

## Article

# Perceived AI-Related Support and Sustainable Administrative Performance in Universities: The Role of Expert Systems, Automated Machine Learning, and Ease of Use

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## Abstract

This study examines administrative staff perceptions of selected AI-related dimensions and their association with sustainable administrative performance at the University of Hail. Specifically, it focuses on expert systems, automated machine learning, and ease of use as perceived dimensions of AI-related administrative support. **Methodology:** A quantitative cross-sectional survey design was employed. Data were collected using a structured Likert-scale questionnaire administered to a purposive sample of 230 administrative staff members. Descriptive statistics and regression analysis were used to assess the perceived level of AI-related support and its association with sustainable administrative performance. **Results:** The overall perceived level of AI-related support was moderate, indicating partial integration of AI-related practices in administrative work. Expert systems, automated machine learning, and ease of use each showed a positive and statistically significant association with sustainable administrative performance. Expert systems showed the strongest standardized association. Collectively, the three dimensions explained a substantial proportion of the variance in sustainable administrative performance. **Limitations:** The study is limited by its cross-sectional design, reliance on self-reported questionnaire data, and focus on a single university using purposive sampling, which restricts causal interpretation and generalizability. The findings also reflect perceptions rather than objectively verified implementation data.

**Keywords:** artificial intelligence; sustainability; sustainable administrative performance; expert systems; automated machine learning; ease of use

**Key Contribution:** The study provides an initial institutional perspective on how administrative staff perceive the contribution of selected AI dimensions to sustainability-oriented administrative performance in higher education, while emphasizing cautious interpretation within the limits of perceptual cross-sectional data.



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## 1. Introduction

Technological change has reshaped contemporary societies in ways that extend beyond innovation itself to influence how institutions operate, govern, and sustain their core functions [1]. This transformation, often described as a smart or digital revolution, has been driven by advances in digitization, global connectivity, and the exponential growth of data availability, enabling unprecedented access to knowledge and information [2].

Unlike earlier technological shifts, current developments are characterized by their depth and speed, as digital systems increasingly permeate organizational structures rather than merely supporting them [3].

Within this broader transformation, the technologies associated with the Fourth Industrial Revolution, such as artificial intelligence, robotics, intelligent networks, and data-driven systems, have altered how organizations manage resources, coordinate processes, and make decisions [4]. Universities, as knowledge-intensive institutions, are particularly affected by these changes. Their traditional administrative models are no longer sufficient to respond to growing demands for efficiency, accountability, and long-term viability [5]. Consequently, digital transformation in higher education is no longer a matter of modernization alone but a strategic requirement for sustainable university management.

Artificial intelligence occupies a central position in this transformation because it enables organizations to move beyond routine automation toward adaptive and knowledge-based decision support [6]. Through intelligent algorithms and data-processing capabilities, AI systems simulate selected aspects of human reasoning and learning, allowing administrative processes to become more responsive and less dependent on manual intervention [7]. In university contexts, such systems support planning, monitoring, and evaluation activities that directly affect administrative performance and institutional continuity [8].

The growing strategic importance of AI-driven information systems has been highlighted in studies examining contemporary developments in communication and management technologies [9]. According to ref. [10] notes that information systems have evolved into integral components of administrative and financial infrastructures in universities, shaping how decisions are formulated and implemented. Rather than functioning as auxiliary tools, these systems increasingly determine the quality, speed, and consistency of administrative outcomes. Similarly, the adoption of innovative AI applications has been associated with enhanced institutional competitiveness and improved positioning in international university rankings [11], indicating that technological capability is closely linked to sustained organizational advantage.

Recent research further suggests that universities are turning to AI-enabled administrative practices not only to improve performance metrics but also to strengthen institutional continuity and adaptability in rapidly changing environments [12]. Intelligent systems facilitate error detection, data integration, and process optimization, which reduces procedural inefficiencies and supports stable service delivery over time [13]. In knowledge-based societies, this shift reflects a broader emphasis on intelligent knowledge management, where artificial intelligence contributes to organizational learning by integrating theories, methods, and applications designed to enhance human and institutional intelligence [14]. Core AI technologies including automated machine learning, natural language processing, expert systems, and data mining have thus become embedded within contemporary university management frameworks [15].

From an administrative perspective, performance is no longer evaluated solely in terms of immediate effectiveness or output volume. Instead, universities increasingly assess performance through the lens of sustainability, emphasizing the capacity to maintain efficiency, ensure service quality, and adapt to future challenges [3]. According to [16] argues that AI applications such as automated assistance tools and digital communication platforms positively influence administrative efficiency by reducing time and effort while improving accessibility and service delivery. These improvements contribute not only to short-term productivity but also to the long-term stability of administrative systems [1]. Accordingly, performance evaluation has become a strategic mechanism for assessing institutional progress, resource utilization, and developmental capacity within structured technological environments [17].

