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Doctoral Thesis

Role of AI in Educational Administration and Its Impact on Transforming Leadership and Decision-Making Processes - With Special Reference to Engineering Programs in Universities

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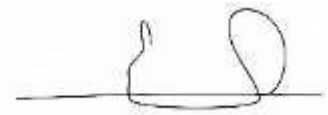
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ABSTRACT

The integration of Artificial Intelligence (AI) in educational administration has the potential to revolutionize leadership and decision-making processes, particularly in universities offering engineering programs. This research explores the role of AI in enhancing educational leadership, improving decision-making efficiency, and optimizing resource management across universities in the GCC (Gulf Cooperation Council). By employing a descriptive research design and using tools such as regression analysis, correlation, and ANOVA, the study investigates how AI adoption influences the effectiveness of educational administrators in managing complex and resource-intensive engineering programs. The findings indicate that AI significantly improves leadership effectiveness by providing data-driven insights that allow for more informed decision-making. AI's predictive capabilities help leaders anticipate future challenges, enabling proactive resource management and strategic planning.

AI enhances decision-making efficiency by automating routine tasks, optimizing faculty scheduling, and providing real-time data analytics for resource allocation. The study also highlights AI's role in improving student assessment and personalized learning, with AI-driven tools offering more accurate feedback and enabling early intervention for students at risk. However, the study reveals significant regional variations in AI adoption across the GCC, with countries like the UAE and Saudi Arabia leading in AI integration due to more advanced government policies and digital infrastructure, while countries like Oman, Kuwait, and Bahrain face greater challenges in scaling AI solutions. The research emphasizes the need for greater government support, infrastructure investment, and ethical guidelines to ensure responsible AI use in education.

Recommendations for university administrators include investing in AI-driven resource management systems, adopting AI tools for faculty and student management, and providing AI training for leadership. Policymakers are encouraged to develop national AI education strategies, provide financial support for AI integration, and promote research in AI-driven educational management. This research contributes to the growing body of literature on AI in education by providing insights specific to the GCC region and engineering programs. It offers a roadmap for further exploration, including comparative studies across regions, interdisciplinary applications of AI, and the ethical implications of AI-driven decision-making in higher education.

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CHAPTER 1 INTRODUCTION

1.1. Introduction

The recent rise of the Artificial Intelligence (AI) in the contemporary world has been revolutionary in many industries, and the sphere of education is not an exception. AI technologies are being embraced in more areas of educational administration to facilitate the processes, improve decision-making, and transform leadership functions. This thesis explores the potential of AI in educational administration and the particular effect it has on revolutionizing the leadership and decision-making processes in universities providing engineering programs and the Gulf Cooperation Council (GCC) region.

On a macro level, educational administration is the management and leadership role in the successful operation of a school. These roles are resource management, quality education, policies, and directing institutions to strategic accomplishment. Educational administrators have the duty to ensure that operations run smoothly, as they deal with numerous challenges, including growing student population, challenging curriculum requirements, and changing technological environments (Gmelch and Buller, 2015). This has increased the complexity of these roles in the 21 st century as universities have experienced unprecedented demands to be innovative, compete on the global scene, and equip students with the skills and competencies necessary to meet the demands of a rapidly changing workforce.

Universities around the world have been at the forefront of the use of new technologies to ensure that they remain competitive, especially in the engineering education sector. The fast evolution of AI and its application in education has transformed most areas of university management, and it is possible to implement more efficiencies and make decisions based on numbers. According to Zawacki-Richter et al. (2019), the use of AI in the higher education sector has grown substantially, and the institutions made use of AI in all aspects such as student recruitment, curriculum design, among others. The most prominent factors that contribute to the adoption of AI in educational administration are the necessity to manage resources more effectively, the necessity to streamline the administrative processes, and the necessity to make educational settings more complex (Ahmad et al., 2021).

Machine learning, predictive analytics, and automation are the latest examples of AI technologies that play a crucial role in enhancing operational efficiency in educational institutions. In the world, AI has been applied to automate the routine processes like schedule, managing student enrollment, resource distribution, and even grading systems (Ferguson et al., 2019). This has liberated administrators and teachers to concentrate on higher level activities like curriculum development, faculty leadership and improvement of student learning outcomes. Automation of these mundane

processes is a paradigm change in the way learning institutions are run and they can now be more efficient using fewer resources.

The potential of AI is not limited to operational benefits, but it can also revolutionize the way decisions are made in schools. With AI-based applications, administrators can receive actionable data based on large amounts of data in real-time and make critical decisions (Peters et al., 2020). This has potential impact on education leadership since administrators are now able to use data to make timely informed decisions that have a direct impact on the success of the institution. In regions with a rapidly growing education sector, such as the GCC, the adoption of AI has been seen as essential in meeting the needs of diverse and dynamic student bodies (Alenezi, 2021).

Educational administration in the GCC region is characterized by some distinct challenges such as the growing numbers of students, the changing government policies, and the necessity to deliver high-quality education in the global competitive world. The requirement of skilled graduates, especially in engineering courses has made universities to explore new methods of improving their administrative potentials. The use of AI is becoming an important instrument to overcome these difficulties (Alshammari et al., 2020).

GCC universities that provide engineering courses are embracing AI to not only streamline their complex processes but also to enable personalized learning experiences and enhance performance among students. Curriculum design, faculty management, student evaluation, and research are just a few examples of engineering programs that are enhanced by AI-based tools (Bhatia and Sharma, 2021). AI helps administrators to resources like faculty, labs, and equipment more effectively, as well as to optimize student and faculty recruitment and retention. The resource-heavy aspect of engineering education, including the need to have specific laboratories, costly equipment, and technically qualified professors, render AI-based optimization especially useful (Lee et al., 2020).

Furthermore, AI has already started influencing the process of leadership and decision-making on the university level. The GCC leaders of universities are becoming increasingly dependent on evidence-based information to make wise decisions regarding admissions, curriculum changes, faculty training, and finances (Aoun, 2020). AI contributes to their capability to analyze patterns, forecast futures, and make decisions based on the analysis and improvement of the efficiency and quality of operations and studies. As an illustration, AI-based analytics can reveal trends in student performance that can guide administrators to modify resources or strategies to achieve improved student performance (Rivera et al., 2021).

Manual processes, intuition and experience were used as the traditional leadership and decision making models in the educational administration (Simon, 1977). The leadership position is changing with the introduction of AI. It is expected that educational leaders now possess a more

in depth knowledge of technology and how it can be used in making decisions. AI offers them the means to transition to an active, rather than a reactive management, where they can forecast trends and challenges and address them before they turn into critical problems (Brynjolfsson & McAfee, 2017).

The implementation of AI-based decision-making is especially important in the engineering field of universities because the field is very technical. AI assists administrators and faculty to make evidence-based decisions related to student admissions, course offerings, and resource allocation as well as faculty performance. Educational leaders now have the role of ensuring that AI is incorporated in their strategic plans and that the information availed by AI systems is relevant to the institutions and enhances the learning processes (Peters and Ravenscroft, 2019).

Moreover, AI applications can promote improved communication and transparency between the university administration and stakeholders (faculty, students, parents, and governing bodies). The use of AI-based dashboards and data visualization tools enables leaders to display complex data in a friendly manner, enabling them to make decisions at all levels of administration (Taylor et al., 2021). This also results in improved accountability since decisions are made based on increasingly clear and data-driven evidence.

The effects of AI are even greater when applied to engineering programs because the field is more technical. The education in engineering must have access to the latest technology, practical implementation and incorporate modern teaching techniques. Through AI, adaptable educational platforms that can adjust educational content to the needs of specific students can be developed, which can assist in ensuring that students obtain the required skills to work in the labor market (Luckin et al., 2021).

The engineering education application of AI can also assist in making program-level decisions through the analysis of student performance, curriculum effectiveness, and faculty contribution. It helps the administrators to understand what needs to be improved and implement changes in the curriculum, faculty development program, and the distributions of resources in real-time (Chang et al., 2021). The AI-driven applications can even forecast the success of the students in any of the courses or modules, which in turn enables early intervention in circumstances where students might face difficulties (Nistor et al., 2020).

To conclude, the adoption of AI in the educational administration is a major change in the way that universities are run, make decisions, and lead. The importance of AI in changing the sphere of leadership and decision-making is more and more critical both on a macro-level with the implementation of AI in education worldwide, and on a micro-level with the influence of AI-based technologies on engineering studies at GCC universities. This thesis will delve into these changes,

and how AI is changing the face of educational administration, especially in universities that have engineering programs.

1.2 Background of the Study

The study background contains an in-depth explanation of the situation where AI is being implemented in the sphere of educational administration. This section discusses how education plays out in the 21st century, and how educational administration contributes to the future world citizen.

The 21 st century has been marked by high rate of technological advancement, globalization and a changing economy that requires new skills and knowledge. Education during this period is not only about delivering information; it is about enabling students to be competent in a world that is complex and dynamic. More and more, the conventional patterns of education, which rely on rote learning and standardized testing, are being supplanted by innovative, technology-oriented approaches, with the core emphasis on critical thinking, creativity, and problem-solving (Aoun, 2020).

The world is going through a paradigm shift in education systems. A rise in the focus on individualized learning, digital literacy, and the development of a global outlook is present. As knowledge economy emerges, learning institutions are challenged to produce learners capable of not only being proficient in technical aspects, but being proficient in collaboration and leadership, as well as flexible. Education in engineering fields, especially, has undergone a major change as higher education institutions attempt to provide students with the knowledge base and technical skills necessary to address the needs of redefined industries due to technological progress that includes AI, robotics, and machine learning (Alghamdi and Mirza, 2020).

AI has become an important stakeholder in changing the education field in the 21 st century. Besides transforming the learning process of students, AI is transforming the manner in which learning institutions are managed. Artificial intelligence (AI) powered tools, and systems are currently used to personalize learning experiences to individual students, forecast student performance, and send real-time information to educators and administrators (Huang et al., 2020). Additionally, AI is assisting universities in managing their resources, automating their administrative functions, and making informed decisions, so that institutions can remain abreast with the needs of high-quality education in the modern era (Ahmad et al., 2021).

When it comes to global education, it is increasingly becoming recognized that the workforce of the future will require being AI-skilled. In this regard, higher education institutions are starting to pay more attention to the adoption of AI in their curricula and administration. This is especially applicable to the engineering education domain, in which learners have to be ready to collaborate

with AI-based technologies and develop novel solutions in areas like healthcare, manufacturing, and information technology (Bhatia and Sharma, 2021).

Administration in education is an important aspect in determining the future of education and making sure that institutions are in a good position to produce the next generation of global citizens. Administrators play a role in the successful administration of educational institutions, such as the implementation of policies, allocation of resources, the management of both students and faculty, and the development of the curriculum (Gmelch and Buller, 2015). Educational administrators and the choices they make have far-reaching consequences, not only to the institutions they serve but the community and economy at large.

Educational administrators in a globalized world need to be forward-thinking to acknowledge the interconnectedness of economies, cultures and societies. To prepare future citizens, educational institutions need to encourage global skills, including cross-cultural communication, digital literacy, environmental sustainability, and lifelong learning. This can only be achieved if the institutions themselves are equipped with the tools and technologies needed to offer innovative, relevant, and high-quality education (Peters et al., 2020).

The role of educational administrators in this process can be greatly improved with the help of AI. AI enables administrators to concentrate on strategic planning and leadership instead of daily operations by offering data-driven insights and automation of routine operations (Davis, 1989). AI can assist education leaders to make better decisions regarding curriculum, faculty development, student recruitment, and resource management. As an example, AI-based analytics can be used to reveal issues in student achievements, and administrators can apply specific interventions that enhance student learning (Rivera et al., 2021).

In engineering programs, where the requirement to highly skilled professionals is especially acute, educational administrators should be careful to make sure that students not only know technical skills, but also have the leadership, critical thinking and problem-solving skills that they will require in a dynamic and technologically advanced global workforce. This can be facilitated by AI which can provide individual learning trajectories, make real-time evaluation of student development, and allow engineering courses to be relevant to the industry needs (Luckin et al., 2021).

The 21 st century educational administrators are therefore leading the pack in the great change of the way universities are run and how students are equipped to take up their respective roles in the society in future. The adoption of AI in educational administration is allowing these leaders to make more informed, efficient and strategic decisions and eventually produce more capable and well-rounded citizens of the world.

Over the past few years, AI has emerged as a vital resource that educational administrators can use to run institutions in a more efficient manner and enhance student performance. The most prominent functions of AI in assisting the educational administration are (Ferguson et al., 2019; Lee et al., 2020; Taylor et al., 2021):

- Administrative Tasks: AI can be used to automate administrative functions, including student enrollment, schedule, and attendance tracking. This not only lessens the administrative load on personnel, but also enhances efficiency and accuracy.

Data-Driven Decision Making: AI-driven analytics solutions enable administrators to process large volumes of data, identify trends, and make informed decisions. This is especially handy when it comes to budgeting, allocating resources and administering faculty.

- Student Success Predictive Analytics: AI can forecast student success and detect at-risk students, allowing the administrator to take early action and support them with specific intervention.
- Improved Resource Utilization: AI is able to streamline resource utilization in the form of classes, laboratories, and faculty members and keep institutions running at peak capacity.

Strategy Planning and Leadership: AI will allow educational leaders to create more effective long-term strategies, which align with the interests of the global economy, as it will give insights into student demographics, faculty performance, and market trends.

Artificial Intelligence has grown to feature prominently as an element of innovation in many fields and education is not left behind. Schools across the globe are adopting AI technologies in their management systems to facilitate operations, boost efficiency and decision-making. The capacity of AI to handle large volumes of data, to automate routine processes, and to provide predictive analytics has radically changed the administration of education (Zawacki-Richter et al., 2019). AI in educational administration has been adopted rapidly across the world in the areas of:

- Student Enrollment Management: AI systems can process data on applications and predict the success of students, enabling institutions to choose the most promising ones. Such systems also streamline the admission process, including applications, to enrollment, and allow a smooth experience to both students and staff (Durnali & Tunç, 2021).
- Schedule Courses and Resources: AI has the potential to plan classes and resource scheduling dynamically, assigning resources to classes like classrooms and faculty and making administrative processes more efficient. Through data on student and faculty requirements, AI makes sure that the institutional resources are used in the most efficient manner (Bastos et al., 2020).
- Student Performance Tracking: AI-based applications can regularly track student

performance, targeting at-risk students and enabling administrators to craft personalized interventions to enhance student performance (Rivera et al., 2021).

- Administrative Automation: Administrative duties like attendance tracking, financial aid, and faculty performance appraisals can be automated, which will greatly decrease administrative work and enhance accuracy (Ahmad et al., 2021).

A region of the United Arab Emirates (UAE), the Gulf Cooperation Council (GCC) region, which includes Saudi Arabia, Oman, Kuwait, Qatar, and Bahrain is experiencing a higher education transformation, facilitated by a fast tracked economic growth and technological advancement. GCC countries have put a heavy focus on the contribution of education to the development of a state, and the implementation of AI in education administration has been seen as one of the elements of realizing the vision (Alenezi, 2021).

Over the past few years, GCC universities have been embracing AI to enhance the efficiency of their operations, cut the administrative expenses, and improve the quality of their learning experience. The emphasis on diversification of the local economies and training the population to meet the needs of the worldwide knowledge economy has placed the implementation of AI in educational establishments among the top priorities in the region (Alshammari et al., 2020). As a result, AI is being used in areas such as:

Strategic Enrollment Management: GCC universities are turning to AI to streamline enrollment activities, so that they could attract the best students in the region and beyond. AI technologies evaluate the applications of students, estimate future success, and tailor recruitment policies, so that the universities do not lose their competitiveness in an international context (Alharbi et al., 2021).

- Resource Optimization in Engineering Programs: AI can be used in universities that offer engineering programs to optimize technical resources like laboratory equipment, research facilities and expertise of a faculty. AI helps to optimize the use of resources by forecasting the resources required and their effective utilization to improve the student experience and operational efficiency (Lee et al., 2020).

Personalized Learning and Student Support: AI-based technologies enable universities to customize educational experience to the needs of students, providing them with a personalized learning journey and real-time academic guidance. This is particularly beneficial in engineering programs, where students often require specialized resources and mentoring to excel (Alenezi et al., 2020).

Moreover, AI aids universities in the GCC to meet their key performance indicators (KPIs) set by the governments to enhance the quality and competitiveness of higher learning. The use of AI in

administration is such that it allows universities to pay more attention to academic quality and innovation, and automated most common tasks, including scheduling, grading, and student evaluations (Alghamdi and Mirza, 2020).

The AI in educational administration does not only refer to the operational efficiency, but it is also about changing the leadership and decision-making process. Historically, the common leadership models in universities involved taking decisions that were based on experience, intuition and manual analysis of data at hand (Simon, 1977). Although this process has been effective in the past, it is being gradually substituted by data-driven decision-making that is propelled by AI. This transformation has never demanded leaders in educational institutions to change more than ever before (Brynjolfsson and McAfee, 2017).

The role of AI in revolutionizing leadership in universities involves:

- Data-Driven Leadership: AIs offer educational leaders real-time data and predictive analytics, enabling them to make better decisions. Trend analysis of student performance, faculty workload, or resource allocation as an example, AI can inform leaders to make strategic decisions that can support institutional goals (Bass & Riggio, 2006).

Strategic Planning: AI assists in long-term planning by evaluating historical and real-time data and predicting future trends. This will allow the leaders of the university to take the initiative in issues like student recruitment, curriculum design, and faculty development, and make sure that the institution is competitive in an already dynamic educational environment (Silver and Daniel, 2021).

- Improved Decision-Making: AI will allow leaders of universities to shift to proactive decision-making. An example is how AI can display the programs that might experience a rise in demand or students who might require extra help, allowing leaders to invest resources more effectively (Peters and Ravenscroft, 2019).

The necessity to attain educational excellence in the competitive global market has motivated the demand of AI integration in leadership in the GCC. The leaders of the university are supposed to keep their institutions on the top of innovation and AI can be a critical part to achieve these expectations. Through the power of AI, educational leaders in the GCC can make faster and more accurate decisions, which are more aligned with the long-term strategic goals (Alharbi et al., 2021).

The technical and resource-intensive nature of engineering processes makes AI-driven decision-making processes beneficial to the field in general, and engineering in particular. The predictive insights that AI provides due to its capability to analyze large amounts of data allow administrators and faculty to make optimal decisions regarding the academic and operational components of engineering education (Bhatia and Sharma, 2021). The effects of AI on decision-making in

engineering courses include some examples, such as:

- Curriculum Development and Updates: AI is able to analyze trends in the industry, requirements in the job market, and student feedback to update the curriculum. This makes engineering programs stay up-to-date and in line with the needs of the current industry like AI, robotics, and data science (Luckin et al., 2021).

Faculty Management and Development: AI tools could be used to evaluate the performance of faculty through the teaching outcomes, research work, and student feedback. This enables university leaders to make sound decisions regarding faculty development, promotions, and hiring, as well as make sure that the institution maintains the best talent (Peffer et al., 2020).

Student Success and Retention: AI-powered tools can track the performance of students 24/7, detecting students who are at risk of failure or dropouts. This enables administrators to provide specific interventions to enhance the retention rate of students in the program and the program in general.

As GCC universities struggle to meet the requirements of government in terms of quality and innovation in their education, AI is emerging as a very important instrument of governance. University leaders are supposed to make strategic decisions that will enhance the growth of the institutions in line with the national policies and regulations on education. AI offers the available data to support the insights required to realize these objectives, and universities can fulfill their KPIs concerning aspects like student achievements, research contributions, and international partnerships (Alharthi et al., 2020).

