the systematic literature review. During the revision stage, AI-assisted tools were used only as editorial support to improve clarity, language, organization, and the preparation of the response to reviewers. All analytical decisions, interpretations, and final textual revisions were reviewed, validated, and approved by the authors, who remain fully responsible for the content of the manuscript.

Systematic Literature Review

The SLR carried out led to the conclusion that the literature is essentially divided into the analysis of two strands when addressing problem-solving: how to define and understand a problem, on the one hand, and problem-solving itself, on the other.

In other words, many of the authors whose work was covered by the present analysis discuss the issue of problem-solving through an upstream perspective, focusing on the definition of the problem.

All things considered, this division makes perfect sense: just as a house is not built from the roof, so the discussion about how to solve a problem cannot begin (metaphorically) there. Instead, it must start at its foundations, which in this case are the root of the problem.

In these terms, the synthesis of the SLR carried out was presented according to this division. However, this division is not evident insofar as there are several articles that address both perspectives. For this reason, the synthesis below tends to be divided between those articles that essentially address the problem perspective (presented first) and those that essentially address how to solve them (presented at the end).

The detailed extraction matrix is presented in Appendix A. In the main body of the paper, the findings are synthesized analytically rather than article by article, in order to emphasize the conceptual patterns that emerged from the review. The following section therefore presents the main clusters identified through the coding procedure and explains how they contribute to understanding strategic problem-solving in the knowledge economy.

Presentation and Analysis of Information

Analytical Clustering of the Reviewed Literature

The reviewed publications were clustered according to their primary analytical contribution to the study of strategic problem-solving. The clustering was derived from the coding procedure described in the Methodology section. Four criteria

guided the classification: the stage of the problem-solving process emphasized by the article; the type of problem addressed; the dominant knowledge mechanism involved; and the strategic implication identified by the authors. Because several articles are conceptually multidimensional, the classification below should not be interpreted as implying that each article deals only with one theme. Rather, each article was assigned to the cluster that best represents its main contribution to the argument developed in this paper.

This approach avoids the overlap generated by multiple categorization and allows the 20 articles to be counted once. At the same time, the analysis acknowledges that themes such as bias mitigation, open innovation, stakeholder knowledge, and problem structuring frequently intersect. This is consistent with the nature of strategic problem-solving in the knowledge economy, where problem definition, knowledge creation, and innovation are mutually dependent processes.

The clustering shows that the reviewed literature is not limited to a technical discussion of problem-solving tools. Instead, it reveals three broader insights. First, strategic problem-solving depends on the capacity to define the right problem before searching for solutions. Second, this capacity is strongly affected by cognitive and organizational biases, particularly when problems are ill-defined or unfamiliar. Third, in the knowledge economy, problem-solving tools matter because they help organizations transform internal and external knowledge into strategic action. Therefore, the reviewed tools can be interpreted as knowledge conversion mechanisms that support innovation, value creation, and organizational adaptation.

Systematic Literature Review: General Considerations

According to the literature reviewed, and in terms of the division and subdivision presented in the previous subchapter, it seemed consensual that the main obstacle to successful problem solving is the way in which the problem is defined and (not) understood.

Indeed, those involved in problem-solving processes are often too close to the problem to have any perspective on it.

The concepts of identifying and framing problems are not synonymous: while in the first action no method is needed, as the problem is already understood, in the second action the problem requires the collection of information, and its understanding. In this case, that action is enabled by strategic knowledge. In another view, problem identification can be classified as passive; formulation as active (Bhardwaj et al., 2018).

Nutt (1999) states that half of the decisions taken fail. The author suggests that this is often due to an impulse to jump to conclusions, through the use of shortcuts, the imposition of solutions at the outset, giving in to time pressure and also to limited information search. This is especially noticeable in the management of companies, to the extent that managers often assume they know what the problem is and immediately set out to solve it, in an eagerness to solve the problem (Bhardwaj et al., 2018). This phenomenon seems to us to be well characterised by what Thomke and Reinertsen (2012) call the fallacy that the sooner the research is started, the sooner it will

be finished, which the Authors accompany with a note on the fear that (not rarely) workers have of being reprimanded for taking too long to solve the problem.

Paradoxically, however, this reality is anything but efficient, because efficient solutions only work if subjects and organizations know which problem they should address, which, when it doesn't happen, may generate waste of resources - human and financial - important for the company. In fact, when companies do not define their problems rigorously, they may only be fostering waste of resources, increasing opportunity cost and fostering work on solutions that are misaligned with their own strategy (Spradlin, 2016). In short, Abdulla and Cramond (2018) show that problem finding is distinct from problem solving and constitutes the first step in any problem-solving process.

Problem Classification and Characteristics

According to the SLR carried out, problems can be classified in various ways and have various characteristics, whereby complex problem-solving processes are essentially called upon to answer more difficult problems; in the case of simpler problems, although they also call upon problem-solving processes, they are less complex. Below we will identify the main classifications and the characteristics that can make a problem more difficult to solve.

McMillan and Overall (2016) use the definition of wicked problems, which is presented as a typology of problems in which complexity prevails and is caused by several reasons, among which we highlight, namely, the existence of antagonistic views among stakeholders, the presence of social and behavioral variables, the occurrence of sequential and simultaneous pressures and timelines, the presence of ideological biases and also the lack of clarity about the means to achieve the end. Additionally, a particularity of wicked problems is that they correspond to a class of problems in which the respective causes and consequences are highly uncertain (McMillan & Overall, 2016).

Churchman (1967) introduced this classification, describing wicked problems as a class of problems that are poorly formulated, in which information is confusing, there are decision makers with conflicting values and the ramifications of the system are confusing.

A second relevant denomination detected within our SLR concerns the concept of unstructured problems. Mingers and Rosenhead (2004) understand them as a type of problem characterised by the existence of multiple actors, by the verification of multiple perspectives and conflicting interests, as well as by the presence of important intangibles and key uncertainties. Ritala et al. (2016) introduce the concept of unfamiliar problems, defining them as complications, opportunities and urgent and unpredictable problems whose resolution goes beyond the company's capacity and routine.

In turn, Steiner (2009) classifies problems as simple, complicated or complex. Simple problems are composed of few variables, which are not interrelated, and show a tendency to stability over time, being also simpler to implement. Complicated problems, on the other hand, already require more sophisticated methods to solve them. Both can generally be solved by standardised methods and on the basis of routine procedures, without the need for particular creativity (Steiner, 2009).

In turn, complex problems cannot be solved through routine procedures, requiring solutions that have not yet been devised; sometimes they are as yet unknown problems. Solving them requires divergent thinking and creative approaches (Steiner, 2009).

Abdulla and Cramond (2018) consider that the simplest way to classify problems is to distinguish them between well-defined and ill-defined problems. This is the most common denomination in the reviewed literature.

According to Pretz et al. (2003)well-defined problems are those whose objectives, as well as the path and obstacles to their solution, are clear according to the existing information. This means, therefore, that in well-defined problems the nature of the problem circumscribes the possible solutions to solve it. In contrast, poorly defined problems are characterised by the lack of a simple path to their solution, in addition to the fact that there is a lack of clarity regarding the objectives, information and resources required to solve them.

From the analysis carried out, it is possible to interpret that, although the classifications are formally different, their essential elements are identical and call for the same types of challenges. For this reason, from now on we will use the definition that was most often detected in the literature review: ill-defined problems.

Problem-Solving: Defining, Understanding and Solving the Problem

When a problem arises, the human tendency is to roll up our sleeves and set out immediately to solve that problem; this impulse can also be motivated by day-to-day practice, time pressure or other subjective factors.

This common phenomenon is highlighted by Bhardwaj et al. (2018) in what these Authors call plunging-in bias and which consists of not understanding the problem and not thinking about the best way to solve it before starting to solve it. In a related way, also Pereira et al. also address this issue, although using the terminology of cognitive bias. These authors highlight the consequences that may arise from the immediate departure to the problem-solving phase.

Ritala et al. (2016) exemplify individual and group/organisational biases, classifying them as phenomena that affect the search for the solution and prevent one from seeing beyond one's own cognition, such as perception bias, information distortion or legal biases), some useful mechanisms are identified to overcome or combat these biases.

