Reaching consensus in group decision-making for collaborative agreement in business and academic environments

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Abstract

Effective decision-making often requires consensus among individuals with diverse backgrounds, goals, and perspectives. In business and academic settings, conflicting stakeholder priorities can complicate the selection of inclusive, ethical, and practical solutions. This research explores how structured decision-making tools, specifically the Analytic Hierarchy Process (AHP), can be used to evaluate competing criteria and support group consensus across two case studies. The first case examines the integration of Artificial Intelligence (AI) in the animation industry, where concerns around such criteria as job security, cost, and creative integrity must be balanced. The second case addresses the challenge of creating accessible educational resources in higher education, where institutions must navigate trade-offs involving such criteria as software compatibility, training, and student support, among others. We developed sets of decision-making criteria for each scenario based on stakeholder needs and perspectives. AHP was then used to construct hierarchical models to enable criteria-based comparisons, with the goal of supporting more equitable and data-driven decisions. Our findings contribute to ongoing research on multi-criteria decision analysis in collaborative contexts and demonstrate how structured consensus-building can promote innovation and inclusivity in complex, real-world environments.

1 Introduction

In both business and academic environments, decision-making often involves multiple stakeholders with diverse roles and experiences, who may hold conflicting perspectives on decision priorities. Stakeholders often differ in how they define success, weigh risks, or value outcomes, which can make consensus hard to reach. Managing these differences is essential for adopting new ideas, aligning organizational goals, and sustaining decisions over the long term. As stakeholder diversity grows, reaching agreement becomes even more challenging. Without a structured way to compare diverging perspectives or reduce cognitive bias, it becomes difficult to justify decisions while clearly evaluating trade-offs. In this context, Multi-Criteria Decision-Making (MCDM) methods are largely considered valuable tools.

Specifically, the Analytic Hierarchy Process (AHP) allows decision-makers to represent a complex problem through a hierarchy of elements and enabling quantitative comparisons through stakeholder input. By assigning weights to different factors and pairwise comparing them, this method allows for inclusive, balanced, and justifiable outcomes. The present research develops two real-world case problems, one from the business sector and one from the educational domain, applying AHP to guide collaborative agreement. We aim to evaluate how criteria are ranked under stakeholder judgments, identifying those that most strongly influence the final rankings within each case context.

This paper is organized as follows. Section 2 presents the literature review, Section 3 describes the methodology, Section 4 discusses the case studies, and Section 5 concludes the paper.

2 Literature Review

Decision-making models are increasingly applied to complex problem-solving contexts [1, 2]. Within this broad landscape, multi-criteria decision-making methods offer a structured process for evaluating multiple criteria and supporting transparent, data-informed choices [3]. Their relevance has been demonstrated across different domains. For example, Sun et al. [4] proposed the use of MCDM to operationalize ethical reasoning in Artificial Intelligence (AI) systems by integrating multiple ethical theories and treating ethical values as decision criteria in AI design and evaluation. Similarly, Correa et al. [5] applied MCDM methods to assess and select bias mitigation strategies in machine learning. By simultaneously considering fairness, accuracy, and robustness, their study demonstrated how MCDM can support ethical decision-making when addressing bias and discrimination in complex AI systems.

As decision contexts become more complex, they often involve multiple stakeholders whose perspectives must be integrated. Achieving group consensus among decision makers is therefore essential for the successful adoption of new solutions and ideas in business settings [6]. Stakeholders differ in what they consider important when incorporating a new idea, reflecting variations in professional background, experience, and training [7].

These differences enrich the planning process by incorporating diverse viewpoints, yet they also create challenges when no clear mechanism exists to structure discussion and reach agreement [8]. To address this need, the AHP has been widely adopted as a method for supporting consensus in complex decision-making processes [9]. As previously mentioned, AHP structures a problem into hierarchical levels and relies on pairwise comparisons to capture stakeholder judgments [7]. By organizing opinions into comparison matrices and calculating the relative priorities of elements, AHP balances competing interests in a systematic manner [9]. This hierarchical approach enables a detailed analysis of the core components of a problem and their interdependencies, facilitating transparent and consistent decisions [10]. The value of AHP is evident across various sectors.

