A Comprehensive Study Using FAHP to Evaluate and Prioritize the Most Critical Skills Required for Success in the Rapidly Evolving IT Industry

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ARTICLE INFO	ABSTRACT
	In the rapidly evolving IT sector, staying competitive is crucial for both organizations and individuals. This study examines four key skills—Communication Skills, Teamwork, Critical Thinking, and Entrepreneurship Skills—using the Fuzzy Analytic Hierarchy Process (FAHP) for analysis. These skills are evaluated to help individuals build strong portfolios and enhance their career opportunities. By equipping students with best practices, the research aims to enable them to contribute effectively to the growth of the IT industry. Continuous learning and practical experience are emphasized as essential for staying ahead in the fast-changing tech landscape. The data for this study was collected from 150 students across various colleges. To ensure accuracy and reliability, a questionnaire was reviewed by experts with over 30 years of teaching experience. The questionnaire was developed in collaboration with two experts with extensive backgrounds in both teaching and industry. Their insights helped refine the design and improve the overall quality of the study. Based on the FAHP analysis, Communication Skills were identified as the most critical factor. These findings highlight the importance of prioritizing Communication Skills in education and training programs. By doing so, individuals can be better prepared for success in the competitive IT field. **Keywords:** : Fuzzy Analytic Hierarchy Process (FAHP), Skill Evaluation in IT Sector, Student Skill Development, IT Industry Competitiveness, Decision Making.

1.INTRODUCTION

The IT sector is one of the fastest-growing and most dynamic industries, where staying competitive is essential for both organizations and individuals. As the industry evolves rapidly, it demands not only technical proficiency but also key soft skills that enable professionals to adapt to change and collaborate effectively. The ability to balance these skills is vital for career success and for driving innovation within organizations. This study focuses on analyzing the significance of Communication Skills, Teamwork, Critical Thinking, and Entrepreneurship Skills in building a strong foundation for professional growth in the IT sector. In this competitive landscape, skills such as Communication and Teamwork have gained particular importance due to their role in fostering collaboration and addressing complex challenges. Critical Thinking helps individuals approach problems creatively and devise innovative solutions, while Entrepreneurship Skills drive initiative and strategic thinking. Developing these competencies enables individuals to build impressive portfolios and enhances their employability, making them valuable contributors to the IT industry. Recognizing the importance of these skills, this study emphasizes continuous learning and hands-on experience as critical elements for maintaining a competitive edge.

To ensure a comprehensive understanding of these skills, the study adopts the Fuzzy Analytic Hierarchy Process (FAHP), a widely used Multi-Criteria Decision-Making (MCDM) method. FAHP allows for a systematic evaluation of multiple factors, incorporating expert opinions and handling uncertainty in the decision-making process. This methodology ensures the accurate prioritization of skills based on their significance in the IT field. The research framework provides valuable insights into which skills hold the greatest weight in preparing individuals for success.

Data for this study was collected from 150 college students across various academic institutions to capture a diverse perspective on skill development. The research process included the design and review of a questionnaire, which was meticulously evaluated by experts with over 30 years of teaching experience. These experts, with substantial knowledge of both academia and industry, provided valuable feedback to refine the questionnaire and ensure its reliability and validity. This collaborative approach strengthened the study's methodology and enhanced the credibility of its findings. Based on the FAHP analysis, Communication Skills emerged as the most critical factor among the evaluated criteria. This result highlights the necessity of prioritizing Communication Skills in educational and professional training programs to better prepare individuals for the demands of the IT sector. By fostering effective communication, students and professionals can adapt more readily to dynamic environments, build strong professional relationships, and contribute to organizational growth. The findings of this study provide a roadmap for educational institutions and organizations to design targeted interventions that enhance these essential skills, equipping individuals to thrive in a competitive IT industry.

