

Challenges on Artificial Expert Acceptance in AHP Analysis*

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Abstract— Mirroring human specialists with artificial intelligence-based expertise presents new opportunities and threats for academic research and development. Despite their potential, the integration of artificial experts in multi-criteria decision-making remains limited, particularly in Analytic Hierarchy Process (AHP) applications. The goal of this study is to explore the artificial expert adoption challenges in AHP analysis and present the practicality of artificial experts in the analysis. To identify the challenges, a systematic literature review (SLR) was conducted. The results of the SLR presented 26 challenges that were categorized into five categories: ethical, legal, financial, technological, and societal. An AHP model was constructed based on the framework and evaluated using artificial expert judgments generated via a generative artificial intelligence (AI) tool (ChatGPT-4o). Findings reveal that ethical concerns, such as bias and misuse of technology, are the most critical barriers.

The main contribution of this study consists of the development of a structured framework of adoption challenges, demonstration of generative AI for expert judgment creation in AHP, and prioritization of challenges using an AI-assisted decision model. This study presents a novel proof-of-concept demonstrating the feasibility of using generative AI to simulate expert input within AHP analysis, while providing practical insights to support responsible and effective AI adoption in structured decision-making.

I. INTRODUCTION

The rising global interest in AI has impacted every aspect of everyday citizens, as well as multi-national businesses. While progress on AI is ongoing, the utilization of artificial experts is increasing to enhance analytical precision, automate complex assessments, and support decision-making across various domains. Artificial expertise refers to systems that emphasize the identification, encoding, and automatic use of knowledge relevant to a task using techniques from AI [1]. Fulbright and Walters [2] define synthetic expertise as “*the ability of an average person to achieve expert-level performance of working with and collaborating with artificial entities capable of high-level cognitive processing*”. Even though there is no consensus on the differences between artificial, virtual, or synthetic expert terms, in this study, the artificial expert term is selected as an umbrella term. Artificial expert refers to an AI-based system that emulates the decision-making and expertise of a human specialist in a given domain.

While artificial experts present promising opportunities for decision-making systems and research, the challenges that impact

their reliability and effectiveness are a significant factor. Bias, transparency, costs, scalability, misuse of technology, and accountability are some of the challenges that require attention. Ensuring artificial experts' accuracy and unbiased judgments is required for methodologies like the AHP, where prioritization depends on expert evaluations.

The goal of this study is to assess the literature on artificial expert challenges in AHP analysis and prioritize the challenges with the support of artificial experts. The significance of both establishing a framework on the challenges and using artificial experts for the AHP analysis can provide a different way for academic researchers to gather data. Even though the capacity and reliability of artificial expert assistance against human expertise is still an ongoing debate, the costs and time spent gathering expert opinions reduction is a significant motivator [3]. The AHP analysis is supported by artificial experts generated by generative AI for presenting the value of generative AI technologies in academic research.

The findings of this study can provide insight to researchers and various industries, as the ability to process vast amounts of information and generate structured expert opinions presents new opportunities for decision-makers across multiple disciplines. Even though there are numerous studies on AI-driven expert systems, there is limited number of research applications in AHP analysis. This study addresses this research gap by systematically evaluating the challenges of artificial experts' adoption in AHP decision-making and demonstrating the benefits of using artificial experts.

The primary contributions of this research are threefold. First, it presents a comprehensive framework of twenty-six adoption challenges, systematically identified through a thematic analysis of existing literature and categorized into five overarching dimensions: ethical, legal, financial, technological, and societal. Second, it introduces a novel methodology for generating artificial expert profiles using the ChatGPT-4o model, involving structured prompt design, refinement procedures, and contextual validation aligned with decision science practices. Third, it applies these AI-generated expert judgments within an AHP framework to perform pairwise comparisons and prioritize the identified challenges. This process serves as a proof-of-concept for the integration of generative AI both as a data generation tool and as an analytical agent within structured decision-support systems.

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Section II includes the related studies on artificial expert generation in AHP analysis. In section III, the outlines of the research methodology are described. Section IV is composed of the proposed research model and the identified challenges. In section V, the artificial expert generation process and AHP analysis results are described. Finally, in section VI, the conclusion of the research is summarized with insights and limitations.

II. RELATED STUDIES

Although the research on artificial expert generation and usage in multi-criteria decision-making methods is scarce, the adoption of AI-agents and large language models presents a need for further research on the subject.

