Analytic Hierarchy Process Model

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ABSTRACT:

A powerful instrument for making decisions, the Analytic Hierarchy Process (AHP) enables complicated and multi-criteria decision-making procedures. Thomas Saaty created the AHP model in the 1970s, and it has since been well-known and used in a variety of industries, including management, engineering, finance, and environmental planning. An overview of the Analytic Hierarchy Process model, its fundamental ideas, and its importance in helping decision-makers tackle complicated issues are given in this abstract. The AHP model, at its heart, uses an organized and methodical approach to deal with situations of decision-making that entail several criteria and choices. The building of a decision hierarchy is the first important stage in the decision-making process in the AHP model. The hierarchy in this structure indicates the primary aim, the criteria, the sub-criteria, and the options. The AHP model then makes use of pairwise comparisons so that decision-makers may determine the relative preference or relevance of various criteria and alternatives in respect to the primary goal. The quantification of subjective judgements is made possible by the use of numerical values to represent these comparisons. The relative weights of the criteria and alternatives are then calculated using a mathematical technique to synthesise the pairwise comparison data. The AHP model has a number of important benefits, one of which is its capacity to handle both quantitative and qualitative data, making it a flexible tool for a variety of decision-making situations. The AHP model further offers a consistency check method to guarantee the accuracy of the decision-makers' assessments throughout the pairwise comparisons, boosting the robustness of the outcome.

KEYWORDS:

Criteria, Decision, Hierarchy, Management, Paradigms.

I. INTRODUCTION

Since its origin by Thomas Saaty in the 1970s, the Analytic Hierarchy Process (AHP) is a well-known decision-making process that has garnered wide-spread acceptance and implementation in several fields. It offers a disciplined and methodical approach to solving complicated decision-making issues including a variety of criteria and options. The AHP model has been widely used in a variety of industries, including management, engineering, finance, and environmental planning. We will examine the foundational ideas and significant elements of the Analytic Hierarchy Process model in this introduction. We'll look into the inspiration for its creation, the principles at work, and the importance of it for assisting decision-makers in tackling difficult and complicated issues. The AHP model's primary goal is to assist decision-makers in circumstances where they must make decisions based on several, often competing factors. This might include anything from picking the finest investment project to selecting the best source for a crucial component. Making a wise and educated choice in these situations becomes crucial, and the AHP model offers a thorough framework to do this[1], [2].

The decision issue is first organized by the AHP model as a hierarchical representation, with the primary aim at the top level and a series of criteria that help achieve that purpose below. Sub-criteria may be added underneath the main criterion to collect more specific information and dependencies. The alternatives or choices up for evaluation are finally positioned at the base of the hierarchy. Then, decision-makers do pairwise comparisons to determine the relative preference or relevance of various criteria and options in relation to the primary goal. Decision-makers convey the relative superiority or

inferiority of one element over another using numerical scales in these pairwise comparisons, which require a subjective judgement process. The AHP approach makes sure that throughout the comparison process, decision-makers take into account both the advantages and disadvantages of the criteria and alternatives. The pairwise comparison data must be synthesized using mathematical techniques in the next stage of the AHP model. The relative weights of the criteria and options, which indicate their respective contributions to accomplishing the primary goal, are decided via this synthesis process. For the pairwise comparisons, the AHP model includes a consistency check method to guarantee the accuracy of decision-makers' assessments. The AHP model's capacity to handle both quantitative and qualitative data is one of its key advantages. Due to its adaptability, it may be used in a variety of decision-making scenarios by allowing decision-makers to take into account different sorts of information[3], [4].

In this introduction, we also emphasize the role played by the AHP model in encouraging decision-makers' ability to communicate clearly, increase transparency, and generate agreement. The AHP model allows stakeholders to obtain a better grasp of the decision-making process and supports cooperation in arriving at well-founded judgements by offering a systematic and rigorous framework for decision-making. The Analytic Hierarchy Process (AHP) model is a useful and adaptable technique for making decisions. Choice-makers may traverse complicated choice issues methodically thanks to the synthesis process, pairwise comparisons, and hierarchical structure of this system. The AHP model has real-world applications, and as we go more into the specifics, we will examine these applications as well as the model's advantages, disadvantages, and current research projects to improve its applicability and influence in various decision-making situations[5], [6].