However, instead of this attitude, before solving the problem we should pay attention to its characteristics, try to identify and understand it. To this end, the tools suggested by Bhardwaj et al. (2018) are an important process to mitigate the risks identified above.

The tripartite process suggested by these authors is described in Table 1, synthesis of the Systematic Literature Review (problem faceting process, the Who-What Matrix and the question tree) appears to be an essential element in the avoidance of bias.

Also the analytical mechanisms - which correspond to the implementation of deduction steps that imply, namely, increasing the available knowledge and can be useful to respond to problems such as anchoring, conflicts of interest between objectives and problems related to dominance - and the synthetic mechanisms - as is the

Table 1 Analytical clustering of the reviewed publications

Analytical cluster	Main focus	Articles
Bias, problem framing, and problem definition	Explains why organizations misdiagnose problems and how reframing, problem finding, and challenge definition can improve strategic problem-solving.	Bhardwaj et al. (2018); Wedell-Wedellsborg (2017); Wedell-Wedellsborg (2020); Beckman (2020); Abdulla and Cramond (2018); Spradlin (2016); Pereira et al. (2021)
Problem structuring under complexity and uncertainty	Examines ill-defined, wicked, unfamiliar, or complex problems and identifies approaches for structuring them before solution generation.	McMillan and Overall (2016); Mingers and Rosenhead (2004); Szarucki (2013); Ritala et al. (2016)
External knowledge, collaboration, and stakeholder-based problem-solving	Shows how organizations use external knowledge, crowdsourcing, collective creativity, brainstorming, customers, and stakeholders to improve problem understanding and solution generation.	Wahl et al. (2022); Steiner (2009); Kavadias and Sommer (2009); Bridoux and Stoelhorst (2022); Ritala et al. (2011)
TRIZ, resource-based tools, and systematic solution generation	Focuses on structured tools for transforming specific problems into abstract problems, identifying contradictions, and generating inventive solutions.	Mueller (2005); Su et al. (2008); Moehrle (2005)
Knowledge management and organizational learning	Connects problem-solving practices with knowledge acquisition, knowledge creation, and organizational learning.	Gray (2001)

case of design thinking or brainstorming - listed by Ritala et al. (2016)aim to respond to this phenomenon.

According to the SLR carried out, it was possible to identify various frameworks to assist the process of understanding and realising a problem.

Abdulla and Cramond (2018) suggest a process consisting of five steps: (1) problem discovery; (2) problem formulation; (3) problem construction; (4) problem identification; and (5) problem definition.

Wahl et al. (2022), in turn, articulating with crowdsourcing and text-mining tools, suggest the following five steps: (1) information gathering; (2) information pre-structuring; (3) problem mapping; (4) problem exploration; and (5) problem understanding.

The position of Spradlin (2016) is that the best way to understand a problem involves first highlighting the importance of establishing the need to have a solution,

focusing on what the basic need is, what the desired outcome is and who will benefit and why. Subsequently, he highlights the importance of justifying the need, analysing whether the effort is aligned with the strategy, what the desired benefits are for the company, including how they will be measured, and how to ensure that the solution is implemented.

Additionally, it is useful to contextualise the problem, which implies understanding what approaches have been tried in the past, what approaches others have tried to implement, and what the internal and external constraints to implementing the solution are.

Finally, the problem statement should be written, trying to understand if the problem is, in fact, several problems, which requirements the solution has to fulfil and which problem solvers we should commit to. Furthermore, at this point, it is important to assess what information and what language the problem statement should contain, as well as to define what the solvers should submit (deliverables) and what incentives they need. Finally, we should try to determine how the solutions will be evaluated and how success will be measured.

As for Su et al. (2008) call the collection the TRIZ, in the following terms:

1) Define the scope of the problem and identify the service it concerns;
2) Extract the determinants that affect customer satisfaction in this service;
3) Develop parameters to create a matching table (based on the TRIZ table) for this specific service;
4) To create feasible solutions through the TRIZ contradiction matrix: to this end, seven elements are listed as useful to correctly define the ideal outcome, namely to assess what the ultimate goal of the system is, what the ideal outcome is and what may prevent the achievement of the final outcome. According to the authors, it is also important to understand why the factors mentioned in the previous point may hinder the achievement of the final result and how these factors can be removed or eliminated. Finally, what type of resources can be used to achieve the ideal solution and whether anyone has already been able to solve identical problems in the past.
5) Implement the ideal solutions;
6) Were the results achieved?

    - If not: return to Step 4;
    - If yes: go to the next step.

7) Identify the next problem that needs to be solved;
8) Does the new problem belong to the same sector as the previous one?

    - If not: return to Step 1;
    - If yes: return to Step 4.

Pereira et al. (2021) provide another suggestion, which we would put forward in the following terms:

1) Define the problem (which must be concrete, specific and isolated);
2) Search for causes (based on facts, so as to allow connecting the dots and finding different perspectives);
3) Define the big picture (succinctly and in such a way that it is possible to answer the question: why does the problem occur?)
4) Search for a solution; this step is subdivided into:

    - Break the problem down into sub-problems or look at it from different perspectives;
    - Present the solution(s);
    - Assess the solution(s);
    - Select the solution(s).

5) Implement the solution(s) and define a plan for its implementation: what, who and when);
6) Evaluate the solution (after some time).

To assist the solution formulation step, Pereira et al.(2021) refer to several techniques, including the Ishikawa Technique (search for the cause-effect), the Five Why technique (identify the root of the problem), the Pareto principle (focus on what is essential and dispense with what is accessory) and the Problem-Breakdown Technique (isolate the problem and make it more objective).

In the context of our SLR it was also possible to identify a process that we consider to be of note. This is the work of Pólya (1975)[1] Pólya (1975) suggests a four-step cognitive process: (1) understand the problem to identify the requirements to solve it; (2) plan a plan to understand how the various components of the problem are connected and develop an idea for its solution; (3) execute the plan; (4) analyse and evaluate the implemented solution to review and discuss it.

Although in a somewhat distinct but still relevant segment, Ritala et al. (2011) bring into the discussion the perspective of the type of services[2] the organisation provides. The categorisation defined (specialised offers, add-on offers, specific offers and standard offers) may be an important contribution to understand the relevance that certain stakeholders (mainly customers or consumers) may have in the problem-solving processes.

Another useful theme for discussion is that introduced by Gray (2001) which focuses on the importance of knowledge management in problem-solving mechanisms (and vice versa). Calling upon the resources of the firm, according to the RBV, the author presents a method for categorising and integrating knowledge manage-

[1] Subsequently, Hayes (1989) added a step at the beginning (*finding the problem*) and a step at the end (*consolidating the problem*) to Pólya (1975); Newell and Simon (1972) divided the initial phase between *understanding the problem* and *searching for solutions;* Mayer, 1992 distinguished between *problem representation* and *problem solution*. (Wahl et al., 2022).

[2] Ritala et al. (2011) understand *services* as *problems to be solved*. The Authors present a categorization (in four modalities) of types of service provision according to degrees of specificity, in a categorization with influence from the standpoint of solving these problems.

ment practices in the face of the emergence of innovative problems, which constitute a major source of learning (Gray, 2001).

Recognising, however, that it is difficult for one person or organisation to have knowledge of and access to all the information available to understand a problem, especially when the problem is complex, Wahl et al. (2022) try to demonstrate the added value of using crowdsourcing tools to collect knowledge for problem-solving purposes, which they complement with a call for the use of text-mining tools for information analysis purposes. Defending and demonstrating the advantages of combining these two tools (crowdsourcing and text-mining) as useful tools for organisations, together with human interpretation and cognition, the Authors present a five-step process to frame the suggestions made that, despite having already been presented above[3], we reproduce here again mentioning those tools:

1) Information gathering (method: crowdsourcing);
2) Information pre-structuring (method: text-mining);
3) Problem mapping (method: text-mining);
4) Problem exploration (methods: text-mining and human interpretation);
5) Understanding the problem (methods: interpretation and human cognition).