In parallel, global discussions on sustainability increasingly recognize the role of digital technologies in supporting responsible governance and resilient institutions [18]. AI-enabled administrative systems have been linked to reductions in resource waste, improvements in transparency, and enhanced adaptability within complex organizational settings [6]. These dimensions align closely with contemporary sustainability frameworks, which emphasize long-term institutional capacity rather than isolated performance outcomes [5].

Within the context of Saudi Arabia, universities operate amid rapid national efforts toward digital transformation and sustainable development [8]. National policies emphasize innovation, efficiency, and institutional modernization as central pillars of Vision 2030, underscoring the role of higher education institutions in building a knowledge-based economy [19]. As a result, universities are increasingly expected to integrate artificial intelligence applications into their administrative systems, not only to enhance performance but also to ensure sustainable organizational development [20]. As [21] observes, higher education institutions that fail to engage with AI-driven transformation risk losing their capacity to respond effectively to technological and societal change.

In light of these considerations, examining the impact of artificial intelligence applications on sustainable administrative performance is both timely and necessary. This study addresses this need by examining how administrative staff perceive the association between selected AI-related dimensions—expert systems, automated machine learning, and ease of use—and sustainable administrative performance at the University of Hail. By linking administrative performance to sustainability-oriented outcomes, the study responds to current scholarly and practical calls for evidence-based insights into the perceived role of artificial intelligence in higher education administration.

In the present study, “AI applications” does not refer to audited institutional implementation records or direct technical usage logs. Rather, it refers to administrative staff perceptions of the extent to which selected AI-related dimensions—expert systems, automated machine learning, and ease of use—are present in, and perceived to support, administrative work. Accordingly, the study examines perceptual evaluations of AI-related administrative support rather than objectively verified implementation intensity or causal organizational impact.

## 2. Literature Review

### 2.1. Conceptualizing AI-Enabled Sustainable University Management

Recent advances in artificial intelligence have shifted the role of digital technologies in universities from supportive tools to strategic enablers of institutional management [5]. AI applications built on internet-based platforms, electronic communication systems, and intelligent automation have enabled universities to expand online services and to continuously assess administrative efficiency and effectiveness relative to peer institutions [6]. This shift has intensified inter-university competition, particularly in how institutions leverage AI to optimize administrative operations and sustain performance advantages over time [22].

Within this context, AI-enabled sustainable university management refers to the deliberate integration of intelligent systems into administrative structures to ensure continuity, adaptability, and responsible resource utilization [23]. Universities increasingly rely on AI applications not only to enhance immediate performance outcomes but also to maintain long-term operational stability in environments characterized by technological acceleration [12]. As noted by ref. [24], administrative personnel can now perform a wide range of services through AI-supported systems, reshaping traditional workflows and redefining managerial roles.

The growing dependence on artificial intelligence has led universities to reconsider administrative performance as a sustainability-oriented construct rather than an efficiency metric [9]. The transition toward electronic administration requires clear strategies, institutional policies, and innovative mechanisms that support the systematic use of AI across departments [25]. Empirical evidence suggests that universities facing increasing operational complexity must adopt AI-based systems to sustain administrative and organizational performance under continuous change [26]. Accordingly, sustainable university management emerges as a framework that aligns intelligent technologies with governance, accountability, and institutional resilience.

In the Saudi Arabian context, higher education is undergoing structural adaptation to align with global scientific and technological advancements [27]. Universities strive to modernize their administrative systems, regulatory frameworks, and digital policies to remain competitive and responsive to international developments [28]. This transformation requires coordinated institutional investment in AI applications that can support administrative modernization and long-term organizational adaptability [29]. Consequently, examining AI-enabled sustainable university management provides a timely lens for understanding how universities navigate digital transformation while maintaining institutional continuity.

### *2.2. Expert Systems as Sustainable Decision Support*

Expert systems constitute a class of artificial intelligence applications designed to replicate expert reasoning by applying predefined rules and knowledge bases to complex problem-solving situations [23]. In university administration, expert systems facilitate decision-making by providing structured evaluations, consistent interpretations of regulations, and rapid access to institutional knowledge [1]. These systems reduce reliance on individual discretion and mitigate the risk of inconsistent or erroneous decisions [30].

From a sustainability perspective, expert systems contribute to what can be described as decision sustainability [8]. By supporting rule-based reasoning and transparent logic, expert systems enhance the predictability and auditability of administrative decisions, which is essential for long-term governance continuity. When administrative decisions are consistent and data driven, universities can reduce costly errors, improve compliance, and ensure stable managerial practices over time [5]. This aligns with findings that emphasize the importance of intelligent decision-support mechanisms in maintaining institutional effectiveness under increasing administrative complexity [22].

Moreover, expert systems enable universities to codify organizational knowledge, thereby preserving institutional memory and reducing vulnerability to staff turnover [3]. This characteristic strengthens administrative resilience and supports sustainable governance structures by ensuring that critical decision-making capabilities remain embedded within the institution rather than concentrated in individuals [24]. As universities expand in scale and scope, expert systems become instrumental in sustaining decision quality across diverse administrative units.

