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RESEARCH ARTICLE

Enhancing Work Efficiency of Grassroots Administrative Staff in Universities through Artificial Intelligence Empowerment

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ABSTRACT

This paper explores the application of artificial intelligence (AI) technology in grassroots administrative work in universities, aiming to analyze how AI empowers university administrative staff to improve their work efficiency. It highlights the significance of grassroots administrative work in universities and the challenges faced. The research determines existing cases of AI applications in university administration and their efficiency estimate. The research intends to consider AI integration to enhance the work efficiency of grassroots administrative staff in universities. It delves into the mechanisms by which AI improve administrative efficiency, including computerization, data-driven decision-making, intellectual examination optimization, and enlargement reengineering. Through typical case studies, this article demonstrates the large impact of AI on improving grassroots administrative work efficiency in universities. Finally, the research summarize the investigate findings are 92.5% accuracy, 91.3% precision, 90.8% recall, and 91.0% F1-score, and forecasts future trends in AI applications in university administration, and calls for a multi-stakeholder contribution structure in digital governance for education. This enhances intelligent management, optimize learning authority effectiveness, and accomplish advanced precision, effectiveness, and technical rigidity in educational management services.

INTRODUCTION

Grassroots administration refers to local-level governance and management system considered to address the immediate needs of communities [1]. It highlights direct engagement with citizens, promoting participation in decision-making, and fostering population development through decentralized approaches. By operating, secure to the people, grassroots administration guarantee proficient source allotment and tailored solution to local challenge [2, 17].

Grassroots administrative staff is the foundational personnel in local governance, dependable for implement policy, supervision community-level operation, and address the necessities of the public at the most instant force [3]. They act as an essential link between management establishment and the society; ensure proficient service delivery and public commitment. These staff associate handle diverse duties such as public wellbeing executive, argument resolution, record protection, and the management of limited initiative, playing a fundamental role in maintaining social concurrence and fostering development at the grassroots level. Their employment requires flexibility, well-built broadcast skills, and a deep understanding of limited context [4].Grassroots administrative staff in universities forms the foundational support structure ensure the smooth functioning of day-to-day operations [5, 18]. These professionals administer significant tasks such as student access, record

administration, departmental management, economic documents, and campus logistics. They act as the primary position of contact for students and facility, bridging declaration gaps and implement university policies at the prepared level. Their role is pivotal in maintaining the efficiency and reliability of administrative processes, contributing to an atmosphere conducive to academic and institutional growth. Artificial Intelligence (AI) is the simulation of human intellect by machinery, enabling them to execute tasks like learning, reasoning, problem-solving, and decision-making. Using natural language processing (NLP), and computer visualization, AI classification analyze data, adapt to innovative inputs, and automate processes, enhancing efficiency and innovation across various fields [6]. AI empowerment refers to the transformative capability of AI technologies to enhance decision-making, optimize process, and create modern solutions across various domains [7]. By leveraging NLP, and superior algorithms, AI enables systems to learn from data, adapt to altering conditions, and perform tasks with minimum human intervention [8]. This empowerment extends to industries like healthcare, schooling, industrialized, and finance, driving effectiveness, fostering innovation, and unlocking new potential. As a cornerstone of the digital age, AI empowerment is shaping smarter systems, improving user experiences, and address difficult dispute, concrete the approach for a more interrelated and intelligent future. **Figure 1** illustrates the AI's role in addressing challenges along with humanizing the effect for grassroots administrative organization.

