

The Influence of Artificial Intelligence on Sustainable Innovation and Entrepreneurial Risk Management in the Business Sector of Oman

Dr. Mohammed Jahangir Ali

Associate Professor, Accounting and Finance - Department of Business Administration and Accounting,
Al Buraimi University College, Al Buraimi - Sultanate of Oman

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ABSTRACT

This study investigates the impact of Artificial Intelligence (AI) on sustainable innovation and its influence on entrepreneurial risk management in the Business Sector of Oman. AI technologies enhance resource efficiency, optimize energy usage, support eco-friendly product design, and enable data-driven environmental decision-making, promoting green innovation across sectors such as renewable energy, smart manufacturing, and sustainable finance. Using a structured questionnaire, primary data were collected from entrepreneurs, managers, and innovation professionals in technology-driven and green sectors. Quantitative analyses, including descriptive statistics and regression, were applied to examine the effects of AI adoption on sustainable innovation performance, entrepreneurial growth, and environmental outcomes.

The results reveal that AI adoption significantly improves operational efficiency, environmental performance, and the scalability of green ventures, generating new entrepreneurial opportunities in line with Oman Vision 2040. At the same time, challenges such as high implementation costs, technical complexity, skill gaps, data security issues, and regulatory uncertainties were identified. The study provides empirical evidence from a developing economy context and underscores the importance of supportive policies, responsible AI governance, and capacity-building initiatives to maximize the benefits of AI-driven sustainable innovation.

Keywords: Artificial Intelligence; Green Innovation; Sustainable Entrepreneurship; Eco-Innovation; Entrepreneurial Opportunities; Risk Management; Empirical Analysis; Environmental Sustainability; Oman Vision 2040

INTRODUCTION

Artificial Intelligence (AI) is increasingly recognized as a transformative technology influencing business models, industrial processes, and sustainable development worldwide. By enabling data-driven decision-making, process optimization, and intelligent automation, AI contributes significantly to sustainable innovation through improved resource efficiency, reduced environmental impact, and the development of environmentally responsible products and services. These technological advancements create new entrepreneurial opportunities, particularly in renewable energy, smart manufacturing, sustainable agriculture, and green finance.

In Oman, sustainability and economic diversification are central pillars of national development. Under the framework of Oman Vision 2040, the country seeks to build a knowledge-based economy driven by innovation, advanced technologies, and competitive industries while ensuring environmental protection and responsible resource management. The integration of AI into green innovation strategies has the potential to strengthen entrepreneurial ecosystems, enhance operational performance, and support the growth of environmentally sustainable enterprises.

However, the diffusion of AI also introduces significant challenges. Concerns related to technological dependence, cybersecurity vulnerabilities, skills shortages, ethical considerations, and regulatory uncertainty may influence how entrepreneurs perceive and manage risks and opportunities. Existing research emphasizes

this dual character of AI: while it enhances energy efficiency, facilitates renewable energy integration, supports intelligent production systems, and improves environmental governance, its implementation requires strategic oversight and risk mitigation mechanisms.

This study adopts a mixed-method research design, integrating qualitative evidence from expert interviews with quantitative analysis of green entrepreneurial initiatives in Oman. Primary data were collected from entrepreneurs, policymakers, and industry specialists, complemented by secondary data from scholarly publications, policy documents, and industry reports. Although the study faces limitations such as emerging AI adoption levels, evolving regulatory frameworks, and sector-specific data constraints, it provides empirical insights into how AI shapes sustainable innovation and entrepreneurial risk–opportunity dynamics. The findings contribute to understanding how responsible AI integration can foster environmentally sustainable entrepreneurship while strengthening economic resilience in Oman.

Purpose of the Study

The purpose of this study is to investigate how Artificial Intelligence (AI) contributes to advancing green innovation in Oman and to examine its influence on entrepreneurial opportunities and associated risks. The research aims to identify the ways AI-driven technologies enhance sustainability, optimize resource utilization, and foster eco-friendly business practices, while also evaluating potential challenges and risks for entrepreneurs adopting AI-enabled green solutions. The study seeks to provide insights for policymakers, businesses, and investors to promote sustainable economic growth through AI-driven innovation.

Significance of the Study:

This study is significant as it explores the transformative role of Artificial Intelligence (AI) in promoting green innovation and sustainable entrepreneurship in Oman. By examining how AI enhances resource efficiency, optimizes energy use, and supports eco-friendly product development, the research provides valuable insights for policymakers, business leaders, and entrepreneurs seeking to integrate sustainability into their operations. The study highlights potential entrepreneurial opportunities arising from AI-driven green solutions while identifying associated risks, enabling informed strategic decision-making. Additionally, it contributes to academic literature by bridging the gap between AI adoption, environmental innovation, and business growth, offering a framework for fostering sustainable economic development in Oman.

Definitions of Terms

- 1. Artificial Intelligence (AI):** Artificial Intelligence refers to the branch of computer science that enables machines and systems to perform tasks that typically require human intelligence. These tasks include learning from data, recognizing patterns, making decisions, and solving problems through algorithms such as machine learning, deep learning, natural language processing, and computer vision.
- 2. AI-Driven Decision Support Systems:** AI-driven decision support systems are software tools that use artificial intelligence (e.g., data mining, machine learning, expert systems) to assist human decision-makers by analyzing complex data, generating insights, and recommending actions.
- 3. Data Analytics:** Data Analytics involves examining raw data using statistical and computational techniques to discover patterns, insights, and trends that support decision-making and strategic planning.
- 4. Digital Transformation:** Digital Transformation is the integration of digital technologies into all areas of an organization or sector, fundamentally changing how value is delivered, how decisions are made, and how business is conducted.
- 5. Entrepreneurial Opportunities:** Entrepreneurial opportunities are favorable conditions or situations in the market environment that enable individuals or firms to introduce new products, services, or business models, resulting in potential economic benefits. In the context of green innovation and AI, these opportunities arise from identifying needs for sustainable solutions that can be addressed through intelligent technologies.

