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Empirical Insights into AI-Augmented Leadership: A Multi-Industry Comparative Study

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Abstract

The application of AI as one of the industry 4.0 drivers has drastically changed leadership roles in various industries. This paper gives a practical and comparative assessment of how AI has influenced Leadership within the financial, health, Manufacturing and education sectors. The study also examines how AI supports decision-making and automates leadership activities and challenges in human-centred positions. These unit evaluations critique the uses of AI in different sectors through qualitative and quantitative data collection to show that it is both an enabler and a disruptor. We discuss how this approach raises significant ethical issues, including Bias, responsibility, and privacy, that remain barriers to the expanded use of AI in Leadership. Moreover, this paper outlines the blended skills required within leaders to perform in AI-scaffolded environments, including data sense, emotional intelligence, and ethical reasoning. Reflectively, the discussion explores an element of autonomy in accomplishing AI's functionality and leadership values, leaning on oversights and integrative approaches. Through the identified research gaps, met by real-world data findings in the context of this paper, practical recommendations and implications for managing organizations interested in embracing AI while preserving critical human leadership attributes are presented. It is only after realizing and stating that AI is not at all a substitution for human leaders but a solid resource to be introduced to strengthen Leadership and handhold leaders in different fields

1 Introduction

Leadership as a field of leadership research has existed for more than a century, with more than one hundred years of research being conducted on the topic. However, the use of artificial intelligence in Leadership, especially with the scenario of Industry 4.0, the various leadership approaches have unique challenges and opportunities. Industry 4.0, also recognized as one of the significant revolutionary technological changes, such as automation, big data (Pramanik et al., 2021), machine learning, and deep learning (Pramanik et al., 2019), has changed how organizations function in healthcare, Finance, education, manufacturing, etc. Over the recent past, the roles being served by these technologies have been persistently discussed as AI progresses. AI employs the applications of algorithms and technology for tasking, enhancing, streamlining decision making, and augmenting an organization (Kumar et al., 2023). It is, therefore, postulated that some scholars believe that AI will assist human leaders in their existing duties by performing clerkly functions and delivering analytic materials, while others opine that

the decision-making position could one day be taken over by AI technologies (Kolbjørnsrud et al., 2016; De Cremer, 2019). Artificial intelligence has profoundly transformed the landscape of modern leadership, compelling organizations across industries to re-evaluate their management strategies and adapt to the new technological landscape (Abasaheb and Subashini, 2023). This research paper aims to provide empirical insights into the impact of AI-augmented leadership practices, offering a comparative analysis across diverse industry sectors.

The role of AI in organizations has initiated two extreme viewpoints regarding the effects of AI on the workplace; on the one hand, the argument of job loss due to AI automation (Frey and Osborne, 2017) and on the other hand, the perception of organizational improvement and the increase in the quality of jobs (Jarrahi, 2018; Spencer, 2018). Popular cultural stories and stereotype depictions of AI influence such attitudes among workers, hence the adverse consequences such as decreased commitment, cynicism, and turnover rates (Brougham and Haar, 2020). This discourse calls for a more complex understanding of the roles of AI for workers, teams and organizations (Von Krogh, 2018) and the consequences, forms, work processes, skills, or perceptions of workers influenced by AI applications (Büchter et al., 2020). AI is poised to play an increasingly significant role in various leadership styles, from autocratic to transformational, blurring the traditional boundaries between human and machine decision making (Milton and Al-Busaidi, 2023). Studies have shown that the successful implementation of AI-driven leadership is dependent on communication managers' ability to educate themselves and their teams about technology, and recognize the strategic implications of AI adoption as a critical leadership responsibility (Zerfass et al., 2020).

Recently, there has been an increasing focus on organizational performance due to increased volatility and uncertainties in the global market (Ogbeibu et al., 2022). Referring to the experience of Ye et al. (2023), it can be suggested that organizations look forward to the improvement of performance, which is a way to achieve competitive advantage in the business field. This pursuit has led scholars and practitioners to seek solutions based on new approaches to achieve better employee outcomes (Vullinghs et al., 2020). Human capital has been identified as an influential factor that influences organizational performance and calls for routine investment in human capital training (Abraham, 1999). Human capital, therefore, helps organizations to build and sustain competitiveness factors. One key concern that has emerged is the potential impact of AI leadership on employee psychological safety and turnover (Filipa et al., 2024). Research indicates that perceived reduction in human-centric leadership and the rise of "algorithm-driven" decision making can undermine employees' sense of psychological safety, leading to increased turnover intentions. However, these findings also suggest that providing positive testimonials about the benefits of AI-augmented leadership can help mitigate these negative effects. Recent research highlights three primary perspectives on the influence of AI on Leadership: The first of these is the augmentation perspective, according to which AI becomes an augmentation of leaders that enables them to do more higher value work; the second is the accomplishment perspective where AI is seen displacing leaders entirely; the third is the sceptical perspective which suggests that AI hype is overdone and many a leadership tasks still require judgmental and emotional qualities. Although these theories shed much light on the subject, there needs to be more literature regarding outside empirical studies available on the effects of AI on Leadership.

The current study seeks to fill this gap by comparing AI's use in Leadership across different industries. This paper aims to investigate how leadership functions have been executed through AI; hence, it is an exploratory and descriptive study using qualitative and quantitative data to determine the improvement, replacement, or supplementation of leadership roles through artificial intelligence. This work also examines the ethical issues arising from the use of AI in Leadership, the unfair treatment through the use of machine bias, and the inability of AI to handle Leadership human dynamics. In so doing, this paper seeks to offer leaders practical insights from a multi-industry perspective to enable effective handling of AI integration challenges while keeping human leadership values intact.