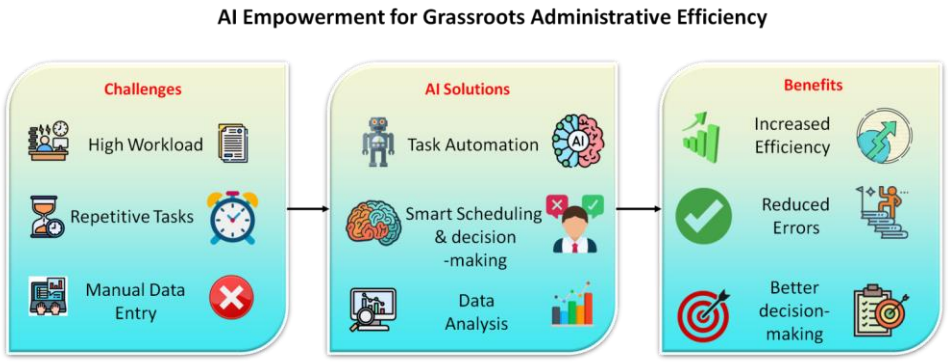

Figure 1: AI's role in addressing the challenges and enhancing the outcomes for grassroots administrative staff

Enhancing the work efficiency of grassroots organizational staff in university through AI involves using technologies like Machine Learning (ML) and mechanization to streamline tasks, reduce errors, and optimize reserve supervision. This allows staff to focus on strategic activities, improving overall prepared efficiency and adapting to the evolving needs of educational institutions. The main objective of the present research is to consider AI integration to enhance the work efficiency of grassroots administrative staff in universities.

Grassroots supremacy faces high-load dilemmas like division, unequal rights, and fragmentation. To decrease government burden, promote organizational structure, system reform, process reengineering, and human-machine reorganization through digital transformation. This improves administrative execution, service delivery, and emergency management capabilities [9]. The article [10] investigated a grassroots movement for structural modifications at a values focused institution. A smaller number of academic and administrative employees formed their organizations to promote leadership education, enlargement, preparation, and assessment within the institute. The effort attempted to illuminate the university's dedication to training and nurturing 'principled leaders' while also addressing conceptual inadequacies. The partnership finding in the formation of an altering agent team, which established a based on values structure for teaching and nurturing principled leaders. The study employed Lewin's Action Research technique and the stage of a well-known four-phase organizational transformation process. The current research determines the critical findings from the grassroots-led transformation initiative, as well as offers implications and suggestions for practitioners driving emergent transformation in higher education settings.

The research [11] examined "grassroots experimentation" among Boston City staff members that experiment with the AI solutions outside of conventional pro-curement processes. This unstructured, under the radar technological adoption has been motivated through an absence of procurement advice to maintain with the emergence of affordable, low-priced AI technologies. The investigation demonstrated how self-directed inquiry affects AI incorporation in municipal based public services. Additionally, it presented ethical as well as security issues about experimental AI use at the level of municipalities. The study indicates that good team leadership as well as a supportive technological culture is critical for avoiding risks and obtaining the advantages of AI exploration. The research findings could be valuable for upcoming policy innovation, empowering staff to use AI technologies to enhance the municipal service administration.

The study [12] applied organizational ecology ideas to grassroots academic groups at Chinese institutions, with an emphasis on organizational boundaries. It developed a structural and ecological model for governance systems, demonstrating how organizational heterogeneity separates these organizations. The model's validation findings indicated a substantial shift in contract governance mechanism assessment. The study aimed to improve and build effective academic governance system in universities, therefore contributing to the promotion of a complete cooperative control system models.

The study [13] investigated the efficacy of common services in data transmission throughout the large data age. It developed a forecast representation for general service motivation as well as performance optimization using general service motivation theory. The investigation evaluated the impact processes and enhancement theories of commuting motivation along with performance and included them into a single model. Data transmission and motivation enhancement analysis are used to provide recommendations to increase general staff motivation and work performance. When compared to other algorithms, the Prophet Prediction model has lower exponential error, higher prediction accuracy, and lower MAE (which is denote as Mean absolute error) values. The study [14] sought to improve corruption prevention in grassroots governments by combining data platform management with the "5W" analytical paradigm. Using the SWOT (which is referred to as Strengths, Weaknesses, Opportunities, Threats), PDCA (which is referred to as Plan, Do, Check, Act), and 5W (which is referred to as Who, What, When, Where, Why) frameworks, the study found a 10.76% increase in public engagement and a 23.24% improvement in government efficiency. The SWOT approach excels in case handling and corruption reporting rates, but the 5W model investigated the underlying reasons for corruption. The integration of these models strengthens corruption prevention skills, supporting transparent and efficient administration in the age of information technology growth.