### *2.3. Automated Machine Learning as Sustainable Process Resilience*

Automated machine learning extends traditional data analytics by enabling the automatic construction, evaluation, and deployment of predictive models without human intervention [9]. In administrative settings, automated machine learning applications support continuous monitoring, anomaly detection, and process optimization by identifying patterns within large datasets and responding dynamically to operational changes [31].

The sustainability contribution of automated machine learning lies primarily in enhancing process resilience [32]. By reducing manual rework, identifying procedural irregu-

larities, and supporting real-time oversight, automated machine learning helps universities maintain reliable administrative processes even under fluctuating workloads or external disruptions [5]. These capabilities are particularly valuable in large institutions where administrative complexity increases the risk of inefficiencies and system failures [25].

Furthermore, automated machine learning strengthens institutional adaptability by enabling proactive rather than reactive management [12]. Predictive insights derived from administrative data allow universities to anticipate bottlenecks, allocate resources more effectively, and maintain service continuity [1]. This aligns with broader findings that highlight AI-driven analytics as a critical factor in sustaining organizational performance and resilience in public sector institutions [23]. As such, automated machine learning represents a foundational component of sustainable university management through its capacity to stabilize and optimize administrative processes over time.

#### *2.4. Ease of Use as Sustainable Adoption and Continuity*

While advanced AI systems offer significant technical capabilities, their effectiveness depends heavily on user acceptance and continued use [8]. Ease of use reflects the extent to which administrative staff perceive AI tools as intuitive, accessible, and compatible with existing workflows [5]. When AI systems are difficult to learn or operate, resistance to adoption may emerge, which may weaken sustained administrative use [33].

User-centered implementation plays a critical role in sustaining AI adoption within university administration [9]. Systems that prioritize usability reduce cognitive and operational burdens on employees, enabling smoother integration into daily routines. This facilitates continuity of use and prevents the abandonment of AI tools after initial implementation [32]. Foundational technology adoption theories emphasize that perceived ease of use significantly influences acceptance and long-term utilization of digital systems [8].

In the context of sustainable university management, ease of use functions as a mediator between technological capability and institutional impact, where AI systems contribute to administrative stability, efficiency, and knowledge integration [5]. Recent research confirms that user readiness and system usability are decisive factors in sustaining AI adoption across organizational contexts [6]. Accordingly, ease of use represents a critical dimension of sustainability by ensuring that AI-enabled systems remain embedded in administrative practice rather than functioning as temporary or underutilized solutions.

#### *2.5. Sustainable Administrative Performance: Efficiency and Effectiveness*

Administrative performance in universities has traditionally been assessed through efficiency and effectiveness metrics [3]. Efficiency refers to the ability of administrative systems to minimize resource consumption, such as time, cost, and effort, while maintaining output quality [34]. Effectiveness, in contrast, reflects the extent to which administrative actions achieve planned objectives and support institutional goals [35].

In sustainability-oriented frameworks, these dimensions acquire a longitudinal significance, where efficient resource use contributes to financial and operational sustainability, while effective goal attainment supports institutional survival and relevance over time [1]. Administrative performance therefore becomes a proxy for sustainable management when evaluated through its capacity to balance resource optimization with consistent achievement of strategic objectives [36].

By integrating artificial intelligence applications into administrative systems, universities can enhance efficiency and effectiveness, thereby supporting long-term sustainability. AI-enabled processes reduce redundancy, streamline workflows, and improve decision accuracy, thereby reinforcing the university's ability to sustain high-quality administrative performance under evolving conditions. In the present study, sustainable administrative

performance is treated as an operational proxy for one dimension of sustainable university management rather than as a full equivalent of that broader construct. This proxy is justified because university management is enacted in part through administrative systems that sustain efficiency, effectiveness, continuity, and service quality over time. Accordingly, the study does not claim to measure sustainable university management in its entirety; rather, it focuses on a single measurable administrative dimension that reflects it in practice. In light of the theoretical framework and the reviewed literature, which emphasize the role of artificial intelligence in supporting sustainable university management, the present study formulates the following research question:

What is the perceived level of the selected AI dimensions, expert systems, automated machine learning, and ease of use, in relation to sustainable administrative performance at the University of Hail?

### 3. Research Hypotheses

Based on the theoretical framework and the review of the relevant literature, the study advances the following hypotheses:

- H1.** *Perceived expert systems support is positively associated with sustainable administrative performance in universities.*
- H2.** *Perceived automated machine learning support is positively associated with sustainable administrative performance in universities.*
- H3.** *Perceived ease of use is positively associated with sustainable administrative performance in universities.*
- H4.** *The three perceived AI dimensions expert systems, automated machine learning, and ease of use jointly predict variation in sustainable administrative performance.*

### 4. Methodology

#### 4.1. Research Design

This study employed a quantitative cross-sectional survey design to examine the association between selected AI-related dimensions and sustainable administrative performance within the University of Hail. Because the data were collected at one point in time through self-reported responses, the design is suitable for identifying patterns of association [37]. To interpret the weighted means, the five-point Likert scale was divided into three equal intervals: 1.00–2.33 = low, 2.34–3.67 = moderate, and 3.68–5.00 = high. Accordingly, mean values falling within 2.34–3.67 were interpreted as indicating a moderate level. The regression analysis was intended as an initial inferential assessment of association patterns. However, the study did not report a full set of regression diagnostics, including tests for multicollinearity, residual normality, and homoscedasticity, as well as checks for common method variance.