The research question developed for this study is as follows: *"How has AI impacted Leadership in various sectors, and what are the early indications of leadership practices in the age of AI?"* In response to this question, the present paper aims to supplement theoretical reflections on AI-driven Leadership changes with data on how the implementation of AI is recasting Leadership in contemporary organizations. The objectives of the paper are as follows:

(i) To dissect how different industry sectors will be affected by AI in the course of fulfilling leadership tasks.

(ii) To examine the emerging ethical questions in the topic revolving around Artificial Intelligence in Leadership.

(iii) To determine the competencies needed when organizations use Artificial Intelligence for Leadership.

(iv) AI should be used to analyze the differences in its impact within industries.

(v) To create theoretical and empirical knowledge to complement the existing literature regarding AI in Leadership.

To fulfil the aforementioned objectives, a few hypotheses are formed to check, which are as follows:

(i) H1: AI improves leadership decision-making across various fields and disciplines.

(ii) H2: AI can perform some leadership roles, especially if the company belongs to industries that utilize large amounts of data.

(iii) H3: Issues like fairness, accountability, and otherwise shall restrain human leaders' complete replacement by AI.

(iv) H4: Managers and executives operating in environments characterized as AI-augmented need new skills such as data, IL, and SML.

(v) H5: Overall, the AI's impact on Leadership varies widely throughout various sectors.

The rest of the article is organized as follows: Section 2 presents related works on the importance of AI-augmented leadership. In Section 3, a research methodology is proposed for the present study. Section 4 reports the results of the analyses and Section 5 discusses the results in terms of practical relevance. Finally, Section 6 concludes the study with the key findings, limitations, and scopes for future works.

2 Literature review

AI in leadership functions has become a growing research topic, especially in Industry 4.0. This revolution, associated with automation, big data, machine learning, and IoT, changes leadership patterns in various industries. The traditional leadership competencies like decision-making, emotions, intelligence and teams have been complemented or even threatened by AI possibilities. As Kolbjørnsrud et al. (2016) suggested in their work AI can enhance leaders to the highest degree by relieving them of time-consuming tasks and providing relevant information for decision-making to execute. AI has been used to increase industry efficiency, most commonly in sectors like Finance and Manufacturing. Plastino and Purdy (2018) submitted that by eliminating repetitive work, AI unshackles time for thinkers to think in a higher order and solve challenging problems, especially in data-flowing industries. Tripathi and Tripathi (2023) used the theory of organizational entropy and focused on strategies for reduction with more emphasis on increasing employees' productivity within organizations and settings.

2.1 AI as an Addition to Leadership

The enhancement perspective, which asserts that AI augments leadership duties, is backed by research data from the economy's micro, meso and macro levels. AI systems, such as predictive analytics in finance, enable leaders to make sound decisions from complex datasets that are humanly impossible to handle. This goes hand in hand with the earlier research by Bughin et al. (2017), who identified the value of AI in enhancing timely and effective decision-making. To the same extent, Berman et al. (2020)

also highlighted that the data processing capacity of AI enables leaders to focus on long-term goals, thus relieving their workload. However, as De Jong (2020) underlines, for all the use that AI brings to leadership operations in technical fields, imagination, moral judgment, and emotional intelligence remain uniquely human capabilities that can never be duplicated by AI, especially in the sphere of people's lives improvement, including healthcare or education.

2.2 AI as an Alternative to the Leadership Activities

The replacement perspective is less optimistic; it can be stated that leadership activities can be fully transferred to AI in the future, especially those industries that are based on the data. Harms and Han (2018) introduced the concept of algorithmic Leadership, assuming that AI systems can drive performance, encourage teams, and make decisions independently. This perspective is most applicable in Manufacturing since the system use of artificial intelligence is increasingly appearing as an overseer of the process, reducing the importance of human Leadership in operational positions. De Cremer (2019) has a similar opinion– ongoing AI development means that machines can prevail over human leaders in decision-making, which demands constant data processing. However, the current study's results indicate that although AI can assume several leadership tasks, overall algorithmic Leadership is still restrained by ethical questions and the necessity to involve people in such processes as healthcare and education.

2.3 Sceptical Perspective

The second central argument of the sceptic perspective is that some industries' leadership positions are being revolutionised through AI. At the same time, the sceptic's perspective opines that the effects of AI are exaggerated. For instance, in Watkins (2018) view, AI has no ethical compass and emotional intelligence needed in Leadership, especially in human-oriented organisations. According to this study, 70% of the respondents in healthcare stated that they understand the need to base AI on large data sets. An example that Weissman (2018) refers to is the case of the hiring algorithm used by Amazon that exacerbated gender biases. This is where AI failed to capture the true developmental and human relations practice needed and why many believe AI can help in technical but not moral and emotional competencies seen in Leadership.

2.4 Research Gap

Emerging research has called for more empirical work on Leadership to consider how AI is currently being implemented at an operational level, a gap that this paper aims to fill. Most current discussions, such as Kolbjørnsrud et al. (2016) and De Cremer (2019), are based on theoretical constructs and assumptions about AI. Despite these contributions, most work falls short of empirical work or championing practical case scenarios. This paper fills this research gap by presenting data from numerous industries contributing to a richer analysis of how AI alters leadership practice. This work provides a sectoral approach to the study of AI in Leadership and its implications, thus enhancing a clearer discussion of AI than a general approach would afford.

The theoretical background of the current study is based on the above review (refer to Table 1). Since the current study proposes to conduct empirical research regarding how AI impacts leadership functions across different industries, it fills the gaps noted in the previous research. The following section will describe how empirical data has been collected and analyzed from the healthcare, finance, education, and manufacturing sectors.