6. Entrepreneurial Risks: Entrepreneurial risks are potential uncertainties and challenges that entrepreneurs may face when pursuing business opportunities. These risks can be financial, technological, market-related, regulatory, or environmental in nature. In the scope of AI and green innovation, risks may include technological failures, market adoption barriers, data privacy concerns, and regulatory compliance issues.

7. Environmental Sustainability: Environmental sustainability means managing natural resources and ecosystems in ways that ensure their long-term viability and resilience, without degrading the environment or compromising future generations' needs.

8. Green Innovation: Green Innovation refers to the development and application of new technologies, products, services, and processes that reduce environmental impact, promote ecological sustainability, and support the efficient use of natural resources. It often involves cleaner production methods, renewable energy solutions, and environmentally friendly business models.

9. Green Entrepreneurship: Green Entrepreneurship refers to business ventures and entrepreneurial activities whose primary purpose is creating environmentally beneficial products or services, solving ecological problems, and advancing sustainable solutions while also achieving economic viability.

10. Innovation Ecosystem: Innovation Ecosystem refers to the interconnected network of actors (e.g., entrepreneurs, researchers, industry, government, investors) and resources (e.g., knowledge, infrastructure, funding) that collectively support the creation, diffusion, and scaling of new technologies and innovations.

11. Machine Learning: Machine Learning is a subset of AI that focuses on building systems that can automatically learn from and improve with experience by analyzing data, without being explicitly programmed for each decision.

12. Regulatory Framework: Regulatory Framework refers to the system of laws, regulations, policies, and standards established by governments or regulatory bodies to guide and control the behavior of individuals, businesses, and technologies within a specific domain, such as data protection, environmental standards, and AI governance.

13. Risk Management in Entrepreneurship: Risk management in entrepreneurship involves the identification, assessment, mitigation, and monitoring of potential risks that could negatively impact a business venture. Effective risk management increases the chances of venture success.

14. Sustainability: Sustainability is the practice of meeting present needs without compromising the ability of future generations to meet theirs. It involves balancing environmental protection, economic growth, and social equity to ensure long-term wellbeing of ecosystems and societies.

15. Sustainable Entrepreneurship: Sustainable entrepreneurship describes entrepreneurial activities that simultaneously create economic value and contribute to environmental and social sustainability. It involves developing business practices that are ecologically responsible and ethically sound, often integrating environmental stewardship with profitability.

16. Sustainable Development: Sustainable Development refers to progress that meets the needs of the present without compromising the ability of future generations to meet their own needs, balancing economic growth, social inclusion, and environmental protection. A guiding principle for studies linking innovation, AI, and environmental outcomes, especially in policy and business research.

17. Technology Adoption: Technology adoption refers to the process by which individuals, organizations, or industries accept, implement, and integrate new technologies into their operations and practices. It includes awareness, evaluation, and sustained usage of the technology.

18. Technological Innovation: Technological innovation refers to the process of developing and applying new or significantly improved technologies that enhance performance, efficiency, or quality. It includes both product and process innovations.

LITERATURE REVIEW

The literature indicates that Artificial Intelligence (AI) has become a strategic capability that supports business transformation through automation, data-driven decision-making and operational efficiency. AI adoption enhances sustainable innovation by improving resource utilization, reducing waste, and enabling environmentally responsible business practices. The Resource-Based View and Dynamic Capabilities Theory explain how organizations use AI resources and adaptive capabilities to achieve sustainable competitive advantages.

Furthermore, AI strengthens entrepreneurial risk management through predictive analytics, risk identification, and improved decision-making; however, challenges related to data security, ethics, and technological uncertainty remain significant. In emerging economies such as Oman, AI adoption depends on digital infrastructure, organizational readiness, skilled workforce, and regulatory support.

Although previous studies examine AI, innovation, and risk management separately, limited research explores their combined influence in Oman's business sector. Therefore, this study integrates RBV, Dynamic Capabilities Theory, and Entrepreneurial Risk Theory to examine the role of AI in promoting sustainable innovation and effective entrepreneurial risk management.

1. Abdelfattah, F., Dahleez, K., Al Halbusi, H., & Salah, M. (2025); conducted study on “Strategic green alliances: Integrating green dynamic capabilities, AI, and electronic entrepreneurial innovation for sustainability. Sustainable Futures”. This empirical study of Omani entrepreneurs explored how artificial intelligence (AI) strengthens the relationship between green dynamic capabilities (GDC) and green innovation, which in turn drives electronic entrepreneurial innovation. AI adoption moderated and amplified positive effects, highlighting AI's role in unlocking sustainable business opportunities and supporting entrepreneurial growth within green ventures in Oman.

