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About the Journal

Overview

The *UrNammu Journal of Business, Accounting and Technology Management (UJBATM)* is a peer-reviewed, open-access, and academic journal, established in 2025 by the UrNammu Academy, and dedicated to advancing knowledge in the fields of business, accounting, and technology management. It serves as a platform for researchers, practitioners, and academics to disseminate original research, case studies, and reviews that contribute to the understanding and development of these disciplines. The journal emphasises interdisciplinary approaches and encourages submissions that explore the intersection of all business practices and technological innovations.

The UJBATM is a biannual journal, has (ISSN: 3105-8558) and (DOI: Applying for DOI), and publishing two issues per year at six-month intervals. The UJBATM is publishing under Creative Commons Attribution 4.0 International (CC-BY) license, and using Turnitin to prevent plagiarism and ensure our submitted manuscripts' originality. A double-blind peer-reviewing system uses to assure the publication's quality in The UJBATM. This journal index into well-known world databases such as Google Scholar. The UJBATM a vision for indexing within DOAJ and Scopus databases in the future. The UJBATM charges a publication fee of 100 USD for each accepted manuscript. The journal does not receive financial support from any governmental or non-governmental organization.

Aims and Scope

The UrNammu Journal of Business, Accounting and Technology Management (UJBATM) acknowledges the evolving landscape in which contemporary organisations, both public and private, must navigate. Recognising the increasing integration of business strategies, accounting practices, and technological advancements, the journal seeks to provide a scholarly platform dedicated to exploring how these interlinked areas can enhance organisational effectiveness and competitive advantage.

The UJBATM offers a robust mix of carefully curated themed issues, empirically sound research articles, timely theoretical insights, and practical overviews that can be directly implemented in professional settings. The journal particularly emphasises interdisciplinary studies that bridge gaps in the fields of business, accounting, and technology management, thereby ensuring comprehensive and up-to-date coverage of emerging trends and practices within these essential fields.

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This policy aligns with UJBATM's mission to promote inclusive, accessible, and high-quality academic research in business, accounting, and technology management.

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Introduction

It is with great pride and excitement that I present to you the inaugural issue of the UrNammu Journal of Business, Accounting and Technology Management (UJBATM). This milestone marks the beginning of a scholarly journey dedicated to promoting high-quality, peer-reviewed research at the intersection of business innovation, financial accountability, and technological advancement.

The launch of UJBATM comes at a critical time when emerging economies are navigating increasingly complex challenges—from digital transformation and sustainable development to resilient business models and ethical leadership. Our journal seeks to provide a platform for researchers, scholars, practitioners, and policymakers to engage in rigorous academic dialogue that bridges theory and practice.

This first issue exemplifies our commitment to scholarly excellence and interdisciplinary inquiry. It features empirical studies on critical topics such as green employee behaviour in healthcare systems and the role of artificial intelligence and knowledge management in driving green innovation within the oil industry. These articles reflect our journal's focus on practical relevance, methodological soundness, and global applicability.

We are especially proud to provide an inclusive, open-access publishing environment supported by ethical standards, transparent review processes, and a strong editorial board comprising experts from diverse academic backgrounds. With each forthcoming issue, we aim to expand our reach and impact by engaging with contemporary debates and contributing to policy-relevant knowledge across business and technology domains.

I would like to extend my sincere gratitude to the authors, reviewers, and editorial team for their dedication and collaboration in bringing this first issue to life. I warmly invite scholars and professionals to contribute to our upcoming editions and join us in shaping the future of impactful research.

Welcome to UJBATM — where knowledge meets innovation.

Prof. Amir A. Abdulmuhsin
Editor-in-Chief
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Impact of Knowledge Application on Green Employee Behaviour: A Healthcare Developing Countries Perspective

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Abstract

The healthcare sector faces increasing pressure to balance service delivery with environmental sustainability, particularly in developing countries where institutional constraints challenge traditional pathways to green transformation. This study investigates the role of knowledge application (Ka) in shaping green employee behaviours across four dimensions: green learning (GL), green voice (GV), individual practice (IP), and influence on others (IO). Drawing on the knowledge-based view of the firm and organisational learning theory, the research conceptualises Ka as a behavioural catalyst that transforms cognitive resources into sustainability-oriented actions. A longitudinal, two-wave survey design was employed involving 1,663 employees from private hospitals in Baghdad, Iraq. Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that Ka exerts a significant and positive effect on all four dimensions of green behaviour, with the strongest impact observed on IP. These results underscore the strategic value of applied knowledge not only in promoting efficiency or innovation but also in cultivating an environmentally conscious workforce. The study advances theoretical discourse by positioning Ka as a central mechanism in organisational sustainability. It also contributes to the growing body of empirical evidence from under-researched contexts, offering practical insights for healthcare leaders, sustainability managers, and policy-makers. Integrating Ka into training, leadership, and performance systems may serve as a low-cost yet high-impact strategy for embedding green behaviour across healthcare institutions.

DOI: ,

1. Introduction

Environmental degradation, climate change, and unsustainable resource consumption have emerged as defining challenges of the 21st century, prompting a critical shift in how organisations, particularly in high-impact sectors such as healthcare, approach their operational, ethical, and strategic responsibilities (Alsharari et al., 2024). Healthcare institutions - by virtue of their intensive energy use, material consumption, and waste generation - bear a significant environmental footprint (Downey, 2023). At the same time, they hold a moral obligation to protect public health not only through clinical services but also through environmental stewardship (Richie, 2024). This paradoxical role underscores the urgent need for more sustainable organisational practices at both institutional and individual levels (Collins & Demorest, 2022).

In response, scholars and practitioners, such as Ones et al. (2012), Davis and Challenger (2015), and Norton et al. (2015) have begun advocating for the integration of sustainability into employee behaviour - commonly conceptualised as green employee behaviour - which includes proactive learning, advocacy, personal action, and influence geared toward environmental responsibility within the workplace (Katz et al., 2022; Zacher et al., 2023). These behaviours are vital to organisational sustainability, yet they are often voluntary, informal, and situated within complex socio-cognitive and institutional dynamics (Robertson & Barling, 2012). Among the organisational antecedents of such behaviours, knowledge management (KM) - specifically knowledge application (Ka) - has been proposed as a potentially powerful enabler (Amir A. Abdulmuhsin, Abeer F. Alkhwaldi, et al., 2025), yet remains underexplored in empirical research.

Although prior studies have established the importance of knowledge sharing and knowledge creation in fostering environmental innovation and green HR practices (Abdul Rahim et al., 2023; Harakan et al., 2021; Jabbour & de Sousa Jabbour, 2016), few have investigated how the *application* of knowledge - where tacit and explicit knowledge are translated into action - shapes the day-to-day green behaviours of employees. Most extant work on Ka has focused on performance and innovation outcomes (e.g., ; Cong (2023); López-Torres et al. (2019); and Krara et al. (2025)), with minimal attention paid to its role in cultivating sustainable mindsets and behaviours among individuals in operational contexts. Moreover, the intersection of Ka and green behaviour remains particularly neglected in high-stakes service environments such as healthcare, where sustainability is not merely an ethical ideal but a clinical necessity (Gilcrease et al., 2024; Huss et al., 2020; Pinzone et al., 2012; Topcu & Kiraz, 2025).

Additionally, much of the current literature has been developed in Western or high-income contexts (Kim et al., 2014; Zhang & Chabay, 2020), leaving a significant gap in understanding how these dynamics unfold in developing countries where institutional pressures, resource constraints, and sustainability awareness differ considerably. In countries such as Iraq - where the healthcare system faces chronic challenges linked to infrastructure, policy, and education - there is a pressing need to investigate how internal capabilities, such as knowledge utilisation, can drive low-cost, high-impact sustainability improvements at the employee level (Al Issa et al., 2022; Ibrahim et al., 2023).

This study therefore targets scholars of organisational behaviour, sustainability, and knowledge management, as well as healthcare leaders and policy-makers striving to operationalise sustainability in constrained environments. For this audience, understanding the mechanisms that drive green employee behaviour is not only academically valuable but strategically critical for meeting sustainable development goals (SDGs), improving institutional legitimacy, and enhancing public trust.

The purpose of this study is to examine the direct influence of Ka on green employee behaviours in the healthcare sector, with a focus on four key dimensions: green learning (GL), green voice (GV), individual practice (IP), and influence on others (IO). Drawing on theoretical perspectives from the knowledge-based view (KBV) of the firm and organisational learning theory, this research investigates how applied knowledge can activate and sustain pro-environmental conduct among healthcare professionals. By employing a two-wave survey of healthcare staff in Iraq, this study aims to provide empirical insights into an under-theorised mechanism with both local relevance and global implications. This paper is organised in seven main sections, introduction, theoretical background and hypothesis development, methodology, results, discussion, implications and future works.

2. Theoretical Background and Hypothesis Development

2.1 Green Employee Behaviour: Concept, Importance, and Application in Healthcare

In recent decades, the world has witnessed escalating environmental degradation driven by human activity, contributing to climate change, resource depletion, and the loss of biodiversity (Zacher et al., 2023). In response to these challenges, governments and organisations have adopted various initiatives aimed at achieving sustainable development (Yuan et al., 2023). Among these, the concept of *green employee behaviour* has emerged as a key strategy for fostering environmental alignment within workplace settings (Chaudhary, 2019).

Green employee behaviour refers to actions undertaken by individuals in the workplace - either as part of formal job responsibilities or stemming from personal initiative - that aim to reduce environmental impact and promote sustainability (Ones et al., 2012; Ones et al., 2018). These behaviours can range from simple acts such as switching off unused equipment and conserving paper to active participation in recycling programmes (Ashraf et al., 2023; Safari et al., 2018). While definitions of green employee behaviour vary across the literature, there is a shared emphasis on its role in supporting both organisational performance and broader environmental outcomes. Some scholars conceptualise it as a form of voluntary (B. Zhang et al., 2021), environmentally responsible conduct (Wu et al., 2024); others highlight its measurable dimensions within the workplace (Bodhi et al., 2024; Zhang, 2024), or frame it as a core element of an organisation's sustainability culture (Cheng et al., 2022; Ozkan et al., 2024). Consequently, green employee behaviour is commonly categorised into two forms: (Ones et al., 2018)

- *Mandatory green behaviour*: Environmentally responsible actions required by the organisation as part of an employee's formal duties - such as prudent energy usage or adherence to waste reduction protocols (Chaudhary, 2019; Telli Danışmaz, 2023).
- *Voluntary green behaviour*: Environmentally conscious practices initiated by employees independently, such as proposing green innovations or promoting sustainable practices, absent any formal organisational obligation (Khalid et al., 2022; Zhang, 2024).

The healthcare sector is among the most environmentally impactful industries, due to its high energy consumption and substantial waste generation (Mandal & Pal, 2024). At the same time, healthcare professionals bear a profound responsibility, as their roles are intimately linked to both human and environmental health (Aslan & Yıldız, 2019; Ozkan et al., 2024). Thus, the integration of green employee behaviour in healthcare settings is of particular significance. Sustainable practices in this sector may include reducing medical waste, adopting electronic health records, optimising energy consumption, and utilising telemedicine to minimise the carbon footprint (El-Sayed et al., 2024; Pacis et al., 2018). Healthcare workers - including physicians, nurses, and technicians - often serve as role models within society (Ozkan et al., 2024). Their commitment to green practices can exert a positive influence on patients and the wider public, thereby fostering a culture of environmental responsibility (Lee & Lee, 2022). The importance of green employee behaviour can be delineated across four levels:

- *Environmental*: It mitigates pollution and emissions, and promotes the responsible use of natural resources (Kerse, 2024; Wang et al., 2024).
- *Organisational*: It enhances institutional performance, reduces operational costs, drives innovation, and strengthens competitive advantage (Mirahsani et al., 2023; B. Zhang et al., 2021).
- *Personal*: It improves employee satisfaction, supports psychological and professional wellbeing, and boosts intrinsic motivation and self-worth (Mi et al., 2020; Mirahsani et al., 2023).
- *Social*: It raises environmental awareness across communities and cultivates a broader culture of sustainability (Al Doghan & Zakariya, 2022).

In healthcare, the salience of green behaviour is amplified by the sector's environmental sensitivity and its impact on public health (Pan et al., 2022). Here, the adoption of such behaviours is not merely a strategic choice but an ethical imperative. Existing studies such as Francoeur et al. (2019), Fadel et al. (2021), Moustafa Saleh et al. (2024), B. Zhang et al. (2021), and Zhang et al. (2024) often rely on four key dimensions to assess green employee behaviour in healthcare institutions:

- *GL*: Refers to employees' acquisition of environmental knowledge and skills that enable them to make informed decisions contributing to sustainability (Alhemimah et al., 2024). This includes two subtypes: *explorative learning*, which involves generating innovative solutions, and *exploitative learning*, which optimises existing practices (Cui et al., 2022).
- *GV*: Encompasses employees' expression of environmentally oriented suggestions and opinions aimed at enhancing the organisation's environmental performance (Nourafkan et al., 2023; Tabrizi et al., 2023). This dimension plays a vital role in catalysing change and promoting more effective sustainable practices (Hosseini & Sabokro, 2022).
- *IP*: Involves self-initiated environmentally responsible actions, such as minimising electricity use or conserving materials (Mi et al., 2020; Taris & Wielenga-Meijer, 2010). While these behaviours may not be formally mandated, they nonetheless contribute meaningfully to environmental improvement (Zhang et al., 2024).
- *IO*: Reflects an employee's ability to positively affect colleagues through role-modelling or advice (Bourgeois et al., 2009; Pandey, 2022), thereby cultivating a workplace culture that supports green behaviour (Zhang et al., 2024).

