mathematics

MDPI

Article

Solving the Problem of Reducing the Audiences' Favor toward an Educational Institution by Using a Combination of Hard and Soft Operations Research Approaches

Wenjing Xu [1], Seyyed Ahmad Edalatpanah [2] and Ali Sorourkhah [3,*]

[1] Department of Management Science and Engineering, School of Economics and Management, Xi'an Shiyou University, Xi'an 710065, China; xuwj518@xsyu.edu.cn
[2] Department of Mathematics, Ayandegan Institute of Higher Education, Tonekabon 46818-53617, Iran; s.a.edalatpanah@aihe.ac.ir
[3] Department of Management, Ayandegan Institute of Higher Education, Tonekabon 46818-53617, Iran
* Correspondence: sorourkhah@aihe.ac.ir or ali.sorourkhah@gmail.com

Abstract: Because of hyper-complexity, a difficulty to define, multiple stakeholders with conflicting perspectives, and a lack of clear-cut solutions, wicked problems necessitate innovative and adaptive strategies. Operations research (OR) has been a valuable tool for managers to make informed decisions for years. However, as we face increasingly complex and messy problems, it has become apparent that relying solely on either hard or soft OR approaches is no longer sufficient. We need to explore more innovative methodologies to address these wicked problems effectively. This study has bridged the research gap by proposing a structured process encompassing a subdivision-based problem structuring method for defining the wicked problem, a multi-attribute decision-making (MADM) for prioritizing subproblems, and a hard OR technique, data envelopment analysis (DEA) for tackling one of the most critical subdivisions. The proposed methodology, the subdivision-based problem structuring method (SPSM), implemented in a case study, focuses on a higher education institution experiencing a decline in student admissions and involves five steps. First, a diverse group of stakeholders is formed to ensure the comprehensive consideration of perspectives. Second, the wicked problem is defined, considering long-term consequences, multiple stakeholders, and qualitative stakeholder opinions. Third, a hierarchical structure is created to break down the wicked problem into manageable subproblems. Fourth, a multi-criteria decision-making (MCDM) method prioritizes subproblems. Finally, the subproblems are addressed one by one using a combination of soft and hard OR tools. The findings highlight the benefits of integrating hard and soft OR approaches. The study concludes with reflections on the implications of using a combined OR approach to tackle wicked problems in higher education and beyond.

Keywords: problem solving; wicked problem; hard OR; soft OR; problem structuring methods; decision-making; subdivision-based PSM

MSC: 90B50; 91B06

Citation: Xu, W.; Edalatpanah, S.A.; Sorourkhah, A. Solving the Problem of Reducing the Audiences' Favor toward an Educational Institution by Using a Combination of Hard and Soft Operations Research Approaches. *Mathematics* **2023**, *11*, 3815. https://doi.org/10.3390/math11183815

Academic Editor: José Niño-Mora

Received: 13 June 2023
Revised: 1 August 2023
Accepted: 3 August 2023
Published: 5 September 2023

1. Introduction

Managers, especially private sector ones, must make the proper decisions to solve organizational problems and preserve their survival in the contemporary turbulent and competitive environment-governing businesses [1]. Making decisions is a complex mental process to determine a desirable outcome while considering various factors [2]. Decision problems related to economic and social systems are becoming more complicated as they become more complex [3]. Decision-making may be impacted by many factors, including the qualitative opinions of stakeholders, situation complexity, and a decision's long-term consequences [4]. Group conflicts occur when system members must make or delegate

collective decisions with conflicting preferences or positions. Every decision in these situations will somewhat affect all members [5]. Ambiguity or disagreements over a situation interpretation can make it difficult for individuals to determine whether a case is problematic, if there is a problem, or how to address it [6]. In such a situation, we require appropriate science, methods, and tools to respond to rapid change and complexity, making long-term reforms urgent [7]. For more than seven decades, operations or operational research (OR) is a knowledge that has been of interest to academics and practitioners to help managers and decision-makers achieve the above goal [8].

OR is referred to by the Global Fund as the "science of better" as it helps solve systems' problems [9]. OR applies advanced analytical techniques to make better decisions, allows managers to make more informed decisions, and build more efficient systems [10]. OR is a distinct academic discipline based on classical mathematics and statistics. By emphasizing the strong relationship between OR and computer science, information systems, and mathematics, OR assists decision-makers in business, industry, government, and academia in solving complex economic, business, engineering, public administration problems, etc. [11]. Growing rapidly, distinct methods involving OR can support a wide range of decision-making processes [12]. In decision support, a system is designed to compute or assist in computing recommendations (hard OR approach), or a direct client–analyst interaction is used to elaborate recommendations (soft OR approach) [13]. So to speak, it is possible to consider OR techniques either quantitatively/hard (HOR) or qualitatively/soft (SOR), or by combining both, and stakeholders may be involved in different degrees [14]. In practice, considering the characteristics of the problem under investigation, OR specialists and consultants exploit one or a combination of the above two approaches for decision support.

Since the beginning (the 1950s), many organizational problems have been solved using HOR techniques, primarily optimizing determined objectives. As a leading player in solving optimization problems, HOR faces challenges in incorporating uncontrollable factors into decision-making and exploiting big data more effectively [15]. Traditionally, mainstream OR methods neglect the importance of properly structuring problems in practice [13]. HOR techniques did not sufficiently address many practical problems encountered in social and political science due to their mathematical sophistication but naive contextualization [16]. Furthermore, according to reviews, another substantial consideration is that HOR contributions are plentiful in some operational domains, but minimal in strategic areas [17]. Strategic decisions need more investigation due to the long-term impacts, different involved stakeholders, the decisive role in systems' success and failure, etc. It is necessary to go through the decision-making process in a structured and scientific way to solve strategic and complex problems (wicked problems). This type of 'messy' and 'wicked' organizational problem led to the development of soft OR [18].

It was after the 1970s that soft OR began to emerge, focusing on structuring and defining complicated organizational problems and addressing future uncertainty [19]. Contrary to HOR, soft techniques emphasize that defining and framing a problem is a significant part of problem-solving [20]. Hence, a SOR method is less mathematically based, encourages stakeholder participation more, and is less mathematically grounded [21]. Quoted from Rosenhead [22], SOR approaches include problem structuring methods (PSMs) to address messy and wicked problems. The definition of PSMs varies depending on what the PSM typically aims to accomplish and how they perform it [23]. PSMs refer to several methods addressing uncertainty, conflict, and complexity in various situations. Modeling is used, typically in a group setting, to structure a problem and understand it better rather than directly solving it [24]. Toward achieving this goal, PSMs enable the integration of many alternatives into the problem–solution process, allow stakeholders with different perspectives and knowledge to visualize the problems cognitively, adjust the representation as the stakeholder group's discussion progresses, and vice versa, and allow partial or local improvements to be made rather than global solutions marginalizing many interests [25]. Through carefully structuring (or defining and redefining) a problem, PSMs seek to deliver a rational framework to resolve messy problems formerly solved by

applying HOR techniques [26]. Many PSMs have been formed in the last 50 years, including Soft Systems Methodology (SSM), Strategic Options Development and Analysis (SODA), Robustness Analysis (RA), Strategic Choice Approach (SCA), etc. [27]. Participants in PSM workshops develop procedures jointly by participating in interactive conversations as part of a workshop setting. These approaches ensure that decision-making and negotiation processes are informed about the problem's nature, potential solutions, and actions that can be taken to solve it [28]; yet, meanwhile, they will most likely not produce exact quantitative solutions [29]. Accordingly, in many cases, PSMs have been criticized [30].

An outline of the problem frame, or system boundaries, reveals the type of matters, solutions, and participants should be considered during decision-making [31]. By addressing each approach's disadvantages, researchers have favorably recommended combining classical operations research (HOR) and problem structuring methods (SOR) in the decision-making literature as multiple paradigmatic practices [32]. By combining hard and soft OR approaches and taking advantage of two ways that are fundamentally opposed, their strengths can be exploited [14]. Combining two decision-aid techniques can reduce complexity and deal with uncertainty [33]. Integrating quantitative indicators with qualitative context descriptions is an apparent demand from many decision-makers since it links theoretical and practical approaches to problem-solving [34]. Practitioners do not have to follow a single procedure but can adapt it to circumstances or combine it with other methods to meet their objectives [35]. Researchers examined the effectiveness of PSMs in practice over the last thirty years, emphasizing renewed scholarly and practitioners' interest in integrating soft and hard OR techniques for addressing complex problems and enhancing decision-making [36]. In practice, the benefits of adding some form of rational structure to discussions, and helping people provide some shape to a problematic situation, are all emphasized [37]. Nevertheless, there have continuously been varying opinions on how best to integrate these two approaches and the order of precedence in their utilization.

Most studies on management problem-solving only focus on the HOR approach [38–40], which mainly addresses decision-making issues at operational or tactical levels. However, this approach falls short when it comes to handling strategic decisions due to their complexity. Conversely, some new studies only consider a soft approach to address strategic issues [22,41–44], but their primary aim is to define and structure the problem for better understanding. However, review findings indicate little explicit recognition of the hierarchical nature of decision problems in the extant literature [17].

Some researchers utilize a blend of hard and soft approaches when dealing with management challenges [45–48]. Mixing hard and soft OR has opened the door for many studies with entire stakeholders' cooperation [49] and solved the much-reported absence of the documentation of successful OR project implementations [50]. Two significant gaps become apparent upon closer examination of research combining hard and soft OR approaches. Firstly, these studies only solve problems at tactical and operational levels. Secondly, they lack a straightforward procedure for combining hard and soft approaches and instead use multiple methods simultaneously. Therefore, the most important motivation of this study is to propose an algorithm based on PSMs that analyzes complex problems, defines subproblems, prioritizes them, and solves them using HOR approaches to handle subproblems.

This research is geared toward assisting managers in handling challenging wicked problems with the help of OR knowledge. Our proposed algorithm involves breaking down complex problems into smaller, more manageable subproblems at different levels of the hierarchy. Following this, we prioritize the subproblems before tackling them at the lowest level, which helps solve the problem at the higher level or a significant portion. Our findings suggest that a soft approach to structuring the problem is necessary when dealing with complex strategic issues, and HOR approaches should be utilized to provide suitable solutions. By combining these two OR approaches, we can capitalize on their strengths while simultaneously overcoming their weaknesses.

The study is divided into multiple sections. Section 2 delves into the research background to highlight the gap between previous studies. Section 3 introduces our proposed method, which we named the subdivision-based problem structuring method (SPSM). Then, in Section 4, we implement SPSM in a case study. Finally, we describe the results and make suggestions for future research.

2. Literature Review

Fifty years ago, the "wicked problems" concept was introduced [51]. Over time, professionals from different disciplines have attempted to address these problems. Here, we shall examine some recent endeavors on this topic.