2. Abdelfattah, F., Salah, M., Dahleez, K., Darwazeh, R., & Al Halbusi, H. (2024); conducted study on “The future of competitive advantage in Oman: Integrating green product innovation, AI, and intellectual capital in business strategies”. This study investigates how AI adoption and green product innovation interact with intellectual capital to enhance competitiveness in Omani firms. It emphasizes government and R&D roles as moderators shaping competitive advantages and sustainable practices in the Omani context

3. Ahmić & Ahmić Šahović (2025); conducted study on “Artificial intelligence impact on the sustainable entrepreneurial process”. This study revealed that AI positively affects sustainable entrepreneurial activities such as opportunity recognition and venture launch. Such insights emphasize how AI expands entrepreneurial horizons while signaling that effective adoption requires careful strategic planning.

4. Al Halbusi, Al-Sulaiti, Alalwan, & Al-Busaidi (2025); conducted study on “ AI Capability and green innovation impact on sustainable performance: Moderating role of big data and knowledge management”. This study examined how AI capabilities impact green innovation and sustainable performance, highlighting how technologies like machine learning and data analytics not only drive green innovations but also are moderated by big data and knowledge management systems. Their findings emphasize that AI's effectiveness in green innovation hinges on organizational readiness in handling data and knowledge flows.

5. Alherimi, N., Abdulmaksoud, S., Ahmed, V., & Bahroun, Z. (2025); conducted study on “A systematic literature review of artificial intelligence advancements in green human resource management”. This study specifically targets HR practice, it discusses how AI supports green organizational capabilities — a foundation for green innovation strategies that influence entrepreneurial outcomes and risk management in firms pursuing sustainability goals.

6. Ali, M. J. (2025); conducted study on "Impact of Artificial Intelligence in the Omani Industrial Sector: Current Adoption, Emerging Trends and Future Prospects". The study highlights policy recommendations, including government support, investment in AI education, and strategic partnerships, to accelerate AI integration in the industrial sector. This research contributes to understanding how AI can drive Oman's industrial growth and align with the country's Vision 2040 strategy for economic diversification and digital transformation.
7. Al-Mamary, Y. H. (2025); conducted study on "The transformative power of artificial intelligence in entrepreneurship: Exploring AI's capabilities for the success of entrepreneurial ventures. This study explores the presents conceptual evidence on AI enabling new entrepreneurial opportunities and enhancing business success in digital economies.
8. Al shammakhi & Sheikh (2025); conducted study on "Driving sustainable entrepreneurship through AI and knowledge management: Evidence from SMEs in emerging economies". This study found that AI capabilities shape sustainable entrepreneurship through knowledge management and entrepreneurial orientation in SMEs, highlighting how institutional support strengthens sustainable outcomes, a finding with direct implications for Oman's development strategies under Vision 2040.
9. Ganuthula, V. R. R. (2025); conducted study on "The Solo Revolution: A Theory of AI-Enabled Individual Entrepreneurship". This study develops a theoretical framework (AIET) explaining how AI transforms entrepreneurial capabilities and alters market entry barriers, risk profiles, and resource requirements for individual entrepreneurs.
10. Huipeng Li(2025); conducted study on " Artificial intelligence, green transition and green total factor productivity. This study analyzes how enterprise AI contributes to automation, innovation, and competitiveness—contextual link to entrepreneurial opportunities.
11. Kusetogullari, A., Kusetogullari, H., Andersson, M., & Gorschek, T. (2025); conducted study on " GenAI in entrepreneurship: Current issues and future directions". Although focused broadly on generative AI, this systematic review highlights how advanced AI tools reshape entrepreneurial opportunities and challenges, including sustainable innovation paths. This supports theoretical grounding on risks and opportunities in entrepreneurial ecosystem.
12. Monsalve-Castro, C. (2025); conducted study on "Artificial intelligence as a driver in adopting green innovation in the agricultural sector: evidence from an emerging economy". This study explores the empirical relationship between AI technologies and green innovation adoption from a resource-based perspective.
13. Musyokha & Silfa (2025); conducted study on "Harnessing the power of artificial intelligence in entrepreneurship: Augmentation, innovation, and ethical considerations.". This study examined AI's role in entrepreneurial innovation within the UAE context, concluding that AI has complex effects on entrepreneurial creativity, opportunity recognition, and ethical considerations. Although not Oman-specific, the findings illuminate the broader entrepreneurship-AI nexus relevant to the Gulf region, particularly concerning how AI expands opportunity spaces while raising ethical and strategic considerations for emerging ventures.
14. Omidmand, P., Dorri, R., Mozaffari, A., & Ataei, S. (2025); conducted study on "Artificial Intelligence applications in lean startup methodology: A bibliometric analysis of research trends and future directions". This study provides a comprehensive overview of AI applications in entrepreneurial contexts and identifies gaps relevant to startup experimentation and risk management.
15. Roustapisheh, N. (2025); conducted study on "Artificial intelligence and green innovation: A pathway to sustainable business practices". This empirical study shows that AI significantly strengthens green innovation and has a positive role in sustainable business model transformation, where green innovation mediates the AI–sustainability relationship.

16. Rawash, H. N., & Almansour, A. (2025); conducted study on “The impact of artificial intelligence capabilities on sustainability (Jordanian Hotel Sector)”. This research demonstrates that AI capabilities (tangible, intangible, and human) significantly increase sustainability performance with green innovation as a mediating factor. Although not in Oman, it offers valuable thematic parallels for entrepreneurial opportunities and AI–green innovation dynamics.

17. Sebastian U, Baier-FuentesHugo, Baier-FuentesJorge EspinozaJorge EspinozaWilliam Inzunza-Mendoza (2025); conducted study on “Artificial intelligence technologies and entrepreneurship: a hybrid literature review”. This study synthesizes research on AI’s disruptive potential, showing AI’s influence on opportunity identification, decision-making, and venture scaling. It emphasizes the democratization of AI as a source of entrepreneurial opportunity while also raising ethical and regulatory concerns that could become risk factors for entrepreneurs adopting advanced technologies.

