PROBLEM FORMULATION IN ORGANISATIONAL CHANGE: A SYSTEMATIC LITERATURE REVIEW

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"If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and five minutes thinking about solutions"

- Albert Einstein

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Contents

Abstract

Background: Organisational change is a complex process, encompassing various steps. It is often observed that change initiatives can be ineffective or fail (Balogun and Hailey, 2004; Sturdy and Grey, 2003). Scholars often associate the success of changes with understanding the problems (Burnes, 1996; Nutt, 1998; Pashiardis, 1995). Considering the above, to better understand organisational changes, it is important to begin with how organisational problems requiring change are approached.

Method: Using a systematic literature review as a research method, this study paused the following research questions: *How does extant research conceptualise problem formulation*; *what are the main findings of extant research in terms of what the straightforward/challenging parts problem formulation are, and which factors affect the problem formulation*; *How did extant research study the process of problem formulation.* The search query developed for this study was applied in the Web of Science database, yielding 1,207 articles, of which nine were included in the final review. The coding of the publications involved both inductive and deductive processes. Prior to coding, the articles were assessed for quality. Inter-rater reliability was 91% for the quality assessment and 77% for the coding process.

Results: The results indicate that problem formulation is conceptualised as socially constructed, iterative, complex, and multifaceted. When conceptualising problem formulation, researchers adopt either a structured or interpretive approach. The chosen approach is linked to the research method employed. Specifically, it is found that researchers who view problem formulation through a structured lens utilise quantitative methods, while those who approach it through an interpretive lens use qualitative methods. Creative logic, sensemaking, leadership behaviour, project experience, and knowledge were identified as influential factors, all of which were grouped under the theme of cognition. Another influential factor was intellectual capital, which was not associated with a theme.

Problem formulation in organisational change: a systematic literature review

Organisational change is a complex phenomenon, spanning across multiple disciplines and is associated with fields such as management, psychology, and economics (Oommen, 2018). It can be defined as adjustments (Oreg et al., 2013) or transitions of an organisation from its current state to a new condition (Oommen, 2018). Such changes may include, but are not limited to, the implementation of new practices, modifications to the organisational structure and culture, revisions in employees' roles and even relocation of the organisation (Oreg et al., 2013).

Changes occur to adapt to current market needs, ensure organisational success for the years ahead, or address existing problems (Balogun & Hailey, 2008; Waddell et al., 2019). These changes can be gradual and planned or radical (Oommen, 2018). The nature and scope of change can vary depending on the organisational context. Specifically, radical changes may require more urgent problem formulations, while incremental changes allow for a more evolutionary problem-solving process (Pettigrew et al., 2001; Waddell et al., 2019). Additionally, organisations in the public sector may approach change differently from private firms, mainly due to regulatory constraints and government structures (Kickert, 2013). Regardless of its nature, change agents control the process (Oommen, 2018). These can be either external or internal. Internal agents consist of leaders, managers, and decision-makers within the organisation, while external agents are consultants who operate independently of the organisation.

A plethora of frameworks have been developed to guide change processes (Waddell et al., 2019). Some of the most influential frameworks include Lewin's change management model, which emphasises unfreezing, changing, and refreezing (Lewin, 1947) and Kotter's eight-step process for leading change, which highlights the importance of urgency and coalition building (Kotter, 2012). Additionally, problem-solving methods such as Simon's (1955) model of bounded rationality provide structured approaches to identify and solve organisational challenges.

Typically, the existence of a problem triggers a change process. Problems can be defined as challenges requiring a solution (Heerkens & Van Winden, 2021) and as a discrepancy between the current and desired situations (Hicks, 1991). Often problems are approached as "analytical concepts" and categorised into "action problems" and "knowledge problems" (Heerkens & Van Winden, 2021, p.21-23). In brief, action problems are discrepancies between the desired and current situation. In many cases, these may be linked to

other problems, necessitating the establishment of a problem cluster and the identification of the core problem. Knowledge problems are associated with limited information. In such cases, decision-makers have to investigate to learn more about the challenges they face. The need for research highlights the explanatory nature of these problems. Despite the problem type, the process of understanding the problem can be summarised under the concept of problem formulation.

Frameworks that guide change processes include problem formulation as an initial step (Sauve-Ciencewicki et al., 2019). Problem formulation is often treated as a straightforward process rather than a complex cognitive and social activity (Dorst & Cross, 2001; Jonassen, 2010). Previous research highlights that problem formulation is a crucial activity for successful changes (Eierman & Philip, 2003). Nutt (1998) further emphasises the importance of problem formulation by illustrating that in two-thirds of change initiatives, failures can be attributed to inadequate problem formulation.

It may appear paradoxical that problem formulation is a well-structured step in problem-solving literature yet remains a problematic aspect in practice. While frameworks such as Lewin's (1947) assume a clearly defined starting point, they often overlook the role of other factors involved in the problem formulation (Dorst & Cross, 2001; Jonassen, 2010). It is often evident that change agents frequently deal with incomplete information, goals and differences in stakeholder's opinions (Kwakkel et al., 2016), which challenge the linear process described in the literature. This gap between the theoretical frameworks and real-world applications necessitates a further understanding. Considering the aforementioned, to better understand and guide organisational changes, it may be essential to begin with how organisational problems requiring change are perceived.

Research on problem formulation is scarce and conceptually diffused (Eierman & Philip, 2003). Furthermore, the terminology is inconsistent. For instance, terms like problem finding (Runco & Nemiro, 1994), problem framing and definition (Bardwell, 1991), and problem recognition (Akdere, 2011) exhibit considerable conceptual overlap. Consequently, there is a need for a systematic literature review. A systematic literature review is considered to be an appropriate research method for this study because it enables a structured synthesis of fragmented knowledge (Tranfield et al., 2003; Snyder, 2019). Systematic literature reviews are common in organisational change and management sciences, with many utilising them in recent years. Examples are Kalwani & Mahesh (2020) or Mohaghehg & Furlan (2020). Besides the fact that each researcher had a unique contribution to the literature, their works highlighted that systematic literature reviews can offer insights that traditional research might

overlook. Generally, through a systematic literature review, a comprehensive contribution to the understanding of organizational change can be achieved. Systematic literature enables the researchers to map the literature, linking studies which address the same topic, even when the terminology is not consistent (Petticrew & Roberts, 2006). Simultaneously, systematically reviewing the literature will lead to a more comprehensive understanding of how the process is conceptualized among researchers, revealing variation in interpretation and understanding of each author's perspective.

The structure of this paper is as follows: Firstly, the definition and key concepts of problem formulation are provided. The straightforward or challenging aspects and influencing factors related to problem formulation, as well as the previously applied research methods, are identified. Then, the research questions and research methodology are described. Subsequently, the data analysis and findings are presented, followed by a discussion of their implications for theory and practice. Finally, the paper concludes with recommendations for future research.

Theoretical framework

Definition and importance of problem formulation

Problem formulation is a crucial managerial and organisational activity that encompasses recognising and structuring issues for resolution (Eierman & Philip, 2003). This process includes identifying the existence of a problem, defining the gaps between the current and desired situations, identifying the causes and effects of issues (Eierman & Philip, 2003), creating an inventory of problems, organising them into clusters, selecting the core problem, and quantifying it (Heerkens & Van Winden, 2021). However, problem formulation does not entail activities aimed at mitigating the discrepancy or manipulating its underlying causes (Eierman & Philip, 2003).

Problem formulation occurs in the early stages of change, it influences all subsequent steps (Volkema, 1983) and affects the ability of decision-makers to devise meaningful solutions. Through the formulation process, variables associated with the problem can be identified (Baer et al., 2013). Although some variables can be identified directly, others may be more challenging to detect. This is particularly true in the context of strategic problems, where identifying the root of an issue and making sense of it can be considerably more difficult. Multiple elements of a problem can be interconnected. Consequently, when one variable changes, another variable may also be altered, thereby affecting the initial problem (Baer et al., 2013). At the same time, while decision-makers engage in problem formulation activities, optimal formulations may be selected (Volkema, 1983), and alternative patterns of ideas may be generated, facilitating creative solutions (Eierman & Philip, 2003).

Problem formulation does not solely lead to the creation of optimal solutions. In many instances, formulating problems can help to avoid biases and errors. An example are the third-type errors, which arises when a solution is applied to a problem that has been formulated incorrectly (Volkema, 1983). Third-type errors occur when problem formulation is based on erroneous, incomplete, or inappropriate representations of the problem (George, 1994). This implies that stakeholders overlooked elements related to the problem environment, leading to solutions based on inaccurate representations of the problem. Such errors can adversely affect an organisation. As the problem-solving process commences and a third-type error occurs, the implemented solution may prove ineffective. In this case, the organisation invests in a solution that does not address the problem, leading to financial loss (Hodgson & Drummond, 2009). Moreover, due to third-type errors, valuable time may be wasted (Volkema, 1983).

This is because decision-makers concentrate on incorrect matters rather than engaging in effective formulation and identification activities.

Lastly, the quantity of information required to change a decision is significantly more than that required to initially make one (Volkema, 1983). Consequently, once a decision path is chosen, redefining the problem becomes less likely. This places a critical emphasis on decision-makers to avoid rushing to conclusions and to choose the first available problem definition. An insufficiently and wrongly formulated problem may also lead to failure of changes (Balogun & Hailey, 2008; Waddell et al., 2019). However, it is essential to highlight that the failure of organisational change is not solely attributed to problem formulation. Processes such as implementation also hold the potential to contribute to failure (Cicmil, 1999).

The challenges of terminology

Problem formulation is not an isolated activity. It interfaces with other fields such as decision-making (Nezu & D'Zurilla, 1981; Nutt, 1992), psychology (Davies, 2005), strategic management (Alkhafaji & Nelson, 2013), and problem-solving (Eierman & Philip, 2003). Within decision-making, activities related to problem formulation are often referred to as *problem recognition* (Akdere, 2011), *conceptualisation* (Adams & Brandt, 1983), or *diagnosis* (McKenzie et al., 2011). In terms of problem-solving, the process of problem formulation is also known as *problem identification* (Rubenstein et al., 2020). In strategic management, the processes may be termed "*environmental analysis and strategy formulation*" (Alkhafaji & Nelson, 2013, p.7). Challenges regarding terminology are not associated solely with problem formulation. Researchers encounter similar issues in the context of organisational change. Specifically, Stickland (2002) emphasised that organisational change is also linked to many domains and may be referred to as *transformation*, *metamorphosis*, *evolution*, *regeneration*, *revolution*, *transition*, and so forth.

The challenge of extensive terminology introduces even more complexities. Specifically, researchers can only assume that the same phenomenon is being studied (Eierman & Philip, 2003). Because problem formulation is referred to and defined differently among researchers, different processes, such as decision-making (Kwakkel et al., 2016; Lempert & Turner, 2020), may be investigated. This, combined with the limited understanding of the topic, adds another layer of complexity. In light of this, it is considered that activities such as decision-making or problem-solving are integral to organisational

changes, as the process begins when the problem is first identified, or a decision must be made.

Straightforward and challenging aspects of problem formulation

Determining whether certain aspects of problem formulation are classified as straightforward or challenging in the literature presents challenges. However, some publications suggest that certain elements may be more complex or straightforward than others. For instance, Locke and Latham (2002) examined goal setting and task motivation, illustrating that clearly defined goals can streamline the decision-making process. When goals are well-described, an organised course of action can be established, inherently simplifying the process. Decision-makers often rely on structured methodologies or analytical techniques, such as SWOT analysis or root cause analysis, to facilitate problem formulation (Mello et al., 2022). Methodologies like this support the evaluation of information, encourage collaboration and reduce ambiguity. Besides that, appropriate strategies not only assist in setting goals but also contribute to a more structured and manageable formulation process.