#### 4.2. Population and Sample

The study was conducted within the administrative context of the University of Hail in Saudi Arabia. The target population consisted of all administrative staff employed during the data collection period, totaling 1196 individuals across different administrative units and functional levels. A purposive sampling strategy was used because the study required respondents who were directly engaged in administrative processes and who had practical exposure to digital systems used in routine university operations [38]. In

this study, “adequate exposure” refers to regular interaction with electronically mediated administrative processes such as digital records, workflow systems, reporting systems, communication platforms, or decision-support tools. The questionnaire was therefore directed to staff members whose roles involved routine administrative processing rather than purely manual or peripheral functions. A total of 394 questionnaires were distributed to eligible administrative staff, of which 230 were returned complete and usable for analysis, yielding a response rate of 58.4%. Thus, the final sample comprised 230 administrative staff members, representing approximately 19.23% of the total administrative population. Prior to analysis, incomplete questionnaires were screened, and only responses with sufficient completeness were retained in the final dataset. Because the study relied on non-probability sampling within a single institution, the findings should be interpreted as institution-specific rather than statistically generalizable to all universities [39].

#### 4.3. Data Collection Instrument

Data were collected using a structured questionnaire developed from the literature and adapted to the higher education administrative context. The instrument included three sections: (1) demographic and occupational characteristics, (2) perceived AI-related dimensions, and (3) sustainable administrative performance. The AI-related section covered expert systems, automated machine learning, and ease of use. Responses were recorded on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. For each construct, item scores were averaged to obtain composite scores, with higher values indicating stronger perceived presence or support of the measured dimension [40].

In revising the manuscript, particular attention was given to the distinction between the original questionnaire wording and the later manuscript-level phrasing used for clarity of reporting. The available original wording of the AI-related items from the earlier instrument version is provided in Appendix A to enhance transparency and traceability. In the previous manuscript version, some statements were presented in revised form for reporting purposes; in the revised version, these are no longer presented as exact administered items.

The AI-related items are presented in Appendix A, and the item structure of the sustainable administrative performance scale is presented in Appendix B for measurement transparency.

To address transparency and traceability concerns, the manuscript distinguishes between the original administered wording of the AI-related items and the revised wording used in the descriptive reporting table. The original items are presented in Appendix A, the revised reporting wording is reflected in Table 3, and a direct item-by-item mapping between the two versions is provided in Appendix C.

#### Operationalization of Variables

In this study, the independent variables represent respondents’ perceptions of AI-related support dimensions rather than objectively verified levels of technical deployment. Similarly, the dependent variable reflects perceived sustainable administrative performance as a perception-based organizational measure derived from the same survey instrument. More specifically, sustainable administrative performance was operationalized through respondents’ evaluations of two administrative dimensions: efficiency and effectiveness. Efficiency refers to the extent to which administrative work is carried out with reduced time, effort, and procedural waste, whereas effectiveness refers to the extent to which administrative processes achieve their intended objectives accurately and consistently. Composite scores were calculated from the relevant questionnaire responses, with higher values indicating greater perceived sustainable administrative performance. In analytical terms, the

dependent construct was treated as a composite perception-based measure derived from these two subdimensions. To improve measurement transparency, the questionnaire items corresponding to this scale are presented in Appendix B.

#### 4.4. Validity and Reliability

##### 4.4.1. Preliminary Internal Consistency Evidence

Internal consistency validity was assessed using Pearson correlation coefficients between each artificial intelligence dimension and the overall scale score, as shown in Table 1.

**Table 1.** Preliminary internal consistency evidence.

| Dimensions                 | Correlation Coefficients | <i>p</i> -Value |
|----------------------------|--------------------------|-----------------|
| Expert systems             | 0.72                     | 0.001           |
| Automated machine learning | 0.75                     | 0.001           |
| Ease of use                | 0.78                     | 0.001           |

Source(s): Author's own work.

Preliminary internal consistency evidence was assessed by correlating each study dimension with the overall scale score. As shown in Table 1, all reported correlations were positive and statistically significant at the 0.001 level, indicating that the dimensions were meaningfully related to the broader measurement framework. However, these correlations are interpreted as limited evidence of internal consistency rather than sufficient evidence of construct validity on their own.

##### 4.4.2. Reliability

The reliability of the questionnaire was examined using Cronbach's alpha coefficients for each dimension and for the overall scale, as shown in Table 2.