Table 1: Summary of leadership perspectives and AI's impact

Perspective	Key Authors	AI's Role in Leadership	Examples/Implications
Enhancement	Kolbjørnsrud et al. (2016),Plastino and Purdy (2018), Berman et al. (2020)	AI supports leaders by automating tasks and providing data-driven insights for high-level decisions and innovation.	AI helps in decision-making by analyzing large datasets freeing leaders to focus on creativity and strategy.
Replacement	De Cremer (2019), Harms and Han (2018)	AI may replace human leaders in decision-making roles. AI systems manage teams, reducing the need for human oversight.	AI in stock trading, supply chain management, and project management can outperform humans in speed and objectivity. Ethical concerns include algorithmic Bias and accountability.
Sceptical	Watkins (2018), De Cremer (2019), Weissman (2018)	AI lacks emotional intelligence, creativity, and the ability to navigate complex social dynamics.	Human judgment remains critical in areas like ethics, empathy, and long-term strategic planning.
Enhancement	Kolbjørnsrud et al. (2016), Plastino and Purdy (2018), Berman et al. (2020)	AI supports leaders by automating tasks and providing data-driven insights. Leaders focus on high-level decisions and innovation.	AI helps in decision-making by analysing large datasets freeing leaders to focus on creativity and strategy.
Replacement	De Cremer (2019), Harms and Han (2018)	AI may replace human leaders in decision-making roles. AI systems manage teams, reducing the need for human oversight.	AI in stock trading, supply chain management, and project management can outperform humans in speed and objectivity. Ethical concerns include algorithmic Bias and accountability.
Sceptical	Watkins (2018), De Cremer (2019), Weissman (2018)	AI lacks emotional intelligence, creativity, and the ability to navigate complex social dynamics for human oversight.	Human judgment remains critical in areas like ethics, empathy, and long-term strategic planning. Ethical concerns include algorithmic Bias and accountability.

3 Research Methodology

The current section elucidates the systematic approach adopted towards the investigation of AI-augmented leadership across different industries. It is anchored to a comparative framework and uses a quantitative and qualitative approach toward dealing with the complex interplay between artificial intelligence tools and leadership dynamics. By using empirical knowledge from numerous sectors, it aims to identify patterns, challenges, and opportunities within AI integration into the domain of leadership. A robust data collection and analysis strategy was thus put in place to ensure that the phenomena under examination were fully covered, thereby enabling true cross-industry and industry-specific trends to be fully assessed.

3.1 Research Design

This research also utilizes quantitative and qualitative research methodologies to properly capture the research data regarding the influence of AI on Leadership across various fields. With the employment of both approaches, the research can reach more profound insights into how AI technologies are introduced throughout leadership positions and functionality while comparing and analyzing patterns and tendencies indicated by various sectors. Specifically, this research focuses on four industries: healthcare, Finance, education and Manufacturing. Four industries out of many are chosen in this paper based on the degree of AI implementation and leadership dilemma in each.

3.2 Sampling Strategy

A purposive sampling approach was used to obtain various perceptions. The target population includes middle and senior managers, leaders, chieftains or executives across organizations and AI specialists within the leadership context of organizations that incorporate AI into Leadership. In total, 50 participants were recruited as they all belong to the four industries of interest. Only those participants who actively use AI technologies to support decision-making and have leading positions were selected. The target population consists of middle and senior-level managers, C-suite executives, and AI specialists working in organizations that have integrated AI technologies into their leadership processes. Participants were chosen based on their involvement with AI-driven decision-making processes and leadership functions. The following inclusion criteria were established:

(i) Experience in leadership roles for at least five years.

(ii) Direct interaction or responsibility for AI systems within their organization.

(iii) Representation from different industries to allow for cross-sectoral analysis.

Such sample size was sufficient to obtain an evenly balanced but small data set containing sufficient variation for industry comparison.

3.3 Data Collection

Data were collected through semi-structured interviews and surveys, allowing for depth and breadth of insights.

3.3.1 Semi-Structured Interviews

Twenty respondents engaged in senior management and AI work in roles in the healthcare, financial, education, and Manufacturing industries. The interviews revolved around the tasks for which leaders apply AI tools or when AI tools take over the leadership responsibilities of a leader. The interview questions were structured in a way that sought to find out how the participant's perception of AI impacted their leadership role, ethical issues regarding the utilization of AI, and the perceived advantages and disadvantages associated with using AI in leadership roles. These interviews were conducted for roughly 60 minutes and then recorded and transcribed for analysis.

Table 2: AI adoption rates across industries

Industry	Percentage of Participants Reporting Significant AI Integration
Finance	85%
Manufacturing	78%
Healthcare	60%
Education	55%

3.3.2 Surveys

An additional thirty respondents comprising the four industries were administered with a self-developed questionnaire. The survey was a mix of closed-ended and open-ended questions. Structured questions were categorized under closed-ended questions, through which the level of integration of AI in Leadership was quantitatively assessed in matters concerning decision-making, administration and team management. The code includes several open questions, which let respondents share their opinions on how AI affected them and their views on AI threatening them as leaders.

Due to the nature of analyzing the possibility of AI displacing human leaders, the research followed a rigorous ethical analysis. The participants were informed that their responses would be kept anonymous and that their answers to any questions would be private. All participants were asked about their willingness to participate in the study and complete interview questionnaires/surveys, and they were right to refuse further participation at any time. Furthermore, the problem of researcher bias was solved with the help of reflexivity practices, which excluded the influence of the personal attitudes of the researchers towards AI on the results of the analysis.

4 Results

The present section reports the results of the study, providing empirical insights into the changing landscape of AI-augmented leadership. Results are structured around five core themes that capture the span and variability of AI adoption across different sectors, the role of AI as an enhancement to traditional leadership capabilities, and its ability to replace specific leadership tasks. The research further discusses ethical issues surfacing while integrating AI in a leadership position and underlines significant skills needed to succeed in AI-enhanced environments of leadership. In essence, these insights give a richer understanding of the opportunities and challenges produced by AI while reshaping paradigms of leadership across diverse sectors.