Wedell-Wedellsborg (2020)based on the concept of problem reframing, which he calls the ability to approach old problems from a new perspective, calls for the importance of taking one step back and then two steps forward. This approach, he believes, can lead to the discovery of new solutions to solve an existing problem.

WedellWedell-Wedellsborg (2017) concludes that reformulating a problem can be a powerful tool for finding new solutions. He suggests, to this end, the following steps:

1) Establishing legitimacy;
2) Bringing outsiders into the discussion;
3) Getting people's views in writing;
4) Ask what's missing;
5) Consider several categories;
6) Analyse the positive exceptions;
7) Question the objective.

Beckman (2020) also highlights, through design thinking, the importance of framing and reframing for achieving a deeper understanding of the problem to be solved. It is also worth highlighting the work of Steiner (2009) on the importance of the collective and collaborative perspective of creativity in the conception of new ideas. The author highlights creativity and open collaboration as essential elements to respond to complex problems.

Steiner (2009) presents a tool, which he calls the Planetary Model, with a view to aiding the understanding and organisation of complex processes of idea creation

[3] Cf. Table 1 - Summary of the *Systematic Literature Review*.

and taking into account the dynamics caused by the interaction of the various participants. The model consists of four planets:

1) A first one, which corresponds to the management of stakeholders and represents their identification and commitment in the creative process;
2) A second one, which corresponds to problem-finding and represents the process of identifying and defining the problem that needs a solution;
3) A third planet, which concerns the search for the goal and represents the process of identifying and defining the objectives to be achieved by the creative process;
4) A fourth and final planet, which focuses on the creation of alternatives and represents the process of creating and evaluating potential solutions or ideas to the problem.

On the other hand, the model also envisages a cosmic cloud surrounding these planets that represents the ways of thinking and skills of the participants, as well as the working environment (e.g. the encouragement of innovation).

Finally, it is also useful to highlight the work of Kavadias and Sommer (2009) who seek to assess whether collective activities such as brainstorming are indeed more productive. Based on experiments, the Authors compare the results obtained between groups (brainstorming groups) on the one hand and individual people (nominal groups) on the other. Within the framework of their tests, the Authors distinguish between problems requiring specific skills and problems which are cross-functional, i.e. requiring several types of skills.

The risks of inefficient brainstorming are highlighted from the outset: blocked productivity, apprehension caused by peer review and free riding.

With regard to problems requiring specific skills, the results show that nominal groups have an advantage over brainstorming groups; this advantage increases, moreover, as the productivity block effect mentioned above also increases. With regard to the other type of problems (cross-functional, i.e. requiring several types of skills) brainstorming groups are able to exploit their diversity more efficiently. However, even then, this advantage fades as the effects of productivity lock-in and free-riding take place. Interestingly enough, on the contrary, peer review does not seem to cause an apprehension, but rather enhances the results obtained, resulting in higher quality solutions and ideas.

Discussion: Problem-Solving Tools as Knowledge-Economy Capabilities

The findings of this review suggest that problem-solving tools should be understood not only as managerial techniques but also as knowledge-economy capabilities. In traditional decision-making models, the problem is often treated as already given, and managerial attention is directed toward selecting the best solution. However, the literature reviewed in this paper shows that, in complex and uncertain contexts, the problem itself is frequently ambiguous, contested, or insufficiently understood. This means that the first strategic task is not to choose among alternatives but to create

a reliable knowledge base about what the organization is actually trying to solve. From this perspective, problem-solving is a knowledge-creation process because it involves collecting information, interpreting signals, challenging assumptions, and transforming dispersed insights into actionable understanding (Gray, 2001).

This interpretation clarifies the contribution of the paper to the study of the knowledge economy. The knowledge economy is not only characterized by the possession of information or technological resources; it is also characterized by the ability to convert information into useful knowledge. The reviewed tools contribute to this conversion in different ways. Reframing tools help organizations reinterpret existing knowledge and challenge dominant assumptions. Crowdsourcing and text-mining help organizations access and process external knowledge when internal knowledge is insufficient. TRIZ helps transform specific managerial or technical problems into more abstract problem structures, allowing organizations to search for inventive solutions across contexts. Stakeholder-based approaches help firms integrate knowledge from actors who are affected by, or can contribute to, the problem-solving process.

The link between these tools and innovation is therefore direct. New products, services, and business models do not emerge only from the generation of ideas; they also depend on the capacity to identify problems worth solving and to connect those problems with relevant knowledge. For example, crowdsourcing and text-mining can support innovation by transforming dispersed external contributions into structured problem maps (Wahl et al., 2022). TRIZ-based approaches can support innovation by identifying contradictions and translating them into inventive principles that guide solution generation (Moehrle, 2005). Stakeholder governance approaches can support innovation by aligning different interests and reducing collective action problems in joint value creation (Bridoux & Stoelhorst, 2022).

The analysis also suggests that knowledge-economy problem-solving changes the relationship between the firm, its employees, and the wider market. Employees are not only implementers of managerial decisions; they are participants in problem framing, interpretation, and knowledge creation. Likewise, customers, users, experts, and stakeholders are not only external recipients of firm decisions; they can become sources of knowledge that help define and solve strategic problems. This shift is particularly relevant in open innovation contexts, where organizations must combine internal capabilities with external knowledge flows to generate value (Livieratos et al., 2024).

At the same time, the findings show that not all problem-solving tools are equally appropriate for all problems. Routine and well-defined problems may not require extensive reframing, crowdsourcing, or stakeholder involvement. These tools become strategically valuable when problems are ill-defined, unfamiliar, complex, or knowledge-intensive. This distinction is important because the overuse of complex problem-solving processes may waste organizational resources, while their underuse may lead firms to misdiagnose strategic challenges. The review therefore highlights the need for future research on the criteria that managers use to determine when a problem requires routine resolution and when it requires more advanced knowledge-based problem-solving tools.

Finally, the review shows that the literature remains fragmented. Some contributions focus on cognitive biases, others on problem structuring, others on crowd-

sourcing, TRIZ, open innovation, or stakeholder governance. The contribution of this paper is to integrate these perspectives into a knowledge-economy interpretation of strategic problem-solving. However, the sample is limited and contains a substantial number of conceptual contributions. Future research should therefore test the proposed relationships empirically, particularly by examining how firms use problem-solving tools to convert raw data, employee experience, stakeholder input, and market signals into innovations such as new services, products, processes, and business models.

Conclusions

This study reviewed the literature on strategic problem-solving tools and interpreted them through the lens of the knowledge economy. The central conclusion is that problem-solving tools are not merely operational instruments for finding solutions. They are knowledge-economy mechanisms that help organizations define ambiguous problems, reduce cognitive and organizational biases, integrate internal and external knowledge, and convert information into innovation-oriented action.

The review shows that a major obstacle to effective strategic problem-solving is the tendency to move directly to solution generation before adequately understanding the problem. This tendency is visible in the literature on plunging-in bias, problem framing, and ill-defined problems. In knowledge-economy contexts, this problem is particularly important because strategic value depends on the quality of the knowledge that organizations create and apply. If the problem is poorly framed, the knowledge created around it will also be misdirected, leading to weak decisions, wasted resources, and missed innovation opportunities.

A second conclusion is that problem-solving tools differ in the knowledge function they perform. Reframing and design thinking help reinterpret existing assumptions. Crowdsourcing, text-mining, and open innovation help organizations access knowledge beyond firm boundaries. TRIZ and related systematic tools help transform specific problems into abstract structures that can support inventive solutions. Stakeholder-based approaches help integrate multiple interests and forms of knowledge in value creation. Taken together, these tools explain how firms can become more knowledge-based: they expand the sources of knowledge used in problem-solving, improve the interpretation of that knowledge, and connect it to innovation outcomes.

A third conclusion concerns the boundary conditions of these tools. The reviewed literature suggests that knowledge-based problem-solving tools are most valuable when organizations face ill-defined, complex, unfamiliar, or strategically relevant problems. They are less necessary for routine or well-structured problems. Future research should therefore examine how managers distinguish between routine problems and problems that require more advanced knowledge-based problem-solving processes.

From the research carried out, it was possible to conclude that these tools are essentially aimed at complex and ill-defined problems. However, it does not seem feasible for organisations to apply problem-solving processes such as those suggested, with several steps, to all the problems they face.