**Table 2.** Cronbach's alpha.

| Dimensions                 | Cronbach's Alpha |
|----------------------------|------------------|
| Expert systems             | 0.74             |
| Automated machine learning | 0.66             |
| Ease of use                | 0.76             |
| Total Reliability          | 0.87             |

Source(s): Author's own work.

The reliability of the questionnaire was examined using Cronbach's alpha coefficients. The overall scale demonstrated good internal consistency ( $\alpha = 0.87$ ). The alpha values for expert systems ( $\alpha = 0.74$ ) and ease of use ( $\alpha = 0.76$ ) were acceptable, whereas the value for automated machine learning ( $\alpha = 0.66$ ) was marginal. Although this value may still be considered tolerable in exploratory social research, it indicates that this dimension would benefit from further refinement in future studies.

#### 4.5. Ethical Considerations

Participation in the study was voluntary, and respondents were informed of the purpose of the research. Anonymity and confidentiality of responses were assured, and the collected data were used exclusively for academic research purposes. These procedures align with ethical standards for research involving human participants.

## 5. Results

### 5.1. Main Question: What Is the Perceived Level of the Selected AI Dimensions Expert Systems, Automated Machine Learning, and Ease of Use in Relation to Sustainable Administrative Performance at the University of Hail?

Descriptive statistics (means and standard deviations) were computed for all items representing the three artificial intelligence dimensions, as shown in Table 3.

**Table 3.** Descriptive Statistics of the Perceived AI-Related Dimensions.

| Dimension                  | Item                 | Statement                                                                                                 | Mean | SD   | Level    |
|----------------------------|----------------------|-----------------------------------------------------------------------------------------------------------|------|------|----------|
| Expert Systems             | ES1                  | Expert systems are used in administrative decision-making processes at the university.                    | 3.71 | 1.03 | High     |
|                            | ES2                  | Expert systems rely on structured databases and rule-based procedures in administrative work.             | 3.62 | 0.95 | High     |
|                            | ES3                  | Expert systems are integrated into planning and administrative organization processes.                    | 3.20 | 1.02 | Moderate |
|                            | ES4                  | Expert systems are used to assist in identifying and addressing administrative problems.                  | 3.19 | 1.13 | Moderate |
|                            | Weighted Mean = 3.43 |                                                                                                           |      |      | Moderate |
| Automated machine learning | ML1                  | Automated machine learning is used to detect errors and irregularities in administrative processes.       | 3.68 | 1.11 | High     |
|                            | ML2                  | AI-driven systems are used for data backup and recovery in administrative work.                           | 3.61 | 1.13 | High     |
|                            | ML3                  | Automated machine learning is applied in maintaining administrative operations during system disruptions. | 3.22 | 1.16 | Moderate |
|                            | ML4                  | Integrated AI systems are used in administrative operations at the university.                            | 3.15 | 1.14 | Moderate |
|                            | Weighted Mean = 3.42 |                                                                                                           |      |      | Moderate |
| Ease of Use                | EU1                  | AI systems used in administrative tasks are easy to learn and operate.                                    | 3.67 | 1.02 | High     |
|                            | EU2                  | User-friendly AI systems are available in university administration.                                      | 3.59 | 0.94 | High     |
|                            | EU3                  | Administrative staff can use AI technologies without major difficulty.                                    | 3.21 | 1.11 | Moderate |
|                            | EU4                  | AI tools used in administrative work are simple and accessible.                                           | 3.16 | 1.03 | Moderate |
|                            | Weighted Mean = 3.41 |                                                                                                           |      |      | Moderate |

Source(s): Author's own work.

As shown in Table 3, the overall perceived levels of expert systems, automated machine learning, and ease of use were moderate, with weighted mean values ranging from 3.41 to 3.43. This suggests that the selected AI dimensions were present to a moderate extent in the administrative context of the University of Hail. Although several items recorded high mean scores, the overall distribution indicates that these dimensions were not consistently high across all measured aspects.

## 5.2. Hypotheses Testing

The regression analyses reported below are interpreted as evidence of statistical association based on respondents' perceptions and should not be taken as proof of causal effects.

**H1.** *Perceived expert systems support is positively associated with sustainable administrative performance in universities.*

Simple linear regression analysis was conducted to examine the association between perceived expert systems support and sustainable administrative performance, with expert systems entered as the independent variable and sustainable administrative performance as the dependent variable. The results are presented in Table 4.

**Table 4.** Association of Expert Systems with Sustainable Administrative Performance.

| Variable       | B                      | Std. Error | Beta      | t    | p-Value         |
|----------------|------------------------|------------|-----------|------|-----------------|
| Constant       | 1.214                  | 0.183      | -         | 6.63 | 0.001           |
| Expert systems | 0.547                  | 0.062      | 0.611     | 8.82 | 0.001           |
| R = 0.611      | R <sup>2</sup> = 0.373 |            | F = 77.79 |      | p-value < 0.001 |

Source(s): Author's own work.