The research [15] investigated the role of Large Language Models (LLMs) in higher education, emphasizing their ability to revolutionize the academic surroundings. It investigated the influence of LLMs on important topics such as comprehension management, credentials, innovation, social change, and employment. Investigation highlighted the obstacles and opportunities for LLMs in academic contexts, demonstrating the importance of strategic integration with Higher Education Institutions (HEIs') goals of encouraging education, significant judgment, and personal development.

Symmetrical communication is critical to an organization's success since it distinguishes it from rivals, resolves disagreements, mitigates crises, encourages openness, and employee involvement, and builds a healthy corporated culture. A research of 183 Czech firms discovered that the organization's size and yearly turnover had a substantial impact on the adoption of symmetric communication. Communication through an HR officer is positively connected with the organization's size, which is generally greater than 250 people. The emphasized the value of balanced communication in dispute resolution and strategic organizational activities [16].

2. MATERIALS AND METHODS

The present research is AI integration for enhancing work efficiency of grassroots administrative staff in universities. It can be divided into 3 phases such as phase 1 (research design, and data collection), phase 2 (pre-processing, feature extraction, and classification), and phase 3 (results). The overview of this research is displayed in **Figure 2**.

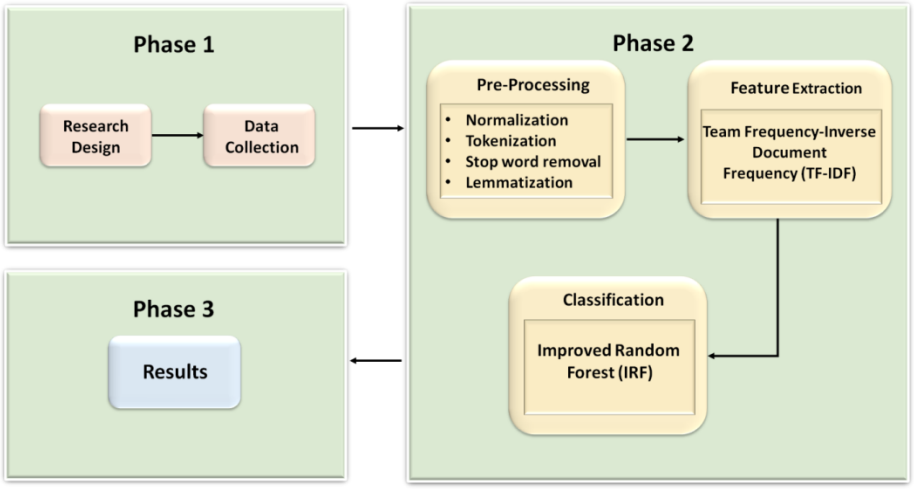

Figure 2: Research flow

2.1 Research design

The research design involves the integration of qualitative as well as quantitative approaches, which are intended to provide a complete understanding of the AI integration process along with its effects on administrative work.

2.1.1 Surveys to assess current administrative challenges

Surveys have been conducted to assess the current challenges faced by the grassroots administrative staff in university settings, and which focus on workload, task complexity, as well as efficiency barriers. The survey captured the perceptions into daily responsibilities, which include scheduling, data entry, along with document management, while identifying the pain points like time-intensive repetitive tasks, frequent errors, and stress levels. Also, the questions have been explored staff familiarity with the existing digital tools along with their openness to adopting the AI-based solutions. The data collected provided a comprehensive outline of the administrative inefficiencies, which serves as a foundation for targeting areas where AI integration drives the meaningful improvements in workflow as well as productivity.