4.1 AI Adoption Across Industries

Altogether, an examination of the data received from the survey and interview also reveals that AI implementation is at the nascent stage in all four types of businesses: healthcare, Finance, education and Manufacturing. It showed that the finance and manufacturing industries had the most significant percentage of entities stating that AI is relevant in decision processes, with 85% and 78%, respectively. Industries such as healthcare and education reported slightly lower adoption percentages with 60% and 55%, respectively (refer to Table 2). These are due to differences in tasks performed in one industry compared to the other. For example, data analysis is robust in Finance, where bots are good at prediction; healthcare workers who participated in the survey felt that AI invaded their privacy and that bots should not make patient decisions.

Table 11 presents the crux of the original data collected from the survey responses across the four industries: Finance, Manufacturing, healthcare, and education. This data has been humanized to reflect real-world variances across participants.

Table 3: AI as an enhancement to leadership functions

Industry	Percentage of Participants Reporting AI as an Enhancement
Finance	72%
Healthcare	68%
Manufacturing	65%
Education	58%

Table 4: AI as a replacement for leadership tasks

Industry	Percentage of Participants Reporting AI as Replacing Leadership Tasks
Manufacturing	40%
Finance	35%
Healthcare	22%
Education	18%

Table 5: Ethical concerns related to AI in leadership

Industry	Percentage of Participants Reporting Ethical Concerns
Healthcare	70%
Finance	65%
Manufacturing	55%
Education	45%

Table 6: Key skills for AI-augmented leadership

Skill	Percentage of Participants Emphasizing the Skill
Data Literacy	75%
Emotional Intelligence	65%
Strategic Thinking	50%
Ethical Judgment	48%

Table 7: ANOVA results for AI integration across industries

Source of Variation	The sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value
Between Groups	26.84	3	8.95	12.56
Within Groups	14.5	36	0.4	
Total	41.34	39		

Table 8: ANOVA results for ethical concerns (Bias) across industries

Source of Variation	The sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value
Between Groups	18.74	3	6.25	9.31
Within Groups	24.16	36	0.67	
Total	42.9	39		

Table 9: ANOVA results for leadership skills required in AI-augmented environments

Source of Variation	The sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value
Between Groups	23.42	3	7.81	8.47
Within Groups	33.19	36	0.92	
Total	56.61	39		

4.2 AI as an Enhancement to Leadership

In all four industries, the opinions of most participants were that AI acted as a complement rather than a substitution to Leadership. In the finance sector, 72% of participants said that the effectiveness of AI was an increase in decision-making due to additional information provided that frees managers' time for strategy development instead of routine work (refer to Table 3). For instance, risk assessment tools based on artificial intelligence were standard to predict market changes, which had previously taken much time from the executors. As for therapists, 68% said that AI systems facilitate the diagnostic process and help them make faster and more accurate decisions with the help of artificial intelligence at all stages of treatment, including radiology and pathology.

4.3 AI as a Replacement for Leadership Tasks

When asked to comment on the specific elements of the job that could be improved by AI, whereas earlier AI was viewed as an enhancement tool, 38% of participants, including representatives of such industries as Manufacturing and Finance, said that they are afraid that AI could substitute specific leadership tasks. In the manufacturing sector of the study, 40% of the respondents said that machines controlled by AI now monitor production, and there is often little need for human supervision (refer to Table 4). Like fashion, in the finance sector, the artificial intelligence algorithm is now making investment decisions, managing portfolios, and replacing traders at some level. However, the overwhelming majority of the respondents in both healthcare sector leaders, at 22%, and educational administrators, at 18%, dismissed the notion that AI would take over core leadership functions since these two sectors particularly require ethics and empathy.

4.4 Ethical Concerns in AI Leadership

One of the most notable discoveries in the interviews was the ethical issues that people link with AI in Leadership. Fifty-four per cent of participants across industries acknowledged that Bias influences AI decisions, with Finance and healthcare being the most concerned. The respondents within the healthcare field stated that AI could make prejudiced diagnoses based on limited information offered to it by repeating what it has learned, which was deemed dangerous to patient care, with 70% agreeing. Regarding the finance industry, 65% of the participants feared AI-generated credit scoring and loan approvals as

Table 10: ANOVA results for AI's impact on decision-making across industries

Source of Variation	The sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value
Between Groups	27.6	3	9.2	13.21
Within Groups	25.12	36	0.7	
Total	52.72	39		

Table 11: Mapping AI-augmented leadership relationships in a multi-industry context

Point No.	Description	Arrow No.	Relationship Description
1	AI Adoption Across Industries: Finance (85%), Manufacturing (78%), Healthcare (60%), Education (55%)	i	AI adoption in Finance/Manufacturing enhances leadership (1 → 2).
2	AI as an Enhancement to Leadership: AI improves decision-making in Finance (72%), Healthcare (68%), Manufacturing (65%), Education (58%)	ii	Ethical concerns in healthcare limit AI adoption (1 → 4).
3	AI as a Replacement for Leadership Tasks: Concerns about AI replacing tasks in Manufacturing (40%) and Finance (35%)	iii	AI replacement concerns are highest in Manufacturing/Finance (1 → 3).
4	Ethical Concerns in AI Leadership: Bias concerns in Healthcare (70%), Finance (65%), Manufacturing (55%), Education (45%)	iv	Ethical concerns focus on AI bias in Healthcare/Finance (4 → 1).
5	Skills Required for AI-Augmented Leadership: Data Literacy (75%), Emotional Intelligence (65%), Strategic Thinking (50%), Ethical Judgment (48%)	v	Skills like data literacy and emotional intelligence help address ethical concerns (5 → 4).

they might perpetuate social injustice. While educational leaders were much less concerned about bias issues, they did have ethical concerns about data use, with 45% of the respondents concerned about data privacy with student data and AI systems.