A study conducted by [4] investigated the potential of ChatGPT as a multi-criteria decision-making tool in the context of supplier evaluation within a supply chain. The primary objective of the research was to assess whether expert judgments generated by ChatGPT could effectively substitute for those provided by human experts. Both human and artificial experts are evaluated separately in an AHP analysis. Findings revealed that the artificial experts' input was highly correlated with the human experts' results, which emphasized the accuracy of generated inputs. The results presented artificial expert generation as a viable, efficient, and practical application for AHP analysis, which can support traditional human expertise.

Another study examined the integration of AHP analysis with ChatGPT to develop an AI-driven decision support system within the cybersecurity domain [5]. The study uses generative AI on artificial expert generation, pairwise comparisons, and interpreting the results for establishing an automatic research method. The findings of the study indicate that AI-based decision-making closely aligns with expert-driven AHP models, which proves the reliability and effectiveness of AI in multi-criteria decision-making.

An AI-driven decision-making framework integrating AHP analysis with ChatGPT for supplier selection in the manufacturing sector is presented in [6]. The use of artificial expert inputs and automation of AHP analysis with ChatGPT presented time and cost reduction compared to traditional AHP. Another contribution of the study is to present a benchmark for artificial and human expert uses in AHP analysis. The findings presented similar results on both artificial and human expert judgements, which emphasizes the consistency and reliability of generative AI support on multi-criteria decision-making analysis.

In addition to domain-specific applications, several studies have examined broader challenges associated with AI adoption. One study [8] prioritized academic barriers using fuzzy evaluation methods, while another [9] investigated the obstacles to virtual assistant adoption in the retail sector through fuzzy AHP. Legal and ethical challenges in AI implementation within the UAE healthcare system were highlighted in [10]. Research in the education domain has produced a prioritized framework of AI adoption barriers using AHP [11], which has informed the methodological approach of the present study. Additionally, a

mixed-methods framework for identifying inhibitors to generative AI adoption in the service industry was proposed in [12].

Beyond AHP-specific literature, similar applications in other multi-criteria frameworks, such as fuzzy AHP in electric vehicle adoption [17] and barrier prioritization in offshore wind energy [18], demonstrate the growing relevance of combining decision science with AI-driven models.

This paper builds on these foundations by offering a structured framework of AI adoption barriers, generated and evaluated via artificial experts using ChatGPT-4o in an AHP model. It aims to bridge the gap between conceptual frameworks and operational AI-assisted decision-making.

III. RESEARCH METHODOLOGY

The methodology of this research consists of identifying the artificial expert adoption challenges in AHP with a SLR, establishing a challenge framework, and analysis of the established framework with an AHP analysis.

A. Systematic Literature Review

The rising research on generative AI within various domains presents new ways of data gathering, analysis, and interpretation. Even though the skepticism of AI used in academic research is a major barrier, newer tools and methods are being developed. The aim of this study is to explore the innovative uses of generative AI in the creation of artificial experts for academic research.

The SLR is planned and conducted on the guidelines established by [7]. The search string was established based on the scope of the research as ("artificial intelligence" OR "ai-based expert" OR "artificial expert" OR "virtual expert" OR "synthetic expert" OR "ai decision support") AND ("analytic hierarchy process" OR "AHP") AND ("adoption" OR "acceptance") AND (challenge" OR "barrier"). Scopus and Web of Science databases were searched with the established string. There were no exclusion criteria concerning date, language, and publication type. The initial search identified twenty-two studies. After conducting title, keyword, and abstract screening, followed by full-text analysis, five primary sources were selected for inclusion. To derive the categories for classifying artificial expert adoption challenges, an inductive thematic analysis was conducted based on the results of the SLR. The initial pool of challenges was extracted from the full texts of the five studies listed in Table I.

TABLE I. STUDIES ON ARTIFICIAL EXPERT ADOPTION CHALLENGES

No	Aim of the Study	Year	Ref.
1	Understanding the barriers to generative AI in the educational context.	2024	[8]
2	Exploring the factors on the adoption of virtual assistants in retail with fuzzy AHP.	2023	[9]
3	Ranking the challenges of AI adoption in healthcare in the UAE	2022	[10]
4	Evaluating the inhibiting and motivating factors on the adoption of AI-based teaching in India	2020	[11]
5	Exploring the challenges of adopting generative AI in the service industry	2024	[12]