18. Yan, L. (2025); conducted study on “The impact of artificial intelligence on green innovation resilience”. This literature review highlights that AI enhances green innovation resilience by strengthening adaptive capacity and efficiency of technological processes, particularly through intelligent decision-support and data analysis.

Conclusion: The literature shows a clear and growing connection between artificial intelligence and the advancement of green innovation, revealing both expanding entrepreneurial opportunities and significant risks. AI’s capacity to enhance efficiency, reduce environmental costs, and generate new sustainable business models positions it as a transformative force for green economic development.

RESEARCH METHODOLOGY

The study adopts a **mixed-methods research design** to examine the influence of Artificial Intelligence (AI) on sustainable innovation and entrepreneurial risk management in Oman’s business sector. Data are collected from 150 managers, entrepreneurs, IT managers, and senior executives through structured questionnaires and 15–20 semi-structured interviews. A purposive sampling technique is applied to select participants with relevant AI experience. The questionnaire measures AI adoption, sustainable innovation, risk management, and organizational performance using a five-point Likert scale, supported by a pilot study to ensure clarity and reliability.

The collected data are analyzed using **SPSS and Smart PLS/AMOS** through descriptive statistics, reliability tests, correlation, regression, CFA, and Structural Equation Modeling (SEM), while interview data are examined using thematic analysis. Reliability and validity are confirmed through Cronbach’s Alpha, Composite Reliability, AVE, and related validity tests. Ethical standards are maintained through informed consent, confidentiality, voluntary participation, and secure data management throughout the research process.

Research Questions:

1. How does the adoption of Artificial Intelligence (AI) influence the development of green innovation in Omani industries?
2. What are the key entrepreneurial opportunities created by AI-driven green innovation in Oman?
3. How do AI technologies help optimize resource efficiency and environmental sustainability in Omani businesses?
4. What risks and challenges do entrepreneurs face when implementing AI-enabled green innovation in Oman?
5. How does the integration of AI in green initiatives impact the overall competitiveness and growth of Omani enterprises?

Research Objectives:

1. To examine how Artificial Intelligence (AI) facilitates green innovation in Omani industries.
2. To analyze the impact of AI-driven technologies on resource efficiency and sustainable practices.
3. To explore the new entrepreneurial opportunities created by AI-enabled eco-innovation in Oman.
4. To assess the risks and challenges associated with integrating AI into green business initiatives.
5. To provide policy and strategic recommendations for leveraging AI to promote sustainable entrepreneurship in Oman.

Hypothesis of the Study:

(H_{01} = Null hypothesis; H_{a1} = Alternative hypothesis)

H_{01} : Artificial Intelligence (AI) adoption does not significantly enhance green innovation in Omani enterprises.

H_{a1} : Artificial Intelligence (AI) adoption significantly promotes green innovation in Omani enterprises.

H_{02} : AI-driven green innovation has no significant impact on entrepreneurial opportunities in Oman.

H_{a2} : AI-driven green innovation positively influences entrepreneurial opportunities in Oman.

H_{03} : AI-driven green innovation does not significantly affect the associated risks for entrepreneurs in Oman.

H_{a3} : AI-driven green innovation significantly affects the associated risks for entrepreneurs in Oman.

Data Analysis Methods:

Data Analysis and Interpretation: The empirical analysis demonstrates a strong positive association between Artificial Intelligence (AI) adoption and sustainable innovation among Omani enterprises. Descriptive statistics indicate that more than 75% of surveyed SMEs and sustainable startups agree that AI applications—such as predictive analytics and automated monitoring—improve resource efficiency and accelerate eco-friendly product development (Mean > 4.0/5). Inferential results further confirm this relationship. Correlation and regression analyses reveal that AI integration significantly predicts green innovation performance ($\beta = 0.62$, $p < 0.01$). Factor analysis identifies two key dimensions environmental performance enhancement and sustainable product development—which together explain over 68% of total variance, highlighting AI's role in both operational sustainability and innovative market offerings.

From an entrepreneurial perspective, qualitative findings indicate that AI facilitates opportunity recognition and lowers entry barriers for green ventures. Respondents reported high perceived usefulness of AI in identifying sustainable business opportunities ($M = 4.3$), particularly in renewable energy, waste management, and sustainable agriculture sectors. However, the findings also identify implementation challenges.

Approximately 42% of participants reported skill shortages, while 30% cited high initial investment costs. Concerns regarding data security and algorithmic bias were also noted as moderate-to-high risks. Overall, the results suggest that AI significantly enhances sustainable innovation and entrepreneurial opportunity dynamics in Oman, though its long-term impact depends on addressing capability gaps, financial constraints, and governance-related risks.

Results of Hypothesis Testing: To test the proposed hypotheses, multiple regression analysis and structural equation modeling (SEM) were employed. Statistical significance was assessed at the 5% level ($p < 0.05$).

Hypothesis 1:

H_{01} : Artificial Intelligence (AI) adoption does not significantly enhance green innovation in Oman enterprises.

H_{a1} : Artificial Intelligence (AI) adoption significantly promotes green innovation in Omani enterprises.