Additionally, it is often observed that the complexity of the process correlates with the complexity of the problem. Problems are context-dependent, shaped by specific circumstances and stakeholders, it can manifest in many different ways (Smith, 1996). The dependency on the context indicates that there are often no standardised procedures to follow. This implies that the initial stages of identification and formulation may prove challenging. Typically, problems become evident when decision-makers act but fail to achieve the desired outcome, particularly in cases where they deliberate and research to identify problems or seek opportunities to utilise available resources more effectively (Smith, 1996). In some instances, problems can remain unnoticed and even become the norm, making it unclear when the problem formulation and solving cycle commences (Heerkens & Van Winden, 2021). However, even when a problem is not complex, the formulation process can be challenging due to unclear or challenging to achieve goals (Smith, 1996). For example, in digital transformation initiatives, businesses pursue broad objectives such as *enhancing digital culture* (Rodrigues et al., 2020). Yet, such goals may lack alignment among decision-makers and may also be underdefined. In these situations, problem formulation relies on assumptions about future outcomes, introducing uncertainties about both the current and desired states. Given this, understanding both the straightforward and challenging aspects is essential not only for conceptual clarity but also for practical impact.

Cognitive capabilities

Problem formulation is influenced by various factors that can shape how problems are approached and solved. One such factor is cognitive capabilities, which influence how individuals function in their roles, behave, or react (Bandura, 1991; Helfat & Peteraf, 2014). Prior to any solution, decision-makers engage in problem formulation activities, that often rely on attention, memory and reasoning. To understand how cognitive capabilities affect problem formulation, it is useful to examine the core cognitive mechanisms. This exploration can include the types of thinking involved or the significance of working memory.

In terms of thinking types, the literature refers either to Dual Process Thinking theory (Kahneman, 2011) or to the different functions of the right and left hemispheres (Volkema, 1983). The dual process theory categorises thinking into Types 1 and 2 (Kahneman, 2011). Type 1, or intuitive thinking, allows individuals to identify objects, focus their attention, avoid negative outcomes, and experience fear towards certain stimuli. Type 2, or deliberate thinking, necessitates a considerable amount of working memory and operates consciously, resulting in a slower but more controlled process. It requires complete focus, and distractions can hinder this thinking process. Typically, this type of thinking is reserved for tasks demanding critical thinking, concentration, and logical reasoning. However, not every demanding task is executed through deliberation. Research indicates that experienced individuals tend to think more automatically. Moreover, even when individuals engage in deliberative thinking, they may overconcentrate on certain stimuli, thereby missing important information (Kahneman, 2011). With respect to the hemispheres, the left is characterised as more analytical and logical, while the right is more creative and intuitive (Volkema, 1983). If a decision-maker tends to use one part of the brain more than the other, the task of problem formulation may be more or less challenging.

Another aspect of cognitive capabilities is working memory (Oberauer et al., 2000). Working memory plays such a crucial role in human cognition that it is challenging to identify activities unrelated to it (Ericsson & Delaney, 1999). A characteristic of working memory is that it is limited in capacity (Simmering & Perone, 2013), which may result in individuals having difficulty remembering all the facts associated with a problem. Generally, individuals do not consciously select which type of memory to use (Kitajima & Toyota, 2014). This poses significant challenges and may influence problem formulation both negatively and positively. Simultaneously, long-term memory is available to store knowledge, records, or prior events and generally important information that an individual would need for a lifetime or for an extended period (Camina & Güell, 2017). In cases where an individual is

not frequently exposed to certain information or lacks sufficient experience, relying on long-term memory may neither be possible nor beneficial.

In conclusion, understanding cognitive mechanisms is crucial as problem formulation depends on how individuals interpret and organise information. For example, limited working memory can hinder the integration of multiple pieces of information, while intuitive thinking may introduce biases (Brainerd & Reyna, 2002; Norman et al., 2016). Cognitive overload, arising from an imbalance between intuitive and analytical processes, can cause premature closure or misidentification of key issues. Given that problem formulation guides organisational changes, grasping these cognitive processes is vital for enhancing organisational effectiveness and avoiding errors.

The role of decision-makers and teams

Problem formulation is not an individual task (Irelend & Miller, 2004). In an organisational context, many individuals are involved, who bring unique information and perspectives to the process. This highlights a social dimension of problem formulation which is directly related to team composition. Recognising this is important because it influences the quality and difficulty of problem formulation. Teams can be heterogeneous or homogeneous regarding their information or backgrounds (Baer et al., 2013). Concerning heterogeneity in a team's background, findings are inconclusive, inconsistent, and mixed. While some associate a team's heterogeneity with the quality of information (Finkelstein, 2004), others indicate that there is only limited evidence that heterogeneous teams outperform homogeneous teams (van Knippenberg & Schippers, 2007). Concurrently, heterogeneous teams are likely to hold different ideals shaped by their diverse backgrounds and experiences (Baer et al., 2013). This diversity can enrich the formulation activity, guiding decision-makers to unique patterns and towards identifying the core problem itself. However, a distinction exists between heterogeneous teams and heterogeneous sets of information. When team members possess heterogeneous sets of information, they may find it more challenging to analyse them compared to those they are familiar with. Exchanging heterogeneous information among decision-makers limits individuals' attention capabilities, leading to processing information at a lower level of the problem (Baer et al., 2013).

Additionally, decision-makers are the ones to engage in problem-solving processes, make sound decisions, consider all the variables affecting the issue, and so forth (De Andreis, 2020). To do so effectively, individuals should possess a certain level of experience or collaborate with teams of professionals. Decision-makers with expertise may have a superior

memory domain, perceive extensive patterns of information, minimise errors, draw distinctions, and engage with the problem on a deeper level (Hutton & Klein, 1999). Novice problem-solvers may introduce irrelevant concepts, overlook critical details, or impede the problem formulation and decision-making process (Cheong, 2014). However, novice users can also significantly influence the process in a meaningful and beneficial manner (Yang et al., 2022). Often, they contribute fresh perspectives and ideas, challenge existing assumptions, and by asking clarification questions, they might approach problems differently.

Alternative conceptualizations of problem formulation

Pounds (1969) differentiates between problem-solving and the problem-finding cycle, considering the latter as the first step in formulating a problem. Based on Pound's work, problem finding consists of four steps: collecting relevant data and information, selecting an appropriate model, identifying problems, and choosing one for problem-solving. Once problems are identified, decision-makers can apply conceptual models to assist them in investigating the cause(s) of the problem. While Pounds outlines this process, his conceptualisation does not include how decision-makers handle different types of discrepancies or gather relevant data for the problem.

According to Sauve-Ciencewicki et al. (2019), problem formulation is considered a framework comprising three steps: problem framing, problem exploration, and mapping the approach. Problem framing is the initial step in this process. At this stage, decision-makers define the problem, outline organisational priorities, and examine the problem's environment and its components. The primary goal of this step is to reach an agreement on the specific scope and problem statement. Following this, problem exploration is conducted, where decision-makers delve deeper into the problem, organise their knowledge, and identify gaps. This step assists decision-makers in selecting an appropriate action method. Before concluding this stage, decision-makers should develop a conceptual model and formulate a hypothesis. Once the conceptual model is established and the problem's environment is sufficiently explored, the mapping the approach phase begins. Mapping the approach involves selecting a strategy and testing the formulated hypothesis. When there is a mutual agreement on the problem-solving approach, decision-makers may proceed with implementation. However, if the proposed approach is deemed inappropriate, the process of exploring the problem recommences (Sauve-Ciencewicki et al., 2019).

Cyert and March (1992) consider problem formulation to be a component of the four-stage decision-making cycle, identifying it as a problemistic search. Problemistic search

suggests that organisations seek solutions in response to low performance, indicating the presence of a problem. This theory assumes that organisations and their decision-makers possess predefined satisfactory performance standards (Cyert & March, 1992). Typically, the search is guided by exploring the problem's environment and that of the "current alternative" (Cyert & March, 1992, p. 170). These two rules emphasise the notion that the source of a problem is usually close to its observable effects, and correspondingly, potential solutions can often be identified near past successful resolutions. When these two search rules do not yield positive results, two developments are presumed: the organisation employs more complex search strategies and introduces a third rule for searching (Cyert & March, 1992). In this case, problem formulation is an ongoing process, occurring through search activities that begin with the most obvious signs from the problem environment. However, it should be noted that while Cyert & March (1992) do not explain how the formulation process is conducted, they do detail how organisations behave.

Lastly, another conceptualisation of problem formulation is addressed by Thissen (2000). Thissen (2000) approaches problem formulation as a five-step process. The first step is " articulation of the initial problem as perceived by the problem owner" (Thissen, 2000, p. 301). At this stage, decision-makers should clearly communicate the key elements of the problem, identify the problem gap, the desired situation, the direction of the solution, and pinpoint the root of the problem. Following this, the second step, known as "critical analysis and specification," begins (Thissen, 2000, p. 302). In this stage, decision-makers are responsible for narrowing the scope of the problem by identifying objectives and related factors, as well as recognising possible solutions, considering the problem owner as an influencing factor. Thirdly, the "actor and dependency analysis" aims to identify all the influencing actors (Thissen, 2000, p. 302). This implies that decision-makers are researching all the individuals who affect or are affected by the problem. Once this is complete, the process of exploring the uncertainties begins. In this step, decision-makers analyse the exogenous factors, identify and select the driving forces, agree on problem scenarios, and commence an analysis of the possible implications. The problem formulation cycle concludes with the "iteration and adjustment of the problem formulation from step 2" (Thissen, 2000, p. 305). The extent to which a problem will be adjusted depends on the preceding steps, specifically steps three and four. Generally, in this step, new factors may be introduced, and the scope may broaden. This step will lead to the formulation of the problem, providing the basis for selecting appropriate methodologies and designing a solution. Considering all the above, it is evident that overall problem formulation is an ongoing and systematic process.

Although authors may approach the process differently or structure it into many different steps, they tend to describe the same concept.

Research methodologies applied in problem formulation

Understanding the research methods used to study problem formulation is essential, mainly because methodological choices are shaped by how the process is conceptualised. This section reviews how different studies have approached the investigation of problem formulation. Rather than listing methods in isolation the link between research design and conceptualisation is highlighted. In the management and business field, problem formulation was researched mainly through quantitative methods.

Firstly, Nezu and D'Zurilla (1981) qualitatively investigated problem definition and formulation, focusing on its effect on decision-making. Although the authors outline procedural components of problem definition and formulation, they do not offer a theoretical conceptualisation of the problem formulation. Instead, they reference the social problem-solving model (Nezu and D'Zurilla, 1971). Their research, specifically 3x2 factorial design, focuses on examining the first two steps of this model, which are problem orientation and problem identification and formulation. The study involved ninety participants, all of whom were undergraduate psychology students. The factors were "problem definition and formulation" and "decision-making" (Nezu and D'Zurilla, 1981, p.101). These factors had three and two levels of instruction, respectively. Specifically, concerning the first factor, the levels were "problem-definition-and-formulation-training," "problem-definition-and-formulation guidelines," and "no problem-definition-and-formulation instructions" (Nezu and D'Zurilla, 1981, p.102). Regarding the second factor, the levels were "decision-making training" and "no decision-making instructions" (Nezu and D'Zurilla, 1981, p.102). This design led to six different groups that represented combinations of problem definition-formulation and decision-making instructions. Participants were randomly assigned to the groups, with each group consisting of fifteen individuals who faced social and community problems. In addition to the problems, participants were also provided with a list of solutions. Problem descriptions were given to the participants, and the problem-solving goal was specified in the form of a question. Each solution could score from one, which indicated poor efficiency, to nine, which indicated high efficiency. Based on the data collected, an ANOVA test was conducted. The results indicated that problem definition and formulation enhance the effectiveness of decision-making. However, the study failed to find any significant interaction effects or identify significant differences between problem-

definition-and-formulation-training and problem-definition-and-formulation guidelines. To conclude, it is evident that the nature of the study fits the approach in the conceptualisation. To put it differently, Nezu and D'Zurilla approach problem formulation in a structured way, overlooking factors related to the process and the nature of problem formulation. This approach results in a quantitative study that simply measures one statistical relationship.