TABLE II. AHP ARTIFICIAL EXPERTS PROFILE

No	Gender	Age	Education	Expertise	Exp.
1	Male	48	PhD in Artificial Intelligence (Stanford University)	AI fairness, transparency, and bias reduction	20
2	Female	52	PhD in Law & AI Governance (Harvard University)	AI accountability, compliance, and legal regulations	25
3	Male	40	MSc in Machine Learning (MIT)	AI scalability, technical compatibility, and system reliability	18
4	Female	45	PhD in Cybersecurity (University of Cambridge)	Cybersecurity risks, data privacy in AI systems	22
5	Male	50	PhD in Economics & Digital Innovation (Oxford University)	AI commercialization, return on investment (ROI), infrastructure costs	20
6	Female	42	PhD in Sociology & Technology (University of Toronto)	AI skepticism, resistance to change, and job displacement	17
7	Male	38	MBA in Digital Strategy & AI Adoption (INSEAD)	AI adoption strategy, digital literacy, AI training gaps	15
8	Female	47	PhD in AI Ethics (University of Barcelona)	AI accountability, fairness, and governance frameworks	19
9	Male	50	PhD in Computer Science (KAUST)	Cybersecurity threats, AI-driven fraud detection, and secure AI deployment	22
10	Male	45	PhD in AI and Business Strategy (Tsinghua University)	AI adoption strategies, automation in industries, and business process optimization	20
11	Female	42	PhD in Human-Computer Interaction (McGill University)	Technology adoption psychology, AI skepticism, and user-centered AI design	18
12	Male	48	PhD in AI & Urban Development (University of Cape Town)	AI integration in public services, digital divide issues, and smart urban planning	21
13	Female	46	PhD in Finance & AI (London School of Economics)	AI-driven financial forecasts, economic impact of AI, and commercialization strategies	20
14	Male	49	PhD in AI Law & Policy (National Law School of India)	AI policy frameworks, legal accountability, and cross-border AI regulations	23

Three domain experts in AI and decision science independently reviewed and coded these challenges. Through iterative discussions and consensus-building, the challenges were grouped into five overarching categories: Ethical, Legal, Financial, Technological, and Societal. These categories reflect recurring macro-themes found in the AI adoption literature and align with established conceptual frameworks, such as the Technology–Organization–Environment (TOE) model, ethical AI guidelines, and cross-sectoral adoption studies.

A total of 26 unique sub-challenges were identified. Each was mapped to one of the five categories based on conceptual alignment and the context of usage in the source studies, ensuring a coherent classification structure for the subsequent AHP analysis.

B. Artificial Expert Generation

Similar to [5], this study utilizes generative AI for expert creation is supported by ChatGPT-4o, consisting of design and refinement stages. The prompt design starts with defining the context and sharing the hierarchical research model. The prompt for artificial expert generation is “*You are an AI tasked with creating artificial expert profiles for an AHP (Analytic Hierarchy Process) evaluation on the adoption barriers of artificial experts. Each expert must have a realistic background, including name, profession, age, gender, education, experience, and expertise in a relevant field. Generate 14 diverse experts with the given attributes*”. The refinement stage consists of evaluating and, if required, changing the generated expert's attributes for suitability. The generated artificial experts are

given in Table II. The generation of individual expert judgements is established by sharing the article [13] on AHP analysis and prompting “*Generate the pairwise comparison matrices for each level and assign expert judgements values based on Saaty’s research on AHP*”.

C. Analytic Hierarchy Process Analysis

AHP analysis is a multi-criteria decision-making method used for alternative selection and prioritization, which was developed by [13]. The analysis consists of establishing the hierarchical model and analyzing pairwise comparisons. The identified challenges from the SLR are categorized with a hierarchical model for further analysis. The second part includes the generation of comparison matrices for evaluating the factor weights, local rank, and global ranks. The results provide significant challenges and their weights for further research.

The comparison matrix (A) is created according to the number of factors (n) in each category given by (1). The inputs of the comparison matrix are obtained from a nine-point scale [13].

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \quad (1)$$

where $a_{ij} = \frac{1}{a_{ji}}$ for $i, j = 1, \dots, n$.

The Consistency Ratio (CR) of the matrix A is calculated by following the steps given below.

Step 1. The weight of each factor (ω_i) is evaluated as

$$\omega_i = \sqrt[n]{a_{i1}a_{i2} \dots a_{in}} \quad i = 1, \dots, n. \quad (2)$$

Step 2. The normalized weight ($N\omega_i$) is computed from

$$N\omega_i = \frac{\omega_i}{\omega_1 + \omega_2 + \dots + \omega_n} \quad i = 1, \dots, n. \quad (3)$$

Step 3. The λ_{max} value is given by

$$A \omega = \lambda_{max} \omega \quad (4)$$

Step 4. The CR is calculated by

$$CR = \frac{CI}{RI} \quad (5)$$

where the consistency Index (CI) is

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (6)$$

and RI denotes the random index determined by [13] given in Table III.