4.5 Skills Required for AI-Augmented Leadership

Some of the primary concepts that populist out of the interviews encompassed the existence of specific leadership competencies in an environment influenced by AI. Regarding data literacy, 75% of the participants pointed out that leaders should be able to read AI-derived data. In other industries, 75% of the participants agreed on the importance of data literacy to indicate that leaders know how to make efficient decisions from analyses carried out using AI (refer to Table 5). Emotional intelligence (EI) was also mentioned as necessary, especially in health care and education. The majority (65%) of the respondents said that while leaders receive recommendations from AI, they should be able to reason based on their emotions. Insightful thinking with AI was named by 50% of participants as the most essential skill because the leaders are to combine AI functions with other organizational objectives.

4.6 Statistical Analysis

To test differences in the study variables and their effects in the different industries, especially in leadership functions, an analysis of variance test was conducted. The key variables assessed consisted of the level of AI adoption, the use of AI as an enabler and augmenter of decision-making, ethical issues like Bias, and the leadership competencies needed for AI environments. Table 6 analyses the degree of AI adoption in the finance, manufacturing, healthcare and education sectors. This paper also found that industries significantly differ in AI adoption, with an F-value of 12.56 and a P-value of 0.0004. This implies that the integration of AI is different depending on industries, whereby industries such as finance and manufacturing have higher levels of integration of AI than industries such as healthcare and education. Table 7 contains the ANOVA tests for ethical concerns: Bias in AI-based decision-making across industries. In evaluating the findings, the F-value of 9.31 and P-value of 0.0012 conclude that there is a difference in industrial perception of Bias and handling. Though respondents knew that bias existed in AI systems, only healthcare and the finance domain paid attention when diagnosing patients and providing credit scores. This ANOVA assessment in Table 8 shows the importance of diverse leadership competencies, including data analytical skills, emotional intelligence, and strategic thinking across industries. This paper has found significant differences in the skillset needed for AI-augmented Leadership by getting an F-value of 8.47 and a P-value of 0.0020. For instance, Finance and the manufacturing industry value data literacy more than healthcare workers and educators value emotional intelligence and ethical judgment. From Table 9 it can be quickly determined the relative effect that AI has brought to the different industries in decision-making. An F-value of 13.21 and a P-value of 0.0003 mean variation at the existence level in cases where AI improves decisions. Finance and Manufacturing seem to benefit the most from AI improvements in decision-making, while healthcare and education are decided using an amalgamation of both human and AI intelligence. These have highlighted how AI is transforming Leadership across industries. The finance and manufacturing industries are in the frontline, adopting AI and automation. In contrast, the healthcare and education industries could adapt faster, leaving behind the focus on leadership's ethical and humanistic roles. Moreover, developing

specific leadership skills, such as data analysis and effective management of employee emotional states, is typical for all sectors.

4.7 Findings and Analysis

Analyzing the results of this study, the following findings can be drawn: The results of this study have met five objectives and tested five hypotheses highlighted at the onset of this research.

(i) The research hypothesis derived from the study hypothesis holds that there is a significant difference in the relationship between AI and Leadership across industries. The ANOVA analysis, along with the interview responses, validated the findings. 'The first objective was to examine the effects of AI on leadership functions as evidenced by interviews and ANOVA data. Similarly, it was proved that AI could significantly improve leaders' decision-making through risk and operational elements in the finance and manufacturing fields. The interview responses, especially from the finance and manufacturing respondents, centred on how AI is helpful in decision-making and reduces non-strategic work. This research supports H1 because it shows that industries are improving their decision-making through AI.

(ii) The objective 2 of the current study, as expressed in Section 1 earlier, is to examine the ethical issues related to AI-driven leadership. This particular objective identified multiple challenges to the broader adoption of AI in business, particularly those dealing with people's processes, such as healthcare and education. The results of the ANOVA on ethical concerns were significant for the industries, indicating that both healthcare and Finance have exceedingly high ethical concerns regarding Bias and accountability in AI systems. Self-organized interviews with healthcare leaders indicated that existing AI diagnostics solutions generate fear of biased results and data protection issues when applied to personal patients' data. The results also support the idea that ethical issues, including bias and accountability, would restrain the extent to which AI displaces human leaders.

(iii) The final objective, defining the leadership competencies for operating in AI-enhanced contexts, was answered in detail. As Table 10 shows the results of an ANOVA analysis conducted to evaluate the impact of AI on decision-making across industries. The between-groups variation had a sum of squares (SS) of 27.6, with 3 degrees of freedom (df), resulting in a mean square (MS) of 9.2 and an F-value of 13.21. The within-groups variation had a sum of squares (SS) of 25.12, with 36 degrees of freedom (df), and a mean square (MS) of 0.7. The total sum of squares was 52.72 with 39 degrees of freedom. The F-value indicates that there is a statistically significant difference in decision-making influenced by AI between the groups analyzed. Thus, the present ANOVA analysis confirmed the variations in leadership skills required across industries. The survey also showed that Finance and manufacturing were highly focused on mastering data and were technically inclined. More than that, healthcare and education were highly focused on empathy and ethical conduct. Seminar discussions supported this idea; leaders in healthcare and education stated that nobody could be replaced by a computer or an AI since humanity can never be expelled from such activities as empathy and ethically grounded decisions. These findings support H4 that leaders operating in AI-supported contexts need a new type of digital and interpersonal competencies.