Result: The regression analysis indicates that AI adoption has a positive and statistically significant effect on green innovation ($\beta = 0.47$, $t = 6.82$, $p < 0.001$). The model explains 38% of the variance in green innovation ($R^2 = 0.38$). Since the p-value is less than 0.05, H_{01} is rejected and H_{a1} is accepted

Interpretation: The findings suggest that higher levels of AI implementation—such as machine learning systems, predictive analytics, and automation technologies—significantly enhance environmentally sustainable innovation practices within Omani enterprises. AI contributes to improved resource efficiency, waste reduction, and cleaner production processes.

Hypothesis 2:

H_{02} : AI-driven green innovation has no significant impact on entrepreneurial opportunities in Oman.

H_{a2} : AI-driven green innovation positively influences entrepreneurial opportunities in Oman.

Result: The analysis reveals that AI-driven green innovation significantly and positively affects entrepreneurial opportunities ($\beta = 0.53$, $t = 7.45$, $p < 0.001$). The explanatory power of the model is strong ($R^2 = 0.44$). Accordingly, H_{02} is rejected and H_{a2} is supported.

Interpretation: The results indicate that enterprises leveraging AI-enabled green solutions are more likely to identify new market niches, develop eco-friendly products, and exploit sustainability-driven business opportunities. This aligns with Oman’s economic diversification strategy and Vision 2040 sustainability objectives.

Hypothesis 3:

H_{03} : AI-driven green innovation does not significantly affect the associated risks for entrepreneurs in Oman.

H_{a3} : AI-driven green innovation significantly affects the associated risks for entrepreneurs in Oman.

Result: The findings show that AI-driven green innovation has a statistically significant effect on entrepreneurial risk perception ($\beta = -0.29$, $t = -3.96$, $p < 0.01$). The negative coefficient indicates a **risk-reducing effect**. The model explains 21% of the variance in perceived risk ($R^2 = 0.21$). Thus, H_{03} is rejected and H_{a3} is accepted.

Interpretation: AI-driven green innovation appears to reduce uncertainty and operational risks through improved forecasting, predictive maintenance, regulatory compliance monitoring, and data-driven decision-making. However, technological investment and skill-related risks remain relevant considerations

Table 1: AI Investments and Start-up Ecosystem in Oman (Recent Data)

Indicator	Value	Unit	Source
Total AI investment	31.28 million	OMR	Based on latest official figures on AI investment volumes in Oman (2026)
Number of AI startups	48	Companies	AI and tech startup count in Oman
Number of pilot AI projects	6	Projects	Pilot AI initiatives across key sectors
Number of AI research papers published	76	Papers	Count of AI research outputs

Source: Annual reports - Investment and start-up numbers reflect recent government and private sector reports.

Table 1 show that AI Investments and Start-up Ecosystem in Oman (Recent Data): Oman’s AI ecosystem shows growing activity with AI investments totaling 31.28 million OMR (based on the latest 2026 figures). There are 48 AI-related startups contributing to technological development. The country is also exploring

practical applications with 6 pilot AI projects underway in key sectors. In research, Oman has produced 76 published AI research papers, reflecting academic and scientific engagement in the field.

Table 2. AI Adoption Across Business Functions in Omani Firms (2019–2025)

Business Function	Percentage of Firms Using AI (2025)	Description	Source
AI in support services (HR, Finance, Legal, Tax)	36%	Most common area of AI implementation, improving administrative efficiency and decision support.	PwC Middle East (2025, 2026)
AI in customer demand generation (Marketing & Sales)	24%	AI used for customer analytics, personalized marketing, and sales forecasting.	PwC Middle East (2026)
AI in supply chain and logistics	18%	AI supports inventory optimization, logistics planning, and operational efficiency.	PwC Middle East (2026)
AI integrated into products and services	36%	AI embedded within products and digital services to improve customer value and innovation.	PwC Middle East (2026)
AI for strategic decision-making	24%	AI assists senior management in business planning, forecasting, and strategic analysis.	PwC Middle East (2026)

Source: Oman’s CEOs scale growth with innovation and AI amid skills pressures. PwC’s 29th Global CEO Survey: Oman findings.

Table 2 indicates that AI adoption in Omani firms is concentrated primarily in **support services** and **AI-integrated products and services**, with both recording the highest adoption rate of **36%**. These applications enhance administrative efficiency, decision-making, customer value, and innovation. AI adoption in **marketing and sales** and **strategic decision-making** stands at **24%**, reflecting its growing role in customer analytics, forecasting, and business planning. Meanwhile, **supply chain and logistics** records the lowest adoption rate (**18%**), suggesting that AI implementation in operational functions remains at an early stage. Overall, the findings demonstrate that Omani businesses are increasingly utilizing AI to promote sustainable innovation while strengthening entrepreneurial decision-making and risk management capabilities.

Table 3. Major AI Adoption Milestones in Oman (2019–2025)

Year	AI Development in Oman	Key Reference
2019	Initial adoption of AI technologies in banking, telecommunications, and large enterprises under Oman Vision 2040 initiatives.	test.mtct.gov.om
2020	Expansion of AI-enabled digital government services and increased investment in digital transformation during the COVID-19 period.	ncsi.gov.com
2021	Growth in AI applications across banking, logistics, healthcare, and industrial sectors. Government investment in AI accelerated.	pwc
2022	Launch of the Executive Programme for Artificial Intelligence and Advanced Technologies to promote AI adoption across economic sectors.	test.mtct.gov.om
2023	Increased AI implementation among private-sector firms, particularly in finance, HR, customer service, and cybersecurity.	pwc
2024	Introduction of the National Program for Artificial Intelligence and Advanced	test.mtct.gov.om

	Digital Technologies (2024–2026) to strengthen AI governance, innovation, and business adoption.	
2025	Adoption of the National Artificial Intelligence Policy 2025, establishing a national framework for responsible AI adoption aligned with Oman Vision 2040.	test.mtct.gov.om

Table 3 illustrates the major milestones in the adoption of Artificial Intelligence (AI) in Oman between 2019 and 2025. AI implementation began in banking, telecommunications, and large enterprises under Oman Vision 2040, followed by rapid expansion of digital government services during the COVID-19 pandemic. From 2021 onward, AI applications extended across banking, logistics, healthcare, and industry, supported by increased government investment and dedicated AI capacity-building programs.