Green employee behaviour constitutes a foundational pillar in organisational responses to environmental challenges and the pursuit of sustainable development goals. Its relevance is particularly pronounced in healthcare, where institutions must strike a delicate balance between delivering high-quality care and protecting the environment. Emphasising the four dimensions - learning, voice, individual practice, and influence - offers a holistic framework for fostering a green organisational culture that advances performance, safeguards the environment, and serves the broader community.

2.2 Knowledge Application: Concept and Importance

Ka constitutes a critical phase within the knowledge management cycle, as knowledge only becomes truly valuable when it is practically employed (Igbinovia & Ikenwe, 2018). Whether acquired or shared, knowledge fails to yield tangible impact unless it is utilised to address real-world challenges or enhance organisational performance (Al-Emran et al., 2018; Alharbi & Aloud, 2024). In this context, Ka refers to the process of transforming knowledge from its *explicit* form—documented and codified—into *tacit* knowledge, embedded in individual behaviour or collective practice, through learning, experience, and action (Shujahat et al., 2019).

Ka is commonly defined as the effective utilisation of information and expertise within an organisation to support operations and inform decision-making, ultimately leading to improved products and services (Mahdi et al., 2019). This phase is indispensable for achieving competitive advantage and producing measurable outcomes, such as heightened efficiency, error reduction, and innovation in both products and organisational policies (Georgakellos et al., 2024). The strategic value of Ka lies in its capacity to:

- Improve the quality of decision-making by aligning knowledge with practical, real-time workplace contexts (Zhang et al., 2022).
- Stimulate innovation by leveraging prior knowledge to generate new ideas and creative solutions (Kiflie & Lo, 2024).
- Enhance competitiveness through greater agility in responding to change and reducing inefficiencies (Georgakellos et al., 2024).
- Drive the development of products and services, thereby enriching the customer or beneficiary experience (Nakash & Bolisani, 2024).
- Strengthen overall organisational performance by supporting the execution of daily operational processes (Abbas, 2020).

However, the process of applying knowledge is not without obstacles. It is often hindered by weak knowledge-sharing cultures, low levels of trust, inadequate technological infrastructure, or insufficient managerial support (Almansoori et al., 2021). These barriers underscore the importance of cultivating a supportive institutional environment to facilitate successful Ka. In healthcare organisations, Ka is particularly vital due to the complexity and sensitivity of the medical environment. Its importance can be observed across several dimensions:

- *Improved Quality of Care*: The application of clinical knowledge allows for more effective and safer treatment, ensuring better outcomes for patients (Ayatollahi & Zeraatkar, 2020).
- *Operational Efficiency*: Leveraging knowledge can reduce operational costs and minimise redundancies or procedural errors (Gesser da Costa et al., 2023).
- *Innovation in Service Delivery*: Knowledge sharing and application among healthcare professionals foster the development of advanced health services (Ayatulloh et al., 2021).
- *Health Promotion and Disease Prevention*: Applied knowledge underpins public health initiatives, such as screening programmes and health education campaigns aimed at reducing the incidence and impact of chronic diseases (Ayatollahi & Zeraatkar, 2020).

- *Empowerment of Healthcare Workers*: Ka enhances staff competence, equipping them with the skills to interpret data and apply evidence-based practices effectively (Kurniawan et al., 2019).

Healthcare institutions that systematically apply knowledge are better positioned to improve patient outcomes, boost satisfaction levels, and achieve superior organisational performance. Moreover, such institutions play a pivotal role in shaping broader public health policy and promoting sustainable development at the societal level.

2.3 Knowledge Application and Green Learning

Ka serves as a primary driver of GL, as it translates theoretical understanding into practical experience. Through engagement in hands-on activities, employees deepen their comprehension, acquire new competencies, and contribute meaningfully to their organisation's sustainability objectives. In the healthcare sector, fostering Ka not only facilitates the assimilation of green initiatives but also ensures their effective implementation. Furthermore, the repeated use of acquired knowledge in decision-making processes can yield measurable environmental improvements (B. Zhang et al., 2021). A shift towards GL reflects an institutional commitment to leveraging environmental knowledge for organisational development (Wang et al., 2020). Ka involves the internalisation and integration of acquired knowledge into the design and delivery of final outputs, thereby enhancing processes and overall performance (Shahzad et al., 2021). Within healthcare institutions, the application of sustainability-related knowledge is recognised as a critical tool enabling professionals to absorb and operationalise environmental insights, which, in turn, positively influences learning outcomes and advances sustainability goals (Nguyen et al., 2024).

This process encompasses several core elements, including organisational commitment, experiential learning, the use of applied expertise, information-driven approaches, and environmentally responsible dedication (Widyanti et al., 2023). Collectively, these elements empower healthcare organisations to refine their operations by introducing environmentally friendly practices and technologies that also support operational efficiency. By aligning with stakeholder interests, dynamic organisations integrate both existing and emergent knowledge into research and development activities, enabling them to deliver high-quality services while conserving vital resources (Sushruta Mishra, 2022). GL, as a construct, is centred on the acquisition and application of environmental knowledge and is widely regarded as a foundational capability that supports the development of environmental decision-support systems and the cultivation of sustainable innovation behaviour. Organisational GL ultimately aims to improve the quality of environmental knowledge transfer and experience-sharing across the organisation (Wang et al., 2022). Based on the foregoing discussion, we propose the following hypothesis:

H1: Knowledge application has a direct positive effect on green learning.

2.4 Knowledge Application and Green Employee Voice

The application of environmental knowledge within healthcare - particularly regarding green practices and sustainability initiatives - plays a pivotal role in fostering green employee behaviour, and more specifically, in empowering *green employee voice*. This concept refers to the active use of accumulated environmental knowledge by individuals to support sustainable decision-making and operational practices within healthcare institutions. By applying such knowledge, healthcare professionals can overcome psychological barriers - such as misinformation, fear, or lack of awareness - that often impede meaningful environmental engagement. While knowledge alone may not guarantee environmentally responsible behaviour, its absence or distortion frequently leads to unsustainable decisions (Fawehinmi et al., 2020; Harakan et al., 2021). Effective Ka activates employees' positive environmental cognition, encouraging them to embrace innovative, well-informed solutions to ecological challenges. This empowerment strengthens employees' confidence in articulating their environmental ideas and initiatives, thereby motivating them to actively contribute to the improvement of institutional environmental performance. As a result, Ka fosters an organisational culture grounded in openness and constructive dialogue, in which green employee voice becomes a genuine force for advancing institutional sustainability goals (B. Zhang et al., 2021). Moreover, the application of environmental knowledge within healthcare settings can initiate a self-reinforcing cycle. When employees participate in sustainability efforts, their sense of responsibility and organisational belonging tends to deepen. This heightened sense of affiliation, in turn, enhances their motivation to express their views and propose green initiatives, thereby amplifying the effectiveness of their contributions to the institution's environmental objectives (Widiantari et al., 2024). Based on the above discussion, we propose the following hypothesis:

H2: Knowledge application has a direct positive effect on green employee voice.

2.5 Knowledge Application and Individual Practices

Ka significantly influences individual green practices within healthcare settings by converting theoretical insights into sustainable practical actions. This transformation facilitates the development of environmentally responsible behaviour at the individual level. When employees apply environmental knowledge effectively, it acts as a powerful green catalyst that encourages proactive engagement with green initiatives. It enables employees to reinforce their positive beliefs and attitudes towards sustainable practices while diminishing negative perceptions (B. Zhang et al., 2021). To enhance individual green practices, healthcare institutions must apply already acquired knowledge—recognising that knowledge, skills, and practices form the foundation of organisational innovation (Shahzad, Qu, Zafar, Ding, et al., 2020). When such knowledge is translated into action, it becomes embedded in organisational behaviour, institutional memory, and the operational routines used to resolve complex problems. The long-term benefit of applying knowledge lies in its capacity to expand individual expertise and enable employees to evolve into domain experts over time (Kejzar et al., 2022). Ka, in essence, refers to the practical use of acquired knowledge in real-world contexts. In the healthcare domain, this involves the implementation of environmentally friendly practices to effectively navigate and address complex ecological challenges (Widyanti et al., 2023). For organisations striving to achieve sustainable development goals, applying absorbed knowledge in day-to-day operations is essential. The degree to which knowledge is internalised has a strong influence on the adoption and integration of sustainable organisational practices (Shahzad et al., 2021). Based on the above rationale, we propose the following hypothesis:

H3: Knowledge application has a direct positive effect on individual green practice.

2.6 Knowledge Application and Influence on Others

Ka plays a pivotal role in enhancing an individual's IO by offering tangible evidence of the benefits of green practices and reinforcing credibility through the practical enactment of sustainability knowledge. Healthcare professionals who effectively apply sustainable knowledge inspire their colleagues and contribute to fostering a culture of environmental responsibility. In healthcare, where teamwork and collaboration are vital, Ka ensures that individual efforts contribute to broader organisational transformation (Heeren et al., 2016). In collaborative work environments - characteristic of healthcare settings - the application of knowledge enables the translation of individual green actions into systemic institutional change. It empowers professionals to effectively demonstrate the outcomes of sustainable practices, thereby motivating others to emulate their behaviour and adopt similar environmentally conscious approaches (Shahzad, Qu, Zafar, Ding, et al., 2020). Furthermore, the green influence derived from Ka facilitates the transformation of negative behavioural patterns while promoting positive practices. It encourages the adoption of new, more sustainable behaviours and strengthens interpersonal relationships. This form of influence enhances organisational performance, boosts productivity, and fosters individual professional growth (Pandey, 2022). Ka also functions as a strategic process within organisations, whereby shared knowledge is mobilised to support various operations and functional areas. This, in turn, leads to improved decision-making and yields concrete outcomes, such as enhanced quality in products and services (Alharbi & Aloud, 2024). Based on this conceptual foundation, we propose the following hypothesis:

H4: Knowledge application has a direct positive effect on influence on others.

3. Methodology

3.1 Data Collection

We employed a longitudinal research design with two waves of data collection (T1 and T2), spaced two months apart. Although no definitive theoretical guidelines currently exist regarding the optimal time intervals for studies in knowledge management and organisational behaviour (Griep et al., 2021), a time lag exceeding one month is generally considered sufficient to mitigate recall and anchoring biases (Taylor et al., 2009), while still short enough to preserve the relative stability of respondents' perceptions over a one- to two-month period (Bakker & Bal, 2010) (Bakker & Ba(Dormann & Griffin, 2015; Ng et al., 2013).

A key advantage of this repeated-measures design is its capacity to reduce potential threats arising from common method bias (Podsakoff et al., 2024). This design enables the estimation of effects across time; for instance, Ka in healthcare organisations was measured at T1, while green employee behaviours - namely GL, GV, IP, and IO - were measured at T2. This temporal separation allows for a more robust examination of causal relationships, rather than relying solely on cross-sectional data gathered at a single point in time. Additionally, it facilitates the inclusion of autoregressive effects to model change over time. Participants received a personalised email invitation containing a link to an online survey. They were asked to complete the survey within ten working days. Responses were treated as missing if participants failed to submit their answers within the allotted timeframe.

At the beginning of the survey, we included a screening question to identify whether respondents had engaged in any sustainability-related activities within their organisations over the past six months. Respondents who answered "No" to this filter question were excluded from the remainder of the study. To ensure conceptual clarity, we provided participants with definitions of both Ka and green employee behaviour, based on Alhemimah et al. (2024) Nourafkan et al. (2023), Pandey (2022), Taris and Wielenga-Meijer (2010), and Shujahat et al. (2019). Confidentiality was fully assured for all participants.

3.2 Study Sample

We contacted senior administrators from a diverse range of private hospitals in Baghdad, the capital of Iraq, following formal approval from the Iraqi Ministry of Health. Upon receiving their consent to participate, we asked these administrators to forward a personalised email to their staff - including medical, nursing, service, administrative, and support personnel - inviting them to take part in the study. The email contained a link to the survey as well as explanatory information about the research. Participation was entirely voluntary, and no compensation was offered.

In total, 2,973 employees were contacted, of whom 2,335 completed the survey, resulting in a response rate of 78.54%. Among these, 1,663 respondents reported having applied their knowledge to perform sustainability-related activities within their respective domains over the previous six months (screening rate = 71.22%). The remaining 672 individuals who indicated no such engagement were excluded from further analysis.

Of the 1,663 respondents who reported engaging in sustainable and green practices at work, 48.9% were male and 51.2% were female. These proportions are comparable to national figures reported for Iraq's healthcare workforce, where 53.7% are male and 46.3% female according to the Iraqi central statistical organisation (in 2023)[1]. The average age of respondents was 39.92 years (SD = 10.49), aligning with the predominant age range (29-49 years) within the national healthcare labour force. Regarding educational attainment, 25.7% of respondents held a secondary or vocational qualification, 13.0% held a postgraduate degree, and 61.3% held an undergraduate degree. This reflects the education profile typically required by private hospitals in Iraq, where primary service delivery is generally entrusted to bachelor's degree holders, supported by specialised and vocational qualifications. On average, respondents had been employed by their current organisation for 5.6 years (SD = 6.2), suggesting familiarity with the evolution of Iraq's sustainable development initiatives, which were launched nearly a decade ago.