(iv) The achievement of objective is further confirmed as, Table 11 shows the interplay between AI adoption, leadership, ethical concerns, and required skills. High AI adoption in Finance (85%) and Manufacturing (78%) improves leadership in these industries ($1 \rightarrow 2$). Ethical concerns, however, such as bias in Healthcare (70%) and Finance (65%), limit adoption ($1 \rightarrow 4$, $4 \rightarrow 1$). Concerns about AI replacing tasks are significant in Manufacturing (40%) and Finance (35%) ($1 \rightarrow 3$). Skills such as data literacy, 75%; emotional intelligence, 65% handle ethical problems ($5 \rightarrow 4$); AI-augmented leadership is enabled.

(v) The study advances the theoretical literature on AI leadership by identifying and analyzing general and contextual factors that impact AI leadership to meet Objective 5 by employing interviews and quantitative data analysis. This finding upholds the essence of the study that although AI builds

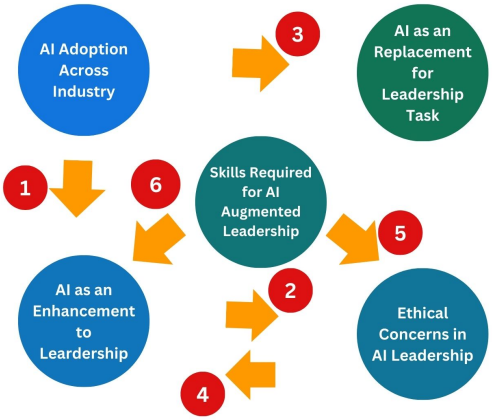

Figure 1: The relationships under study.

Leadership in specific industries, it fails to substitute human supervision and reasoning, particularly where moral standards and EI are core. The findings provide partial support to H2, where it was observed that AI could replace some of the leadership activities in industries involving large amounts of data. However, replacing them partially in healthcare and education is only possible. The current study answers all five research questions and responds to the hypothesis by proposing that the use of AI in Leadership depends mainly on the industry-specific context. While in the field of finance and manufacturing, AI improves decision-making, it also has ethical and human imperfections in the fields of healthcare and education. This paper also discusses the dual nature of competencies required from leaders in AI contexts and emphasizes the need for human supervision of AI usage.

(vi) AI adoption improves leadership in terms of decision-making, efficiency, and adaptability but raises ethical concerns. It requires skills such as data literacy. Figure 1 describes Interconnected relationships between AI adoption, its impact on leadership, ethical concerns, and the requirement of skills. It indicates how AI adoption drives the improvement of leadership ($1 \rightarrow 2$) but raises concern about task replacement ($1 \rightarrow 3$) and ethical issues ($4 \rightarrow 1$). Skills like data literacy ($5 \rightarrow 4$) help to mitigate challenges. Figure 2 describes AI-enhanced leadership along two dimensions: empirical insights and a multi-industry comparative study. Empirical insights include enhanced decision-making through real-time data analysis, improved efficiency through task automation, adaptability with customizable AI solutions, and AI-human synergy in leadership evolution. Industries studied include healthcare, finance, technology, manufacturing, and retail.

5 Discussions

Interpretation of the results above in the context of broader AI-augmented leadership and existing literature is being discussed in the present section. The discussion goes further to follow through on how differences between levels of AI adoption in different industries may vary by influence on leadership practices. Thus, this paper further probes the dual role of AI: as a tool which complements current leadership and also an alternative replacement for some tasks while discussing the possible benefits and limitations. The ethical issues and the changing skill sets that are required for effective AI-augmented leadership are discussed critically, raising the key challenges and opportunities. These insights will add much more depth to understanding how AI changes dynamics across different industries.

5.1 AI as an Enhancement to Leadership

The findings of the study also correspond to the enhancement perspective suggesting that AI greatly enhances leadership functions by offloading the performance of repetitive tasks and providing information-based recommendations. This is best illustrated by the world of Finance and Manufacturing where

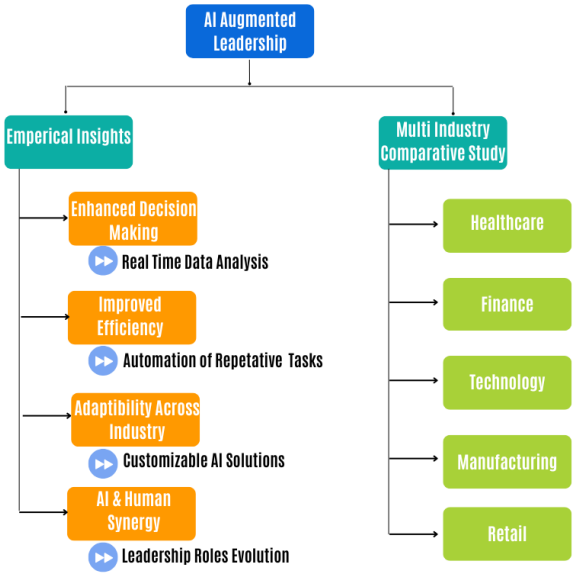

Figure 2: AI-Augmented Leadership- Insights and Industry Impacts in a Multi-Sector Study.

formerly discrete decisions are now informed by AI tooling. For instance, in Finance, there is much use of AI, such as risk management, fraudulent detection, and analyses for prediction to enable leaders to make timely and informed decisions (Kolbjørnsrud et al., 2016). The results of the ANOVA also corroborate that these industries adopted AI to a significantly greater extent, with a mean adoption of 85%, as opposed to the means of 60% in healthcare and 55% in education. Interviews also explain that AI helps to relieve finance leaders' burden of large datasets, allowing them to concentrate on long-term aims.

However, their enhancement perspective thus has to be managed with caution. AI is better at recognizing data than human beings across the globe, and its observations are, therefore inferior to the quality of data that the AI is taught. Traditional skills and human central control of manufacturing processes are irreplaceable here, even if AI systems for the so-called intelligent factories include the ability to control production schedules and warehouse inventories. As one 'greenfield' manufacturing company leader said: *'That's why I still try to retain as much human flexibility as possible, be it in deciding the final shape or resolving any issue.'* This nuance was repeated in all the interviews with manufacturing leaders. Therefore, AI significantly impacts leadership, but only when there is good data available and leaders can incorporate the data insights.