Volkema (1983) focused on problem formulation in the context of planning and design. The researcher did not adopt a specific conceptualisation of problem formulation but rather emphasised the role of problem formulation and the factors influencing the process, with emphasis on problem formulation heuristics, expansion, and reduction. By conducting a laboratory study, Volkema (1983) aimed to investigate problem formulation and problem-purpose expansion. Participants were students from a Midwestern university, categorised based on their field of study and level of creativity. The study's categories included engineering and counselling students, while the creativity categories were classified as low or high. Participants were asked to address two different problems. The total working time was 36 minutes, divided into four-minute intervals. Both the control and treatment groups were introduced to brainstorming techniques, while the treatment group also received instructions on problem-purpose expansion. The problems investigated in the study were "The Staffing Problem" and "The Elevator Problem" (Volkema, 1983, p. 646). The total number of solutions, their quality, varying conceptualisations of the problem, and the ability to generate solutions were all considered indicators of effectiveness. After concluding the experiment, a post-exercise questionnaire was distributed, and all collected data were analysed using ANOVA. The results of the study highlighted the importance of creativity in problem formulation activities, specifically finding that participants with high creativity outperformed those with low creativity. However, it is important to note that although Volkema (1983) adopts a broad perspective in the theoretical development of problem formulation and considers many aspects and factors relevant to the process, the research method lacks a deeper understanding. Specifically, his research overlooks the exploration of which types or aspects of creativity, along with the role that creativity plays.

Pracht and Courtney (1988) aimed to assess whether graphical, interactive tools for problem formulation enhanced comprehension of the problem's structure. Problem formulation was conceptualised as a structured and cognitively demanding process rooted in cognitive and imagery theory. The authors theorised that problem formulation constitutes a distinct phase of problem-solving, encompassing tasks such as identifying information relevant to a problem. This conceptualisation led to the design of a laboratory study using a 2

x 2 factorial design, examining the effect of GISMO. Eighty-four participants, all students in a business policy course, took part (Pracht & Courtney, 1988). The two groups were formed based on their course enrollment status, meaning that students in section one of the policy course constituted one group, while those in section two formed the second group. Each group was then randomly assigned to either the control or the experimental group, with the latter allowed to use GISMO. To prevent "contamination," the researchers specified time limits for the groups and advised each participant against engaging in peer discussions. Furthermore, databases created by Kasper (1983, as cited in Pracht & Courtney, 1988) were employed, consisting of two hundred fifty items, "each of 20 periods" (Pracht & Courtney, 1988, p. 611). The study lasted for three weeks. Questionnaires were distributed to the participants during the first and third weeks, while the experimental group was introduced to GISMO in the second week. Once all the data were collected, statistical analysis was performed using a t-test (Pracht & Courtney, 1988). The study found that the use of GISMO assisted field-independent users in problem understanding, while field-dependent users did not experience significant changes in their problem understanding.

The current study

Research questions

The current theoretical framework forms the basis for the subsequent research questions:

1) How does extant research conceptualise problem formulation?
2) What are the main findings of extant research in terms of what are the straightforward/challenging parts of problem formulation, and which factors affect the problem formulation?
3) How did extant research study the process of problem formulation/ identification?

Methodology

Systematic literature review

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) were used as the foundation of this systematic literature review (Page et al., 2021). Prior searches in the literature guided the selection of keywords for the search queries. This resulted in identifying terminology related to the topic. The terminology and keywords identified are *problem formulation* (Volkema, 1983), *problem identification* (Breuker, 1994; Rubenstein et al., 2020), *problem recognition* (Akdere, 2011), *conceptualization* (Adams and Brandt, 1983), *diagnosis* (McKenzie et al., 2011), *problem sensing*, *problem finding* (Mohangheng & Grossler, 2019), *problem structuring* (Days et al., 1979; Smith, 1988), *problem definition* (Breuker, 1994), *problem perception* (Schoenfeld & Herrmann, 1982), *problem framing* (Euchner, 2019) and *organisational search* (Nigam et al., 2016).

Given the number of keywords, it was essential to analyse each keyword individually. To enhance the accuracy of the pilot testing, the following inclusion criteria were applied: publication year (2023[1]-2013), the language and the inclusion in the Social Sciences Citation Index. The exact queries and results of the pilot testing can be found in Appendix 1 and 2. All the terms were evaluated based on a sample size of ten randomly selected articles. When the results were ten articles or less, all the articles were screened. Moreover, terms were tested both with and without truncation. Based on the pilot, the keywords c*onceptualisation*, *diagnosis*, *problem perception*, *problem sensing* and *organisational search* were eliminated. The keywords business AND management were added, as was NOT health*. During the pilot testing, no new keywords related to problem formulation were found.

The selection of the databases was in accordance with the database catalogue of the University of Twente. Web of Science was considered as an appropriate database for the search and data extraction. Upon completing the pilot testing, the search query for the review was finalised as follows: *("problem recogni*" OR "problem structur*" OR "problem defin*" OR "problem find*" OR "problem fram*" OR "problem formulat*" OR "problem identificat*") AND (business OR management) NOT health**. The aforementioned search query resulted in a pool of 1207 publications.

[1]Includes studies first available through early access in 2023.

Inclusion criteria

Before the pilot test and final data extraction, inclusion criteria were applied. Articles included in the systematic literature review should be 1) written in English, 2) peer-reviewed, 3) empirical academic research in the field of management or business, 4) be included in the social science citation index (SSCI), 5) have a method section, 6) pertain or focus on problem formulation, 7) pertain or describe organisational change, 8) to be published within the last 10 years ago, in this case, 2013-2023.

Explaining the rationale behind the criteria is crucial. Working with English articles allows all readers to comprehend those included in the literature review. Peer-reviewed articles ensure the published information is valid (Steer & Ernst, 2021). The Social Science Citation Index adds another layer of validity, helping researchers find trusted sources. Including empirical research from management or business ensures articles are relevant, evidence-based, and applicable to real-world organisational change, especially if published in the last ten years. In this review, empirical research is defined as studies that involve the collection and analysis of primary data through methods such as surveys, interviews, case studies, or experiments. As such, conceptual papers and theoretical discussions, without original data are excluded. Relevance is confirmed when articles focus on problem formulation and organisational change. Lastly, the methodology should be documented, including sample characteristics, data collection methods, and analysis techniques. Publications with a methods section support rigorous quality control process.

The aforementioned criteria and research strategy resulted in 1207 studies, out of which nine were left for analysis. Three studies used qualitative research methods, and six used quantitative research methods. The data encompassed scholarly papers from a diverse range of global sources. Specifically, Italy (1), USA (4), China (1), Norway (1), Denmark (1) and Ireland (1).

Data collection and extraction

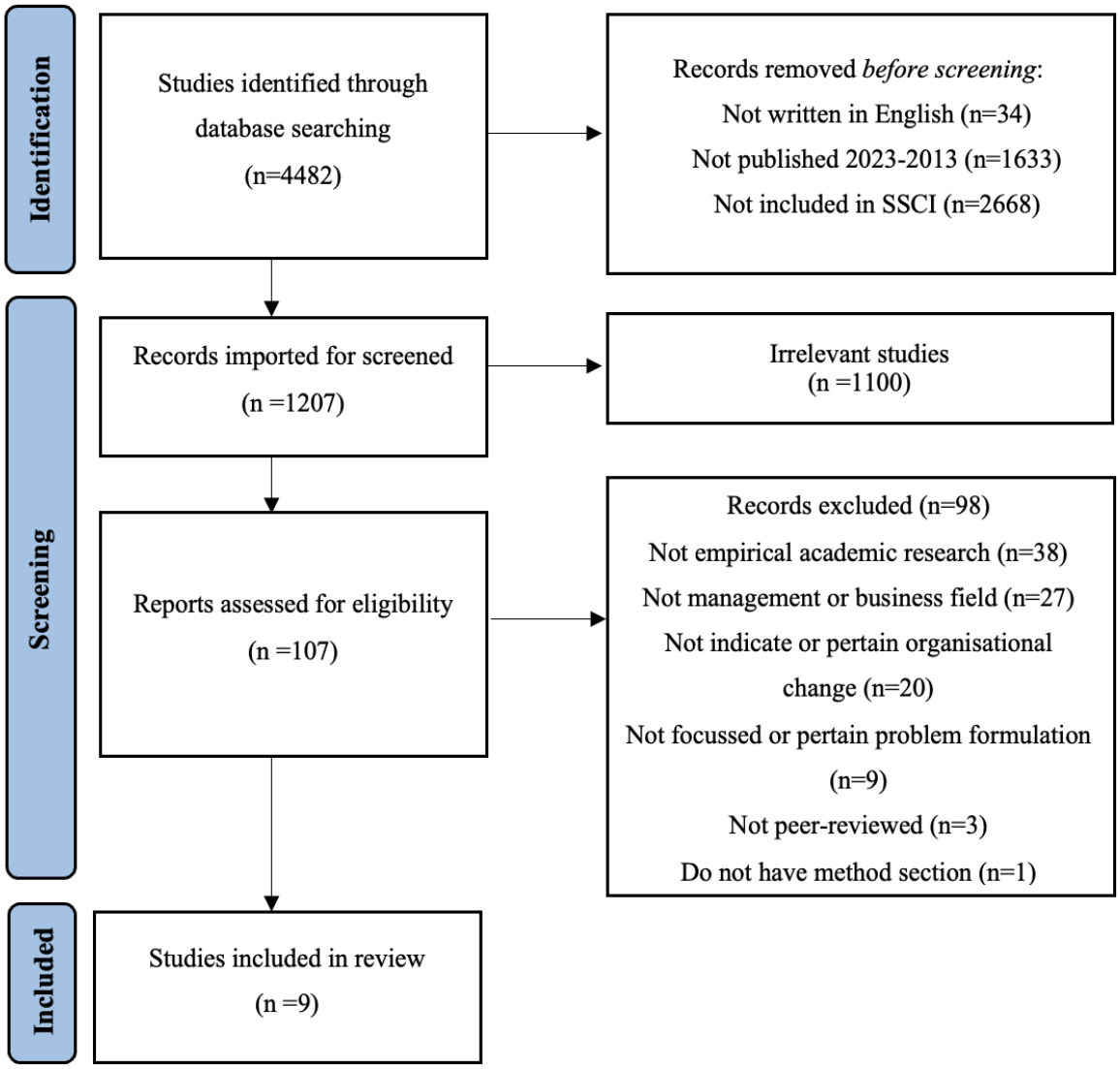
The data was collected on 20 September 2024 using the aforementioned search query. This query yielded 4,482 articles, of which 3,275 were automatically excluded (see Figures 1 and 2). The excluded articles did not meet the criteria for inclusion regarding publication year, language, and SSCI. The automatic exclusion resulted in 1,207 articles, which were imported into Covidence (see Figure 2).