II.   DISCUSSION

The decision science, business, and engineering sectors have all conducted extensive study on the Analytic Hierarchy Process (AHP) paradigm. Its distinct method of decision-making, which incorporates pairwise comparisons and hierarchical architecture, has inspired several discussions and investigations on its advantages, disadvantages, and potential uses. In this talk, we examine some of the salient AHP model-related topics:The analytical hierarchy process (AHP) is a technique for ranking options in order to simplify decision-making. The AHP, created by Thomas L. Saaty in the 1970s, gives the decision-maker a way to divide a complicated issue into a hierarchy of levels. Then, using a pairwise comparison technique, the decision-maker may rank different aspects within any given level. Because AHP has broad appeal and has been utilised widely in a number of administrative decision-making scenarios, it is a pertinent subject within this encyclopaedia.This post gives a summary of the general AHP method, goes through some supporting ideas, addresses some objections, and goes over several management applications[7], [8].

Fundamentals

Goals, criteria, and alternatives are only a few examples of the hierarchical levels that make up the analytical hierarchy process (AHP). Each entity on a level is examined by the manager(s) at each level across all possible pairings for the subordinate level. For instance, if choosing a vehicle to buy was the objective, considering the automobile's fuel efficiency may be one of the criteria. Each automobile would be compared to all other alternative cars in terms of that specific criteria in order to establish a priority of cars for a given criterion. In this scenario, a midsize sport utility vehicle (25 mpg) would not be preferred over a hybrid sedan (40 mpg). This would be done again for every criterion, including storage capacity, cost, maintenance requirements, and style. Then, every criterion would be compared to every other criterion. The range of choices choice of automobiles will have been prioritised in accordance with the criteria after all comparisons have been done and the rating and ranking finished. The general method through which the AHP is used in a decision-making setting is as follows. Key details regarding the choice dilemma are elicited using the basic framework described by AHP as follows:

1. Clearly state the issue at hand.

2. Create a hierarchy for the issue in question. Objectives at the top, criteria at the next level, and options at the lowest level can make up a simple AHP hierarchy. There may be more levels or fewer.

3. Based on this hierarchy, a set of pairwise comparisons is created such that n [n-1]/2 relative scale judgements may be made for each level of the hierarchy. For instance, if two goods, A and B, are being compared, the decision-maker might be questioned on which part is preferable, more significant, etc? The decision maker would next specify the degree of that relationship's strength: equal, moderate, strong, very strong, or extreme (and the corresponding absolute numbers are assigned: A may be given the number 3 to denote that it is three times more significant than B, for instance, if A is thought to be considerably more essential than B. In contrast, B (the reciprocal) is just a third as significant as A. We do pairwise comparisons at every level of the hierarchy.

A solution approach is utilised to determine the primary eigenvalues for each item at a certain level of the hierarchy after pairwise comparison judgements have been made. The relative weights that were given to each item are represented by these eigenvalues[9], [10]. In order to establish the most favoured option based on the decision-maker's assessments from the pairwise comparisons, the relative weights may be merged across the different levels for example, decision criteria. The consistency index, which assesses the coherence of judgements as shown by the frequency of intransivities, is another factor that may be taken into account using AHP. The following set of judgements would show such a discrepancy: The order of preference is A over B, B over C, and Cover A. Several strategies may be employed with this consistency index: It may be used to assess the consistency of a certain collection of judgements or to provide the decision-maker feedback to reassess their erroneous conclusions.

This hypothesis is supported by a number of ideas, including: The decision problem can be represented as a hierarchy; people can only effectively consider a certain number of items at once; at a certain level of difference, people can distinguish differences in stimuli between two items; and the judged relationships between items can be expressed as ratio scales. As a result, a derived scale will reveal a closest integer approximation of the ratio between the compared values, clustering and pivoting can extend the arbitrary scale, the weights are insensitive to minor changes in judgements under some circumstances, the tangibility of the criteria will determine the solution method (top-down or bottom-up), and the synthesis is additive in nature.

The fact that the AHP suffers rank reversal when alternatives are added or deleted was one of the main critiques levelled against it. This has been handled in a number of ways, one of which is to point out that the choice criteria rely on the alternatives. As a result, when new alternatives are considered or eliminated, the criteria and judgements must change as a result. Other critiques include issues with incomplete hierarchies, inconsistent evaluations of paired comparisons, and the specific solution approach for determining relative weights. Despite these critiques, AHP is praised for its clarity and capacity to make complicated decision-making issues simple has seen widespread use across various corporate areas such as logistics, manufacturing, marketing, and strategy and across many domains including the private, public, and nonprofit sectors. Additionally, AHP has been combined with other approaches, including data envelopment analysis, quality function deployment, and SWOT (strengths, weaknesses, opportunities, and threats) analysis. AHP has been used in several management contexts and applications throughout the public, commercial, and not-for-profit sectors. Agriculture, building, manufacturing, transportation, financial services, retail commerce, services, and education are just a few of the industries that have employed it.