In business strategy development, Riahi and Moharrampour [11] applied AHP to evaluate strategic management alternatives for the PARS household appliance company. Their analysis led to the selection of a cost leadership strategy to enhance market competitiveness, illustrating how AHP supports structured decision-making in dynamic markets. In the field of e-business, Lee and Kozar [12] used AHP to evaluate website quality by examining multiple qualitative and quantitative factors. They showed that the website with the highest AHP-based quality score also achieved the best financial performance, highlighting the method's capacity to link user preferences with business outcomes. In the animation industry, Jiang [13] demonstrated the adaptability of AHP in helping companies align their outputs with audience expectations and support informed managerial decisions. AHP has also been extensively applied in academic contexts. Feng et al. [14] employed AHP to quantify and prioritize classroom environment criteria based on students' perceived importance across several factors. Mahmoodi et al. [15] developed a hybrid model based on AHP to prioritize experiential learning strategies at Carleton University. In their study, AHP was used to compute the weights of evaluation criteria, enabling the structured integration of diverse stakeholder perspectives into strategic academic planning. The results showed that the use of AHP improved decision-making and strengthened the alignment between institutional goals and the priorities of students and faculty.

Based on the reviewed literature, the present research presents two cases, one in the animation industry and one in an academic environment, to illustrate how consensus can be achieved through the AHP when multiple stakeholders collaborate to determine the most important decision-making elements. The novelty of our work lies in its cross-sector examination of AHP as a consensus-building mechanism, providing a comparative perspective and analyzing how stakeholder priorities are structured in two distinct contexts. Furthermore, this study extends existing literature by identifying and validating key decision criteria across different domains.

3 Methodology

AHP is proposed to evaluate complex group decisions involving competing priorities by structuring criteria hierarchically and capturing stakeholder judgments through pairwise comparisons.

This methodology has been applied to two cases, via a consistent sequence of steps for systematic and comparable analysis.

- Defining the decision goal and scope for each case study.
- Identifying suitable stakeholders and grouping them according to the case study of interest (i.e., seven for the business case and four for the academic case). Stakeholder weights were assigned based on a structured evaluation of domain expertise, professional experience, and relevance to the specific decision context. Relative weights were normalized to sum to one, ensuring proportional influence in the aggregation process while maintaining methodological transparency.
- Building the hierarchy for each case, organizing the decision-making criteria required to achieve the defined goal.
- Collecting pairwise comparisons from each stakeholder by using the standard 9-points based AHP preference scale.
- Aggregating the pairwise comparison matrices obtained from each stakeholder into a single matrix for each case study, reflecting the overall group preference. This was done using the geometric mean of the individual judgments.
- Computing final weights using the Row Geometric Mean Method (RGMM). The geometric mean of each row of the aggregated comparison matrix was calculated and then normalized to obtain one consolidated ranking of criteria for each case study. This approach provides a consistent approximation of the principal right eigenvector and is widely adopted in group-AHP applications.
- Checking consistency to ensure reliability of comparisons by computing the Consistency Ratio (CR) and verifying compliance with the 10% threshold. When the CR exceeded this limit, stakeholders were invited to review their pairwise comparisons in structured follow-up sessions. Rather than modifying judgments algorithmically, revisions were made directly by contributors to preserve the authenticity of their perspectives while improving logical coherence.

Readers are encouraged to consult [16] for additional methodological details about AHP application. All calculations were performed in Python through a two-stage procedure. First, individual expert judgments were aggregated to produce a consolidated matrix, which was visualized alongside the individual matrices using heatmaps to enable clear comparison of influence patterns. After performing consistency checks, the second stage included the calculation of the final weights displayed through suitable bar charts. All individual matrices satisfied the acceptable consistency threshold ($CR < 0.10$) prior to aggregation.

4 Case Study

This section presents two case studies used to examine consensus-building through AHP across different decision-making contexts. The first business case focuses on the integration of AI in the entertainment and animation industry, while the second academic case addresses the development and distribution of accessible educational resources in higher education.

Given the exploratory nature of this research, the number of contributors to each case was intentionally limited to stakeholders with direct expertise or experience relevant to the related domain. While the sample size is appropriate for structured AHP applications, the findings should be interpreted as context-specific rather than statistically generalizable.