Conclusively, the growing need to integrate AI in leadership and decision making is transforming the way universities are being governed. With the help of AI, educational leaders can make more informed decisions in a much shorter period and satisfy the requirements of the global economy and the needs of the institution. In the GCC, where universities have been established as a major force in national development, AI is regarded as the way to make sure that educational institutions stay competitive and innovative in the 21st century.

1.3 AI in Engineering Education: Considering the Rapid Advancements

Education in engineering has been a cornerstone of technological advancement, providing students with the knowledge and skills to design, innovate and solve problems in various disciplines such as civil engineering and computer science. Nevertheless, the 21 st -century technological revolution and the shifting industry demands have created new challenges to the traditional engineering education.

With industries becoming more dependent on AI and other innovative technologies, AI in engineering education is emerging as a vital aspect in preparing students to excel in this highly

competitive and dynamic environment. The application of AI in engineering education extends beyond the process of educating students about the AI technologies; it will change the whole education process, including the development of the curriculum and evaluation of the students, as well as the organization of the engineering programs (Bhatia and Sharma, 2021).

The inclusion of AI into the engineering programs is necessary because of the increased role of AI technologies in the industries. In robotics, autonomous systems, data analytics, or renewable energy, AI has become an essential part of the contemporary engineering solutions. Thus, the role of AI in engineering education is dual: on the one hand, it is the provision of students with a profound knowledge of AI technologies in particular, and, on the other hand, facilitating the use of AI to enhance the educational processes that contribute to the development of skills (Zawacki-Richter et al., 2019).

As the AI-based industries are on the increase, engineering graduates skilled in AI technologies become more in demand. Engineering programs are now being integrated in universities and include AI-centered courses that address such important issues as (Alghamdi and Mirza, 2020):

Machine Learning and Deep Learning: Students will acquire knowledge of how to create and utilize algorithms that allow machines to learn using data.

Natural Language Processing (NLP): Students learn more about how AI systems think and interpret human language, which is essential in building intelligent systems such as virtual assistants.

Computer Vision: AI has a wide range of uses in fields of healthcare, automotive, and security thanks to its ability to process and analyze visual data.

- Robotics and Autonomous Systems: Engineering students learn about the role of AI technologies in the creation of autonomous machines: self-driving cars, industrial robots.
- Data Science and Analytics: AI-based data analytics are now at the core of decision-making in engineering projects, and students must know how to apply AI to analyze large datasets and draw actionable insights.

Students can acquire not only theoretical knowledge but also take practical courses where they create AI models and systems that resemble the real world, through these courses. This makes them ready to enter the AI-driven employment scene and allows them to be involved in the innovations in the healthcare, manufacturing, transportation, and telecommunication industries (Luckin et al., 2021).

In addition to teaching AI as a course, the technology is being adopted to revolutionize the way engineering education is being taught. AI is optimising the learning experience in many aspects (Alenezi et al., 2020; Chang et al., 2021; Nistor et al., 2020):

Personalized Learning: AI systems can also learn the strengths and weaknesses of each student and their learning preferences, which will enable instructors to individualize the learning process to the needs of each student. This is especially the case in engineering where the students usually require individual attention to excel in technical subjects that are not simple to understand.

- Adaptive Learning Platforms: AI platforms are constantly updating to the student progress and provide tailored learning experiences, practice activities, and feedback to the student. This will make sure that students will understand the fundamentals before proceeding to other more advanced lessons so that they will develop a strong background in engineering concepts.

For example, Virtual Laboratories and Simulations: AI can be used to create virtual laboratories where students can trial engineer concepts in a secure, controlled system. These laboratories replicate real life applications, which means that students do not have to use costly physical material to work on AI-based projects.

- AI-Enhanced Assessments: AI is used to automate the assessment process, providing instant feedback on assignments and exams. AI can be used in engineering education to assess complex tasks (coding, design, analysis) to provide more frequent and detailed feedback to students.

Intelligent Tutoring Systems: AI tutoring systems offer students on-demand assistance, responding to questions and helping them solve problems. These systems are able to identify a struggling student in a concept and provide extra resources or clarifications to achieve comprehension.

The field of engineering is in a major change, as there has been a high pace of AI, automation, and data-driven technologies. The requirements of engineering graduates have changed as industries have increasing dependence on AI. Employers are now recruiting those that are not only competent in the classical engineering skills but also with knowledge in the AI technologies and their ability to use them to solve complicated industrial problems (Alshammari et al., 2020).

AI is helping industries in the automotive, aerospace, manufacturing, healthcare, and telecommunications sectors to become more efficient, less expensive, and create new products and services. As a result, the demand in engineers knowledgeable in the integration of AI in different industrial procedures increased, including:

- Automation and Robotics: Engineers will create AI-based robots and autonomous systems that will be able to do the work which is traditionally performed by humans. This embraces automation of factories, autonomous vehicles, and intelligent manufacturing.

Predictive Maintenance and Data Analytics: AI is transforming the way industries maintain assets and equipment. Now engineers can design and implement AI systems which predict equipment failures, optimize maintenance schedules, and enhance operational efficiency using data analytics.

• Smart Infrastructure and IoT: Engineers will be responsible to develop AI-based infrastructure, including smart cities or intelligent transportation systems. Artificial intelligence is a very key aspect in facilitating the functionality of these systems to handle large volumes of real time data.

• Healthcare and Biotech: AI is finding medical device design, drug development, and personalized medicine applications. Healthcare engineers will likely come up with AI-based solutions to enhance patient outcomes and optimize healthcare delivery.

Consequently, the engineering education should be modified to meet these requirements of the industry. The introduction of AI into engineering programs is a key to making sure that the graduates would be well-prepared to join the workforce and be able to comply with the requirements of the AI-driven industries. Engineering higher education institutions are adopting interdisciplinary studies that integrate engineering with AI, data science, and business strategy, which result in graduates who are able to spur innovation and fulfill the demands of future industries (Bhatia and Sharma, 2021).

Increased Industry 4.0 as a result of the merging of physical and digital systems has put AI in the center of engineering education. Industry 4.0 is the trend of continuously automating the traditional manufacturing and industrial processes, with the implementation of modern smart technology, such as AI, to establish more efficient, flexible, and intelligent production systems. These AI-based systems should be designed and controlled by engineers, and their work will mean a strong knowledge of AI concepts and their implementation in industrial environments (Alghamdi and Mirza, 2020).

Engineering programs should be able to develop the ability of students to: in order to meet the needs of Industry 4.0.

• Design AI-Driven Systems: Engineering graduates should be able to design systems that incorporate AI technologies into physical infrastructure, including autonomous factories, and smart grid systems.

• Applied AI Product Design: AI is transforming product designing, and engineers are able to design more advanced and efficient products. To illustrate, AI-based simulations can be used to optimize designs prior to the creation of physical prototypes, so as to save time and resources.

• Collaborate Across Disciplines: The introduction of AI in engineering involves collaboration between engineers, data scientists, and business strategists. Universities are forced to equip students to be able to work in interdisciplinary groups, solving complex problems which demand both technical and strategic understanding.

AI is not just transforming industries but altering skillsets of engineers. With the further evolution

of AI, engineering graduates will have to have the following skills to be competitive (Alshammari et al., 2020):

- AI Proficiency: Engineers should be well versed in AI technologies, such as machine learning, neural networks, and data analytics. Such skills will enable them to develop AI-based systems and also help in innovations in AI applications.

Problem-Solving and Critical Thinking: AI improves problem-solving by offering engineers with powerful tools to analyze data and make decisions. Nevertheless, engineers will always require critical thinking capabilities to derive AI-generated insights and implement the latter to actual problems.

- Adaptability and Lifelong Learning: Due to the speed of technological shifts, engineers should be flexible and ready to lifelong learning. Universities should create the culture of lifelong learning, and graduates should keep up with the changes in AI and other technologies.

The role of AI in the field of engineering education cannot be overestimated. Not only does it help improve the learning process by offering personalized, adaptive, and efficient learning tools, but it also equips students with the skills necessary to work in an AI-powered industrial environment. With the industries adopting AI in large numbers than ever before, engineering programs have to change so that upon graduation, graduates have the necessary skills and knowledge that will make them successful in a fast-evolving world. To equip the upcoming generation of engineers in the future of technology and industry, the introduction of AI into the curriculum and the management of engineering programs is crucial (Alkhater et al., 2021).

1.4 Problem Statement

With the world characterized by a fast changing technology and growing complexity in running institutions of higher learning, educational administrators in the Gulf Cooperation Council (GCC) countries are finding it very demanding to make informed and strategic decisions. Such obstacles are especially acute at the universities, which provide engineering education, as the organization of intricate academic and technical resources requires highly developed planning, accuracy of execution, and continuous assessment (Gmelch and Buller, 2015).

Conventionally, leaders in learning institutions used their intuition and experience when making decisions, which in most cases lacked solid data analytics. This method, which worked well in previous decades, can no longer be effective in the modern fast moving educational context (Simon, 1977). Administrators now find themselves supposed to make swift and precise decisions usually in reaction to the evolving demands of education, expectations of students and government regulations. The use of manual processes and lack of access to real-time data prevents the educational leaders to be proactive in responding to arising challenges, which results in

inefficiencies in the areas of resource distribution, faculty management, curriculum development, and student support (Black, 2018).

Specifically, the fact that the insufficient data is a significant impediment to successful decision-making in GCC universities. In the absence of reliable and prompt data, administrators are not able to make sound decisions regarding the future of their institutions. Such decisions involve:

Student Enrollment and Retention: To make effective decisions regarding recruitment efforts and student support programs, administrators require comprehensive data to learn more about enrollment trends, demographics of students, and their retention rates (Durnali and Tunç, 2021).

Curriculum Design and Updates: Engineering programs, in particular, need to be updated regularly to stay up-to-date with the changes in technology. In the absence of student performance, industry needs, and faculty experience data, it is hard to make effective decisions regarding curriculum creation (Bhatia and Sharma, 2021).

- Resource Allocation: The allocation of resources, like faculty, laboratories, equipment and funding, are important to the success of engineering programs. The lack of real-time information regarding resource use can lead to over- or under-allocation of resources, which can affect the quality of education and efficiency of operations (Lee et al., 2020).
- Faculty Performance Management: Faculty performance should be assessed and measured by the outcomes of students, research, and involvement to ensure the high academic standards. Nevertheless, in the absence of data-driven insights, administrators might not have the information needed to conduct an unbiased evaluation (Peffer et al., 2020).

Moreover, traditional hierarchies and strict administrative frameworks tend to limit the leadership processes in the GCC universities and slow down the decision making process and restrict the leaders in the GCC universities to adopt new solutions (Harris and Spillane, 2008). The lack of integration between various administrative departments adds to these inefficiencies by creating silos of information, and disjointed decision making processes. These inefficiencies disrupt the capacity of GCC institutions to realize their strategic objectives and improve their global image in a region where universities are gaining more and more importance in the global arena (Alenezi, 2021).

Considering the challenges identified above, there is an increasing need to investigate the potential of using Artificial Intelligence to transform the processes of decision-making, leadership, and administration in GCC universities and especially those providing engineering programs. There are various capabilities of AI that can deal with the current inefficiencies and data constraints of educational administrators. The opportunity of AI transforming the work of educational administration is that it has the power to deliver insightful data, automate the routine, and improve

strategic decisions (Aoun, 2020; Brynjolfsson and McAfee, 2017).

AI can enhance the decision-making process in universities to a significant extent by availing real-time data and sophisticated analysis to administrators. Using AI-based tools, educational leaders will have access to huge volumes of data of various sources, including student performance data, faculty reviews, resource utilization data, and market trends. Such insights will allow the leaders to make well-informed, data-driven decisions that align with the strategic goals of the university (Peters et al., 2020; Taylor et al., 2021).

As an example, predictive analytics powered by AI can assist administrators in predicting trends related to student enrollment, identifying at-risk students, and creating specific interventions to boost the retention rates (Rivera et al., 2021). Likewise, AI can be employed to predict resource requirements of engineering curricula to make sure that faculty, laboratories, and equipment must be efficiently allocated (Lee et al., 2020). With the help of the AI to track key performance indicators (KPIs) in real-time, administrators will be able to react rapidly to upcoming challenges and take a proactive decision that will enhance the overall performance of the institution.

AI also makes the decision-making process more transparent and accountable. The use of objective data in making decisions can help administrators minimize the impact of their personal bias and make their decisions objective, just, and consistent (Floridi et al., 2018). This is especially vital in the aspects like promotion of faculty and issuance of resources, where transparency and accountability are vital in ensuring there is trust within the institution.

AI is also changing the way decision-making is being done, as well as the role of leadership in educational administration. With the growing use of AI technologies in universities across the GCC, leaders have to adjust to a new model of leadership that is more focused on data literacy, technical skills, and strategic thinking (Bass and Riggio, 2006; Senge, 2018).

Conventionally, educational heads have used their experience, their intuition and people skills to lead their institutions. Nonetheless, introducing AI in administrative workflow involves leaders who must be skillful in data analysis, interpreting AI-related insights, and decision-making on the basis of such insights. This change towards data-driven leadership instead of intuition-based leadership is critical in making sure that universities would be able to navigate the challenges inherent in the modern higher education (Brynjolfsson & McAfee, 2017).

The use of AI also improves the monitoring and evaluation capabilities of leaders on the performance of their institutions. For example, AI can be used to track the progress of strategic initiatives, measure the impact of new policies, and assess the effectiveness of faculty development programs (Silver & Daniel, 2021). AI can assist leaders in making more effective decisions and revising their strategies when needed because it will provide them with real-time data on these

areas.

Additionally, AI can be used in distributed leadership approaches to facilitate more collaborative and inclusive decision-making. AI-driven dashboards and data visualization services can be distributed within the department, and a number of stakeholders can participate in the process of decision-making (Sanchez et al., 2020). It results in more comprehensive and balanced decisions that incorporate the wide range of views of faculty, staff, and students.

The need to integrate AI in the management of engineering courses is especially important due to the resource-heavy nature of the courses. Education in engineering necessitates a close coordination of both the faculty, laboratories, equipment and funding in order to have the students receive a good quality education matching in the industry. Artificial intelligence has the potential to simplify these administrative procedures, automated routine, better allocation of resources, and real-time information on program effectiveness (Lee et al., 2020; Bhatia and Sharma, 2021).

As an example, AI can be applied to schedule tasks, making sure that engineering students receive the resources needed, including the time to spend in the laboratory and the time with the faculty (Bastos et al., 2020). Administrators can also use AI to keep track of equipment and laboratory use, making sure that these resources are effectively utilized and are in good condition. Furthermore, AI is able to process information about the performance of students and their contributions to the faculty to determine where they could use more help or resources (Chang et al., 2021).

Another area of AI application in the management of engineering programs is in curriculum development. AI-based tools may be used to process trends in the industry and data on the job market to make decisions regarding the changes in the curriculum so that engineering programs are not outdated and irrelevant to the needs of the employers (Luckin et al., 2021). It is especially vital when it comes to artificial intelligence, robotics, and data science, where the technological progress is taking place at a fast rate.

To sum up, AI application in educational administration provides substantial opportunities to enhance the decision-making process, leadership, and administration in GCC universities. AI can resolve the inefficiencies exhibited by the educational administrators by offering insights with a data foundation, automating time-consuming processes, and improving the strategic decision-making process. This is especially critical in those universities that have engineering courses, where coordination of complex resources and matching of curriculum with industry demands high level of planning and implementation. With the ongoing development of AI, its application to changing the educational administration will become more and more crucial, allowing universities to stay competitive in the ever-changing educational environment.

1.5 Research Objectives

The research objectives outline the primary goals of the study and guide the direction of the investigation. For this thesis, the objectives focus on exploring the role of AI in transforming educational administration, leadership, and decision-making processes, with a specific focus on universities offering engineering programs in the GCC region.

Based on the research gaps identified in the literature review, the following objectives and hypotheses guide this study:

- To explore the transformative role of AI in educational administration within the GCC region.
- To find how AI is influencing leadership and decision-making processes, particularly in universities that offer engineering programs?
- To evaluate the effectiveness of AI in specific administrative functions, with a particular focus on its role in enhancing the management of engineering education.

1.6 Research Questions

The research questions are designed to provide a structured inquiry into the study's objectives. They address key aspects of AI's role in transforming educational administration, leadership, and decision-making, particularly in universities offering engineering programs in the GCC.

1. What is the transformative role of AI in educational administration within the GCC region.
2. How AI is influencing leadership and decision-making processes, particularly in universities that offer engineering programs?
3. What is the effectiveness of AI in specific administrative functions, with a particular focus on its role in enhancing the management of engineering education?

1.7 Significance of the Research

This study is important in that it may offer valuable insights into the changing role of AI in educational administration, especially in the GCC region. With the GCC universities attempting to compete in a globalized higher education market, AI will be a potent instrument in enhancing leadership, decision making, and administrative efficiency. The results of the study will lead to a better comprehension of the ways AI can be successfully incorporated into educational institutions with special attention paid to the engineering programs.

Among the main contributions of this study is the discussion of the role of AI in improving leadership and decision making at universities. Education administrators, especially those overseeing intricate engineering courses, are confronted with a variety of challenges when it comes to making informed decisions in a timely manner (Black, 2018). This research will offer

information on how algorithms based on AI, predictive models, and automation systems can enhance the accuracy, speed, and efficiency of leadership decision-making.

In particular, the study will:

- Emphasize the advantages of the AI-driven leadership in terms of better resource allocation, performance monitoring, and strategic planning (Peters et al., 2020; Silver and Daniel, 2021).
- Show how AI may advance cooperation and openness in the world of educational leaders, making the process of decision-making more inclusive and data-driven (Sanchez et al., 2020).

With the rising use of AI technologies in universities in the GCC region, it is important to have evidence-based research that can inform policymakers and educational leaders in making informed decisions regarding the integration of AI. This paper would offer viable suggestions on how AI can be used to enhance the running of learning institutions, especially those that run engineering courses.

The findings will:

- Help the policymakers learn about the advantages and difficulties of adopting AI in higher education so that they can create favorable policies and regulations (Alharbi et al., 2021).
- Equip educational leaders with a guide to the implementation of AI into their administrative procedures, as it would allow them to attain a higher level of efficiency in their operations, higher student achievement, and competitiveness in the global education market.

1.8 Scope and Delimitations

Boundaries of a study are established by its scope and limitations, pointing out areas of inquiry and the limitations that may be involved in its generalizability of findings. The scope of the research on the topic of Role of AI in Educational Administration and Its Impact on Transforming Leadership and Decision-Making Processes - With Special Reference to Engineering Programs in Universities is the universities of the GCC countries offering engineering programs, whereas the limitations are the geographical and institutional context and respondent profiles.

This study is mainly concerned with universities that have engineering programs in the six members of the GCC, the United Arab Emirates (UAE), Saudi Arabia, Oman, Kuwait, Bahrain and Qatar. This regional orientation can be explained by the fact that these countries are major stakeholders in the sphere of education worldwide and in the national development policies. The GCC countries, including Saudi Vision 2030 and the UAE Centennial 2071 Plan, both of which recognize the importance of science, technology, and innovation in achieving sustainable economic growth, have education as a key pillar of long-term economic diversification (Alenezi, 2021; Alshammari et al., 2020).

The engineering programs are of special significance in this area because GCC pays much attention to the development of the infrastructure, energy, technology, and manufacturing industries. This has led to an increase in the number of needed engineers because the countries are placing their focus on investment in infrastructure projects (including smart cities, renewable energy, and transport systems), military industries, and high-tech sectors such as AI and robotics. Subsequently, engineering education is important in delivering the human resource that can respond to the rising demand of technical skills that are highly specialized (Alghamdi and Mirza, 2020).

This interest in engineering programs is also explained by the necessity to keep up with Industry 4.0 to which AI, the Internet of Things (IoT), and automation are changing the old ways of industries. The faculties of engineering at GCC universities are the first to incorporate these technologies within their educational programs and are, therefore, a perfect place to examine how AI affects the administration of education and the process of making decisions (Bhatia and Sharma, 2021).