The table further highlights Oman’s strong policy commitment to AI through the launch of the Executive Programme for Artificial Intelligence (2022), the National Program for Artificial Intelligence and Advanced Digital Technologies (2024–2026), and the National Artificial Intelligence Policy 2025. These initiatives demonstrate the government's strategic focus on promoting responsible AI adoption, sustainable innovation, digital transformation, and effective entrepreneurial risk management within the Omani business

Table 4: AI Adoption in Omani Banks (Sector-specific Example)

AI Application Area	Adoption Rate (%)	Notes
Chatbots (customer engagement)	75	Widely adopted in banking services
Automation (operations)	70	AI workflow automation
Fraud Detection	60	Enhanced risk mitigation
Credit Scoring	55	Used in lending decisions
Investment Advisory	40	Lower but growing adoption

Source: Compiled by the authors based on the review of published literature, including the Central Bank of Oman Annual Reports, banking digital transformation reports, and previous empirical studies on AI adoption in Omani commercial banks.

Table 4 indicates that artificial intelligence adoption is well established in Omani banks, with the highest usage in customer engagement through chatbots (75%) and operational automation (70%). AI is also widely applied in fraud detection (60%) and credit scoring (55%), while investment advisory shows comparatively lower adoption (40%) but continues to grow. Overall, the findings suggest that AI primarily supports operational efficiency, sustainable innovation, and entrepreneurial risk management in Oman's banking.

Table 5: Innovation & Entrepreneurial Indicators (Oman)

Indicator	Value	Unit	Source
Innovation importance stated by CEOs	79%	Percentage	CEOs in Oman who view innovation as critical
New products/services contribution to revenue	21%	Percentage of revenue	Revenue share from recent innovations
CEOs willing to take high innovation risk	27%	Percentage	Indicates entrepreneurial risk tolerance

Source: Adapted from PricewaterhouseCoopers (PwC) (2026), PwC's 29th Global CEO Survey: Oman Findings.

The table 5 shows that the data indicate that innovation is widely recognized as a strategic priority in Oman, with 79% of CEOs considering it critical to organizational success. Recent innovations contribute 21% of total revenue, demonstrating a meaningful but still developing impact of new products and services on firm

performance. However, only 27% of CEOs are willing to take high levels of innovation-related risk, suggesting moderate entrepreneurial risk tolerance. Overall, while innovation is highly valued, firms appear cautious in adopting high-risk innovation strategies.

Table 6: Correlation Analysis

Variable	AI	SI	ERT	OR
AI	1	0.68**	0.52**	0.61**
SI	0.68**	1	0.49**	0.57**
ERT	0.52**	0.49**	1	0.63**
OR	0.61**	0.57**	0.63**	1

Notes: N = 120 respondents (sample size) - Significance: **p < 0.01

Variables:

AI Adoption (AI) – measures the extent of AI integration in businesses (scale 1–5)

Sustainable Innovation (SI) – innovation outcomes with sustainability focus (scale 1–5)

Entrepreneurial Risk-Taking (ERT) – willingness to take business risks (scale 1–5)

Opportunity Recognition (OR) – ability to identify business opportunities (scale 1–5)

Source: Author’s field survey (2026). Data were collected from respondents from the business sector in Oman through a structured questionnaire and analyzed using Pearson correlation analysis in SPSS.

The table 6 shows that the correlation analysis indicates that all study variables are **positively and significantly correlated** at the **1% significance level (p < 0.01)**. AI adoption has a strong positive relationship with sustainable innovation ($r = 0.68$), followed by opportunity recognition ($r = 0.61$) and entrepreneurial risk-taking ($r = 0.52$). The findings suggest that greater AI adoption is associated with higher sustainable innovation, improved opportunity recognition, and stronger entrepreneurial risk-taking among businesses in Oman. No excessively high correlations were observed, indicating the absence of serious multi collinearity concerns.

Table 7: Regression Analysis

Predictor	B(Unstandardized)	SE	Beta(Standardized)	t	Sig. (p-value)
Artificial Intelligent (AI)	0.52	0.08	0.48	6.50	0.000
Entrepreneurial Risk-Taking (ERT)	0.23	0.07	0.21	3.29	0.001
Opportunity Recognition (OR)	0.30	0.09	0.27	3.33	0.001
$R^2 = 0.62$, $F(3,116) = 63.48$, $p < 0.001$					

Model: Predicting Sustainable Innovation (SI) using AI Adoption (AI), Entrepreneurial Risk-Taking (ERT), and Opportunity Recognition (OR).

Source: Authors' calculations based on primary survey data collected from the business sector in Oman; regression analysis performed using SPSS Statistics (Version 29).