4.1 Business Case

For the business case study, the decision problem is aimed at selecting an approach for integrating AI into the entertainment and animation industry. Decisions surrounding AI adoption affect creative professionals, production workflows, and organizational sustainability, while raising concerns related to efficiency, cost, job security, and creative integrity. The following criteria have been analyzed and formalized for this study.

- **C_1 Training**. It measures the availability and effectiveness of training programs that enable workers to adapt to AI-assisted tools. Adequate training supports smoother technology adoption and helps ensure that employees can work alongside AI systems rather than be displaced by them.
- **C_2 Job security.** This criterion evaluates the perceived impact of AI integration on employment stability within the animation industry. Particularly, it reflects potential concerns regarding workforce displacement, role redefinition, and the long-term viability of creative professions.
- **C_3 Innovation.** This criterion assesses the extent to which AI technologies enable creative experimentation, new workflows, and novel forms of content production. Innovation captures AI's potential to expand artistic and technical capabilities rather than merely automate existing tasks.
- **C_4 Cost.** It evaluates aspects of financial feasibility, including development, implementation, and maintenance costs associated with AI systems. Cost influences whether AI solutions are accessible to smaller studios and independent creators, in addition to large production companies.
- **C_5 Integrity.** This criterion represents issues of ethical and creative integrity, including originality, authorship, and respect for artistic labor. The goal is to reflect stakeholder concern that AI adoption should not compromise creative authenticity or ethical standards within the industry.
- **C_6 Efficiency.** Measures improvements in production speed, workflow optimization, and resource utilization. Efficiency captures the operational benefits of AI integration that often motivate adoption in competitive production environments.

4.2 Academic Case

For the academic case study, the main goal of the decision problem is focused on promoting accessible educational resources by selecting an approach to create and distribute learning materials in higher education. Accessibility-focused decisions affect students with diverse needs, faculty workflow, and institutional support capacity. The criteria analyzed are reported as follows.

- **C_1 Compatibility.** It measures how well tools and strategies integrate with existing educational systems, platforms, and devices commonly used by students and educators.
- **C_2 Software quality and accessibility features.** This criterion Evaluates the quality, functionality, and built-in accessibility of the educational software (e.g., Zoom, Canvas).
- **C_3 Cost.** It assesses financial feasibility, including upfront investment, licensing fees, and hidden or ongoing costs.
- **C_4 Training.** This criterion measures the availability and quantity of training for educators and support staff.
- **C_5 Student support.** It considers the level of direct assistance available to students, such as help desks, tutorials, and peer-support programs, among other initiatives.
- **C_6 Awareness.** This criterion captures how well the institution promotes knowledge and understanding of accessible resources among students, educators, and staff.
- **C_7 Accommodations.** This criterion examines flexibility in meeting a wide range of individual needs, including accommodations for visual, auditory, and cognitive impairments.

4.3 Results and Discussion

For the business case, we interviewed seven individuals that either identify as film industry workers or consumers of film industry production. We elicited a pairwise-comparison matrix for each of them and attributed a weight to each of them on the basis of their experience in the field. In this direction, higher industry experience received higher weight while consumer participation received the lowest weight, ensuring that the final evaluation reflects informed industry judgment while still incorporating diverse perspectives in a structured and balanced way.

Similarly, for the academic case, we involved four contributors who provided pairwise comparison matrices, namely a subject-matter expert and three student researchers, assigning greater weight to the subject-matter expert due to their deeper theoretical knowledge and extensive research experience, which strengthen the rigor and validity of the evaluation, while the inclusion of student researchers adds value by contributing diverse viewpoints, critical engagement with current literature, and perspectives that reflect emerging academic thinking.

In both cases, judgments were aggregated across contributors using the weighted geometric mean approach and two aggregated matrices were obtained, one for each case. This process is illustrated in Figures 1, 2. Ensuring the consistency of input judgments was critical for the reliability of the results. Therefore, multiple structured brainstorming sessions were conducted with stakeholders until the required consistency levels were achieved, without altering their original perspectives.

