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Review

Decision Making: Models, Processes, Techniques

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Abstract: Decision-making is one of the steps in problem-solving that can be applied in manifold areas from personal situations to the management of organizations. There are functions and processes to lead to making a decision; however, it may sound complicated to select between decision-making models and approaches as different factors and different outcomes get involved in the decision-making process. This article is a survey of decision-making with managerial insight to explain what it is, what kinds of decisions are made, and how they are applied in many sectors, including computers, management, business, psychology, etc. This paper aims to provide an overview of the decision-making concept, its functions, process steps, and its main types, models, and categories. Overall, it provides valuable insights for individuals and organizations seeking to improve their decision-making abilities.

***Keywords*:** decision making, models, decision making types and concept, decision making techniques steps, decision making problems, managerial concept

1. Introduction

Every day, individuals face many challenging and tough situations to make decisions. In the management decision-making process, conscious and reasoned as opposed to random decisions are made [1-2]. Before making decisions, it is necessary to make the appropriate option. This choice is based on pertinent data and produces the desired outcomes. The choice is a process, not an instantaneous thing. The choice itself is significant, but most individuals recall the decision's outcome [3-4]. Each option may have some benefits and drawbacks that are crucial to be considered before making the choice. Thus, it is critical to gather data and weigh the benefits and drawbacks of each choice [5-6]. Generally, an appropriate decision can help to overcome the gaps between reality and ideals, and it helps us to identify the way from initiation to both implementation and termination in a design process. It also helps to consider necessary limitations, and the preferable situations in case people face a situation in different aspects of their lives [7]. As the situations get more complicated and many side effects get involved, making an appropriate decision gets more challenging [8]. However, the outcomes of making mistakes in decision-making in real life may be irreparable considering time, money, and reputation loss [9-10]. On the other hand, it is not realistic to make error-free decisions in real life as every decision comes with a range of side effects. However, considering various determining factors and the benefits and drawbacks of each option increases the likelihood of making appropriate decisions to a great extent [11-12].

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The options that are commonly offered to people can be a vast range of subjects such as opportunities, predictions, strategies, events, and requirements, although in all situations the decision always needs ‘‘a commitment to a course of action that is intended to yield results that are satisfying for specified individuals’’ [13] (p.24). Decisions generally include four main categories:

• Acceptances: It is a binary choice between accepting or rejecting;
• Choices: Opting for a subset from a group of alternatives;
• Constructions: Creating an ideal solution given accessible resources;
• Evaluations: Here, commitments back up the statements of worth to act [14].

On the other hand, decisions can be simple or complex with manifold criteria with several perspectives for each of them. Decision-making is the process of opting for an option between manifold alternatives. These alternatives can be different situations from personal ones to the choices through an organization. When you select a choice between all available possibilities, the process is decision-making [15-16]. The aim of decision-making is both identifying all possible alternatives and choosing the best one out of available choices that fit the expected goals and objectives. For doing this, all choices are expected to be evaluated considering different aspects such as cost, efficiency, etc., and all merits and demerits to gain the best decision. For example, considering a rational perspective, the option with maximum utility would be the best possible choice. On the other hand, a naturalistic perspective decides based on whether an option is the most consonant with previous experiences and personal beliefs to opt for the best choice.

Decision-making is a critical function in management that overshadows different aspects from controlling the staff to directing and organizing them [15, 17-18]. Furthermore, decision-making can be considered the most common and moderately ill-structured type of problem-solving that is a vital skill in the more complex and ill-structured problem-solving kinds. For example, in design and policy problem-solving decision-making possesses a necessary role [19-21].

2. Decision-making models

It is commonly complicated to make good decisions as the number of alternatives gets increased since every decision comes with several benefits and drawbacks. Considering the complexity of making appropriate decisions and encountering various outcomes, decision-making models facilitate the process of choosing between different available options [22]. Decision-making models provide frameworks and guidelines to make the best choice and better manage the decision-making process. They are tools to be employed and make effective decisions in cases where decision-making may get complicated.

Different decision-making models provide a framework to analyze the situation, regard likely solutions, and eventually lead to an informed decision. They also suggest a range of approaches to making effective decisions based on the context of the decision and alternatives that influence it. Relying on decision-making models to make structured decisions facilitates making appropriate decisions to a great extent and may decrease the probability of failure [23]. Getting to know different decision-making models helps decision-makers to get equipped in making appropriate decisions when there is a range of different options.