Wicked problems were thoroughly examined in a book chapter, concluding that these problems cannot be solved outright but can be lessened by discovering improved solutions. The suggested approach was to make the design solutions more varied, although not necessarily exclusive [52]. A study utilized an improved version of design thinking—a creative and collaborative problem-solving technique to address a wicked problem within teams. This method blends insights from organizational development, social psychology, systems theory, and design research into a distilled design structure. The researchers proposed that by integrating learning and reflective practices into the design thinking framework, a hybrid design thinking model can be created that is more effective in framing, contextualizing, and solving complex problems within teams [53]. A researcher studied how social enterprise can benefit the public sector supply chain by analyzing a case using the socio-technical systems theory. The case study examined how public procurement policy can support social entrepreneurs in addressing a wicked problem related to social care. The study used a survey-based gap analysis to compare the opinions of local authority procurement officers and social enterprise care providers and evaluate the impact of public policy [54]. According to researchers, the varying views on the readiness of graduates for the workforce suggest that it is a wicked problem to solve completely. However, careful interventions can help bridge gaps between stakeholders' expectations. The authors conducted ten-year action research cycles to improve graduate work readiness. Their work provides design principles and actions that can be applied locally to address similar problems [55]. Researchers argued that we acknowledge that professional learning is a multi-faceted process with interconnected elements; however, when we study this phenomenon, we often simplify it by reducing it to tangible variables and actors that theoretical frameworks can explain—we tend to treat professional learning as a "tame" problem that is easy to define, is stable, and predictable. To illustrate this point, they presented an example of how visual analysis was used to address such a wicked problem [56] empirically.

A study explored the challenges of implementing sustainable development in supply chains, particularly in sustainable supply chain management. It identified "wicked" problems and proposed a conceptual framework to link them with SSCM characteristics. The study emphasized the need for stakeholder engagement to establish shared sustainability values and language, ensure clarity and transparency in supply chain activities, and promote continuity and equity in long-term partnerships [57]. In an article, a group of researchers argued that classical modern planning is insufficient for solving wicked problems but that a collaborative and rational approach can effectively address them and lead to innovative strategies. They described the characteristics of such a process and demonstrated how it can be applied as a model for second-generation systems. The article concludes with practical advice on organizing these processes and discusses the role of planners in them [58]. An article explored the potential application of agency theories in solving wicked problems faced by health professionals and educational scholars. The report focused on the specific challenge of interprofessional education and identified ten agency theories that could be used to address the issue. After discussing each idea about HPE's challenges, a subset of approaches was selected through debate and reflection. The chosen theories were deemed applicable in shedding light on the wicked problems faced by HPE [59]. Researchers argued that most traditional research on solving wicked problems focuses

on the role of specific individuals or groups (like the design thinking approach); However, they believed that the best way to address wicked problems is by creating effective ecosystems that allow various perspectives and knowledge. They discussed two different types of ecosystems, affiliation-based and structure-based, and explored prefigurative and partial forms of knowledge ecosystems. Their analysis showed that affiliation-based ecosystems are better suited for dealing with the complexity of wicked problems. A study investigated the potential of citizen science in finding innovative solutions for wicked problems. Through examples of citizen science projects, the authors demonstrated the significant contribution made by citizens in developing solutions and initiating change. The authors urged a greater acknowledgment and implementation of citizen science in public administration and management research [60].

A paper examined boundary-spanning mechanisms in policy deliberation fora, pilots, and labs. The authors focused on healthcare and climate change policies, contrasting policy fields facing perpetual and escalating crises. Their analysis showed that these approaches address different dilemmas of policy-making: the idea, implementation, and legitimacy dilemmas. All three approaches made them more manageable by grounding wicked problems in local decision-making, reducing their scope, or analyzing the problem. They also facilitated relationship and trust building, knowledge translation, and development solutions [61]. A study aimed to provide evidence on how public marketing can be used to address wicked problems. It reviewed the existing literature on wicked problems in political science and showed how marketing strategies can be applied in the public sector. The essay proposed a state action model that involves three key stages: analyzing the environment, communicating with stakeholders, and formulating public policies. According to the authors, effectively executing these stages can confront wicked problems [62]. Experts identified "maternal and infant morbidity and mortality" as a wicked problem. To tackle this problem, they devised a groundbreaking approach called the Expanded Whole System Prevention Framework. This approach integrates life course theory, prevention methods, and systems thinking to address the issue. The researchers found that this approach allowed for a fresh perspective on strategic planning and the creation of early-stage interventions to improve health equity and decrease maternal and infant health issues. Furthermore, they suggested that this methodology can be applied to other wicked problems beyond maternal and infant health [63]. A researcher argued that knowledge management could be applied beyond organizational boundaries to tackle wicked social problems: through problem-driven research, knowledge management can be used to address substantial issues by taking a critical stance; by recognizing the potential of knowledge management to improve society, not merely organizations, researchers, practitioners, and policy-makers can work together in collaborative organizational coalitions to help solve complex problems, which can be a more practical approach than relying solely on communities of practice [64]. According to researchers, strategy scholars tend to tackle wicked problems using the same methods they would for business problems. This approach involves creating models that aim to maximize organizational success. The researchers suggested that applying systems thinking to strategy research could be beneficial. They urged scholars to broaden their perspectives by (1) studying the co-evolution of dynamics instead of relying solely on static models, (2) focusing on processual insights instead of causal identification, and (3) acknowledging tipping points and transformative change instead of assuming linear, monotonic changes [65].

Researchers have recently developed a model of general collective intelligence, a method of organizing humans or artificially intelligent agents with the potential to exponentially increase the problem-solving ability of groups. According to them, many "wicked problems" are collective optimization problems that cannot be reliably solved without a system of collaborative optimization. However, such problems may be addressed more reliably through such a system [66]. By combining decision theory with management principles, a paper discussed the concept of sustainable development goals as a wicked problem. It used a case study of deforestation and its connection to supply chains, multi-stakeholder

initiatives, and sustainable development goals reporting to demonstrate the significance of decision theory in addressing complex problems. The study employed a conceptual framework that included Soft Systems Methodology and Value-Focused Decision Analysis [67]. An article addressed the issue of managing wicked problems from theoretical and practical viewpoints. The research recommended utilizing dynamic performance management to assist policy-makers in simultaneously addressing social diversity, institutional complexity, and scientific uncertainty. The study emphasized that dynamic performance management effectively manages performance in challenging situations by adopting a comprehensive perspective, experimenting with alternative strategies through simulation, and benchmarking performance results against simulated trends [68]. A paper used grounded theory to build a theoretical framework for addressing wicked organizational problems. Qualitative comparative analysis was then employed to examine the strategy portfolios that could effectively handle these problems. The study identified six key dimensions that can serve as decision-making tools for management: change adaptation, goal performance, administration, mechanical and organic integration, and entrepreneurs. The authors asserted that this study provides a comprehensive research approach for identifying and addressing organizational wicked problems and can serve as a valuable reference for organizations facing similar challenges in the future [69].

As can be seen, most experts, whether from the field of OR or other disciplines, present general approaches based on system thinking to address wicked problems while they avoid presenting practical algorithms. However, despite claims of universality, the solutions provided only apply to specific case studies and may not work for other issues due to their characteristics. These studies often suggest involving stakeholders in decision-making and taking a non-linear approach when dealing with wicked problems. This criticism has brought more attention to wicked problems among OR specialists recently. In the following, we will examine the efforts made by this group of experts.

According to [70], traditional approaches to problem-solving overlook the importance of some factors because of high levels of competition. To overcome this weakness, researchers should conduct relevant procedures from soft systems' thinking perspective. Due to the structural complexity of managerial problems and the diverse points of view of many stakeholders, a methodological approach centered on soft systems can provide solutions. This viewpoint has received more attention in recent years. A study using the systems thinking and modeling methodology structured a complex problem situation based on determining and investigating stakeholders. The solution was developed by utilizing a participatory approach to build a model that captures the underlying structure responsible for the problem. The authors argued that efforts to reduce delays in transportation infrastructure projects could be achieved through effective multi-stakeholder participation, which may lead to a multi-stakeholder partnership. This framework can help conflicting stakeholders reach an accommodation [71]. By December 2021, a systematic review of SOR in healthcare was conducted. These methods were employed in various healthcare fields, e.g., healthcare management, e-health, health informatics, etc. Researchers concluded that most reviewed articles applied the SSM to structure diverse problems. They argued that SOR approaches could identify and understand stakeholders' needs in health systems, but they have received little attention [21]. In a study, a substantial background for a deeper exploration of the study's multidimensional, complex research questions and context was provided by PSM techniques, including cognitive mapping, SODA, and nominal group techniques. Through the investigation, stakeholders' expertise and experiences were shared and aggregated, enabling a more realistic analysis framework and the cause-and-effect relationships among factors related to the subject matter. Regional stakeholders creating age-friendly smart living environments could use the proposed holistic analysis framework to analyze and share their knowledge and expertise about identified conditions and practices [72]. A study proposed combining Value-Focused Thinking (VFT) and SODA techniques to structure a hierarchy of key objectives to solve a workstation problem in the footwear industry. Furthermore, the Flexible and Interactive Tradeoff method (FITradeoff)

was utilized to obtain decision-makers' preferences. Researchers concluded that combining the structuring methods and FITradeoff facilitates decision-making [73]. By emphasizing that, according to evidence from risk management, a deep understanding of the massive problems should be integrated with stakeholders' proficiency and risk perception, researchers proposed a combination of PSMs for the exploration of stakeholders' risk perceptions through individual Fuzzy Cognitive Maps (FCMs) and Ambiguity Analysis (AA) for the examination of distinctions in risk perceptions and problem structure [74]. A case study using a problem structuring methodology was introduced to illustrate the difficulty of entangling involved and affected stakeholders in the dialogical process. Viable System Diagnosis (VSD) was presented using the systemic problem structuring approach. This case showed how such a systemic approach to problem structuring could benefit running a hospital service for present and future generations [75]. Stating that previous research on digital creative ecosystems has primarily utilized the HOR approaches that fail to address problems involving multiple stakeholders, leading to formulating incorrect explanations or strategies, a study examined how stakeholders perceive their positions and interactions to create a model. This study's contribution was a customization of the SODA technique to cope with the Indonesian stakeholders' communication style, tending to emphasize hierarchy [22]. Despite all the efforts made, as stated in the introduction, the most critical weakness of these tools is that they only deal with the knowledge and understanding of the problem and do not necessarily lead to an answer to the problem.