TABLE III. AHP RANDOM INDEX

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.21	1.24	1.32	1.41	1.45	1.49

The CR value of the matrix is required to be less than 0.10 for reliability in factor comparison [13]. If the value of CR is greater than 0.10, the comparison matrix is unsuitable for analysis and will require new data from existing or new participants.

The usefulness and practicality of AHP analysis can be seen in various research domains such as; blockchain adoption in healthcare [14], AI acceptance in programming [15], selection of agricultural irrigation systems [16], electric vehicle adoption [17], offshore wind energy adoption [18] and big data adoption [19] etc.

IV. PROPOSED RESEARCH MODEL

The research model consists of five categories as ethical, technological, societal, legal, and financial challenges. Twenty-six factors are categorized under these main factors as given in Fig. I.

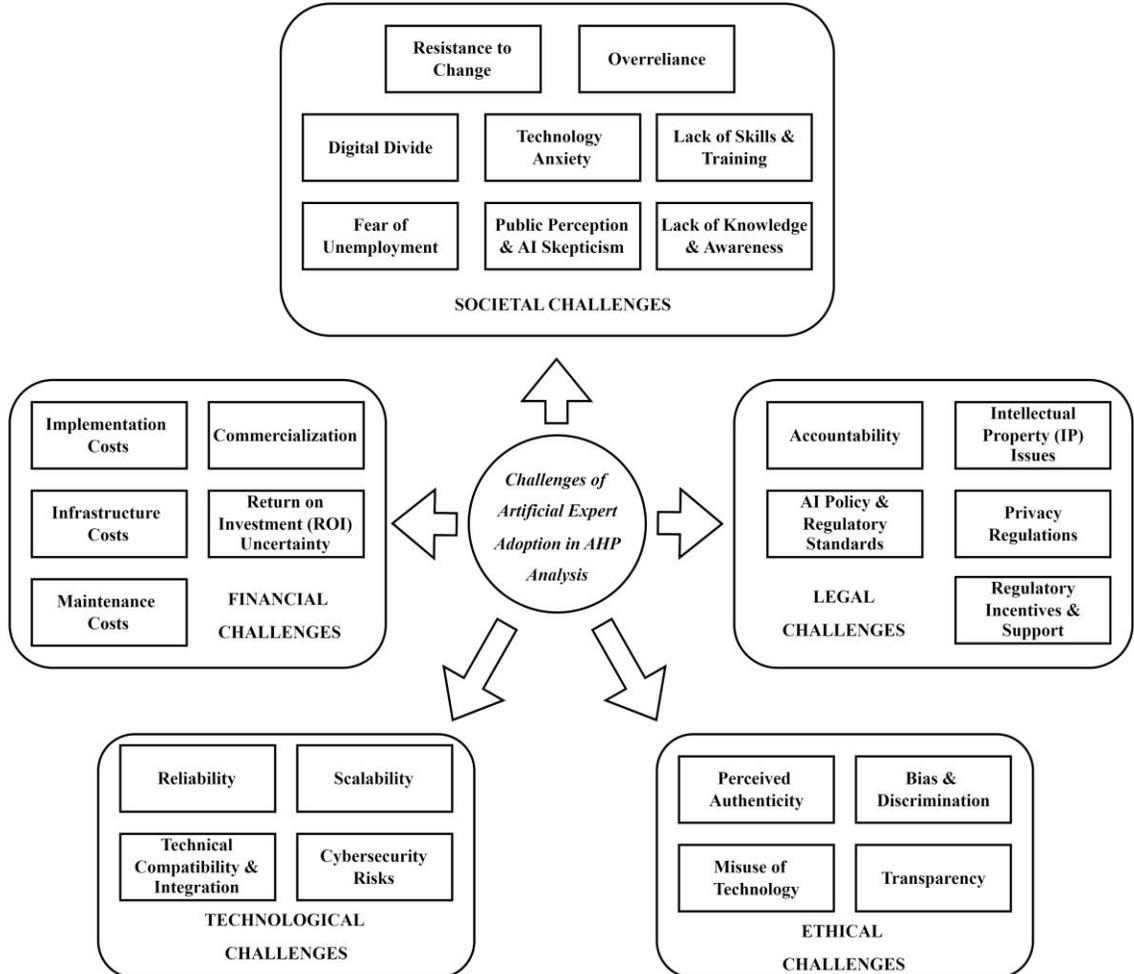


Figure I. Proposed Research Model for Artificial Expert Adoption Challenges in AHP Analysis.