In the business case, Expert 3 exerts the greatest influence on the aggregated matrix (24.39%), decisively shaping its overall structure. Experts 1 and 2 follow with equal and substantial contributions (18.29% each), while Experts 4, 5, and 7 provide moderate influence (12.2% each); in contrast, Expert 6 has a minimal effect (2.44%).

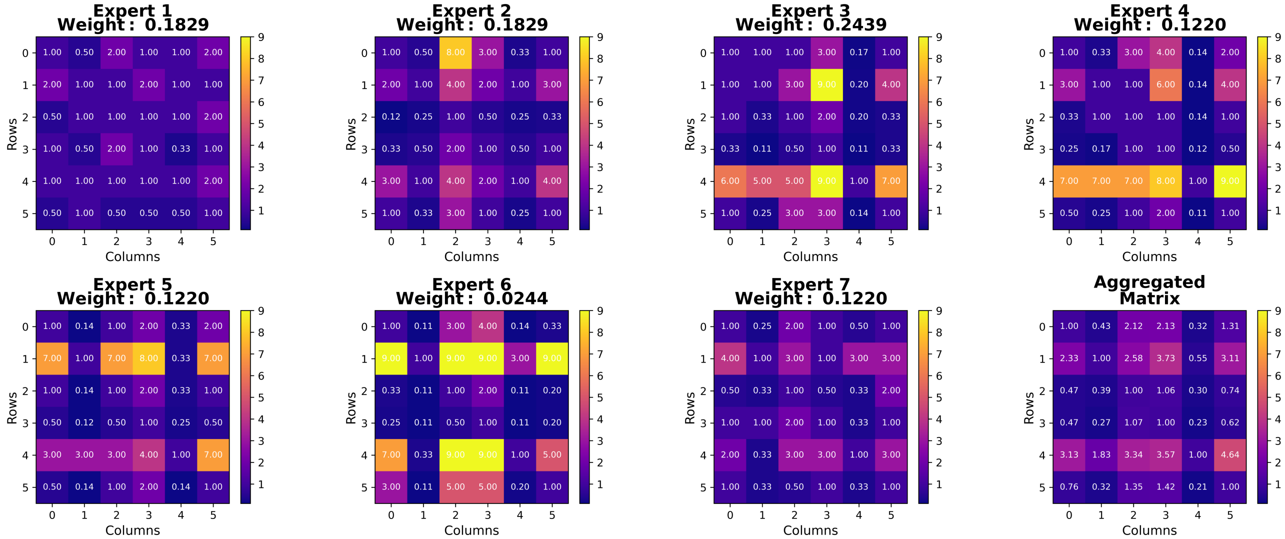

Figure 1. Pairwise comparison matrices, expert weights and aggregated matrix for the business case

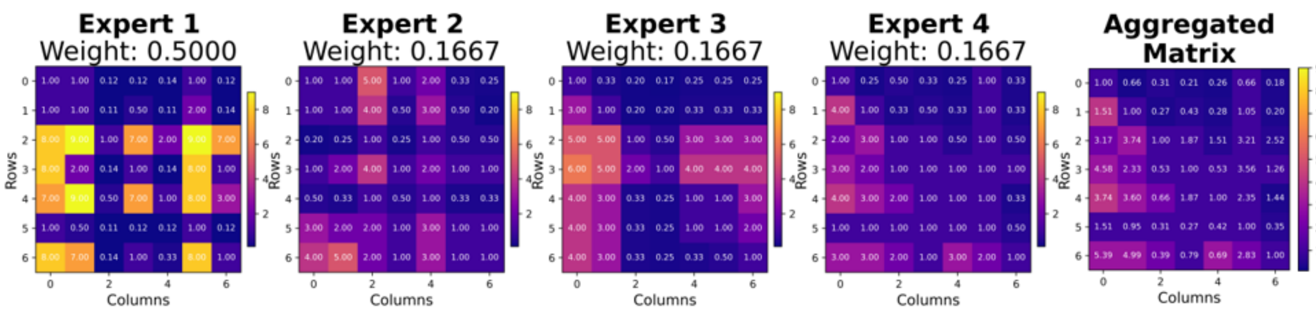

Figure 2. Pairwise comparison matrices, expert weights and aggregated matrix for the academic case