Some researchers have tried to provide answers to the problem under investigation by combining soft and hard approaches. Seeking to create a potential comprehensive methodology to help health decision-makers, a study designed a mixed framework to aid the medical training planning under the complexity of medical school vacancies and residency programs affected by multiple stakeholders with diverse attitudes and medical training specificities. It combined structuring the purposes and particularities of the problem with an SSM through the Customer, Actor, Transformation, Weltanschauung, Owner, Environment (CATWOE) method and formulating a Mixed-Integer Linear Programming (MOLP) model evaluating the entire relevant characteristics. As a result of observing the specificities of each country, a multi-objective planning model evolved, which laid out how multiple vacancies ought to be filled and closed in medical schools and each specialty each year [76]. Researchers developed a streamlined procedure to address the complexity of the private partner selection problems, including several indicators, inaccurate human judgments, and the environment's inherent uncertainty. They employed Single-Valued Neutrosophic Sets (SVNSs) to accumulate decision-makers' opinions. Subsequently, by utilizing the similarity measure, they determined the options ranks. Furthermore, they used the Robustness Analysis to examine the alternatives' effectiveness in various potential scenarios [77]. Researchers combined hard and soft OR techniques to solve a problem related to coordination and conflict in the supply chain. As a result of Delphi-Fuzzy methods and Interpretive Structural Modeling (ISM), quantitative variables were identified for measuring social responsibility. By modeling each player's payoff functions based on their bargaining power, the problem was modeled and optimized [78]. In an investigation, the authors applied a PSM technique, Cognitive Mapping (CM), to establish a Fuzzy Inference System (FIS). A framework for extracting and organizing aviation specialists' information was developed in this study using CM, with levels of risk assessment defined for each State and each Aviation Safety Branch; using FIS, ICAO's big data were converted into risk levels for each state and audit area by using FIS [79]. Researchers argued that the multi-objective optimization (MOO) literature typically focuses on problem-solving, assuming that problems have been formulated correctly. They contributed a systematic framework for structuring MOO problems using PSMs. According to them, in addition to objective functions, decision variables and constraint functions should also be elicited from expert knowledge to construct a MOO problem appropriately [80]. Applying a combination of soft and hard OR methods, Strategic Choice Approach (SCA), and ELETCRE (ÉLimination Et Choix Traduisant la REalité) 3-B, a study demonstrated decision models that link problem

structuring to strategic organizational objectives to operate with the process uncertainties, enabling decision-makers to explore information and address decision-making, allowing players a comprehensive and systemic vision connected to corporate purposes [81]. Researchers applied soft and hard OR techniques to assess and rate schools using quantitative and qualitative criteria and the system stakeholders' perspectives. Operating a soft method, they excluded the insignificant subcriteria. Then, utilizing The Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), they computed the subcriteria significance and the rating according to the experts' ideas. The sensitivity analysis findings indicated that ignoring the system's opinions from other stakeholders can distort the results [82]. As seen, wicked problems have been less considered in such hybrid methodologies.

In the past few decades, some other researchers have combined soft techniques with Multi-Criteria Decision-Making (MCDM) methods to solve wicked problems. A study analyzed a problem by proposing some detailed instruction PSM tools. The framework included Critical Systems Heuristics (CSHs) from Emancipatory OR, RA and SCA from soft OR, and the Best Worst Method (BWM) from quantitative and Multi-Attribute Decision-Making (MADM) procedures. The authors named their proposed methodology System Redesigning toward Creating Shared value (SYRCS) [4]. A study applied cognitive mapping and the BWM to identify essential evaluation criteria within urban digitalization to assess municipalities' degree of digitalization and improve city officials' understanding of intervention areas. By defining the most pertinent criteria for evaluating urban digitalization, researchers conducted SODA [83]. Research highlights the complementary nature of decision-making approaches by using the SCA to structure the decision problem and the ELECTRE technique to describe the action space. Examples of how alternative policies, enhancement activities, and projects can be analyzed and evaluated to be ranked or selected are given [33]. Using Value-Focused Thinking (VFT) for problem structuring, authors have developed a method to support group decision-making. The problem was structured using Rich Picture (RP) and VFT, and the rating was executed using the AHP. In this approach, values were the focus, and a process was defined to incorporate those values into a multi-criteria tool [25]. In a study, as part of the decision-making process of policy-making, an Analysis Network Process (ANP) approach and an SCA were proposed as a multi-methodological approach. The researchers used Latour's concept of the "collective" as a conceptual framework to describe the decision-making process, with its conflict and negotiation, openings, and closings [26]. To generate purposes for sustainable wastewater management through a game-based intervention, researchers designed a card game to aid participatory decision-making processes. Using an MCDA approach, they employed complementary data to assess the game-based intervention, including qualitative data, self-reported assessments, and empirical performance measures [84]. A study aimed to structure the characteristics influencing the interests of container terminals. The study examined the library and interviewed experts to identify CT (Container Terminals)-related factors. After identifying the elements, each influence degree was quantified by questioning CT experts. A fuzzy cognitive map was drawn after the feedback loop was calculated using the fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique [85]. Researchers applied soft and hard OR techniques to estimate the relative importance of factors influencing financial reporting reliability. They determined the cause-and-effect relationship between factors using the DEMATEL approach and identified variable weights by operating the fuzzy AHP [86]. Overall, it can be seen that despite the rising consideration paid by practitioners to the above hybrid approach, not enough attention has been paid to wicked problems.

The research background indicates that relying solely on HOR cannot effectively solve wicked problems. Similarly, SOR has limitations and often only leads to a deeper understanding of the issue. The challenge lies in the fact that hybrid approaches have yet to analyze wicked problems using specific algorithms effectively. While many combined approaches focus on tactical and operational issues, wicked problems are typically associated

with strategic issues. To overcome this challenge, we aim to showcase the effectiveness of a soft approach in breaking down wicked problems into smaller, solvable subsets, which can then be addressed using HOR. This research endeavors to provide a practical solution to wicked problems. Unlike many previously presented approaches, SPSM is a simple and practical approach that can be used in many wicked problems. Using the advantages of SOR, it achieves a deeper understanding of the problem, considers different stakeholders' views, manages the problem's complexity, and solves the wicked problem by addressing subproblems at lower levels applying HOR.

3. Methodology

The algorithm proposed in this study utilizes soft methodology to address complex problems effectively. The approach involves five steps, as illustrated in Figure 1. It is important to note that the number of steps can be adjusted based on the situation (problem characteristics) as long as they lead to a more accurate and precise understanding of the situation. However, based on our experience, we recommend the following procedure.

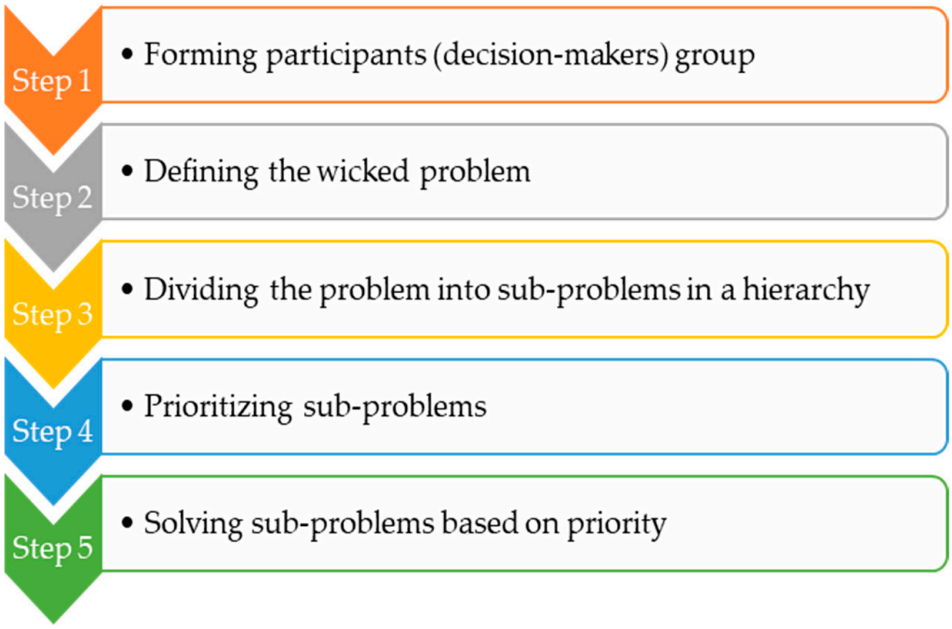

Figure 1. The proposed algorithm.

- Step 1: Set the decision-makers' group (d_r, r = 1, 2, . . ., k)
- Step 2: Define the wicked problem (WP)
- Step 3: Identify the next level problems P_i (i = 1, 2, . . ., n) and their subproblems SP_{ij} (i = 1, 2, . . ., n & j = 1, 2, . . ., m)
- Step 4: Prioritize subproblems SP_{ij} (i = 1, 2, . . ., n & j = 1, 2, . . ., m)
- Step 5: Solve subproblems SP_{ij} (i = 1, 2, . . ., n & j = 1, 2, . . ., m)

The above steps are explained in detail below.

Step 1 involves forming a group of contributors/decision-makers (d_r, r = 1, 2, . . ., k), where k represents the number of decision-makers, including representatives from all stakeholders involved in the problem. This group should aim to consider the views and opinions of all key stakeholders, especially in turbulent problems. We suggest using the input of 5 to 15 contributors to examine the situation and consider various perspectives effectively.

In Step 2, the wicked problem (WP) is defined, considering its long-term consequences, multiple stakeholders, group conflicts, future uncertainty, and qualitative stakeholder opinions. The operations research specialist, acting as a facilitator, plays a significant role in defining the problem.

Step 3 involves identifying the main dimensions of the wicked problem, which can be further examined as separate problems. The step to tackle wicked problems involves breaking them down into minor problems, P_i (i = 1, 2, . . ., n), where n is the number of problems at the first level. Similarly, every P_i at the previous level is further divided into subproblems, SP_{ij} (i = 1, 2, . . ., n & j = 1, 2, . . ., m), where m is the number of subproblems at the subsequent hierarchy level. This hierarchical structure can be formed based on the group's decision and ultimately leads to the most prior subproblem that needs to be solved. An example of this structure is shown in Figure 2.