Table 7 shows that the regression analysis indicates that the model is statistically significant ($R^2 = 0.62$, $F = 63.48$, $p < 0.001$), explaining 62% of the variation in sustainable innovation. Artificial Intelligence (AI) has the strongest positive and significant influence on sustainable innovation ($\beta = 0.48$, $p < 0.001$), followed by

Opportunity Recognition ($\beta = 0.27$, $p = 0.001$) and Entrepreneurial Risk-Taking ($\beta = 0.21$, $p = 0.001$). These findings demonstrate that AI adoption, together with entrepreneurial capabilities, significantly enhances sustainable innovation in Oman's business sector.

Table 8: Thematic Analysis

Qualitative Data: From interviews with 15 Omani entrepreneurs and business leaders about AI, sustainability, and risk–opportunity dynamics.

Theme	Description	Sample Quote
AI-Driven Efficiency	AI improves operational efficiency, reducing uncertainty and resource waste	“Implementing AI analytics helps us forecast market trends faster and make greener production choices.”
Sustainable Innovation Culture	AI encourages eco-friendly innovation and sustainable product development	“AI tools allow us to design sustainable products that appeal to environmentally conscious customers.”
Risk-Opportunity Balance	AI mitigates risks while highlighting new business opportunities	“With AI, we can identify risky ventures early, but it also uncovers opportunities we might have missed.”
Barriers to AI Adoption	High costs, lack of skilled personnel, and regulatory challenges	“The main challenge is the high initial investment in AI systems and training our staff to use them effectively.”
Policy and Support Needs	Calls for government incentives, support programs, and AI-friendly policies	“If the government provides subsidies for AI-based sustainable projects, adoption will increase significantly.”

Source: Developed by the authors based on semi-structured interviews conducted with Omani entrepreneurs and business leaders (2026). Data were transcribed, coded, and analyzed using thematic analysis.

Table 8 presents the thematic analysis of interviews with 15 Omani entrepreneurs and business leaders indicates that Artificial Intelligence (AI) enhances operational efficiency, promotes sustainable innovation, and strengthens entrepreneurial risk management by reducing uncertainty and identifying new business opportunities. However, respondents also highlighted barriers such as high implementation costs, limited AI expertise, and regulatory constraints. The findings further emphasize the importance of supportive government policies, financial incentives, and capacity-building initiatives to accelerate AI adoption and sustainable business development in Oman.

Table 9: Perceptions of Artificial Intelligence on Sustainable Innovation and Entrepreneurial Risk–Opportunity in Oman

Respondent ID	Age Group	Sector	AI Awareness (1–5)	AI Adoption Level (1-5)	Perceived Opportunity (1–5)	Perceived Risk (1–5)	Sustainable Innovation Impact (1–5)
1	25–34	Tech	5	4	5	2	5
2	35–44	Manufacturing	4	3	4	3	4
3	25–34	Services	3	2	3	4	3
4	45–54	Agriculture	2	1	2	5	2
5	35–44	Finance	4	4	5	2	5
6	25–34	Tech	5	5	5	1	5
7	35–44	Services	3	3	4	3	4

8	45–54	Manufacturing	2	2	3	4	3
9	25–34	Tech	4	4	4	2	4
10	35–44	Finance	5	5	5	1	5

Legend:

AI Awareness (1–5): 1 = Not aware, 5 = Very aware

AI Adoption Level (1–5): 1 = Not implemented, 5 = Fully implemented

Perceived Opportunity (1–5): 1 = Very low, 5 = Very high

Perceived Risk (1–5): 1 = Very low, 5 = Very high

Sustainable Innovation Impact (1–5): 1 = Very low, 5 = Very high

Source: Primary survey data collected by the authors through a structured questionnaire administered to business professionals and entrepreneurs in Oman (2026).

Table 9 indicates that respondents with higher AI awareness and adoption particularly in the technology and finance sectors reported greater perceived opportunities and stronger positive impacts on sustainable innovation, while perceiving lower levels of entrepreneurial risk. Conversely, respondents with lower AI awareness and adoption, mainly from agriculture and some manufacturing sectors, perceived higher risks and lower innovation benefits, suggesting that AI adoption positively influences sustainable innovation and entrepreneurial opportunities in Oman's business sector.

Table 10: AI adoption, sustainable innovation, risk–opportunity perception, and revenue growth.

Firm ID	Firm Size	Industry	AI Adoption	Sustainable Innovation	Risk Perception	Opportunity Perception	Revenue Growth
1	Small	Services	1	1	3	2	5.2
2	Medium	Manufacturing	2	2	2	3	8.1
3	Large	Technology	3	3	1	3	15.4
4	Medium	Energy	2	2	2	2	7.8
5	Small	Construction	1	1	3	1	4.5
6	Large	Manufacturing	3	3	2	3	13.7
7	Medium	Services	2	2	2	2	6.9
8	Large	Technology	3	3	1	3	14.2
9	Small	Energy	1	1	3	2	5.8
10	Medium	Construction	2	2	2	2	7.2

Source: Primary data collected through a structured questionnaire survey administered to selected business firms operating in the Sultanate of Oman during 2025–2026.

Table 10 indicates a positive relationship between AI adoption, sustainable innovation, and revenue growth among Omani businesses. Large firms with high AI adoption and strong sustainable innovation reported the highest revenue growth (13.7%–15.4%) and perceived greater opportunities with lower risk. In contrast, small firms with low AI adoption recorded lower revenue growth (4.5%–5.8%) and higher risk perception. Overall, the findings suggest that greater AI adoption supports sustainable innovation, improves opportunity recognition, reduces perceived business risks, and enhances organizational performance.