The screening process in Covidence was conducted in three stages: title and abstract screening, full-text screening, and full-text review. During the first stage, all articles irrelevant

to the study were excluded, while those that raised uncertainty were further examined in the full-text screening stage. If uncertainty about an article persisted, it was investigated further during the full-text review stage. This implies that, in many cases, articles were reviewed more than twice to ensure their exclusion or inclusion. In addition to documenting exclusion reasons in Covidence, all full-text screened and reviewed articles were reported in an Excel workbook.

Figure 1

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.



Note. Figure 1 details the identification, screening and inclusion of studies (Page et al., 2021).

Figure 2

Data collection

Note. Figure 2 presents the automatic exclusion of articles which did not follow the language and publication criteria or were not part of the SSCI.

Before proceeding with data extraction, a quality assessment of the articles was conducted. This assessment consisted of eleven questions, which can be found in Appendix 3. Each publication could score a maximum of 10 points, with a score of 0.9 awarded for each positively answered question (0.9 x 11 = 10). Questions that were not adequately addressed received a score of 0. Articles were required to achieve a minimum score of 6.5 to qualify for inclusion. The decision to assign scores of 0 and 0.9 was made to ensure precision in the assessment process. This approach avoids the use of midpoint scores, such as 0.5, which could lead to ambiguity. Based on the quality assessment, the mean score for the articles was 8.69. A second peer reviewer assessed 33% of the articles for quality. The differences between the peer reviewer and researcher were discussed, resulting in an agreement rate of 91% (Cohen's Kappa = 0.91) (see Table 2). Due to the quality control scores, all the articles were included in the systematic literature review.

Table 2

Inter-rater reliability for quality control

Measure	κ	95% CI (Lower – Upper)
Unweighted kappa	0.91	0.80 – 1
Weighted kappa	0.91	0.80 – 1

Note. Table 2 illustrates Cohen's Kappa as calculated on RStudio.

Coding of the publications

Upon completing the quality assessment, the publications were extracted and assigned unique identification numbers. They were subsequently imported into ATLAS.ti, and a codebook was developed. Twenty-three per cent (23%) of the publications were blindly double-coded to ensure the reliability of the data extraction. The differences were discussed, and adjustments were made, resulting in an agreement rate of 77% (Cohen's Kappa = 0.77) (see Table 3). Since Cohen's Kappa exceeded 70%, the coding process was conducted by a single coder.

Table 3

Inter-rater reliability for blind double coding of the publications.

Measure	κ	95% CI (Lower – Upper)
Unweighted kappa	0.77	0.63 – 0.91
Weighted kappa	0.77	0.63 – 0.91

Note. Table 3 illustrates Cohen's Kappa as calculated on RStudio.

Both deductive and inductive coding approaches were utilised. Initially, a general review of the articles was conducted, and codes were applied using the predefined codebook, adhering to a deductive coding approach (see Appendix 4). This process facilitated a structured analysis of the article, drawing on the existing framework and research objectives. Subsequently, the researcher revisited the articles and carried out a detailed analysis, generating new codes inductively. These codes were developed based on the insights emerging from the previously applied codes, allowing for a precise interpretation of the data. Upon completing the coding of all the articles, the quotations were synthesised and analysed.

Results

The results section presents the findings of the systematic literature review and is organised around the three research questions that guide this study. First, it outlines how problem formulation has been conceptualised across the selected studies. Second, it explores how problem formulation has been studied, focusing on the research methods and approaches adopted. Third, it identifies factors that influence the problem formulation processes. Together, these findings provide a structured overview of the current state of knowledge and establish a foundation for the subsequent discussion.

Conceptualisation of problem formulation

Characteristics of problem formulation

In response to the first research question concerning the conceptualisations of problem formulation, all nine studies were utilised to synthesise the findings (see Table 4). Across the studies, there is a notable absence of a shared definition of problem formulation. Instead, the literature conceptualises problem formulation through characteristics. Particularly, it was found that problem formulation is conceptualised as *socially constructed* (Gralla et al., 2016; Morais-Storz et al., 2020; Pham et al., 2023; Tippmann et al., 2017), *iterative process* (Choo, 2014; Gralla et al., 2016; Foss et al., 2016; Morais-Storz et al., 2020), *complex and multifaceted* (Min & Oh, 2020; Li & Liu, 2018; Foss et al., 2018; Heiman & Hurmelinna-Laukkanen, 2024; Tippmann et al., 2017).

To begin with, problem formulation is characterised as socially constructed. This is derived from the fact that problems are not objective or static entities. Instead, they are shaped by decision-makers' knowledge, interpretation, and experience. This means that problem formulations emerge through dialogue, debate and negotiation. Studies such as Gralla et al. (2016), Morais-Storz et al. (2020), Pham et al. (2023), highlight that the process is deeply embedded in social contexts, where various stakeholders contribute to how problems are framed. Additionally, Tippmann et al. (2017) specify that “formulating complex problems is challenging, and no single actor’s knowledge covers all aspects of a problem”. The authors also state that problems are socially constructed, not objectively defined and continue with highlighting that “problem formulation can thus benefit tremendously from effective boundary spanning enabled by the micro-social activities of individuals collectively achieving knowledge transformation” (p.461).

Table 4

Title

Authors, year and country	Terminology	Aim	Conceptualisation	Methodology	Data and analysis
Choo, (2014), USA	Define	Examines the impact of time allocated to defining problems on the problem-solving process.	Problem formulation is part of decision-making, and it is the first step of the DMAIC methodology. The process entails recognising deviations from the current and desired situation and choosing the project's scope. Emphasis is placed on the *social dimension* and the *interaction among stakeholders*.	Quantitative	Secondary data, which included 1558 completed Six Sigma projects from 1998 till 2002; ordinary least squares regression analysis.
Foss et al. (2016), Denmark	Problem formulation	Examine the behaviours linked to projects and the communication factors affecting these behaviours within the open-source software community.	Problem formulation entails identifying and framing problems into solvable ones. This process may begin when a problem arises and restart if the initial formulation is flawed. Emphasis is placed on the *social dimension* of problem formulation, because of the *role of communication*, and the *iterative nature* of the process.	Quantitative	Data derived from SourceForge.net from September 2020 till December 2022; the data was sourced from a repository of open-source software projects, ensuring a comprehensive dataset; employed Poisson regression with robust standard errors for statistical analysis.
Gralla et al., (2016), USA	Problem formulation	Examine mechanisms through which individuals formulate and solve problems.	Problem formulation is the process of identifying problems, which is carried out through sensemaking. In the light of new information, the *iterative nature* of problem formulation is highlighted.	Qualitative	Observations of training exercises conducted by the United Nations World Food Program; thematic analysis and iterative comparison of data and theory.
Heiman & Hurmelinna-Laukkanen (2024), USA	Problem formulation	Examine how managers' awareness of biases affects their intensity and influences problem formulation performance	Problem formulation is distinct from problem-solving, and it is a key managerial activity. Problem-solving focuses on generating solutions, whereas problem formulation involves identifying and defining problems worth addressing. The *complexity of the process is emphasized due to its relation to cognitive constructs*.	Quantitative	Surveys collected from organisations in US, China and Finland; descriptive statistics applying regressor analysis

(continued)

Table 4 continued

Authors, year and country	Terminology	Aim	Conceptualisation	Methodology	Data and analysis
Li &Liu (2018), China	Problem identification	Examine the connections between various aspects of intellectual capital and competitive advantage.	Problem formulation is a core capability that entails identifying problems clearly and systematically. The process involves recognising and defining issues. This is achieved by breaking complex problems into manageable parts and integrating knowledge and perspectives to enhance the organisation's ability to tackle problems efficiently. This capability serves as a mediator for competitive advantage and intellectual capital. The *complex nature of problem formulation is emphasized because of its mediative effect.*	Quantitative	Survey data from hotels in China; the sample was purposive and consisted of 337 managers; correlations and variance inflation factor to check multicollinearity.
Min & Oh (2020), USA	Problem identification	Examine how different sources of evidence used to identify performance gaps influence performance improvement, and whether proactive solution-seeking activities mediate this relationship.	Problem formulation involves identifying performance gaps through internal or external reference points. Internal reference points involve comparisons, in which managers assess their organisation's current performance against its past performance (historical comparisons). External reference points involve comparisons where managers evaluate an organisation's performance relative to other organisations or peers (social comparison). Additionally, *the cognitive and interpretative nature of the process* is emphasised as during problem formulation. Individuals should recognise poor performance and decide if the problem requires attention.	Quantitative	Data was derived from Korean Ministry of Strategy and Finance and it included questionnaires for K-PART; panel path analysis; ordinary least squares effort to examine the mediation effect, which included tests for homoscedasticity, multicollinearity and normality of residuals.
Morais-Storz et al. (2020) Norway	Problem formulation	Examines how problem representations are reformulated.	Problem formulation is the process of establishing problem representations. This is achieved through sensemaking processes. Emphasis is given to the *iterative nature* of the process, mainly due to failure events. The *social dimension* is also highlighted due to the connection of problem formulation to communication and leadership behaviour.	Qualitative	Archival documents and semi-structured interviews; thematic analysis and iterative comparison of data and theory.

(continued)

Table 4 continued

Authors, year and country	Terminology	Aim	Conceptualisation	Methodology	Data and analysis
Pham et al. (2023), Italy	Problem framing	Examines creative processes in problem framing activities.	Problem formulation entails creating mental representations that simplify the problem. This is accomplished by creative processes that assist in the formulation process. The conceptualisation emphasises the two different types of frames, which are referenced and crafted frames. The former involves reliance on preexisting problem representations, primarily based on prior theoretical knowledge. Crafted frames involve constructing new representations or engaging in activities to alter the existing problem representation. The conceptualization emphasizes the complexity of problem formulation due to the influence of cognitive constructs. It also highlights the social dimension of problem formulation.	Qualitative	Ethnographical observations of six innovation workshop participants; open coding and iterative analysis
Tippmann et al. (2017), Ireland	Opportunity formulation	Examine how knowledge transformation in MNCs influences creative solution development through opportunity formation.	Problem formulation is an entrepreneurial approach that involves (re)framing and (re)defining problems. It is conceptualised as socially constructed, shaped by the diverse knowledge of the individuals involved. This perspective emphasises the importance of different viewpoints and highlights the complexity associated with the process.	Quantitative	Paired surveys administered to project leaders and senior colleagues, with some surveys conducted face-to-face; the origin of the data was from UK, France and Ireland; partial Least Squares; Stone-Geisser Q to assess predictive relevance.

Note. Table 4 presents a summary of the selected studies, providing key information including the authors, year of publication, and country of origin. It also outlines the terminology used, the main aim of each study, how problem formulation was conceptualised, the methodological approach adopted, and the nature of data collection and analysis employed.

Moreover, problem formulation is conceptualised to be iterative. Specifically, the process is not a one-time activity but a continuous and adaptive process. It evolves in response to new information, insights and changes. From the publications, it is clear that problem formulation may commence, conclude, and resume as necessary. A primary example is "when failure occurs during a project, it may be necessary to reconsider the project's problem representation, or it may be necessary to frame, a new representation of the problem based on the knowledge gained by the failure event" (Morais-Storz et al., 2020, p. 485). The iterative nature of problem formulation is specifically important within the context of urgent and ill-structured problems, where revisions are necessary (Gralla et al., 2016).