To assess the statistical power of our regression analysis, we conducted a Monte Carlo simulation based on a set of methodological assumptions (Griep et al., 2025). We assumed a standard error of 0.10 for each standardised beta coefficient, a unique variance of 1.0 for each independent variable, and a significance threshold of $\alpha = 0.05$. The simulation aimed to estimate the statistical power required to detect direct effects (Standardised Betas) across five effect sizes (0.1, 0.2, 0.3, 0.4, 0.5) and five different sample sizes (n = 50, 100, 200, 300, 500). For each ($\beta \times n$) combination, 5,000 replications were run, generating estimates of the coefficients and testing their statistical significance. The results revealed low statistical power for small effect sizes, even at larger sample sizes. However, for medium effects ($\beta = 0.3$), power exceeded 85% across all sample sizes and approached 100% for large effects ($\beta = 0.5$). These findings confirm that the actual sample size used in this study (n = 1,663) is more than adequate for detecting statistically significant medium to large effects.

[1] https://mop.gov.iq/en/central-statistical-organization

3.3 Measures

Data for this study were collected using a structured questionnaire developed based on validated scales drawn from prior literature. The items were translated from English into Arabic in a manner that ensured alignment with the local cultural context (Amir A. Abdulmuhsin, Haitham O. Owain, Abdulkareem H. Dbesan, Mohd Abass Bhat, et al., 2025). All constructs were measured using a five-point Likert scale, ranging from (1) “Strongly disagree” to (5) “Strongly agree”. To ensure content validity, the questionnaire was reviewed by a panel of nine academic experts specialising in knowledge management and organisational behaviour (Amir A. Abdulmuhsin, Marco Valeri, et al., 2025). The questionnaire was organised into two main sections. The first section included demographic information and the independent variable, measured at Time 1 (T1), as follows:

- *Knowledge Application (Ka)*, the independent variable, was measured using a four-item scale adapted from previous studies, such as Alharbi and Aloud (2024), Maraqa (2019), and Yu et al. (2022). Participants were asked to assess the extent to which their organisation applies knowledge management practices, such as encouraging innovation and the exchange of new ideas, using a five-point Likert scale ($\alpha = 0.956$).

The second section covered the dependent variables, which were assessed at Time 2 (T2) and represented the four dimensions of green employee behaviour:

- *Green Learning (GL)* was measured using four items adapted from the studies of B. Zhang et al. (2021) and Zhang et al. (2024). Sample items included statements such as, “I actively seek knowledge about environmental practices at work,” rated on a five-point Likert scale ($\alpha = 0.944$).
- *Green Voice (GV)* was assessed using a four-item scale adopted from Ari et al. (2020) and B. Zhang et al. (2021), capturing participants’ willingness to speak up and propose environmental ideas within their organisation ($\alpha = 0.941$).
- *Individual Practice (IP)* was measured through four items adapted from Xu et al. (2022), such as, “I personally reduce environmental resource use in my daily work,” also rated using a five-point Likert scale ($\alpha = 0.958$).
- *Influence on Others (IO)* was evaluated using a four-item scale developed by Zhang et al. (2024). Participants rated the extent to which they encourage colleagues to act in environmentally responsible ways ($\alpha = 0.936$).

All items related to green employee behaviour were rated on the same five-point Likert scale, from (1) “Strongly disagree” to (5) “Strongly agree”. The internal consistency of each scale was confirmed through Cronbach's alpha coefficients, all of which exceeded the generally accepted threshold of $\alpha > 0.70$ for social science research (A. A. Abdulmuhsin et al., 2025).

3.4 Statistical Analysis

To test the proposed theoretical model and research hypotheses, Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed using SmartPLS version 3.9. PLS-SEM is a widely adopted technique in studies aiming to predict relationships among variables and estimate both simple and complex models involving latent constructs (Rehman et al., 2025). It is particularly well-suited to exploratory research, models with a moderate number of indicators, those involving mediation or moderation effects, and situations where the assumption of multivariate normality is not met (Hair et al., 2021).

The PLS-SEM analysis was conducted in two primary stages:

- *Measurement Model Evaluation*: The reliability and validity of the constructs were assessed through convergent validity - using Average Variance Extracted (AVE) - and internal consistency reliability, using both Composite Reliability (CR) and Cronbach's Alpha (Alkhwaldi et al., 2025). Discriminant validity was examined using the Fornell–Larcker Criterion and the Heterotrait–Monotrait Ratio (HTMT) (Amir A. Abdulmuhsin, Haitham O. Owain, Abdulkareem H. Dbesan, Abeer F. Alkhwaldi, et al., 2025). The thresholds applied followed established methodological standards: AVE ≥ 0.50, CR ≥ 0.70, and HTMT < 0.90.
- *Structural Model Evaluation*: Once the quality of the measurement model was confirmed, causal relationships among the constructs were assessed using a bootstrapping procedure with 5,000 resamples (Bhat et al., 2025). This allowed for the estimation of path coefficients and the evaluation of their statistical significance. Model explanatory power was examined using the coefficient of determination (R^2), while predictive relevance was assessed using the cross-validated redundancy index (Q^2), providing an indication of the model's predictive validity for the dependent variables (Alshaher et al., 2022).

A significance level of $\alpha = 0.05$ was used as the criterion for hypothesis acceptance or rejection (Abdulmuhsin & Ali, 2022). The application of SmartPLS was deemed appropriate for this study given the multivariate and complex nature of the research model, as well as the study's predictive orientation.

4. Results

This section presents the findings derived from the PLS-SEM analysis, addressing the psychometric properties of the measurement model and evaluating the structural model to test the proposed hypotheses. The reliability and validity of the constructs were first assessed to ensure robustness in the measurement model. As shown in *Table 1*, all constructs demonstrated strong internal consistency, with Cronbach's alpha (α) values ranging from 0.936 to 0.958, and Composite Reliability (CR) values between 0.954 and 0.970 - both exceeding the recommended threshold of 0.70 (Hair et al., 2019). Convergent validity was confirmed, with all constructs exhibiting Average Variance Extracted (AVE) values well above the 0.50 cut-off, ranging from 0.839 to 0.889.

Table 1. Correlation analysis.

Constructs	M (SD)	Kurtosis (Skewness)	1	2	3	4	5
1. Ka	3.560 -1.390	-0.450 (-1.000)	1				
2. GL	2.908 -0.570	0.107 (-0.013)	0.399	1			
3. GV	2.915 -0.582	0.013 -0.080	0.398	0.698	1		
4. IP	2.992 -0.589	0.278 -0.002	0.439	0.753	0.699	1	
5. IO	2.975 -0.596	0.087 -0.047	0.390	0.703	0.704	0.723	1
Cronbach's alpha (α)			0.956	0.944	0.941	0.958	0.936
Composite Reliability (CR)			0.968	0.960	0.958	0.970	0.954
Average Variance Extracted (AVE)			0.882	0.857	0.850	0.889	0.839

Notes: *N=1663, **P<0.001, M=Mean, SD=Standard Deviation.*
Source: *Authors' own work*

To assess discriminant validity, both the Fornell–Larcker criterion and the Heterotrait-Monotrait ratio (HTMT) were applied. As presented in *Table 2*, the square root of the AVE (bold diagonal values) for each construct exceeded its inter-construct correlations, confirming the Fornell-Larcker condition. In addition, all HTMT values remained below the conservative threshold of 0.90, further establishing discriminant validity.

Once the adequacy of the measurement model was established, the structural model was evaluated to test the hypothesised relationships between Ka and the four dimensions of green employee behaviour. Bootstrapping with 5,000 subsamples was employed to estimate the path coefficients, t-statistics, and effect sizes. As shown in *Table 3* and visualised in *Figure 1*, all four hypotheses were supported:

- *H1: Ka had a significant positive effect on GL ($\beta = 0.399$, $t = 18.962$, $p < 0.001$), with a moderate effect size ($f^2 = 0.189$), and acceptable predictive power ($Q^2 = 0.158$; $R^2 = 0.159$).*
- *H2: Ka significantly influenced GV ($\beta = 0.398$, $t = 18.609$, $p < 0.001$), with a comparable effect size ($f^2 = 0.188$), and explanatory power ($Q^2 = 0.157$; $R^2 = 0.158$).*
- *H3: A stronger effect was observed on individual green practice ($\beta = 0.439$, $t = 21.288$, $p < 0.001$), yielding the largest effect size ($f^2 = 0.239$), and explaining the highest variance among the four behaviours ($Q^2 = 0.192$; $R^2 = 0.193$).*
- *H4: Ka also significantly predicted IO ($\beta = 0.390$, $t = 18.808$, $p < 0.001$), with an effect size of $f^2 = 0.179$ and predictive indicators ($Q^2 = 0.151$; $R^2 = 0.152$).*

Table 2. Constructs' Discriminant validity.

Constructs	GL	GV	IO	IP	Ka
GL	**0.926**	*0.740*	*0.748*	*0.791*	*0.419*
GV	0.698	**0.922**	*0.750*	*0.736*	*0.419*
IO	0.703	0.704	**0.916**	*0.763*	*0.412*
IP	0.753	0.699	0.723	**0.943**	*0.459*
Ka	0.399	0.398	0.390	0.439	**0.939**

Notes: Bold number= √AVE, *Italic number=HTMT*
Source: *Authors' own work*

Table 3. The path analysis of the study model

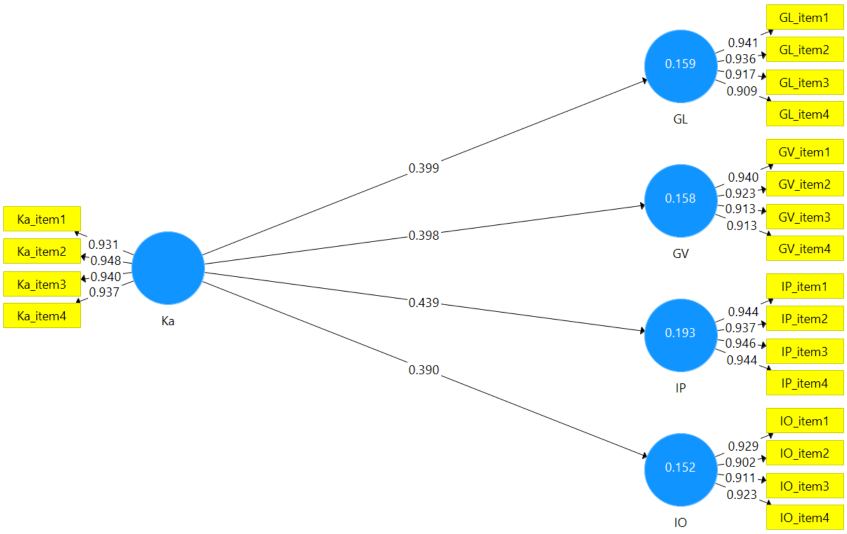
Relationships	*β*	*SD*	*T Statistics*	*P Values*	*F²*	*Q²; R²*	*Results?*
H1: Ka → GL	0.399	0.021	18.962	0.000	0.189	0.158; 0.159	*Accept*
H2: Ka → GV	0.398	0.021	18.609	0.000	0.188	0.157; 0.158	*Accept*
H3: Ka → IP	0.439	0.021	21.288	0.000	0.239	0.192; 0.193	*Accept*
H4: Ka → IO	0.390	0.021	18.808	0.000	0.179	0.151; 0.152	*Accept*

***Note**: β = Standard regression, SD = Standard Deviation.*
NFI = 0.947, SRMR = 0.022

Source: *Authors' own work*

Model fit indices further supported the adequacy of the structural model, with a Standardised Root Mean Square Residual (SRMR) of 0.022 and Normed Fit Index (NFI) of 0.947, both indicating excellent model fit (Hair et al., 2020). The results provide strong empirical support for all proposed hypotheses. Ka emerged as a significant and consistent predictor across all four dimensions of green employee behaviour - GL, GV, IP, and IO - thus affirming its pivotal role in shaping environmentally responsible workplace conduct within healthcare institutions.

Figure 1. The structural model of the study



***Source:** Authors' own work*

5. Discussion

The present study set out to examine the impact of Ka on four distinct dimensions of green employee behaviour - namely, green learning (GL), green voice (GV), individual green practice (IP), and influence on others (IO) - within the healthcare sector in Iraq. Grounded in contemporary perspectives from knowledge management and organisational sustainability literature, the findings offer robust empirical validation for the proposed hypotheses and provide several important theoretical and practical implications.

The results reinforce the theoretical argument that Ka is not merely a concluding step in the knowledge management cycle, but a strategic enabler of behavioural change (Alharbi & Aloud, 2024; Shahzad et al., 2021). Consistent with our expectations, Ka was found to have a significant and positive effect on all four green behavioural dimensions, confirming Hypotheses H1 to H4.

The positive relationship between Ka and GL supports the conceptualisation of Ka as a mechanism for experiential and transformative learning. Theoretically, this aligns with the view that GL involves not only the acquisition of environmental knowledge but also its integration into practice through reflection, experimentation, and feedback (Nguyen et al., 2024; Wang et al., 2020). Our results suggest that healthcare professionals who actively apply their knowledge are more likely to develop deeper environmental insights and adaptive green capabilities - whether through explorative efforts that generate innovative ideas or exploitative learning that enhances existing procedures.

The positive effect of Ka on GV corroborates the idea that applied knowledge increases employee confidence and perceived efficacy in suggesting sustainable improvements. This supports Fawehinmi et al. (2020) and W. Zhang et al. (2021), who assert that the internalisation of environmental knowledge strengthens employees' willingness to speak up, thereby fostering a psychologically safe climate for constructive dialogue around green initiatives. The findings imply that when healthcare workers are equipped with usable, practice-based environmental knowledge, they are more inclined to contribute ideas and advocate for systemic change within their institutions.