As shown in Table 4, the simple regression model was statistically significant ( $F = 77.79$ ,  $p < 0.001$ ), indicating that perceived expert systems support was positively associated with variation in sustainable administrative performance. The model explained 37.3% of the variance in the dependent variable ( $R^2 = 0.373$ ). Expert systems showed a positive standardized association with sustainable administrative performance ( $\beta = 0.611$ ,  $t = 8.82$ ,  $p < 0.001$ ). These findings indicate that higher perceived expert systems support was associated with higher reported sustainable administrative performance.

**H2.** *Perceived automated machine learning support is positively associated with sustainable administrative performance in universities.*

Simple linear regression analysis was conducted to examine the association between perceived automated machine learning support and sustainable administrative performance. Automated machine learning was entered as the independent variable, while sustainable administrative performance was treated as the dependent variable. The results are presented in Table 5.

**Table 5.** Association of Automated Machine Learning with Sustainable Administrative.

| Variable                   | B                      | Std. Error | Beta      | t    | p-Value         |
|----------------------------|------------------------|------------|-----------|------|-----------------|
| Constant                   | 1.176                  | 0.194      | -         | 6.06 | 0.001           |
| automated machine learning | 0.523                  | 0.067      | 0.587     | 7.81 | 0.001           |
| R = 0.587                  | R <sup>2</sup> = 0.345 |            | F = 61.01 |      | p-value < 0.001 |

Source(s): Author's own work.

As shown in Table 5, the simple regression model was statistically significant ( $F = 61.01$ ,  $p < 0.001$ ), indicating that perceived automated machine learning support was positively associated with variation in sustainable administrative performance. The model explained 34.5% of the variance in the dependent variable ( $R^2 = 0.345$ ). Automated machine learning showed a positive standardized association with sustainable administrative performance ( $\beta = 0.587$ ,  $t = 7.81$ ,  $p < 0.001$ ). These findings indicate that higher perceived

automated machine learning support was associated with higher reported sustainable administrative performance.

**H3:** *Perceived ease of use is positively associated with sustainable administrative performance in universities.*

Simple linear regression analysis was conducted to examine the association between perceived ease of use and sustainable administrative performance. Ease of use was entered as the independent variable, while sustainable administrative performance was treated as the dependent variable. The results are presented in Table 6.

**Table 6.** Association of Ease of Use with Sustainable Administrative Performance.

| Variable    | B                      | Std. Error | Beta      | t    | p-Value         |
|-------------|------------------------|------------|-----------|------|-----------------|
| Constant    | 1.298                  | 0.176      | -         | 7.38 | 0.001           |
| Ease of use | 0.486                  | 0.058      | 0.552     | 8.38 | 0.001           |
| R = 0.552   | R <sup>2</sup> = 0.305 |            | F = 70.23 |      | p-value < 0.001 |

Source(s): Author's own work.

As shown in Table 6, the simple regression model was statistically significant ( $F = 70.23$ ,  $p < 0.001$ ), indicating that perceived ease of use was positively associated with variation in sustainable administrative performance. The model explained 30.5% of the variance in the dependent variable ( $R^2 = 0.305$ ). Ease of use showed a positive standardized association with sustainable administrative performance ( $\beta = 0.552$ ,  $t = 8.38$ ,  $p < 0.001$ ). These findings indicate that higher perceived ease of use was associated with higher reported sustainable administrative performance.

**H4.** *The three perceived AI dimensions, expert systems, automated machine learning, and ease of use, jointly predict variation in sustainable administrative performance.*

Multiple linear regression analysis was conducted to examine the joint association of the three perceived AI dimensions—expert systems, automated machine learning, and ease of use—with sustainable administrative performance. The three AI dimensions were entered simultaneously as independent variables, while sustainable administrative performance was treated as the dependent variable. The results are presented in Table 7.

**Table 7.** Joint AI Dimensions and Sustainable Administrative Performance.

| Variable                   | B                      | Std. Error | Beta                            | t    | p-Value                   |
|----------------------------|------------------------|------------|---------------------------------|------|---------------------------|
| Constant                   | 0.942                  | 0.201      | -                               | 4.69 | 0.001                     |
| Expert systems             | 0.318                  | 0.074      | 0.364                           | 4.30 | 0.001                     |
| Automated machine learning | 0.291                  | 0.081      | 0.332                           | 3.59 | 0.001                     |
| Ease of use                | 0.247                  | 0.069      | 0.298                           | 3.58 | 0.001                     |
| R = 0.716                  | R <sup>2</sup> = 0.513 |            | Adjusted R <sup>2</sup> = 0.506 |      | F = 78.64 p-value < 0.001 |

Source(s): Author's own work.

As shown in Table 7, the multiple regression model was statistically significant ( $F = 78.64$ ,  $p < 0.001$ ), indicating that the three perceived AI dimensions were jointly associated with variation in sustainable administrative performance. The model explained 51.3% of the variance in the dependent variable ( $R^2 = 0.513$ ). Among the predictors, expert systems showed the strongest standardized association ( $\beta = 0.364$ ), followed by automated

machine learning ( $\beta = 0.332$ ) and ease of use ( $\beta = 0.298$ ). These findings indicate that higher perceived levels of the three AI-related dimensions were jointly associated with higher reported sustainable administrative performance.