The concept of decision-making models is divided into several types in different ways. Here, two main ways of dividing decision-making models are discussed [14].

Firstly, the decision-making process can be divided into two different district models including normative (perspective), and descriptive (naturalistic) are described in the following.

2.1 *Normative models*

The normative decision frameworks are theories that assist managers in making choices by examining the level of team participation. These theories include the decisions made by rational decision-makers considering the maximum utility to gain the optimum option in any uncertain circumstance that may detour decision-making. Thus, it is based on considering the goals of the decision-maker and its likely outcomes to make the best possible decision out of available choices. The process of decision-making, therefore, is based on standards and norms and guides people with specific rules and directions in making the best possible decision. In other words, the normative models of decision-making simply refer to the fact that the best choice is the one that leads to the best result. These models usually use assigned

numerical values to the options to make the process of decision-making rational [24].

2.2 *Descriptive models*

The study of naturalistic decision-making is descriptive rather than prescriptive, and it examines how individuals utilize their experience to make choices in real-world situations. The focus is on three elements that impact decision-making: characteristics related to the decision-maker, including knowledge and experience, factors linked with the job, such as its degree of complexity, and environmental factors [25]. These models are based on examining the ways individuals make their decisions in an actual situation. Individuals rarely can follow a rational process (as normative ones), usually, the decision-making is unconscious and based on prior experiences. Therefore, instead of adopting numerical values, the decision-making process is based on explaining stories about the possible consequences. The decision-making is impacted by personal identities and their related social expectations. Here, between the different stories about future events, the most coherent scenario affects the final choice [14].

On the other hand, some literature also divides the decision-making models into rational and bounded rationality models which are discussed following as well.

2.2.1 *Rational models*

As discussed in normative models, during this process, decisions are made with certainty. That is to say, the alternatives, the decision criteria, and their outcomes are known to the decision-makers, and they can make the optimum choice and finally implement that choice. All these steps are necessary when the process is rational [8]. The rational model is based on a sequence of steps that are logically set to lead to a decision. Thus, the problem is first identified and possible solutions are analyzed and brainstormed then. This model is effective in cases where there is a great understanding of the problem and enough time to discuss and brainstorm and eventually decrease the level of risk. However, it cannot be effective in cases where there is limited time or understanding of the problem [26].

2.2.2 *Bounded rational models*

In many decision-making processes, all the above steps cannot be approved completely due to the limits in time, information, cost, etc. Therefore, decision-making is based on an incomplete list of solutions, limited rationality, and considering intuition, experiences, and advice. Decisions will always be made based on a partial and, to some extent, insufficient understanding of the full nature of the situation being confronted. In these models, it is not feasible to consider all choices, conduct a comprehensive review, provide an accurate forecast, or guarantee the optimal decision [8].

As discussed above, the majority of decisions are made unconsciously. However, in other situations, a decision-making process could be also based on weighing the merits and consequences of the options in a controlled environment. Overall, the decision-making process involves different factors which overshadow the results. These factors could be rational, cultural, psychological, and social factors [27].

Rational factors are the main factors in many decision-making problems and they are quantitative ones such as time and price. People prefer to focus on quantitative elements and neglect qualitative ones. The experiences, capabilities, and personalities of the decision-makers are some of the psychological factors. The common values and trends accepted in a specific environment and culture are known as cultural factors. Finally, social factors are other agreements that can impact the decision of the decision-maker [28]. Thus, in the bounded rational models, the focus is on addressing the problem rather than searching for the most ideal situation. Therefore, this model can be a working solution to make immediate decisions for teams with limited time to discuss and brainstorm the situation [27].

3. Decision-making process

Decision-making is a process that starts from a point and leads to a conclusion. Making a decision happens by following a process including several steps with specific strategies to pass each step appropriately. This process helps the decision-makers to realize what they need to do in each step and what is the reason [29]. As stated in [29] there are manifold processes for decision-making recommended by different authors based on their targets. However, a

general decision-making process that is commonly accepted by many is described in the following eight steps, and it is summarized in Figure 1 as well:

Defining the problem: This step includes identifying the main causes, issues, limitations, interfaces, and boundaries. Here, the problem should be expressed in a concise, clear, and unambiguous statement considering the initial and the desired conditions [29].