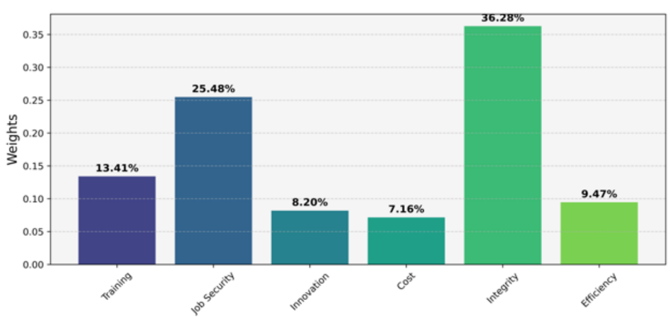

Figure 3. Business case results

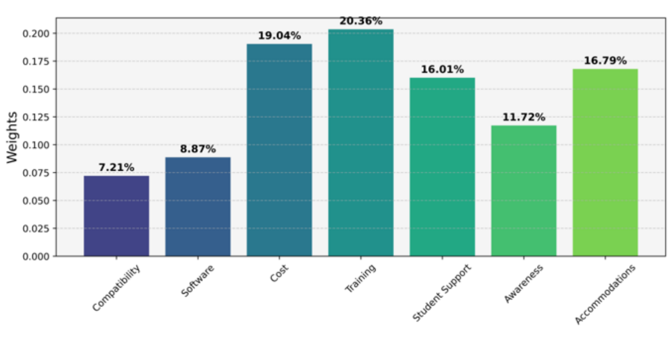

Figure 4. Academic case results

As illustrated in Figure 1, the final matrix is therefore largely driven by Expert 3's assessments, with the remaining experts contributing a stabilizing effect. The results shown in Figure 3 indicate that Integrity ranks highest (36.28%), highlighting the prominence of ethical considerations, followed by Job Security (25.48%), reflecting industry concerns regarding automation. Training and Efficiency receive moderate priority, whereas Cost and Innovation are comparatively less emphasized.

In the academic case, Expert 1 was assigned a 50% weight in recognition of their lived experience, academic background in computer science at both undergraduate and graduate levels, and professional role as an accessibility educator, while the remaining 50% was distributed equally among three undergraduate research interns specializing in accessibility in education, thereby balancing established expertise with emerging scholarly perspectives. The aggregated matrix showed in Figure 2 is consequently shaped primarily by Expert 1's assessments, with the interns contributing a moderating and complementary influence. The results reported in Figure 4 indicate that Training emerges as the leading criterion (approximately 20% of total priority), highlighting the importance of staff preparedness for effective accessibility implementation. Cost and Accommodations rank second and third, highlighting budgetary considerations and the practical delivery of support services as key factors. In contrast, Compatibility and Software receive lower weights.

5 Conclusions

This research highlights the importance of applying structured decision-making tools to address the complexities of group consensus in environments where diverse stakeholder perspectives must be considered. Through application of the AHP in two separate case studies, integration of AI in animation and the development of accessible learning materials in higher education settings, we demonstrated the way systematic evaluation of criteria can lead decision-making. In both cases, AHP enabled stakeholders to weigh trade-offs between conflicting priorities such as cost, integrity, equity, and accessibility within a transparent and replicable framework. Importantly, the process underscored the value of continuous feedback exchange with experts. As the number of criteria and the level of expertise increase, achieving consistency becomes more complex, making it essential to place stakeholders at the center of an iterative brainstorming until acceptable consistency levels are reached. At the same time, methodological rigor must not override practical relevance. The final outcomes must remain grounded in and reflective of stakeholders' authentic perspectives.

Rather than proposing a new decision-making method, this study contributes by demonstrating the cross-sector applicability of AHP as a structured consensus-building framework and by providing a transparent, reproducible computational implementation for matrix aggregation, consistency verification, and visualization. However, various limitations should be acknowledged. First, the reliance on a limited number of stakeholders may restrict the representativeness of perspectives. Second, the case studies are context-dependent and may not fully capture variability across different institutional or industrial environments. Third, the stakeholder weighting scheme, while structured, introduces an element of subjectivity inherent to expert-based decision models. Future research should expand the number and diversity of contributors and incorporate formal sensitivity analysis to test the robustness of the proposed framework.

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