An AI Roadmap in Predicting the Performance of SME in UAE Procurement Industry

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***Abstract*— This research aims to address the challenges faced by the small and medium enterprises (SMEs) in the UAE procurement industry through the development of an artificial intelligence (AI) roadmap based on decision tree (DT) classification and data-driven decision-making approaches. Current procurement methods often reply to manual processes that are time-consuming and prone to bias, leading to inefficiencies and misused opportunities for SMEs. This study proposes a structured AI roadmap that utilizes hybrid classification techniques to assess various strengths and weaknesses of the SMEs, ensuring transparency and objectivity in decision-making processes. Employing quantitative methods, the research will analyze data collected from SMEs to develop and evaluate the AI model. The intelligent approach proposed in this research aims to enhance the operational efficiency and competitiveness of SMEs by facilitating informed decision making and strategies planning. This study is significant as it contributes to economic development objectives by demonstrating how AI can be effectively enhanced into local procurement practices while addressing unique challenges faced by SMEs in the UAE.**

Keywords*— *Artificial Intelligence; Small and Medium Enterprises. Decision Tree, Procurement, United Arab Emirates

I. INTRODUCTION

Small and medium Enterprises (SMEs) play a vital role in the economic landscape of the UAE, contributing significantly to the nation's GDP and employment rates. However these enterprises face numerous challenges in the procurement sectors, which can hinder their operational efficiency and competitiveness. The dynamic nature of the market, coupled with the complexities of procurement processes, often leaves SMEs at a disadvantage compared to large firms. Factors such as limited access to resources, lack of technological assistance, and inefficiencies in decision-making processes exacerbate these challenges [34] .

Recent studies indicate that many SMEs struggle with outdated procurement methods that rely heavily on manual processes, leading to delays and biases in decision-making [21]. The reliance on traditional procurement practices not only consumes time and resources but also limits the ability of the SMEs to respond swiftly to market changes, ultimately impacting their growth and sustainability. Furthermore, the lack of advanced data analytics and predictive capabilities prevents SMEs from identifying opportunities and threats in a timely manner.

In the UAE, where the SME sector represents approximately 75% of the GDP and 95% of employment, the need for effective procurement strategies is critical [34]. However, many SMEs remain unaware of how to leverage artificial intelligence (AI) and machine learning technologies to optimize their procurement processes. Current methods of identifying and addressing procurement inefficiencies often do not incorporate data-driven insights, which can lead to missed opportunities for improvement.

Traditional approaches to procurement evaluation typically rely on historical data and manual assessments, which may overlook the complexities of SME operations and the unique challenges they face [43]. As a result, there is a pressing need for structural AI roadmap that not only predicts the performance of the SMEs in procurement but also provides actionable insights to enhance decision-making capabilities.

This research aims to develop an AI roadmap tailored specifically for SMEs in the procurement industry, utilizing decision tree (DT) classification and explainable AI approaches. The proposed roadmap will serve as a strategic tool to identify the strengths and weaknesses of SMEs, enabling them to make more informed decisions based on real time data. By implementing advanced analytics and machine learning techniques, this research seeks to empower SMEs to overcome procurement challenges and enhances their operational efficiency.

The significance of this research lies in potential to transform the procurement landscape for SME in UAE. By leveraging AI technologies SMEs can streamline their procurement processes, reducing biases in decision-making. And ultimately improve their competitive positioning in the market. This research also acknowledges the importance of interpretability in AI systems, ensuring that stakeholders can understand, and trust decisions made by these advanced technologies.

In summary, the identification of effective procurement strategies for SMEs is essential for their growth and sustainability. This research will address the gap in existing

knowledge by providing a comprehensive AI roadmap that facilitates the development of AI into procurement processes, ultimately contributing to a broader economic development objective of the UAE.

II. LITERATURE REVIEW

The procurement landscape for small and medium enterprises (SMEs) in the UAE is characterized by several changes, primarily due to the fast-paced digital market. SMEs are under pressure to remain competitive, necessitating transformative procurement strategies that ingrate modern technologies such as artificial intelligence (AI). This literature review aims to highlight the key factors influencing the SME performance in procurement, emphasizing the importance of aligning procurement processes with contemporary business practices.".

A comprehensive analysis reveals several critical factors that affect SME performance in procurement. These factors are categorized into regulatory, contractual, procedural, support, operational and external features. Understanding these elements is essential for developing strategies that enhance SME competitiveness and participation in procurement processes.