The Connection between AHP and Six Sigma

AHP is a distinct method. It is not included in the traditional Six Sigma technique. It was really created several years after the Six Sigma technique. However, six sigma projects have found it to be widely applicable. AHP is used by managers to give factors numerical weights. These criteria may be utilized by consumers when evaluating a product or by management when assessing potential solutions.

Analytical and Sociological Paradigms

Young British academics Gibson Burrell and Gareth Morgan pondered the discordance that characterized the discipline of sociology in the second part of the 20th century in the 1970s.The philosophical traditions that impacted diverse schools of thinking were examined in their 1979 book Sociological Paradigms and Organizational Analysis.

Philosophy and Paradigms

Burrell and Morgan made the argument that theories of organisations reflect assumptions that are often implicit and taken for granted by theorists and others who are inspired by their theorising in the language of philosophy. These suppositions have notWhether 'reality' is a given 'out there' in the universe, or the creation of one's mind, is a question of ontological character, which means that they involve the substance of phenomena and reality. In addition, they represent attitudes about knowledge, including what it is, how it is acquired, and if and how it is determined to be "true." The authors contend that there are underlying presumptions about how people interact with society, such as whether people are socially conditioned to become its members or if they have significant agency to affect social change. Finally, Burrell and Morgan propose that one's views on ontology, epistemology, and human nature influence methodology, or the approach one should use while looking at social phenomena in order to get knowledge.

Four paradigms or intellectual traditions were provided by Burrell and Morgan. Before going into detail about each paradigm, it's essential to note that Thomas M. Kuhn's early work in discussions of the physical sciences used the term "paradigm" in a way that is different from how it is used here in the context of sociology and organisations theory. According to Kuhn, a paradigm of "normal science" takes hold despite its failure to fully explain any given phenomenon, as Norman Jackson and Pippa Carter have shown in detail.As anomalies that cannot be explained by the prevailing paradigm emerge over time, new theories and paradigms are developed. If these new paradigms are effective, they will eventually replace or transcend the (earlier) dominant paradigm and become the new standard for science. Accordingly, there is always a dominant paradigm in the Kuhnian approach, albeit dominance switches from one paradigm to another as new information is acquired. Instead, Burrell and Morgan show their four paradigms as existing concurrently and in conflict with one another. In spite of the book's title, a significant portion of their discussion of the paradigms in 1979 focused on the social rather than the organizational level of analysis. Over the next several decades, some implications for organisations would emerge, most notably in critical management studies.

The Four Paradigms

As can be seen in Figure 1, the horizontal dimension of the model alludes to various interpretations of managerial reality as intrinsically subjective and reliant on the viewpoint of the person, as opposed to consisting of physical parts that are connected in predictable, regular patterns. The model's vertical component relates to several management "focus" hypotheses, such as societal control, order, unity, and integration, as opposed to social tensions, conflict, inequality, and emancipation.The presumption that there is an objective reality that is apart from the participant and spectator is reflected in the aforementioned prevailing functionalist paradigm. The rules of normal science, which were formed from the natural sciences, should be followed in social science. These rules call for a researcher to have had formal training in the scientific method and to make an effort to pursue knowledge in a way that is uninfluenced by personal beliefs. Functionalism holds that society may evolve and advance by using a problem-solving strategy and finding solutions that aim to improve the status quo rather than change it. It emphasizes how information gained from a specific research may often be used or generalised.
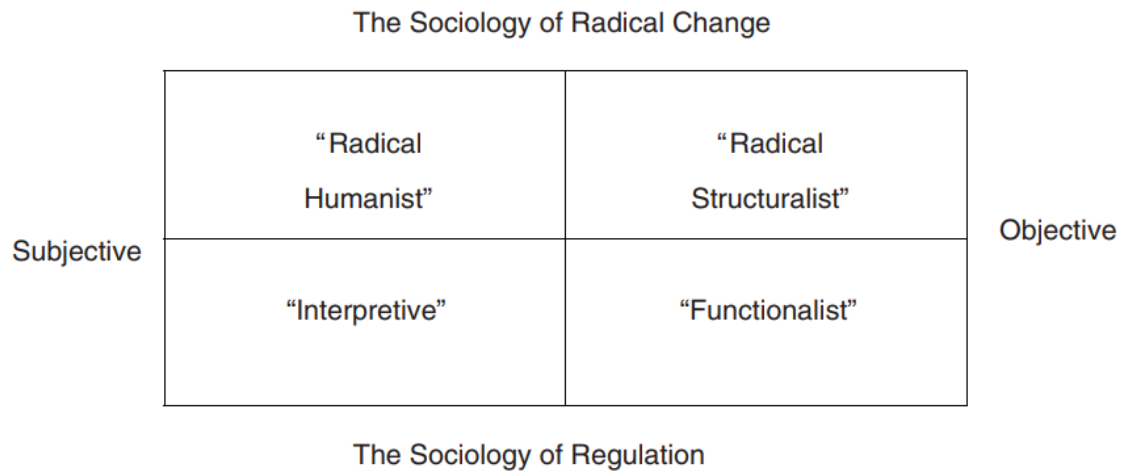
The Sociology of Radical Change