Lastly, problem formulation is conceptualised to be complex and multifaced. This is derived from the fact that problem formulation is shaped and influenced by cognitive, organisational and contextual factors. Each factor contributes to the complexity of problem formulation for distinct reasons. For example, several studies emphasise that problem formulation is influenced by biases, existing knowledge, or heuristics and suggest that decision-makers rely on pre-existing beliefs and cognitive shortcuts (e.g. Hurmelinna-Laukkanen, 2024; Morais-Strotz et al., 2020). Beyond cognition, organisational settings, and decision-making processes also contribute to the complexity of problem formulation. Foss et al. (2016) and Heiman & Hurmelinna-Laukkanen (2024) specifically highlight that problem formulation can become more complex due to innovation strategies, and organisational structure. In addition, problem formulation is shaped by external environmental conditions (Min & Oh, 2020). These are associated with dynamic and uncertain global markets or urgent situations which cannot be controlled by decision-makers (Min & Oh, 2020; Tippmann et al., 2017). The impact of each factor contributes to the complexity of problem formulation, while the interaction among cognitive and contextual influences adds to its multifaceted nature. Cognitive constraints influence how individuals within organisations define problems, but organisational structures determine whether these individual problem framings are reinforced, challenged, or refined through broader knowledge-sharing mechanisms. Simultaneously, external conditions and market dynamics require continuous adaptation, making problem formulation an ongoing and evolving process.

Beyond the above characteristics, problem formulation is viewed as the initial step when approaching a problem, whether it is in the context of problem-solving, decision-making, organisational or innovation processes. The process begins when a problem arises, or an indicator of a problem is present and is finalised by selecting a project scope. In a nutshell,

problem formulation is associated with collecting information, understanding the problem, converting an ill-structured problem into a solvable one, and constructing frameworks.

Approach and focus in conceptualising problem formulation

Across publications, conceptualisations of problem formulation exhibit differences. These differences relate more to how each author approaches the conceptualisation of problem formulation rather than to the characteristics they attribute to it. The root of this divergence lies in the specific focus of each study, which shapes how problem formulation is framed and understood. Simultaneously, certain studies do not investigate problem formulation as an independent subject, which influences the extent to which problem formulation is theoretically developed (Choo, 2014; Heiman & Hurmelinna-Laukkanen, 2024; Li & Liu, 2018; Min & Oh, 2020; Tippmann et al., 2017). To demonstrate the distinction in conceptualisations, the example of three publications is considered. Heiman & Hurmelinna-Laukkanen (2024) investigated how stakeholders formulate problems to focus on. The authors briefly mentioned that "problem formulation is considered a relevant part of innovation" (p. 434) and "involve cognitive, motivational, and informational impediments" (p. 435).

In contrast to the above, Gralla et al. (2016) and Morais-Storz et al. (2020) provided more detailed conceptualisations. Gralla et al. (2016) investigate mechanisms used by decision-makers to formulate and solve problems. The context of the research was in extreme cases, where urgent formulations were needed. The authors conceptualised problem formulation by integrating sensemaking theory and analyse the process based on the mechanisms of sensemaking. Particularly, they highlight that:

> "A promising model of problem formulation is the theory of sensemaking... In the sensemaking process, experts perceive environmental cues and, based partly on past experience with similar cues, conceive a frame or understanding of the situation, which then suggests appropriate actions" (Gralla et al., 2016, p.24).

Morais-Storz et al. (2020), who investigated how problem reformulations occur, also included sensemaking in the conceptualisation of the process. They indicated that problem formulation begins with sensemaking. This process then results in verbal expression or different problem representations, which all together constitute the problem formulation process. Specifically, Morais-Storz et al. (2020) state:

> "Project team members make sense of the situation and socially construct a verbal expression... The process of formulating a verbal expression that could be the driver of

> action is problem formulation, and the outcome of this process is problem representation... The process of framing new problem representations starts with sensemaking" (p. 484).

The above examples highlight the differences in the theoretical development of the conceptualisations, which are mainly related to the studies' focus. However, the focus of each publication influences not only the depth of theoretical development but also the approach taken. Specifically, it becomes evident that based on the focus, certain publications adopt either a structured approach or an interpretative approach in conceptualising problem formulation. Studies that adopt a structured approach tend to refer either to the steps involved in the problem-solving or decision-making cycle. Additionally, they may consider one factor at a time or associate problem formulation with variables that are measurable. For example, Choo (2014), who investigates the effect of time spent on problem definition in problem-solving, positions problem formulation as the first step of the DMAIC methodology. His conceptualisation is more structured because problem formulation is analysed as a step in a specific setting. Additionally, it is also structured because the author links problem formulation to measurable variables. For example, engagement in problem formulation is "the number of days taken by the define phase of a project and divided by the total number of days taken by the entire project" (Choo, 2014, p.1467). Another example is Foss et al., (2016), who focus on the influence of communication on problem-solving projects. In the context of their study, they refer to problem formulation in the context of the FOSS software community and how it evolves in such circumstances. The approach is structured because the analysis of problem formulation is in relation to the steps taken when engaging in problem formulation activities.

Studies that frame problem formulation through cognitive theories or interpret it using thinking frameworks tend to adopt a more interpretative approach. This differs from merely acknowledging an association between problem formulation and cognitive theories. Instead, these studies actively conceptualise problem formulation as a cognitive process or relate it to other cognitive processes. For instance, Pham et al. (2023), investigate the creative processes associated with problem formulation. Their approach is interpretative because they explore the cognitive aspect of the process, such as analogical reasoning, and associate problem formulation with variables that can be observed and explained rather than measured.

Concluding remarks

Taken together, the studies reviewed show that there is no single, unified definition of problem formulation. Meanwhile, the authors agree that problem formulation is the initial step when approaching a problem, whether this is in the context of problem-solving, decision-making or innovation. When it comes to the definition of problem formulation, it is consistently viewed as the process of structuring and defining problems in a way that makes them solvable. Additionally, author agree that problem formulation is an iterative rather than static process, which requires revision in the light of new information (Foss et al., 2016; Gralla et al., 2016; Morais-Storz et al., 2020). Moreover, there is a shared understanding that problem formulation is a complex and multifaced process, due to the influence of many factors. These include cognitive processes and contextual factors. Lastly, studies agree that problem formulation is socially constructed, which means that its characteristics and significance may vary based on the context or nature of the problem, as well as stakeholders' interaction (Gralla et al., 2016; Pham et al., 2023; Tippmann et al., 2017).

Despite the shared views, the studies diverge in two ways. One key difference is in the use of terminology. While all the studies investigate problem formulation in some degree, they do not necessarily use the same language. Specifically, besides problem formulation, terminology such as problem identification, opportunity formulation, define and problem framing was employed. Moreover, a second difference identified is associated with the viewpoint of authors when conceptualising problem formulation. Certain publications employ a structured approach, while others employ an interpretative approach. This is mainly related to the focus of each publication, and it is a choice made in the conceptualisation that influences how problem formulation is researched.

Research methodologies

Previously, the conceptualisations of problem formulation across the reviewed publications were examined, including the approaches adopted. Although the reviewed publications tend to agree on certain characteristics of problem formulation they differ in how they arrive at this understanding. In other words, authors arrive at conceptualisation either by employing a structured or an interpretative approach. This is mainly important in answering the research questions of *how extant research studies the process of problem formulation,* because decisions made during the conceptualisation shape also the way problem formulation is researched.

In the reviewed publications, researchers utilise both qualitative and quantitative methods (see Table 4). Particularly, three studies employed qualitative methods, while six studies used quantitative methods. The analysis is organised according to the type of research method employed. Finally, a comparison between the two approaches is presented.

Qualitative research

Data collection and analysis. Qualitative research was conducted in three distinct settings: an innovation workshop, a training programme, and case studies within four companies. Two researchers collected data through observation (Pham et al., 2023; Gralla et al., 2016), while one employed semi-structured interviews (Morais-Storz et al., 2020). Studies using qualitative methods adopted an interpretative lens in their conceptualisation of problem formulation.

Firstly, Pham et al. (2023) explored creative processes behind problem formulation through observation-based research. Therefore, they conceptualise problem formulation through the lens of creative processes. Besides that, they consider the nature of problems. Within this framework, analogical reasoning, associative thinking, and abductive reasoning are highlighted as central mechanisms of creative logic. Researchers participated in three online workshop events as “silent participants” (p.497). The observations were documented, and relevant notes were taken. In this study, the researchers abstained from engaging with participants, and the discussion among participants was “guided by a facilitator through the individual and group activities” (p.497). The analysis involved an iterative process moving between data and theory. This approach led to the identification of themes related to the three creative logics under investigation. The findings indicated that each creative logic played a unique role in shaping how problems were formulated.

Secondly, Gralla et al. (2016) investigate mechanisms by which decision-makers formulate problems. This was accomplished through a field case study in which the researcher engaged in on-site observation. The authors incorporated sensemaking into their conceptualisation of problem formulation, and their theoretical framework included an analysis of the nature of problems. The data was collected through on-site observations. To discourage participants from engaging in discussion with researchers and remain unnoticed, researchers wore a red ribbon. In addition to the observations, notes, quotations, and relevant information were collected. Since only one researcher was present for data collection, it was not possible to observe more than one training session simultaneously. This required the selection of training sessions that the researcher believed would best illuminate the research questions. Data analysis involved an inductive, theory-building approach rooted in grounded theory and process research. Researchers began with within-case coding of team actions during problem-solving and followed by cross-case comparisons to identify patterns. The findings indicated problems are formulated through sensemaking, problem formulation entails goals, constraints and dynamic perception, with search playing a central role in formulation activities.

Lastly, Morais-Storz et al. (2020) focused on how problems are reformulated after incidents of failure. The authors incorporated the sensemaking theory into their conceptualisation. Additionally, they acknowledge the importance of learning from failure and the impact of leadership behaviours in this context. Considering the conceptualisations it is evident that Morais-Storz et al. (2020) also approached problem formulation through an interpretive lens. Data was collected via semi-structured interviews. However, prior to collecting the data researchers acknowledged that the subject pertains to cognitive and emotional aversions. As a result, the researchers made a deliberate effort to engage in discussions that emphasised the importance of their research while steering clear of language that could disrupt the flow of information. Specifically, it was stated that:

> "The authors met with leaders from each company to discuss our research interests and the importance of learning from experience, agreeing that experience is variegated and learning from experience is important"... "The term "challenges" rather than "failure" was used initially, because it is often easier for managers to discuss challenges, as respondents may have emotional and cognitive aversions to discussing failures" (Morais-Storz et al., 2020, p. 488).

All team members were interviewed. The teams could consist of engineers, general managers, the president, specialists, and others. After completing the initial data collection, the

researchers gathered additional data in instances where they required further clarification. As the interviews were semi-structured, researchers began with questions such as:

> "What were the symptoms that triggered the project? Had the organization experienced these symptoms before? Was the project initiated because there was a problem to be solved, a crisis to be addressed, or a new opportunity?"..."How was the project defined? Who was it defined by (management, customer, or the team)?" (Morais-Storz et al., 2020, p. 505).

Data analysis involved iterative steps, progressing from literature review to data analysis and collection. This iterative approach allowed the authors, while developing a specific conceptual framework, to identify key patterns and concepts. The study concludes that in the context of failure, sensemaking is a crucial mechanism of problem formulation.

Remarks on qualitative methods. Although each study differed in focus, they shared a common methodological orientation. Specifically, they all utalised qualitative methods to examine how problem formulation unfolds in real-life settings, with attention to process and context. The researchers aimed to gain insight into how decision-makers understand, define, and respond to problems over time. This was reflected in their choice of settings (e.g., workshops, training sessions, organizational projects) and the flexibility of the research designs. Overall, the qualitative studies contributed to a more detailed understanding the mechanisms of problem formulation. While the studies vary in terms of data collection and analytical techniques, they all underscore the importance of observing or capturing how problems are actively worked through in practice.