High-quality procurement regulations are fundamental for SME success. Regulations must align with internationally accepted practices to foster an environment conductive to competition. Clear guidelines and specifications are necessary to help SMEs navigate procurement opportunities without misunderstanding that can lead to delays [20]. Contractual features such as the size and structure of contracts significantly influence SMEs ability to participate in procurement. Smaller contracts or those subdivided into manageable lots enhance accessibility for SMEs. Procedural frameworks must strike a balance between fostering competition and ensuring fair participation with timely payments being crucial for maintaining operational sustainability (2016) [17]. Support features, including suppliers' assistance and timely feedback, empower SMEs to navigate complex procurement processes effectively. Operational features encompass the adoption of best practices, such as green purchasing and ethical standards, which not only improve the procurement efficiency but also enhance the reputation of the SMEs, fostering long-relationships [45]. External influences such as access to finance and economic conditions play a significant role shaping SME procurement capabilities. Recognizing these factors enables stakeholders to create an environment that better supports the SME participation in the procurement processes [17]. Integrating AI technologies into SMEs operations has merged as a pivotable factor in enhancing operational efficiency and economic performance. Various framework for AI adoption highlights the need for tailored approaches that consider the specific contexts of SMEs, ensuring successful assistance and impactful outcomes [4].

The literature identifies gaps that are considered as critical regarding the practical implementation of AI in SME procurement processes. While existing studies emphasize the benefits of AI, there is a need for comprehensive research that addresses the unique challenges SMEs face, providing actionable insights and roadmaps for effective AI assistance in procurement [2].

TABLE I. Key Aspects of Literature Review Summary

Objective	Methodology	Findings	Discussion	Citation
Analyze the impact of regulatory features on SME participation in procurement.	Comparative analysis of procurement regulations.	High-quality regulations enhance SME participation and success in securing contracts.	Effective regulatory frameworks reduce uncertainties and foster competition for SMEs.	Hoekman & Taş (2022)
Investigate the importance of clarity in procurement specifications for SMEs.	Qualitative analysis of procurement practices.	Clear guidelines improve SMEs' understanding and performance in procurement.	Vague specifications hinder SMEs' ability to meet standards, emphasizing the need for clarity.	van Scheers (2016)
Explore operational features that enhance procurement efficiency in SMEs.	Case studies and best practice analysis.	Adoption of green purchasing and ethical standards boosts competitiveness and reputation.	Operational excellence can improve procurement effectiveness and foster long-term relationships.	Nyakundi (2018)
Examine frameworks for AI adoption in SMEs and its impact on performance.	Literature review and framework analysis.	A holistic approach to AI adoption enhances operational efficiency and economic performance.	Understanding the interplay of factors is crucial for effective AI integration in SMEs.	Badghish & Soomro (2024)
Analyze the role of AI in new product development (NPD) within SMEs.	Focused case studies on NPD processes.	AI can improve product development metrics by approximately 27%.	AI serves as a driver of innovation and market responsiveness in product development.	Cooper (2025)
Investigate the role of AI-Assisted Social Media Marketing (AISMM) for SMEs.	Empirical study on marketing strategies.	AISMM significantly enhances customer engagement and profitability for SMEs.	Proactive AI integration in marketing can lead to improved customer relationships and sales.	Basri (2020)
Explore AI's role in performance management systems in SMEs.	Qualitative analysis of management practices.	AI-driven insights improve employee engagement and productivity.	Adapting management frameworks to include AI is essential for fostering a responsive workforce.	Nyathani (2023)

Unveil next-gen supplier strategies in the UAE's oil & gas sector.	Case study analysis.	Innovative supplier strategies can enhance procurement efficiency.	Emphasizing next-gen strategies helps SMEs adapt to industry challenges and improve performance.	Alhammadi et al. (2024)

III. Background

The fourth industrial revolution poses a significant challenges for small and medium enterprises (SMEs) in procurement, which is vital for economic growth and accounts for substantial share of GDP in developed economies. SMEs often struggle with manual processes that are time-consuming and biased, hindering their competitiveness. This research aims to explore how artificial intelligence (AI) can transform procurement by providing advanced analytics for data-driven decision-making, ultimately enhancing operational efficiency and resilience. By leveraging AI, SMEs can streamline their procurement processes, capitalize on their strengths, and achieve sustainable growth in a competitive market.