"Radical Humanist"	"Radical Structuralist"
"Interpretive"	"Functionalist"

Subjective — Objective

The Sociology of Regulation

Figure 1: Four Paradigms for the Analysis of Social Theory[sagepub].

To other circumstances. Depending on how knowledge is applied to different settings and how new information is developed, the social world is seen to be either certain or predictable. The pervasive contingency approach to organisations serves as an example of the functionalist worldview. According to the findings of earlier research, the "best way" for a given organisation to be managed and grow in efficiency and effectiveness is dependent on elements like its size, age, and technology.The second interpretative paradigm emphasises regulating or maintaining the status quo, much as functionalism does, although it does it mostly by default rather than on purpose. The subjectivity of human experience is heavily stressed. As understanding and meaning of the social world can only be attained at the level of subjective experience, the emphasis is placed on understanding and meaning from the perspective of involved participants, negating the legitimacy and relevance of functionalism's notions of generalizability and predictability.

In fact, the interpretative paradigm contends that reality is socially produced or enacted by participants rather than experienced as a subjective perception of an objective reality. The interpretative paradigm, according to Morgan's perspective on paradigms from 1984, "suggests that the world we live in is much more of our own making than we are usually prepared to recognize. The ethnographic, participant-observer methodology of John Van Maanen, who once took part in a police training programme in order to comprehend the socialisation process of new police officers and acquire insight into their attitude towards their line of work, serves as an example of interpretive research.

The third paradigm put out by Burrell and Morgan is radical humanism, which contrasts with functionalism by advocating drastic change to the current quo while also being subjective. Human awareness, as well as the alienation and feeling of helplessness that come from being ingrained in social structure (such as organisations), are stressed by radical humanists. The Frankfurt Critical School of Philosophy or its critical theory, most notably that of Jürgen Habermas, are linked to it together with the literature of the young Karl Marx. Knowledge is never neutral, but rather serves human goals, according to Habermas. Radical humanism holds that only by overcoming taught inactivity and achieving radical social change can the human spirit be freed and human potential realised.

John Mingers promoted management education as presenting managing as a broad, important activity that is both "done by all" and "done to all," reflecting the radical humanist paradigm, and that learning should be viewed as the process of one's self-development related to real-life struggles.The latter writings of Karl Marx serve as a representation of the fourth paradigm of radical structuralism. It emphasises power interactions from an objective, realist standpoint that is comparable to functionalism and is dedicated to liberation from current society power systems. In contrast to radical humanism, radical structuralism is more concerned with the capacity to create mechanisms that may disclose and alter the "deep" social structure and the current order of power than it is with the liberation of the human soul. Margaret Blair has argued that knowledge-age employees "own" a significant portion of the company's intellectual capital but are not fairly paid for their efforts, which is similar to Marx's radical structuralist view of workers. Contrary to Marx, Blair's response to workers' perceptions of unfairness

preserves a capitalist framework; her "mediating hierarchy approach" promotes giving workers a role in running the company and advocating for their interests via active employee ownership. By promoting radical change in social practise, radical structuralism openly promotes revolutionary transformation in organisations and governments, which are tools of dominance. Organisational power structures and social divides at work are reflections of the larger society structure.social research under functionalism focuses on recording and codifying social reality; within interpretism, it considers how social reality is constructed; within radical humanism, it critiques reality; and within radical structuralism, it confronts social reality.