1.1. Literature Review

In the rapidly evolving Information Technology (IT) sector, the demand for a combination of technical and soft skills has increased significantly in the last two decades. While technical proficiency remains essential, professionals are also expected to demonstrate strong interpersonal skills and critical thinking capabilities to thrive in the competitive IT landscape (Bennett et al., 2007). According to Drucker (2007), the intersection of technical knowledge and soft skills determines success in the IT field, with communication skills, teamwork, critical thinking, and entrepreneurship identified as essential for IT professionals. A recent study by Tannenbaum (2013) highlights that the increasing complexity of IT projects necessitates strong communication and teamwork abilities, making these skills as important as technical expertise. Communication skills have consistently been emphasized as a crucial factor in IT success. According to Möller et al. (2011), effective communication enables IT professionals to translate complex technical information for non-technical stakeholders and collaborate efficiently across teams. Tharp et al. (2008) further argue that strong communication abilities help bridge the gap between technical teams and management, facilitating smoother decision-making and project execution. This is particularly important as IT organizations increasingly work with cross-functional teams and global partners (Adkins, 2004). A study by Salas et al. (2008) concludes that team-based work environments, where communication is key, lead to enhanced productivity and innovation, thus underlining the importance of communication in IT teams.

Teamwork has become an essential competency in IT due to the collaborative nature of many projects. Bennis (2009) notes that in fast-paced, high-stakes IT environments, successful teams require diverse skills and the ability to work collaboratively towards common goals. The research by Cummings & Kiesler (2007) shows that strong teamwork leads to better project outcomes, particularly in complex IT projects that involve interdisciplinary collaboration. These findings align with Salas et al. (2008), who argue that teams in IT settings that demonstrate cohesion and effective communication are more likely to deliver high-quality solutions within tight timelines. Critical thinking and problem-solving are foundational skills for IT professionals as they help individuals navigate the complex challenges that arise in the development and implementation of technology solutions. Facione (2015) emphasizes that critical thinking is integral to decision-making processes, allowing professionals to evaluate information, identify issues, and devise effective solutions. In the context of IT, where problems are often multifaceted and dynamic, critical thinking empowers professionals to approach challenges from various perspectives, ensuring comprehensive and innovative solutions (Smith & Ehlers, 2018). Furthermore, Zhao & Wei (2016) discuss the importance of critical thinking in IT project management, where the ability to analyze complex issues and weigh multiple alternatives is crucial to successful outcomes. Entrepreneurial skills have gained prominence in the IT sector, where innovation is the key driver of growth. Kuratko (2017) explains that entrepreneurial skills, such as opportunity recognition, risk-taking, and resource management, are essential for driving innovation in IT companies. This concept of intrapreneurship, where employees act as entrepreneurs within organizations, has become a central focus in IT industries (Rae, 2017). According to Hahn & Ku (2016), fostering an entrepreneurial mindset among employees allows organizations to stay competitive by promoting a culture of innovation and agility. As the IT sector continues to evolve, professionals are increasingly expected to think like entrepreneurs to identify new opportunities and drive technological advancements.

The integration of Multi-Criteria Decision-Making (MCDM) methods, particularly the Fuzzy Analytic Hierarchy Process (FAHP), has become an effective tool for evaluating and prioritizing skills in the IT sector. The FAHP

methodology, as described by Saaty (2008), is particularly useful when decision-making involves multiple criteria with varying degrees of importance. This approach allows for more accurate decision-making by capturing expert judgment and handling uncertainty (Zhao & Wei, 2016). The application of FAHP in prioritizing IT skills provides valuable insights into which competencies should be emphasized in educational and training programs to meet industry needs (Rahman & Ali, 2016). The findings from this study reveal that communication skills are often regarded as the most critical attribute for IT professionals, as they enable effective collaboration and problem-solving in diverse work environments (Bennis, 2009; Tannenbaum, 2013). In addition to traditional education, experiential learning plays a critical role in developing these competencies. According to Kirkpatrick (2014), hands-on experiences such as internships, hackathons, and open-source contributions allow students to apply theoretical knowledge to real-world problems, further enhancing their technical and soft skills. This approach has been shown to improve both technical expertise and interpersonal skills, particularly in communication, teamwork, and problem-solving (Smith & Ehlers, 2018).