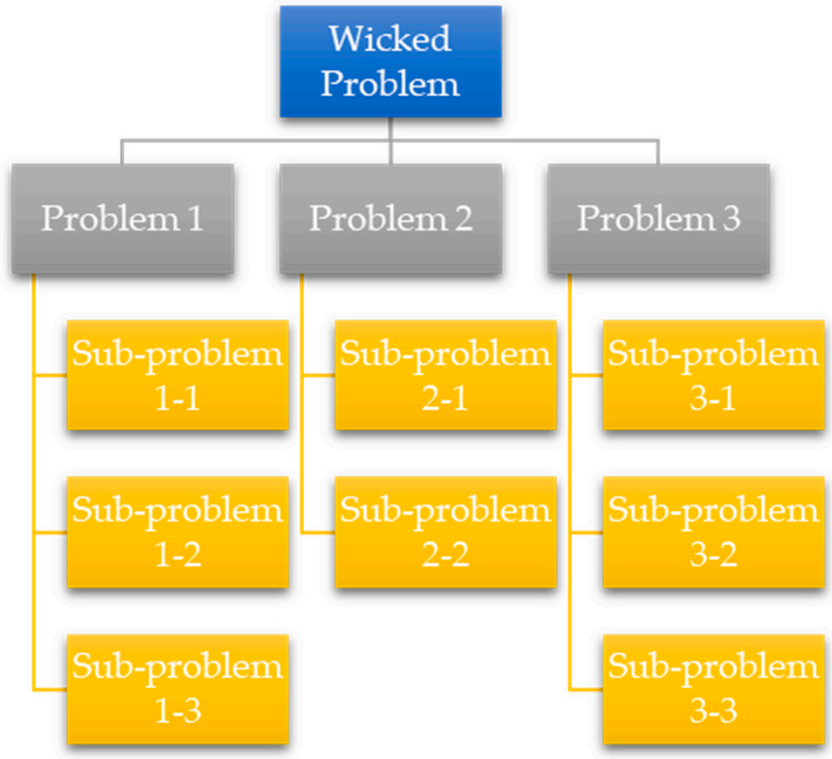

Figure 2. The hierarchy of a presumptive problem.

When creating a hierarchical structure, the aim is to tackle lower-level subproblems (SP_{ij}) to resolve higher-level problems (P_i). For example, a wicked problem (WP) at level 1, like improving product quality in a production system, can be broken down into problems at level 2 (P_1, P_2, and P_3). These problems may include low-quality raw materials (P_1), outdated equipment (P_2), and inefficient personnel (P_3). At level 3, each problem is further investigated. For instance, the problem of inefficient production personnel (P_3), caused by factors such as low wages (SP_{31}), long hours (SP_{32}), and inflexible schedules (SP_{33}), can be tackled by modifying wages, hours, and schedules. Addressing these subproblems at level 3 can significantly reduce or eliminate the higher-level problem of inefficient personnel (P_3). Similarly, resolving level 2 problems, such as personnel shortages, outdated equipment, and poor materials, can help solve the level 1 wicked problem.

As we move forward, it is crucial to establish an agreement among all participants, which is a key objective of PSMs. Depending on the unique circumstances of the issue at hand, various techniques, like group meetings, Delphi, and SSM, can be utilized to achieve consensus. It is advisable to have a soft OR specialist serve as a facilitator. The facilitator should consider various factors, such as the diverse interests of stakeholders, participants' familiarity with the issue and its various aspects, interpersonal dynamics, time constraints, and urgency when selecting the ideal method for reaching a consensus. Ultimately, this phase will result in a hierarchical structure that outlines the system's problems, from the most complex to the most specific.

In the fourth step, we recommend utilizing MCDM methods to prioritize subproblems (SP_{ij}). MCDMs are designed to assist decision-makers in choosing a preferred variant among many possible alternatives while considering a variety of variables [87]. Research on MCDM has been conducted since the 1960s, leading to many theoretical and applied publications. In the context of conflicting criteria, MCDM is a generic term for all methods that help people decide based on their preferences [88]. Problem owners can apply MCDMs to deal with the complexity of decision problems [89]. The advantages of these methods are that they can simultaneously handle conflicting goals and multiple stakeholders [90]. Over the last few decades, many authors have developed and improved MCDM methods. The main differences between these methods are the methodologies, weighting procedures, ways of expressing preferences, uncertain data, and data aggregation mechanisms [91]. Despite some placing it in the soft paradigm [9,92] and others in the hard paradigm [38], the multi-criteria decision-making method is the boundary between the soft and hard OR approaches [93]. Regardless of which category MCDMs fall into, a detailed evaluation of multi-criteria should be carried out after determining the structure of the problem [88].

In the fifth step, we should solve the subproblems considering the priority in the previous step. Thus, we solve the subproblem given the highest priority in the previous step. Once we have addressed the first priority problem, we move on to the second priority problem and continue the process until all subproblems are solved. As previously mentioned, most soft approaches may not be able to solve the problem. Therefore, it is likely that HOR tools will be necessary to solve it.

4. Case Study

In Iran, higher education institutions provide fee-based bachelor's, master's, and sometimes doctorate programs. The number of students seeking admission to these institutions has significantly decreased in recent years due to various factors, such as an increased admission capacity in public universities offering free education, expanding the number of private institutions, and a decreasing young population. The institution under study in this research has also faced this challenge. To address this complex issue, we have applied the proposed approach.

In the first step, a meeting was held with key stakeholders, including the president, educational, research, and administrative vice presidents, the public relations director, two faculty members, and two student representatives. This step aimed to engage all the stakeholders involved in the problem-solving process. It became apparent that the challenge of reducing the favor of the local community toward the institution was a complex issue that could have significant implications for the organization's sustainability. Participants were invited to share their recommendations for addressing the issue. As expected, the diverse viewpoints expressed by group members revealed a lack of agreement and shared understanding on how best to tackle the problem.

During the next step, we requested input from participants on the most critical controllable factors causing the wicked problem. After discussion and exchanging viewpoints, three main factors were identified: low-quality output, a lack of organizational differentiation, and ineffective advertising. These factors were then defined as the main issues at the second level of the hierarchy. Moving forward to step three, it was agreed upon that each group member would present the most critical factors causing level-two problems in the next meeting. During the second meeting, the group members shared their perspectives and eventually agreed on the most vital factors driving each problem at level two, as shown in Figure 3.

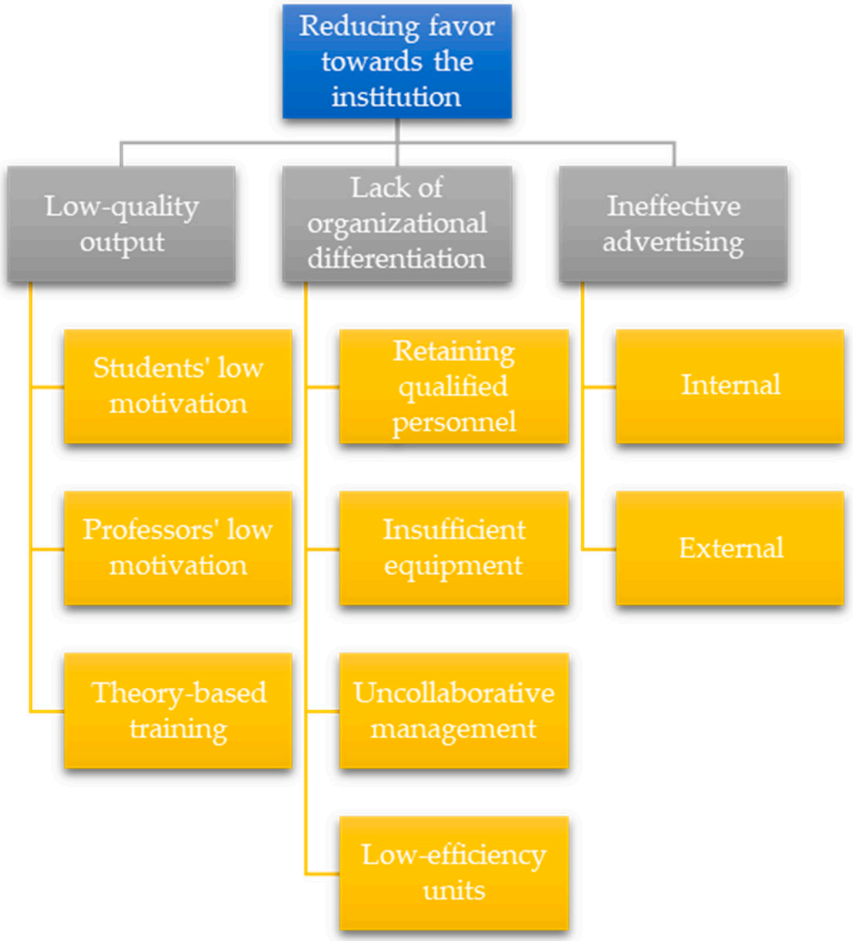

Figure 3. The wicked problem hierarchy.

During this stage, certain uncontrollable factors introduced by members, including the not updated university course titles and those not agreed upon by other members in terms of their importance, like planning end-of-semester exams, were excluded from further investigations. Finally, nine subproblems were defined at the third level: students' low motivation, professors' low motivation, theory-based training, retaining qualified personnel, insufficient equipment, uncollaborative management, low-efficiency units, and internal and external ineffective advertising.

During the fourth step, we utilized TOPSIS, one of the most commonly used MADM methods, to prioritize subproblems. As stated in the literature, various ways exist to combine participants' perspectives in group decision-making. Based on their input, we have decided that the members will collaborate to create a decision matrix during our next meeting. To form the decision matrix, the problem owners first determined the appropriate criteria to evaluate the alternatives. For this purpose, they introduced effectiveness (C_1), time consumption (C_2), ease of implementation (C_3), and financial burden (C_4). Then, to fill the matrix with the performance values for each alternative on each criterion, the decision-makers collectively reached a consensus on the values to be included in the decision matrix through a structured discussion. It should be noted that this approach promotes collaboration and allows for the exchange of ideas and viewpoints.

During the third session, the group evaluated and ranked subproblems based on effectiveness, time consumption, ease of implementation, and financial burden indicators. It is imperative to allocate weights to each indicator while utilizing the TOPSIS method. After discussion and agreement, the group decided on weights of 0.4 for effectiveness, 0.3 for time consumption, 0.2 for ease of implementation, and 0.1 for financial burden. To ensure accurate subproblems ranking, we calculated indicator weights applying Shannon

entropy. The criteria weights were obtained: $C_1 = 0.29$, $C_2 = 0.32$, $C_3 = 0.23$, and $C_4 = 0.16$. The final criteria weights were obtained by combining the weights the problem owners presented with the entropy weights. Accordingly, the final criteria weights are $C_1 = 0.344$, $C_2 = 0.309$, $C_3 = 0.214$, and $C_4 = 0.133$. The group then created a decision matrix as shown in Table 1, using qualitative measurements for all four indicators on Saaty's scale (ranging from 1, very low, to 9, very high).

Table 1. The decision matrix.

Subproblems	Effectiveness	Time Consumption	Ease of Implementation	Financial Burden
Students' low motivation	7	1	9	9
Professors' low motivation	8	3	7	9
Theory-based training	9	5	7	8
Retaining qualified personnel	7	6	6	5
Insufficient equipment	8	5	5	7
Uncollaborative management	2	6	6	3
Low-efficiency units	3	8	3	6
Internal advertising	3	9	2	4
External advertising	8	8	4	5

Pearson's correlation ratio (ρ), which determines the actual contribution of each criterion by examining how the categories in each criterion explain the variation [94], is shown in Table 2.

Table 2. Pearson's correlation ratio (ρ).