Contribution of Sociological Paradigms and Organizational Analysis

The field of management is a wide, applied social science that draws from and uses a variety of fundamental and applied social science disciplines. But the fundamental social science for the study of management is sociology, namely the sociology of organisations. a large portion of the conception andCulture, roles, conventions, and power are all aspects of management language that are influenced by sociological theories of organisations.Later in the 20th century, sociology underwent significant change. For many years, Talcott Parsons and his followers commonly referred to as the structuralists ruled the field of sociology. According to Parsonian sociology, power, culture, roles, and social norms all play a part in preserving the status quo.

How social order is not omnipotent but rather is in conflict with the causes of disorder and how social change might happen are concepts that Parsonian sociology did not address. In Parsons' works, there was little to no acknowledgment of human agency or the capacity for responding to imposed structure and creating change, which led British sociologist Anthony Giddens to refer to Parsons's view of people as "social dopes." Giddens's formulation of structuration theory, which eventually supplanted Parsonian sociology, offered an intellectual foundation for comprehending how society is truly both self-perpetuating and capable of changing via human activity.However, Parsonian sociology has problems that went beyond its failure to account for social change. The paradigm of normal science produced in the physical sciences by Newton and others was undoubtedly recognised as adequate for the social sciences by Parsonian sociology, which reflected the American dominance of sociology. Other sociology researchers, notably those in Europe, were constructing new theories by partially reexamining the work of Marx and others on liberation and domination. These scientists were working far beyond the bounds of conventional science. Given the context-specific character of organisational life and human existence, several academics questioned the generalizability or applicability of management study findings.

In 1979, Burrell and Morgan joined the fight. Their work Sociological Paradigms and Organisational Analysis made a superficial contribution by creating a classification system for sociological paradigms. Although it is not just another management theory, Burrell and Morgan's work is a successful effort at the challenging intellectual challenge of building metatheory, or producing theory about theorising, thus to consider it superficially would be a tremendous injustice.They were quite successful in their ambitious effort to widen management theory by exposing a number of unconventional, marginalised ideas from the periphery to an audience that was previously ignorant of the perspectives. Since then, many significant study areas have developed on their ideas or used their reasoning in novel ways. The radical paradigms, for instance, form the cornerstone of the extensive and significant body of work known as critical management studies (CMS), which was started in the 1990s by academics in the United Kingdom who applied critical theory to the field of management. CMS contests the idea that organisations serve as a vehicle for achieving logical, economically motivated objectives since this idea tends to see people both managers and nonmanagers as inert cogs in the organisational machine. CMS argues for a less dehumanising, less corrupt kind of management that emphasises the development and distribution of products and services that are beneficial to society and puts equal focus on the moral, political, and technical aspects of management. Ken Benson's dialectical theory of organisations and Sumantra Goshal's model of "bad" ideas are two more expansions of the heterodox paradigms.

Pluralism or Solo Acts, Harmony or Cacophony?

Sociological paradigms and organisational analysis have a paradoxical character. First, despite their excellent articulation of the four paradigms, Burrell and Morgan assert that interparadigmatic research is uncommon because it demands a researcher who can only inhabit one paradigm to undertake the apparently impossible effort of altering his or her paradigmatic assumptions. Burrell and Morgan, though, handled it fairly effectively on their own. Second, they presented the paradigms in a very impartial manner, suggesting that researchers may in fact attain a certain amount of objectivity. Third, they assert as "fact" that the paradigms are mutually incompatible and that, due to their incompatibilities, a synthesis of them is not feasible. It is an odd juxtaposition of paradigms when researchers who do not subscribe to the functionalist paradigm refer to a metatheoretical concept as reality.The book received both high acclaim and harsh criticism from a variety of scholars.

Among the criticisms were that the writers oversimplified and neglected to adequately consider the variety or schools of thought within each paradigm, that researchers may have a preference for more than one paradigm, and that the book's comparison of the two radical paradigms and its implications was its weakest point.thoughts on "antiorganization theory." The political and exploitative features of organisations are emphasised in both radical perspectives, and it is somewhatIt is difficult to distinguish the two of them in Burrell and Morgan's work. The focus of the most criticism and discussion, however, is on their insistent claim that the paradigms are mutually exclusive.