Quantitative methods

Data collection and analysis. Studies employing quantitative research methods conceptualised problem formulation through a structured lens. They often focus on steps or single factors associated with problem formulation and do not investigate the nature of problems. Instead, problem formulation is examined through quantifiable constructs such as decision-making behaviours, knowledge search, or innovation practices. These constructs are usually incorporated within broader models of organisational development and innovation.

While individual studies vary in focus, reflecting different theoretical frameworks, these variations do not significantly alter the structured conceptualisation of problem formulation. In other words, when an author follows a structured approach in conceptualizing problem formulation, they follow similar steps. Specifically, they begin by

providing a definition of problem formulation and outlining some characteristics before focusing on analysing the topic under investigation.

Beyond that, quantitative studies do not research problem formulation as a standalone topic. The analysis is focused on the topic under investigation rather than problem formulation. Therefore, it is not necessary to elaborate on each publication's focus. However, for illustrative purposes, two examples of structured approaches are considered. Li and Liu (2018) examine the relationship between intellectual capital and competitive advantage. In this study, problem formulation is acknowledged as a mediating variable between intellectual capital and competitive advantage. The study is based on survey data collected from hotel managers, with only one of nine measured items directly related to problem formulation. Min and Oh (2020) investigate how performance gaps influence organisational performance. Performance gaps are theorised as indicators of problem formulation and are divided into internal and external reference points. In this case, specifically, the authors focus on specific factor associated with problem formulation. Data includes performance data obtained from the Ministry of Strategy and Finance and problem formulation is measured through variables representing internal and external reference points.

Regarding the data collection methods applied, researchers utilised surveys with scales, paired surveys, or analysed organisational data to develop variables. Specifically, among the six publications, three employed surveys (Heiman & Hurmelinna-Laukkanen, 2024; Li & Liu, 2018; Tippmann et al., 2017), while three sourced data from organisations (Choo, 2014; Foss et al., 2015; Min & Oh, 2020).

Firstly, in studies employing surveys, problem formulation was typically measured using three to four scale items. Examples of scale items include “our employees spend considerable time trying to understand the nature of a problem” (Li & Liu, 2018, p.164) and “our firm consistently identifies relevant projects to work on” (Heiman & Hurmelinna-Laukkanen, 2024, p.455). It remains unclear whether the scale items are suitable for measuring problem formulation. Specifically, Cronbach’s alpha, which was used to assess the scale items, raised concerns in some instances while being acceptable in others. For example, Heiman and Hurmelinna-Laukkanen (2024) employed two distinct surveys: one for the USA/China and another for Finland. These surveys measured problem formulation performance. The Cronbach’s alpha for the USA/China survey was 0.653, with each item individually scoring between 0.402 and 0.616. Meanwhile, the Cronbach’s alpha for the Finland survey was 0.783, with each item individually scoring from 0.565 to 0.972. It is important to highlight that the differences in scores relate to the researchers' use of different

items for each survey, indicating that some items may measure problem formulation more effectively than others. Another observation relevant to the surveys is the choice of language. In other words, Heiman and Hurmelinna-Laukkanen (2024) use phrases such as “very good”, “unable to focus”, and “does not do a good job” (p.455), while Li & Liu (2018) use phrases like “employees spend considerable time” or “employees decompose difficult problem” (p.164). Studies utilising organizational data (Choo, 2014; Foss et al., 2016; Min & Oh, 2020) focused on defining variables based on existing records. For instance, in Choo's (2014) study, the variable “define intensity is calculated as taking the number of days taken by the define stage of a project and divided by the total number of days taken by the entire project” (p. 1467). Foss et al. (2016), who focused on problem formulation in FOSS community, identified variables such as “projects launched, which refers to the number of new project launches by individuals *i* in a period *t*” (p. 2596). Another example is Min and Oh (2020), who associated problem formulation with performance gaps and defined variables such as external reference point, which is “average overall performance score within organisation of the previous year minus previous performance score of the program within organisation” (p. 778). In general, all the above examples highlighted how data derived from an organisation, could be utilised to measure the phenomenon of problem formulation.

Lastly, in terms of data analysis, the studies employed a range of statistical methods, with descriptive statistics being among the most commonly used. However, no consistent pattern of statistical analysis emerged across the publications. Techniques such as regression analysis, Poisson regression, and fixed-effects panel OLS regression were applied to test hypotheses and examine statistical relationships. To ensure validity and reliability, researchers used methods such as factor analysis and Cronbach’s alpha, conducted pilot tests, and incorporated expert feedback. Some studies also included triangulation and robustness checks to strengthen the credibility of their findings.

Conclusions and remarks

This review reveals important differences in how qualitative and quantitative studies approach problem formulation. Qualitative research tends to conceptualise problem formulation in an interpretative lens, which reflects the focus of each publication.Through interviews, observations, and case studies, these studies prioritise depth, often using inductive, theory-building methods that allow insights to emerge gradually. In contrast, quantitative studies adopt a more structured view. Problem formulation is often treated as a predefined variable embedded within broader frameworks such as decision-making or innovation. These

studies rely on survey data or organisational records and statistical techniques to test hypotheses and identify generalisable patterns. While this approach enables comparison across cases and supports replicability, it does not recognise the underlying processes or contextual complexity of problem formulation.

The differences in focus lead to differences in what each approach contributes. Qualitative studies offer richer, more nuanced understandings of problem formulation by revealing cognitive and social dynamics such as sensemaking or creative reasoning. Quantitative studies, while more limited in conceptual depth, are valuable for measuring associations and validating constructs across larger populations. Taken together, these methodological traditions are not competing but complementary. Qualitative research deepens understanding of what problem formulation is and how it unfolds. Simultaneously, quantitative research helps to understand when and where it occurs, and with what effects. Recognising the strengths and limitations of each allows for a comprehensive understanding of this phenomenon.

Easy/difficult aspects and influential factors

This part addresses the third research question, exploring the factors that influence problem formulation, and which aspects of the process are deemed more straightforward or challenging. All nine articles were reviewed to identify the straightforward/challenging parts of problem formulation and the factors influencing the overall process. Seven articles provided insights into the factors that influence problem formulation (Choo, 2014; Foss et al., 2016; Gralla et al., 2016; Li and Liu, 2018; Morais-Storz et al., 2020; Pham et al., 2023; Tippman et al., 2017), while none clearly indicated which parts are straightforward or challenging. In light of the lack of findings on straightforward or challenging aspects of problem formulation, this section reports factors influencing the process.

Influential factors

One main theme identified in seven articles was cognition, which encompasses creative logic, sense-making and leadership behaviour, project experience, and knowledge. Other influential factors noted were communication and intellectual capital, with the latter not being classified within a specific theme. The influential factors identified are derived from the findings of each study. It is observed that those employing an interpretative approach, and thus a qualitative research method, provided richer in-depth results and analysis (Gralla et al., 2016; Morais-Storz et al., 2020; Pham et al., 2023). Therefore, for influential factors such as creative logics and sensemaking, the analysis is more in-depth. Conversely, studies that utilised a structured approach, applying quantitative methods, described statistical relationships (Choo, 2014; Foss et al., 2016; Li and Liu, 2018; Tippman et al., 2017). These diverges lies in the focus of each publication. To provide a holistic understanding of the factors influencing problem formulation, each factor is analysed separately. However, for illustrative purposes, readers may refer back to Table 4, which specifically outlines each study's aim, conceptualisations, and research methods to support comparison and synthesis across the literature.

Creative logics. Pham et al. (2023) identify creative logic as a factor that influences problem formulation and, in particular, the outcome of this process, which is problem representation. In an effort to understand the effects of logic, Pham et al. (2023) distinguish between analogical reasoning, associative thinking, and abductive reasoning. Regarding analogical reasoning, individuals identify parallels or employ metaphors to formulate problems. Both parallels and metaphors are grounded in individuals' knowledge, beliefs, or experiences. An example is:

> "He transferred user needs for sustainable consumption to Negozio alla Spina, automatically perceiving 'packaging-free' as synonymous with sustainability. Hence, he assumed that the store's customers were sensitive to sustainability. Of course, this may not be true, as they might also have different motivations" (Pham et al., 2023, p.501).

In instances of associative thinking, individuals establish unexpected connections, recognise differences, and uncover similarities between new information and their existing knowledge. Examples include:

> "I know that we are talking about health safety, but I was thinking 'what about personal security?': I am a woman and I live alone in Bologna. A car sharing system gives you security" (Pham et al., 2023, p.502) and "However, instead of thinking of ways to prohibit something (AI) that already exists today and is not going in the right direction, the way I see it, we should think of ways to educate its mechanics" (Pham et al., 2023, p.503).

Lastly, in cases of abductive reasoning, decision-makers collect cues to support their pre-existing beliefs, break down information and thoughts into manageable parts, or use their imagination to interpret problems. For instance:

> "I imagine they are workers with hectic lives, with little time to waste, and if they do have some free time, they want to spend it in a quality way, with their friends and family. In this scenario, they don't go to the shops, so they need a weekly solution for their groceries" (Pham et al., 2023, p.504).

Considering all the above, creative logics play a crucial role in shaping how problems are framed and understood. They influence the depth and flexibility of problem representation by guiding how information is interpreted, connected, and restructured. Creative logics contribute to the exploration of novel perspectives and the development of innovative problem-solving approaches.

Sensemaking and leadership change behaviour. In total, two publications referred to problem formulation as an influential factor towards problem formulation. Although both studies examine sensemaking, they focus on different aspects of the process. Gralla et al. (2016) discovered that sensemaking influenced problem formulation by shaping the search process through the components of problem formulation. In other words, sensemaking directed the problem search process, which unfolds as a part of problem formulation. Morais-Storz et al. (2020) found that prospective sensemaking positively influences problem formulation. This suggests that when individuals engage in prospective sensemaking, they

formulate problems more successfully. The positive relationship between prospective sensemaking and problem formulation is even stronger when leadership change behaviours are present. Leadership change behaviours encourage innovative thinking, drive change, challenge assumptions, and involve taking personal risks. Morais-Storz et al. (2020) specifically mentioned that "leaders of the Vacula and Balato projects engaged in sensegiving and in encouraging feedback, initiating the cycles of prospective sensemaking that ultimately enabled these projects to find success" (p.498). In conclusion, considering the aforementioned points, the formulation of problems is positively affected by sensemaking processes that aid in problem search. This relationship becomes more significant when leaders encourage behaviours that promote change.

Project experience. Choo (2014) examined the impact of project experience on problem definition and overall problem-solving. It was discovered that prior experience negatively moderates the relationship between the time spent on problem definition and project duration. However, these findings do not imply that a more experienced decision-maker will spend less time on problem formulation. Rather, they suggest that an experienced decision-maker will effectively balance the time spent on problem definition within a project.

Knowledge. Tippmann et al. (2017) focused on the significance of knowledge transformation within a multinational corporation context. Their findings suggest that the exchange of knowledge among various stakeholders promotes a more dynamic and holistic understanding of organisational challenges, ultimately enhancing problem formulation. Specifically, they assert that "MNC knowledge transformation offers the possibility of generating a reframed perspective on organizational challenges, revealing previously unforeseen opportunities for not just firm value creation, but potentially for building entrepreneurship across the MNC" (Tippmann et al., 2017, p. 474). However, it is crucial to highlight that the implications of knowledge transformation may extend beyond problem formulation to innovation and value creation.