Criteria	Correlation
Effectiveness	0.492
Time consumption	0.909
Ease of implementation	−0.190
Financial burden	0.457

The correlation coefficient (0.492) between the rank and Effectiveness indicates a moderate linear relationship between the ranking of the alternatives and their Effectiveness scores. However, it is important to note that the correlation is not extremely strong, suggesting that other criteria also play a role in determining the final rank. The strong correlation coefficient (0.909) between the rank and Time consumption indicates a strong linear relationship between the ranking of the alternatives and their Time consumption scores. The correlation coefficient (0.190) between the rank and Ease of implementation indicates a weak linear relationship between the ranking of the alternatives and their Ease of implementation scores. The correlation is not strong, meaning that Ease of implementation alone might not be a significant driver of the final rank. The correlation coefficient (0.457) between the rank and Financial burden indicates a moderate linear relationship between the ranking of the alternatives and their Financial burden scores. However, similar to Effectiveness, the correlation is not extremely strong, indicating that other criteria also influence the final ranking. Time consumption appears to be the most decisive influence on the final ranking, followed by Effectiveness and Financial burden. Ease of implementation has a weaker impact on the ranking.

The prioritization of subproblems was determined by implementing the TOPSIS method and based on the relative closeness measure C_i.

According to Table 3, among the problems of the third hierarchy level, the subproblem of low-efficiency units (SP_{24}) has been given the highest priority.

Table 3. The subproblems' priority.

Subproblems	C_i	Ranks
Students' low motivation	0.401	9
Professors' low motivation	0.487	5
Theory-based training	0.485	6
Retaining qualified personnel	0.440	7
Insufficient equipment	0.555	4
Uncollaborative management	0.411	8
Low-efficiency units	0.723	1
Internal advertising	0.647	2
External advertising	0.585	3

After determining the priority of the various subproblems, the next crucial step is tackling them effectively. As this study aims to highlight the advantages of employing soft and hard approaches when resolving a wicked problem, in this report, we will only focus on the subproblem identified as the most critical and elaborate on its solution.

During the fifth phase, we focused on enhancing the institution's distinctiveness by identifying and addressing inefficient units. To accomplish this, we carried out a thorough evaluation of fifteen different units by utilizing the data envelopment analysis technique. The participating group opted to employ two indicators, namely the number of personnel and referrals, as inputs and three indicators, namely quality of responsiveness, availability level, and the number of complaints, as outputs. The responsiveness and availability levels were assessed on a scale of 0 to 10, with 0 indicating poor performance and 10 indicating excellent performance. The normalized data obtained during this critical stage of the institution assessment is presented in Table 4 for further analysis.

Table 4. The DEA data.

Units	Input 1	Input 2	Output 1	Output 2	Output 3
1	0/500	0/900	0/889	0/185	1/000
2	0/143	0/500	0/667	0/282	1/000
3	0/050	0/700	0/333	0/580	0/500
4	1/000	1/000	1/000	0/185	1/000
5	0/111	0/600	0/556	0/321	1/000
6	0/125	0/700	0/778	0/496	0/500
7	0/043	0/400	0/333	1/000	0/333
8	0/083	0/600	0/444	0/461	0/500
9	0/143	0/500	0/444	0/241	1/000
10	0/091	0/400	0/333	0/282	1/000
11	0/083	0/800	0/667	0/539	0/500
12	0/050	0/800	0/556	0/901	0/333
13	0/059	0/400	0/444	0/509	0/500
14	0/500	0/800	1/000	0/259	1/000
15	0/100	0/600	0/444	0/262	1/000

Consequently, applying the CCR, input-oriented BCC, output-oriented BCC, and additive DEA models, the efficiency of the institution's fifteen units was calculated, as shown in Figure 4.

According to Figure 4, units 2, 3, 5, 9, 10, 13, and 15 are not functioning efficiently. Our next step is to pinpoint the specific areas of inefficiency and develop a plan to improve them. It is worth noting that since this study focuses on demonstrating the practicality of combining hard and soft approaches, we will refrain from discussing the subsequent actions taken to address the problem in this particular case.

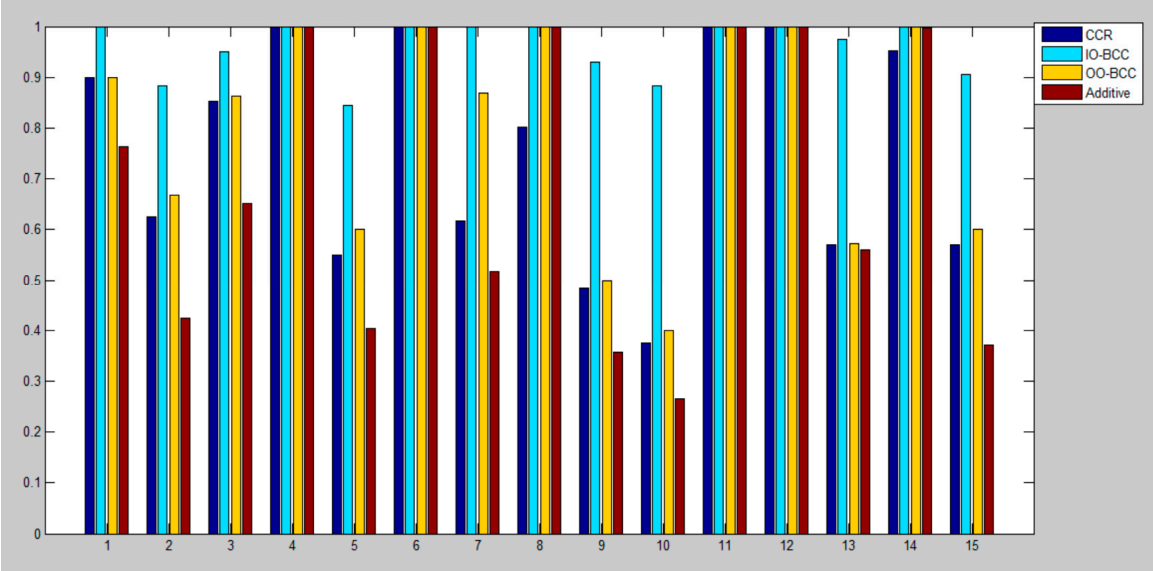

Figure 4. Units' efficiency.

5. Managerial Implications

The study emphasizes the limitations of relying solely on either hard or soft OR approaches in tackling wicked problems, which are characterized by their hyper-complexity, multiple stakeholders with conflicting perspectives, and a lack of clear-cut solutions. The study proposes a structured process incorporating problem structuring methods, multi-attribute decision-making, and some HOR tools to overcome these challenges. By combining HOR techniques, which emphasize quantitative analysis and optimization, with SOR techniques, which emphasize qualitative insights and stakeholder participation, decision-makers can leverage the strengths of both approaches. This integration allows for a more holistic understanding of the problem and facilitates more informed decision-making. The study's findings emphasize the benefits of integrating hard and soft OR approaches in addressing complex problems in higher education institutions and beyond. By adopting a combined OR approach, managers can navigate the intricacies of wicked problems, make informed decisions, and drive positive changes within their organizations. Managers can adopt this combined approach to improve decision-making processes within their organizations. By incorporating both quantitative and qualitative factors, managers can make more informed and comprehensive decisions.

The study highlights the significance of problem structuring in addressing complex problems. Managers can focus on specific areas requiring attention by breaking down wicked problems into manageable subproblems and prioritizing them using multi-criteria decision-making methods. The proposed subdivision-based problem structuring method (SPSM) provides a structured approach for defining and breaking down complex problems into manageable subproblems. Managers can apply this method to analyze and prioritize the factors contributing to a particular problem. This procedure enables them to focus on addressing the most critical issues and allocate resources effectively.

Furthermore, one of the critical implications of this research is the importance of involving a diverse group of stakeholders to ensure a comprehensive consideration of perspectives. Managers can adopt this approach to consider views and increase stakeholder buy-in thoroughly. Managers can gain valuable insights and increase the likelihood of successful problem-solving outcomes by involving relevant parties. By including various stakeholders, such as students, faculty members, administrators, and other appropriate parties, decision-makers can gain valuable insights and ensure a more well-rounded approach to problem-solving.

Implementing these approaches can assist managers in effectively addressing complex challenges and achieving desired outcomes in educational institutions and other

organizational settings. The study promotes using innovative methodologies to address complex and wicked problems effectively. Managers can embrace a culture of continuous improvement and adaptability within their organizations. By recognizing the limitations of traditional OR approaches and exploring new methodologies, managers can stay ahead of evolving challenges and identify innovative solutions.

6. Conclusions

OR looks for better ways to conduct organizational operations using mathematical, computer-based, or other analytical methods [95]. OR has been divided into two branches, hard OR and soft OR. HOR continually has failed to address the many practical problems in political, social, and management sciences. This disadvantage and the increasing uncertainty and unpredictability existing in structuring managerial problems are directed to the supremacy of the SOR perspective [96]. For academics, SOR, also known as problem structuring methods, is a legitimate branch of OR [97]. PSMs are widely used in OR to address wicked problems, messes, and swamps in plural/complex contexts [98]. Problem structuring methods seek to generate a shared understanding of complex problems from the perception of the involved actors, aiming at structuring them before solving them [43]. Based on the literature, PSMs facilitate transparent and participatory ways of formulating and modeling problems [99]. It has been demonstrated in the review of these techniques that when applied by academics and other actors, soft OR methods have consistently produced beneficial policy results [35]. Over the last 20 years, some have acknowledged the importance of problem structuring and PSMs for Decision Analysis (DA), moving beyond the idea that DA begins with a well-structured problem. Even though PSMs can bring significant advantages to decision-making, little engagement appears to have been made to this point of view in the literature [26].

In this research, we proposed a hierarchy-based PSM approach that helps problem owners better understand a system's wicked problem. To solve an unstructured problem, according to the proposed approach, decision-makers must first identify the most critical factors causing the wicked problem. The factors identified in this stage are considered next-level problems. Keeping in mind that PSM approaches cannot provide a specific solution for the problem, those responsible for addressing the problem should deconstruct it to the most granular level in the hierarchy, where a feasible solution can be executed. The main idea of this research is that, by solving the subdivisions of each hierarchy level, the higher level problem is solved either entirely or to a significant extent. In the next step, after identifying and defining the subdivisions at the lowest level of the hierarchy, it is time to rank them and determine their importance or priority. At this stage, decision-makers can use different MADM techniques to determine the priority of subdivisions. Finally, problem owners should consider solving subdivisions with the help of hard OR approaches or other practical tools.