Despite the notion that paradigms are mutually exclusive, scholars have looked at the possibility of commensurability and have offered a variety of ideas. In defence of reciprocal exclusivity, Norman Jackson and Pippa Carter have voiced concern that efforts at comparability are ultimately assimilations of the heterodox paradigms into functionalism. Martin Parker and Gerard McHugh openly criticise a research that uses a cross-paradigmatic method, but they go on to indicate perhaps as a dig at the reviewed work that it is possible provided the paradigms' integrity is maintained. The paradigms can be connected or bridged by researchers who are positioned at points close to the centre of Figure 1, and diversity or pluralism in paradigms can be maintained despite the bridging, according to Gary Weaver and Dennis Gioia and Evelyn Pitre, who also hold this view. The paradigms do, however, have permeable boundaries. Marianne Lewis and Mikaela Kelemen have described a method for multiparadigm inquiry and contend that this approach, which is founded on pluralism and paradox, may provide fresh discoveries.

Importance

This encyclopedia contains several of the broad, all-encompassing typologies and classification systems that are found in management philosophy.Burrell and Morgan's paradigms are undoubtedly among the most thought-provoking and important of them. Their work brings much that has been profoundly ingrained as unquestionable truth to light. It makes us consider the nature of social reality specifically, how our education and life experiences shape the lens through which we see and understand social reality and it shapes our conception of epistemology, or what we consider to be knowledge of the social world.On the one hand, from a theoretical standpoint, Burrell and Morgan were promoting upcoming research that would prioritise the desire to significantly modify social structure in order to better the human condition. Nevertheless, despite all of the ensuing theorising, there are still many basic questions about our connection with the paradigms.

 A review of the book by Orion White in 1983 noted that exposing paradigmatic commitments helped enhance theory development. However, it's also likely that in certain instances, discovering our paradigmatic inclinations can make us protective and perhaps inflexible about them or even cause us to overthink ourselves and weaken us as management researchers, students, and practitioners. Whether and to what extent we are captives, citizens, squatters, converts, visitors, or tour guides of our paradigms are also up for debate.However, from an applied standpoint, the useful implications of heterodox research what working managers can "learn" from them to enhance their organisations and people's interactions with and within them are undeveloped. However, the same criticism might be levelled about traditional functionalist research. However, a number of implications from the three heterodox paradigms have

come to light that unquestionably have had a significant impact on both "orthodox" scholars and management practitioners.

These include the significance of subjective experience in shaping one's understanding of a phenomenon, how power and power imbalances shape societies and human experience, how teaching assumptions about human behavior in business programmerssuch as self-interest as a motivator in agency theory can be seen as legitimizing these assumptions, and how managerial action should be informed by critical reflection about assumptions and lived experiences. The realization that the corpus of knowledge known as management is founded on deeply ingrained beliefs and ideals as to what is proper and desirable is brought about by heterodox paradigms. The paradigms provide us the chance for businesses, especially corporations, to function as change agents with a focus on achieving greater social justice as one of their objectives.

III. CONCLUSION

The Analytic Hierarchy Process (AHP) model is a strong and adaptable method that is essential for making decisions and solving problems in a variety of fields. It is very useful in practical applications because it can organise complicated issues, simplify multi-criteria assessment, and combine subjective and objective aspects.Decision-makers may use the AHP model to acquire insights into the relative weights of various criteria and options, empowering them to make well-informed decisions. The hierarchical model aids in comprehending the interdependencies and connections between various choice issue components, resulting in a more thorough analysis.However, it is important to recognise the AHP model's shortcomings, including the subjectivity of pairwise comparisons, the difficulty of dealing with huge hierarchies, and the difficulty of quantifying intangible aspects. Researchers and practitioners are looking at ways to enhance consistency, sensitivity analysis, and the handling of interactions across criteria in order to solve these constraints.

The AHP model continues to be a useful tool for resource allocation, strategic planning, supplier selection, risk assessment, and diverse decision-making settings despite its shortcomings. Its openness and capacity to encourage stakeholder consensus play a role in successful decision-making and communication.To get the most out of the AHP model, decision-makers should combine rigorous analysis with their domain knowledge, take steps to lessen subjectivity and bias in judgements, and, where necessary, think about completing the AHP model with sensitivity analysis and other decision-making approaches.The Analytic Hierarchy Process model, which offers a systematic framework and mathematical foundation for making well-informed and reasonable judgements in both academic and practical contexts, continues to be a significant and prominent method in decision science overall. The area of management and decision-making will surely progress as a result of its continuing development and use.

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