Among all hypothesised paths, the strongest effect was observed between Ka and individual green practice. This validates the assertion that applied knowledge transforms into habitual, self-directed action (Kejzar et al., 2022; Xu et al., 2022). In the healthcare context, where environmental sustainability is increasingly critical, staff who routinely apply knowledge are more capable of embedding green behaviours into their daily routines—such as minimising waste, conserving energy, or optimising the use of medical resources. These micro-level behaviours, although often informal, have been shown to contribute meaningfully to organisational sustainability goals.

The significant relationship between Ka and IO underscores the social and normative aspects of environmental behaviour. Employees who demonstrate competence and commitment in applying sustainable knowledge often serve as role models, encouraging others to follow suit (Pandey, 2022; Shahzad, Qu, Zafar, Rehman, et al., 2020). This peer influence fosters the diffusion of green practices throughout the organisation, shaping a collective environmental identity and reinforcing sustainability as a shared organisational value. In line with (Heeren et al., 2016), our results suggest that healthcare professionals can exert substantial informal influence through knowledge-based demonstration and encouragement.

These results collectively affirm the central theoretical proposition that Ka functions as a behavioural bridge between cognitive resources and sustainable action. As posited in our conceptual model, Ka serves as a proximal driver that activates individual intentions and capabilities into tangible environmental outcomes. The four dimensions of green employee behaviour examined in this study - learning, voice, practice, and influence - reflect both internal (cognitive-motivational) and external (social-institutional) manifestations of sustainability engagement, all of which are rooted in the strategic application of knowledge.

This study also resonates with organisational learning theory, particularly the notion that learning is an embedded, continuous process shaped by the application and contextualisation of knowledge. Furthermore, from the lens of knowledge-based theory, the findings highlight the strategic value of knowledge as a renewable and actionable asset capable of influencing both individual behaviour and organisational culture.

6. Conclusion

This study makes several important contributions to both the theoretical development and practical implementation of knowledge management and sustainability practices in healthcare institutions. By empirically examining the influence of Ka on green employee behaviours - GL, GV, IP, and IO - this research addresses significant gaps in the intersection of knowledge management, organisational behaviour, and environmental sustainability.

6.1 Theoretical Implications

First, the study advances the theoretical understanding of Ka as a critical antecedent of pro-environmental behaviour in organisational settings. While much of the extant literature has focused on knowledge creation and sharing, relatively little attention has been paid to the transformative role of Ka in shaping behavioural outcomes. By validating its effect across four dimensions of green employee behaviour, the study provides a more nuanced view of how applied knowledge functions not only as a cognitive asset but also as a behavioural driver. Second, the study contributes to the broader organisational sustainability literature by proposing and empirically testing a multidimensional framework of green employee behaviour. This framework reflects both individual and relational dimensions—ranging from internalised practices (learning and individual action) to externalised influence (voice and social impact). The integration of these dimensions with Ka provides a holistic model that bridges cognitive processes with sustainability engagement, responding to calls for more comprehensive behavioural models in sustainability research.

Third, from a knowledge-based view (KBV) of the firm, the findings offer evidence that knowledge, when effectively applied, can yield not only economic but also environmental value. This aligns with the view that intellectual capital - particularly in knowledge-intensive sectors such as healthcare - can be leveraged to advance strategic sustainability goals. Moreover, the results support principles from organisational learning theory, in that learning is most impactful when derived from experiential, applied engagement with environmental knowledge, rather than passive absorption alone. Finally, the study enriches the understanding of green organisational behaviour in developing country contexts, particularly within healthcare systems. By focusing on Iraq, a setting often underrepresented in sustainability and KM research, the findings contribute to the growing recognition of how contextual and cultural factors shape knowledge enactment and behavioural transformation.

6.2 Practical Implications

From a managerial standpoint, the findings offer actionable insights for healthcare administrators, policy-makers, and sustainability practitioners:

- *Embedding Ka in Sustainability Training*: Institutions should prioritise applied learning opportunities that encourage healthcare professionals to operationalise environmental knowledge. This may include green simulations, case-based learning, and problem-solving workshops that go beyond theoretical instruction.
- *Fostering a Culture of GV*: Encouraging open dialogue and idea-sharing around sustainability practices can empower staff to voice suggestions and co-create green innovations. Managers can implement idea submission platforms, green suggestion schemes, or cross-functional sustainability committees to institutionalise GV.
- *Supporting Individual Green Practices through Enablers*: Access to relevant technologies, environmental guidelines, and personal accountability mechanisms (e.g., self-monitoring tools, eco-feedback systems) can help translate knowledge into consistent, voluntary green behaviours.
- *Amplifying Positive Peer Influence*: Recognising and showcasing employees who model green behaviours can foster a ripple effect, encouraging others to adopt similar practices. Green leadership programmes, peer mentorship, and storytelling of sustainability successes can be particularly effective in this regard.
- *Linking Ka to Organisational KPIs*: Institutions should incorporate sustainability-related Ka into performance evaluation and reward systems. This alignment reinforces the strategic importance of green behaviour and its role in service quality and institutional reputation.

Thus, healthcare organisations that strategically invest in mechanisms to apply and operationalise knowledge will be better equipped to cultivate an environmentally conscious workforce, enhance institutional resilience, and contribute to national and global sustainability targets.

7. Limitations and Future Research Directions

Despite the theoretical and empirical contributions of this study, several limitations must be acknowledged, each of which offers promising avenues for future research. First, the study's data were collected from private healthcare institutions in a single geographic context - Baghdad, Iraq. While this context is both timely and underexplored, the findings may not be fully generalisable to other regions, cultures, or institutional settings. Organisational dynamics, leadership practices, and environmental norms may differ significantly across national and sectoral boundaries. Second, although a two-wave longitudinal design was employed to strengthen causal inference and reduce common method bias, causality cannot be definitively established due to the observational nature of the study. Additional experimental or time-lagged designs involving three or more measurement points would further clarify the temporal relationships among constructs. Third, the study relied on self-reported data, which may be subject to social desirability or cognitive bias. While confidentiality was assured and a screening filter was used to enhance response validity, objective behavioural measures or supervisor ratings could add rigour to future investigations. Fourth, the study focused exclusively on Ka as the antecedent of green behaviour. While this choice aligns with our theoretical model, other knowledge processes - such as knowledge retention, knowledge integration, or absorptive capacity - may also play crucial roles in influencing sustainable workplace behaviours and deserve further exploration.

To build upon these findings, future research could consider several extensions:

- *Cross-Cultural Comparative Studies*: Investigating how the relationship between Ka and green behaviours unfolds in different national or institutional contexts (e.g., public vs. private hospitals, emerging vs. developed economies) would deepen the understanding of cultural and structural contingencies.
- *Moderators and Mediators*: Exploring potential moderators (e.g., organisational climate, leadership style, psychological empowerment) or mediators (e.g., environmental commitment, green identity, eco-centric motivation) could reveal the underlying mechanisms that amplify or buffer the effects of Ka.
- *Mixed Methods Designs*: Future studies may benefit from combining quantitative approaches with qualitative techniques - such as interviews or ethnographic observations - to gain deeper insight into how knowledge is enacted in real-time workplace practices.
- *Broader Sectoral Applications*: Extending the current model to other environmentally impactful sectors - such as manufacturing, logistics, or education - could help generalise the findings and generate sector-specific interventions.
- *Long-Term Impact and Organisational Outcomes*: Future research could examine how knowledge-driven green behaviours accumulate over time to influence broader organisational outcomes such as innovation performance, resource efficiency, institutional reputation, or patient satisfaction.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

Authors' contributions

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published this version of the manuscript.

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Data availability

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Appendix A. Study Questionnaire Items

T1 – Independent Variable

Knowledge Application (Ka): Alharbi and Aloud (2024), Maraqa (2019), and Yu et al. (2022).

"KA1. Our organisation encourages employees to use acquired knowledge to improve work performance. KA2. Employees in our hospital apply their knowledge to solve sustainability-related problems. KA3. We regularly implement new ideas and insights generated from past experiences. KA4. Our teams are encouraged to convert shared knowledge into green initiatives."

T2 – Dependent Variables (Green Employee Behaviours)

Green Learning (GL): B. Zhang et al. (2021) and Zhang et al. (2024).

"GL1. I seek knowledge about environmental practices related to my work. GL2. I learn how to reduce environmental impact in my workplace. GL3. I improve my work habits by acquiring green knowledge. GL4. I try to enhance my environmental understanding through workplace learning."

Green Voice (GV): Ari et al. (2020) and B. Zhang et al. (2021).

"GV1. I express my environmental concerns in the workplace. GV2. I suggest environmentally friendly solutions to improve operations. GV3. I openly share ideas for reducing the environmental footprint of our organisation. GV4. I speak up when I notice unsustainable practices."

Individual Practice (IP): Xu et al. (2022).

"IP1. I personally take steps to minimise the use of resources at work. IP2. I avoid unnecessary waste in my daily tasks. IP3. I proactively reduce energy consumption in my department. IP4. I adopt eco-friendly behaviours even when not formally required."

Influence on Others (IO): (Zhang et al., 2024).

"IO1. I encourage my colleagues to adopt environmentally friendly practices. IO2. I serve as a role model for green behaviour in my organisation. IO3. I share my environmental knowledge to support others' actions. IO4. I positively influence team members to act in sustainable ways."

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Harnessing Artificial Intelligence for Green Innovation in the Oil Industry: The Mediating Role of Knowledge Management

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Abstract

In light of growing environmental concerns and sustainability imperatives, green innovation (GI) has become a strategic priority for industries worldwide. This study investigates the role of artificial intelligence (AI) in enhancing green innovation - both proactive (PGI) and reactive (RGI) - through the mediating mechanisms of knowledge management (KM) processes, namely knowledge generation (Kg), knowledge storage and sharing (KSS), and knowledge application (Ka). Grounded in knowledge-based and resource-based theories, the study examines data collected from 572 engineers working across Iraq's three largest state-owned oil companies. Using Partial Least Squares Structural Equation Modelling (PLS-SEM), the results confirm that AI significantly enhances both PGI and RGI. Furthermore, KM processes mediate the relationship between AI and GI, with knowledge application showing the strongest mediating effect. The findings provide robust empirical support for the integrative role of KM in translating AI capabilities into environmentally sustainable innovation. Within the context of the Iraqi oil sector - a resource-dependent and environmentally sensitive industry operating in a developing economy - the study highlights how digital transformation, if strategically managed through KM practices, can foster sustainability without compromising operational performance. Theoretically, this research extends the understanding of AI-GI linkages by embedding KM as a central mediating mechanism. Practically, it offers actionable insights for energy sector leaders and policymakers in developing countries on how to leverage AI not only for efficiency gains but also for advancing environmental objectives through effective knowledge mobilisation.

DOI: ,

1. Introduction

In an era increasingly defined by escalating environmental crises - ranging from climate change and biodiversity loss to resource depletion - organisations are under mounting pressure to strike a sustainable balance between environmental stewardship and economic performance (Rehman et al., 2021). In this context, green innovation (GI) has emerged as a critical pathway to organisational resilience and competitiveness. It has garnered widespread attention across both scholarly and industrial domains (Mothe et al., 2017). It defined as the development and application of environmentally sound products, processes, and practices, GI encompasses both proactive and reactive dimensions. Proactive green innovation (PGI) involves anticipatory strategies to pre-empt environmental challenges, whereas reactive green innovation (RGI) focuses on adaptive responses to external ecological demands (Alkaraan et al., 2024; Bai et al., 2022). However, the implementation of GI, particularly in resource-intensive sectors such as oil and gas, requires more than policy compliance or technological adoption—it demands robust systems of knowledge acquisition, integration, and utilisation.

Among the transformative technologies enabling this shift, artificial intelligence (AI) stands at the forefront. AI encompasses a suite of computational techniques—including machine learning, deep learning, neural networks, natural language processing, and computer vision—that enable systems to learn from data, predict outcomes, and enhance decision-making (Kaplan, 2023; Taha & Abbas, 2023). Within the industrial sector, particularly oil and gas, AI has demonstrated substantial potential in predictive maintenance, emissions monitoring, resource optimisation, and anomaly detection (Eloranta et al., 2021; Holmström, 2022). However, the value derived from AI hinges not solely on its technological features but on an organisation's capacity to absorb and apply AI-generated knowledge. This is particularly true in developing economies where technological modernisation often encounters institutional and human capital barriers.

This brings to the fore the critical role of knowledge management (KM). As a strategic organisational capability, KM encompasses a range of processes such as knowledge generation (Kg), storage and sharing (KSS), and application (Ka) that facilitate the conversion of data into actionable insights (Acharya et al., 2022; Al Shraah et al., 2021). These KM processes are essential for translating AI-generated data into environmental innovations that align with sustainability goals. For instance, the generation of eco-specific knowledge enhances innovation design, while sharing that knowledge across departments supports cross-functional collaboration. Ultimately, the application of such knowledge leads to tangible outcomes in green product development, resource-efficient processes, and regulatory compliance (Benabdellah et al., 2021; Mothe et al., 2017).