In a case study, we implemented our proposed approach to solving the problem of declining student enrollment in a higher education institution. We first formed the participating group consisting of the system's main stakeholders. Then, we asked them to introduce the most critical factors causing the wicked problem. After the discussion, we identified three main elements, namely low-quality output, a lack of organizational differentiation, and ineffective advertising, causing the situation. Each of these factors was considered a new problem in the second level of the hierarchy, and in the same way, the third level of the hierarchy was formed by defining nine solvable subproblems. Next, we asked the participating group to prioritize the subproblems based on their importance. After determining the indicators, the ranking of subproblems was performed using the TOPSIS method, and it was found that the problem of low-efficiency units has the highest priority. In the next step, we used the DEA technique to evaluate the units and identify inefficient ones, which showed that seven units of the institution do not have the necessary efficiency. The next step, which we did not cover in this report, was to identify the reasons for the low efficiency of the units and plan to eliminate them.

When utilizing the findings of this study, it is crucial to consider its limitations. Because of the lack of the participants' familiarity with specialized OR methods, several limitations may arise in solving complex problems. Participants' lack of understanding of technical OR methods can hinder problem formulation, limit the awareness of available techniques, lead to inaccurate assumptions, hinder effective tool utilization, make result interpretation challenging, and restrict their ability to handle complex problem scenarios. During our research, we encountered instances where we could not obtain complete expert participation. For example, when determining the criteria weights for implementing the TOPSIS approach, although it would have been more appropriate to use conventional methods for weighting them, the experts instead opted to use a judgmental process for determining the weights. It is important to note that if research experts understand OR approach well, such issues will decrease. To mitigate this limitation, seeking appropriate training and support is crucial to enhance participants' understanding and application of OR methods.

MADM methods aim to capture diverse viewpoints and preferences from multiple decision-makers. However, specific perspectives may be underrepresented or not adequately considered in practice. This limitation can arise due to various factors such as power dynamics, the dominance of particular individuals, or insufficient efforts to ensure equal participation. In such cases, the decision-making process may not fully reflect the interests and preferences of all stakeholders. Furthermore, MADM methods often involve subjective judgments and assessments. Decision-makers may have inherent biases, personal preferences, or limited information, which can introduce subjectivity. Biases can influence the weighting of indicators, the interpretation of data, and the final decision outcome. In this study, the institution's president was responsible for selecting the participants. Unfortunately, we could only include two faculty members and two student representatives. Thus, the number of proposed members was less than that of elected members. Moreover, there is a chance that the viewpoints of individuals might have been swayed by the organization's officials, which could have distorted the interpretation of the outcomes.

Furthermore, the assumption of monotonicity in data envelopment analysis (DEA), where the efficiency scores of decision-making units (DMUs) increase or remain constant as additional inputs or outputs are added, can pose challenges in specific real-world scenarios. This point has not been considered in the current research. Researchers can use solutions such as Variable Returns to Scale (VRS) models, non-monotonic DEA models, etc., to deal with this problem in future research.

There are multiple ways to enhance the proposed approach in this research. For instance, in the fourth step (subproblem prioritization), we utilized the TOPSIS method, which treats the alternatives as separate entities and disregards the internal connections between the indicators. To improve the dependability of the findings, we can employ different hard and soft techniques like [100], ANP [101], Interpretive Structural Modeling (ISM) [102], and System Dynamics [103], which have more realistic assumptions. Additionally, the experts' judgments' uncertainty was not accounted for in this stage. Various fuzzy and fuzzy extension sets, like intuitionistic fuzzy [104], neutrosophic [105], plithogenic [106], etc., can address this shortcoming.

Author Contributions: W.X. was responsible for formal analysis and methodology in the hard methods section. S.A.E. oversaw resources, supervision, and validation. A.S. handled conceptualization and methodology in the soft methods section, as well as writing and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: All data are included in the article.

Conflicts of Interest: This is the original work of the authors, and all authors have seen and approved the final version of the submitted manuscript. The authors declare no conflict of interest.

References

1. Imeni, M.; Edalatpanah, S.A. Resilience: Business Sustainability Based on Risk Management. In *Advances in Reliability, Failure and Risk Analysis*; Springer: Singapore, 2023; pp. 199–213.
2. Taherdoost, H.; Madanchian, M. Multi-Criteria Decision Making (MCDM) Methods and Concepts. *Encyclopedia* **2023**, *3*, 77–87. [CrossRef]
3. Wątróbski, J.; Jankowski, J.; Ziemba, P.; Karczmarczyk, A.; Zioło, M. Generalised Framework for Multi-Criteria Method Selection. *Omega* **2019**, *86*, 107–124. [CrossRef]
4. Khazaei, M.; Ramezani, M.; Padash, A.; DeTombe, D. The Quantification Role of BWM in Problem Structuring Methods: SYRCS Methodology. In *Advances in Best-Worst Method*; Rezaei, J., Brunelli, M., Mohammadi, M., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 252–271.
5. Horita, M.; Maemura, Y. Supporting Community Decisions. In *Handbook of Group Decision and Negotiation*; Kilgour, D.M., Eden, C., Eds.; Springer International Publishing: Cham, Switzerland, 2021; pp. 341–354. ISBN 978-3-030-49629-6.
6. Pluchinotta, I.; Salvia, G.; Zimmermann, N. The Importance of Eliciting Stakeholders' System Boundary Perceptions for Problem Structuring and Decision-Making. *Eur. J. Oper. Res.* **2022**, *302*, 280–293. [CrossRef]
7. Laouris, Y. Managing Large-Scale Societal Change. In *Operations Management and Management Science*; Márquez, F.P.G., Ed.; IntechOpen: Rijeka, Croatia, 2022; p. 6. ISBN 978-1-80355-981-0.
8. Skolfield, J.K.; Escobedo, A.R. Operations Research in Optimal Power Flow: A Guide to Recent and Emerging Methodologies and Applications. *Eur. J. Oper. Res.* **2022**, *300*, 387–404. [CrossRef]
9. Silal, S.P. Operational Research: A Multidisciplinary Approach for the Management of Infectious Disease in a Global Context. *Eur. J. Oper. Res.* **2021**, *291*, 929–934. [CrossRef]
10. Weber, G.-W.; Thomas, J.J.; Saucedo, J.A.M.; Fiore, U.; Litvinchev, I.; Vasant, P. Preface: Special Issue on Modeling, Simulation, and Optimization in Operational Research. *J. Oper. Res. Soc. China* **2022**, *10*, 685–688. [CrossRef]
11. Sinuany-Stern, Z. Foundations of Operations Research: From Linear Programming to Data Envelopment Analysis. *Eur. J. Oper. Res.* **2023**, *306*, 1069–1080. [CrossRef]
12. Doumpos, M.; Zopounidis, C.; Gounopoulos, D.; Platanakis, E.; Zhang, W. Operational Research and Artificial Intelligence Methods in Banking. *Eur. J. Oper. Res.* **2023**, *306*, 1–16. [CrossRef]
13. Bellenguez, O.; Brauner, N.; Tsoukiàs, A. Is There an Ethical Operational Research Practice? And What This Implies for Our Research? *EURO J. Decis. Process.* **2023**, *11*, 100029. [CrossRef]
14. Conlon, M.; Molloy, O. Modelling a Computed Tomography Service Using Mixed Operational Research Methods. *J. Simul.* **2023**, *17*, 1–13. [CrossRef]
15. Raeesi, R.; Sahebjamnia, N.; Mansouri, S.A. The Synergistic Effect of Operational Research and Big Data Analytics in Greening Container Terminal Operations: A Review and Future Directions. *Eur. J. Oper. Res.* **2022**, *310*, 943–973. [CrossRef]
16. Azar, A.; Sorourkhah, A. Designing a Model for Three-Dimensional Robustness Analysis: A Case Study of Iran Khodro Machine Tools Industries Company. *Indian J. Sci. Technol.* **2015**, *8*, 82447. [CrossRef]
17. Grieco, L.; Utley, M.; Crowe, S. Operational Research Applied to Decisions in Home Health Care: A Systematic Literature Review. *J. Oper. Res. Soc.* **2021**, *72*, 1960–1991. [CrossRef]
18. Howlett, M. Dealing with the Dark Side of Policy-Making: Managing Behavioural Risk and Volatility in Policy Designs. *J. Comp. Policy Anal. Res. Pract.* **2020**, *22*, 612–625. [CrossRef]
19. Fathi, M.R.; Maleki, M.H.; Sobhani, S.M.; Koksal, C.D. Future Study of Operations Research Based on Scenario Planning and Soft Systems Methodology. *Foresight* **2020**, *22*, 223–249. [CrossRef]
20. Kogetsidis, H. Dealing with Complexity—The Contribution of Problem Structuring Methods to Management Science. *Int. J. Organ. Anal.* 2023; *ahead-of-print*. [CrossRef]
21. Shafaghsorkh, O.; Ayough, A. Application of Soft Operations Research Methods in Healthcare: A Systematic Review. *J. Ind. Eng. Manag. Stud.* **2022**, *9*, 136–147. [CrossRef]
22. Novani, S.; Cyntiawati, C.; Kijima, K.; Hasyimi, V.; Trianto, A.S.; Mayangsari, L.; Alamanda, D.T.; Anggadwita, G. Empowering Digital Creative Ecosystem Using Problem Structuring Method and a Service Science Perspective: A Case Study in Cimahi and Bandung, Indonesia. *Asia Pac. Manag. Rev.* **2023**, *28*, 215–228. [CrossRef]
23. Smith, C.M.; Shaw, D. The Characteristics of Problem Structuring Methods: A Literature Review. *Eur. J. Oper. Res.* **2019**, *274*, 403–416. [CrossRef]
24. Morrill, N.O.R. Support for Planning under Uncertainty. *Impact* **2021**, *2021*, 13–15. [CrossRef]
25. Logullo, Y.; Bigogno-Costa, V.; da Silva, A.C.S.; Belderrain, M.C. A Prioritization Approach Based on VFT and AHP for Group Decision Making: A Case Study in the Military Operations. *Production* **2022**, *32*, e20210059. [CrossRef]
26. Lami, I.M.; Todella, E. A Multi-Methodological Combination of the Strategic Choice Approach and the Analytic Network Process: From Facts to Values and Vice Versa. *Eur. J. Oper. Res.* **2023**, *307*, 802–812. [CrossRef]
27. Françozo, R.V.; Belderrain, M.C.N. A Problem Structuring Method Framework for Value-Focused Thinking. *EURO J. Decis. Process.* **2022**, *10*, 100014. [CrossRef]
28. Lami, I.M.; Tavella, E. On the Usefulness of Soft OR Models in Decision Making: A Comparison of Problem Structuring Methods Supported and Self-Organized Workshops. *Eur. J. Oper. Res.* **2019**, *275*, 1020–1036. [CrossRef]