Communication. Foss et al. (2016) explored the influence of communication on problem formulation. The researchers differentiate between open-ended and artifact-based communication. The former takes place when stakeholders engage in discussions and share their ideas, whereas the latter relates to all the artifacts that facilitate and are pertinent to communication. The effects of these two forms of communication vary. The more an individual is exposed to open-ended communication, the more problems are likely to be formulated. Conversely, when an individual encounters artifact-based communication, they will participate in problem formulation activities. Specifically, the author emphasises that:

> "Individuals exposed for a long period to very dense open-ended communication the expected number of projects lunched increases by one third, and the effect remains very relevant (more than 10%) even when w=50%. Prolonged exposure to dense artifact-base communication has an even stronger effect: it increases the expected number of project joined by an individual by two-thirds when w=10% and by one-fourth when w=50%." (Foss et al., 2016, p. 2603).

Conclusions and remarks on cognition. Considering all that has been discussed, it is evident that cognition plays a fundamental role in problem formulation. It shapes how individuals interpret, structure, and present problems. The meta-analysis highlights that cognition may influence both the depth and adaptability of problem formulation. Specifically, depth is linked to the richness of the formulation, while adaptability refers to the adjustments that may occur or shifts in the approaches employed for problem formulation. Furthermore, it has been observed that cognition interacts with other factors such as leadership behaviours, and in some instances, types of cognition may be interconnected. For instance, Pham et al. (2023) have noted that creative logics are associated with experiences, beliefs, and knowledge. This indicates that not only is problem formulation influenced by creative logics, but also that the creative logics of stakeholders are shaped by knowledge and beliefs.

Intellectual capital. Li and Liu (2018) found that intellectual capital is positively related to problem formulation. This suggests that intellectual capital enhances problem formulation capabilities by strengthening the robustness of the process. Intellectual capital is divided into three components: customer, structural, and human capital. Each of these plays a different role and may influence problem formulation in various ways. The research by Li and Liu (2018) indicated that, generally, intellectual capital has a positive effect on the process, although there is no indication that any specific component affects the process more or less than another.

Discussion

This study was designed to better understand organisational changes by beginning with how organisational problems that require change are perceived. By conducting a systematic literature review, this study aimed answering the following questions: *How does extant research conceptualise problem formulation; How did extant research study the process of problem formulation; What are the main findings of extant research in terms of what are the straightforward/challenging parts problem formulation, and which factors affect the problem formulation*.

In response to the first research questions, *how does extant research conceptualise problem formulation*, it was found that problem formulation is conceptualised as iterative, socially constructed, complex and multi-faced. Although authors do not agree on a specific definition, there is agreement on what actions decision-makers engage in when formulating a problem. These involve gathering information, analyzing the issue, transforming a poorly defined problem into a manageable one, and developing frameworks. Besides that, it is evident that problem formulation is understood as the initial step when approaching a problem, whether this is in the context of an innovation project or decision-making. The main difference found when analysing the conceptualisations is that although authors agree on specific characteristics, they differ in how they approach the conceptualisation of problem formulation.

When collectively reviewing the characteristics of problem formulation, it is clear that these are mutually reinforced. The iterative nature of problem formulation is reflecting the evolutionary dimension of the process, rather than describes repetition or revision. This aligns with the view that problem formulation constitutes one of the stages of problem-solving and is not just a precursor in the process (Dorst, 2006). Each iteration brings new insights, and opportunities, reshaping the framing of the issue and altering what is perceived as desirable or feasible. The idea of no stopping rule (Rittel & Webber, 1973) becomes central, not because actors are indecisive, but because the problem itself is fluid and emergent.

Iteration alone does not explain why formulations change. The social nature of the problem might fill this gap in the understanding. The reviewed studies (e.g., Morais-Storz et al., 2020) show that problem formulation evolves through interaction, dialogue, and reflection among decision-makers. The interactions facilitate the generation of new problem representations and challenge assumptions. Therefore, it is clear that the iterative nature of problem formulation is a form of collective reframing where meanings are continuously

altered. In this sense, social construction is a mechanism through which iteration unfolds. As new decision-makers enter discussions or existing reinterpret problems, new frames emerge and problem definitions evolve accordingly. This dynamic has been documented in research on design teams, policy formulation, and collaborative learning. In the context of design practice, Stumpf and McDonnell (2002) show that problem framing often shifts through communication and argumentation. Similarly, Coburn (2006) illustrates how in policy environments, problem definitions emerge through iterative negotiation among stakeholders, where authority relations and social networks influence whose frames are adopted. Hargadon and Bechky (2006) also highlight that reframing occurs through interaction, where decision-makers gradually abandon narrow, sectoral views in favor of collectively constructed interpretations.

Beyond the above, problem formulation is also context-dependent. Considering the literature, context can be theorised to be both a structuring constraint and a dynamic force that co-evolves with the formulation process (Tippmann et al., 2016). Moreover, the context plays a role in which frames emerge or how frames are structured. Pluchinotta et al. (2021) show that in multi-stakeholder environments, differences in system boundaries and problem framings influence how problems are approached and prioritised. These variations in formulations reflect how different stakeholders interpret the same context differently. This mainly results in formulations of the same problem depending on their background, interests, and goals. The interplay of the above, which adds to the multifaced nature of problem formulation, mainly reflects why problem formulation is challenging to simplify. Capturing it as a simple task or a single phase fails to address the nature of the process. Instead, problem formulation should be understood as an activity linked to past experiences and beliefs, interactions, context.

In conceptualising problem formulation authors either take a structured or an interpretative approach. Authors' decisions during conceptualisation also influenced how problem formulation is researched. In answering the research question *how did extrantresearch study the process of problem formulation*, it became evident that a structured approach to conceptualisation led authors to employ quantitative research methods. Meanwhile, studies with a more interpretative approach utilised a qualitative research design. Drawing on Langley's (1999) structured studies (e.g., Min & Oh, 2020; Li & Liu, 2018) predominantly followed a variance logic, explaining problem formulation in terms of causal relationships among variables. These publications adopt a relatively stable conceptualisation, treating problem formulation as a step rather than a cognitive process. The strength of this

approach lies mainly in the capability for generalisation and hypothesis testing. Studies with interpretative approaches follow a process logic. These are focusing on how meanings emerge, evolve, and shift over time (Langley, 1999). In the context of this study these types pf studies utilised qualitative research methods. The strength of qualitative approaches lies mainly in the capability of gaining a deeper understanding of a topic. Additionally, it is important to highlight that while the theoretical framework of this study identified research that studies problem formulation through quantitative methods and approaches it through a structured lens (Nezu & D'Zurilla, 1981; Pracht & Courtney, 1988; Volkema, 1983;), the current review found greater methodological diversity. This suggested that researchers are increasingly exploring problem formulation through an interpretative lens. This discovery also underscores a discrepancy between previous and contemporary research

Lastly, in answering the research question *what are the main findings of extant research in terms of what are the straightforward/challenging parts problem formulation, and which factors affect the problem formulation*, this study revealed that cognition is a central influential factor in problem formulation. This theme emerged across multiple studies and include creative logic, sensemaking, project experience, communication, and knowledge. These constructs may be characterised as interrelated because creative logic and sensemaking rely on knowledge and prior experience (Gralla et al., 2016;Pham et al., 2023). Simultaneously, knowledge or prior experience would not benefit problem formulation without some kind of thinking process (Britton & Tesser, 1982). Moreover, knowledge and prior experience are rooted in working memory and, specifically, long-term memory (Camina & Güell, 2017). Relying on long-term memory allows stakeholders to generate new problem formulation by connecting new and prior information (Fandakova & Bunge, 2016). However, despite the general role of cognition, it remains difficult to fully understand the specific relationship between individual cognitive abilities and problem formulation. This might be linked to the presence of influential or mediating variables, making it challenging to determine when and how these mediating effects come into play.

Scientific and practical relevance

Scientific relevance

This study contributes to organisational research in three ways. First, it clarifies how problem formulation is conceptualised across the literature. Although recognised as important yet understudied (Baer et al., 2013), existing research provides vague or inconsistent definitions. This review identifies four key characteristics of problem formulation: iterative,

socially constructed, context-dependent, and multifaceted. While not entirely new (Thissen, 2000; Volkema, 1983) their consolidation across studies offers valuable theoretical clarification.

Second, this review reveals how different conceptual approaches shape research. A structured approach emphasise on factors relevant to problem formulation, while interpretative approaches show how problem formulation evolves over time. This distinction indicates a link between theoretical frameworks and methodological choices and highlights that choices in conceptualisation influence the way problem formulation is studied.

Third, the study identifies cognitive factors influencing problem formulation. Both qualitative and quantitative studies highlight their significance. However, qualitative research offers in-depth analysis, while quantitative research simplifies cognitive influential factors into measurable variables. The study also notes challenges in establishing clear relationships between cognitive factors and problem formulation due to multiple mediating variables. This insight reveals limitations in current research and emphasizes the need for future work.

Overall, these contributions aid in the theoretical development of problem formulation within organisational research by clarifying conceptualisations, revealing methodological influences, and identifying key factors in the process. Therefore, the study lays important groundwork for a more coherent understanding of the process in complex organisational environments.

Practical relevance

This study offers a structured overview to help researchers and practitioners navigate problem formulation complexities in organisations settings. First, by clarifying how problem formulation is conceptualised across different settings, the study helps scholars make more informed choices when designing their research. This, in turn, ensures greater alignment between theoretical frameworks and methodological approaches, as well as practical usability and coherence of future research.

Second, the study highlights which cognitive factors influence problem formulation. This understanding can support the implementation of practical interventions within organisations. For example, practitioners focusing on employee development may increase interventions that promote awareness of mental frames. Additionally, practitioners may adopt techniques that assist decision-makers in exploring and formulating problems. Considering all the above, the study equips both researchers and practitioners with tools to approach problem

formulation in a more systematic and transparent way, which is essential for managing change in complex organisational environments.

Limitations

Before collecting data, pilot testing was conducted to establish a focused and systematic search strategy. This process led to the selection of key terms related to problem formulation in the context of business and management (see Appendix 2). However, as previously discussed, the terminology surrounding problem formulation is inconsistent and varied. Terms such as conceptualisation, problem sensing, and problem perception were excluded from the final query. This represents a limitation in the study's methodology.

While limiting the number of search terms was necessary to keep the scope manageable within the project's time constraints, it also carries certain risks. Specifically, excluding these terms may have led to the exclusion of studies that conceptualise problem formulation differently. For example, studies focusing on early-stage cognitive processes or organisational sensemaking may use different terminology. As a result, the review may underrepresent the full conceptual diversity of the field. This could limit the comprehensiveness of the findings and affect the generalizability of conclusions about how problem formulation is understood across research.

Suggestions for future research

This study found that cognition influences problem formulation. Analysis of the findings highlighted that components of cognition may also be interrelated. Considering this, future research should investigate cognitive components involved in problem formulation. Psychology is deemed to be an appropriate field to further research this topic, because it has available theoretical and methodological tools necessary to examine internal mental processes. Such research is important in order to understand how individual cognitive processes contribute to or shape the process. Simultaneously, this type of research may also reveal underlying mechanisms that moderate, mediate, or control the way decision-makers formulate problems. For example, future research may explore the relationship between creative thinking and problem formulation, with particular attention to the role of working memory. Investigating this relationship could reveal whether creativity influences independently on the process, or whether it is moderated by the ability to hold relevant information. However, the above is just an example. More broadly, future research may explore a wide range of cognitive processes. These could include attention, cognitive

flexibility, thinking types or reasoning. Mixed-method research designs would be particularly valuable here. This research design allows researchers to both explore the process in depth and test hypotheses about statistical relationships. Moreover, conducting research in settings that allow the process of problem formulation to unfold naturally, like Gralla et al. (2016) or Pham et al. (2023) would enhance the validity of findings and deepen the understanding of cognitive dynamics in real-world contexts.