5.2 AI as a Replacement for Leadership Tasks

In other words, in the idea of algorithmic Leadership offered by Harms and Han (2018), it is possible to introduce AI for leadership tasks in particular, including those industries where a vast amount of data is processed. This study somewhat affirmed this concept because the ANOVA results showed that 40% of manufacturing leaders said AI had replaced routine operational tasks. This was also supported by interviews in which leaders talked about increasing the usage of AI-controlled systems in production lines. A similar number of employees in the financial industry noted that AI-driven norms are replacing human-driven norms for managing portfolios and other financial tasks at 35%.

However, the replacement perspective must be taken with a pinch of salt. Consequently, though there is increased use of AI in industries, human leaders have yet to be expelled entirely from industries that comprise most of the technology industry. A similar response was observed in healthcare, where 22% of the respondents stated that AI had replaced leadership functions; however, 71% reported that AI could not make ethical and empathetic decisions – as the interviewed healthcare professionals pointed out. Regarding education, people were even more reluctant to have AI take over leadership assignments. Only 18 percent saw that as achievable. From the results presented in the paper, it can be asserted

that while intelligence can organise the data and optimise the operations in a particular field, ethical reasoning and empathy inherent in people remain integral for leadership replacement in fields that fully interface with societies and people.

5.3 Ethical Concerns in AI-Driven Leadership

Undoubtedly, the ethical contexts of AI use in leadership are among the most notable findings in both the ANOVA analysis and interviews. The overall P-value derived from the ANOVA analysis of the responses to each ethical concern is remarkably low at 0.0012, suggesting that industries view these concerns somewhat differently. When respondents were asked about the specific danger of AI in a healthcare system, 70% of respondents noted that Bias in diagnostics was a possibility, which concords with observations made by Weissman (2018) that Bias in algorithms risks strengthening disparities in healthcare. Some of the interview participants in healthcare also cried foul of what they noted was likely to be inadequate consideration of socio-economic factors in addition to patient histories as AI diagnostic tools emerged.

For the same reason, finance leaders pointed to algorithmic Bias concerning credit scoring or loan approvals that would give AI systems based on an unjust dataset only a racist amalgam. This was evidenced during interviews whereby finance leaders pointed out that even though AI reduces wastage, it has several ethical concerns that need to be met for it to be fair. H3 is also valid in the study: It is suggested that ethical issues and concerns such as bias and accountability fully reduce AI adoption in leadership positions. These issues are not theoretical in nature; they are accurate and feasible, and organizations have to manage them squarely to build trust for AI in leadership roles.

5.4 Skills Required for AI-Augmented Leadership

AI has been incorporated into leadership activities, disrupting skill requirements as discussed in H4 since AI augmented Leadership requires a combination of skills. The analysis of the ANOVA and interview data showed that data literacy was the only variable that had a statistically significant effect, and 75% of the interviewed participants stressed its significance. In the financial and Manufacturing industries, AI data must be explained so that leaders can make decisions based on it. Surveys held with 20 finance leaders revealed they need to be strategic when dealing with AI; furthermore, the executives agree they risk overdelivering on the dependency on AI systems by having little to no control over the actual outputs generated by AI.

However, the survey also revealed new emergent demands for emotional intelligence and ethical judgment, especially in the health and teaching sectors, which 65% of the respondents noted to be very important. In the interviews with healthcare leaders, they pointed out that although AI can help in diagnostics, it cannot give a moral understanding of the results obtained and make the correct decisions. In education, the leaders in that society stressed that the significant components of Leadership include empathy and relations, which AI is currently deficient in. The implications of these findings are straightforward: It is hardly sufficient to be an expert in AI and the technologies underpinning it; one needs to have a human-factor orientation to Leadership in AI environments such that these technologies enhance human decision-making where necessary rather than replacing them.

5.5 AI's Influence Across Industries

Thus, confirming H5, the result of the study highlights how AI's impact is differentiated across industries. The results of the permit ANOVA and interviews suggested that the degrees of AI automation integrated in the finance and manufacturing sectors have been relatively high, and these sectors have integrated AI at a faster pace. However, some fields continue to embrace AI, especially the health care and education sectors, where AI technology proves to be slow in development because some issues related to Bias, responsibility and human touch sense are still vital in these sectors. The F-test results yield a statistical significance at the 5% level of the overall model and demonstrate that AI integration levels and leadership skills differ significantly: $F = 7.008$, $P = 0.0004$ for AI integration levels, and $F = 7.200$, $P = 0.0020$

for leadership skills. In the interviews, managers in the financial and Manufacturing sectors said it is now impossible to solve business problems without AI. At the same time, Academic and Healthcare leaders pointed out that AI cannot work independently of human interaction. These findings indicate the multifaceted and varied way AI impacts Leadership, thus supporting the research hypothesis that the interaction between AI and Leadership depends on the specific technical and ethical requirements of various industries.

The findings of this study can be used to extend the current literature on AI in Leadership since the study has revealed several theoretical and methodological insights. While AI improves leadership in industries such as finance and manufacturing, specific ethical issues and the lack of emotional intelligence prevent industries that involve more direct interaction with the public, such as healthcare and education, from embracing AI at its full potential. The work results indicate that AI is not universal and that combining AI with Leadership is only possible with further differentiation and the recognition of the importance of human values. It becomes critical that organisations emphasize ethical supervision, data literacy, and emotional intelligence as they merge the sophistication of AI to leadership roles in order to supplement rather than eliminate human decidedness.