Identifying the requirements: These are the conditions that the problem must meet. These are, considering mathematical form, the group of feasible solutions are provided in quantitative forms. Mathematics is used to assess and enhance the quality of data in the face of ambiguity, to present and explain choices, and to model existing alternatives and their outcomes.

Establishing the objectives and goals: The goals are higher than the necessary minimum values. A goal is an all-encompassing declaration of the desired values and purposes. In mathematics, the objective may be distinguished from the requirement, which is a restriction, by stating that the objective is the aim.

Determining the alternatives: Alternatives assist to change the initial conditions to the desired ones by using manifold approaches. All of these alternatives should meet the requirements. The number of alternatives can be finite or infinite. If the alternatives are finite, then all of them should be analyzed to obtain whether they meet the requirements or not to examine the ones that are infeasible and should be eliminated. In the second situation, when an infinite number of alternatives are faced, the alternatives' set is the solutions' set that fulfills the constraints (considering the requirements of the mathematical form). The expected disutility is lower when there is only one choice than when there are more (or an infinite number) choices. This is because consumers in the middle of the market get a disutility close to zero when there is only one choice, but they don't get this result when they choose randomly from a larger number of products [30].

Determining the criteria: Criteria are defined based on goals and aim to discriminate between the alternatives. These criteria help to evaluate to what extent the alternatives can reach the goals. For each purpose, at least one criterion should be developed. However, for complicated aims, numerous criteria might be generated.

Selecting a tool (method) for decision making: Manifold decision-making tools are available, but to choose a suitable one, different aspects such as the concrete of the problem, and the objectives should be considered. For example, for complex decision-making problems, complex methods are applicable.

Evaluating alternatives considering criteria: This step is a necessary input data to gain a correct decision-making method. The assessment can be objective or subjective based on the criterion. The objective assessment considers an understood measurement scale such as money, but the subjective assessment is judgmental. The decision-making tool selected in the previous steps is used to rank the alternatives based on the achieved results of evaluations. Finally, the most promising subsets would be chosen [31].

Validating step: In this step, the chosen terms from the previous step should be validated considering the requirements of the decision-making problem to be sure the decision-making tool was not misapplied [32-33].

When the above steps are considered, it is time to execute the decision made in the process; however, it is also noteworthy that planning is also a beneficial point in the decision-making problems as it can assist to develop independent goals, gaining standards for measurements, transform values to actions, and finally effectively and systematically devote the resources [28].

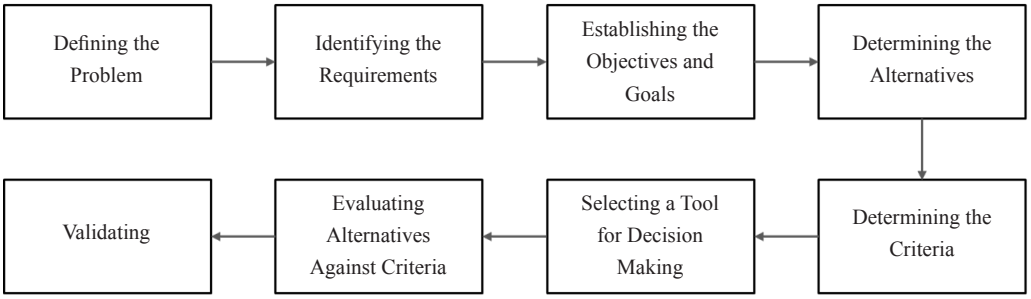

Figure 1. Decision-Making Process Steps

4. Decision-making types and techniques

Decision Analysis approaches are logical systematic/processes procedures for using critical thinking to information, facts, and experience to make a well-balanced choice among uncertain options. They give structured methods for applying critical thinking abilities earned via the accumulation of responses to problem-related questions. Hence, before describing the decision-making techniques, it is beneficial to identify the important aspects of decision-making problems better by using simple examples in Table 1 [32].

Table 1. Examples of important Concepts in Decision Making

Concepts	Goals	Criteria	Strategic Requirements
Examples	Minimizing costs, minimizing environmental aspects, maximizing efficiency, minimizing project risks, and meeting a schedule.	Scheduling the risks, considering the potential Dollar saving, and project available resources.	Treating the project's remaining materials and waste, preventing the spread of nuclear materials.