Additionally, the study did not report any straightforward or challenging aspects related to problem formulation. Previous research has highlighted several challenges, such as unclear or conflicting goals (Locke & Latham, 2002), dependence on multiple stakeholders or external circumstances (Smith, 1996), and uncertainty regarding when and how the problem-solving cycle begins. Future research may empirically investigate aspects deemed to be straightforward or challenging. This is important because understanding these enablers and obstacles can inform the development of tools, training programs, or frameworks. These tools or frameworks could potentially assist decision-makers in formulating problems more effectively. Studies could explore factors such as goal clarity or team composition, determine how these affect decision-makers ability to recognise, define, and structure problems. Such research would benefit from involving real-world practitioners and decision-makers. The expertise of such professionals could reveal contextual factors that may not be visible in controlled settings. Lastly, both qualitative methods and quantitative approaches could be employed to capture a more comprehensive picture of the problem formulation process in practice.

Conclusion

This study investigated how organisational problems that necessitate change are perceived. Methodologically, a systematic literature review was conducted to provide a structured synthesis of existing research on the topic. The findings show that problem formulation is consistently conceptualised as an iterative, socially constructed, and context-dependent process, regardless of the research method. A key contribution of this study lies in identifying two broad orientations, structured and interpretative, that shape how problem formulation is approached and studied. While these approaches do not lead to fundamentally different findings, they influence how problem formulation is framed and embedded within broader research designs.

In addition, this review synthesises the cognitive factors influencing problem formulation, such as knowledge, experience, communication, and sensemaking. Although these factors are acknowledged across studies, their relationships with problem formulation remain complex and are often mediated by contextual variables. This suggests the need for further empirical work that explores how these factors interact over time and across settings.

Lastly, directions for future research emerge. First, more empirical work is needed to explore the influence and effect of cognition on problem formulation. Additionally, research should focus on identifying both straightforward and challenging aspects of problem formulation. This specific part of the literature currently remains unexplored.

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Appendix 1

Table Appendix 1

Development of appropriate search queries for the systematic literature review

Search Query	Search Result	Notes
"problem recognition" AND (business OR management)	30 articles	Articles are associated with organisational ingenuity, healthcare studies, innovation, government public relations, policy making, problem-solving, communicational behaviors on social media and idea generation.
"problem recogni*" AND (business OR management)	33 articles	Introduction of 3 articles.
conceptuali$ation AND (business OR management)	6,495 articles	Articles are associated with research agendas or theorical conceptualizations. Additionally, the term is used as phrase to refer to conceptualisation process or conceptualizations of frameworks, questions, brand and models.
"problem conceptuali$ation" AND (business OR management)	5 articles	Articles associated healthcare, system dynamics and water supply management.
"problem conceptual*" AND (business OR management)	5 articles	No additional articles are found.
diagnosis AND (business OR management)	22,812 articles	Articles associated with diagnostic issues related to management, diagnostic tools in the chemical engineering industry, sales and healthcare.
diagnosis AND (business OR management) NOT health*	5,596 articles	Removed articles related to healthcare.
diagnos* AND (business OR management) NOT health*	9,663 articles	Introduction of 4,067 articles.
"problem diagnosis" AND (business OR management)	25 articles	Articles associated with water management and lean production, sustainability, innovation, policy making, and engineering.
"problem diagnosis" AND (business OR management) NOT health	15 articles	Removed the articles related to healthcare.
"problem diagnos*" AND (business OR management) NOT health*	20 articles	Introduction of 5 articles.
"problem sensing" AND (business OR management)	1 article	Articles associated with problem recognition in the context of policy making.
"problem sens*" AND (business OR management)	5 articles	Introduction of four new articles. Articles related to financial exploitation, pharmaceutical supply chain, production systems and dynamic programming.
"problem structuring" AND (business OR management)	238 articles	Articles associated with innovative technologies, technology management, problem structing processes in the healthcare domain, operational research.
"problem structuring" AND (business OR management) NOT health*	195 articles	Articles associated with management and organisational processes, operational research, business models and innovation.
"problem structur*" AND (business OR management) NOT health*	253 articles	Introduction of 58 articles.

(*continued*)

Table Appendix 1 continued

Search Query	Search Result	Notes
"problem perception" AND (business OR management)	13 articles	Articles associated with environmental studies, diminishing returns, healthcare, climate change and common-pool resources.
"problem perception" AND (business OR management) NOT health*	10 articles	Removed articles related to healthcare domain.
"problem perce*" AND (business OR management) NOT health*	20 articles	Introduction of 10 articles.
"problem definition" AND (business OR management)	641 articles	Articles associated with healthcare, problem-solving and ddysolution generation, policy making and innovation.
"problem definition" AND (business OR management) NOT health*	537 articles	Removed articles related to healthcare domain.
"problem defin*" AND (business OR management) NOT health*	580 articles	Introduction of 43 articles.
"problem framing" AND (business OR management)	87 articles	Articles associated with problem framing processes, management, problem solving, stakeholders' analysis, organisational project planning and healthcare.
"problem framing" AND (business OR management) NOT health*	80 articles	Removed articles related to healthcare domain.
"problem fram*" AND (business OR management) NOT health*	108 articles	Introduction of 28 articles.
"problem finding" AND (business OR management)	17 articles	Articles associated with AI and innovative idea generation, change, innovation, crowdsourced, problem solving and student performance.
"problem find*" AND (business OR management)	46 articles	Introduction of 29 articles.
"problem formulation" AND (business OR management)	142 articles	Articles associated with problem formulation processes, problem solving, innovation, healthcare, strategic resilience and decision making.
"problem formulation" AND (business OR management) NOT health*	128 articles	Removed articles related to healthcare domain.
"problem formulat*" AND (business OR management) NOT health*	155 articles	Introduction of 27 articles.
"problem identification" AND (business OR management)	162 articles	Articles associated with problem formulation mechanisms and processes, healthcare, Behavioral Theory of the Firm, and general problem-solving in the context of solution generation.
"problem identification" AND (business OR management) NOT health*	84 articles	Removed articles related to healthcare domain.
"problem identificat*" AND (business OR management) NOT health*	85 articles	Introduction of 1 article.
"organi$ational search" AND (business OR management)	42 articles	Articles associated with innovation, impact of organisational search on business models, strategy development, behavioral theory of the firm and organisational routines.

Note. Appendix 1 describes the first phase of the pilot test. The results specified above are based on applying the publication year (2023-2013), the language and the inclusion to Social Sciences Citation Index.

Appendix 2

Table Appendix 2

Development of the final search query for the systematic literature review

Search Query	Results	Notes
problem AND (within eg 5 words recogni* OR structur* OR defin* OR find* OR fram* OR formulat* OR identificat*) AND (business OR management) NOT health*	241,763 articles	The search is too board and not appropriate for a systematic literature review.
("problem recognition" OR "problem structuring" OR "problem definition" OR "problem finding" OR "problem framing" OR "problem formulation" OR "problem identification") AND (business OR management) NOT health* NOT innov*	2,785 articles	The search is more precise and gives a better sample to work with. Articles related to innovation and healthcare are excluded.
("problem recognition" OR "problem structuring" OR "problem definition" OR "problem finding" OR "problem framing" OR "problem formulation" OR "problem identification") AND (business OR management) NOT health*	3,348 articles	Articles only related to healthcare are excluded.
("problem recogni*" OR "problem structur*" OR "problem defin*" OR "problem find*" OR "problem fram*" OR "problem formulat*" OR "problem identificat*") AND (business OR management) NOT health*	4,474 articles	Expanding the search with the use of asterisks.

Note. Appendix 2 displays the second phase of the pilot test. In this phase we reached which search query provides the best findings.

Appendix 3

Table Appendix 3

Quality assessment questions

Category	Quality questions posed
General	Is the research objective clearly stated?
	Is the research question or the aim clearly stated?
	Is the research context (e.g. industry, country, etc.) clearly stated?
Methodology	Is research methodology clearly explained and justified?
	Is the research methodology suitable for providing an answer to the research questions?
Data and sample	Do(es) the author(s) provide clear information regarding the sample (participants, profile of participants, sampling method, etc?)
	Does the study include enough data to support its conclusion?
	Are steps taken to ensure validity?
	Are steps taken to ensure reliability?
Analysis and findings	Is the data analyzed in clear and accurate way?
Conclusions	Are the conclusions consistent with the findings and supported by evidence?

Note. Quality control questions. The questions were designed taking as example the work of Heitink et al., 2016.

Appendix 4

Table Appendix 4

Codebook used for deductive coding

Section	Subsection	Code	Description	Example
General information	Author(s) & Title	#GI_AT	The title of the paper and record of the author(s).	How do you frame ill-defined problems? A study on creative logics in action, C.T. A. Pham, S. Magistretti, C. Dell'Era
	Year of publication	#GI_YP	Year the study was published.	January 2023
	Country	#GI_CNT	Country in which the article was published.	School of Management – Politecnico di Milano, Milan, Italy
	Context	#GI_C	Record of the situational or organisational context.	"Ethnographically observing six design thinking workshops, this study adopts a qualitative approach to explore the problem framing creative process" (Pham et al., 2023, p. 493)
Research Desing	Research question(s)	#RD_RQ	Record of research question(s) and sub-question(s) as posed by the author.	"How do individuals enact creative logics in problem framing?" (Pham et al., 2023, p.494)
	Research Setting	#RD_S	Setting in which the research was carried out.	"Three main events hosting six innovation workshops focused on the problem framing topic" Pham et al., 2023, p.496 "The annual initiative organized by the Italian Design Thinking community" (Pham et al., 2023, p. 497)
	Research Method	#RD_M	Research methodology applied.	"Abductive, qualitative" (Pham et al., 2023, p.496)
	Instruments	#RD_I	Data collection tools used.	Observations, video recordings, information on the participants, materials and guides.
	Analytical Approach	#RD_AA	Analytical techniques.	"We followed an iterative process combining protocol analysis practices (Ericsson & Simon, 1980) using Strauss and Corbin's (1998) cyclical movement from data to theory, and vice versa" (Pham et al., 2023, p. 498).
Research Population	Number of Participants/ Data	#RP_P	Record of number of the participants.	"72 individuals"
	Profile of Participants/ Data	#RP_PP	Details regarding the participants.	"The individuals participating in the workshop were very heterogeneous both in terms of background and experience in the field. Their expertise spanned from design to development to business, and their experience varied from junior to c-level positions" (Pham et al., 2023, p. 497)

(*continued)*

Table Appendix 4 continued

Section	Subsection	Code	Description	Example
	Sampling Method	#RP_SM	Description of the sampling method applied.	snowball sampling
Results	Conceptualization of Problem Formulation	#RFC_C	Describe how authors define and conceptualize problem formulation.	"Problem framing means forming mental representations that simplify the problem (Cyert & March, 1963). Through problem framing, individuals frame their interpretation of the problem's goal, the assumptions and the paths towards a solution in a clearer mental representation (Holyoak et al., 1984; Mumford et al., 1994)" (Pham et al., 2023, p. 495)
	Challenging Aspects of Problem Formulation	#RFC_CH	Identify challenging aspects of problem formulation.	Complex problems
	Straightforward Aspects of Problem Formulation	#RFC_EA	Identify easy aspects of problem formulation.	Clear goals
	Influential Factors for Problem Formulation	#RFC_IF	Identify factors which affect problem formulation.	"The seven creative operations provide new insights on the cognitive" (Pham et al., 2023, p. 505)

Note. The table provides details regarding the codes designed for deductive coding. Each entry outlines a specific code, grouped under broader sections, with corresponding subsections, code identifiers, and descriptions.