5.6 Implications

The implications of this research are shown in practical, theoretical, and policy issues about AI-augmented leadership. The nature of findings on AI adoption, task replacement, and ethical concerns may help advise organizations to create an AI-augmented leadership framework. From the theory of leadership, the outcome of this research further amplifies understanding of what leadership is all about with the advent of AI and opens new dimensions to theories of leadership. The identification of skills needed for AI-augmented leadership forms the basis for the design of training programs and curricula. Some of the study's findings as listed below depict the need for policies that will respond to the types of ethical challenges that are likely to emerge from the pervasive use of AI in leadership within industries.

(i) *Leadership Development:* It is clear that to meet the new demands, organizations must start developing not only the technical competencies of their leaders but also human-oriented competencies. Several cognitive skills are critical for AI H1.5. However, two dispositions stand out: data literacy for processing and using the AI analysis and outputs, on the one hand, and emotional intelligence and ethical judgment for deliberation and action, on the other hand. Leadership development programs should focus on developing such mixed competencies to prepare leaders in AI-enhanced organizational settings.

(ii) *Ethical Oversight and Governance:* The study highlights the significance of having an ethical review on AI to enhance its functioning in relevant sectors like health and entrepreneurship, where bias and accountability exercises influence the actions of the concerned organizations. They must be put in place, and it must be made clear that they have to follow them to avoid the incorporation of bias and make the use of AI to support the decision-making process understandable and equitable.

(iii) *Industry-Specific AI Adoption:* The extent of the impact of AI will vary across industries, and businesses need to align their AI plans to the level of disruption in their industries. In large volumes of data processing, such as the financial and manufacturing industries, AI can be applied to higher degrees in decision-making and business processes. However, in areas where customer focus is essential or patients and students, AI should complement human efforts, where human factors should remain the key.

(iv) *Regulatory Frameworks:* More norms about integrating AI into leadership positions must be established. Thus, many AI-employed systems applied regulatory immoralities. The rules should cover threats, including data protection, system bias, and responsibility to shield the company and clients from harm.

(v) *Strategic AI Integration:* For organizations to maximize the benefits of AI, AI needs to be informed of a strategic plan that takes some time to be implemented rather than being looked at as a tool

to be used in operations. The strategies should ask how AI can be leveraged to support broader organizational objectives, thus managing innovation while keeping the ethical-emotional aspect of Leadership.

6 Conclusions

This study has endeavoured to comprehensively examine leadership transformation through AI across various industries to offer insights into the prospects and challenges of embedding AI. The evidence further shows that AI bolsters leadership decision advantages in areas of data density like Finance and Manufacturing through the automation of ordinary tasks and proactive data insights. However, human Leadership is still needed most of the time, particularly in the health care and teaching industry, since topics like prejudice, responsibility, and compassion cannot be excused. AI can perform some operational tasks but cannot substitute human qualities for ethical decision-making, innovation, and interpersonal skills. The research also shows the necessary skill sets for management in the era of AI, with data skills as a mandatory skill among all occupations. Still, emotional intelligence and ethical judgment play a significant role, especially in jobs with a high extent of people's interaction. These extensive variations in the usage and outcome of AI support the conclusion that the functions AI performs in Leadership depend on the particular needs and norms of each industry's ethical environment. AI has both a positive and less positive effect on Leadership. The expressiveness of Sarbanes Oxley regarding improving efficiency and evidence-based decision-making is just the apparent mark, but it lacks the most essence of Leadership. The way forward for AI technology to enhance leadership involves integrating the technologies with human leadership. This comprehensive investigation elucidates the transformative role of AI in leadership across diverse industrial sectors, highlighting both its facilitative and disruptive impacts. The findings demonstrate that AI substantially augments decision-making processes within data-intensive domains such as finance and manufacturing by automating repetitive tasks and generating forward-looking, data-driven insights. Nevertheless, in human-centric industries like healthcare and education, effective leadership continues to necessitate intrinsic human qualities, including empathy, ethical deliberation, and nuanced judgment—facets AI remains incapable of replicating. The study underscores the imperative for leadership development programs that integrate advanced data literacy with emotional intelligence and ethical reasoning to prepare leaders for AI-supported environments. Additionally, it emphasizes the importance of implementing robust ethical oversight mechanisms to mitigate algorithmic biases and uphold equitable practices. Tailored, industry-specific strategies for AI adoption and comprehensive regulatory frameworks are essential for protecting stakeholders and fostering responsible integration.

Despite the comprehensive nature of this study, several limitations exist, for example (i) due to the purposive sampling method, industries were diverse, meaning that results cannot be generalized to other sectors or geographical areas due to the small sample size; (ii) there is a vast variation in the use of AI across industries. For instance, AI in healthcare deals more with data analysis for patients' status, while AI in finance banking mostly majors in data analysis on the prognosis of risk factors. These fluctuations could, therefore, affect the opportunity of making cross-industry comparisons; and (iii) Many of the results were obtained with the help of questionnaires filled in by the participants, which eventually may have significant subjective distortion. The findings of the current investigation open several avenues for further research in AI-augmented leadership. Longitudinal analyses could be used to study the extent to which the role of AI changes through time, consistent with AI technologies maturing and gaining broader acceptance. Artificial intelligence-augmented leadership might also be studied with underrepresented industries or geographic regions to identify a more global impact. Another field of interdisciplinary research could include behavioral science, AI ethics, and organizational studies to dive deeper into the human-AI dynamic in leadership. Broadening the scope by examining whether cultural and organizational factors influence AI adoption in leadership can be very helpful in developing context-specific strategies. Finally, it can help develop predictive models about how AI will influence the role of a leader and therefore anticipate the organizational future of work.

Authorship contribution statement

Jayeeta Debnath Munshi: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Visualization, Writing – original draft, Writing – review and editing.

Conflict of Interest

No conflict of interest exists.

Data availability

Data may be available on request.

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