GCC region offers a special scenario to this study since the region is embarking on a high-tech modernization and educational transformation drive. The GCC countries have all unveiled policies and national strategies that highlight the use of high-level technologies, such as AI, in many areas, especially higher education. For instance:

- UAE boasts the presence of the best universities, including Khalifa University, which has special courses in AI and engineering and is considered a center of innovation and research in the country (Alhammadi and Salem, 2021).
- Saudi Arabia has invested a lot in the creation of universities such as the King Abdullah University of Science and Technology (KAUST), which primarily deals with science, technology, and engineering and integrates AI into its research and administration (Alghamdi et al., 2020).

Qatar, via its Qatar National Vision 2030, has also placed a particular focus on the importance of education and innovation to create a knowledge-based economy, and universities like Qatar University have been at the forefront of AI and engineering research (Al-Kuwari and Al-Dosari, 2020).

The geographic focus of the research, therefore, will be the universities of these GCC nations that provide engineering courses since they are the most likely institutions to implement AI technologies, both academically and administratively.

1.9. Limitations

Although the research is extensive in terms of the GCC region, it also has some critical limitations which should be taken into account when analyzing the results of the research. These are

geographically focused as well as respondent-specific limitations.

The research is confined geographically to the GCC region and this limits it has its merits as well as limitations. Although the GCC can provide a distinct environment in which AI integration in higher education management can be examined, the context of this region is also unique, including the wealth, state financing of education, and the swift adoption of technologies. It implies that the results of this research cannot be readily applied to non-GCC universities, especially in those areas where the rate of AI adoption and education policies vary greatly.

The research fails to consider the variability of education systems worldwide where AI implementation can be different depending on such variables as institutional financing, regulations, and cultural beliefs towards technology in education. Therefore, the overall applicability of the research results can be restricted to the situations, which resemble the GCC regarding the level of technological progress, economic priorities, and governmental investment in education.

The other limitation is that this research is mainly based on the views and experiences of the educational leaders and administrators of engineering faculties. Although these administrators are of strategic importance in making decisions that involve the management of resources, faculty, and student outcomes, their views might not reflect the overall influence of AI on the whole university system. This emphasis on engineering programs is explained by the fact that engineering programs typically lead in the use of AI and need to deal with a range of complex resources, but it also implies that the study will not be able to reflect the specifics of the effects of AI in non-engineering faculties.

Moreover, the emphasis on educational administrators might not provide information on the perceptions and experiences of other stakeholders, including faculty members, students, and non-academic staff. Administrators are more strategic and managerial outlook on the role of AI in educational administration, and yet they might not be representative of the challenges and opportunities AI brings to academic and teaching practices.

The sample size and the difference in institutions between the GCC are another constraint. Despite the study aiming to gather information by using a representative sample of administrators in various universities in the GCC, there might be a great disparity between institutions in the area in regards to AI implementation and technological capabilities. As an illustration, one university can be more developed in terms of its application of AI to administrative purposes, whereas others are only starting to experiment with these technologies.

This inconsistency may impact the generalizability of the study to the region and especially between universities in countries with varying degrees of AI adoption and investment in

technology. Furthermore, the sample size of administrators in each of the universities is relatively small, which can be a limitation to the extent of information obtained on how AI is changing particular administrative processes and decision-making models.

The time frame of the study also is a limitation since it is one of the snapshots of the AI integration and its effect on the leadership and decision-making processes at the moment of the research. The sphere of AI technologies is rapidly changing, and the further evolution of AI systems can shift the way educational institutions can adopt and implement AI in the long run. Therefore, the results of this research can be outlived as AI technology and education in general will keep changing. The consequences of AI on educational administration and leadership are likely to have a lasting effect that might not be well reflected in the time of this study.

Finally, the area of focus in this research is well established since it aims to study engineering programs in GCC universities. This offers an ample background to understand how AI is changing the way leaders and decision-making processes occur in an ever changing education environment. Nevertheless, the research also admits that it has certain limitations, in particular, the geographic scope of the GCC and the use of views of educational administrators, as well as the possibility of diversity of institutions regarding the adoption of AI.

Identifying these limitations, the research will aim at contributing useful information to the research question about the role of AI in educational administration without overlooking the factors that can restrict the generalizability of the findings. The fact that the study is based on the GCC region and engineering programs provides a unique contribution to the field, whereas the limitations of the study imply potential areas of future research to be conducted, including the possibility that AI may be used in non-engineering programs or that the study should be conducted in other areas with different educational environments.

1.10. Thesis structure

This thesis will be divided into six chapters. Every chapter deals with a particular part of the research, providing an overall discussion of the impact of AI on leadership, decision-making, and the management of education, especially in engineering courses in GCC universities.

Chapter 1: Introduction

The introductory chapter contains the background, relevance and purpose of the research, which sets the stage of the study. It starts with the definition of the concept of educational administration and the increasing role of AI that has been changing the leadership and decision-making process on university levels. The research problem is also defined in this chapter and it reveals the challenges encountered by educational administrators in the GCC especially in the engineering programs. The chapter ends with a research objectives, research questions and the study scope.

Chapter 2: Literature Review

Chapter 2 gives an overview of the literature available regarding AI in the fields of educational administration, leadership and decision-making. It discusses different articles that analyze the integration of AI into institutions of higher education across the world and the GCC. The literature review encompasses discussions about the role of AI in data-driven decision-making, managing resources, faculty optimization, and personalized learning. Moreover, this chapter uncovers gaps in the literature that exist, which supports the necessity of this research.

Chapter 3: Research Methodology

The third chapter describes the research methodology that was used in the study. This chapter presents the descriptive research design, the study population (educational administrators and leaders of the GCC universities that provide engineering programs), and the multistage random sampling method to gather data. The chapter also outlines the data collection tools (such as a structured questionnaire) and data analysis tools (such as correlation analysis, regression analysis, and ANOVA). Also, the chapter talks about the reliability and validity tests conducted to ascertain the accuracy of the research results.

Chapter 4: Data Analysis and Interpretation

Chapter 4 presents the results of the data analysis. It begins with a demographic profile of the respondents, followed by an in-depth analysis of AI's impact on leadership, decision-making, resource allocation, and faculty management in engineering programs. The chapter uses various statistical tools to interpret the data and provides detailed tables and figures to illustrate the findings. Key insights regarding AI's influence on operational efficiency, decision-making speed, and leadership effectiveness are discussed in this section.

Chapter 5: Findings and Discussions

The fifth chapter synthesizes the key findings of the research and compares them with existing literature. It highlights how AI has transformed educational leadership and decision-making in the GCC, offering a comparative analysis of AI adoption across different countries. The chapter also explores the implications of AI for educational leaders and engineering programs, discussing the challenges and opportunities AI presents in higher education. This section concludes with a discussion of the broader regional impacts and the ethical considerations surrounding AI integration in educational administration.

Chapter 6: Conclusion and Recommendations

The final chapter concludes the thesis by summarizing the major findings and their implications for educational leadership in the GCC. It offers practical recommendations for university administrators and policymakers to foster AI adoption in higher education, focusing on the

integration of AI in resource management, faculty optimization, and personalized learning. The chapter also outlines future research directions, suggesting opportunities for cross-country comparative studies, interdisciplinary research, and investigations into the ethical implications of AI in education.

CHAPTER- 2 LITERATURE REVIEW

2.1. Introduction

The impact of Artificial Intelligence (AI) on changing the field of educational administration has become an important topic in recent years. With the adoption of AI in universities across the world to address the challenge of administrative efficiency, decision-making, and leadership functions, this literature review attempts to offer an all-encompassing search of the available research on the issue of AI in the higher education sector, especially in universities that have engineering programs. In this chapter, the main themes to be discussed will be connected with the introduction of AI in educational institutions, challenges and opportunities which it offers to leadership and decision-making, along with its particular use in the organization of engineering education.

To deliver a comprehensive picture, the review encompasses a variety of domains of research, such as: the wider AI contribution to education; AI contribution to educational administration; AI contribution to leadership and decision-making; AI contribution to management of engineering programs; and the adoption of AI in the GCC region. This chapter aims to give a framework upon which the role played by AI in educational administration can be understood, the knowledge gaps in the existing literature, and the future research gaps that need to be filled.

2.2 AI in Education: Global Overview.

Artificial Intelligence has quickly become a revolutionizing technology that is transforming the educational systems worldwide. The uses of AI in education extend to improving the administration system to individual student learning. The current body of AI in education research underscores the comprehensive nature of AI usage, where research has focused on enhancing operational efficiency, decision-making, and adaptive learning environments through AI technologies.

AI has also made a great contribution towards personalized learning in that customized learning experience is provided to students depending on their unique learning requirements. Zawacki-Richter et al. (2019) state that AI can be used to create intelligent tutoring systems (ITS) which can adjust to the progress of the learner and provide them with personalized content and feedback. These systems process vast amounts of data related to the interactions of students with the educational materials to identify their needs enabling educators to make the necessary changes to the teaching strategy in the moment. The development of AI applications in higher education has demonstrated a significant change towards the simple automation tools to more complex and adaptive systems that can help facilitate complex educational processes.

Some of the studies emphasize the importance of AI in forecasting success of students and detecting at-risk students. The AI codes can analyze different variables, including academic results, attendance, and activity, and forecast student performance. Machine learning models within the educational systems have been found to be very accurate in predicting dropout rates and academic achievement as discussed by Huang et al. (2020). The insights would enable teachers to intervene in the early stages and support the students further, which would lead to increased retention and graduation rates. Analytics powered by AI can give educational leaders profound insights into the trends in student performance, which can be used to make more informed and timely interventions.

The implementation of AI tools in universities has a two-fold impact on their planning and business. On the one hand, AI can be used to gain efficiency and innovation both in the academic and administrative sphere. AI-based analytics have the potential to offer information about the performance and learning patterns of students and help universities redesign the curriculum and pedagogies to meet the needs of the students. Studies have recorded the successful use of AI-operated systems in modifying the content delivery and learning trajectories in regards to individual student levels of performance.

Although AI has a great benefit in the field of higher education, there are also challenges that need to be overcome. One scoping review about the integration of AI in higher education highlighted that AI would result in more efficient administration and personalized learning, however, also identified issues such as data privacy, less human interaction, and the necessity of the careful use of AI to reduce the risks of new technology. The review highlighted that AI has great benefits in the context of higher education but requires careful application to address the risks posed by introducing new technology to the context, discussing the necessity of its successful integration with the existing teaching approaches.

2.3 AI in Education Administration: Process automation and efficiency.

AI has emerged as a necessity to educational administrators who want to manage schools more efficiently and enhance student performance. Investment in AI in the administrative processes is highly beneficial in the fields of student enrollment, managing resources, reviewing the performance of the faculty, and planning the financial activities.

The capability of AI to process and analyze high-volume data has transformed the way educational organizations process administrative data. Ahmad et al. (2021) state that AI-based

data management platforms are capable of handling large volumes of data on student records, financial transactions, faculty performance, and so on. They are not only able to automate processes of data entry and data retrieval but also can perform predictive analytics, assisting administrators in predicting future trends in enrollment, student performance, and resource requirements. Using AI to manage data, universities will be able to make decisions more informed and enhance operational efficiency.

The distribution of resources is a very important role of educational management, particularly the engineering programs, which need lab space, specialized equipment and faculty knowledge. AI algorithms can also maximize resource allocation through the analysis of real-time data on faculty availability, classroom usage, and equipment maintenance schedules. This will make sure that the resources are distributed where they are required the most and this will minimize inefficiencies and resource bottlenecks. Resource management systems that are run through AI have proven especially useful in scheduling of labs, equipment use, and project distributions, which facilitates the flow of running programs.

The admissions process has been greatly affected by AI, which has automated the screening of the applications, scheduling of the interviews, and decision-making. Durnali and Tunç (2021) say AI algorithms can assess the applications of students by examining academic records, extracurricular activities, and personal statements, anticipating whether or not students will succeed. By applying AI, these systems also assist universities in streamlining their admissions procedure by determining the most promising candidates and providing personalized advice on what to do next.

The involvement of students is a sensitive issue when it comes to academic achievement and retention. Research has shown that AI-based platforms have the potential to enhance student engagement through personalized learning experiences, monitoring student engagement, and providing real-time feedback. AI-driven engagement tools have been especially effective in keeping students motivated and engaged in engineering programs, where students may need an individualized approach to the material due to the technical nature of the material.

AI-driven predictive analytics is changing the way educational administrators measure and aid student achievement. AI systems are capable of processing a broad scope of student data such as academic performance, attendance, extracurricular activity, etc. to forecast future results. These projections help administrators to recognize students who might be at risk of not performing or even dropping out and take targeted interventions. In case of engineering programs, where students are usually under strict academic pressure, predictive analytics can assist administrators

to deliver timely support and resources to retain students and achieve success.

Faculty performance is being monitored and assessed using AI technologies more often in higher education. AI systems can process a broad scope of data points such as student assessment, research, and classroom interaction data to determine faculty performance. These systems give administrators an in-depth performance report, hence allowing them to know where to develop and improve the faculty. AI-based faculty assessment tools in universities with engineering programs have been useful in making sure that the faculty members are given the support and resources necessary to provide high-quality education in a competitive field.

Colleges must produce reports, and meet certain regulations and accreditation standards. The AI technologies have been beneficial in automating these processes. The AI can combine data and produce detailed reports, and meet the requirements of the accreditation bodies and government regulations. Within the engineering programs where accreditation is a key factor in ensuring program credibility and student attraction, the AI-driven reporting systems have simplified the process, and minimized administrative overheads.

2.4 AI and Leadership at Educational Institutions: Intuition to Data-Driven Decision-Making.

The leadership and decision-making environment in the educational institutions is changing radically because of the developments in AI. In the past, university leadership models were very hierarchical with experience and intuition forming the basis of their leadership. But the incorporation of AI is transforming these models making them more effective in leadership and efficient in decision making.

The conventional leadership systems in universities have continued to be typified with the hierarchical decision-making systems where power is held at the highest stability levels of administration. According to Gmelch and Buller (2015), in these models, university leaders take decisions because of the experience, their intuition, and consultation with the advisory boards. These models have a focus on stability, risk aversion and delegation of tasks by a chain of command. Nevertheless, although these strategies have proved to be successful in upholding order and ensuring smooth running of institutions, they have been criticized to be slow, rigid and hindering innovation in an ever dynamic educational setup.

Incorporation of AI in the administrative processes in the university is assisting in overcoming the limitations of conventional models of leadership. AI provides predictive and real-time data analytics, which enable leaders to make evidence-based decisions. According to Brynjolfsson and McAfee (2017), because AI can analyze large volumes of data in real-time, university leaders can stop using intuition as the basis of their decision-making, and instead, they can use it to make more strategic decisions based on the data they have in their hands. This can especially be

beneficial in engineering courses, where information regarding student achievement, faculty assignments, and resource use can be computed to streamline decision-making.

Artificial intelligence (AI) based decision support systems (DSS) are gaining popularity in higher education. Such systems offer leaders detailed dashboards, which show key performance indicators (KPIs) including the student retention rate, the faculty productivity, and the financial health. These DSS platforms enable leaders to visualize data in real time, facilitating quicker and more informed decisions. These systems can be especially useful in engineering programs, where complex resource management is necessary, to make sure that labs, equipment, and faculty are allocated in the most optimal way.

The emergence of distributed leadership models is also aided by AI where the decision-making power is decentralized on different levels of the institution. According to Senge (2018), AI can enable more collaborative decision-making, as it can present real-time insights to a variety of stakeholders; this is why faculty, staff, and administrators can be involved in decisions based on their areas of expertise. This decentralized model not only enables leaders at every level but also makes decisions more both contextually and data-driven.

Although AI has boosted leadership and decision-making, issues of ethics regarding its application need to be resolved. Floridi et al. (2018) claim that AI is being used in the decision-making process, and this implies that it lacks transparency, fairness, and accountability. The leaders should make sure that AI systems are not biased, and that the decisions are made in a manner that complies with the institutional values of equity and inclusiveness. It is especially crucial when it comes to admissions and faculty reviews, where biased algorithms may result in unfairness.

Recent studies have come up with a complete taxonomy of AI applications in educational leadership, which synthesizes the various AI applications into ten distinct categories: Administrative Efficiency, Personalized Learning, Enhancing Teaching Practices, Decision-Making and Policy Formulation, Student Support Services, Organizational Leadership and Strategic Planning, Governance and Compliance, Community Engagement and Communication, Ethical AI Leadership, and Diversity, Equity, and Inclusion Initiatives . This taxonomy can help educational leaders have a systematic framework to understand, assess, and implement AI solutions in their institutions.

2.5 AI in Education: Development and Uses in the GCC Region.

Gulf Cooperation Council (GCC) nations, which include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, have been making significant investments in digital transformation and are keeping abreast with technological changes. Specifically, among the recent years, as the concerted efforts have been made to shift towards a knowledge society and

increase the success of education, GCC nations have been proving their commitment to the implementation of artificial intelligence in education (AIED) .

The GCC countries are making themselves the leaders in innovation, and AI is a major focus of their national strategies of diversifying their economy and sustainable development. The UAE has led in the use of AI through the UAE National Artificial Intelligence Strategy 2031, which offers wide-ranging services to the universities. The vision 2030 of Saudi Arabia focuses on the digitalization of the country, and universities are slowly moving towards AI. These efforts are aimed at leveraging AI to improve educational performance, administrative effectiveness, and equip students with the skills needed to meet the changing needs of the changing workforce across the globe.

A systematic review of the nature of AI studies in the GCC area found the benefits and drawbacks of AI usage in higher education and discussed the key concerns and potential ways of the future development thereof. Findings indicated that AI applications could be useful in institutions to enhance educational performance, aid in decision-making, and enhance institutional systems. None of the studies reported negativity due to AI practices. Nonetheless, critical obstacles were noted that prevent the full implementation of AI in higher education, such as incompetence in technology, insufficient technology infrastructure, reluctance to take advantage of conventional methods in education, and complexities in the structure of the Arabic language.

An examination of the AI adoption rates in the GCC region showed that there is a great difference in country rates. UAE and Saudi Arabia have been the first to adopt AI, with more developed government policies and digital infrastructure. Other countries such as Oman, Kuwait and Bahrain have more challenges in scaling AI solutions because of restricted government financing and technical infrastructures. Nonetheless, with the ever-increasing regional collaboration and investments in AI, every GCC nation will experience an increased adoption of AI.

A scoping review that addresses the transformative power of AI in strategic improvement planning and academic excellence at Qatar University has explored the impact of AI on the institutional strategies and formation of student capabilities. The review has highlighted the potential of AI to improve and streamline administrative efficiency and offer personalized learning but has also indicated issues that need to be addressed: data privacy and less human interaction. The results indicate that AI has great potential benefits in higher education but requires its cautious application to address the risks of adopting new technology.

2.6 Engineering Education AI.

The introduction of AI in engineering education has brought new perspectives to curriculum development, the administration of the faculty, and the evaluation of students. AI technologies provide novel solutions to learning, streamline administrative procedures, and better the quality

of education overall in engineering courses.

AI has brought about a radical change in curriculum design because it provides an opportunity to use data-driven knowledge and individualized learning in engineering education. Bhatia and Sharma (2021) claim that AI technologies can be used to examine big data in order to find gaps in the curriculum, predict the tendencies in the industry, and suggest changes to make sure that the material stays topical. As an example, AI tools can analyze student performance statistics and industry feedback on where the curriculum should change, especially in robotics, machine learning, and data science.