While scholarly attention to AI, KM, and green innovation is growing, significant theoretical and empirical gaps persist. Firstly, much of the existing literature examines AI and innovation in isolation, neglecting the integrative role of KM (Mariani et al., 2023; Sahoo et al., 2022). Secondly, the dual nature of GI—proactive and reactive—has been underexplored in relation to AI technologies, especially in developing country contexts where institutional readiness and digital capabilities are heterogeneous (Sudirjo, 2023). Thirdly, there is a paucity of empirical studies within the oil sector, which is both knowledge-intensive and environmentally sensitive, and thus an ideal setting for examining AI-KM-GI linkages. Existing studies have examined AI's potential in operational efficiency (Khelifi et al., 2020) or KM's role in innovation (Daradkeh, 2023), but rarely within a unified conceptual framework that captures the mediating function of KM in the AI–GI nexus.

This research is particularly salient for Iraq, a country whose economy is deeply entrenched in the oil sector, which contributes over 90% of government revenues. Iraq's state-owned oil companies operate in an environment of high environmental vulnerability, antiquated infrastructure, and increasing international pressure to decarbonise (Abdulmuhsin, Alkhwaldi, et al., 2025). Despite possessing vast reserves and a skilled engineering workforce, many Iraqi oil enterprises lag in digital integration and environmental innovation due to bureaucratic inertia, weak regulatory enforcement, and underdeveloped knowledge systems. The integration of AI into these companies - particularly when coupled with strong KM practices - presents a promising avenue to overcome structural inefficiencies and facilitate the transition to greener operations. For instance, AI can assist in leak detection, emissions tracking, and reservoir modelling, while KM processes can ensure these insights are institutionalised and leveraged across operational units.

While prior research has examined AI in manufacturing and KM in service industries, few studies have explored their synergistic effects on green innovation in oil-dependent developing countries (Abdulmuhsin et al., 2024; Abdulmuhsin, Hussein, et al., 2025). This constitutes a notable gap in the literature, both conceptually and contextually. Existing studies tend to isolate the roles of AI and KM or focus exclusively on reactive compliance rather than strategic sustainability. Moreover, empirical studies in the Middle East and North Africa (MENA) region often neglect the nuanced organisational dynamics within state-owned enterprises operating under political and economic constraints.

Accordingly, the current study seeks to address these gaps by examining the impact of AI on both proactive and reactive forms of green innovation, mediated by KM processes, within the Iraqi oil sector. By focusing on engineers within the country's three largest oil companies, the study contributes new empirical insights into how digital technologies and organisational knowledge capabilities intersect to drive environmental performance in a high-stakes industrial setting.

The primary objective of this research is to develop and empirically test a conceptual model that elucidates the relationships between AI, KM processes, and GI outcomes. In doing so, it offers both theoretical enrichment - by integrating digital transformation with knowledge-based and innovation management theories - and practical guidance for policymakers, environmental managers, and oil-sector executives in Iraq and other resource-rich developing nations facing similar sustainability challenges. This paper is organised in seven main sections, introduction, theoretical background and hypothesis development, methodology, results, discussion, conclusion and implications, and finally the future works.

2. Theoretical Background and Hypothesis Development

2.1 Green Innovation

Green innovation (GI) represents a natural evolution of the broader innovation paradigm, arising in response to heightened environmental awareness and the urgent need to mitigate the adverse impacts of economic activities on the natural environment. The term "green innovation" first gained traction in the mid-20th century, describing innovations aimed at reducing or eliminating environmental harm (Franceschini et al., 2016). The general concept of innovation can be traced back to Schumpeter in 1934, who characterised it as the industrial or commercial application of something novel (Datta et al., 2019; Ziemnowicz, 2013). Over time, the concept has expanded to encompass organisational, managerial, and technological changes that enhance a firm's environmental performance (Spena et al., 2016). Green innovation has thus emerged as a multidimensional construct serving environmental, economic, and social objectives.

It is broadly defined as the development or implementation of new products, processes, or organisational methods that improve a firm's environmental performance while conserving natural resources (Laihonen & Kokko, 2020). The accelerating pace of environmental degradation and the intensification of global challenges, such as climate change, have compelled organisations to adopt green innovation as a strategic necessity (Cosgrove & Loucks, 2015). This form of innovation has become closely linked to contemporary business models that seek to enhance competitiveness by reducing environmental costs and strengthening corporate image (Chen et al., 2006). Empirical evidence also suggests that green innovation transcends technological tools; it encompasses a cultural orientation within organisations that promotes learning, collaboration, and co-creation among employees (Muñoz-Pascual et al., 2019).

A core objective of green innovation is to develop products and services that minimise waste and emissions while advancing the use of renewable energy sources (Pata & Balsalobre-Lorente, 2022). As such, green innovation is increasingly recognised as a critical enabler of the United Nations

Sustainable Development Goals (SDGs) (S. J. Khan et al., 2021), positioning it as a strategic imperative in addressing global environmental challenges (Rajkhowa & Sarma, 2021).

The significance of green innovation lies in its ability to reconcile environmental and economic goals. It contributes to improved productivity, cost-efficiency over the long term, and enhances employee satisfaction and organisational commitment (Asadi et al., 2020). Furthermore, it confers a competitive advantage in green markets through the delivery of environmentally friendly and value-added products (Song et al., 2020). Stakeholders - including consumers, suppliers, and regulatory bodies - are increasingly incentivising organisations to adopt green practices, thereby making green innovation a vital determinant of corporate reputation and stakeholder loyalty (El Baz & Laguir, 2017). Additionally, green innovation facilitates regulatory compliance and enables organisations to meet environmental standards, serving as an effective mechanism to ensure organisational survival and sustainability amid growing ecological pressures (Bask et al., 2018). In light of these benefits, it is recommended that organisations prioritise green innovation as a strategic pillar, acting as a bridge between economic advancement and environmental stewardship.

2.2 Green Innovation: Characteristics and Types

Green innovation is distinguished by five fundamental characteristics that render it a potent strategic tool in the governance of modern organisations. First, *strategic orientation* - green innovation enables organisations to design and implement sustainable practices that minimise resource consumption and reduce emissions. This, in turn, enhances organisational performance and fosters long-term competitive advantage (El-Kassar & Singh, 2019; Wu & Sekiguchi, 2023). Second, *cost efficiency* - green innovation facilitates cost reduction by improving operational efficiency and mitigating financial and environmental risks (Zhang & Vigne, 2021). Third, *environmental protection* - this dimension places ecological benefits at the forefront of organisational goals, enabling firms to respond constructively to environmental challenges, particularly in pollution-intensive sectors such as manufacturing (Fang et al., 2020; Rennings, 2000). Fourth, *competitive advantage* - green innovation supports early market entry and the delivery of environmentally friendly, innovative solutions, which foster clear differentiation and enhance market value (Aziz & Samad, 2016; Cillo et al., 2019). Fifth, *sustainability* - green innovation is a cornerstone of both internal and external sustainable development, encouraging individuals and institutions to adopt positive environmental behaviours and practices (Guoyou et al., 2011; Singh & El-Kassar, 2019).

Green innovation is typically categorised into two principal dimensions: Proactive Green Innovation (PGI) and Reactive Green Innovation (RGI) (Chen et al., 2012). Proactive green innovation entails a voluntary and forward-looking approach, where organisations pre-empt environmental threats by developing novel eco-friendly products and practices. This dimension reflects an entrepreneurial market orientation aimed at cost reduction, environmental distinction, and stakeholder trust (Aragón-Correa & Sharma, 2003; Hart, 1995). Its benefits are often realised over the long term, promoting green creativity and enabling radical innovation (Bianchi et al., 1997). Conversely, reactive green innovation represents an organisation's response to external environmental pressures and regulatory mandates, rather than a self-initiated commitment to innovation. It is predominantly compliance-driven, focusing on meeting existing environmental standards rather than shaping them (Yol Lee & Rhee, 2007). While often viewed as less progressive, reactive strategies may nonetheless yield incremental environmental improvements that meet beneficiary expectations and enhance environmental performance (Chen et al., 2006). The key distinction between the two lies in orientation: while proactive green innovation drives the market through innovation, reactive green innovation follows the market through adaptation.

2.3 Artificial Intelligence

The theoretical foundations of artificial intelligence (AI) can be traced back to the mid-twentieth century, particularly through the seminal work of Alan Turing, who laid the groundwork for conceptualising how machines could emulate human thought processes (Ali et al., 2023). However, the formal inception of the field is widely recognised as the 1956 Dartmouth College Conference, where foundational research questions were proposed, shaping the trajectory of future AI development (Glauner, 2020). The term "artificial intelligence" was coined by John McCarthy, who defined it as a scientific domain concerned with developing systems capable of performing cognitive tasks akin to those carried out by humans, such as speech and image recognition, natural language processing, and decision-making (Yablonsky, 2019).

Over time, AI research has evolved into two major streams: expert systems based on rule-driven logic, and machine learning, which relies on data analysis and pattern recognition (Strickland, 2021). With the rapid advancement of digital technologies, the scope of AI has broadened to include areas such as deep learning, computer vision, and natural language processing (Mich, 2020). These technologies have significantly enhanced capabilities in data analytics and decision-making, particularly in an era increasingly shaped by big data (Apell & Eriksson, 2021).

Contemporary definitions underscore AI's multidimensional nature: it is seen as an interdisciplinary scientific field (Bobrow & Stefik, 1986), a problem-solving and decision-making tool that mimics human reasoning (Ross, 2008), and a set of systems capable of learning, adapting, and engaging in complex interactions (Budhwar et al., 2023; Popenici & Kerr, 2017). This diversity of perspectives has catalysed the adoption of AI across a wide range of sectors.

AI's value lies in several intrinsic advantages. Notably, automation and efficiency - AI systems can perform repetitive tasks with high speed and accuracy, thereby boosting productivity (Kunduru, 2023). Data analysis and insights - AI can process vast volumes of data, identify patterns, and derive actionable insights for decision-making (Polonsky & Rotman, 2023). Innovation and creativity - AI technologies can generate novel solutions and designs across various disciplines (Vartiainen & Tedre, 2023).

Furthermore, AI plays a central role in personalised services by analysing user behaviour to deliver tailored recommendations, as exemplified in streaming platforms and e-commerce (Vijayan et al., 2023). In healthcare, AI supports diagnostics, medical imaging analysis, and drug development (Iqbal et al., 2023). Applications such as digital assistants leverage natural language processing to improve human-machine interaction (Domini et al., 2023). AI is also instrumental in cybersecurity, where it detects threats and analyses data to identify anomalies (Raza et al., 2023).

Additionally, AI is embedded in autonomous systems, including vehicles and drones (Bratu, 2023). It contributes to reducing operational costs through automation and resource optimisation (Banga & Peddireddy, 2023) and supports global economic growth and job creation (Jermsittiparsert et al., 2019). From an environmental perspective, AI fosters positive sustainability outcomes - enhancing energy efficiency and reducing emissions (Ahmad et al., 2021). It also aids in tackling complex challenges in climate, transport, and energy systems, positioning AI as a vital driver of innovation and future development (M. I. Khan et al., 2021).

2.4 The Application of Artificial Intelligence in the Oil Sector

Oil remains one of the most vital sources of energy globally, accounting for approximately one-third of total energy consumption. It is a fundamental component of daily human life, underpinning transportation, electricity generation, and petrochemical products (Zhiznin et al., 2023). Amid rising global demand for fossil fuels, there is an urgent need to adopt innovative approaches to enhance the efficiency of the oil and gas industry. In this context, AI has emerged as a strategic enabler for improving operational processes, enhancing safety, and supporting data-driven decision-making with greater precision (Choubey & Karmakar, 2020).

AI technologies are employed across various facets of the oil industry, beginning with geological exploration. Here, AI algorithms play a key role in analysing seismic data and accurately predicting the location of potential oil and gas reservoirs (Kuang et al., 2021). Machine learning techniques further assist in interpreting well logs and sedimentary environments, helping reduce risk and improve the understanding of reservoir characteristics (Iraji et al., 2023).

In drilling operations, AI-powered smart drilling systems optimise drilling parameters in real time, significantly reducing downtime and enhancing overall efficiency (Guo et al., 2023). Predictive maintenance is another critical application, where sensor data are analysed to anticipate equipment failures before they occur, thus lowering operational costs and minimising system outages (Rahman et al., 2023).

Within the production and supply chain context, AI systems help detect patterns and anomalies in production processes, allowing companies to improve performance and identify bottlenecks in advance (Md et al., 2022). Historical data can also be leveraged to forecast material and equipment requirements, thereby improving inventory management efficiency and reducing waste (Albayrak Ünal et al., 2023; Kehayov et al., 2022).

From a safety and environmental perspective, AI enhances the monitoring of industrial facilities through the deployment of drones and smart sensors, which are used to detect safety breaches, monitor compliance, and identify leaks or system failures at an early stage (Kuru et al., 2023). Intelligent robotics play a vital role in inspecting and maintaining pipelines, which are often buried underground or submerged. These pipelines are susceptible to issues such as corrosion or cracking, posing significant risks to both the economy and environment in the event of a spill (Elankavi, 2020; Shukla & Karki, 2013). Given the dangers of manual maintenance under extreme conditions involving high pressure and temperature, robotic systems offer an efficient and safe alternative, making them a critical asset in oil infrastructure management (Lin et al., 2021).

Therefore, artificial intelligence is proving instrumental in transforming the oil and gas sector by improving operational efficiency, reducing costs, enhancing safety, and advancing environmental sustainability in an industry facing growing ecological and technological challenges.