2.1.2 Case studies of AI implementation in select university departments

In this research, the case studies could be focus on the implementation of AI tools within select university departments, such as student affairs, academic administration, as well as human resources, to examine their impact on the administrative efficiency. These departments have been selected depending on their relevance to core administrative functions as well as their openness to adopting the AI technologies. The study tracks the introduction of particular AI tools, similar to AI-powered chatbots for the student inquiries, and automated scheduling systems, as well as data analytics platforms for decision making support. The data collection includes qualitative perceptions from staff through interviews as well as focus groups, and capturing their experiences with the tools, along with challenges faced during deployment and entire transforms in effectiveness of workflow. Through analyzing these case studies, the research intends to identify the best practices, and measure the AI integration effectiveness, as well as provide an apparent understanding of how these

technologies streamline the routine administrative tasks, reduce workload, along with enhance the operational outcomes.

2.1.3 Experimental trials using the AI tools for specific tasks

Experimental trials have been carried out to assess the effectiveness of AI tools in particular administrative tasks by comparing the before and after their implementation performance. The selected administrative tasks, which includes scheduling, data entry, report Generation, Responding to Emails, and document management that has been assigned to staff that perform using AI-powered tools with a focus on automation as well as efficiency. The baseline data on task completion time, error rates, and staff productivity are collected before AI tools are introduced. After the AI tools are implemented, the same metrics are gathered to assess improvements in work efficiency. The results analyzed quantitatively to measure reductions in task duration, errors, and overall workload, providing a clear assessment of the AI tools' impact on administrative productivity.

2.2 Data collection

Data collection involves a combination of qualitative and quantitative approaches to assess the impact of AI tools on grassroots administrative staff in universities. Staff feedback has been gathered through surveys, interviews, and focus groups to understand their experiences with AI integration, including usability, effectiveness, and any concerns. Additionally, task efficiency logs were collected using digital tracking tools to record key data points such as time spent on tasks, interruptions, and revisions. This comprehensive data collection provides valuable insights into the effectiveness of AI in enhancing administrative workflows.

2.3 Pre-processing

The purpose of pre-processing is to clean along with prepare data, and eliminating excessive data to improve the accuracy of ML models for administrative task efficiency enhancement. The involved preprocessing techniques are normalization and NLP techniques. Some NLP techniques are tokenization, stop word removal, and lemmatization.

2.3.1 Normalization

After the data collection, the pre-processing utilizes the normalization. The purpose of normalization is to assures that numerical data is scaled consistently (for example, task timings, and workload metrics), which improves ML model efficiency and reduces bias in analysis. It is the process of reducing numerical data to a standard range, usually from 0 to 1 and converting it into a mean of 0 as well as a standard deviation of 1. This procedure assures that every characteristic is provided equally to ML models through removing the impact of different scaling among characteristics. It concludes that the normalization produces standardized data, which reduces characteristic scale differences. This leads to enhanced task prioritizing, workload investigation, and the detection of feedback patterns in administrative procedures.

2.3.2 Tokenization

Tokenization is the dividing of phrases to words, characters, and punctuation, every one of which is referred to as tokens. The dividing criterion relies mostly based on the presence of a punctuation or space. The process assists in filtering out undesirable terms in subsequent processing stages.

2.3.3 Stopword removal

Stopwords have been frequently employed words in a language, such as "a", "is", "the" etc. Removing stopwords from a text does not change its meaning as these words do not give essential information.

2.3.4 Lemmatization

Lemmatization is the process of eliminating or substituting the suffix of a word to get it back to its original base, known as a lemma. Lemmas are always meaningful terms. It is a frequently utilized text preparation technique in NLP that has shown excellent outcomes.

2.4 Feature extraction

The preprocessed data has been fed into the feature extraction using Term frequency-Inverse document frequency (TF-IDF). It extracts essential phrases from staff input and quantifies text data, which allows the examination of feedback trends to make AI decisions. TF-IDF constitutes one of the widely detectable feature extraction approaches in NLP, particularly for textual modeling. Term frequency (TF) refers to the frequency that a particular phrase or word appears in a document, and inverse document frequency (IDF) signifies to the word's appearances throughout all of the documents. The TF-IDF equation is as described in Equation (1).

$$tfidf_s = f_{t,c} \times log \frac{M}{cf_t} (1)$$

Here, $tfidf_s$ is the term weight t, $f_{t,c}$ is the term frequency t in c document, M provides the entire amount of documents, and cf_t is the amount of documents that contain the phrase t.It provides numerical vectors that indicate key phrases that allow the investigation of staff feedback. It emphasizes essential concerns, patterns, and perceptions, which assist AI-powered decisions to improve administrative process workflow and task prioritization.