Without prejudice to the conceptual distinction between simple and complex or well or ill-defined problems, which help organisations to assess when those tools might be useful, the literature reviewed, according to our interpretation, appears to start from the assumption that it is possible to classify problems between well or ill-defined before applying problem-solving processes. In other words, in the literature reviewed the question of how, and on the basis of which criteria, organisations can perceive that they are facing complex or ill-defined problems remained unanswered. What is the barrier between a well-defined and an ill-defined problem? If the problem-solving tools are essential to the good definition and understanding of a problem, from a day-to-day point of view, how can organisations decide when to allocate resources to the application of the suggested tools or, on the contrary, consider a problem as simple or well defined and, therefore, dispense with the use of those tools and start solving it?

In fact, problems have different types of impact. Some can be solved mathematically almost immediately, without much consideration from a problem-solving perspective. Others, on the other hand, manifest themselves in such a complex way that it is immediately obvious to the organisation that they can only be addressed through the careful use of problem-solving tools. However, there is a whole universe between these two extremes for which the answer does not seem evident.

It is not efficient for an organisation to have to apply the tools mentioned in this research when faced with any problem it may encounter. In this way, the search for mechanisms and processes that help organisations to define, from the outset, whether or not they are facing a complex or ill-defined problem, starting from their conceptual classification, seems to us to be an interesting point of view for future research.

On the other hand, we conclude by the importance of using sources external to the discussion and also to the organisation itself to solve ill-defined problems. It should be noted that this theme is transversally addressed throughout the literature reviewed. Teams and organisations seem to close in on themselves when looking for solutions to their problems; phenomena such as micromanagement or lack of trust in third parties seem to have a negative effect on the search for good solutions. Naturally, these tools should, however, be combined with organisations' own resources and with the resource-based strategy tools, and open creativity, open innovation or crowdsourcing should be seen as complementary to the company's resources (Gemelgo et al., 2025).

Within this scope, we highlight the findings related to brainstorming (Kavadias & Sommer, 2009) which we do not consider to be insignificant. The three factors that these authors identify (productivity blockage, apprehension caused by peer evaluation and free riding) as an obstacle to the greater added value of this activity should be addressed and mitigated by organisations in order to avoid the risk of their occurrence. Organisations are usually divided into teams and the collective activity implies, with greater or lesser intensity, brainstorming activities, so these suggestions seem to be of extreme importance. This point also seems to us to be an interesting point of view for future research.

Finally, we consider that this research provides interesting points of view that you can explore. Not only from the perspective of the problem-solving tools identified, but also from the point of view of the challenges highlighted: the creation of services that mitigate them can be of high added value for your customers.

Appendix

Table 2 Extraction matrix of the reviewed publications

Authors, year	Main topics
(Abdulla & Cramond, 2018)	Abdulla & Cramond (2018) begin by stating that any creative problem-solving process is necessarily preceded by a process of problem finding, identification and realisation. Indeed, several authors recognise the importance of problem finding as a crucial step in the creative process; however, they emphasise that this is not only important in the fields of science and research, but also in industry, business and, as well as, in citizens' daily lives. Being able to identify and frame a problem can lead to more efficient and effective solutions. The authors add that it is possible to identify several classifications of problems in the doctrine, highlighting the dichotomy between well and ill-defined problems, indicating that problem finding processes essentially aim to identify and solve ill-defined problems, that is, problems where the path to a solution is not clear. Abdulla & Cramond (2018) subsequently present a five-step hierarchy with a view to defining a problem. These steps are presented in a decreasing manner in light of the problem's vagueness, i.e., they start by presenting the step to follow when the problem is poorly defined and end with the step concerning the moment when the problem is defined. This means, therefore, that these processes present a decreasing degree of idealisation, creativity and evaluation of the problem. This hierarchy is presented as follows: 1) Discovery of the problem; 2) Problem formulation; 3) Construction of the problem; 4) Problem identification; 5) Problem definition.
(Beckman, 2020)	This article addresses the theme of design thinking, which coadjuvates problem reformulation. Beckman (2020) highlights that the ability to reformulate problems is increasingly important in a world of constant and rapid change. The author presents a four-step process: 1) Framing and reframing: this step is fundamental in design thinking and involves reflective observation and abstract conceptualisation. It is essential to achieve a deep understanding of the problem to be solved. The process implies a commitment to sensemaking, attention to language and understanding of mental models. To frame the problem also requires openness to a process of spontaneous dialogue and willingness to compromise in which divergences and convergences are assessed in order to explore the diversity of perspectives within a group and a holistic view of those perspectives. The outcome of this type of exercise is that the decision-making process in an organisation can be guided by the existence of different and interconnected positions; 2) Observe and notice: involves understanding the context and concerns of customers, users or other stakeholders, as well as paying attention to political, economic, social, environmental, technical (or other) movements. Beckman (2020) highlights the importance of research (whether market or quantitative, such as interviews, other observations and studies, or even questionnaires or big data analytics) for the purpose of understanding customers, their needs and their profiles; 3) Imagining and designing (design): this step, associated with experiential learning, involves the creation of a range of solutions or alternatives to respond to a problem, which are then implemented and tested. In view of the results obtained, the process may require a return to the framing and reframing stage, particularly if additional relevant information emerges; 4) Doing and experimenting: corresponds to the moment when the concepts generated in the previous steps come to life. From this moment on, it is possible to visualise and fine-tune the output of the information gathered in the previous steps. Characterised by a large practical aspect and high levels of interaction and learning through testing, it is also the moment when failure can be faced. This phase can also be important to support managers to overcome the fear of taking risks on new or risky things.
(Bhardwaj et al., 2018)	This article addresses the issue of the difficulty that organisations have in identifying the strategic problems they must face, especially in the face of constant market mutation. In particular, Bhardwaj et al. (2018) focus on what they call the plunging-in bias, which corresponds to the tendency of managers to plunge into solving problems without first fully understanding them. Bhardwaj et al. (2018) point out that a poor problem-solving process can lead to equally poor decisions, even if the decision-making process - which is distinct from the problem-solving process - is well executed. Bhardwaj et al. (2018) identify three sequential tools to reduce plunging-in bias: 1) The problem faceting process; 2) A Who-What Matrix; 3) The Tree of Questions. The problem faceting process is a method for framing poorly structured problems. It serves to help managers identify relevant factors, to identify patterns and possibilities and to structure the problem in a way that enables effective solutions. As its name implies, the method is influenced by the diamond faceting process and is based on five facets: situation, obstacles, facilitators, time and core question. The first facet aims to identify the future situation that one intends to achieve and compare it with the current situation; the second and third facets focus on the factors that stand between the current situation and the situation one intends to achieve (hurdles or enablers); the fourth facet corresponds to time and the pressure it may exert, which must be taken into account; the fifth facet corresponds to the synthesis of all the previous facets and aims to frame the problem in a single sentence. The Who-What Matrix aims to add people and processes to the previous mechanism, and is therefore a complement to the process described there. By people we mean people from different functions and hierarchical positions and not only those who are competent to take decisions. Once the previous steps have been completed, the next step is the issue tree, which aims to identify what type of analysis and information is needed to solve the problem. This phase also aims to facilitate the deconstruction of the problem. This final step is crucial as it enables an integrative view. In addition, being the final step, it reduces the risk of creating hypotheses too early, thus mitigating the risk of plunging-in bias.
(Bridoux & Stoelhorst, 2022)	This article focuses on the relationship between organisations and their stakeholders for the purposes of value creation. The theory on the subject has shown that the creation of value between the two does not only imply general motivation of stakeholders to cooperate with the organization, but is important especially when there are collective problems, i.e. problems that affect both, understood as such, according to Bridoux & Stoelhorst (2022)a tension between the short term interest of the stakeholders and the long term interest of the organisation. The Authors exemplify with situations related to production and with specific investments. With a view to enhancing value creation, Bridoux & Stoelhorst (2022) present three forms of interaction with stakeholders: hub-and-spoke interaction, the lead role governance form and the shared governance form. By governance form we mean the set of rules that support cooperation among the various players by defining who makes decisions regarding the company's resources, who monitors and sanctions in case of conflict of interests and how the jointly created value is divided. The way the three typologies are presented can be visually described according to Figure 2.
(Gray, 2001)	This article focuses on the influence of knowledge management on problem-solving mechanisms and vice-versa, highlighting the influence that problem-solving processes have within the scope of knowledge management. Addressing the importance of the constant acquisition of knowledge in order to guarantee competitiveness, the RBV is called upon to highlight how essential organisational resources are, namely those associated with competencies. Gray (2001) highlights that, considering the rapid and constant evolution of various sectors of society, the acquired skills have an increasingly shorter life span, which forces organizations to be constantly updating on this matter to preserve their competitiveness. The author presents a method to categorise and integrate the various practices related to knowledge management, highlighting the importance of the problem-solving processes for this purpose as they are, per se, a great source of learning. Indeed, Gray (2001) highlights that organisations which do not continuously innovate in their problem-solving processes indicate a reproductive practice of processes, which may lead to a lack of flexibility and adaptability to drastic changes in reality. On the contrary, organisations which constantly update their problem-solving processes increase their adaptive capacity, also discovering new ways of creating added value. The framework suggested by Gray (2001) can be described in terms of Figure 3.
(Kavadias & Sommer, 2009)	This paper discusses the effects and advantages of brainstorming in problem solving. This article starts from the fact that, although brainstorming tools are widely used, there is no evidence that brainstorming groups perform better than individual people working alone (nominal groups). Kavadias & Sommer (2009) (2009) identify some reasons why brainstorming may be less efficient: productivity blockage (the fact that only one person can speak at a time, which increases the likelihood that good ideas will be forgotten while listening to the person speaking or that the impulse to participate will be lost); apprehension caused by peer evaluation (reluctance to speak for fear of what other participants might think); and free riding (which translates into less incentive to contribute to the discussion).