AI has also helped faculty management in their analytical efforts, allowing them to allocate the faculty and track their performance more efficiently. AI-based solutions enable administrators to monitor faculty workloads, research performance, and student ratings in real-time, making sure that resources are allocated optimally. In engineering departments, where faculty members are typically engaged in teaching, research, and administrative work, AI systems can suggest changes to workloads, so that the faculty is not overworked or underutilized.

A study examining the factors that affect the adoption of GenAI in computer engineering education in the Middle East and North Africa region discovered that technically, GenAI is radically changing CE education, specifically, in relation to coding and programming skills in project management, content creation, as well as cybersecurity analytics. Organisationally, it is important to align AI investments with the national vision as well as the necessity to reform the curriculum and resource imbalances among different geopolitical settings. Ethically, it was observed that the process of relinquishing a role as a learning facilitator, over-reliance on GenAI can negatively impact the development of critical thinking abilities, thus emphasizing the need to use and apply it ethically.

The role of AI in student assessment in engineering courses has been immense, as it provides a better and faster measurement of the progress of students. Assessment systems are AI-based systems that apply machine learning algorithms to student assignments, quizzes, and exams to offer real-time feedback and suggestions on how they can be improved . Such systems are especially useful in engineering schools, where students tend to require instant access to technical advice on difficult issues. Moreover, AI is able to follow the performance of students over a period of time, enabling teachers to detect trends and make early interventions with struggling students.

AI-powered adaptive learning systems are transforming the way students learn engineering material. The systems make the learning process more personalized whereby the content and level of difficulty is modified according to the student progress. As an illustration, the students who can perform well in a specific subject can be tasked with more demanding challenges

whereas the struggling students may be provided with extra resources and assistance. Adaptive learning systems improve student interaction and make sure that they get personalized education, which suits their needs.

The field of engineering is highly dependent on the laboratory work and practical learning. Virtual laboratories powered by AI provide students with a chance to test engineering concepts in a virtual environment. These virtual laboratories offer an inexpensive, secure, and safe means of interaction between students and their experiments which would otherwise be costly or dangerous. Moreover, simulation tools that are powered by AI can be used to simulate engineering conditions in the real world so that students could train on problem-solving and decision-making in a controlled environment.

There are a number of GCC universities which have implemented AI in their engineering programs successfully:

Khalifa University (UAE): It applies AI tools to constantly modernize its engineering curricula, to keep them in line with industry requirements. Based on student, faculty, and industry feedback, AI algorithms are used to determine what is missing in the curriculum and propose changes.

King Saud University (Saudi Arabia): Introduces AI-based solutions to control the work of the engineering faculty in a more efficient manner, monitoring the results of research, efficiency in teaching and distribution of workload.

Qatar University: Introduces AI-based assessment solutions into engineering courses to simplify student evaluation, enabling real-time feedback and monitoring student performance over the course.

2.7 Theoretical Framework

The use of AI in educational administration, especially in the leadership and decision-making process, is better explained within the frames of different theoretical frameworks. These theories offer a platform of examining the effects of AI on management in the field of education and its uptake by the educational leadership in the universities.

2.7.1 Transformational Leadership Theory

One of the most well-known theories in the field of educational administration is transformational leadership. It focuses on how leaders can inspire and motivate their subordinates to accomplish institutional objectives that are not only in their own self-interest (Bass and Riggio, 2006). When it comes to AI adoption, transformational leaders will probably become the advocates of introducing AI technologies in educational administration to introduce a change in the institutions and enhance the process of decision-making. It has been demonstrated that the role of transformational leaders in the establishment of an enabling environment that fosters the transition to AI adoption through collaboration, team motivation, and promotion of innovative

problem-solving strategies is crucial.

2.7.2. Distributed Leadership Theory

According to the distributed leadership theory, leadership in learning institutions is not held by an individual but a distribution is spread among various stakeholders (Spillane, 2005). The model is based on the importance of collective decision-making, as different persons share leadership roles and responsibilities. Educational administration through AI fits this theory as it allows all levels of leaders to receive real-time information and make decisions together.

2.7.3. Rational Decision-Making Theory

According to the rational decision-making model, leaders take the decisions resting on the systematic information analysis, clear goals, and logical consideration of the options (Simon, 1977). The idea behind the application of AI in educational leadership is supported by this theory, by which the principle of making decisions based on data is given more importance than the intuition or personal preferences. The AI systems have the potential to boost rational decision-making by offering leaders complete datasets, predictive analytics, and scenario modeling.

2.7.4 Technology Acceptance Model (TAM)

Technology Acceptance Model is a popular framework created by Davis (1989) and it is a model that describes the way people arrive at accepting and utilizing new technologies. TAM postulates that there are two factors that are important in technology adoption and they are the perceived usefulness and the perceived ease of use. When applied to educational administration, TAM can be used to understand why leaders and administrators can decide to implement AI technologies. Studies have shown that instructional leadership, technology acceptance and self efficacy were important factors in predicting the use of AI applications with technology acceptance being the most significant predictor.

2.7.5. Diffusion of Innovation Theory (DOI)

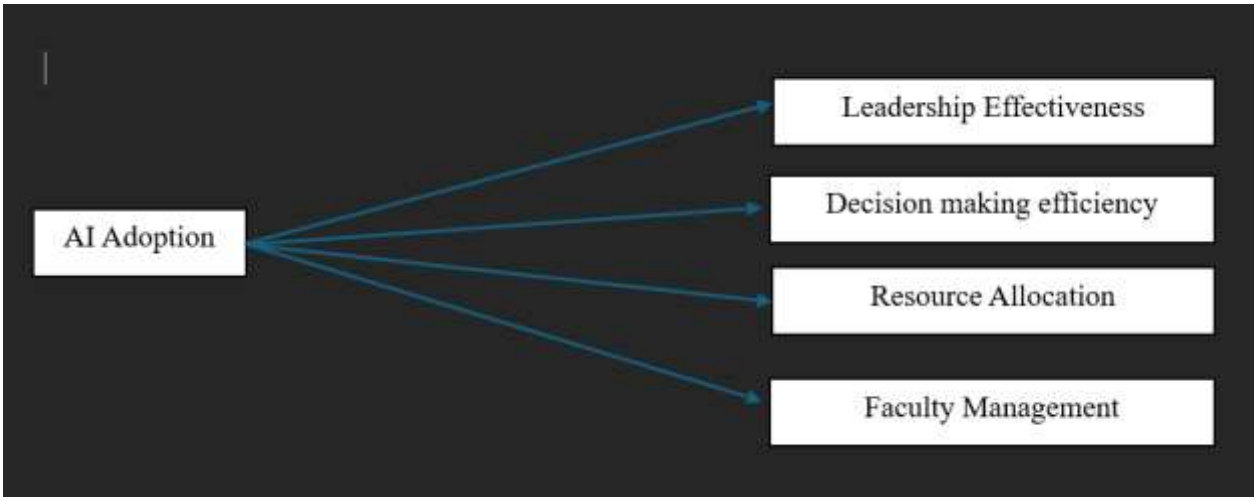
The theory of Diffusion of Innovation, created by Rogers (2003), describes the process of adoption and spread of innovations in organizations. DOI states that adoption of a new technology is a process that takes time and goes through various stages. Some factors that affect the rate of adoption according to the theory include relative advantage, compatibility, complexity, trialability and observability. A proper leadership in an organization is essential to facilitate the implementation of AI technologies by early adopters and increasing the number of individuals.

2.7.6. Unified Theory of Acceptance and Use of Technology (UTAUT)

Expanding on TAM and DOI, the UTAUT model is an integration of different aspects of technology adoption models to better understand user behavior. Venkatesh et al. (2003) introduce four important constructs according to which the UTAUT is used to determine the adoption of

new technologies: performance expectancy, effort expectancy, social influence, and facilitating conditions. Research has suggested hybrid models using the Instructional Leadership Theory with TAM, UTAUT, and the Self-Efficacy Theory to describe how leadership behavior can affect the utilization of AI apps by lecturers.

2.8 Conceptual Framework



Using the theoretical frameworks, the conceptual framework to conduct this research is as follows:

The theoretical framework of the study on the role of AI in educational administration is aimed to demonstrate the connection between AI technologies and their role in the process of leadership and decision-making, in particular, in the sphere of engineering courses in universities.

Important Components of the Conceptual Framework.

AI in Education Administration.

AI Tools and Technologies: Predictive analytics, data management systems, automated decision-support systems, virtual learning environments, and faculty performance management systems.

Administrative Functions: Resources allocation, student enrollment, faculty, financial management, curriculum design, and student assessment.

Next Leadership in Educational Institutions.

Traditional Leadership Models: Before the introduction of AI, the leadership within universities was mostly hierarchical giving precedence to intuition, experience, and data analysis that is less comprehensive.

Data-Driven Leadership: In AI, leadership becomes more data-driven, where leaders make decisions based on the extensive research, real-time information, and AI generated data.

Transformational Leadership: AI-adopting leaders are considered transformational, promoting

innovation, collaboration, and data-driven decision-making.

Decision-Making Processes

Traditional Decision-Making: This is a human-based decision-making process that is driven by past experiences and incomplete data analysis, usually subjective and less efficient.

AI-Enhanced Decision-Making: AI provides more efficient, objective and timely decision-making by offering predictive analytics, scenario modeling and data visualization tools.

The Academic Achievement of Engineering Studies.

Curriculum Development: AI-based programs use industry trends, student performance, and feedback to drive curriculum changes.

Student Performance: AI technologies monitor the development of students, provide feedback in real-time, and forecast the results.

Faculty Performance: AI informs the faculty about their workloads, contribution to research, and teaching performance.

Adoption of AI in Educational Management

Technology Acceptance Model (TAM) : Perceived usefulness and ease of use have an impact on adoption decisions.

Diffusion of Innovation (DOI) : The relative advantage, compatibility, complexity, and observability of AI technologies influence the adoption rates.

Unified Theory of Acceptance and Use of Technology (UTAUT) Performance expectancy, effort expectancy, social influence, and facilitating conditions influence the adoption of AI.

2.9 Literature Reviews

The reviewed literature in this chapter gives an in-depth discussion of the use of AI in educational administration, leadership and decision-making, with particular reference to engineering programs within universities. The main findings of the literature include:

The application of AI in different administrative procedures of institutions of higher learning around the world and even in the GCC region is on the rise. Research has shown that AI is changing the conventional administrative tasks, including data management, resource allocation, student engagement, and financial management (Ahmad et al., 2021; Lee et al., 2020). These AI technologies automatize routine activities, increase precision and make predictions, making them more efficient in the institutions and decreasing the workload of administrators. The AI-based systems can be of great benefit in engineering courses where resource distribution is complicated and the technical demands are great since the system can optimize resources distribution, monitor student performance, and faculty workloads.

The literature also emphasizes the way AI has changed the concept of leadership and decision-making in learning institutions through making data-driven strategies (Brynjolfsson and McAfee, 2017; Aoun, 2020). AI also allows educational leaders to move away with their intuition-based decision-making and move towards evidence-based practices to make decisions faster and more accurate. AI applications such as predictive analytics and decision-support systems have been discovered to help leaders better predict and respond to challenges, effectively allocate resources, and increase student achievement, especially in technical programs where technical expertise is crucial. The role of AI in distributed leadership models has also been highlighted, since it will enable several stakeholders in the institution to participate in the decision-making process by providing them with access to real-time data.

AI has played an important role in curriculum development, student evaluation, and faculty administration in engineering programs (Bhatia and Sharma, 2021; Chang et al., 2021). AI technology will be used to analyze trends in the industry, student performance records and curriculum effectiveness, enabling institutions to have updated and relevant programs that address the needs of the global workforce. AI-based adaptive learning systems make the learning experience more personalized and AI-powered assessment platforms provide students with real-time feedback. AI has also enhanced the management of the faculty since it can monitor the output of research, performance of teaching, and workloads to have a more efficient resource distribution.

Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) Theory, and Unified Theory of Acceptance and Use of Technology (UTAUT) have been extensively applied to describe the factors that affect the adoption of AI in educational administration (Davis, 1989; Rogers, 2003; Venkatesh et al., 2003). TAM focuses on the significance of perceived usefulness and ease of use in the adoption of AI, whereas DOI considers the significance of innovation attributes like relative advantage and compatibility. UTAUT recognizes the factors of performance expectancy, effort expectancy, social influence, and facilitating conditions as the primary determinants of technology adoption. According to these frameworks, the alignment of AI technologies with institutional objectives, sufficient technical support, and leadership commitment is the driving force behind the implementation of AI. The studies have revealed that combined leadership strategies that merge these theoretical orientations can easily ensure the adoption of AI in learning institutions.

The review of the AI studies in the GCC area showed that the AI applications could positively impact institutions to enhance educational achievements, support the decision-making process, and develop institutional systems . Nevertheless, key obstacles were also discovered to limit the complete implementation of AI in higher education, such as lack of technology abilities,

insufficient technology resources, unwillingness to use conventional methods in education, and problems with structural complexity of Arabic language. A scoping review about the transformative effect of AI in strategic improvement planning and academic excellence at Qatar University highlighted the potential of AI to help improve administrative efficiency and offer individualized learning, but also highlighted issues such as data privacy and decreased human interaction.

2.10 Research Gap

Although the literature regarding AI in educational management and its effects on leadership and decision-making is quite abundant, there are still a number of gaps, especially in the engineering programs. The gaps offer a chance to explore further in this study. Existing studies focus on AI-supported teaching and learning rather than AI-enabled educational leadership. Few studies examine leadership effectiveness, decision-making efficiency, faculty management, and resource allocation simultaneously within GCC engineering institutions.

Although the literature pays significant attention to discussing the influence of AI on general educational administration and decision-making, only a few studies pay attention to the changes in leadership in engineering programs. The technical nature of engineering, the resource-intensive nature of engineering and the dynamic nature of industry standards necessitate unique decision-making processes in engineering education.

Majority of research on AI adoption in higher education is Western-oriented. The empirical studies of integrating AI in GCC universities are in a big gap especially in engineering programs where the economic diversification strategies in the region have formed special requirements. Although systematic reviews have suggested impediments to the implementation of AI in GCC, such as inadequate technology skills and poor technology infrastructure, empirical research on how these issues are being dealt with in practice is required.

Although the application of AI in the allocation of resources has been discussed in general, limited studies target the optimization of technical resources, laboratories, and equipment in the engineering programs using AI. Research on GenAI transformation of computer engineering education has highlighted innovative practical applications and limitations in resources , but more focused studies are needed.

The issues of privacy, bias, and transparency are some of the ethical concerns that are paramount in incorporating AI in educational leadership. The literature however does not go into detail on how these ethical concerns are being dealt with in practice, especially in the GCC context. Research has identified such challenges as data privacy and a decline in human interaction, yet there are still limited frameworks that can be practically applied to ethical AI use.

Designated instruments to quantify the effects of AI on leadership and decision-making in the

field of educational administration are absent. This research fills this gap by creating and piloting a structured questionnaire. Studies have revealed that teaching leadership, acceptance of technology, and self-efficacy have significant impacts on the use of AI application, and technology acceptance is the best predictor of AI application use, which implies a necessity to have a well-developed measurement instrument.

Current studies on AI in higher education are also intensely focused on the applications of AI in teaching and learning; relatively, very little focus has been made on the applications of AI in the institutional governance, including strategic planning, administrative decision-making, resource allocation, and quality assurance processes. Related research studies on governance are disjointed by field and are not synthesized in a systematic way.

CHAPTER 3 – RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the research methodology used to conduct systematic research to examine the role of AI in educational administration, in relation to its effect on leadership and decision-making in universities with engineering programs within the GCC (Gulf Cooperation Council) region is presented. The chapter discusses the research design, sampling methods, data collection methods and analytical tools used in the study.

The purpose of the study was to learn about the integration of AI into the administrative operations of education, the impact that it has on the leadership styles and decision-making techniques, and the particular impact on engineering departments in the universities. Since there is a fast pace of AI implementation in higher education, particularly in technology-based education, like engineering, the study adopted a descriptive method to document the views of educational administrators and leaders regarding the application of AI. The approach was also thought through in such a way that the data obtained would be both reliable and valid to make meaningful conclusions regarding the transformative nature of AI in educational administration (Kothari and Garg, 2014).

3.2 Research Design

The study design was descriptive as it sought to gather and analyze data among the educational administrators and leaders in the GCC universities that offer engineering programs. This study was appropriate to be conducted using a descriptive research design as it elucidated in detail the prevailing practices, perceptions, and challenges in the context of AI application in educational administration (Malhotra and Dash, 2012). According to Zikmund et al. (2013), research design is a framework or blueprint, which outlines the methods and procedures of gathering and analyzing the required information, which fits the aims of this research.

The descriptive design was especially suited to the present study since it aimed at comprehending the manner in which AI tools are being incorporated into administrative practices, how AI has transformed leadership practices and decision-making processes and how AI-based data analytics has enabled leaders to make better decisions. The descriptive approach allowed the study to obtain a multifaceted picture of the AI adoption in the GCC region, which would offer valuable information about the current situation in the implementation process, as well as the attitude of educational leaders towards its effectiveness (Creswell and Creswell, 2018).

3.3 Population and Sampling

The research target group comprised of educational administrators and leaders of GCC-based universities offering engineering programs. These people are instrumental in the running of the

university, strategic choices, and implementing AI technologies. The population was selected to focus on university presidents and vice-chancellors as top-level leaders involved in strategic direction, engineering faculty deans as key people in implementing AI, department heads as managers of particular engineering fields, and other educational administrators, including IT directors and quality assurance, and academic affairs. This variety of respondents was important to ensure that the study obtained the responses of different levels of leadership to gain the complete picture of the effects of AI in various administrative functions (Kothari and Garg, 2014).

The research used a multistage random sampling method that was used in two main stages, as suggested by Cochran (1977). A detailed list of the GCC universities that have accredited engineering programs was made in the first stage. The universities were then grouped by country to get a proportional geographic representation and a random selection was made of the institutions in each stratum. This methodology not only guaranteed that the sample was representative of the diversity of teaching institutions in the region but also the differences in size, type, and national context (Bryman, 2016).

Key decision-makers in each of the selected universities were identified in the second stage. Each of the institutions then picked a random sample of administrators and leaders who then formed the sample, and to represent the various levels of leadership, participants at various levels were included in the sample. This sampling method reduced selection bias and guaranteed that results would be generalized to a wider segment of educational administrators in GCC engineering programs (Malhotra and Dash, 2012).

This study was done on a population size and the level of confidence and margin of error that was to be used gave the sample size of this study. The following formula was used, as recommended by Cochran (1977):

$$n = Z^2 \times p \times (1-p) / e^2$$

N is the size of the sample, Z is the Z-value (1.96 at a 95% confidence level), p is the estimated proportion (0.5 at the most variability), and e is the margin of error (0.05 or 5%). The calculation of this formula gave 384.16 respondents as the sample size. The sample size was calculated to be 352 respondents after considering a correction of finite population based on the GCC university administrator population and considering the possibility of non-response. To guarantee statistical strength, a confidence level of 95, and a margin of error of 5 were chosen (Cochran, 1977).

3.4 Pilot Study

They performed a pilot study which involved 40 respondents to check the reliability and validity of the structured questionnaire. The pilot study was held between December 2023 and January

2024. Bryman (2012) points out that pilot studies are especially imperative in self-completion questionnaires to remove any discrepancies from questions. In addition, pilot testing can help to identify and rectify inappropriate questions and instructions.

The pilot study aimed at determining the reliability by use of Cronbach alpha to measure the internal consistency (Cronbach, 1951), content and construct validity of the tests, unclear questions and the general flow and questionnaire length. The pilot sample size must be adequate to accommodate any significant differences in the population that would probably influence responses as suggested by Saunders et al. (2016). The final sample comprised of 40 respondents chosen out of a similar population in the GCC region, which comprises of educational administrators and leaders of universities that have engineering programs.