2.5 Improved random forest (IRF)

The feature-extracted data has been entered into the IRF. The purpose of IRF is to improve task classification performance accuracy and estimate administrative task completion time periods, as well as prioritize tasks to improve grassroots administrative staff effectiveness. IRF constitutes an improved version of Random Forest (RF) variation that improves feature selection, decision-making processes, as well as forecasting accuracy for complicated, structured, and unbalanced data. The IRF classification intends to improve the diversity of trees as well as feature selection. IRF focuses on selecting the most pertinent characteristics throughout the every tree's formation. This improved technique assures that the greatest factors contribute significantly to the classification procedure, and decreasing repetition as well as enhancing accuracy. Furthermore, IRF promotes an increased range within the trees, reducing excessive fitting and improving generalization to current data.

The IRF classifier's ensemble outcome has been determined through the majority votes from each of the decision trees, as given in Equation (2).

$$\hat{z} = argmax\left(\sum_{l=1}^{N} g(w, \theta_l)\right) (2)$$

Here, $g(w, \theta_l)$ represented the classification outcome from the $l - th$ tree for input w, whereas N represents the entire amount of trees in the environment. This method enhances model effectiveness in classification through assure that every tree concentrates on pertinent characteristics whereas maintaining the resilience as well as computing effectiveness. IRF enhances task categorization accuracy, decreases forecast errors, as well as offers actionable perspectives, which leads to more efficient workflow processes, improved allocation of resources, and enhanced staff productivity performance in the administrative activities.

3. RESULTS

This research evaluates the integration of AI for enhancing the work efficiency of grassroots administrative staff in universities. This section includes task completion time, error rates, staff productivity, workload distribution, Adoption Rate and Utilization of AI Tools, staff satisfaction, IRF outcomes, and Staff Feedback on AI Tools.

3.1 Task completion time

The purpose of task completion time is to assess the AI tool's influence on decreasing the time necessary to accomplish the administrative activities by analyzing efficiency enhancements across diverse university administrative roles. Table 1 provides the task completion time for before and after AI outcomes. The outcomes of tasks in before and after AI are Scheduling Student Appointments (before AI = 45, after AI = 15), Document Management (before AI = 60, after AI = 25), Report Generation (before AI = 50, after AI = 20), data Entry for Student Records (before AI = 30, after AI = 10), and Responding to Emails (before AI = 35, after AI = 12). **Figure 3** displays the improvement in task completion time. It concludes that the AI techniques are significantly decreased task completion time, and enhanced administrative effectiveness by 58-66%, which demonstrates AI's ability to simplify procedure workflows and increase efficiency among grassroots administrative staff.

Table 1: Findings of task completion time for before and after AI

Task	Before AI (Time in Minutes)	After AI (Time in Minutes)	Improvement (%)
Scheduling Student Appointments	45	15	66.67
Document Management	60	25	58.33
Report Generation	50	20	60
Data Entry for Student Records	30	10	66.67
Responding to Emails	35	12	65.71