2.5 Artificial Intelligence and Green Innovation

The rapid advancement of information technologies has fundamentally reshaped business models, positioning AI as a powerful catalyst for innovation - particularly within the domain of green innovation, which seeks to foster sustainable development while minimising the environmental impact of industrial activities. In this regard, AI is considered a versatile general-purpose technology that enhances productivity, supports informed decision-making, and stimulates environmental innovation across both proactive and reactive dimensions (Agrawal et al., 2019; Brynjolfsson & Mitchell, 2017).

The relationship between AI and green innovation is grounded in several key pillars. Foremost among these is the integration of big data and the Internet of Things (IoT), which together generate vast volumes of real-time data that AI algorithms can analyse to drive ecological innovation (Filiou et al., 2023). Predictive technologies are employed to forecast environmental demand, allocate resources efficiently, optimise supply chains, and reduce waste and emissions (Rahman et al., 2023).

With respect to proactive green innovation, AI provides robust tools for developing environmentally sustainable solutions that anticipate regulatory changes or market needs. This is achieved through the analysis of future trends and early responses to climate and environmental fluctuations (Chen et al., 2006; Keicher et al., 2022). Such capabilities support the design of sustainable products and the cultivation of competitive advantage. Furthermore, AI strengthens institutional innovation by facilitating collaborative creativity, evaluating external ideas, and integrating them effectively (Arias-Pérez & Huynh, 2023).

In the context of reactive green innovation, AI enables the analysis of large-scale environmental data to support regulatory compliance, respond to consumer and stakeholder demands, and adapt existing processes in line with sustainability requirements (Liao et al., 2023). It contributes to more efficient resource allocation, emissions reduction, and the implementation of environmentally friendly solutions across production and logistics operations (Slimani et al., 2024).

In the oil sector in particular, AI has become a critical enabler of environmental transformation. It is employed in a wide array of functions, including exploration, seismic analysis, drilling optimisation, predictive maintenance, inventory management, and emissions monitoring through drones and intelligent robotics (Guo et al., 2023; Kuang et al., 2021). These applications not only reduce environmental costs but also enhance safety and operational efficiency. Additionally, AI-related technologies—such as machine learning, deep learning, and IoT - support environmental sustainability by enabling greater energy control, reducing resource consumption, and improving industrial and environmental planning (Panda et al., 2024).

This convergence of technological and environmental innovation has given rise to new paradigms such as “sustainable intelligence” and “green smart manufacturing”, underscoring the synergy between technological advancement and ecological transition (Abdulmuhsin, Hussein, et al., 2025). Accordingly, AI, with its analytical and predictive capabilities, emerges as a central driver in advancing environmental innovation and fulfilling strategic sustainability goals. Based on the above, the following hypotheses are proposed:

H1: Artificial intelligence has a positive impact on green innovation, with the following sub-hypotheses:

H1-1: Artificial intelligence positively influences proactive green innovation.

H1-2: Artificial intelligence positively influences reactive green innovation.

2.6 The Mediating Role of Knowledge Management

The contemporary era is witnessing a growing convergence between AI and knowledge management (KM), with AI technologies emerging as pivotal enablers in the advancement of organisational knowledge practices. AI empowers organisations to leverage both *explicit knowledge*—that which is codified and structured - and *tacit knowledge* - which is rooted in personal experience—through intelligent tools that facilitate the generation, storage, sharing, and application of knowledge in more efficient and adaptive ways (Ferreira et al., 2024; Nakash & Bouhnik, 2021).

AI enhances knowledge generation by processing and analysing large-scale data to uncover new knowledge patterns. This process includes not only the development of novel ideas but also the recombination of existing knowledge into practical solutions (Bhatt, 2001; Kumbure et al., 2024). Technologies such as artificial neural networks, natural language processing (NLP), and genetic algorithms are employed to extract textual information, analyse context, and generate new knowledge from both internal and external sources (Abdulmuhsin et al., 2024; Goel et al., 2022).

In terms of knowledge storage and dissemination, AI can construct intelligent organisational memory systems that systematically track, store, and organise knowledge in digital repositories (Alavi & Leidner, 2001; Otioma, 2022). Intelligent assistants and virtual agents streamline knowledge retrieval processes and enhance user experience by interpreting natural language inputs, ensuring timely and accessible information delivery (Abdulmuhsin, Hussein, et al., 2025). Semantic classification tools and content analysis algorithms are further used to structure knowledge assets, ensuring both accuracy and rapid accessibility (DeBellis & Neches, 2023).

Regarding knowledge application, AI supports the effective deployment of retrieved knowledge by informing decision-making and offering contextualised insights and recommendations (El Asri et al., 2021). Recommendation systems identify the most relevant knowledge to be applied, while AI-driven tools automate routine procedures and facilitate more effective knowledge transfer to employees (Maedche et al., 2019; Taherdoost & Madanchian, 2023). Moreover, AI enhances human–machine collaboration within the workplace, promoting cooperative learning and the contextual transfer of knowledge (Siwach & Li, 2024).

Practical cases, such as Repsol's implementation of AI in its oil drilling operations, demonstrate these benefits vividly. The company achieved a 40%–50% reduction in non-productive time by using AI to simulate and assess millions of scenarios, enabling engineers to evaluate outcomes rapidly (Majumder & Dey, 2024). Such examples underscore AI's capacity to serve as a core driver of knowledge activation in modern organisations through intelligent tools that foster innovation, operational efficiency, and sustainability. Through these capabilities, AI significantly supports all phases of the knowledge management cycle—from creation and acquisition to storage, dissemination, and application. Based on this understanding, the following overarching hypothesis and sub-hypotheses are proposed:

H2: Artificial intelligence positively influences knowledge management. with the following sub-hypotheses:

H2-1: Artificial intelligence positively influences knowledge generation.

H2-2: Artificial intelligence positively influences knowledge storage and sharing.

H2-3: Artificial intelligence positively influences knowledge application.

In light of rapid environmental transformations and the growing imperative for resource sustainability, KM has become a strategic pillar in fostering green innovation. As knowledge constitutes a foundational organisational resource, aligning it with environmentally friendly practices directly enhances organisational performance across economic, ecological, and social dimensions (Kaur, 2022; Wang et al., 2024).

Knowledge generation represents the initial step in advancing green innovation. This is facilitated through interpersonal interaction, experience sharing, and the development of novel ideas concerning environmental practices and green technologies (Chamba-Rueda et al., 2021; Gauthier & Zhang, 2020). Newly generated knowledge enables organisations to understand their internal strengths and weaknesses while proactively anticipating environmental challenges (Alkaraan et al., 2024). Embedding an environmental culture within the organisation also encourages the creation of innovative environmental concepts and motivates employees to respond effectively to ecological changes (Asiaei et al., 2022). This process contributes to both proactive green innovation—by designing forward-looking environmental solutions - and reactive green innovation - through stakeholder engagement and the mobilisation of collective intelligence (Bachtiar et al., 2024; Bai et al., 2022).

Knowledge storage systems serve as the backbone for documenting and transferring environmental ideas and sustainable technologies. When green knowledge is centralised, it becomes readily accessible for continuous development and cross-functional utilisation (Mukhtar et al., 2023). Knowledge sharing further facilitates cognitive interaction among researchers, practitioners, and communities, thereby expanding the potential for environmental innovation (Abu-AlSondos, 2023; Allioui & Mourdi, 2023). Knowledge storage and dissemination act as key drivers of both proactive green innovation - by enabling the transfer and documentation of successful environmental experiences - and reactive green innovation - by supporting collaborative efforts to address ongoing ecological challenges (Sestino et al., 2023; Tabuenca et al., 2024).

Knowledge application refers to the integration of knowledge into practical activities aimed at developing green products and services (Mothe et al., 2017). This is reflected in an organisation's ability to convert environmental insights into actionable solutions, thereby enhancing its responsiveness to environmental and competitive pressures (Barão et al., 2017; Ben Arfi et al., 2018). In the case of proactive innovation, knowledge application helps forecast environmental crises and formulate pre-emptive solutions (Fosu et al., 2024; Maheshwari et al., 2024). In the reactive context, participatory knowledge application enables improved environmental responses based on continuous feedback from stakeholders (Feng et al., 2022; Valujeva et al., 2023).

Thus, knowledge management - encompassing the generation, storage, and application of knowledge - plays a decisive role in advancing both proactive and reactive forms of green innovation. It constitutes the cognitive foundation upon which future environmental solutions are constructed. Accordingly, the following hypotheses are proposed:

H3: Knowledge management positively influences green innovation, with the following sub-hypotheses:

H3-1: Knowledge management positively influences proactive green innovation.

H3-2: Knowledge management positively influences reactive green innovation.

H4: Knowledge management positively moderates the relationship between artificial intelligence and green innovation, with the following sub-hypotheses:

H4-1: Knowledge management positively moderates the relationship between artificial intelligence and proactive green innovation.

H4-2: Knowledge management positively moderates the relationship between artificial intelligence and reactive green innovation.

3. Methodology

3.1 Data Collection and Sampling

The present study adopted a deductive research approach, which aligns closely with the positivist paradigm (Abdulmuhsin, Valeri, et al., 2025). This philosophical orientation facilitated the formulation and analytical testing of hypotheses within a probabilistic framework of expected outcomes. To ensure representative coverage of major state-owned oil companies in Iraq, the study employed random sampling techniques from databases comprising over 7,000 engineers employed in these companies across the northern, central, and southern regions. This sampling strategy ensured neutral and representative cross-sectional selection of participants from the Iraqi state-owned oil sector.

Data were collected using a two-part structured questionnaire. The first section gathered demographic information, including gender, age, educational background, and work experience. The second section contained 47 items related to the latent constructs under investigation. Given that the majority of the targeted participants were native Arabic speakers, the questionnaire was translated into Arabic to maintain linguistic and conceptual accuracy with the original measurement items (Abdulmuhsin, Owain, Dbesan, Alkhwaldi, et al., 2025).

The survey was designed using Google Forms and distributed via email through company-specific databases. To maximise the response rate, multiple engagement strategies were employed, including polite reminder emails and the use of professional intranet networks (Abdulmuhsin, Owain, Dbesan, Bhat, et al., 2025). The study also verified that all respondents possessed sufficient domain-specific knowledge relevant to their professional roles. The research targeted the three largest state-owned oil companies in Iraq. A random sample of engineers was surveyed between May and December 2024. From an initial pool of 700 randomly selected engineers (selected at a ratio of 1 in 10 based on their order in the database), a total of 572 valid responses were received and deemed suitable for analysis, resulting in a response rate of 81.71%. *Table 1* presents the demographic characteristics of the participants.

Table 1. Respondents' demographics.

Categories	*Details*	#	%
Gender	*Male*	475	83.0
	Female	97	17.0
Education	*PhD*	56	9.8
	MSc	191	33.4
	Bachelor	325	56.8
Age (#years)	*Less than 33*	193	33.7
	33 – 42	222	38.8
	43 – 52	103	18.0
	More than 52	54	9.4
Job Experience (#years)	*Less than 11*	140	24.5
	11 – 20	193	33.7
	21 – 30	159	27.8
	More than 30	80	14.0

Notes: *N=572*
Source: *Authors' own work*

3.2 Measurement of Constructs

This study examined three principal variables. The construct of artificial intelligence (AI) was measured using 13 items, adapted from prior studies including Al Mansoori et al. (2021), Al-Sharafi et al. (2022), and El Bhilat et al. (2024). The knowledge management (KM) construct was assessed using 26 items, adapted from studies such as Al Yami et al. (2021), Botega and da Silva (2020), and Raudeliuniene et al. (2020). Specifically, the KM scale comprised: 8 items for *knowledge generation*, 12 items for *knowledge storage and sharing*, 6 items for *knowledge application*. The green innovation (GI) construct was measured using 8 items, evenly distributed between *proactive green innovation* and *reactive green innovation*. These items were drawn from established sources, including Chen et al. (2006), Chen et al. (2012), and Trivedi and Srivastava (2023). All items were rated on a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.3 Data Analysis Strategy

Data analysis for this study was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM) with the support of SmartPLS version 3.2.9. PLS-SEM is a robust statistical tool particularly suited for examining complex theoretical relationships between observed and latent variables (Rehman et al., 2025). This technique is especially valuable in management research, where many constructs are inherently abstract and cannot be directly measured (Abed et al., 2021). The decision to employ PLS-SEM was based on three key considerations. First, the complex structure of the study's constructs aligns well with the multivariate analytical capabilities of PLS-SEM (Hair Jr et al., 2017). Second, the method's ability to assess both direct and indirect relationships among variables enables a comprehensive approach to model development and evaluation (Hair Jr et al., 2011). Third, the sample size exceeded the minimum threshold of 100 observations recommended by Churi et al. (2021), thereby establishing a statistically sound basis for the use of PLS-SEM in this research.

4. Results

4.1 Measurement Model Assessment

The evaluation of the measurement model was conducted to establish the reliability and validity of the latent constructs, which are AI, KM, and GI. Reliability was assessed using Cronbach's alpha (α) and Composite Reliability (CR). As shown in *Table 2*, all constructs exceeded the recommended threshold of 0.70 (Hair Jr et al., 2011), with Cronbach's alpha values ranging from 0.895 to 0.960, and CR values from 0.916 to 0.963, indicating strong internal consistency.

Convergent validity was established through Average Variance Extracted (AVE), with all constructs exceeding the minimum recommended value of 0.50. The AVE values were 0.661 (AI), 0.598 (KM), and 0.577 (GI), suggesting that the items significantly reflect their respective constructs. Discriminant validity was assessed using the Fornell–Larcker criterion and HTMT (Heterotrait–Monotrait) ratio. As presented in *Table 3*, the square roots of the AVE (bold diagonal values) for each construct were greater than their correlations with other constructs, satisfying the Fornell–Larcker criterion. HTMT values (italicised) were also below the conservative threshold of 0.85, confirming discriminant validity (Alshaher et al., 2022).