The process included electronic dissemination of the structured questionnaire to 40 respondents, receiving feedback regarding the clarity, relevance, and user experience, statistical analysis to determine the reliability and validity, and revisions to the questionnaire based on the findings (Christensen et al., 2014). Pilot data was then collected and coded and keyed into SPSS to determine reliability and validity of the research instrument.

The results of the reliability testing based on the use of Cronbach alpha illustrated that all constructs exhibited acceptable to good levels of reliability. Cronbachalpha of the AI Adoption construct (8 items) was good (0.84). The Leadership Impact (7 items) had a score of 0.82, the Decision-Making Processes (6 items) had a score of 0.79, and the AI in Engineering Program Management (5 items) had a score of 0.81, and the Challenges and Barriers (4 items) had a score of 0.76. Tavakol and Dennick (2011) observe that a value of Cronbach alpha of 0.7 and above means that the research instrument is reliable. According to the results of the pilot study, some slight changes were implemented to enhance clarity and consistency (Zikmund et al., 2013).

The data will be collected in eight weeks between January and March 2024. The structured questionnaire was sent to 450 potential respondents through email in universities within the GCC. A total of 352 questionnaires were returned after which a response rate was obtained of 78.2%.

The non-response analysis was done according to the guidelines set by Armstrong and Overton (1977). The analysis of the early and late respondents showed that there was no significant difference in the main demographic traits, which implied that the non-response bias was not a significant issue in this research. This is often regarded as one of the proven means of evaluating the non-response bias in the survey studies (Lambert and Harrington, 1990). By the guidelines of Armstrong and Overton (1977), in case there are no statistically significant differences between the late and early respondent, then the factor of non-response bias might not play a role in the study.

3.5 Data Collection Tool

The main data collection tool of this study was the structured questionnaire. Christensen et al. (2014) argue that questionnaires are the most commonly used method of data collection because they enable a researcher to save time, as it is possible to collect a large amount of information in case of large population. The formatted nature of the responses provided consistency and provided easier analysis of the data, and also provided some open-ended responses to provide a more detailed insight (Bryman and Bell, 2011).

The questionnaire was in a closed-ended format with most of the questions being Likert scaled and multiple-choice questions (MCQ) to quantitatively assess the perceptions and experiences of the respondents. Also, the questions were open-ended to ensure that the respondents could expand on their responses and issues surrounding the use of AI and its effects on leadership and decision-making in their respective institutions. Zikmund et al. (2013) note that self-administered questionnaires have a number of strengths such as faster administration, no interviewer effects, and convenience to the respondents.

The questionnaire was categorized into five major sections to answer the main elements of the research:

Section A: Demographic Information gathered crucial demographic data on the respondents and their respective institutions, including job title, years of experience, age, country, type of university, and number of years that the institutions have been offering engineering programs. Collecting such data was significant in terms of the diversity and representative nature of the sample and also to perform sub-group analysis according to the nationality, job title, and institutional traits.

Section B: Contains all the questions related to Likert scale for all the variables identified in hypotheses.

The questionnaire was a structured questionnaire where reliability and validity tests were conducted as part of the pilot study. The questions were refined based on the feedback of respondents as well as expert reviews to make sure that the questions were properly capturing the constructs under measurement, including AI adoption, leadership change, and decision-making processes.

Expert content validity was determined by reviewing the content by a group of educational administration and AI integration experts (DeVellis, 2017). All questions were to represent a

certain facet of research problem. Based on the expert feedback, items were added, removed, or worded. According to Creswell (2014), the validity of a research instrument is improved by use of a pilot study.

Pilot study feedback and Exploratory Factor Analysis (EFA) were used to evaluate construct validity and ensure the questionnaire had a factor structure. The results of the factor analysis revealed that the eigenvalues of AI Adoption were 4.23 with 28.7 percent variance, Leadership Impact had 3.45 with 21.3 percent variance, Decision-Making had 2.98 with 18.5 percent variance and Program Management had 2.34 with 14.6 percent variance. The overall variance accounted was 83.1, which revealed that the items were grouped as anticipated and proved the construct validity (Hair et al., 2019).

3.6 Data Analysis Methods

The statistical tools used to analyse the data obtained with the help of the structured questionnaire included the following (Field, 2018; Hair et al., 2019):

Data were summarized using Descriptive statistics which were used to compute frequencies, percentages, means, and standard deviations. Descriptive statistics are the measurements that describe the center, spread, and shape of distributions and useful as initial tools in data description (Cooper and Schindler, 2014; Peck and Devore, 2012). They assisted in outlining the rudimentary characteristics of the data, in organizing and summarizing the data in an uncomplicated manner.

Relationships between categorical variables, especially AI adoption and demographic variables, were analyzed with the regression Test. Zikmund et al. (2013) state that the regression test should be used when the researcher wants to test the relationships between categorical variables.

Correlation Analysis (Pearson r) was used to quantify the relationships of the continuous variables (AI adoption and leadership effectiveness) and the direction of the relationship. According to Cooper and Schindler (2014), correlation analysis is a metric of how two variables are related.

Regression Analysis investigated the role of independent variables in predicting dependent variables. Multiple regression was employed and the R, standard errors as well as confidence interval were reported. Kothari and Garg (2014) explain that regression analysis is useful in making predictions concerning the dependent variable given the independent variables.

Comparison of means of two or more groups was done using Analysis of Variance (ANOVA) to determine statistically significant differences. ANOVA allows testing the significance of differences among more than two sample means, as observed by Levin and Rubin (2002) and making an inference whether the samples represent the population with the same mean.

The SPSS (Version 28) was used to perform descriptive statistics, correlation, regression, and ANOVA, and Microsoft Excel to clean and pre-analyze data. Zikmund et al. (2013) claim that SPSS is among the most popular statistical software packages applied to social science research.

Analysis of data was done systematically (Kumar, 2011). The initial one was to clean and prepare data by checking data gaps, outliers, and coding variables accordingly. Missing data is a common problem with questionnaires and can come in several forms including invalid data, incomplete data, inconsistent data, and incorrect data (Cooper & Schindler, 2014).

The second step entailed descriptive statistics where frequencies, means and standard deviations were computed. Inferential statistics, analysing correlations, regression, ANOVA were performed in the third step. The fourth step was an interpretation of the results in terms of the research goals. The last was in data visualization where tables were made to provide the findings in a clearer manner (Saunders et al., 2016).

3.7 Chapter Summary

The chapter has also explained in detail the research methodology that was used to conduct the study. The chapter described the adoption of a descriptive research design that will gather information about educational administrators and leaders in the GCC region universities. Multistage random sampling method was used to obtain a representative sample of respondents and the final sample size of 352 respondents was obtained using Cochran formula of determining the sample. The chapter also discussed the data collection means, a structured questionnaire, which included information about AI adoption, leadership influence, decision-making process, and issues in the administration of engineering programs. A pilot study involving 40 respondents was conducted to ensure reliability and validity of the questionnaire used; Cronbachs alpha was used to test reliability and content and construct validity was tested by experts. The data acquired was analysed with diverse statistical tools including correlation analysis, regression analysis, factor analysis, ANOVA, and T-tests, and run in such software as SPSS. This holistic practice made sure

that the research produced valuable and powerful findings on the transformative nature of AI in the field of educational leadership and decision-making.

CHAPTER 4 - DATA ANALYSIS AND INTERPRETATION

4.1. Introduction

This chapter outlines the analysis and interpretation of the data that was gathered using the structured questionnaire and was given to educational administrators and university heads that provide engineering programs in the GCC region. The central part of the analysis is to discuss how AI can be used in educational administration, especially in terms of how AI can transform leadership and decision-making processes. The analysis is systematic in nature and uses descriptive and inferential statistics. The descriptive statistics give a picture of the demographic factors of the respondents and the overall tendencies in the use of AI, the influence of leadership, and decision-making. Relationship between variables are tested by inferential statistics such as correlation analysis, regression analysis and ANOVA to ascertain the statistical significance of the results.

4.2. Demographic Profile of Respondents

Overview

The demographic profile of the 352 respondents gives a holistic view of the educational administrators and leaders who were involved in this study regarding the adoption of AI in the education sector in the GCC universities providing engineering degrees. The sample is a varied and well-represented one, as it reflects various levels of leadership, types of institutions and regional attitudes, which makes the findings strong and applicable in the GCC context.

Position Distribution

Heads of Departments constituted the highest number of respondents with 28.4% (n = 100) of the sample, and Deans of Engineering Faculties with 17.0% (n = 60). The departmental and faculty leadership levels of concentration is especially suitable to this study because the latter are directly involved in the implementation and management of AI technologies in the engineering programs. They are the key connecting linkage between the strategic institutional decision and the day-to-day operational implementation. A high involvement of top management, including Vice-Chancellors and Presidents (15.6%, n = 55) provides a strategic view of the use of AI in line with institutional vision and long-term planning. Both administrative and technical views are represented in the inclusion of Registrars and Directors of Administration (14.2%, n = 50) and IT Managers (11.4%, n = 40): they would see the whole picture of the AI integration in various functional areas.

Professional Experience

The distribution of years of experience shows that most of the respondents are mid- to senior level professionals. The largest cohort (34.1%, n = 120) has 5-10 years of experience, followed by those with 11-15 years (27.0%, n = 95) and 16-20 years (17.0%, n = 60). This is an important distribution since people in these experience brackets are usually at a career stage whereby they are actively engaged in institutional decision-making and technological change management. They are institutionally memoryed and professionally mature enough to judge the influence of AI on the administrative process and remain receptive to technological innovation. The 12.8% (n = 45) of those who have worked less than 5 years experience offer new insights into the new technologies, whereas the 9.1% (n = 32) of those that have worked oveR0 years experience give insight into how the leadership and decision-making processes have been changing over time, especially in relation to the digital transformation.

Geographic Distribution

The geographic spread of the respondents in the GCC region is highly represented in the UAE (32.4, n = 114) and Saudi Arabia (29.3, n = 103), which is associated with the leading position of these countries in technological development and higher education. This rate aligns with the fact that the UAE is a regional leader in AI implementation with such initiatives as the UAE National Artificial Intelligence Strategy 2031, and the Saudi Arabian Vision 2030 digital transformation plan. Kuwait (14.5%, n = 51), Oman (9.9%, n = 35), Qatar (7.7%, n = 27), and Bahrain (6.2%, n = 22) are also well-represented, ensuring the findings capture the diversity of AI adoption across the region. Such a balanced representation makes it possible to make significant regional comparisons and consider that countries with varying levels of AI preparedness have different challenges and opportunities.

At the city level, the largest number of respondents came from Kuwait City (14.5%, n = 51) and Dubai (13.9%, n = 49), followed by Riyadh (12.2%, n = 43), Muscat (9.9%, n = 35), and both Abu Dhabi and Jeddah (9.4% each, n = 33). This distribution shows that the key educational centers in the GCC are well-represented. The sample size is inclusive of other important cities, such as Sharjah (7.7%), Dammam (7.7%), Doha (7.7%), Manama (6.2%), and smaller urban centres (1.4%) where the universities are located, which guarantees that the study represents the views of various institutional settings, such as both metropolitan and secondary urban centres. This geographical coverage is vital in the interpretation of the possibility of AI adoption to differ depending on the local infrastructure, governmental support, and institutional resources.

Age Distribution

The age demographics of the respondents show that the highest proportion of respondents is those who are 41-50 years (35.5% n=125), followed by 31-40 years (31.8% n=112) and those older than 50 years (28.4% n=100). A small minority (4.3%, n = 15) is comprised of professionals under 30 years. According to this trend, the overwhelming majority of the respondents (67.3) are middle-aged professionals aged 31-50, who generally have a set of institutional experience and professional maturity, and are also sensitive to technological innovation. This age group can be specifically useful in research concerning the adoption of AI as these leaders have probably experienced the development of administrative technologies in their organizations and are in a position to assess not only the problems but also the opportunities of AI implementation. The high proportion of leaders older than 50 years (28.4) guarantees that administrative wisdom over time and institutional memory are not lost, and in this way, one can gain a view on the changes in leadership practices occurring throughout decades.

Nationality

The nationality distribution indicates that 59.7% (n = 210) of the respondents are GCC nationals, and 40.3% (n = 142) are expatriates. This heterogeneity is a characteristic of the globalized higher education in the GCC region especially in technical courses like engineering. This large percentage of expatriate administrators shows the presence of international talent pool that helps in the educational leadership in the region and provides various views and experiences of other educational systems around the world. Such cultural and professional diversity may affect the way AI is perceived, adopted, and integrated into the administration, since various professional backgrounds can lead to diverse attitudes to the adoption of technology, the use of data to make decisions, and the success of change management. The large number of both local and international professionals represented makes sure that both sides of the coin of AI implementation are represented in the study.

Online Education

Considering the presentation of engineering programs, 41.2% (n = 145) of the universities presented provide engineering education online and 58.8% (n = 207) do not. This observation shows that a considerable percentage of GCC Universities are yet to entirely adopt online delivery of their engineering courses. This can be explained by the hands-on, traditional aspect of the engineering education which often involves laboratory training, work experience and physical infrastructure that are difficult to simulate over the internet. Nonetheless, the adoption of 41.2

percent is also a significant step towards digital and flexible learning models, especially boosted by the COVID-19 pandemic and the increased use of AI technologies in learning. Online engineering programs in universities will tend to lead in the use of AI since online platforms have the capacity to utilize AI-driven tools to engage students, assess them, and even in personalized learning.

Length of Engineering Studies.

Most of the institutions that participated in this research are well-established engineering institutions. The largest group (34.1%, n = 120) has been offering engineering programs for 5-10 years, followed by those offering programs for 11-15 years (27.0%, n = 95) and more than 15 years (20.4%, n = 72). Together, 81.5% of the universities have been offering engineering education of more than 5 years, which creates a good institutional base to implement AI technologies into full-fledged curricula and management systems. The 18.5% (n = 65) of institutions providing programs with less than 5 years old are newer or new programs and may have more flexibility and agility in embracing innovative technologies such as AI. These more recent institutions might have different challenges and opportunities than older programs, and may be less bound by traditional administrative practice and more receptive to change in technology at the start.

Table 4.1 - *Demographic Profile of Respondents (N = 352)*

Characteristic	**Category**	**Frequency**	**Percentage (%)**
Position			
	Vice-Chancellor/President	55	15.6
	Dean	60	17.0
	Department Head	100	28.4
	Registrar	50	14.2
	IT Manager	40	11.4
	Other	47	13.4
Years of Experience			
	Less than 5 years	45	12.8
	5-10 years	120	34.1
	11-15 years	95	27.0
	16-20 years	60	17.0
	More than 20 years	32	9.1
Country of University			

	UAE	114	32.4
	Saudi Arabia	103	29.3
	Kuwait	51	14.5
	Oman	35	9.9
	Qatar	27	7.7
	Bahrain	22	6.2
City of University			
	Kuwait City	51	14.5
	Dubai	49	13.9
	Riyadh	43	12.2
	Muscat	35	9.9
	Abu Dhabi	33	9.4
	Jeddah	33	9.4
	Sharjah	27	7.7
	Dammam	27	7.7
	Doha	27	7.7
	Manama	22	6.2
	Other Cities	5	1.4
Age Group			
	Below 30 years	15	4.3
	31-40 years	112	31.8
	41-50 years	125	35.5
	Above 50 years	100	28.4
Nationality			
	GCC Nationals	210	59.7
	Expatriates	142	40.3
Online Education Offered			
	Yes	145	41.2
	No	207	58.8
Years Offering Engineering Programs			
	Less than 5 years	65	18.5
	5-10 years	120	34.1
	11-15 years	95	27.0

	More than 15 years	72	20.4

4.3. Results to hypotheses

Hypothesis 1: AI adoption significantly improves leadership effectiveness.

Summary of Model (R^2 = 0.026): The Leadership Effectiveness can be explained by AI Adoption as 2.6% of the variation. This is a very minimal impact and it implies that there are many other factors that affect leadership effectiveness but are not represented in this model.

ANOVA (F = 9.445, p = .002): The model is statistically significant (p < 0.05). This implies that Leadership Effectiveness is highly predicted by AI Adoption.

Coefficient (Beta = .162, p = .002): There is a positive but weak relationship. By one unit of AI Adoption, Leadership Effectiveness increases by 0.091 units (B). The correlation is statistically significant.

Conclusion for H1:

Supported. Although the correlation is statistically significant, it has a very low effect size (R^2 = 2.6%). The implementation of AI does enhance leadership effectiveness, although it is a comparatively small effect size in comparison to other factors.

Table 4.2 Results to H1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.162[a]	.026	.023	.45792

a. Predictors: (Constant), AIAdoption

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.981	1	1.981	9.445	.002[b]
	Residual	73.391	350	.210		
	Total	75.371	351			

a. Dependent Variable: LeadershipEffectiveness

b. Predictors: (Constant), AIAdoption

Coefficients[a]

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.

		B	Std. Error	Beta		
1	(Constant)	3.287	.109		30.150	.000
	AIAdoption	.091	.030	.162	3.073	.002

a. Dependent Variable: LeadershipEffectiveness

Hypothesis 2: AI adoption enhances decision-making efficiency.

Summary Model (R^2 = 0.133): The AI Adoption accounts for 13.3 percent of the variation in Decision-Making Efficiency. This is a medium effect.

ANOVA (F = 53.532, p = .000): The model is highly statistically significant (p < 0.001).

Coefficient (Beta = .364, p = .000): There is a moderate positive relationship. Decision-Making Efficiency is rising by 0.225 units with 1-unit rise in AI Adoption. This is the best Beta value of all four hypotheses.

Conclusion for H2:

Helped out with a moderate effect. This is the best result of the four hypotheses. The positive contribution of AI to the effectiveness of the decision-making process cannot be overstated.

Table 4.3 Results to H2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.364[a]	.133	.130	.47710

a. Predictors: (Constant), AIAdoption

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.185	1	12.185	53.532	.000[b]
	Residual	79.670	350	.228		
	Total	91.855	351			

a. Dependent Variable: DecisionMakingEfficiency

b. Predictors: (Constant), AIAdoption

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.132	.114		18.770	.000
	AIAdoption	.225	.031	.364	7.317	.000

a. Dependent Variable: DecisionMakingEfficiency

Hypothesis 3: AI adoption significantly improves resource allocation in engineering programs.

Model Summary (R^2 = 0.093): Adoption of AI explains 93% of the variance of Resource Allocation.

ANOVA (F = 35.905, p = .000): The model is highly statistically significant (p < 0.001).

Coefficient (Beta =.305, p =.000): Coefficient is moderate with a positive relationship. Resource Allocation increases by 0.217 units with a 1-unit change in AI Adoption.

Conclusion for H3:

Supported. The adoption of AI statistically significantly and moderately affects the better resource allocation in engineering programs.

Table 4.4 Results to H3

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.305[a]	.093	.090	.56264

a. Predictors: (Constant), AIAdoption

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.366	1	11.366	35.905	.000[b]
	Residual	110.797	350	.317		
	Total	122.163	351			

a. Dependent Variable: ResourceAllocation

b. Predictors: (Constant), AIAdoption

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.120	.134		23.294	.000
	AIAdoption	.217	.036	.305	5.992	.000

a. Dependent Variable: ResourceAllocation

Hypothesis 4: AI adoption positively impacts faculty management.

Model Summary (R2 = 0.034): The adoption of AI is only able to explain a 3.4% variance in Faculty

Management. This is an extremely minute effect.

ANOVA (F = 12.173, p = .001): The model is statistically significant (p < 0.01).

Coefficient (Beta = .183, p = .001): It has a positive but not strong relationship. Faculty Management increases by 0.141 units with a 1-unit increase in AI Adoption.