Bhattacherjee et.al,(2024) The proposed Hybrid Fuzzy AHP-TOPSIS approach offers a comprehensive framework for prioritizing employability skills, bridging the gap between academic training and industry requirements. This study provides valuable insights for both employers and students to understand and focus on the most critical skills for career success. Madsen & Milgrom (2008) suggest that these types of experiences help bridge the gap between academic learning and industry expectations, enabling students to better navigate the challenges they will face in their careers. Overall, while communication, teamwork, critical thinking, and entrepreneurial skills have been identified as crucial competencies in the IT sector, there remains a need for a deeper understanding of how these skills interact and their relative importance in career development. The combination of expert input, MCDM methods like FAHP, and hands-on experience can provide more comprehensive insights into the skills required for success in the IT industry. Limited research exists on integrating the Fuzzy Analytic Hierarchy Process (FAHP) to quantitatively prioritize essential soft skills like Communication, Teamwork, Critical Thinking, and Entrepreneurship in the IT sector.

CONTRIBUTION

Integrating the Fuzzy Analytic Hierarchy Process (FAHP) to prioritize essential soft skills like Communication, Teamwork, Critical Thinking, and Entrepreneurship in the IT sector offers a structured, quantitative approach to decision-making. FAHP helps address the subjectivity and uncertainty in evaluating these intangible skills, allowing experts to rank them using fuzzy logic. This method enables HR professionals and managers to prioritize skills based on the evolving needs of IT roles and projects. Additionally, FAHP can be tailored to specific sub-sectors within IT, improving training and development initiatives. This approach fills a gap in research and offers a more adaptable, dynamic framework for workforce skill management in the tech industry.

2. FUZZY ANALYTIC HIERARCHY PROCESS (FUZZY AHP)

The Analytic Hierarchy Process (AHP), developed by Thomas L. Saaty in 1980, organizes complex decisions into a hierarchical structure and uses pairwise comparisons to derive priority scales. Incorporating fuzziness, the method is extended with Triangular Fuzzy Numbers (TFN) to model uncertainty in judgments.

1. Developing a fuzzy comparison matrix

First the scale of linguistics is determined. The scale used is the TFN scale from one to nine are shows in Table 1.

Table 1. Scale of Interest

Scale of Interest	Linguistic Variable	Membership Function
1	Equally important	(1,1,1)
3	Weakly important	(2,3,4)
5	Strongly more important	(4,5,6)
7	Very strongly important	(6,7,8)
9	Extremely important	(8,9,10)

Then, using the TFN to make pair-wise comparison matrix for the main criteria and sub-criteria.

Equation (1) shows the form of fuzzy comparison matrix.

$$\bar{\mathcal{A}} = \begin{bmatrix} 1 & \cdots & \overline{a_{1n}} \\ \vdots & \ddots & \vdots \\ \overline{a_{n1}} & \cdots & 1 \end{bmatrix} \tag{1}$$

2. Define Fuzzy Geometric Mean

The fuzzy geometric mean is then calculated using Equation (2)[13]:

$$\bar{x}_i = \left(\bar{a}_{(i1)} \otimes \bar{a}_{(i2)} \otimes \ldots \otimes \bar{a}_{(in)} \right)^{\frac{1}{n}} \tag{2}$$

Where $\tilde{a}_{in}$ is a value of fuzzy comparison matrix from criteria I to n. Result from the fuzzy geometric mean will be referred to later as local fuzzy number.

3. Calculate the weight of fuzzy of each dimension

The next step is to calculate the global fuzzy number for each evaluation dimension with Equation (3).

$$\tilde{w}_i = \tilde{x}_1 \otimes (\tilde{x}_1 \oplus \tilde{x}_1 \oplus \ldots \oplus \tilde{x}_1)^{-1} \tag{3}$$

4. Define the best non fuzzy performance (BNP)

The global fuzzy number is then converted to crisp weight value using the Centre of Area (COA) method to find the value of best BNP from the fuzzy weight in each dimension, calculated using Equation (4).

$$BNP_{wi} = \frac{[(u_{wi} - l_{wi}) + (m_{wi} - l_{wi})]}{3} + l_{wi} \tag{4}$$

2.1. Case study

The numerical experimental data was collected from 150 students across various colleges in Andhra Pradesh, India. To ensure the validity of the pairwise comparison matrix, the questionnaire was reviewed by experts with over 30 years of teaching experience. The research involved designing the questionnaire in consultation with two experts possessing extensive experience in both teaching and industry. The study focused on four key criteria: Communication Skills (C1), Teamwork (C2), Critical Thinking (C3), and Entrepreneurship Skills (C4). These criteria were used to determine the weights through **Fuzzy AHP**, and the FAHP values are presented in Table 1. The representation of these criteria is shown in Figure 1.