Table 2 (continued)

Authors, year	Main topics
	The conclusions of experiments carried out by the Authors are then presented, which are based on two scenarios: one, in which we are faced with problems requiring specific skills; a second, in which the problems are cross-functional, i.e. they require skills from different functional areas. In the first case, the study shows that there is an advantage of nominal groups over brainstorming groups. Furthermore, as the complexity of the problem increases, so does the advantage of nominal groups over brainstorming groups. Kavadias & Sommer (2009) (2009) argue that the main reason for this result is that nominal groups generate more ideas, mainly because of the productivity deadlock phenomenon experienced in brainstorming groups (this claim is further supported by the fact that the advantage of nominal groups decreases as productivity deadlock decreases). In the second scenario, concerning cross-functional problems, the response varies according to the degree of complexity of the problem: in complex problems, nominal groups have advantages over brainstorming groups; in less complex problems, this group prevails over the former; the productivity block also has an effect on the results here, because as the complexity increases, the effects of that block increase, worsening the results of the brainstorming groups. On the other hand, peer evaluation does not seem to cause apprehension, but rather to improve the results obtained, encouraging higher quality solutions and ideas.
(McMillan & Overall, 2016)	This article is about the challenges that decision-makers face in the face of the complexity and disruption - caused, namely, by globalisation and the digital transition and evolution - that is taking place in the world at large; this (not so) new reality makes the classical doctrines of strategic management no longer adequate for such volatility, namely to face ill-defined problems. McMillan & Overall (2016) highlight in this article the limitations of current tools and theories related to strategic management to address wicked problems. Indeed, notwithstanding the evolution of the strategy, McMillan & Overall (2016) highlight that it is increasingly common that managers do not have at their fingertips the right tools to address unconventional problems. McMillan & Overall (2016) draw on the concept of wicked problems which was introduced by Churchman (1967) and which characterises them as ill-defined problems, difficult to understand and for which classical solutions are neither adequate nor efficient. According to Churchman (1967)wicked problems consist of social problems that are poorly formulated, based on conflicting information and whose ramification is confusing. This type of problem is also characterized by its causes - and outcomes - being highly uncertain. Wicked problems are opposed to well-structured problems, which are easily definable and the relationship to their solution is clearer. They are usually the type of problems that can be solved by mechanical and mathematical processes. In effect, this type of problem is characterised by its novelty, disruption and permeability to social dynamics. For this reason, traditional approaches to strategic management (e.g. SWOT analysis) do not add much value to their understanding and resolution. To address this limitation, McMillan & Overall (2016) advocate the use of collaborative mechanisms; additionally, they suggest that organisations should seek to adopt new approaches, particularly multidisciplinary ones that take into account historical, social and technological factors.
(Mingers & Rosenhead, 2004)	This article introduces us to problem structuring methods, providing a historical context by listing some of its main success stories. Mingers & Rosenhead (2004) In this article, we present the results of a study carried out with the purpose of analyzing the problem structuring methods. Specifically, Mingers & Rosenhead (2004) characterise Problem Structuring Methods (PSM) as a family of methods that were developed from the 1960s onwards with a view to addressing poorly formulated problems. They aim at providing a way of presenting the situation underlying a problem so as to clarify its characteristics, associate it with another problem whose solution is simpler or facilitate the detection of compromises that may facilitate its resolution. Mingers & Rosenhead (2004) point out that these methods are useful for obtaining commitments in relatively small groups, usually between 12 and 15 people. A PSM should enable several different perspectives and the participation of individuals with different backgrounds; moreover, it should allow partial solutions to the problem, i.e. it should not only admit global solutions. Mingers & Rosenhead (2004) identify several methods that are worth highlighting: 1) Strategic options development and analysis, which is a problem identification method that uses cognitive mapping to collect individual perspectives to solve specific problems. These cognitive maps are then used in group discussions (composed of the subjects who originated the individual perspectives) to seek consensus and compromise; 2) Soft systems methodology, which is a method used to redesign systems; this involves participants creating conceptual models that they consider to be ideal. Subsequently, these perspectives are discussed collectively in order to reach a workable balance; 3) Strategic choice approach, which is a planning method that helps management by creating models from the interconnection of different decisions, also comparing different alternatives. In this case, participants define priorities and contingency plans; 4) Robustness analysis, which is a method aimed at maintaining flexibility in the face of uncertainty; it involves an interactive process in which participants and analysts evolve in compatibility with their initial positions. The system constructs configurations, which it evaluates in the face of different future environments that can be anticipated, which makes it possible to assess the level of commitment that participants will have to reach. 5) Drama theory, which is an interactive method that analyses convergence and conflict between different participants; the method builds models from the options available to the participants and seeks to identify dilemmas that exist in that situation. This model assumes that the parties seek to be efficient and rational. In brief, Mingers & Rosenhead (2004) conclude that the use of PSMs proves to be efficient in a broad spectrum of problems, especially in operational research contexts.
(Moehrle, 2005)	This article addresses the TRIZ theme, explaining how it operates. We would highlight the steps listed by Moehrle (2005) to apply this theory: 1) Step 1: analyse the situation in detail; 2) Step 2: link the specific problem detected to an abstract problem; 3) Step 3: select the inventive principles that can be associated with the abstract problem mentioned in the previous step, from among the 40 inventive principles defined according to TRIZ; 4) Step 4: link the inventive principle to a specific solution, which will help to achieve the answer to the specific problem detected in step 1. Thus, Moehrle (2005) indicates that the application of TRIZ implies that a specific problem is transformed into an abstract problem; this abstract problem should be associated with an abstract solution. Finally, the initial step is repeated, but in an inverted manner: the abstract solution should be transformed into a specific solution. In short, TRIZ theory is a useful method for problem-solving processes, which uses a systematic approach to identify and overcome obstacles during the invention process; the author contextualises that the 40 inventive principles result from the historical analysis of several inventions by the creator of TRIZ; this analysis led to the conclusion that those inventions could be associated with at least one of the 40 inventive principles.
(Mueller, 2005)	This article begins by pointing out that management problems arise from areas such as planning, control and organisation, as well as from other more personal aspects, such as leadership. In order to address these problems, Mueller (2005) calls upon a tool known as TRIZ: The Theory of Inventive Problem Solving. This theory, originally from the field of patents, is increasingly used in management, after certain adaptations, through a variant of the original. This is called the Management TRIZ (Management-TRIZ). These adaptations focus essentially on problem-solving and the role of management as an activity pursued by a human being. On the other hand, the author invokes the importance of an organisation's resources, questioning the type of resources that should be applied to solve management problems. She uses the resource doctrine as an important element in answering the question of how to allocate the best resources to solve problems. The paper then identifies several theories on the identification of relevant resources. Highlights, for example, that Terninko et al. (1998) e Pannenbäcker (2001) divide resources into six categories (substances, fields, functional, information, temporal and spatial). Alternatively, Orloff (2002) (2002) defines an alternative division: instead of substances, he uses substances in terms of properties; on the other hand, he adds two categories: structural resources and system resources. He makes yet another division, separating between system-technical and physical-technical resources. It is also worth mentioning Mann (2002)who classifies resources in the following terms: environmental, low-cost, material, transforming, producing and those associated with man; this author also divides resources into three subcategories: spatial, temporal and interface. Finally, the article also highlights the division made by Ideation International, which divided resources into four categories: financial, human, technical and other business assets. Mueller (2005) then invokes the Resource-Based View (RBV), classifying it as a strategic management approach that focuses on the organization's internal resources as the basis for achieving sustainable competitive advantages. He highlights that RBV emphasises the importance of developing, protecting and effectively using the company's resources as key drivers of its competitive advantage. According to the RBV, the resources of an organisation can be classified into several categories, namely tangible, intangible and financial resources. In sum, Mueller (2005) considers that the joint use of TRIZ (in the resource-based view) and RBV constitutes a useful approach to solving management problems. Based on this understanding, an approach based on six categories and three levels of detail is suggested (see Figure 1).
(Pereira et al., 2021)	This article addresses the issue of problem-solving by presenting a methodology for problem solving. Pereira et al.(2021) begin by highlighting management as an instrument for the creation of value - economic and social - namely for the respective stakeholders. Subsequently, highlighting the effects that uncertainty and volatility have on the life cycles of organisations, they appeal to the fact that these must be in permanent transformation. The authors also address the topic of open innovation, i.e., innovation using external sources that are beyond the company's borders, as a key element to obtain knowledge and technological evolution. Detailing what problem-solving theories entail, Pereira et2021) introduce the concept of problem-solving cycle, which consists of a multistep cycle involving the recognition of the problem, the analysis of the causes of its existence, the search for knowledge to solve it, and the implementation of a strategy for that