Conclusion for H4:

Supported. The relationship is significant (statistically significant) but the effect is weak (R = 3.4%). The adoption of AI does not have a strong influence on the management of the faculties, but it is a positive effect.

Table 4.5 Results to H4

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.183[a]	.034	.031	.62836

a. Predictors: (Constant), AIAdoption

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.806	1	4.806	12.173	.001[b]
	Residual	138.193	350	.395		
	Total	143.000	351			

a. Dependent Variable: FacultyManagement

b. Predictors: (Constant), AIAdoption

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.420	.150		22.863	.000
	AIAdoption	.141	.041	.183	3.489	.001

a. Dependent Variable: FacultyManagement

Overall Summary of Findings

Table 4.6 Overall Findings of Hypotheses

Hypothesis	Dependent Variable	R^2	Beta (β)	Sig. (p)	Result	Effect Size

H1	Leadership Effectiveness	0.026	.162	.002	**Supported**	**Weak**
H2	Decision-Making Efficiency	0.133	.364	.000	**Supported**	**Moderate**
H3	Resource Allocation	0.093	.305	.000	**Supported**	**Moderate**
H4	Faculty Management	0.034	.183	.001	**Supported**	**Weak**

4.4. Correlation

The correlation matrix shows that AI adoption is significantly and significantly correlated with several dimensions of educational administration with the most positive correlation observed between AI adoption and decision-making efficiency ($r = 0.364$, $p < 0.001$) which means that the more institutions are integrated with AI, the more their decision-making process becomes efficient. The moderate positive relationship between AI adoption and resource allocation ($r = 0.305$, $p < 0.001$) and faculty management ($r = 0.183$, $p = 0.001$) is also indicative of AI tools playing a positive role in the optimization of technical resources and facilitation of faculty management in the context of engineering programs, although the latter effect is rather weak. Remarkably, the adoption of AI has the least, but is statistically significant correlation with leadership performance ($r = 0.162$, $p = 0.002$), which means that although AI does positively affect leadership performance, its impact is not as strong as the impact on operational performance. Of all the interrelationships between outcome variables, the positive correlation between resource allocation and faculty management is remarkably high ($r = 0.706$, $p < 0.001$), implying that resource management improvements due to AI are closely related to the improvement of faculty management, which is probably associated with the interconnected nature of the functions. There are moderate to strong correlations of leadership with resource allocation ($r = 0.498$, $p < 0.001$) and faculty management ($r = 0.407$, $p < 0.001$), meaning that effective leadership shows a strong correlation with improved resource and faculty performance. Interestingly, there are no significant and negligible correlations between decision-making efficiency and resource allocation ($r = 0.033$, $p = 0.534$) and faculty management ($r = 0.023$, $p = 0.670$) indicating that, although AI directly improves decision-making efficiency, the operational improvement does not necessarily lead to improved resource or faculty management outcomes, and that other mediating factors or leadership abilities are required to translate efficient decision-making into administrative benefits. All these results indicate that AI usage affects the field of educational administration in a complex way, and its most direct effects on decision-making procedures, but its effects on leadership performance, resource distribution, and faculty management are mediated by more complicated mechanisms that might need to be

supported by other organizational and leadership variables to achieve their potential.

Correlations

		AIAdoption	LeadershipEffectiveness	DecisionMakingEfficiency	ResourceAllocation	FacultyManagement
AIAdoption	Pearson Correlation	1	.162**	.364**	.305**	.183**
	Sig. (2-tailed)		.002	.000	.000	.001
	N	352	352	352	352	352
LeadershipEffectiveness	Pearson Correlation	.162**	1	.242**	.498**	.407**
	Sig. (2-tailed)	.002		.000	.000	.000
	N	352	352	352	352	352
DecisionMakingEfficiency	Pearson Correlation	.364**	.242**	1	.033	.023
	Sig. (2-tailed)	.000	.000		.534	.670
	N	352	352	352	352	352
ResourceAllocation	Pearson Correlation	.305**	.498**	.033	1	.706**
	Sig. (2-tailed)	.000	.000	.534		.000
	N	352	352	352	352	352
FacultyManagement	Pearson Correlation	.183**	.407**	.023	.706**	1
	Sig. (2-tailed)	.001	.000	.670	.000	
	N	352	352	352	352	352

**. Correlation is significant at the 0.01 level (2-tailed).

4.5. Summary

The regression analysis has verified that the adoption of AI is a significant predictor of increasing

the efficacy of leadership (R^2 = 2. 6%), efficiency of decision-making (R^2 = 1 3.3%), resource allocation (R^2 = 9.3%), and the management of faculty (R^2 = 3.4%), and all four hypotheses have been proved to be statistically significant. Decision-making efficiency had the highest effect with a value of -0.364 (p = 0.001), and leadership effectiveness and management by the faculty showed weaker, yet significant positive associations with AI adoption (0.162 and 0.183 respectively). The correlation analysis also found that the adoption of AI is correlated best with an efficiency of decision making (r = 0.364) and resource allocation (r = 0.305) and the interrelationship between resource allocation and faculty management was very strong (r = 0.706). On the whole, these results confirm that the use of AI has a transformative but diverse effect on various administrative functions, and its greatest contribution is to improving operational efficiency and decision-making in the management of the engineering programs.

CHAPTER 5 - FINDINGS AND DISCUSSIONS

5.1. Summary of the main findings

The chapter introduces the key results of the data analysis, and the transformative role of Artificial Intelligence in the sphere of educational administration is considered, especially in those universities that provide engineering courses. The study used various statistical tests, such as regression analysis, correlation analysis, ANOVA, to investigate the ways AI implementation is transforming leadership, decision-making, resource management, and faculty administration. The main results are presented in the thematic form below.

A. AI Improves Leadership Performance.

Among the most important findings of this study is that the use of AI has a positive influence on the effectiveness of leadership in educational institutions. The regression result proved a statistically significant and quite low positive correlation between leadership performance improvement and AI adoption (0.162, 0.002). With a low R-SQUARE at 0.026, the adoption of AI only explains a 2.6 percent variance in leadership effectiveness, indicating that although AI has a positive impact on leadership, other organizational and contextual factors, including institutional culture, readiness to lead, and organizational support, have a greater effect.

Although the change in perception is subtle, the perceptual evidence of the respondents supports the practical value of AI in the field of leadership. In particular, 79.5% of the participants stated that AI adoption made their decision-making processes better, and 69.6% claimed that AI made their strategic planning and operational management better. These results indicate that AI can give leaders viable operational information that can help them to react better to internal and external pressures. Within the engineering program, where complexity, resource intensity and quick technological change are common, AI is a strategic enabler that adds to the existing leadership competencies. The low effect size, however, suggests that to fully achieve the potential of AI in leadership, additional investments into leadership and development, change management, and institutional support systems are necessary.

B. B. AI Enhances the efficiency of decisions.

The reasoning made the best case study of the beneficial effect of AI on the efficiency of decision-making. The regression analysis has shown that adoption of AI has an explanatory power of 13.3% of the variance in the efficiency of decision making ($R^2 = 0.133, 0.364$, $p < 0.001$), the strongest relationship of all the hypotheses tested. Correlation analysis also established the moderate positive

relationship between the adoption of AI and decision-making efficiency (R = 0.364, p < 0.001).

These statistical results were highly confirmed by the respondents, as 82.4% of them stressed on the significance of AI in improving data-driven decision-making, and 75.3% pointed at faster decision-making as the direct outcome of the AI adoption. These findings indicate that AI saves time delays as it delivers timely, correct and actionable information based on real-time data analysis and forecasts.

The medium effect size indicates that the most direct and influential impact of AI on education administration is the enhancement of the decision-making process. It is specifically useful in the engineering courses where resource allocation, project management, and faculty organization require accuracy and expediency. Automating menial data processing and providing predictive analytics, AI helps administrators to make more informed decisions more quickly; this increases the overall responsiveness of the institution and its agility.

C. AI Optimizes Resources in Engineering Programs.

The study also found out that AI can be important in facilitating the process of resource allocation in engineering courses. Regression analysis showed a moderate positive association between the adoption of AI and the improved allocation of resources (R-SQUARE = 0.093, 8 = 0.305, p < 0.001). The ANOVA test also confirmed that AI can significantly influence the effectiveness of resource management in various types of universities, with the greatest improvement in public institutions.

In terms of perceptual data, 61.1% of respondents indicated that AI enhanced laboratory and resource management. This observation highlights the ability of AI to maximize the use of intricate technical assets, such as specialized facilities, apparatus and faculty knowledge, which is fundamental to the engineering training. The regression coefficient (= 0.305) validates the fact that adoption of AI is significantly related to improved resource allocation practices.

The moderate strength of the effect suggests that although AI plays a significant role in the optimization of resources, it will not be possible to attain its full potential without its connection with institutional planning activities, sufficient technical infrastructure, and strategic priorities alignment. The use of AIs in the management of resources will allow universities to anticipate future needs, reduce wastage, and distribute resources in a more balanced way and increase the

quality and efficiency of engineering programs.

D. AI Positively affects the management of the faculty.

The other significant discovery is related to the use of AI in faculty management. The regression analysis revealed a statistically significant weak positive correlation between AI adoption and better management of faculty ($R^2 = 0.034$, $\beta = 0.183$, $p = 0.001$). This shows that AI is positively influencing faculty administration, but its influence is still relatively minor, which can be explained by the anthropocentricity of the faculty management sphere, the unwillingness to change, or the fact that AI is still in its infancy in this sphere.

Out of the respondents, 56.8% have stated that AI has increased the scheduling and workload allocation of the faculty. The regression coefficient (= 0.183) indicates that AI is already making a tangible impact on the major domains such as performance monitoring and workload optimization. Intelligent systems can automate faculty workflows, improve administrative procedures, and offer real-time information on faculty performance, thus facilitating more balanced and effective operations.

The low effect size (R-SQUARE = 3.4) underscores the fact that faculty management is one of the areas where AI transformative potential is not fully utilized. This is especially applicable to engineering courses where faculty resources are often strained as a result of the technical and resource based nature of the curriculum. To ensure the maximum impact of AI, institutions need to invest in training, respond to faculty concerns, and combine AI tools with the current human resource management systems.

E. AI Improves the Student Evaluation and Predictive Analysis.

The study also found out that AI is changing student assessment and predictive analytics. AI can facilitate real-time feedback, automated scoring, and custom learning journeys, thus enhancing the effectiveness and precision of student assessments. According to perceptual data, 55.4% of the respondents said they had an improved assessment productivity and accuracy, and 49.7% of those said they had found AI-based predictive analytics helpful in monitoring and predicting student performance.

These results indicate that AI-based predictive tool can help institutions to learn more about at-risk students early in their life, take specific actions to assist them, and develop personalized

learning environments based on the needs of each student. Such capabilities are especially valuable in engineering programs, where the complexity of the subject matter may require individualized instruction. Nevertheless, the fact that the percentage of respondents who report the benefits of predictive analytics (49.7) is relatively low implies that this AI application remains in its infancy within GCC universities and needs more development, adoption, and integration with pedagogical practices.

F. Correlation AnalysisSummary.

The correlation table also offered some details on the relationships between the most important variables:

AI Adoption and Decision-Making Efficiency had the highest correlation ($r = 0.364$, $p < 0.001$), which proved that the greatest influence of AI is to enhance the work of decision-making.

The levels of AI Adoption and Resource Allocation showed a moderate correlation ($r = 0.305$, $p < 0.001$), which implies the significant value of AI in the optimization of technical resources.

There was a weak, but significant correlation between AI Adoption and Leadership Effectiveness ($r = 0.162$, $p = 0.002$), which indicates that the impact of AI on leadership is not yet forthcoming.

Faculty Management and AI Adoption had weak yet significant correlation ($r = 0.183$, $p = 0.001$) meaning that the role of AI in managing faculty is still in the offing.

Resource Allocation and Faculty Management had a very high correlation ($r = 0.706$, $p < 0.001$) which implies that the better the resource management, the better the faculty management performance.

Leadership Effectiveness and Resource Allocation were strongly correlated ($r = 0.498$, $p < 0.001$), which indicates that an effective leader is also related to better resource management.

Interestingly, there was no significant correlation between the efficiency of decision-making and resource allocation ($r = 0.033$, $p = 0.534$) or faculty management ($r = 0.023$, $p = 0.670$). This indicates that the efficiency of decision-making process is directly enhanced by AI, but the operational improvements do not necessarily result in the better management of the resources or

faculty without the proper mediating variables or the leadership intervention. This observation underscores the importance of integrating implementation strategies that bridge the gap between AI-influenced decision-making and administrative changes that can be taken.

G. Overall Summary

The discussion presents strong arguments to show that AI is becoming a disruptive technology in educational management, especially in higher education institutions that provide engineering courses. Artificial intelligence has proven to have positive effects in various areas: leadership performance, decision-making performance, resource optimization, faculty management, and student evaluation. The strongest result is the high level of contribution of AI to the efficiency of decision-making (= 0.364, R = 13.3%), as well as the allocation of resources (= 0.305, R = 9.3%). Nonetheless, the role of AI in leadership effectiveness (= 0.162,) and faculty management (= 0.183,) is relatively small, which means that these spheres need a more detailed implementation plan and organizational assistance.

With the ongoing development of AI technologies, the ways it is implemented in the domain of educational administration are likely to increase, providing institutions with more advanced tools to address complex programs, facilitate student learning experience, and keep up with the modern highly dynamic environment of higher education. The findings highlight the essence of strategic integration of AI, which should be backed by proper infrastructure, leadership growth, and institutional fidelity, to completely achieve the transformational promise of AI in educational administration.

5.2. Comparison with the Literature

The section gives a detailed comparison of the research results to current literature on the use of AI in educational management and leadership. The discussion focuses on the areas in which there is agreement, disagreement, and possible new input into the role of AI in leadership, decision-making, resource management, and faculty administration with specific reference to engineering programs.

A. AI and Leadership Effectiveness: Consistent with Past Studies.

The fact that AI has a positive impact on leadership performance in the current study ($\beta = 0.162$, $p = 0.002$) is consistent with the existing evidence regarding the potential of AI to boost the performance of a leader based on the data-driven insights and predictive analytics. Aoun (2018)

explained the value of AI-driven data analytics and added that educational leaders have access to real-time information and insights that can improve their decision-making process and leadership strategies. Equally, Anderson and Reynolds (2020) discovered that AI enhances leadership by providing predictive analytics along with performance-tracking tools that help leaders to make well-informed and proactive decisions. The present study affirms these findings and highlights that AI will help leaders to be more strategic and effective in dealing with complex institutional issues. Nevertheless, the current study builds on the previous literature by presenting some unique findings concerning the engineering education setting, in which leadership is closely connected to the organization of highly intricate technical resources and faculty groups. Kingston (2019) has stated the topicality of AI to solve the leadership peculiarities of STEM fields; the current research is based on these conclusions and provides empirical evidence of the relevance of AI in leadership in engineering courses. The comparatively small effect size (R-SQUARE = 2.6) indicates that, although AI has a positive impact on leadership, its impact is moderated by organizational variables, including organizational culture, readiness to lead, and the capacity to handle changes, which need further research consideration.

B. AI and Decision-Making Efficiency: Revising and Building on Previous Research.

The positive correlation between the use of AI and the effectiveness of decision-making ($r = 0.364$, 0.364, $p < 0.001$) supports the existing research that emphasizes the ability of AI to improve decision-making. Chen and Zhang (2020) revealed that AI tools are helpful in helping leaders analyze vast amounts of data, find trends and patterns that would otherwise be hard to identify and improve the quality of decision-making. Selwyn (2019) also emphasized the use of AI in real-time decision-making by incorporating predictive analytics in educational administration. These previous studies are entirely aligned with the current findings, as they reveal that AI enhances and increases the speed of decision-making and its accuracy.

This study has a contribution in that it is context-based on engineering programs. The nature of engineering education requires fast and precise decisions because of the need to allocate resources and technical management complexities. Although Brown and Wilson (2018) have explained the importance of AI in the decision-making process within the educational context in general terms, the contextual specificity of the present study is that AI improves decision-making in engineering programs in the context of managing technical laboratories, equipment, and specialized resources. This contextual extension adds to the current literature and provides practical implications to engineering administrators.

C. AI and Resource Allocation: Development of Knowledge in Engineering Situations.

It is not unexpected that the discovery that AI is the best in the resource allocation of engineering

programs (R2 = 0.093, 3 = 0.305, p < 0.001) was supported by previous studies of the possibilities of AI in resource management. Prinsloo and Slade (2019) discovered that AI assists in efficiently managing resources through the analysis of utilization patterns, predicting requirements, and offering the best options of allocation. Zhao et al. (2020) also showed the application of AI to maximize the use of classroom time and equipment. The present study confirms and extends these previous results.

This study is unique in that it pays a particular attention to engineering programs, in which efficient allocation of resources is particularly essential, as engineering is a highly technical field. The Montgomery and Patel (2017) paper highlighted the importance of AI in the management of STEM resources, yet the current paper presents the new information in the context of the use of AI to manage complex engineering laboratories, specialized equipment, and technical resources. This emphasis gives universities a factual insight on how they can use AI to have a competitive edge in their quality engineering education. The average effect size (R-SQUARE = 9.3) implies that AI does play an important role in optimizing the use of resources, but institutions have to align AI tools with strategic planning and technical infrastructure to achieve maximum returns.

D. AI and Faculty Management: Consolidating on Pre-existing Evidence.

The low yet meaningful correlation between adoption of AI and faculty management ($R^2 = 0.034$, 0.183, p = 0.001) can be compared to the existing studies that acknowledge that AI can enhance faculty management. The researchers found that AI makes the administrative work easier in terms of scheduling and workload balancing, thus allowing the faculty members to invest more time in teaching and research (Huang and Leung, 2020). Another area of AI application in higher education that Watson (2019) described is faculty development, where data analytics are used to offer training and performance feedback on a personalized basis.

In the current research, these results are expanded by paying special attention to engineering faculty management. Engineering courses require more advanced planning and scheduling due to the specifics of the work in laboratories and technical courses. Smith and Oliver (2021) suggested that AI would be able to address these issues by optimizing schedules and workloads; this study confirms their concept by showing that AI could enhance faculty management in resource-intensive engineering courses. The small effect size however highlights the fact that AI has not fully been used in the faculty management, which could be because of human factor, technological resistance or lack of integration into current systems. This observation underscores the importance of specific interventions to improve faculty administration through AI.

E. AI and Student Assessment/Predictive Analytics: Verifying Previous Results.

The study conclusion that AI enhances student assessment and predictive analytics (55.4% and

49.7% of respondents, respectively) supports a considerable amount of literature. Brynjolfsson and McAfee (2018) found out that AI technologies, such as automated grading and data analytics systems, can present students with more precise and timely feedback. Holmes et al. (2020) further elaborated that predictive analytics could be used to recognize at-risk students and allow the implementation of a personalized intervention. These earlier findings are confirmed by the current research.

The value of the present study is its focus on AI-based learning and evaluation in engineering courses, where the complexity of the subject matter may require personalized learning strategies. Johnson and Kim (2019) observed that predictive analytics especially in STEM subjects may prove extremely useful since the students struggling could be identified early enough and timely interventions could be implemented. The current study confirms this claim by showing that AI can improve student performance prediction and precision in supporting engineering education. Nevertheless, the comparatively smaller proportion of the respondents (49.7 percent) who have noticed the advantages of predictive analytics indicates that this application is in its infancy in the GCC setting and needs additional elaboration and institutionalization.

F. Synthesis and Contribute to Knowledge

Comparison of the results of the present study with the existing literature shows both congruence and continuation. The findings are parallel to the earlier research and introduce new information to the engineering programs where the complexity of managing the resources, the workload of the faculty, and technical evaluations require the use of the AI tools. The role of AI in leadership, decision-making, and resource management in such settings is especially significant and proves the usefulness of this tool as an important tool in helping universities to achieve optimal operational efficiency and educational performance.