Table 2. Correlation analysis.

Constructs	M (SD)	Kurtosis (Skewness)	1	2	3
1. AI	3.489 0.621	-0.219 (-0.082)	1		
2. KM	3.963 0.715	-0.247 (-0.030)	0.687	1	
3. GI	4.005 0.679	-0.129 (-0.084)	0.638	0.766	1
Cronbach's alpha (α)			0.957	0.960	0.895
Composite Reliability (CR)			0.962	0.963	0.916
Average Variance Extracted (AVE)			0.661	0.598	0.577

***Notes**: N=572, **P<0.001, M=Mean, SD=Standard Deviation.*
***Source:** Authors' own work*

Table 3. Constructs' Discriminant validity.

Constructs	AI	KM	GI
AI	**0.813**	*0.717*	*0.689*
KM	0.687	**0.706**	*0.827*
GI	0.638	0.766	**0.760**

***Notes: Bold number= √AVE,** Italic number=HTMT*
***Source:** Authors' own work*

4.2 Structural Model Assessment

The structural model was evaluated to test the hypothesised relationships among AI, KM, and GI, including their subdimensions - proactive green innovation (PGI), reactive green innovation (RGI), and the three KM processes (knowledge generation, storage and sharing, application). The path coefficients (β), t-statistics, p-values, effect sizes (f^2), and R^2 values are reported in *Table 4*. The direct effect of AI on GI was significant (β = 0.211, t = 9.683, $p < 0.001$), supporting H1. Furthermore, both dimensions of GI—PGI and RGI—were significantly influenced by AI, supporting H1-1 (β = 0.184, $p < 0.001$) and H1-2 (β = 0.186, $p < 0.001$).

AI also had a substantial positive impact on KM (H2, β = 0.687, t = 55.586, $p < 0.001$), with significant effects observed across all KM subdimensions: Knowledge Generation (H2-1, β = 0.578, $p < 0.001$), Knowledge Storage & Sharing (H2-2, β = 0.622, $p < 0.001$), and AI → Knowledge Application (H2-3, β = 0.542, $p < 0.001$). KM also significantly influenced GI (H3, β = 0.622, $p < 0.001$), including both PGI (H3-1, β = 0.543, $p < 0.001$) and RGI (H3-2, β = 0.548, $p < 0.001$).

Table 3. The path analysis of the study model

Relationships	*β*	*SD*	*T Statistics*	*P Values*	*F^2*	*R^2*	*Results?*
H1: AI → GI	0.211	0.022	9.683	0.000	0.060	0.611	*Accept*
H1-1: AI → GI → PGI	0.184	0.019	9.717	0.000	0.060	0.764	*Accept*
H1-2: AI → GI → RGI	0.186	0.019	9.640	0.000	0.060	0.777	*Accept*
H2: AI → KM	0.687	0.012	55.586	0.000	0.894	0.472	*Accept*
H2-1: AI → KM → Kg	0.578	0.012	46.236	0.000	0.894	0.707	*Accept*
H2-2: AI → KM → KSS	0.622	0.012	50.825	0.000	0.894	0.819	*Accept*
H2-3: AI → KM → Ka	0.542	0.014	40.147	0.000	0.894	0.623	*Accept*
H3: KM → GI	0.622	0.020	31.493	0.000	0.524	0.611	*Accept*
H3-1: KM → GI → PGI	0.543	0.018	29.699	0.000	0.524	0.764	*Accept*
H3-2: KM → GI → RGI	0.548	0.018	30.526	0.000	0.524	0.777	*Accept*
H4: AI → KM → GI	0.427	0.016	26.674	0.000	0.060	0.611	*Accept*
H4-1: AI → KM → GI → PGI	0.373	0.015	25.072	0.000	0.060	0.764	*Accept*
H4-2: AI → KM → GI → RGI	0.376	0.015	25.594	0.000	0.060	0.777	*Accept*

***Note**: β = Standard regression, SD = Standard Deviation.*
NFI = 0.919, SRMR = 0.042
***Source:** Authors' own work*

The mediation role of KM was also confirmed. AI's indirect effect on GI through KM was statistically significant (H4, β = 0.427, $p < 0.001$), as were its effects on PGI (H4-1, β = 0.373, $p < 0.001$) and RGI (H4-2, β = 0.376, $p < 0.001$). Effect sizes (f^2) ranged from 0.060 (small) to 0.894 (large), particularly for the paths from AI to KM subdimensions, indicating substantial predictive relevance. The R^2 values were moderate to substantial: GI (0.611), PGI (0.764), RGI (0.777), KM (0.472), Kg (0.707), KSS (0.819), and Ka (0.623), confirming the model's strong explanatory power.

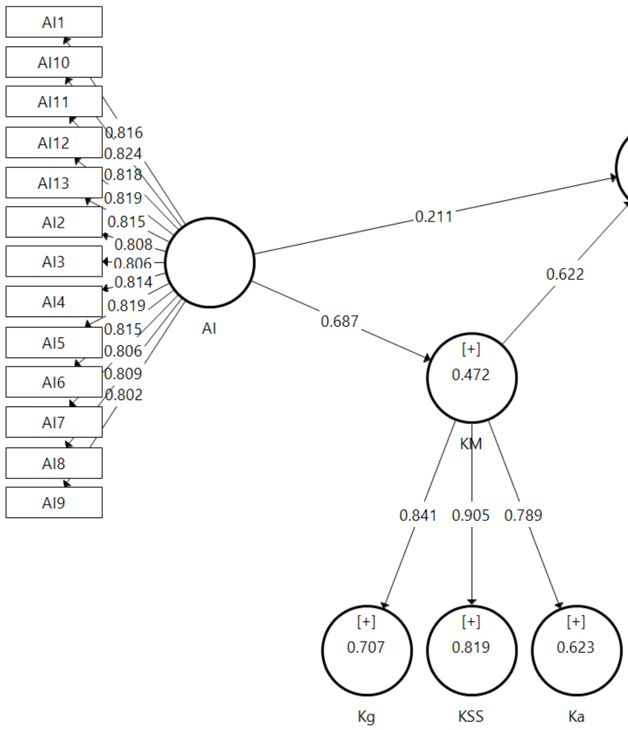
4.3 Model Fit Indices

Model fit was evaluated using Standardised Root Mean Square Residual (SRMR) and Normed Fit Index (NFI). The model exhibited an SRMR of 0.042 and an NFI of 0.919, both within acceptable thresholds (SRMR < 0.08, NFI > 0.90), indicating an excellent model fit (Alkhwaldi et al., 2025; Bhat et al., 2025). The structural model is illustrated in *Figure 1*, highlighting the significant pathways between AI, KM, and GI and their respective subdimensions, with standardised loadings supporting construct validity.

5. Discussion

This study provides compelling empirical evidence underscoring the pivotal role of AI in fostering GI within the Iraqi oil industry. By integrating AI capabilities with KM processes, the research unveils a complex, yet coherent, pathway through which organisations can strategically respond to sustainability imperatives. The findings contribute to an emerging body of scholarship situated at the intersection of digital transformation and environmental sustainability (Brynjolfsson & Mitchell, 2017; Budhwar et al., 2023).

Figure 1. The structural model of the study



Source: *Authors' own work*

The direct positive relationship between AI and green innovation (β = 0.211, $p < 0.001$) validates H1 and aligns with previous research asserting that AI technologies can enhance eco-innovative outcomes (Chen et al., 2006; Panda et al., 2024). Specifically, AI exhibited significant influence on both proactive GI (H1-1: β = 0.184) and reactive GI (H1-2: β = 0.186), supporting the notion that AI not only anticipates environmental trends but also enables firms to adapt to evolving regulatory and stakeholder demands. These findings reflect the dual function of AI: as a strategic foresight tool and as a tactical problem-solving mechanism (Filiou et al., 2023). In proactive terms, AI enables predictive modelling of environmental risks and emissions, allowing oil firms to develop technologies and strategies ahead of regulatory enforcement. This is crucial in countries like Iraq, where environmental regulations are still evolving and often inconsistently enforced. On the reactive side, AI-driven systems help organisations swiftly respond to stakeholder pressures, such as international reporting requirements, ESG metrics, and investor demands for decarbonisation (Kuang et al., 2021; Panda et al., 2024). These outcomes reinforce AI's potential to redefine environmental governance in the oil industry, transitioning it from compliance-focused to innovation-driven. In regions where environmental management has historically been underprioritised, AI offers an automated and data-rich alternative to traditional, manual, and often inefficient monitoring systems.

AI demonstrated a strong predictive effect on KM (H2: $\beta = 0.687$, $p < 0.001$), affirming the argument that intelligent systems facilitate organisational learning by optimising knowledge flows (Nakash & Bouhnik, 2021). This relationship extended across all three KM subdimensions—knowledge generation (H2-1: $\beta = 0.578$), storage and sharing (H2-2: $\beta = 0.622$), and application (H2-3: $\beta = 0.542$)—thereby reinforcing AI's capacity to support organisational memory, learning, and decision-making capabilities (Bhatt, 2001; Ferreira et al., 2024). These outcomes suggest that AI is instrumental not only in gathering environmental knowledge but also in operationalising it to support innovation and sustainability initiatives. The relationship between AI and KM is particularly salient for oil companies in developing countries, where tacit knowledge is often concentrated among a small cadre of senior engineers and technical experts (Abdulmuhsin et al., 2024). AI systems can codify, scale, and operationalise this knowledge, thereby reducing knowledge silos and addressing succession planning issues. The positive effects across all KM subprocesses - knowledge generation, storage and sharing, and application - demonstrate that AI fosters an intelligent organisational memory and supports evidence-based decision-making even in volatile contexts (Bhatt, 2001; Nakash & Bouhnik, 2021). For Iraqi oil firms operating under infrastructural constraints and international scrutiny, such a digitally enabled KM system ensures operational continuity, minimises human error, and facilitates cross-generational knowledge transfer - especially important given the demographic gap between experienced workers and digitally literate younger engineers.

Confirming H3, KM exhibited a significant positive impact on green innovation ($\beta = 0.622$), with strong effects on both proactive (H3-1: $\beta = 0.543$) and reactive (H3-2: $\beta = 0.548$) GI. These results align with the knowledge-based view (KBV) of the firm, which posits that organisations derive competitive advantage by leveraging and mobilising internal knowledge assets (Serenko, 2021). Notably, KM enables the translation of environmental insights into concrete green practices, thereby linking intellectual capital to sustainability outcomes (Asiaei et al., 2022; Barão et al., 2017). The results strongly confirm that KM enhances green innovation, particularly through proactive and reactive pathways. In the oil context, where environmental degradation and resource depletion are acute, embedding environmental knowledge into routine operations is not just a competitive advantage but a socio-political necessity (Abdulmuhsin et al., 2024). KM allows firms to develop eco-centric competencies by capturing field-level innovations - such as leak detection, emission control, and equipment efficiency - and scaling them across departments and geographies. In resource-constrained environments, formalising these knowledge assets helps reduce dependence on external consultants and costly imported technologies. Furthermore, the dissemination of context-specific green practices among oil engineers and technicians enhances organisational resilience and long-term ecological performance (Allioui & Mourdi, 2023; Asiaei et al., 2022).

The indirect effects of AI on GI via KM (H4: $\beta = 0.427$, $p < 0.001$) further elucidate the central thesis of this study: that KM processes serve as critical mediators in the digital-green nexus. This mediation holds for both proactive (H4-1: $\beta = 0.373$) and reactive (H4-2: $\beta = 0.376$) dimensions of GI. The significance of these indirect paths underscores that AI's environmental benefits are contingent upon the organisation's ability to institutionalise knowledge practices (Alavi & Leidner, 2001; Goel et al., 2022). In effect, KM amplifies the transformative power of AI by ensuring that insights generated by intelligent systems are shared, contextualised, and applied effectively within the organisation. The mediating role of KM in the AI-GI relationship adds theoretical nuance and practical depth to our understanding of innovation systems in developing countries. AI alone is insufficient unless its analytical outputs are internalised, shared, and actioned within the firm. KM processes serve as the 'absorptive capacity' that converts AI-derived insights into operational change, product redesign, or process optimisation (Alavi & Leidner, 2001; Goel et al., 2022). In Iraqi NOCs, where bureaucratic inertia and hierarchical decision-making often hinder innovation, KM systems offer a structured mechanism for diffusing AI-enhanced environmental intelligence throughout the organisation (Abdulmuhsin et al., 2024). The significance of the indirect effects on both proactive and reactive GI further suggests that in developing-country contexts, environmental innovation must be underpinned by both technological capabilities and internal knowledge infrastructures. The dual emphasis on people (KM) and platforms (AI) aligns with socio-technical systems theory, reinforcing the importance of harmonising technological tools with organisational routines and human expertise.

The structural model demonstrates strong explanatory power (R^2 up to 0.819) and satisfactory model fit indices (SRMR = 0.042; NFI = 0.919), validating the reliability of the relationships tested. The high Composite Reliability (CR) and Cronbach's Alpha ($\alpha > 0.89$) for all constructs confirm the internal consistency of the measures used. These indicators are particularly notable given the study's context—a developing economy with unique institutional and environmental complexities—which attests to the model's robustness and cross-contextual relevance.