29. Carter, M.W.; Busby, C.R. How Can Operational Research Make a Real Difference in Healthcare? Challenges of Implementation. *Eur. J. Oper. Res.* **2023**, *306*, 1059–1068. [CrossRef]
30. Franco, L.A.; Rouwette, E.A.J.A. Problem Structuring Methods: Taking Stock and Looking Ahead. In *The Palgrave Handbook of Operations Research*; Salhi, S., Boylan, J., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 735–780, ISBN 978-3-030-96935-6.
31. Bérard, C.; Cloutier, L.M.; Cassivi, L. The Effects of Using System Dynamics-Based Decision Support Models: Testing Policy-Makers' Boundaries in a Complex Situation. *J. Decis. Syst.* **2017**, *26*, 45–63. [CrossRef]
32. Castellini, M.A.; Paucar-Caceres, A. A Conceptual Framework for Integrating Methodologies in Management: Partial Results of a Systemic Intervention in a Textile SME in Argentina. *Syst. Res. Behav. Sci.* **2019**, *36*, 20–35. [CrossRef]
33. Curto, R.; Norese, M.F.; Rolando, D. A Multicriteria Decision Aid Perspective That Guides an Incremental Development of Knowledge and Fosters Relationships and Decisions. *EURO J. Decis. Process.* **2022**, *10*, 100023. [CrossRef]
34. Estellita Lins, M.P.; Netto, S.O.A.; de Castro Lobo, M.S. Multimethodology Applied to the Evaluation of Healthcare in Brazilian Municipalities. *Health Care Manag. Sci.* **2019**, *22*, 197–214. [CrossRef]
35. Leong, C.; Soon, D.W.X.; Ong, C.; Howlett, M. Problems in Applying Soft OR Methods to Climate Actions: Lessons from Two Cases of Governmental Use. *npj Clim. Action* **2023**, *2*, 1. [CrossRef]
36. Christie, J.S.; Mingers, J.; Kotiadis, K. Using Problem Structuring Methods with Quantitative OR: Six Methodological Designs. In Proceedings of the 64th Annual Conference of the Operational Research Society (OR64), Coventry, UK, 13–15 September 2022.
37. Lane, D.C. Fons et Origo: Reflections on the 60th Anniversary of Industrial Dynamics. *Syst. Dyn. Rev.* **2022**, *38*, 292–324. [CrossRef]
38. Ebrahimi, E.; Fathi, M.R.; Sobhani, S.M. A Modification of Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) through Fuzzy Similarity Method (a Numerical Example of the Personnel Selection). *J. Appl. Res. Ind. Eng.* **2023**, *10*, 203–217. [CrossRef]
39. Adak, A.K.; Kumar, G. Spherical Distance Measurement Method for Solving MCDM Problems under Pythagorean Fuzzy Environment. *J. Fuzzy Ext. Appl.* **2023**, *4*, 28–39. [CrossRef]
40. da Silva, G.M.; Frej, E.A.; de Almeida, A.T. Ranking Potential Investors Using the FITradeoff Method and Value Focused Thinking in a Group Decision Problem. In *Group Decision and Negotiation in the Era of Multimodal Interactions*; Springer: Cham, Switzerland, 2023; pp. 37–52.
41. Savona, N.; Brown, A.; Macauley, T.; Aguiar, A.; Hayward, J.; Ayuandini, S.; Habron, J.; Grewal, N.K.; Luszczynska, A.; Mendes, S.; et al. System Mapping with Adolescents: Using Group Model Building to Map the Complexity of Obesity. *Obes. Rev.* **2023**, *24*, e13506. [CrossRef]
42. Sosa, P.R.B.; dos Santos, L.D.; Pavani, B.F.; Ribeiro, A.N.; De Almeida Sinisgalli, P.A.; de Sousa Júnior, W.C.; Schlindwein, S.L. Identifying Priorities through the Problem Structuring Method to Reduce the Dependencies on Ecosystem Services in Electricity Distribution. *Ambiente Soc.* **2023**, *26*, 1–24. [CrossRef]
43. Gomes Júnior, A.d.A.; Schramm, V.B.; Schramm, F. Problem Structuring Methods in Social-Ecological Systems. *Syst. Pract. Action Res.* **2023**, *36*, 461–478. [CrossRef]
44. Heravi, A.; Zamani Moghadam, A.; Hashemi, S.A.; Vakil Alroaia, Y.; Sajadi Jagharg, A. Evaluation of the Influential Factors in Human Resource Development in State-Owned Enterprises Using a Mixed Method. *J. Appl. Res. Ind. Eng.* **2023**, *10*, 238–255. [CrossRef]
45. de Almeida, A.T.; Frej, E.A.; Roselli, L.R.P.; Costa, A.P.C.S. A Summary on Fitradeoff Method with Methodological and Practical Developments and Future Perspectives. *Pesqui. Oper.* **2023**, *43*, e268356. [CrossRef]
46. Ehsani, A.; Mehrmanesh, H.; Mohammadi, M. Identifying and Prioritizing Technology Capability Drivers in the Supply Chain Using the Fuzzy Hierarchical Analysis Process (Case Study: Iran Khodro and Saipa Automotive Company). *Int. J. Res. Ind. Eng.* **2023**, *12*, 88–105. [CrossRef]
47. Werner, C. Simulation Input Modelling in the Absence of Historical Data for Decision Support during Crises: Experience with Assessing Demand Uncertainties for Simulating Walk-through Testing in the Early Waves of COVID-19. *J. Oper. Res. Soc.* **2023**, *74*, 489–508. [CrossRef]
48. Balaei, S.; Mohammadi, N.; Doroudi, H. Designing a Hybrid Model for the Green Supply Chain in Gilan Steel Industry. *Int. J. Res. Ind. Eng.* **2023**, *12*, 73–87. [CrossRef]
49. Pessôa, L.A.M.; Lins, M.P.E.; da Silva, A.C.M.; Fiszman, R. Integrating Soft and Hard Operational Research to Improve Surgical Centre Management at a University Hospital. *Eur. J. Oper. Res.* **2015**, *245*, 851–861. [CrossRef]
50. Lamé, G.; Jouini, O.; Stal-Le Cardinal, J. Combining Soft Systems Methodology, Ethnographic Observation, and Discrete-Event Simulation: A Case Study in Cancer Care. *J. Oper. Res. Soc.* **2020**, *71*, 1545–1562. [CrossRef]
51. Rittel, H.W.J.; Webber, M.M. Dilemmas in a General Theory of Planning. *Policy Sci.* **1973**, *4*, 155–169. [CrossRef]
52. Li, W.; Song, Z.; Suh, C.S. Extenics: A Methodology for Solving Wicked Problems. In *Principles of Innovative Design Thinking*; Springer Nature Singapore: Singapore, 2022; pp. 55–79.
53. Bender-Salazar, R. Design Thinking as an Effective Method for Problem-Setting and Needfinding for Entrepreneurial Teams Addressing Wicked Problems. *J. Innov. Entrep.* **2023**, *12*, 24. [CrossRef]
54. Aitken, A. Developing Social Entrepreneurship through Public Procurement: A Wicked Problem! *Int. J. Entrep. Behav. Res.* 2022; *ahead-of-print*. [CrossRef]

55. Thompson, J.; Houston, D. Resolving the Wicked Problem of Quality in Paramedic Education: The Application of Assessment for Learning to Bridge Theory-Practice Gaps. *Qual. High. Educ.* **2022**, 1–18. [CrossRef]
56. Kyndt, E.; Aerts, J. Addressing 'Wicked Problems' Using Visual Analysis. In *Methods for Researching Professional Learning and Development: Challenges, Applications and Empirical Illustrations*; Goller, M., Kyndt, E., Paloniemi, S., Damşa, C., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 329–348, ISBN 978-3-031-08518-5.
57. Pederneiras, Y.M.; Meckenstock, J.; Carvalho, A.I.C.; Barbosa-Póvoa, A.P. The Wicked Problem of Sustainable Development in Supply Chains. *Bus. Strategy Environ.* **2022**, *31*, 46–58. [CrossRef]
58. Innes, J.E.; Booher, D.E. Collaborative Rationality as a Strategy for Working with Wicked Problems. *Landsc. Urban Plan.* **2016**, *154*, 8–10. [CrossRef]
59. Varpio, L.; Aschenbrener, C.; Bates, J. Tackling Wicked Problems: How Theories of Agency Can Provide New Insights. *Med. Educ.* **2017**, *51*, 353–365. [CrossRef]
60. Hodgkinson, I.R.; Mousavi, S.; Hughes, P. New Development: Citizen Science—Discovering (New) Solutions to Wicked Problems. *Public Money Manag.* **2022**, *42*, 133–136. [CrossRef]
61. Zeigermann, U.; Ettelt, S. Spanning the Boundaries between Policy, Politics and Science to Solve Wicked Problems: Policy Pilots, Deliberation Fora and Policy Labs. *Sustain. Sci.* **2023**, *18*, 809–821. [CrossRef]
62. de Siqueira, F.R.; da Silva Müller, C.A.; de Morais, F.R. Public Marketing to Face Wicked Problems: Theoretical Essay for Conceptual Model Construction. *Int. Rev. Public Nonprofit Mark.* **2023**, *20*, 477–489. [CrossRef]
63. LaFave, L.A.; Clemmons, N.; Kotelchuck, M.; Morales Cozier, N.; Geltman, A.; Browne, D.R.; Kenyon, K. Activating Life Course Theory through a Whole System Prevention Framework to Address the Wicked Problem of Maternal and Infant Morbidity and Mortality. *Community Health Equity Res. Policy* **2023**. [CrossRef]
64. Dumay, J. Using Critical KM to Address Wicked Problems. *Knowl. Manag. Res. Pract.* **2022**, *20*, 767–775. [CrossRef]
65. Grewatsch, S.; Kennedy, S.; Bansal, P. Tackling Wicked Problems in Strategic Management with Systems Thinking. *Strateg. Organ.* 2021; *in press*. [CrossRef]
66. Williams, A.E. Are Wicked Problems a Lack of General Collective Intelligence? *AI Soc.* **2023**, *38*, 343–348. [CrossRef]
67. Alexander, A.; Walker, H.; Delabre, I. A Decision Theory Perspective on Wicked Problems, SDGs and Stakeholders: The Case of Deforestation. *J. Bus. Ethics* **2022**, *180*, 975–995. [CrossRef]
68. Noto, G.; Prenestini, A.; Cosenz, F.; Barresi, G. Tackling Wicked Problems in Performance Management and Governance of Public Health: An Empirical Analysis of COVID-19 Vaccination Strategies. *Int. J. Public Sect. Manag.* **2023**, *36*, 130–151. [CrossRef]
69. Wang, X.; Xiao, M.; Jia, L. Tackling Organizational Wicked Problems: A Heuristics Study Based on a Qualitative Comparative Analysis Approach. *Chin. Manag. Stud.* 2023, *ahead-of-print*. [CrossRef]
70. Valafar, M.-A.; Hamidi, N.; Alborzi, M.; Iranban, S. Systematic Structuring of the Business Domain of Local Mobile Apps Stores Using Soft Systems Methodology (SSM). *J. Syst. Manag.* **2020**, *6*, 135–154. [CrossRef]
71. Elias, A.A. Multi-Stakeholder Participation for Achieving Sustainable Development Goals: A Systems Thinking Approach. In *Environmental Sustainability and Agenda 2030*; Tauringana, V., Moses, O., Eds.; Advances in Environmental Accounting & Management; Emerald Publishing Ltd.: Bingley, UK, 2022; Volume 10, pp. 45–65, ISBN 978-1-80262-879-1, 978-1-80262-880-7.
72. Weck, M.; Humala, I.; Tamminen, P.; Ferreira, F.A.F. Supporting Sustainable Development Using Multiple Criteria Decision Aid: Towards an Age-Friendly Smart Living Environment. In *Multiple Criteria Decision Making for Sustainable Development: Pursuing Economic Growth, Environmental Protection and Social Cohesion*; Doumpos, M., Ferreira, F.A.F., Zopounidis, C., Eds.; Springer International Publishing: Cham, Switzerland, 2021; pp. 151–173, ISBN 978-3-030-89277-7.
73. de Morais Correia, L.M.A.; da Silva, J.M.N.; dos Santos Leite, W.K.; Lucas, R.E.C.; Colaço, G.A. A Multicriteria Decision Model to Rank Workstations in a Footwear Industry Based on a FITradeoff-Ranking Method for Ergonomics Interventions. *Oper. Res.* **2022**, *22*, 3335–3371. [CrossRef]
74. Santoro, S.; Pluchinotta, I.; Pagano, A.; Pengal, P.; Cokan, B.; Giordano, R. Assessing Stakeholders' Risk Perception to Promote Nature Based Solutions as Flood Protection Strategies: The Case of the Glinščica River (Slovenia). *Sci. Total Environ.* **2019**, *655*, 188–201. [CrossRef]
75. Vik, M.B.; Finnestrand, H.; Flood, R.L. Systemic Problem Structuring in a Complex Hospital Environment Using Viable System Diagnosis—Keeping the Blood Flowing. *Syst. Pract. Action Res.* **2022**, *35*, 203–226. [CrossRef] [PubMed]
76. Cardoso-Grilo, T.; Monteiro, M.; Oliveira, M.D.; Amorim-Lopes, M.; Barbosa-Póvoa, A. From Problem Structuring to Optimization: A Multi-Methodological Framework to Assist the Planning of Medical Training. *Eur. J. Oper. Res.* **2019**, *273*, 662–683. [CrossRef]
77. Qiu, P.; Sorourkhah, A.; Kausar, N.; Cagin, T.; Edalatpanah, S.A. Simplifying the Complexity in the Problem of Choosing the Best Private-Sector Partner. *Systems* **2023**, *11*, 80. [CrossRef]
78. Amoozad Mahdiraji, H.; Turskis, Z.; Jafarnejad, A.; Rezayar, A. Non-Cooperative Two-Echelon Supply Chains with a Focus on Social Responsibility. *Technol. Econ. Dev. Econ.* **2019**, *25*, 1162–1187. [CrossRef]
79. Junior, A.d.L.C.; Belderrain, M.C.N.; Junior, M.M.C. State Aviation Risk Assessment Level Determination Using Hierarchical Fuzzy Inference System Based on Cognitive Maps. *J. Artif. Intell. Syst.* **2021**, *3*, 1–15. [CrossRef]
80. Afsar, B.; Silvennoinen, J.; Miettinen, K. A Systematic Way of Structuring Real-World Multiobjective Optimization Problems. In *Evolutionary Multi-Criterion Optimization*; Emmerich, M., Deutz, A., Wang, H., Kononova, A.V., Naujoks, B., Li, K., Miettinen, K., Yevseyeva, I., Eds.; Springer Nature Switzerland: Cham, Switzerland, 2023; pp. 593–605.