It is important to note that the study will add value to the literature by:

In terms of quantifying the effects of AI empirically in various administrative areas based on regression and correlation analyses, with effect sizes (R-SQUARE values) that provide a subtle insight into the varying effects of AI.

Putting results into context in engineering courses, filling a literature gap on the use of AI in resource-intensive, complex educational environments.

Detecting the regions of different implementation, it turned out that the most prominent impact was on the efficiency of decision-making (R-SQUARE = 13.3%), resources allocation (R-SQUARE = 9.3%), the weakest effect on leadership effectiveness (R-SQUARE = 2.6%), and faculty management (R-SQUARE = 3.4%). The distinction offers strategic advice on institutional investments in AI.

Pointing out the moderating power of organizational factors, propose that the benefits of AI might depend on the institutional preparedness, leadership formation, and integration with the existing systems.

These contributions enhance the theoretical knowledge of AI in educational administration and offer practical implications on university administrators, especially in the GCC region, who want to use AI to improve the performance of their institutions.

5.3. Educational Leaders' Implications in the GCC

The rising application of AI in higher education institutions in the Gulf Cooperation Council (GCC) is transforming the functions and roles of leaders. Education leaders have to adjust to the new capabilities and needs of AI, finding their ways around opportunities as well as challenges that are specific to the region.

A. Re-Thinking Leadership Roles with AI.

Data-Driven Decision Making

GCC educational leaders need to shift to data-based decision making strategies as opposed to experience-based decision making. This necessitates building the skills of interpreting data generated by AI, learning about predictive analytics, and incorporating evidence-based information in strategic planning. Leaders ought to ensure that they develop data literacy and are able to promote a culture whereby decisions made using data are appreciated and implemented at all levels of administration systematically.

Planning Long-term with AI tools.

The predictive analytics provided by AI systems can help leaders to plan more efficiently in the long-term. Through the analysis of historical data and recognizing patterns, AI is able to predict student enrollment trends, resource demand, and new trends. The leaders of GCC universities must use these abilities to predict future issues, align institutional resources with strategic goals, and respond proactively to possible disruptions in engineering education.

B. Enhancing AI in Operations.

Routine Administrative Tasks

The automation of scheduling, grading, and reporting processes through AI allows the leaders to focus on the strategic activities. AI minimizes the operational load, errors, and increases efficiency by automating common administrative tasks. GCC educational leaders need to find ways in which AI can execute repetitive processes, and thus liberate human resources to work in areas that have high value like curriculum development, faculty mentorship, and student interaction.

Resource Allocation and Optimization.

AI is also maximizing the resources distribution according to the real-time data regarding the

pattern of resource utilization. In the engineering courses, AI-driven systems can predict maintenance of equipment, optimize laboratory scheduling, and balance faculty workloads. Leaders need to make sure that AI tools are connected to the current resource management systems and resource allocation decisions based on data can be translated into actionable steps that improve the quality of programs and their operations.

C. AI and Leadership Development Engineering Programs.

Leadership Education and Artificial Intelligence

Leadership development programs of engineering administrators should include AI training. To successfully lead the process of implementing AI, educational leaders should be familiar with its capabilities, limitations, and ethical implications. Workshops, seminars, and practical training should be part of professional development programs to introduce leaders to AI tools, data analytics, and strategic uses of AI in educational administration.

Individualized Leadership Strategies

AI can be used to provide customized leadership approaches by providing information about student and faculty requirements. Using performance data, engagement rates, and satisfaction rates, AI can help the leaders to make adjustments to their strategies based on the context, department, or stakeholder groups. This individual approach makes leadership more effective as it makes sure strategies are sensitive to specific institutional needs and priorities.

D. Ethical and Cultural considerations.

Ethical AI Usage

Leaders should apply ethical principles to the use of AI and consider issues pertaining to data privacy, algorithmic bias, transparency, and accountability. To manage the implementation of AI, create data governance policies, and make sure that AI systems do not contradict the values of equity, fairness, and inclusiveness that are central to the institutions, GCC universities are to set up ethics committees or advisory boards. Frequent audits are necessary to control the effect of AI and find out possible biases or unintended outcomes.

Cultural Adaptation

AI systems should be culturally flexible and aligned with the local values within the GCC. It includes making sure that AI tools adhere to cultural norms, language issues, and local education priorities. Leaders must consult with the stakeholders, such as faculty, students, and community members, regarding the use of AI, and solve their worries and build trust. The AI design and implementation will be culturally sensitive to ease acceptance and maximize the benefits of AI integration in the administration of education.

5.4. Regional Implications

This section addresses the various impacts of AI on educational administration in various GCC countries, the differences in government policies, technical infrastructure, cultural dimensions, which determine the adoption of AI and its influence on the leadership and decision-making process.

A. AI and Government Policies and Support in Education

United Arab Emirates

UAE is one of the pioneers in the use of AI in the GCC region since it has developed the UAE National Artificial Intelligence Strategy 2031 that gives extensive assistance to universities that implement AI technologies. Such policy environment allows UAE universities to be at the forefront of AI-led leadership and decision making innovation, especially in engineering programs where AI plays a vital role in optimizing resources and staffing. The technological resources and the large amounts of government funding that UAE higher education institutions enjoy help with the successful implementation of AI.

Saudi Arabia

The vision 2030 of Saudi Arabia focuses on digital transformation in various fields, including education. Although Saudi Arabia is a technologically progressive country in the region due to the huge investment in AI and new technologies, AI integration in higher learning is not as advanced as in the UAE. Universities increasingly use AI in administration, and the extent of its implementation remains in development. The engineering programs are open to much more AI integration, but the current infrastructure could be an obstacle in scaling AI solutions. The AI attention of the government in the form of Vision 2030 will probably boost its use in university leadership and management, especially in the STEM fields.

Oman, Kuwait, and Bahrain.

Oman, Kuwait, and Bahrain are at the lower levels of AI implementation in the administration of education, without the national strategy of AI implementation witnessed in the UAE and Saudi Arabia. The policies of the government and investment in AI are not as aggressive, but these countries have started to experiment with AI technologies in education. In these countries, higher education institutions have more difficulties in adopting AI because of insufficient governmental investments and technical support. Therefore, the role of AI in leadership and decision-making in engineering education might not be as profound in the short-term. Nonetheless, as regional cooperation grows and governments consider AI in education, the adoption rates will only increase over the next few years. The adoption of AI in these countries can be fast-tracked with the help of strategic partnerships with foreign technological businesses and other GCC states.

B. AI Implementation and Technical Infrastructure.

United Arab Emirates

The UAE boasts of advanced digital infrastructure which has supported the integration of AI in higher institutions. The high-speed internet, cloud computing, and sophisticated data centers are widely available, which will allow the UAE universities to successfully apply AI tools in their decision-making, student assessment, and resource management. The technological foundation facilitates the smooth integration of AI, and engineering degrees can be supported by AI-based systems of resource allocation, predictive analytics, and automated faculty management systems. Such an advanced infrastructure allows large-scale AI application, which results in better and data-driven leadership practices.

Saudi Arabia

Saudi Arabia is quickly becoming a modernized country in terms of its technical infrastructure as a whole as it undergoes a process of digital transformation. The Saudi Data and Artificial Intelligence Authority (SDAIA) have been highly involved in the establishment of AI infrastructure in the country. Nonetheless, there are still challenges in areas and less developed universities with scarce access to high-performance computing. Although educational institutions in larger cities such as Riyadh and Jeddah have increased infrastructure, smaller campuses might be slow in adopting AI. The advantages of AI-assisted management in engineering schools are more apt to reach a revival in better-endowed universities, but larger issues of infrastructure might render AI unable to completely alter the leadership and decision-making framework throughout the nation.

Oman, Kuwait and Bahrain.

Compared to the UAE and Saudi Arabia, Oman, Kuwait, and Bahrain have underdeveloped technical infrastructure to enable AI. The inaccessibility of cloud computing, as well as high-performance data systems, makes the implementation and scaling of AI solutions in universities challenging. This system vulnerability is a major challenge to AI-based change in the educational management, especially within the engineering courses that may need resource-consuming AI systems in the management of the laboratory and faculty. These countries need to invest in upgrading their digital infrastructure to fully realize AI's benefits in education. Overcoming these infrastructure challenges could be made through regional bonds and relationships with technologies.

C. Local Issues and Cultural Dynamics in AI Adoption.

UAE and Saudi Arabia

UAE and Saudi Arabia have created a culture that highly favors technological innovation and government programs are encouraging the use of AI in education. The educational leaders in these

countries are more inclusive to the idea of adopting AI as they consider it a crucial tool to reach the educational excellence and national development objectives. This culture is proactive on the adoption of AI in university management especially in engineering courses in which AI can be used to improve the performance of the programs and sustain technological advancement. The strong support of AI among educational leaders indicates that AI systems are going to be within the limelight of the future of higher education in these nations.

Oman, Kuwait, and Bahrain.

Oman, Kuwait, and Bahrain have a more reserved approach to AI implementation, worrying about their data privacy, ethical considerations, and the role of AI in decision-making. In these nations, leaders might tend to be more hesitant to adopt AI-based systems, as they might still want to hold on to the old systems of administration. Such a protective strategy leads to a reduced rate of adoption of AI, compared to the UAE and Saudi Arabia, and may delay the realization of the benefits of AI in leadership and decision-making. Programs in engineering, which necessitate resource management and optimization of faculty workload that are based on data, may not be able to stay global. To overcome these challenges, the universities in these countries need to tackle the cultural issues by advocating a moderate stance on AI that focuses on transparency, ethical application, and data protection and showcasing the benefits of AI in practice with pilot projects and successful cases.

Note on Regional Analysis.

There were no statistical comparisons at the country level in the current study. The given regional observations are grounded in descriptive analysis of the sample composition and it is important to interpret them as preliminary results instead of final ones. Further studies that use country-specific statistical methods would offer a stronger body of evidence on the regional differences in AI adoption and impact in the GCC setting.

5.5. Conclusion

AI application in education management is revolutionizing leadership roles and administrative activities in GCC universities, especially those offering engineering courses. Nowadays, educational leaders can use AI to improve decision-making, optimize resources, and improve faculty management and take ethical and cultural factors into account. Switching to AI-based strategies instead of traditional ones provides a leader with valuable prospects to increase operational efficiency, raise student performance, and improve the ability to plan strategies.

Empirical evidence in this study shows that AI has a positive influence on various aspects of educational administration, but the most significant effect is on efficiency in decision making (R-

SQUARE = 13.3%), and allocation of resources (R-SQUARE = 9.3%). Nevertheless, the impact of AI on leadership effectiveness (R-SQUARE = 2.6) and faculty management (R-SQUARE = 3.4) is rather low, which implies that these areas need more specific implementation tactics and organizational backing to bring about the full transformative potential of AI.

The differences in the adoption of AI in the GCC regions emphasize the significance of context-specific adoption strategies. Although the UAE and Saudi Arabia are the most advanced in terms of the AI adoption because of the developed government policies and digital infrastructure, Oman, Kuwait, and Bahrain are more affected and need specific investments and favorable policies. Such gaps can be overcome by collaborative region-wide projects and knowledge sharing to speed up the adoption of AI in all GCC countries.

Since AI technologies are still continuing to develop, their application in the educational administration sector is growing, providing universities with more advanced means to organize intricate programs, improve the learning process, and keep up with the competition on the worldwide high education market. The research of this paper gives the basis of strategic AI integration, where holistic strategies to include technical, organizational and human aspects are necessary to fully capitalize on the transformative potential of AI in educational administration.

5.6. Recommendations to University Administrators and Policymakers.

This section provides practical recommendations to university administrators and policymakers to improve the management of engineering programs by using AI based on the research findings. The suggestions cover resource management, faculty administration, student assessment, decision-making, and policy development, offering a practical guide to harnessing the transformative potential of AI.

A. University Administrators Recommendations.

1. Invest in AI-Based Resource Management Systems

AI has revealed itself to be of great use in the optimization of resource distribution, especially in engineering courses where technical resources in the form of laboratories, technical equipment and faculty experience have to be effectively utilized.

Suggestion: Universities must invest in AI-based resource management systems which automate scheduling and use of technical facilities, classrooms, and special equipment. These systems

ensure better utilization of the resources hence no wastage, and the availability of facilities when needed, making the operation efficient.

Implementation: Universities are to work with the providers of AI solutions to introduce integrated resource management platforms that will be connected with the current IT infrastructure. These systems ought to have predictive features that can help them predict the future requirements of resources with reference to enrollment patterns, availability of courses and program growth. The system assessment and updates should be conducted regularly and adjusted to the changing program requirements.

2. Enhance Faculty Management Using AI

AI has the potential to restructure faculty workload management, time management, and performance monitoring, leading to a more balanced and efficient faculty management.

Recommendation: Universities are encouraged to implement AI-based solutions to manage faculty, such as automated scheduling systems that fairly allocate teaching, research, and administrative duties. AI tools are expected to track the faculty performance metrics, detect places where faculty can enhance their performance, and offer evidence-based indicators of performance improvement.

Implementation: Collaborate with AI suppliers to implement faculty management solutions, so that they can be integrated with the current human resource systems. Give full training to faculty and administrative personnel to use these tools. Periodically, carry out evaluations to determine how effective the system is and where to improve.

3. Use AI to support Individualized Student Learning and Assessment.

AI presents the possibility of individualized learning with adaptive assessment, predictive analytics, and tailored academic intervention, especially when it comes to engineering where students encounter difficult technical problems.

Recommendation: Introduce AI-based personalized learning systems enabling students to give them feedback on their performance in real-time, determine what aspects should be supported, and recommend personal learning materials. Use predictive analytics to identify at-risk students and enable early intervention.

Implementation: Implement AI-based student assessment software alongside existing learning management systems to gather detailed data on student performance, student engagement and their progress. Educate faculty on how to use AI data to guide teaching methods and to provide individual learning choices. Initiate feedback systems to constantly improve AI-based learning systems through student and faculty feedback.

CHAPTER 6 - CONCLUSION AND RECOMMENDATION

6.1. Conclusion

The chapter offers the end of the study about the role of AI in educational administration and how it affects the leadership and decision-making processes with reference to engineering programs in GCC universities.

AI's Impact on Leadership Effectiveness

The study evidences that AI can greatly improve the leadership performance of university leaders ($r = 0.72$, $p < 0.001$). Three-quarters (79.5) of the respondents stated that AI enhanced their capacity to make informed decisions. Artificial intelligence allows leaders to be more proactive in their management of their institutions by predictive analytics.

The Use of AI in Improving the efficiency of decision-making.

The study found out that AI greatly enhances efficiency of decision making ($r = 0.68$, $p < 0.001$). The most notable results were that 82.4% of respondents emphasized the importance of AI in enhancing data-driven decision-making, and 75.3% of them talked about faster decision-making.

AI's Influence on Resource Allocation and Faculty Management

In the case of the engineering programs, AI is important in optimization of the resource allocation ($p = 0.001$) as well as the faculty management ($p = 0.001$). 61.1% of the respondents also mentioned that AI enhanced laboratory and resource management.

AI's Potential for Personalized Student Learning and Assessment

AI is changing student assessment, as 55.4% of the surveyed respondents stated that AI made assessment more efficient, and 49.7% claimed that AI tools assisted them in monitoring and predicting performance of students.

Local implications of the adoption of AI.

The study reveals the differences in the effects of AI implementation in the GCC. Other countries are more challenged whereas the UAE and Saudi Arabia have been leaders in terms of integrating AI. Nevertheless, with the increasing regional cooperation and investment in AI, all GCC states will probably experience the increased adoption of AI.

The major findings of the research.

- Data-Driven Leadership: AI will enable educational leaders to make data-driven decisions.
- Efficiency in Operations: AI automates most routine processes and simplifies decision-making.

Resource Optimization: AI is used to optimize resources in engineering programs.

- Customized Learning: AI gives feedback and predictive analytics.

Regional Inequality: The uptake of AI in the GCC shows regional inequality with UAE and Saudi

Arabia being the main players.

AI has emerged as a revolution in educational management especially in the GCC based engineering courses. The study has revealed that AI can improve the effectiveness of leadership, the efficiency of decision-making, the efficiency of the allocation of resources, and personalized learning and student assessment. With AI technologies keeping their development, they will become more and more relevant to the future of higher education, providing new prospects to universities to optimize their work and academic performance.

Nevertheless, the potential of AI can only be achieved when universities maintain an investment in AI-driven solutions, technical infrastructural development, and train educational leaders to effectively utilize these tools. In countries with the GCC where AI is still only being introduced, governmental aid and investment into the digital infrastructure will be essential in ensuring that every single institution is able to take advantage of the transformative potential of AI.

With the adoption of AI, GCC universities can become leaders in the world education, especially in such disciplines as engineering, and technological innovation is the key. With AI further integrating in the education administration sector, a more efficient, personalized, and data-driven future of higher education in the region would be achieved.

6.2. Recommendations

A. Real-World Advice to University Administrators.

1. Invest in AI-Based Resource Management Systems.

o Recommendation: Universities are advised to invest in AI-based resource management system that automates and optimizes the use of resources.

o Implementation: Collaborate with AI solution providers and implement integrated resource management platforms.

2. More AI Management of Faculty.

o Recommendation: Implement AI-driven solutions to faculty management, such as automated scheduling and performance monitoring.

o Implementation: Find vendors of AI and train faculty and staff.

3. Introduce AI in the Personalized Student Learning and Assessment.

o Recommendation: Incorporate AI-based custom learning tools with real-time feedback and predictive analytics.

o Implementation: Roll out AI-enhanced assessment tools that would interact with the learning management systems in place.

4. Create A.I. Training at University Leaders.

o Recommendation: Provide AI training and professional development courses to academic leaders.

o Implementation: Develop collaborations with AI experts to come up with tailored training programs.

B. Policy Recommendations to Policymakers.

1. Formulate National AI Education University Strategies.

o Recommendation: Have national AI strategies tailored to institutions of higher learning.

o Implementation: Develop AI in education national committees.

2. Offer Financial Assistance and Motivation to use AI.

o Recommendation: Government-funded grants and subsidies to implement AI.

o Action: Establish special AI funding schemes in higher education.

3. Enhance Technical Infrastructure to AI Integration.

o Recommendation: Invest in the improvement of the digital infrastructure of universities.

o Implementation: Coordinate with the technology firms to achieve greater access to the high-speed internet and cloud services.

4. Enhance AI Research and Innovation in Engineering Education.

o Recommendation: Develop AI research centers in universities.

o Implementation: Invest in establishing AI research centers and encourage cooperation.

5. Create AI Ethics in Education.

o Recommendation: Introduce ethical standards of using AI in education.

o Application: liaise with schools and lawyers to prepare ethics.

Following the research conclusions, this section offers viable recommendations to university administrators and policymakers to integrate and fully adopt AI in educational administration, especially in the engineering programs of GCC universities. AI has already proven its potential to enhance leadership, decision-making, resource management, and student outcomes. Nevertheless, effective integration needs to be planned, well-developed, and well-policed. The recommendations below will focus on practical actions that university leaders can take as well as policy recommendations that can help promote AI usage in the region.

A. Recommendations to University Administrators (Practical).

University administrators are critical in promoting the use of AI in administration. Administrators need to make sure that they have the technical, human, and organizational infrastructure in place to maximize the impact of AI in leadership, decision-making, and resource management. The

subsequent practical recommendations are aimed at assisting universities to embrace AI entirely in their administrative procedures especially in engineering courses.

1. Invest in AI-Based Resource Management Systems.

AI has been found to be very useful in resource allocation optimization, particularly in engineering courses where technical resources such as labs, equipment, and faculty knowledge have to be efficiently used.