6. Conclusion

This study investigated the interrelationships between AI, KM, and GI, with a particular focus on proactive and reactive innovation practices in Iraq's oil sector. By employing a robust PLS-SEM approach on a sample of 572 oil engineers from state-owned petroleum companies, the findings establish a comprehensive and empirically supported model in which AI serves as a significant enabler of green innovation, both directly and indirectly through KM processes. Specifically, AI positively influences knowledge generation, storage and sharing, and application—subsequently promoting green innovation initiatives that are either anticipatory of or responsive to environmental demands.

In resource-rich yet institutionally constrained contexts such as Iraq, where oil firms are under growing pressure to align with international sustainability norms, the convergence of AI and KM emerges as a pivotal strategy. This integration not only drives technological modernisation but also enhances environmental responsiveness and innovation agility. The study thereby contributes a novel framework that addresses critical gaps in the environmental innovation literature, particularly in the under-explored domain of digital transformation within the oil industry in developing economies.

6.1 Theoretical Implications

This research contributes to theoretical development in several meaningful ways. *First*, it enriches the literature on green innovation by dissecting its dual dimensions - proactive and reactive - thus offering a more granular understanding of how environmental innovation manifests across strategic and operational levels. *Second*, it extends the discourse on the role of AI in sustainability by demonstrating that AI does not act in isolation but requires strong internal knowledge infrastructures to maximise its innovation potential. This highlights KM as a critical mediating mechanism, a conceptual "bridge" that operationalises the value of AI insights. *Third*, the study contributes to organisational knowledge theory by empirically validating the three-stage KM framework - generation, storage/sharing, and application - as key antecedents to innovation in environmentally complex and data-intensive sectors such as oil and gas. This aligns with and extends Nonaka (1994)'s SECI model and Alavi and Leidner (2001)'s framework into the digital sustainability domain. *Finally*, by focusing on oil companies in a developing country, the study contextualises these relationships within an environment characterised by institutional fragility, limited regulatory enforcement, and human capital asymmetries - thereby enriching the boundary conditions of current innovation and KM theories.

6.2 Practical and Managerial Implications

The findings of this study offer strategic and actionable insights for managers, policymakers, and technology strategists in the oil and energy sectors of developing countries. Managers in state-owned oil companies should integrate AI tools not only for operational efficiency but also for fostering environmental innovation. Predictive analytics, sensor networks, and intelligent automation can serve as catalysts for both regulatory compliance and competitive green positioning. To fully capitalise on AI capabilities, organisations must build robust KM systems that institutionalise knowledge flows. This includes investing in digital repositories, incentivising knowledge sharing among field engineers, and formalising feedback loops from green project outcomes. Rather than treating AI and KM as discrete functions, oil companies should develop integrated AI-KM platforms that allow real-time knowledge capture, contextual analysis, and application in field operations. Smart dashboards, digital twins, and AI-enhanced training systems are examples of such integrations. Given the unique socio-political and infrastructural constraints in developing countries, green innovation strategies must be contextually embedded. This means aligning AI investments with local capacity-building, environmental challenges (e.g. gas flaring, water use), and indigenous knowledge. Governmental bodies and regulatory agencies in developing economies should support the digital transformation of public oil companies by mandating ESG disclosures and incentivising AI-driven green initiatives through subsidies or technology transfer programmes. Thus, the study affirms that for oil companies in developing economies to transition toward sustainable operations, they must treat AI and KM not as auxiliary functions but as core enablers of strategic environmental innovation.

7. Limitations and Future Research Directions

Despite its valuable contributions, this study is subject to several limitations that offer pathways for future research. Firstly, the study's cross-sectional design limits the ability to draw causal inferences. Although PLS-SEM is a powerful method for testing theoretical models, future research should consider longitudinal approaches to assess how the relationships among AI, KM, and green innovation evolve over time, particularly as digital maturity progresses in the oil sector. Secondly, the study is contextually bound to state-owned oil companies in Iraq - a developing country with distinct institutional, cultural, and regulatory characteristics. While this specificity enriches the contextual relevance of the findings, it may limit generalisability to other industries or countries. Future research could undertake comparative studies between public and private oil firms, or between firms in high-income versus low-income contexts, to test the external validity of the proposed model. Thirdly, this study focused on engineers' perceptions and organisational-level innovation practices, without incorporating external stakeholder views such as suppliers, regulators, or communities. Given the systemic nature of green innovation, future studies should adopt multi-stakeholder perspectives to capture broader environmental, social, and governance (ESG) dynamics. Moreover, although the model captured three core KM processes, it did not explore how organisational culture, leadership styles, or absorptive capacity might moderate or mediate these relationships. Integrating such constructs could yield a richer understanding of the socio-technical ecosystem surrounding green innovation in resource-intensive sectors. Finally, while AI was treated as a multidimensional construct, this study did not distinguish between different types of AI (e.g., machine learning, expert systems, NLP). Future research could explore how specific AI technologies differentially affect knowledge processes and innovation outcomes, thereby offering more granular managerial guidance.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

Authors' contributions

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published this version of the manuscript.

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Data availability

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Appendix A. Study Questionnaire Items

Artificial Intelligence (AI), *Adapted from El Bhilat et al. (2024); Al Mansoori et al. (2021); Al-Sharafi et al. (2022)*

> *"Our organisation uses AI tools to improve decision-making efficiency. AI is used to analyse environmental data to support green strategies. We utilise AI for forecasting and predictive analytics in operations. AI helps identify risks related to environmental management. AI systems assist in real-time monitoring of performance indicators. Our*

organisation integrates AI with existing business processes. Employees are trained to work with AI applications. AI contributes to process automation in our organisation. We use AI to support R&D activities. AI applications enhance supply chain and logistics operations. AI supports strategic planning through data-driven insights. Our company allocates investment in AI to promote innovation. We apply AI to optimise resource usage and reduce waste."

Knowledge Management (KM), *Adapted from Al Yami et al. (2021); Raudeliuniene et al. (2020); Botega & da Silva (2020)*

Knowledge Generation (8 items)

"Our organisation encourages the development of new ideas. AI tools support the generation of novel knowledge. We actively explore innovative ways to improve environmental practices. Employees contribute their insights to knowledge creation. Cross-functional teams collaborate to generate solutions. Environmental challenges are used to stimulate idea generation. Learning from past projects is promoted. We adapt external knowledge to improve our operations."

Knowledge Storage and Sharing (12 items)

"Knowledge is systematically documented for future use. Environmental best practices are stored in digital repositories. AI is used to index and retrieve stored knowledge. Our employees have easy access to stored knowledge. There is a culture of knowledge sharing in the organisation. Employees are encouraged to share knowledge informally. Our systems support sharing knowledge across departments. Environmental data and experiences are shared regularly. Knowledge from past projects is reused in new initiatives. Knowledge repositories are kept up to date. Our knowledge systems help avoid repeating mistakes. Experts contribute actively to knowledge-sharing platforms."

Knowledge Application (6 items)

" We apply previously acquired knowledge to solve new problems. Knowledge is used to improve environmental decision-making. AI recommendations are implemented in operational processes. Employees utilise organisational knowledge to meet sustainability goals. Environmental knowledge is embedded in routine tasks. We customise knowledge application based on project needs."

Green Innovation (GI), *Adapted from Y.-S. Chen et al. (2016b); Y. S. Chen et al. (2012); Trivedi & Srivastava (2023)*

Proactive Green Innovation (4 items)

"We develop green products or processes before being required by regulation. Our organisation invests in eco-innovation to gain competitive advantage. We proactively identify opportunities for environmental improvement. We innovate to reduce environmental impact beyond compliance."

Reactive Green Innovation (4 items)

"We modify existing products or operations in response to environmental regulations. Customer demands for green solutions drive our innovation. We react to competitors' environmental practices by adapting our own. Environmental innovation is often triggered by external pressures."

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Knowledge management in metaverse: does knowledge storage matter as a factor affecting adoption and acceptance?

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Abstract:
This study aims to examine the behavioral intention of educators in higher education institutions regarding the adoption of knowledge management-driven metaverse technology (KM-D-MT). Grounded in unified theory of acceptance and use of technology 2 (UTAUT2), this research aims to enhance understanding of metaverse adoption factors, examining correlations among key constructs such as performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), perceived value (PV), hedonic motivation (HM), stability and knowledge storage. Using a cross-sectional design and a quantitative approach, this study collects 278 responses from medical college educators and employs structural equation modeling-partial least squares to analyze the data, assessing the reliability and validity of research instruments. The findings reveal significant positive impacts of PE, PE, SI, FC, PV and HM on the behavioral intention to adopt KM-D-MT. Stability is identified as a key factor positively influencing knowledge storage. In addition, knowledge storage shows positive correlations with behavioral intention. This study highlights the transformative potential of metaverse technology in reshaping knowledge management processes. In terms of originality, this research contributes significantly to theoretical perspectives by advancing metaverse research, extending UTAUT2 frameworks in the medical education context and contributing to knowledge management paradigms. The study's exploration of metaverse adoption in Iraqi medical colleges provides valuable insights for global research and practical applications.

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The *UrNammu Journal of Business, Accounting and Technology Management (UJBATM)* welcomes submissions of original, high-quality research articles, review papers, and case studies that align with the journal's scope. The following guidelines are intended to help authors prepare and submit their manuscripts effectively and ethically.

🔰 Before You Start

For questions regarding the status of your manuscript—before or after acceptance—please contact the **Editor-in-Chief**. Editorial contact information is available on the journal's website under the "Editorial Team" section.

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UJBATM is committed to providing authors with a professional and respectful peer-review and publishing experience. In turn, we expect authors to uphold the following responsibilities:

- **Respond Promptly:** Authors should reply to editorial queries and reviewer comments in a timely manner.
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If your research involves **human participants**, you must obtain approval from an institutional ethics committee and provide informed consent from participants. Submit a declaration of ethical compliance with your manuscript, and refer to our detailed Research Ethics Guidelines for clarification.

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We support openness in research. Authors are encouraged to:

- Reference all datasets, software, and tools used in the study
- Use persistent identifiers such as DOIs
- Ensure compliance with data protection and privacy regulations
- Follow guidelines outlined in our **Research and Publishing Ethics Statement**

🛠️ Prepare Your Submission

We recommend using **UrNammu Academy's Manuscript Services** (optional) for support with:

- Language editing and translation
- APA referencing
- Formatting, visual design, or abstract optimisation

This support is paid and optional. Using it does **not guarantee** acceptance or expedited review.

📐 Manuscript Requirements

🔹 **File Format**

- Submit manuscripts in **Microsoft Word (.doc or .docx)** format.
- PDF may be attached as supplementary, not primary format.
- LaTeX submissions are **not accepted**.

🔹 **Length and Structure**

- Research articles: **10,000–15,000 words** (including references, tables, figures, appendices)
- Abstract: Maximum 250 words
- Keywords: Up to 6 relevant terms

Use this general structure:

1. Title
2. Abstract (structured)
3. Keywords
4. Introduction
5. Literature Review
6. Methodology
7. Results
8. Discussion
9. Conclusion and Implications
10. References

✍️ Manuscript Elements

🔸 Article Title

- Maximum 20 words
- Clear, concise, and relevant

🔸 Author Information

Each author must register on the **OJS system** and provide:

- Full name
- Institutional affiliation
- Email address
- ORCiD ID (strongly recommended)

List authors in the preferred order of publication. Upload **bios (max 100 words each)** and acknowledgements as a **separate file**.

🔸 Research Funding

Disclose all funding sources, including the funder's role in the research.

🔸 Structured Abstract Format (max 250 words)

Use the following subheadings:

- **Purpose**
- **Design/methodology/approach**
- **Findings**
- **Originality/value**

Optional subheadings:

- **Research limitations/implications**
- **Practical implications**
- **Social implications**

🔸 Headings Format

- **Level 1:** Bold

- **Level 2:** Italics
- **Level 3:** Sentence case (no formatting)

🔸 **Figures**

- Accepted formats: .jpeg, .png, .eps, .tif
- Inserted into the manuscript and submitted as separate files
- Include clear captions, credit lines, and figure numbers (Figure 1, Figure 2…)

🔸 **Tables**

- Submit tables in a separate Word document
- Indicate placement in text: (Insert Table I here)
- Use Roman numerals (I, II, III…)

📚 Referencing Style: APA 7th Edition

All in-text citations and reference lists must follow **APA (7th edition)**. Please refer to the journal's **APA Style Guide** available on the website for examples and formatting.

🛡️ Plagiarism Policy

UJBATM has a **zero-tolerance policy** for plagiarism and academic misconduct. All manuscripts are screened using plagiarism detection software (e.g., Turnitin). Manuscripts with:

- 15% similarity (excluding references/methodology) will be returned or rejected
- Fabricated or manipulated data will be escalated to the editorial board and may be blacklisted

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📤 Submit Your Manuscript

All manuscripts must be submitted through the **UJBATM Open Journal System (OJS):**

🌐 https://ujbatm.urnammuacademy.org

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📬 After Submission

- You will receive a confirmation email with your **manuscript ID**.
- The manuscript will be **screened for scope and quality**, then sent for **double-blind peer review** by at least two independent reviewers.
- A decision (Accept / Revise / Reject) will be communicated within **60 days**.

All updates can be tracked via your OJS dashboard.

✅ **If Accepted**

- You will receive a request to sign the **Creative Commons Licence (CC BY 4.0)**
- **Article Processing Charges (APCs)** will be applied as per journal policy
- Final editing and typesetting will follow, and **page proofs** will be sent to the corresponding author
- Once approved, your article will be published **online with a DOI** and assigned to the next issue

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