Table 2 (continued)

Authors, year	Main topics
	purpose, to which a monitoring step is added. The authors emphasise that only after the problem has been described and analysed can one start searching for its causes and solutions. In addition, the importance of certain complementary and essential skills to the problem-solving processes is highlighted, namely: interpersonal skills, communication skills, motivation, organisation and delegation, strategic thinking and planning, problem-solving and decision making skills, business skills and, finally, mentoring and coaching skills. Starting from a classification based on the maturity of management, from which we highlight faith-based management and scientific management, the authors highlight the relevance and negative effects of phenomena such as cognitive bias or decision-making based on assumptions (and not data), as opposed to decisions based on data and knowledge. The negative effects of cognitive bias, which causes more importance to be given to the discussion of the solution than to the analysis of the problem, should be highlighted. The Authors subsequently present a proposed problem-solving process, which we would present in the following terms: 1) Define the problem (which must be concrete, specific and isolated); 2) Search for causes (based on facts, so as to allow connecting the dots and finding different perspectives); 3) Define the big picture (succinctly and in such a way that it is possible to answer the question: why does the problem occur?) 4) Search for a solution; this step is subdivided into: • Break the problem down into sub-problems or look at it from different perspectives; • Present the solution(s); • Assess the solution(s); • Select the solution(s). 5) Implement the solution(s) and define a plan (the effect: what, who and when); 6) Evaluate the solution (after some time). For the formulation of the solution, Pereira et2021) call to mind a number of worthy techniques, of which we highlight the Ishikawa Technique (search for the cause-effect), the technique of the Five Why (identify the root of the problem), the Pareto principle (focus on what is essential and dispense with what is accessory) and the Problem-Breakdown Technique (isolate the problem and make it more objective).
(Ritala et al., 2011)	This paper proposes a new way of understanding services through a problem-solving perspetive. Ritala et al. (2011) focus on the relevance of knowledge, in conjunction with the problem-solving perspective, for improving service delivery, also taking into account the perspectives of the customer and the service provider. Ritala et al. (2011) assume services as problems to be solved, dividing service provision according to the degree of specificity of the resolution of these problems. In addition, they highlight the levels of co-creation - i.e. the processes of joint construction between the service provider and the customer - in the classification presented. The defined categorisation, presented here according to the intensity of co-creation and problem solving, is as follows: 1) specialised offers; 2) add-on offers; 3) specific offers; 4) standard offers. The authors believe that this division is useful to allow a greater and deeper understanding of the knowledge processes necessary for service provision, here understood as activities which constantly presuppose problem-solving mechanisms. This approach also makes it possible to understand the challenges to be faced in this area. These examples can be presented in the following terms on Table 2.
(Ritala et al., 2016)	This article discusses the concept of dynamic capabilities and ad hoc approaches for problem solving purposes. Ritala et al. (2016) specify that dynamic capabilities aim to respond to problems that evolve simultaneously with industrial and environmental changes and correspond to the ability of organizations to promote changes in their resources and their organizational capabilities. In this context, the authors introduce the concept of unfamiliar problems - configured as complications, opportunities and urgent and unpredictable problems whose resolution goes beyond the capacity of the company and its routine - which, together with disruptive changes, are an obstacle to the success of the theory of dynamic capabilities, especially because in these situations, paradoxically, dynamic capabilities are characterised by a certain level of rigidity that is not compatible with the speed required by problems that are unpredictable, emerge quickly and must be quickly resolved. This reduces their effectiveness and performance. Thus, Ritala et al. (2016) highlight the importance of ad hoc approaches for the purposes of problem identification and resolution, considering them useful tools to complement the theory of dynamic capabilities when faced with problems with the particularities described above. The Authors further describe ad hoc approaches as being non-routine, non-patterned and non-reproducible options. Emphasising that problem-finding processes involve dealing with individual and group/organisational biases (biases can be classified as phenomena that affect the search for the solution and prevent one from seeing beyond one's own cognition, such as perception, information distortion or legal biases (Ritala et al., 2016)Some useful mechanisms to overcome or combat these biases are identified. On the one hand, analytical mechanisms, which correspond to the implementation of deduction steps that imply, namely, increasing the available knowledge and may be useful to respond to problems such as anchoring (relying on past performance to determine the direction of a current or future research), conflicts of interest between objectives and problems related to dominance (e.g. when a hierarchical superior discourages the exchange of opinions by means of his/her authority). On the other hand, synthetic mechanisms, such as design thinking or brainstorming. These mechanisms aim to respond to unknown problems that may occur, for example, at the operational level (e.g. reaction to an unpredictable problem in the raw materials supply chain). Ritala et al. (2016) thus suggest the integration between the two concepts addressed: dynamic capabilities and ad-hoc approaches (the latter as complementary to the former) especially in order to address unfamiliar problems, insofar as ad-hoc approaches respond better to this type of problems (i.e. that are urgent and unpredictable). According to the Authors, this integration would improve problem-solving processes.
(Spradlin, 2016)	The present article addresses the issue of problem definition. Spradlin (2016) starts by arguing that the lack of rigor when defining the scope of their problems generates lost opportunities, wasted resources and the search for innovative solutions that are misaligned with the organizations' strategies. To avoid this scenario, the Author points out, organisations must improve their definition processes, becoming better at answering the right questions and tackling problems appropriately. To do this, organisations must improve their innovation processes through what Spradlin (2016) calls challenge-driven innovation, which involves implementing improvements in the definition of business, technical, social and policy problems that organisations face, particularly from an innovation perspective. To this end, a process is presented that can contribute to making these processes more efficient. Spradlin (2016) starts by highlighting the importance of establishing the need for a solution, focusing on what the basic need is, what the desired outcome is and who will benefit and why. Subsequently, he highlights the importance of justifying the need, analysing whether the effort is aligned with the strategy, what the desired benefits are for the company, including how they will be measured, and how to ensure that the solution is implemented. Additionally, it is useful to contextualise the problem, which implies understanding which approaches have been tried in the past, which approaches others have tried to implement and which are the internal and external constraints to the implementation of the solution. Finally, the problem statement should be written, trying to understand if the problem is, in fact, several problems, which requirements the solution has to meet and which problem solvers we should commit to. Furthermore, at this point, it is important to assess what information and what language the problem statement should contain, as well as to define what the solvers should submit (deliverables) and what incentives they need. Finally, we should try to determine how the solutions will be evaluated and how success will be measured.
(Steiner, 2009)	Steiner (2009) starts by emphasising the importance of the collective and collaborative perspective of creativity in the design of new ideas. This perspective recognises that creativity is not only the product of individual effort, but also the result of interaction and collaboration between different people and groups, which also encompasses different stakeholders. In this sense, it is urgent to recognise creativity and open collaboration as essential elements to respond to complex problems. These mechanisms also foster the identification of interdependencies and relationships between different components of a problem, which is fundamental to achieve innovative solutions. Furthermore, it allows a holistic view to be taken of the different visions of the various stakeholders. Creative collaboration should be understood as the ability of a group or organisation to create new and useful ideas through collaboration and communication. In addition, reference to openness presumes that not only the individual and group creativity of a given organisation is taken into account, but also external sources, including customers and stakeholders. The integration of these elements allows greater levels of dynamism and complexity to be achieved, which generates more efficient and sustainable solutions, and is also essential for identifying solutions to complex problems. Notwithstanding its advantages, it is essential to highlight that this phenomenon also carries some risks, which can be mitigated by taking into account the different values, preferences and backgrounds of those involved. The author presents a tool he calls the Planetary Model, which helps to understand and organise complex processes of idea creation, also taking into account the dynamics caused by the interaction of the various participants. Additionally, according to Steiner (2009)the Planetary Model has the advantage of highlighting appropriate skills to solve the problem. The model is based on four planets; the first planet corresponds to stakeholder management and represents the identification and commitment of stakeholders in the creative process. Its conception presupposes the identification of key stakeholders and their needs; it also implies managing expectations and levels of involvement in the process.