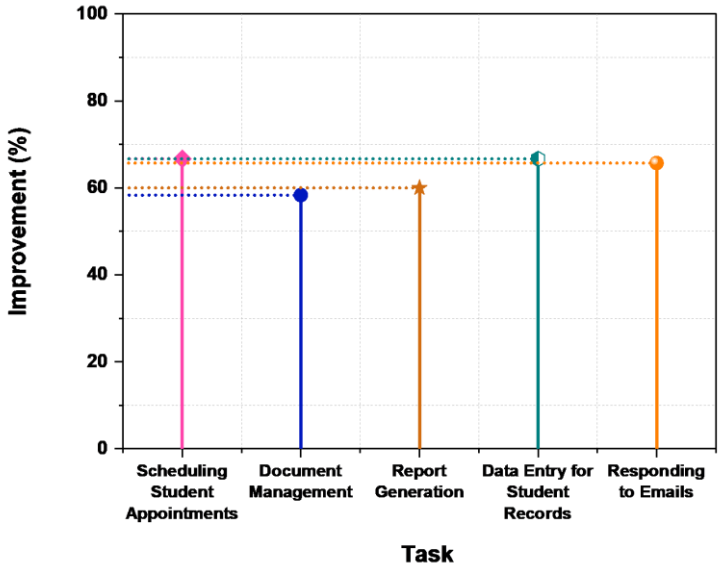

Figure 3: Graphical illustration of improvement in task completion time

3.2 Error rates

The error rate purpose is to determine the efficiency of AI tools in decreasing errors and enhancing the reliability of administrative tasks carried out by staff. **Table 2** provides the error rates for before and after AI outcomes. The error rate outcomes of tasks in before and after AI are Scheduling Student Appointments (before AI = 12, after AI = 3), Document Management (before AI = 18, after AI = 4), Report Generation (before AI = 10, after AI = 2), data Entry for Student Records (before AI = 15, after AI = 5), and Responding to Emails (before AI = 8, after AI = 1). **Figure 4** displays the reduction in

errors. The incorporation of AI substantially decreased error rates throughout tasks, and with decreases ranging from 66-87%, which demonstrates the efficiency of AI in improving task reliability and reducing human errors in university administration.

Table 2: Findings of error rates for before and after AI

Task	Before AI (Error Rate)	After AI (Error Rate)	Reduction in Errors (%)
Scheduling Student Appointments	12	3	75
Document Management	18	4	77.78
Report Generation	10	2	80
Data Entry for Student Records	15	5	66.67
Responding to Emails	8	1	87.5

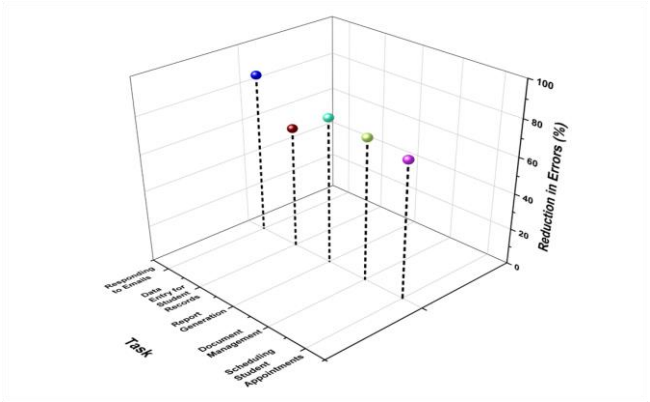

Figure 4: Graphical illustration of reduction in errors

3.3 Staff Productivity

The purpose of staff productivity is to assess the AI tool's influence on the number of tasks accomplished per day, including enhancements in effectiveness and total task performance efficiency of administrative staff. Table 3 provides the staff productivity for before and after AI outcomes. The productivity outcomes of tasks in before and after AI are Scheduling Student Appointments (before AI = 10, after AI = 30), Document Management (before AI = 8, after AI = 25), Report Generation (before AI = 6, after AI = 20), data Entry for Student Records (before AI = 12, after AI = 40), and Responding to Emails (before AI = 15, after AI = 50). It concludes that the AI tools greatly enhanced staff productivity, along with task completion rates exceeding doubling for every administrative task, which indicates AI's beneficial impact on operational effectiveness as well as staff performance.