IV. Motivation

The research aims to address the challenges faced by small and medium enterprises (SMEs) in navigating increasingly complex procurement landscapes particularly in the competitive UAE market. It highlights the necessity for SMEs to adopt efficient, data-driven decision-making practices to maintain their competitive edge. Current manual processes are criticized for being time- consuming, resources-intensive, and prone to biases, leading to suboptimal outcomes. The study explores how artificial intelligence (AI) can transform procurement method by providing SMEs with access to advanced analytics that facilitate informed, real time decision-making, moving away from outdated practices [31] , the research emphasizes the importance of advanced procurement analytics for improved decision-making and cost efficiency in the global supply chain. It investigates specific ways AI cem empower SMEs to leverage their strength and weaknesses, enhance operational resilience, ultimately positioning SMEs for sustainable growth in a dynamic market.

V. Problem Statement

The procurement processes for small and medium enterprises (SMEs) in the UAE face several significant challenges that hinder operational efficiency and effective decision-making. The first issue is the reliance on the manual processes, which limits SMEs ability to respond to market change optimize procurement strategies [21] emphasizes that integrating artificial Intellgence (AI) into supply chain management can automate routine task and provide real time data analytics, underscoring the need to transition from manual to AI driven processes to enhance performance.

The second challenge is the prevalence of biased decision-making in manual procurement, leading to inaccurate outcomes poor supplier selection and resource misallocation which ultimately affects SMEs competitiveness. AI can help create a structured roadmap to mitigate biases, thereby improving decision-making accuracy and enabling a more objective evaluation of strengths and weaknesses [8].

The third issue is the time and cost inefficiencies associated with manual procurement processes [43], which can limit SMEs ability to undergo digital transformation. This underscores the urgent need for an AI roadmap that not only implement technology but also provides actionable solutions to overcome these challenges and facilitate smoother transitions to more efficient e-procurement practices.

VI. Research objectives

Understand influential factors: to identify and analyze the factors that impact performance of SMEs within UAE procurement sector.

Exploring AI assistant tool: to investigate the role of artificial intelligence (AI) in enhancing procurement processes and improving decision-making capabilities for SMEs.

Designing a framework for the implementation of AI in procurement and to evaluate the collaboration with industry expert.

Proposing a practical roadmap for SMEs informed by insights gained from decision tree analysis, outlining clear and actionable steps for the successful AI implementation for procurement processes.

VII. Methodology Followed

This research adopts a data-driven methodology centered in utilizing Decision Tree (DT) to classify the strengths and weaknesses of small and medium enterprises (SMEs) in the UAE procurement sector. The DT approach is a supervised learning technique used for classification tasks, where data is systematically divided into smaller subsets based on specific features. This method not only predicts outcomes related to the classification of the SMEs but also [provides a clear explanation for its predictions making it accessible for SME stakeholders to understand what influence performance.

The research aims to address the following questions:

1. How can the implementation of artificial intelligence (AI) improve the procurement performance of small and medium-sized enterprises (SMEs) in the UAE?

2. How can a decision tree model be designed to assist SMEs in making informed decisions regarding the adoption of AI in their procurement strategies?

To identify the strength and weakness of SMEs, data will be collected through a structured questionnaire aimed at SMEs stakeholders. This research will utilize a quantitative approach focused on employing surveys to explore the factors influencing the productivity of the SMEs within the procurement sector, particularly concerning the implementation of artificial intelligence. The workflow begins with gathering raw data from the questionnaire which will cover various aspects of procurement performance, operational capabilities and the market challenges faced by SMEs. This raw data will be reprocessed to clean transform and prepare it for analysis using the DT classification technique.

Decision tree analysis will be conducted to identify the critical factors that enhance AI assistance in the procurement processes of UAE SMEs. Based on that insight gathered from the questionnaire, the framework of the paper will be designed and presented to subject matter experts for their input. This feedback will then be used to refine and adjust the framework accordingly. The resulting model will visually represent the key factors contributing to identified strengths and weaknesses of each SME, allowing the stakeholders to explore and understand the critical areas that require improvement. This model will serve as a valuable resource for SME managers, enabling them to make data-driven decisions regarding their procurement strategies.

Soon, we plan to implement the decision tree approach using python programming language to facilitate model development and analysis. A structured questionnaire will gather quantitative data on the strengths, weaknesses, and market dynamics of SMEs, supplemented by secondary data analysis. The findings will contribute to the development of comprehensive AI roadmap that include strategic initiatives and practical recommendations to address barrier to adoption. The proposed methodology will provide insights into the strength and weaknesses of the SMEs, ensuring that the outputs are both predictive and actionable for end users such as procurement managers. By focusing on strength and weaknesses identified through the decision tree analysis, SMEs will be better equipped to navigate the challenges in the procurement landscape and improve their overall operational efficiency.

Currently, the identification of the questionnaire will be identified to prepare the questionnaire and gather the data.