Table 2 (continued)

Authors, year	Main topics
	The second planet corresponds to problem-finding and represents the process of identifying and defining the problem that needs solving; this includes understanding the problem as well as identifying the underlying issues and opportunities. The third planet concerns goal-seeking and represents the process of identifying and defining the objectives to be achieved by the creative process; it includes understanding the desired outcome and identifying barriers to success. The fourth and last planet focuses on the creation of alternatives and represents the process of creating and evaluating potential solutions or ideas to the problem; it presupposes divergent thinking and brainstorming. The model also envisages a cosmic cloud surrounding these planets that represents the ways of thinking and skills of the participants, as well as the working environment (e.g. the encouragement of innovation). This highly figurative model is intended to help organise the complex system of idea creation for solving complex problems.
(Su et al., 2008)	This paper addresses TRIZ, in particular its contradiction matrix. Su et al. (2008) (2008) begin by identifying the advantages of TRIZ in the scope of the elimination of contradictions in order to identify creative solutions to solve a problem. In particular, the aim of the authors was to create a framework, based on the TRIZ methodology, in order to solve problems in the e-commerce sector, focusing on the aspect of service quality. The approach proposed by Su et al. (2008) is as follows: 1) Step 1: define the scope of the problem and identify the service it concerns; 2) Step 2: extract the determinants that affect customer satisfaction in that service; 3) Step 3: develop parameters to create a matching table (with the TRIZ table) for that specific service; 4) Step 4: create feasible solutions through the TRIZ contradictions matrix: for this purpose, seven elements are listed as useful to correctly define the ideal result, namely to assess what the final objective of the system is, what the ideal result is and what might prevent the final result from being achieved. According to the authors, it is also important to understand why the factors mentioned in the previous point may hinder the achievement of the final result and how these factors can be removed or eliminated. Finally, what type of resources can be used to achieve the ideal solution and whether anyone has already been able to solve identical problems in the past. 5) Step 5: implement the optimal solutions; 6) Step 6: have the results been achieved? • If not: return to Step 4; • If yes: go to the next step. 7) Step 7: identify the next problem that needs to be solved; 8) Step 8: Does the new problem belong to the same sector as the previous one? • If not: return to Step 1; • If yes: return to Step 4.
(Szarucki, 2013)	This article addresses how organisations can prepare for the negative effects resulting from the uncertainty caused by globalisation from a management problem-solving perspective. Szarucki (2013) highlights the importance of the existence of management problem-solving mechanisms in organisations, proposing a framework that aims to allow managers to compare and select the most appropriate methods taking into account the specific requirements of a given problem that requires a management decision; those suggestions are grouped according to the types of problem. The suggested process is divided into two phases and corresponds to the following: Phase 1: 1) Determine and assess the problem; 2) Select the method for solving the problem; The Phase 1 steps assume the following sub-steps: • Identify the problem to be solved, • Analyse the problem (structurally and procedurally); • Assess the importance of the problem; • Determine the conditions for solving the problem. Phase 2: 1) Define the set of methods to solve the problem; 2) Identify the criteria envisaged by the method and their verification; 3) Analyse the methods against the selected criteria; Select an appropriate method.
(Wahl et al., 2022)	This article discusses the importance of organisations understanding their problems, particularly those that are innovative. The article is set against the backdrop of the COVID-19 disease pandemic and focuses on a problem-solving perspective; the article bases its analysis on the tourism sector's response to the challenges posed by the COVID-19 disease pandemic. The distinction between problem-solving and problem-understanding is addressed, highlighting that the latter is a key step in the latter, but that they represent different realities. Wahl et al.(2022) (2022) point out that recognising and understanding a problem is essential for finding solutions to it. Recognising that it is difficult for a person or an organisation to have knowledge and access to all the available information to understand a problem, especially when it is complex, the authors intend to demonstrate the added value of using crowdsourcing tools to collect knowledge with a view to problem solving. However, they also verify that this may be insufficient, since the same limitations are verified in the analysis of the collected information, Wahl et al.(2022) In this context, it should be noted that the use of text-mining tools is also recommended for the analysis of the information. Defending and demonstrating the advantages of the combination of these two tools (crowdsourcing and text-mining) as useful tools for organizations, together with human interpretation and cognition, for the purpose of understanding the problems they have to deal with, the Authors present a five-step process to frame the suggestions made: 1) Information gathering; method: crowdsourcing; 2) Information pre-structuring; method: text-mining; 3) Problem mapping; method: text-mining; 4) Problem exploration; methods: text-mining and human interpretation; 5) Understanding the problem; methods: interpretation and human cognition.
(Wedell-Wedellsborg, 2020)	Wedell-Wedellsborg (2020) starts from the concept of problem reformulation, which he classifies as the ability to approach old problems from a new perspective; this approach, he considers, can lead to the discovery of new solutions to solve an existing problem. We highlight the relevance attributed by the author to the importance of involving customers and stakeholders in the formulation of the problem, in a perspective of exchanging impressions with a view to confirming whether the problem really exists or whether it can be seen from another perspective. On the other hand, Wedell-Wedellsborg (2020) points out that sometimes the problem framework may even be correct, but through reframing, it becomes possible to detect important nuances of the problem - which were missed in the first analysis - that can lead to an even better solution. To this end, he highlights the importance of taking a step back and looking outside the frame, looking for undetected problems or opportunities. Wedell-Wedellsborg (2020) states, finally, that managers cannot only be good at solving problems, but also at framing and reformulating them: these two skills will facilitate the search for solutions.
(Wedell-Wedellsborg, 2017)	This article highlights the difficulty that organisations have in diagnosing problems. One of the justifications given concerns the fact that managers tend to quickly dive into the solution without first confirming whether they really understand the problem. Wedell-Wedellsborg (2017) further suggests that current problem diagnosis tools, such as TRIZ or Six Sigma, are sometimes too complex and time-consuming to be used on a daily basis. Wedell-Wedellsborg (2017) proposes a new approach to diagnose problems: reformulate them. He exemplifies with the case of the lift, where a problem related to the waiting time for lifts is mitigated by placing mirrors next to them, which help to relativize the waiting time. Wedell-Wedellsborg (2017) identifies seven steps to be used to reformulate problems: 1) Establishing legitimacy: It is essential to establish legitimacy, for example vis-à-vis the company, for the method adopted. He suggests, for example, using the example of the lift mentioned above to establish legitimacy for the reeast process. This step is especially important in environments where there is usually no room to ask questions; 2) Bringing outsiders into the discussion: having an outside perspective can be effective and constructive in reframing a problem, as this often corresponds to a fresh view of it. Wedell-Wedellsborg (2017) stresses, however, that it is important that these are people who understand the issue under analysis, but who are not part of the universe of people who are discussing the problem, so that there is freedom of opinion. It is also important, in this step, not to expect concrete solutions to the problem, but only general input; 3) Getting people's views in writing: this step aims to mitigate the risk of participants leaving a meeting with the perception that they all share the same understanding of the problem, when this is not the case; the Author suggests that people's understanding be collected in advance of the discussion and shared anonymously during the discussion. This will allow participants to react to and be aware of different perspectives; 4) Ask what's missing: this step recommends asking participants what is missing from the problem definition. In other words, ask participants to zoom out and try to identify what has not yet been identified by their analysis. This step therefore aims to mitigate the risk that people get stuck in the details of the problem without realising that they are missing important information; 5) Consider several categories: This step is to invite participants to identify which category of the problem they think is being analysed, then invite them to come up with an alternative category. This approach - also called thinking about thinking - can be helpful in getting people to look at the problem from a different perspective and to come up with new solutions. Here too, the aim is to avoid getting bogged down in a pre-established solution; 6) Analyse the positive exceptions: in this step the aim is to analyse the positive exceptions (or bright spots), i.e. for participants to analyse historically other similar situations where the problem did not occur, exploring the differences between the two situations. This step can help identify forgotten or hidden factors which, if identified, can provide new insights into the problem; 7) Questioning the objective: the last step concerns the importance of understanding the objective of each of the parties involved. By questioning these objectives, it may be possible to reformulate the problem, which may lead to more efficient solutions. Again, the aim is to avoid pre-defined objectives and to motivate a change of approach. Wedell-Wedellsborg (2017) concludes that reformulating a problem can be a powerful tool for finding new solutions.