Table 3: Findings of staff productivity for before and after AI

Task	Before AI (Tasks per Day)	After AI (Tasks per Day)	Increase in Productivity (%)
Scheduling Student Appointments	10	30	200
Document Management	8	25	212.5
Report Generation	6	20	233.33
Data Entry for Student Records	12	40	233.33
Responding to Emails	15	50	233.33

3.4 Workload Distribution

The purpose of workload distribution is to determine how the incorporation of AI reallocates administrative tasks, which allows staff to concentrate on strategic as well as value-added activities. Table 4, provides the outcomes of workload distribution. It concludes that the AI shortens regular task time, while improving concentration on strategic responsibilities, and enhances staff decision making and development capabilities.

Table 4: Findings of workload distribution

Staff Task	Workload (%)
Administrative Tasks (Routine)	20
Data Processing and Analysis	25
Interdepartmental Communication	10
Strategic Decision-Making	15
Staff Training and Development	30

3.5 Adoption rates and utilization of AI tools

The purpose of the Adoption Rate and Utilization of AI Tools is to assess the level of AI tool incorporation as well as utilization, which evaluates the staff acceptance, involvement, and influence on administrative task effectiveness. Table 5 and Figure 5 demonstrate the Adoption rates and utilization of AI tools outcomes based on the departments. It concludes that the higher adoption rates along with frequent utilization for every department, which implies significant staff engagement, and provide AI's effective integration as well as a positive influence on administrative effectiveness and management of workflow enhancement.

Table 5: Findings of Adoption rates and utilization of AI tools

Department	AI Tool Adoption Rate (%)	Frequent User Rate (%)
Student Affairs	90	80
Human Resources	85	70
Academic Administration	95	85
Finance and Budgeting	80	60
IT and Data Management	88	75

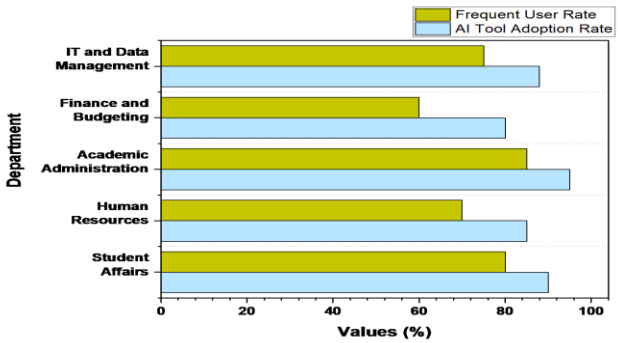

Figure 5: Graphical illustration of Adoption rates and utilization of AI tools

3.6 Staff satisfaction

The purpose of staff satisfaction is to evaluate the AI tool's influence on staff health, job satisfaction, and the entire work environment in university administration. Table 6 and Figure 6 show the staff

satisfaction for before and after AI outcomes. It concludes that the AI tools substantially enhanced satisfaction among, and staff decreased job-related stress as well as enhanced confidence, which demonstrates AI's beneficial positive influence on work life.

Table 6: Findings of staff satisfaction for before and after AI

Category	Before AI (%)	After AI (%)
Satisfaction with Work Efficiency	50	85
Satisfaction with AI Tools Usability	45	90
Staff Confidence in Technology	40	80
Job Stress Level	70	40
Interest in Further AI Training	55	85