A stratified random sampling technique will be used to select a representative sample of SMEs from various industries and regions within the UAE, ensuring diversity and generalizability of the findings.

Data will be collected through a structured questionnaire targeting SME stakeholders, covering procurement performance, operational capabilities, and AI-related challenges. Secondary data from industry reports and government publications will also be utilized to complement the primary data.

To ensure the validity and reliability of the findings, a pilot test of the questionnaire will be conducted, followed by data triangulation to compare primary and secondary data results. Additionally, the decision tree model will be validated using a holdout sample to assess its predictive accuracy, reinforcing the credibility of the conclusions drawn from the analysis.

Scenario: Decision Tree Output

Consider a hypothetical retail SME using the decision tree model. Key factors influencing its procurement performance include:

Technological Readiness: Investment in modern procurement software.

Staff Training: 70% of staff trained, enhancing efficiency.

Market Awareness: Strong understanding of AI capabilities.

The decision tree predicts a potential 25% improvement in procurement efficiency with further AI investment, while financial constraints are identified as a significant barrier.

Prototype Output

The prototype output of the decision tree can be visualized as follows:

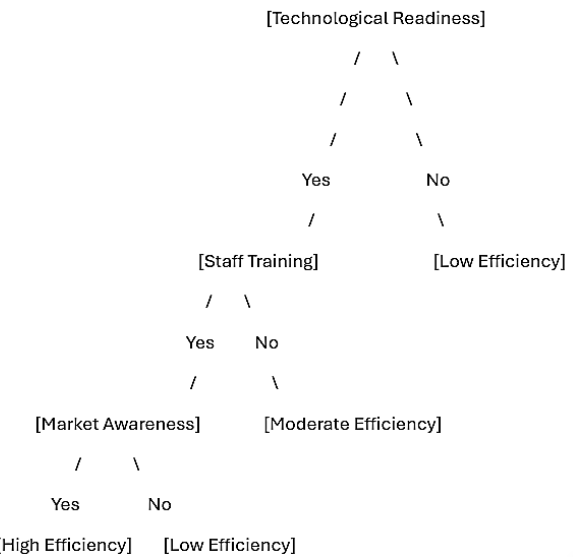

Fig. 1. Example of Decision Tree Diagram.

This visualization helps stakeholders understand how these factors contribute to procurement performance and indicates that improving financial resources could enhance efficiency.

The results show that SMEs with strong technological readiness and staff training are better positioned to leverage AI, while financial constraints hinder adoption. Targeted interventions, such as financial support and training programs, are essential for facilitating AI integration in procurement processes. The decision tree model serves as a valuable tool for SMEs to develop actionable strategies for improving operational efficiency.

VIII. Result

The results of this paper, which utilized a Decision Tree (DT) classification model to analyze data collected from SMEs in the UAE procurement sector, revealed critical insights into the strengths and weaknesses of these enterprises regarding AI adoption. The analysis identified key factors influencing procurement performance, such as technological readiness, staff training, and market awareness, highlighting strengths like agility and cost efficiency among SMEs. However, it also uncovered weaknesses, including limited financial resources and resistance to change, which hinder AI assistance. The developed framework, refined through expert feedback, visually represents these strengths and weaknesses, serving as a valuable resource for SME managers to make informed, data-driven decisions in their procurement strategies. Overall, the findings underscore the potential of AI to enhance procurement processes, equipping SMEs with actionable insights to navigate challenges and improve operational efficiency.

IX. Conclusion

In conclusion, this research presents a comprehensive AI roadmap designed to enhance the procurement processes of the SMEs in the UAE, addressing the inefficiencies of traditional methods that hinder competitiveness. By utilizing the decision tree classification and data-driven insights, the roadmap empowers SMEs to identify their strengths and weaknesses facilitating informed decision making and strategic planning. The assistance of AI technologies not only streamlines procurement practices but also fosters transparency and trust in the decision-making process. Ultimately, this study underscores the potential for AI to transform the procurement landscape for SMEs, contributing to their growth and sustainability in the dynamic UAE market.

Future work will focus on conducting longitudinal studies to assess the long-term impacts of AI assistance on procurement performance in SMEs, as well as expanding research to include a broader range of sectors and regions within the UAE. Additionally, developing tailored training programs for employees to enhance their skills in using AI tools will be essential. Finally, exploring advanced machine learning techniques, such as neural networks and ensemble methods, could further refine the decision-making framework and improve its predictive capabilities. These initiatives aim to continuously enhance procurement practices, fostering innovation and competitiveness among SMEs in the UAE.

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