Decision-making problems can be divided into different subcategories by considering different aspects. For example, the decision-making can be divided into routine vs strategic decisions (based on the importance of problems), individual compared with group decision-making (based on the number of decision-makers), programmed compared with un-programmed decisions (based on the process of decision-making), etc. For this reason, some of the main and most important views are considered to determine different types and techniques of decision-making. The categories are discussed below and are listed in Figure 2.

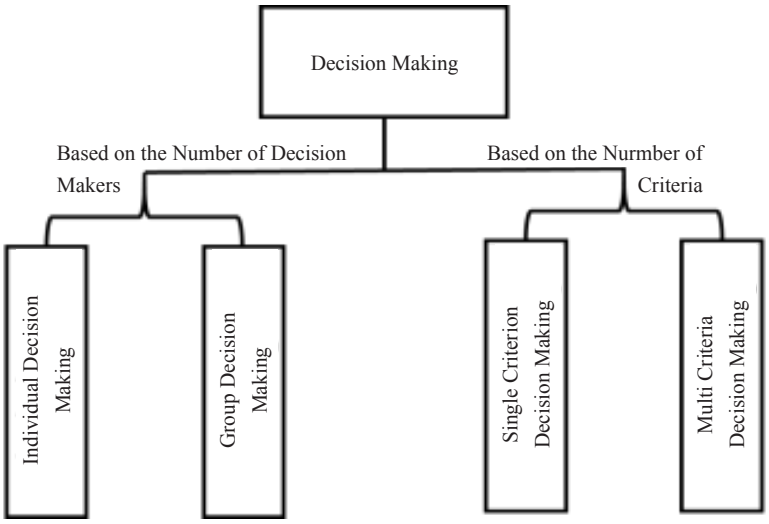

Figure 2. Two Main Typologies of Decision Making

First of all, the way the decisions are made can be considered to identify the decision-making techniques. Considering this viewpoint, the decision-making problem can be categorized as to:

4.1 *Normative models*

The decision-maker is one person; therefore, the process is the responsibility of that one. In the majority of cases,

the subject of the problem is not collective affairs cases. But the individual decision maker (who can be, for example, the organization's head or CEO, etc.) can impact collective destiny in this situation. Some of the main individual decision-making techniques are participative decision-making, opportunity cost estimation, non-scientific methods (such as draw cards, coin throw, tarot cards, astrology, authority obedience), preference trees, pros and cons analysis, etc.

4.2 *Normative models*

In contrast with individual decision-making methods, a cooperative level of decision-making uses a team or group of decision-makers to make the final decision. This technique is also known as the collective and participatory method of decision-making, voting-based methods, democratic, brainstorming (which separates ideas from evaluations by people grouped), nominal group (based on both generating and evaluating ideas by a group of individuals grouped), Delphi technique (Iterative organized group communication procedure where professionals analyze difficult and unclear situations), and consensus decision-making (deciding on a proposal when the aim is acceptance of it by all the group participants) are between the main group decision-making techniques (that are described in the listed literature in detail). In this method, the ideal group size can be considered between five to 12 participants who should be motivated and able to meet the tasks [8, 28, 32].

However, group decision-making is so likely to get biased by group members, and also some conflicts may happen in groups to conclude [34]. Besides, following the aim to maintain unanimity, some alternatives may be underestimated in consideration which will eventually lead to poor examinations.

In addition to the above-mentioned categories, the decision-making techniques can be divided into single-creation and multiple-criteria decision-making (MCDM) problems.

4.2.1 *Rational models*

The problem of decision-making considers a single aggregate measure or criterion like cost. The alternative with the best value (considering the criterion) is determined as the final solution. This is a classic optimization problem. For example, if the minimum cost is the criterion, the alternative with the lowest cost is the solution. Manifold optimization techniques can be utilized to find the solution in these cases based on the functional description and the form of the problem such as discrete optimization, and linear, and nonlinear programming. In all cases, the criterion is the objective function, and the requirements on the alternatives are the constraints of the optimization problem [28, 35].

4.2.2 *Rational models*

MCDM problems are the techniques used to solve decision-making problems with more than one criterion. When there are diverse factors to consider, decision-making gets complicated [36]. On the other hand, several factors should be addressed. Multi-criteria decision-making refers to complex situations that involve different choices to make a decision. It is a valuable tool in cases where there are various alternatives to consider. So, each qualitative or quantitative criterion is analyzed to determine whether it is beneficial or undesirable for the outcome [37].