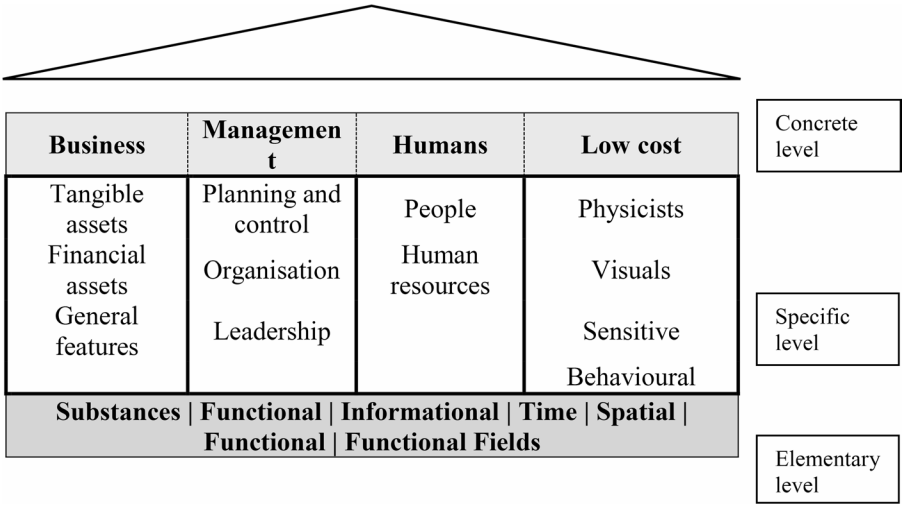


Fig. 1 Resources in TRIZ management (adapted from Mueller, 2005)

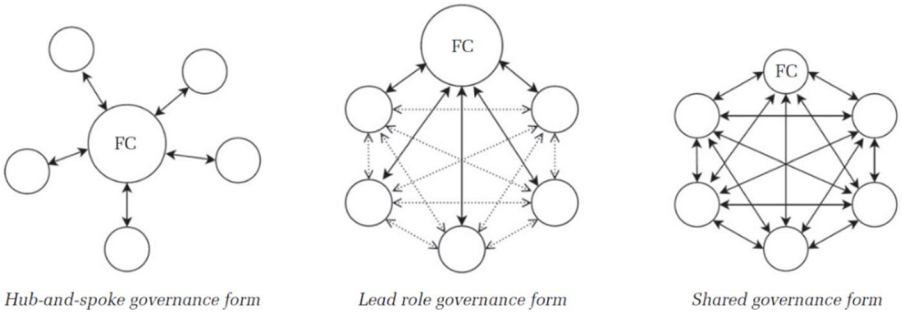


Fig. 2 Forms of interaction between stakeholders (adapted from Bridoux & Stoelhorst (2022)

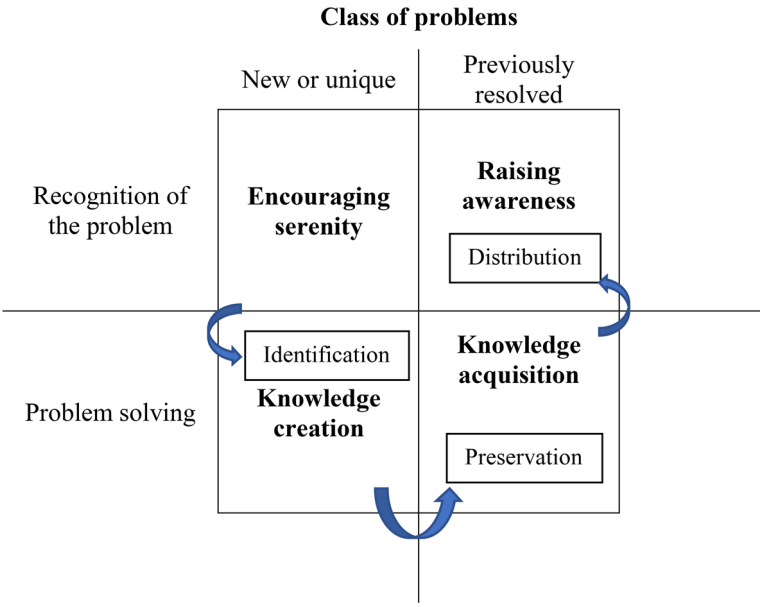


Fig. 3 Framework for knowledge management (adapted from Gray (2001)

Table 3 Problem-solving processes and knowledge requirements in services adapted fom Ritala et al., (2011)

	Standard offers	Offers add-on	Specific offers	Specialised offers
Nature of the problem-solving process	Routine, rigid	Mostly routine, although with some customisation	Mostly unstructured	No structure
Knowledge requirements and co-creation	No need to know the customer	Basic knowledge (preferences)	Low customer knowledge but high service knowledge	High knowledge of the client and the service
Examples (B2C) Banking services	Open an account	Bank loan	Heritage management	Renegotiation of credit
Examples (B2B) Marketing consultancy	Market report	Market research	Research on future trends	Marketing strategy consultancy

Author Contributions David Rodrigues: conceptualization, investigation, formal analysis, methodology, and writing - original draft. Leandro F. Pereira: conceptualization, methodology, supervision, validation, and writing - review and editing. Álvaro L. Dias: methodology, validation, supervision, and writing - review and editing. José Crespo de Carvalho: validation, supervision, and writing - review and editing. All authors have read and approved the final version of the manuscript.

Funding Open access funding provided by FCT|FCCN (b-on). This work was supported by Fundação para a Ciência e a Tecnologia, grant UIDB/00315/2020.

Data Availability The data that support the findings of this research are available on request from the corresponding author.

Declarations

Conflict of interest There is no conflict of interest in this research.

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