TABLE IV. AHP ANALYSIS RESULTS – RANKINGS OF ARTIFICIAL EXPERT ADOPTION CHALLENGES IN AHP ANALYSIS

<i>Main Challenge</i>	<i>Relative Weight</i>	<i>Sub-Challenge</i>	<i>Local Weight</i>	<i>Local Rank</i>	<i>Global Weight</i>	<i>Global Rank</i>
Ethical Challenges	0,322	Bias & Discrimination	0,376	1	0,121	1
		Misuse of Technology	0,263	2	0,085	2
		Perceived Authenticity	0,187	3	0,060	4
		Transparency	0,174	4	0,056	5
Financial Challenges	0,244	Commercialization	0,260	1	0,063	3
		Implementation Costs	0,198	3	0,048	7
		Infrastructure Costs	0,189	4	0,046	8
		Maintenance Costs	0,216	2	0,053	6
		Return on Investment (ROI) Uncertainty	0,137	5	0,034	13
Legal Challenges	0,158	Accountability	0,246	2	0,039	11
		AI Policy & Regulatory Standards	0,239	3	0,038	12
		Intellectual Property (IP) Issues	0,251	1	0,040	10
		Privacy Regulations	0,158	4	0,025	15
		Regulatory Incentives & Support	0,105	5	0,017	17
Societal Challenges	0,135	Digital Divide	0,129	3	0,017	17
		Fear of Unemployment	0,158	2	0,021	16
		Lack of Knowledge & Awareness	0,129	3	0,017	17
		Lack of Skills & Training	0,125	4	0,017	17
		Overreliance	0,091	6	0,012	19
		Public Perception & AI Skepticism	0,094	5	0,013	18
		Resistance to Change	0,090	7	0,012	19
		Technology Anxiety	0,182	1	0,025	15
Technological Challenges	0,140	Cybersecurity Risks	0,304	1	0,043	9
		Reliability	0,240	2	0,034	13
		Scalability	0,227	4	0,032	14
		Technical Compatibility & Integration	0,229	3	0,032	14

V. ANALYSIS AND DISCUSSION

The planning, data gathering, and calculations were conducted using Microsoft Excel spreadsheets, ChatGPT-4o, and the AHP-OS online tool for AHP analysis [20]. The findings of the analysis, including the weights, local ranks, and global ranks of the challenges, are given in Table IV.

Findings of the AHP analysis presented that the most significant challenge, based on experts' judgements, is ethical challenges, followed by financial challenges. These findings are expected as the major debate on AI implementation is on ethical issues. Financial factors are considered one of the major motives of technology adoption. Therefore, the challenges in finance will

have a significant impact on the adoption of AI expert usage in AHP analysis.

According to the findings, the most significant sub-challenges are bias & discrimination, misuse of technology, commercialization, perceived authenticity, and transparency. Bias & discrimination, receiving the highest scores, can be addressed by the AI applications used in various industries that generate biased results. Misuse of technology is the second highest challenge, which can be seen in rising malicious activities that are possible with the assistance of AI systems. Apart from the ethical challenges, commercialization is a major challenge as it limits accessibility behind a paywall. Perceived authenticity and transparency are also considered significant challenges that

are associated with inaccurate solutions given by AI systems and the black box policy of the process, data source, and methodologies of AI systems.

The least significant sub-factors are considered as resistance to change, overreliance, public perception & AI skepticism, lack of skills & training, lack of knowledge & awareness, regulatory incentives & support, and digital divide. Apart from regulatory incentives & support, all the least significant challenges are societal challenges, which present that society does not have significant concerns on the impact of AI expert use.

VI. CONCLUSION

The perceptions on artificial expert adoption in AHP analysis will provide significant feedback to researchers and decision-makers. The contribution of this study consists of systematically identifying the challenges of artificial expert adoption and demonstrating artificial expert generation and use in AHP analysis. The findings of the AHP analysis present the prioritization of the factors and their respective weights, which is planned to be benchmarked with human experts and different generative AIs for validation in future studies.

A limitation of this study is the number of artificial experts generated. Another limitation is using only one generative AI for the artificial expert generation. As a future study, multiple generative AI platforms such as Gemini, Claude, DeepSeek, etc., will be tested for a comparative evaluation.

Another limitation is the demographic attributes of the generated artificial experts, particularly age and professional experience. In this study, the expert profiles were deliberately designed to reflect seniority and depth of knowledge, based on the assumption that expertise in high-stakes decision-making domains is typically associated with years of experience. However, this may inadvertently introduce a bias toward conventional or established viewpoints, potentially underrepresenting emerging or innovative perspectives more common among younger professionals. Future studies could experiment with varying age and experience distributions across expert profiles to evaluate whether generational differences in judgment affect AHP outcomes.

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