In these cases, the decision-maker can face two general and main subsets:

• Multi-objective decision-making (MODM) methods: In these methods the attributes and goals are implicit and the possible options are Infinite/Unclear.

• Multi-attribute decision-making methods: These are the problems with finite possible answers, clear goals, and attributes [28, 35, 37].

Finally, some authors use more specific categories for decision-making types based on the fields of study. For example, Litvaj et al. [38] described three main types of decision-making spontaneous decision-making, intuitive decision-making, and rational decision-making. As an example, they identified all of the decision-making by managers as a rational type that considers consistency, objectivity, and logical elements for the decision-making process. Therefore, the element of rationality in the manager's decision-making process is a necessary need for the fulfillment of management duties.

There are several MCDM methods available such as the analytical hierarchal process (AHP), the analytical network process (ANP), technology for order performance by similarity to optimal solution (TOPSIS), data envelopment analysis

(DEA), rough set, etc. Here, some of the main sub-groups based on article number (Scopus results-February 15th, 2023) are listed. Moreover, Table 2 lists available MCDM techniques, many of which are performed by specialized decision-support software.

4.2.2.1 *Rational models*

AHP has been extensively investigated and used in practically all applications connected to MCDM since its conception because of its simplicity, usability, and significant adaptability [39]. Decision-makers pay the most attention to AHP as the most popular MCDM technique because there is a wealth of literature on its use. So, it is crucial to comprehend the precise decision issues that AHP can handle [40]. The approach is predicated on the idea that assessments should be consistent, and it also springs from the idea that inconsistent evaluations tend to occur between options that seem to be of minimal relevance to the decision-making manager [41]. To decide which approach is effective for the calculation and to establish the right order of criteria, the study by Stofkova et al. [41] set out to examine and describe the AHP method as being necessary for strategic managerial decision-making. The research looks at several topics, including managers' perceptions of the AHP approach and the accuracy of computations. Talent was considered crucial by managers for making decisions in their managerial roles.

4.2.2.2 *Rational models*

DEA is based on linear programming and transforms several input and output metrics into a single, all-encompassing indicator of productive efficiency. Peer groups are identified, and a production frontier built on empirical data is used to achieve this. Each unit is assessed as a composite unit that is created by concatenating the evaluations of the other units in the peer group. DEA has now been used in numerous managerial settings [42]. The determinants influencing the managerial effectiveness of Malaysian insurers were identified using truncated regression analysis in the research by Nourani et al. [43]. The DEA is used to calculate overall and divisional efficiency. The decomposition analysis demonstrates that the observed inefficiencies are brought on by the division of investment capabilities. The regression outcomes show that factors affecting divisional and overall efficiencies have different effects. According to this study, financial liberalization is a way to increase managerial effectiveness.

4.2.2.3 *Rational models*

A mathematical formalism and tools for representing and evaluating data are provided by rough sets. The theory appeals to practitioners because of several distinctive characteristics. Simple, beautiful, and versatile all describe the rough set. It has been used successfully in a variety of contexts [44]. The study by Do Couto and Gomes [45] sought to pinpoint the leaders who exhibit a strategic alignment with the standards established by a firm. The dominance principle is applied (i.e., the Dominance based Rough Set Approach). By employing a Dominance-based Rough Set Method, it is possible to deduce decision-making guidelines and spot changes that go against that principle. The primary benefit of employing these procedures (i.e., Dominance-based Rough Set and Rough Set) for an organization is providing the organizational

4.2.2.4 *Rational models*

TOPSIS is a helpful method for solving real-world multi-attribute decision-making or MCDM problems [46]. The fundamental tenet of TOPSIS is rather simple. It is based on the idea of a displaced optimal point from which a reasonable compromise is reached with the least amount of travel time [47]. In the work of AlKassem and AlKabi [48], TOPSIS is used to optimize decision-making while considering a variety of criteria. The decision criteria are evaluated by a thorough investigation. The consequences of this research aid in the development of an algorithm that communicates the practical outcomes of this study to the machine and the energy market aggregator for an energy management scheduling system.