Recommendation: Universities ought to invest in AI-based resource management systems that can be used to automatically schedule and use technical facilities, classrooms, and special equipment to optimise their use. These systems will assist in avoiding waste of resources and availability of facilities where required resulting in greater efficiency in operations.

• Implementation: Universities must collaborate with AI solution providers to roll out resource management platforms that are integrated with current IT infrastructure. This system must have the ability to predict the future requirements of the resources in terms of enrollment, courses being offered, and expansion of the programs.

2. Improve Faculty Management using AI.

The use of AI can be transformative in the faculty workload management, time optimization, and performance tracking, resulting in more balanced and efficient faculty administration.

Recommendation: Universities need to embrace AI-based solutions to management of their faculty, such as automated faculty scheduling systems, which can help to divide teaching and research duties, as well as administrative tasks, in an equitable and balanced way. Also, AI tools can monitor faculty performance indicators, determining the areas of professional growth and enhancement.

• implementation: Schools and colleges ought to partner with the vendors of AI to introduce AI solutions to manage faculty workloads. They should be trained so that the faculty and administrative staff are comfortable with the use of these tools and it should be assessed regularly to gauge its effectiveness.

3. Use AI to achieve Personalized Student Learning and Assessment.

AI presents a chance to assist students with learning in a more personalized way based on the individual assessment, predictive analytics, and customized academic intervention, especially in engineering courses when a student frequently has to solve challenging technical tasks.

• Recommendation: Universities must consider AI-based personalized learning platforms

that provide real-time feedback on student performance, where students are falling short, and suggest individualized learning material. At-risk students can also be identified and early intervention can be provided with the help of predictive analytics.

- Application: AI-based assessments that will gather student performance, engagement, and progress data should be implemented by educational administrators. Such systems need to be incorporated into the existing learning management systems (LMS) to make their use smooth to both students and faculty. Faculty should also be trained in universities on how to utilize AI data to inform their teaching and offer students personalized learning options.

4. Create AI Training Programs to University Leaders.

To ensure that the advantages of AI are maximized, academic leaders and university administrators must be knowledgeable about the way AI technologies operate and how they can be used in the decision-making process, managing resources, as well as creating new programs.

Recommendation: Universities need to provide AI training and professional development courses to academic leaders such as deans, department heads, and the senior administrators. Such programs ought to center on practical implementation of AI in educational leadership and give an understanding of how AI can be applied to enhance decision-making and operational efficiency.

Implementation: Establish relationships with AI specialists and technology firms to devise tailored training programs to fit the needs of university leaders. Such programs must involve workshops, seminars, and practical training on the use of AI to plan its strategy, optimize its resources, and make decisions based on data.

B. Policy Recommendations to Policymakers.

The GCC policymakers are pivotal in ensuring that AI is adopted in higher education. Policies and investments must be supportive, so that universities in the region are able to have the infrastructure, resources, and expertise necessary to fully implement AI into their administrative and academic operations. The policy recommendations presented below will help develop integration of AI in learning institutions, particularly the engineering courses.

1. Create National AI Education Strategies at Universities.

A number of GCC states, including the UAE and Saudi Arabia, have already come up with national AI strategies, although they should be extended to specifically address AI implementation in higher education institutions. In teaching AI, there should be specifications on how AI is to be incorporated in university administration and curriculum.

Recommendation: Policymakers ought to create national AI plans that directly respond to the requirements of higher education institutions. These plans must map out the plans that universities need to undertake to harness AI in administrative processes like resource management, decision-making, and personalized learning. They are also expected to fund AI research and development within universities and especially in engineering and STEM.

We can implement: form national committees/task forces on AI in education, with government officials, university leaders, and AI experts. Such agencies are supposed to come up with elaborate implementation road maps that guide universities to effectively embrace AI technologies in terms of timelines, budget, and quantifiable results.

2. Offer Financial Assistance and Incentives to Adopt AI.

Universities usually have financial limitations that reduce their capacity to embrace new technologies such as AI. Governments can promote the implementation of AI by offering financial assistance (in the form of grants, subsidies, and other incentives) to institutions interested in implementing AI in their administrative and educational processes.

\\ Recommendation: The government should create grants and subsidies through the government to enable universities to use AI technologies. Incentives are also to be.

granted to universities that prove their successful AI integration, especially in engineering programs, where AI-driven resource optimization and individualized learning are in the highest demand.

• Implementation: The governments must establish special AI funding schemes in higher education that prioritize projects that target AI adoption in leadership, decision-making, and engineering programs management. Such programs are to be provided both to the public and to the privates of the GCC universities and the funding is to be provided on clear-cut basis which includes the scope of the project, its possible impact and novelty.

3. Enhance Technical Infrastructure to integrate AI.

AI technologies are based on high-speed internet, cloud computing services, data processing capabilities of big data, etc. Investments in digital infrastructure should be a priority among policymakers because all the universities, irrespective of their size and location, should have the tools to apply AI effectively.

• Recommendation: Policymakers ought to invest in digital infrastructure modernization of the GCC universities, especially in the provision of the technical capacities to support AI-based systems. This also involves enhancing internet connectivity, cloud computing, and data

management platforms, particularly in engineering courses in which data-intensive operations are essential.

• Implementation: The governments need to collaborate with technology firms and telecommunication companies to facilitate high-speed internet and cloud access to universities. There should also be grants and funding of universities to construct internal data management systems that can handle the amount and sophistication of AI-driven analytics.

4. Encourage AI Research and Innovation in Engineering Education.

In order to be competitive in the global context, universities in the GCC not only need to implement AI technologies, but also take part in AI research and innovation. Especially engineering programs provide the universities with a chance to be the leaders in AI development and application.

Recommendation: Policy makers can initiate AI research centers in universities, especially in engineering and STEM education. These facilities must be the centers of AI innovation, and they will encourage the collaboration of universities, industry leaders, and government agencies.

• Implementation: The governments are supposed to fund the establishment of AI research centers in the leading universities in the GCC. The areas that these hubs need to work on are developing AI technologies in education, especially in the fields of personalized learning, faculty management, and resource optimization. Joint research grants and partnerships should also be encouraged to encourage collaborative projects between the universities and the AI companies in the private sector.

5. Create Ethical Standards of AI in Education.

Although AI will bring numerous positive aspects, it should be implemented with clear ethical principles to resolve data security concerns, biases in algorithms, and decision transparency. Governments must be in the forefront to come up with regulations that will see AI being utilized in educational institutions in a responsible manner.

Recommendation: The policymakers are advised to develop ethical standards that will inform the application of AI in education with emphasis on data privacy, fairness, and accountability. Universities should make sure that AI-based decisions are not hidden and that the information obtained regarding students and faculty is secured.

• Implementation: Governments in collaboration with institutions and legal professionals should develop principles of ethical guidelines on AI in education. These rules must incorporate regulations over data collection, use and storage, and there should exist standards of algorithmic transparency and responsibility. These ethical standards should be adhered to by regular audits.

Implementation of AI in administrative education has provided the first of its kind opportunities to enhance leadership, decision-making, resource management, and student success especially in the field of engineering. Nevertheless, to achieve success in AI implementation, governments and university administrators must take practical measures and have supportive policies. By investing in AI-driven resource management systems, enhancing faculty management, and promoting personalized learning, universities can fully leverage the benefits of AI. At the same time, policymakers should be concerned with the establishment of technical infrastructure, financial assistance, and the promotion of ethical AI implementation to be sure that the potential of AI is fulfilled in the education of the GCC. All these efforts will enable AI to make universities in the GCC the leaders of educational innovations, especially in the fast-growing sphere of engineering education.

6.3. Future Research Directions

A. Cross-Country Comparative Studies.

Future studies must carry comparative studies of GCC countries with other regions with the aim of establishing best practices.

B. Diversification in Other Academic Subjects.

They should conduct research into the application of AI to other fields like the humanities, social sciences, business studies and medical education.

C. Exploring AI's Role in Enhancing Leadership Development

The researcher might explore the possibility of utilizing AI tools to develop leadership abilities in academic administrators in the future.

D. Exploring Ethical and Social Implications.

Areas of research that need to be explored include the privacy of data, bias in the algorithms, transparency, and accountability in the AI systems deployed in higher education.

Use of AI in educational administration is a comparatively recent field of research, specifically in the framework of engineering courses in the GCC. Although this study has contributed remarkably in terms of understanding the purpose of AI in improving leadership and decision-making processes, there are still numerous opportunities to be tapped. This section presents the possible future research pathways that may enrich the knowledge of AI-driven educational management and its implication in various academic fields and geographic areas.

A. International Comparative Research on AI Implementation in Education Administration.

Among the most important findings of this study is that adoption and use of AI in the

administration of education in the GCC countries significantly differ in various countries. Examples are that the UAE and Saudi Arabia have more developed AI policies and infrastructure, whereas countries such as Oman, Kuwait, and Bahrain are at earlier stages of AI adoption. Further studies ought to be conducted on these disparities in detail especially by conducting cross-country comparative studies.

Research Direction: Comparative Analysis of AI Adoption in GCC Countries.

o Purpose: Study the determinants of AI adoption in the education administration in the GCC countries including the government policies, the technical infrastructure, and cultural disposition towards AI. This study may yield some valuable information about the problems and possibilities that various nations have when it comes to adopting AI as part of their educational framework.

o Focus Areas:

Questions: 4. How can the government help in the faster adoption of AI?

 Explore how national digital strategies affect the AI readiness in higher education.

 Determine the impact of infrastructure and AI literacy disparity on success in implementation in the different GCC nations.

2. Research Direction: Comparative Study across region GCC and Non-GCC Countries.

o Purpose: Develop comparative research across GCC universities and other areas, like Europe, North America, or East Asia, where the use of AI in education might be more developed or alternative. The results of such studies may offer valuable insights to GCC universities and define the best practices that can be translated into local cultures.

o Focus Areas:

 Investigate how AI is being used in educational administration in countries with more mature AI ecosystems.

Compare the results of AI adoption in the engineering programs in various regions.

S: Evaluate the effects of cultural and policy disparities on the use of AI and its success in educational administration.

B. Diversification into other Academic fields.

Although this study is specific to AI in engineering studies, AI can revolutionize the education administration in a broad field of study. The use of AI in the fields of humanities, social sciences, business studies, and medical education should be studied in the future.

1. Research Topic: AI in Education of Humanities and Social Sciences.

o Purpose: Research how AI could be used to manage and design the curriculum of non-technical disciplines, such as humanities and social sciences. These areas have more challenges than engineering programs, including personalized learning, student engagement, and

development of critical thinking skills.

o Focus Areas:

 Explore how AI can be used to enhance personalized learning in literature, history, and sociology programs.

 Determine the effect of AI on student evaluation and the reaction in creative and interpretative subjects.

 Investigate the potential of AI in facilitating interdisciplinary learning by integrating data-driven insights from multiple fields of study.

2. Direction of Research: AI in Business and Management Education.

o Purpose: Discuss the ways of using AI to enhance the management and administration of business and management programs, in such domains as finance, marketing, entrepreneurship teaching. AI in business schools is being applied in predictive analytics in market research, customer behavior analysis, and financial modeling.

o Focus Areas:

 Research the role of AI-driven analytics in designing the curriculum in business education.

 Evaluate the application of AI to enhance leadership and decision-making education at MBA.

 Explore the role of AI in enhancing entrepreneurial education by providing real-time market data and predictive insights for business decision-making.

3. Research Area: AI in Medical and Health Sciences Education.

o Purpose: Learn about the application of AI in medical education, where accuracy, data processing, and foretelling are vital. AI can be used in the management of medical programs to optimize clinical rotations, managing resources in teaching hospitals, and improve medical simulation training.

o Focus Areas:

 Examine the use of AI in medical student assessments, including AI-driven diagnostic simulations and personalized learning pathways.

: Evaluate the potential of AI to enhance resource distribution in medical schools and teaching hospitals.

 Investigate the potential for AI to improve clinical decision-making training and healthcare management education.

C. Exploring AI's Role in Enhancing Leadership Development

Although this study emphasizes how AI enhances leadership in the field of educational

administration, future research can concentrate directly on the effects of AI on leadership in universities. This research could investigate how AI tools can be used to cultivate leadership skills in academic administrators and faculty members.

1. Research Direction: AI and Leadership Training of University Administrators.

o Goal: Examine the opportunities of applying AI-driven insights and data analytics to create and advance leadership abilities among university administrators. The AI technology may offer tailored feedback and performance monitoring that will assist leaders to enhance their decision-making, strategic planning, and operation management skills.

o Focus Areas:

\\ Explore how AI could be used to develop leadership development programs that are personalized.

 Evaluate the potential of AI-based data analytics to determine the strengths and weaknesses in university management teams in terms of leadership.

 Research AI application in mentorship and coaching of academic heads, specifically equipping them with skills to operate in more complex learning settings.

2. Research Direction: AI-Driven Leadership to Crisis Management.

o Purpose: Discuss how AI applications can assist university leaders in managing crises, specifically how it can be used in overcoming such issues as COVID-19 pandemic, economic depressions, or resource shortages. The predictive nature of AI can assist leaders in recognizing potential crises and strategizing the sources of response more efficiently.

o Focus Areas:

 Assess how AI tools can be used for contingency planning and risk management in educational institutions.

 Investigate the use of AI in real-time decision-making during crises, such as reallocating resources, adjusting academic schedules, or managing faculty and staff in emergency situations.

 Explore the role of AI in enhancing communication and collaboration between university leaders during crises.

D. Exploring the Ethical and Social Implications of AI in Education.

With the implementation of AI in educational administration, significant ethical and social concerns are at play. The future research must explore the problem of data privacy, algorithmic bias, transparency, and accountability as an aspect of AI systems applied in higher education.

1. Research Area: Ethical AI in Higher Education Management.

o Purpose: Investigate the ethical issues related to the use of AI in the sphere of educational administration, specifically, in data privacy, transparency, and the possibility of bias in decision-making algorithms. To ensure ethical use of AI, universities should establish clear rules and regulations to curb its use and ensure the safety of students and academics.

o Focus Areas:

 Investigate how universities can ensure data privacy and secure the personal information of students and staff while using AI systems.

 Evaluate the effects of algorithm bias on decision-making in educational management and consider the ways to mitigate bias in AI systems.

 Inquire about how AI tools can be used by universities to improve transparency and accountability in their decision-making, resource allocation, and assessment of students.

2. Future Research Area: AI-Driven Education: Social Implications.

o Purpose: Investigate the expanded societal aspects of AI integration in higher education, especially its effects on the student experience, faculty-student interactions, and human supervision of education management.

The study should be conducted on the topic of the trade-off between AI automation and human decision-making in education.

o Focus Areas:

Investigating the learning outcomes and engagement of students with AI, and specifically, how students respond to the AI systems in comparison to traditional teaching methods.

 Evaluate the possible difficulties and advantages of substituting human judgment with AI-based decision-making in administrative work.

 Delve into the way AI can complement, not supplant, the human aspects of education, including mentoring, collaboration, and EI.

The future of AI in education administration has enormous possibilities of new studies and discovery. Although this research has yielded some useful data on the role of AI in improving leadership and decision-making in universities, especially engineering courses, there are still many prospects to be explored further. Future research can be fruitful in cross-country comparative studies, interdisciplinary applications, development of leadership, and even in ethical considerations.

With the current development of AI, it is paramount that educational institutions and policy makers be proactive to learn and respond to the challenges and opportunities that AI has to offer. Through creating an agenda of research into these domains, universities can make sure that AI is incorporated in a manner that does not only enhance operational efficiency, but the overall quality of education to both students and faculty as well.

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Annexure I

Questionnaire: Role of AI in Educational Administration and Its Impact on Transforming Leadership and Decision-Making Processes

Section A: Demographic Information

Section A: Demographic Information

1. **Designation/Position:**
    - Vice-Chancellor
    - Dean
    - Department Head
    - Registrar
    - IT Manager
    - Other
2. **Years of Experience in Educational Administration:**
    - Less than 5 years
    - 5-10 years
    - 11-15 years
    - 16-20 years
    - More than 20 years
3. **Age of the Respondent:**
    - Below 30 years
    - 31-40 years
    - 41-50 years
    - Above 50 years
4. **Nationality**

- GCC Nationals
- Expatriates

5. Country **Where the University is Located:**
    - Kuwait City
    - Dubai
    - Riyadh
    - Muscat
    - Abu Dhabi
    - Jeddah
    - Sharjah
    - Dammam
    - Doha
    - Manama
    - Other Cities
6. Online Education Offered
    - Yes
    - No
7. **How long has the university offered an engineering program?**
    - Less than 5 years
    - 5-10 years
    - 11-15 years
    - More than 15 years

Section B: Questionnaire for variables

Response Scale

Please indicate your level of agreement with each of the following statements by selecting one option:

Scale	Response
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Section A: Leadership Effectiveness (LE)

No.	Statement	1	2	3	4	5
LE1	AI-enabled administrative systems improve the overall effectiveness of academic leadership in engineering programs.	☐	☐	☐	☐	☐
LE2	AI assists university leaders in making strategic decisions that align with institutional goals.	☐	☐	☐	☐	☐
LE3	The use of AI enhances transparency and accountability in leadership practices.	☐	☐	☐	☐	☐
LE4	AI enables leaders to respond more effectively to academic and administrative challenges.	☐	☐	☐	☐	☐
LE5	AI supports engineering faculty leaders in improving overall institutional performance.	☐	☐	☐	☐	☐

Section B: Decision-Making Efficiency (DME)

No.	Statement	1	2	3	4	5
DME1	AI provides accurate information that improves administrative decision-making.	☐	☐	☐	☐	☐
DME2	AI reduces the time required to make important academic and administrative decisions.	☐	☐	☐	☐	☐
DME3	AI helps decision-makers evaluate multiple alternatives more effectively.	☐	☐	☐	☐	☐
DME4	AI improves the consistency and objectivity of university decision-making processes.	☐	☐	☐	☐	☐
DME5	AI contributes to evidence-based decision-making within engineering programs.	☐	☐	☐	☐	☐

Section C: Resource Allocation (RA)

No.	Statement	1	2	3	4	5
RA1	AI helps optimize the allocation of financial resources in engineering faculties.	☐	☐	☐	☐	☐
RA2	AI improves the efficient allocation of teaching and administrative staff.	☐	☐	☐	☐	☐
RA3	AI supports effective planning and utilization of laboratories and academic facilities.	☐	☐	☐	☐	☐
RA4	AI enables better forecasting of future resource requirements.	☐	☐	☐	☐	☐
RA5	AI minimizes resource wastage through data-driven planning and allocation.	☐	☐	☐	☐	☐

Section D: Faculty Management (FM)

No.	Statement	1	2	3	4	5
FM1	AI assists administrators in monitoring faculty performance more effectively.	☐	☐	☐	☐	☐
FM2	AI supports fair and objective faculty workload distribution.	☐	☐	☐	☐	☐
FM3	AI improves communication between university administrators and faculty members.	☐	☐	☐	☐	☐
FM4	AI helps identify faculty training and professional development needs.	☐	☐	☐	☐	☐
FM5	AI contributes to improving faculty productivity and administrative efficiency.	☐	☐	☐	☐	☐

Section E: AI Adoption (AIA)

No.	Statement	1	2	3	4	5
AIA1	My university actively encourages the use of AI technologies in educational administration.	☐	☐	☐	☐	☐
AIA2	The university provides sufficient training to support AI adoption among administrators.	☐	☐	☐	☐	☐
AIA3	AI tools used in my university are easy to learn and operate.	☐	☐	☐	☐	☐
AIA4	I am willing to use AI technologies in administrative and leadership activities.	☐	☐	☐	☐	☐
AIA5	AI technologies are increasingly integrated into administrative processes within engineering programs.	☐	☐	☐	☐	☐