81. Schotten, P.C.; Morais, D.C. Problem Structuring and Strategic Sorting Model for Financial Organizations. *Eur. J. Bus. Manag. Res.* **2023**, *8*, 100–111. [CrossRef]
82. Li, P.; Edalatpanah, S.A.; Sorourkhah, A.; Yaman, S.; Kausar, N. An Integrated Fuzzy Structured Methodology for Performance Evaluation of High Schools in a Group Decision-Making Problem. *Systems* **2023**, *11*, 159. [CrossRef]
83. Vieira, F.C.; Ferreira, F.A.F.; Govindan, K.; Ferreira, N.C.M.Q.F.; Banaitis, A. Measuring Urban Digitalization Using Cognitive Mapping and the Best Worst Method (BWM). *Technol. Soc.* **2022**, *71*, 102131. [CrossRef]
84. Aubert, A.H.; McConville, J.; Schmid, S.; Lienert, J. Gamifying and Evaluating Problem Structuring: A Card Game Workshop for Generating Decision Objectives. *EURO J. Decis. Process.* **2022**, *10*, 100021. [CrossRef]
85. Khajeh, F.; Shahbandarzadeh, H. Modeling Factors Affecting the Interests of the Container Terminal Using Fuzzy Cognitive Map and Fuzzy DEMATEL. *J. Model. Manag.* 2022, *ahead-of-print*. [CrossRef]
86. Eghbali Amooghin, A.; Mohammadzadeh Salteh, H.; Salehi, M.; Nonahal Nahr, A. akbar Determining the Importance of the Variables Influencing Financial Reporting Quality Using the Fuzzy Analytic Hierarchy Process. *Int. J. Nonlinear Anal. Appl.* **2023**, *14*, 1683–1696. [CrossRef]
87. Jing, D.; Imeni, M.; Edalatpanah, S.A.; Alburaikan, A.; Khalifa, H.A. Optimal Selection of Stock Portfolios Using Multi-Criteria Decision-Making Methods. *Mathematics* **2023**, *11*, 415. [CrossRef]
88. Mardani, A.; Jusoh, A.; Nor, K.; Khalifah, Z.; Zakwan, N.; Valipour, A. Multiple Criteria Decision-Making Techniques and Their Applications—A Review of the Literature from 2000 to 2014. *Econ. Res.-Ekon. Istraživanja* **2015**, *28*, 516–571. [CrossRef]
89. Cubukcu, C.; Cantekin, C. Using a Combined Fuzzy-AHP and Topsis Decision Model for Selecting the Best Firewall Alternative. *J. Fuzzy Ext. Appl.* **2022**, *3*, 192–200. [CrossRef]
90. Duc, D.A.; Hang, D.T.; Tam, P.M.; Hue, T.T.; Van Loi, T.; Lien, L.T.; Dat, L.Q. Lecturers' Research Capacity Assessment Using an Extension of Generalized Fuzzy Multi-Criteria Decision-Making Approach. *Int. J. Fuzzy Syst.* **2020**, *22*, 2652–2663. [CrossRef]
91. El-Morsy, S. Stock Portfolio Optimization Using Pythagorean Fuzzy Numbers. *J. Oper. Strateg. Anal.* **2023**, *1*, 8–13. [CrossRef]
92. Mingers, J. Soft OR Comes of Age—But Not Everywhere! *Omega* **2011**, *39*, 729–741. [CrossRef]
93. Dhurkari, R.K. MCDM Methods: Practical Difficulties and Future Directions for Improvement. *RAIRO Oper. Res.* **2022**, *56*, 2221–2233. [CrossRef]
94. Saltelli, A.; Annoni, P.; Azzini, I.; Campolongo, F.; Ratto, M.; Tarantola, S. Variance Based Sensitivity Analysis of Model Output. Design and Estimator for the Total Sensitivity Index. *Comput. Phys. Commun.* **2010**, *181*, 259–270. [CrossRef]
95. Cock, J.; Jiménez, D.; Dorado, H.; Oberthür, T. Operations Research and Machine Learning to Manage Risk and Optimize Production Practices in Agriculture: Good and Bad Experience. *Curr. Opin. Environ. Sustain.* **2023**, *62*, 101278. [CrossRef]
96. Leong, C.; Howlett, M. Soft OR as a Response to Inherent Vices: Problem Structuring to Offset Policy Volatility. *EURO J. Decis. Process.* **2022**, *10*, 100019. [CrossRef]
97. Yearworth, M. Problem Structuring in OR Practice. In Proceedings of the 64th Annual Conference of the OR Society (OR64), Warwick, UK, 13–15 September 2022.
98. Yearworth, M.; White, L. The Construction of Wicked Problems. In Proceedings of the 22nd Conference of the International Federation of Operational Research Societies (IFORS 2021), Seoul, Republic of Korea, 23–27 August 2021.
99. Laouris, Y.; Romm, N.R.A. Structured Dialogical Design as a Problem Structuring Method Illustrated in a Re-Invent Democracy Project. *Eur. J. Oper. Res.* **2022**, *301*, 1072–1087. [CrossRef]
100. Venugopal, R.; Veeramani, C.; Edalatpanah, S.A. Analysis of Fuzzy DEMATEL Approach for Financial Ratio Performance Evaluation of NASDAQ Exchange. In *Proceedings of International Conference on Data Science and Applications*; Springer: Singapore, 2022; pp. 637–648.
101. Ocampo, L.A.; Himang, C.M.; Kumar, A.; Brezocnik, M. A Novel Multiple Criteria Decision-Making Approach Based on Fuzzy DEMATEL, Fuzzy ANP and Fuzzy AHP for Mapping Collection and Distribution Centers in Reverse Logistics. *Adv. Prod. Eng. Manag.* **2019**, *14*, 297–322. [CrossRef]
102. Sarkar, M.R.; Masud, S.R.; Hossen, M.I.; Goh, M. A Comprehensive Study on the Emerging Effect of Artificial Intelligence in Agriculture Automation. In Proceedings of the 2022 IEEE 18th International Colloquium on Signal Processing and Applications, CSPA, Selangor, Malaysia, 12 May 2022; pp. 419–424.
103. Li, Y.; Liang, C.; Ye, F.; Zhao, X. Designing Government Subsidy Schemes to Promote the Electric Vehicle Industry: A System Dynamics Model Perspective. *Transp. Res. Part A Policy Pract.* **2023**, *167*, 103558. [CrossRef]
104. Sadeghi, M.E.; Nozari, H.; Khajezadeh Dezfoli, H.; Khajezadeh, M. Ranking of Different of Investment Risk in High-Tech Projects Using TOPSIS Method in Fuzzy Environment Based on Linguistic Variables. *J. Fuzzy Ext. Appl.* **2021**, *2*, 226–238. [CrossRef]
105. Duran, V.; Topal, S.; Smarandache, F. An Application of Neutrosophic Logic in the Confirmatory Data Analysis of the Satisfaction with Life Scale. *J. Fuzzy Ext. Appl.* **2021**, *2*, 262–282. [CrossRef]
106. Tayal, D.K.; Yadav, S.K.; Arora, D. Personalized Ranking of Products Using Aspect-Based Sentiment Analysis and Plithogenic Sets. *Multimed. Tools Appl.* **2023**, *82*, 1261–1287. [CrossRef]