4.2.2.5 *Rational models*

Table 2. Different types of MCDM method

Method	Definition	Developer	Number of articles (Scopus)	Main field included
AHP	A methodical approach based on psychology and mathematics for organizing and understanding complex problems.	Saaty [39]	30599	Engineering: 13,679 articles
DEA	A nonparametric approach for estimating production boundaries in operations research and economics.	Charnes, Cooper and Rhodes [51]	22994	Business, Management and Accounting: 6,729 articles
Rough set	A formal approximation of a crisp set using two sets that represent the bottom and higher approximations of the original set.	Pawlak [52]	22645	Computer Science: 16,560 articles
TOPSIS	Based on the core tenet that the closest answer to the positive-ideal solution is the best one.	Hwang and Yoon [53]	15164	Engineering: 7,045 articles
GRA	A procedure for calculating the degree of gray relations and figuring out how much the system's primary behavior contributes to the overall picture or how much the system factors impact one another.	Ju-long [54]	7252	Engineering: 4,018 articles
Goal programming	A subset of MCDA and multi-objective optimization.	Charnes and Cooper [55]	5473	Engineering: 2,204 articles
ANP	An expanded version of the MCDA tool, the AHP.	Saaty [56]	3180	Engineering: 1,375 articles
VIKOR method	Optimization for many criteria and a compromise solution.	Opricovic [57]	2724	Engineering: 1,212 articles
PROMETHEE (Outranking)	Method of preference ranking organization for evaluation of enrichment.	Brans [58]	2554	Engineering: 978 articles
ELECTRE (Outranking)	Elimination and choice, which express reality, form a family of decision support techniques whose distinctive feature is the partial aggregation according to the creation of relations of performance comparisons for each pair of options.	Roy [59]	1887	Computer Science: 786 articles
Value engineering/ analysis	Reviewing current or new products throughout the design stage to lower costs and improve functionality to boost the product's value.	Miles [60]	1552	Engineering: 852 articles
Best worst method	To compare a group of options to a set of criteria for making a selection.	Rezaei [61]	1310	Engineering: 569 articles
Multi-attribute utility theory	To determine a conjoint measure of the utility (attractiveness) of each result from a collection of options.	von Winterfeldt and Fischer [62]	828	Engineering: 394 articles
Dominance-based rough set approach	Rough set theory expansion for MCDA.	Greco, Matarazzo and Słowiński [63]	430	Computer Science: 332 articles
Evidential reasoning approach	A general method for dealing with problems that have both qualitative and quantitative requirements under a variety of uncertain conditions, such as ignorance and chance.	Dempster [64] Shafer [65]	422	Engineering: 240 articles
Evaluation Based on Distance from Average Solution	The distances in the positive and negative directions are calculated separately from the average solution and by the selected criteria, whether they are beneficial or not.	Keshavarz Ghorabaee [66]	240	Computer Science: 111 articles
Weighted sum model	Assessing several options in light of various choice criteria.	Fishburn [67]	237	Computer Science: 102 articles
Stochastic Multicriteria Acceptability Analysis	An MCDM approach to situations involving missing or insufficient information	Lahdelma, Hokkanen and Salminen [68]	223	Computer Science: 88 articles
Decision Expert	A qualitative version of the MCDA approach.	Sol HG [69]	213	Computer Science: 99 articles

Table 2. (cont.)