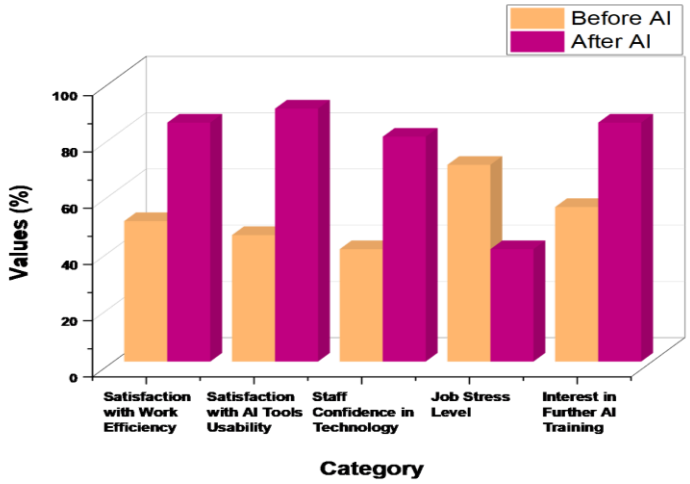

Figure 6: Graphical illustration of staff satisfaction for before and after AI

3.7 Outcomes of Improved Random Forest (IRF)

It includes the performance metrics such as accuracy, precision, recall, and f1-score. The purpose of accuracy is to assess the entire accuracy of the IRF classification in forecasting the administrative task efficiency and outcomes, which shows model dependability. The purpose of precision is to measure the percentage of actual positive forecasts between every positive prediction. It assesses the model's accuracy for recognizing pertinent administrative tasks and results, as well as reducing false positives. The purpose of recall is to assess the capability of the model to appropriately recognize every pertinent result, and ensure significant administrative tasks aren't ignored. The purpose of the F1-score is to balance recall and precision, offering a single percentage value to analyze the efficiency of the model in administrative task forecasts, and particularly with unbalanced data. Table 7 and Figure 7 illustrate the outcomes of IRF. The IRF results in performance metrics are precision (91.3%), recall (90.8%), f1-score (91.0%), and accuracy (92.5%), which achieves better outcomes in AI integration for enhancing the work efficiency of grassroots administrative staff in universities.

Table 7: Findings of IRF

Metric	Value (%)
Accuracy	92.5
Precision	91.3

Recall	90.8
F1 Score	91.0

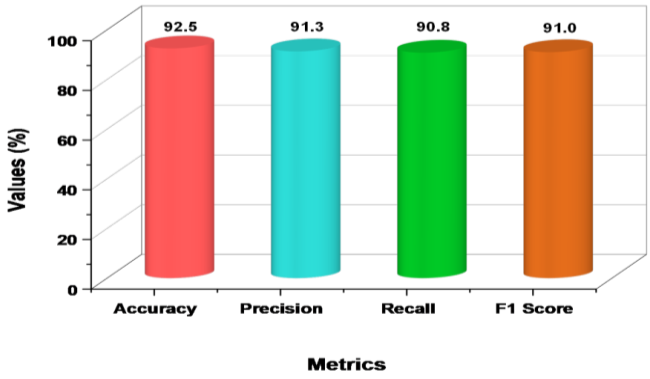

Figure 7: Graphical illustration of IRF outcomes

3.8 Staff Feedback on AI Tools

The purpose is to evaluate staff satisfaction, usefulness, and perceived advantages of AI tools for improving administrative tasks as well as effectiveness. **Table 8** demonstrates the survey results for staff feedback on AI tools.

Table 8: Survey Outcomes for Staff Feedback on AI Tools

Statement/Aspect	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
AI tools made tasks easier and faster	60	35	5	0	0
The AI tools were easy to learn and use	50	40	10	0	0
AI implementation reduced errors in daily tasks	70	25	5	0	0
I feel more confident in my work since AI integration	55	35	10	0	0
AI has positively impacted my work-life balance	45	40	15	0	0

4. DISCUSSION

The research reveals that AI can significantly improve the efficiency as well as effectiveness of university administrative staff. It shows that AI automates routine tasks, reduces error rates, and increases productivity. High adoption and utilization rates across departments demonstrate AI's relevance and scalability in university administration. Staff feedback suggests that AI adoption not only streamlines operations but also boosts job satisfaction by reducing workload pressures and errors. The findings suggest a strategic adoption of AI for improved operational efficiency and digital transformation.

5. CONCLUSION

This research mainly focused on AI integration to enhance the work efficiency of grassroots administrative staff in universities. The AI integration significantly enhances the efficiency, accuracy, and productivity of grassroots administrative staff in universities, reducing errors and task completion time, while improving staff satisfaction and staff productivity. The IRF results are 92.5% in accuracy, 91.3% in precision, 90.8% in recall, and 91.0% in f1-score, and it attains better outcomes

in AI integration for enhancing the work efficiency of grassroots administrative staff in universities. The future should be to increase the accuracy.

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