## 6. Discussion

The findings indicate that the overall perceived level of artificial intelligence-related support for sustainable administrative performance at the University of Hail was moderate, despite the presence of some relatively high-scoring practices. This pattern may reflect the gradual nature of digital transformation at the university, where AI-related practices appear to be partially present in administrative work but not yet fully embedded within a comprehensive sustainability-oriented administrative framework. This interpretation is consistent with [1], who emphasized the importance of coordinated institutional frameworks for sustainable digital transformation in higher education.

The results also show that expert systems were positively and statistically significantly associated with sustainable administrative performance. This pattern may suggest that respondents perceive expert systems as supportive of structured decision-making, reduced administrative errors, and continuity of institutional knowledge. In the context of the University of Hail, this may reflect the perceived contribution of centralized decision-support tools in administrative operations rather than a directly verified causal effect. This finding aligns with [30].

Automated machine learning was likewise positively and statistically significantly associated with sustainable administrative performance. This result may indicate that respondents view automated machine learning-related applications as supportive of process reliability, service continuity, and administrative adaptability. Rather than demonstrating a direct causal effect, the finding suggests a positive perceptual relationship between this dimension and sustainability-oriented administrative outcomes. This interpretation is consistent with [31], who highlighted the role of AI-driven analytics in improving organizational efficiency and adaptability.

In addition, ease of use showed a positive and statistically significant association with sustainable administrative performance. This may reflect the importance of user acceptance and lower resistance to technological change in supporting the continued use of AI-related systems in administrative tasks. From this perspective, ease of use may be understood as an enabling condition that is positively linked to sustainability-oriented administrative performance as perceived by respondents. This finding is consistent with the technology acceptance perspective proposed in [8].

Finally, the joint analysis showed that expert systems, automated machine learning, and ease of use were collectively associated with sustainable administrative performance. This result suggests that respondents perceive sustainable administrative performance as more strongly supported when decision-support capabilities, process-related analytical functions, and user-centered system design are considered together. However, given the cross-sectional and self-reported nature of the data, this finding should be interpreted as evidence of a combined statistical association rather than a confirmed causal mechanism. This interpretation is consistent with [13].

Although the regression analyses revealed statistically significant associations, these models should be regarded as initial inferential evidence rather than fully validated predictive models. This caution is warranted because the study relied on cross-sectional self-reported data and did not include a full set of regression diagnostics, such as multicollinearity assessment, residual normality, homoscedasticity testing, or common method variance checks.

## 7. Conclusions and Recommendations

This study examined administrative staff perceptions of the role of selected artificial intelligence (AI) dimensions in supporting sustainable administrative performance at the University of Hail, with particular attention to expert systems, automated machine learning, and ease of use. The findings indicate that the overall perceived level of AI-related support was moderate, suggesting that AI-related practices are present in administrative work but may not yet be fully embedded within a comprehensive sustainability-oriented administrative framework.

The results showed that all three AI dimensions were positively and statistically significantly associated with sustainable administrative performance. Among these dimensions, expert systems showed the strongest standardized association, followed by automated machine learning and ease of use. These findings suggest that respondents perceive decision-support functions, process-related analytical capabilities, and user-friendly system design as important factors linked to sustainability-oriented administrative performance. However, these results should be interpreted cautiously, as the study is based on cross-sectional self-reported data and does not establish causal effects.

Based on these findings, universities may benefit from developing more coordinated AI-related administrative strategies aligned with sustainability objectives, investing in continuous training for administrative staff, and prioritizing user-centered system design to encourage effective and sustained use. Future research could extend this model to other universities or comparative contexts, incorporate more direct measures of AI implementation, and employ longitudinal or multi-source designs to strengthen generalizability and improve causal interpretation.

Overall, the findings should be interpreted as perception-based institutional evidence rather than direct proof of objectively verified AI implementation or causal organizational effects.

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## Appendix A. Original Questionnaire Items for the AI-Related Dimensions

**Table A1.** Original Questionnaire Items for the AI-Related Dimensions.

| Dimension        | Item | Original Statement                                                                                               |
|------------------|------|------------------------------------------------------------------------------------------------------------------|
| Expert Systems   | ES1  | Expert systems support sustainable administrative decision-making by reducing errors and ensuring consistency.   |
| Expert Systems   | ES2  | Expert systems enhance long-term institutional knowledge retention through structured databases.                 |
| Expert Systems   | ES3  | Expert systems contribute to sustainable planning and administrative organization.                               |
| Expert Systems   | ES4  | Expert systems enable universities to address administrative problems efficiently and sustainably.               |
| Machine Learning | ML1  | Automated machine learning enhances process sustainability by detecting errors and irregularities automatically. |
| Machine Learning | ML2  | AI-driven systems support institutional resilience through automated data backup and recovery.                   |
| Machine Learning | ML3  | Automated machine learning improves sustainable service continuity during system disruptions.                    |
| Machine Learning | ML4  | Integrated AI systems contribute to efficient and sustainable administrative operations.                         |
| Ease of Use      | EU1  | Ease of use facilitates the sustainable adoption of AI systems in daily administrative tasks.                    |
| Ease of Use      | EU2  | User-friendly AI systems support continuous digital transformation in university administration.                 |
| Ease of Use      | EU3  | Ease of use reduces resistance to change and promotes long-term use of AI technologies.                          |
| Ease of Use      | EU4  | Simple and accessible AI tools enhance sustainable administrative performance.                                   |