Table 1: Determining the weights of the criteria by FAHP Approach

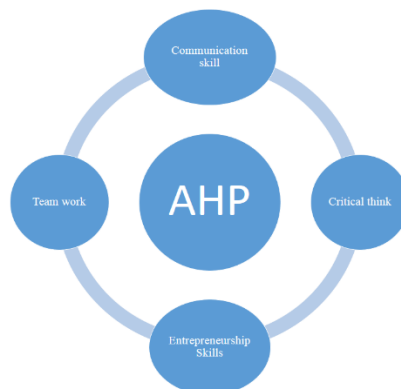| Criteria	C_1	C_2	C_3	C_4
Fuzzy Weights	0.3865	0.1564	0.2079	0.1716
Rank	1	4	2	3

Fig1.Fuzzy AHP criteria

2.2. Results and Discussion

This study aimed to evaluate the relative importance of four key skills—Communication Skills, Teamwork, Critical Thinking, and Entrepreneurship Skills—for building strong portfolios and enhancing career prospects in the IT sector, using the Fuzzy Analytic Hierarchy Process (FAHP). Data collected from 150 students across various colleges

were analyzed, and the results provide valuable insights into skill prioritization in the IT industry. The findings emphasize the need for academic institutions and training programs to prioritize the development of **Communication Skills**, as they form the foundation for career success in the IT industry. Employers consistently value professionals who can effectively convey ideas, negotiate solutions, and foster strong interpersonal relationships. The significant weight of **Critical Thinking** suggests that fostering analytical and creative problem-solving abilities is crucial. This aligns with the IT industry's demand for innovative solutions to rapidly evolving challenges. **Teamwork**, although ranked third, remains an essential skill, as IT projects often require collaboration among diverse professionals, such as developers, designers, and business analysts. The findings suggest that teamwork skills should be integrated into practical learning experiences, such as group projects and internships. Finally, the relatively lower ranking of **Entrepreneurship Skills** indicates that while entrepreneurial mindsets are beneficial for long-term career growth, they are not immediately essential for most IT professionals at the start of their careers. Nonetheless, exposure to entrepreneurial concepts could help students develop leadership skills and adaptability for future opportunities. The results of this study provide actionable insights for educators, curriculum designers, and policymakers. By emphasizing **Communication Skills** while integrating activities that enhance **Critical Thinking** and **Teamwork**, educational institutions can better align student competencies with industry needs. Additionally, fostering a culture of **continuous learning and practical experience** is imperative for preparing individuals to adapt to the rapidly changing IT landscape.

3. CONCLUSION AND FUTURE WORK

This study, using the Fuzzy Analytic Hierarchy Process (FAHP), highlights the critical importance of essential soft skills—Communication, Teamwork, Critical Thinking, and Entrepreneurship—in preparing individuals for success in the rapidly evolving IT sector. The findings emphasize that Communication Skills are the most pivotal in equipping professionals for effective collaboration, problem-solving, and leadership, underscoring the need for educational and training programs to prioritize this skill. Additionally, the research stresses the value of integrating continuous learning and practical experience to ensure adaptability in the competitive tech landscape. Based on expert-reviewed questionnaires and data from 150 students, the study provides reliable insights that can inform curriculum designs and training initiatives, ultimately helping students build strong professional portfolios. By focusing on communication while nurturing complementary skills, institutions can better prepare individuals to meet the challenges of the ever-changing IT industry.

Future research could expand on this study by exploring the integration of additional soft skills, such as **adaptability** and **emotional intelligence**, which are becoming increasingly important in the IT sector. Further studies could also investigate the **long-term impact** of prioritizing specific soft skills on career outcomes, including job performance, job satisfaction, and career advancement. Additionally, exploring how these skills vary across different IT subfields, such as cybersecurity or data science, could provide deeper insights into role-specific skill requirements. Implementing **real-time feedback** from industry professionals and incorporating emerging technologies like **AI** and **machine learning** into skill assessment frameworks would also enhance the robustness of future models. Lastly, longitudinal studies could evaluate the effectiveness of educational programs that focus on these prioritized skills, ensuring continuous alignment with evolving industry demands.

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