Method	Definition	Developer	Number of articles (Scopus)	Main field included
Multi-attribute value theory	To explain how a decision maker balances their values between two or more goals and related criteria	Fishburn [70] and Keeney and Raiffa [71]	172	Computer Science: 66 articles
Simple Multi-Attribute Rating Technique	A procedure for carrying out MCDA where the evaluation and selection of the most suitable project alternative, among several alternatives, is based on a list of pertinent criteria.	Edwards [72, 73]	140	Engineering: 46 articles
Measuring Attractiveness by a categorical Based Evaluation Technique	An MCDM technique that compares choices against several criteria	Bana e Costa and Vansnick [74]	108	Business, Management and Accounting: 40 articles
Choosing By Advantages	A technique for making decisions in groups that enables team members to decide in a way that maximizes value and produces the greatest results for all parties involved	Suhr [75]	85	Engineering: 78 articles
Weighted product model	It is comparable to the model of weighted sums. The primary distinction is that multiplication is used as the primary mathematical operation rather than addition.	Bridgman [76]	82	Computer Science: 36 articles
Characteristic objects method	Delivering consistent object evaluations that are not impacted by the addition of new objects to the initial object collection.	Sałabun [77]	36	Computer Science: 31 articles
Ordinal Priority Approach	An MCDA approach that supports resolving preference-based group decision-making issues.	Ataei [78]	30	Computer Science: 14 articles
Superiority and inferiority ranking method	A model for MCDM that can work with actual data and offers the system user six different preference structures.	Xu [79]	22	Computer Science: 12 articles
Disaggregation-Aggregation Approaches	To exmaine the Decision Maker's actions and cognitive style.	Rogers [80]	19	Decision Sciences: 13 articles
Potentially All Pairwise Rankings of all possible Alternatives	A pairwise comparison-based MCDA method	Hansen and Ombler [81]	19	Medicine: 6 articles
Brown-Gibson model	Serving as a guide for choosing a leader	Brown and Gibson [82]	12	Computer Science: 6 articles
New Approach to Appraisal	Constructed on the known cost-benefit analysis and environmental impact evaluation methodologies for evaluating transportation projects and proposals.	Department for Transport, Environment and the Regions [83]	7	Social Sciences: 6 articles
Multi-Attribute Global Inference of Quality	According to the assignment of ratings using rank order centroids and the hierarchical breakdown of comparative attributes.	McCaffrey [84]	6	Engineering: 4 articles
Stratified Multi Criteria Decision Making	An MCDM approach incorporates uncertainty into the decision-making process.	Asadabadi [85]	6	Computer Science: 3 articles
Nonstructural Fuzzy Decision Support System	Applied to make the MODM process easier.	Tam et al. [86]	3	Business, Management and Accounting: 2 articles
Aggregated Indices Randomization Method	A version of a well-known aggregated indices method aimed at complicated objects exposed to multi-criteria evaluation under uncertainty.	Aleksey Krylov [87]	2	Engineering& Computer Science: 2 articles
Conjoint Value Hierarchy	The development of a performance appraisal system for external disclosure that can withstand scrutiny from outsiders	Kourie [88]	1	Business, Management and Accounting & Social Sciences: 1 article

Under an ambiguous research system model, inadequate data, and unclear operation state, grey relational analysis (GRA) is utilized to apply relational relevant analysis, decision-making, prediction, and model establishment of a system [49]. In this work, Ruan and Yan [50] looked at MADM issues to assess the firm financial management. The enterprise's financial management was assessed using an extension of the GRA paradigm. According to the classic concepts of GRA, the relational degree of each alternative, the positive ideal solution, and the negative ideal solution is used to identify the optimal alternative(s). Its foundation is the premise that the best option should be the most closely related to the positive ideal solution and, conversely, the least related to the negative ideal solution.

5. Conclusion

This article provides a general description of decision-making with a managerial perspective to explain what it is, what sorts of choices are formed, and how they are applied in various fields, covering computers, management, business, psychology, etc. In this paper, the concept of decision-making and the importance of the decision-making process have been clarified. Also, the decision-making process and factors that may be involved in the decision-making process are recognized. Then, the most common decision-making model types are listed considering different aspects to categorize them. The decision-making types can be divided into single-criterion and MCDM methods. On the other hand, the way decisions are made in the process can be in an individual or a group decision-making method. The rationality degree of the process also is an important factor when a decision-making problem is defined. Understanding the cognitive biases that can influence decision-making is essential for enhancing the quality of decisions as a whole. By recognizing and minimizing these biases, decision-makers can make more objective and rational decisions. Moreover, the integration of advanced technologies, such as artificial intelligence and machine learning, can improve decision-making processes by providing data-driven insights and predictive analytics, thereby enabling organizations to make more informed and effective decisions. Future studies may focus on evaluating each of the MCDM approaches, tools, and updated versions, as well as their benefits and drawbacks, and their applications.

Author contributions

Conceptualization, Hamed Taherdoost; methodology, Hamed Taherdoost, Mitra Madanchian; formal analysis, Hamed Taherdoost; resources, Mitra Madanchian; writing-original draft preparation, Mitra Madanchian; writing-review and editing, Hamed Taherdoost; visualization, Mitra Madanchian, Hamed Taherdoost; supervision, Hamed Taherdoost. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no competing financial interest.

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