## Appendix B. Questionnaire Items for Sustainable Administrative Performance

**Table A2.** Questionnaire Items for Sustainable Administrative Performance.

| Dimension                    | Item | Statement                                                                                     |
|------------------------------|------|-----------------------------------------------------------------------------------------------|
| Administrative Efficiency    | EFF1 | AI-supported administrative systems help complete administrative tasks more quickly.          |
| Administrative Efficiency    | EFF2 | AI-supported tools reduce the time required to process routine administrative work.           |
| Administrative Efficiency    | EFF3 | AI applications help minimize administrative errors and repeated corrections.                 |
| Administrative Efficiency    | EFF4 | AI-supported systems improve the use of available administrative resources.                   |
| Administrative Efficiency    | EFF5 | AI technologies help reduce unnecessary workload in daily administrative procedures.          |
| Administrative Efficiency    | EFF6 | AI-supported processes contribute to smoother and faster administrative service delivery.     |
| Administrative Effectiveness | EFA1 | AI-supported systems improve the quality of administrative decisions.                         |
| Administrative Effectiveness | EFA2 | AI applications enhance the university's ability to achieve its administrative objectives.    |
| Administrative Effectiveness | EFA3 | AI-supported administrative processes improve the overall quality of services provided.       |
| Administrative Effectiveness | EFA4 | AI technologies help administrative units respond more effectively to work-related problems.  |
| Administrative Effectiveness | EFA5 | AI-supported systems contribute to better coordination and follow-up of administrative tasks. |
| Administrative Effectiveness | EFA6 | AI applications improve the reliability and usefulness of administrative outputs.             |

## Appendix C. Mapping of Original and Revised AI-Related Item Wordings

The table below provides an item-by-item mapping between the wording originally administered for the AI-related questionnaire items and the revised wording used for reporting in Table 3. This appendix is included to improve transparency, traceability, and construct alignment between the administered instrument and the manuscript presentation.

**Table A3.** Mapping of Original and Revised AI-Related Item Wordings.

| Dimension                  | Item | Original Administered Wording                                                                                    | Revised Wording Used in Table 3                                                                           |
|----------------------------|------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Expert Systems             | ES1  | Expert systems support sustainable administrative decision-making by reducing errors and ensuring consistency.   | Expert systems are used in administrative decision-making processes at the university.                    |
| Expert Systems             | ES2  | Expert systems enhance long-term institutional knowledge retention through structured databases.                 | Expert systems rely on structured databases and rule-based procedures in administrative work.             |
| Expert Systems             | ES3  | Expert systems contribute to sustainable planning and administrative organization.                               | Expert systems are integrated into planning and administrative organization processes.                    |
| Expert Systems             | ES4  | Expert systems enable universities to address administrative problems efficiently and sustainably.               | Expert systems are used to assist in identifying and addressing administrative problems.                  |
| Automated Machine Learning | ML1  | Automated machine learning enhances process sustainability by detecting errors and irregularities automatically. | Automated machine learning is used to detect errors and irregularities in administrative processes.       |
| Automated Machine Learning | ML2  | AI-driven systems support institutional resilience through automated data backup and recovery.                   | AI-driven systems are used for data backup and recovery in administrative work.                           |
| Automated Machine Learning | ML3  | Automated machine learning improves sustainable service continuity during system disruptions.                    | Automated machine learning is applied in maintaining administrative operations during system disruptions. |
| Automated Machine Learning | ML4  | Integrated AI systems contribute to efficient and sustainable administrative operations.                         | Integrated AI systems are used in administrative operations at the university.                            |
| Ease of Use                | EU1  | Ease of use facilitates the sustainable adoption of AI systems in daily administrative tasks.                    | AI systems used in administrative tasks are easy to learn and operate.                                    |
| Ease of Use                | EU2  | User-friendly AI systems support continuous digital transformation in university administration.                 | User-friendly AI systems are available in university administration.                                      |
| Ease of Use                | EU3  | Ease of use reduces resistance to change and promotes long-term use of AI technologies.                          | Administrative staff can use AI technologies without major difficulty.                                    |
| Ease of Use                | EU4  | Simple and accessible AI tools enhance sustainable administrative performance.                                   | AI tools used in administrative work are simple and accessible.                                           |

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