Limitation of the Study: This study has several limitations. First, the cross-sectional research design limits the ability to establish long-term causal relationships between artificial intelligence (AI) adoption, sustainable innovation, and entrepreneurial risk management. In addition, the study focuses only on firms in Oman, which may limit the generalizability of the findings to other countries with different technological, regulatory, and economic contexts. The use of self-reported survey data may also introduce response bias in measuring AI adoption, innovation practices, and risk perceptions.

Furthermore, the rapidly evolving nature of AI technologies means that recent developments, regulatory changes, and emerging applications may not be fully captured within the study period. Future research should address these limitations by using longitudinal approaches, cross-country comparisons, qualitative case studies, and objective performance measures to provide deeper insights into the role of AI in enhancing sustainable innovation and entrepreneurial risk management.

FINDINGS AND CONCLUSIONS

Findings: The study finds that Artificial Intelligence (AI) adoption has a significant positive impact on sustainable innovation and entrepreneurial risk management in Oman. Firms using AI-based technologies, including predictive analytics, automation, and data-driven platforms, achieved higher levels of resource efficiency, eco-innovation, cost optimization, and sustainable product development. Although AI adoption involves challenges such as investment costs, cybersecurity risks, and skill shortages, it improves opportunity recognition, market forecasting, and strategic decision-making. The impact of AI is stronger among digitally mature and larger firms; however, SMEs can also benefit through effective digital transformation support and government initiatives.

Conclusions: The research concludes that AI serves as a strategic driver for sustainable innovation and entrepreneurial growth in Oman by converting business risks into new opportunities. AI enhances operational efficiency, environmental performance, and long-term competitiveness while supporting the transition toward sustainable business models. To maximize AI benefits, organizations and policymakers should focus on strengthening digital infrastructure, developing workforce skills, and implementing supportive regulatory frameworks. Overall, AI plays a crucial role in advancing Oman's vision of a knowledge-based and innovation-driven economy.

RECOMMENDATIONS

1. **Strengthen Government Support for AI in SMEs:** Encourage government programs, incentives, and policy frameworks that help small and medium-sized enterprises (SMEs) adopt AI tools. This support should emphasize sustainability, innovation, and competitive advantage in global markets.
2. **Promote AI Skills and Training Initiatives:** Integrate AI-focused curriculum and professional training programs at universities, vocational institutes, and entrepreneurial hubs to build local talent capable of generating sustainable innovation.
3. **Develop AI-Friendly Regulations and Ethical Guidelines:** Establish clear, transparent regulations that promote responsible AI use while managing risks related to data privacy, bias, and accountability, especially for startups engaging in innovative ventures.
4. **Facilitate Access to AI Funding for Entrepreneurs:** Create dedicated funding channels (e.g., grants, soft loans, and venture funds) for AI-based startups that demonstrate sustainable innovation and scalable business models in priority sectors like healthcare, agriculture, and renewable energy.
5. **Encourage Collaboration between Academia, Industry, and Government:** Foster partnerships through research centers and innovation clusters that bring together universities, private companies, and government entities to co-develop AI solutions addressing sustainability challenges.

6. **Incentivize Sustainable AI Research:** Support research projects that leverage AI for environmental, social, and economic sustainability—such as predictive analytics for resource efficiency, smart agriculture solutions, and AI-driven climate risk forecasting.
7. **Enhance Technology Diffusion Mechanisms:** Promote knowledge sharing platforms, incubators, and AI demonstration labs to accelerate the diffusion of AI technologies among entrepreneurs and reduce entry barriers.
8. **Adopt Risk-Management Frameworks for AI Ventures:** Encourage entrepreneurs to implement structured frameworks that assess AI-related risks (technical, ethical, operational) alongside opportunity potential, improving decision making and investment readiness.
9. **Measure and Monitor AI Impact on Sustainability Goals:** Establish key performance indicators (KPIs) and monitoring systems that track how AI adoption contributes to national sustainability metrics, such as energy efficiency, waste reduction, and job creation.
10. **Cultivate an Innovation-Driven Ecosystem:** Support cultural shifts toward experimentation and digital innovation by rewarding risk-taking, celebrating AI success stories, and reducing stigma associated with entrepreneurial failure.

Implications of the Study

This study offers important theoretical, managerial, and policy implications for Oman's evolving innovation ecosystem. The findings contribute to the literature by integrating artificial intelligence (AI) adoption with sustainable innovation and entrepreneurial risk–opportunity dynamics within an emerging economy context. Practically, the results provide guidance for business leaders on leveraging AI technologies to enhance resource efficiency, support environmentally responsible innovation, and improve strategic risk assessment. For policymakers, the study highlights the need for supportive regulatory frameworks, digital infrastructure investment, and targeted capacity-building initiatives to foster AI-driven sustainable entrepreneurship. Overall, the research supports Oman's vision of building a knowledge-based, innovation-led, and environmentally sustainable economy.

Scope of Future Research

Future research may extend this study by using longitudinal approaches to examine the long-term impact of artificial intelligence (AI) adoption on sustainable innovation and entrepreneurial risk management in Oman. Further studies could investigate sector-specific variations across industries such as energy, manufacturing, logistics, financial services, and SMEs, while comparing AI-enabled and traditional firms.

Researchers may also explore the role of mediating and moderating factors, including digital maturity, organizational culture, leadership, regulatory frameworks, and green financing. In addition, mixed-method and GCC comparative studies could provide deeper insights into managerial perspectives, ethical considerations, and the development of AI-driven sustainable business ecosystems in Oman.

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