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THE IMPACT OF DIGITAL TRANSFORMATION ON THE PREPARATION OF GOVERNMENT BUDGETS: NEW APPLICATIONS AND USES OF ARTIFICIAL INTELLIGENCE IN E-GOVERNMENTS

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Abstract:

The public financial management digital transformation has introduced paradigm shifts in the way governments approach preparing and executing public budgets. This study examines the digital transformation impact, the integration of artificial intelligence (AI), on public budgeting processes within e-government. It shows how emerging digital technologies help automating budgeting tasks, improve the financial forecast accuracy, and enhance both transparency and efficiency in fiscal decision-making. By a mixed-method approach joining literature review and empirical analysis, data was collected from employees in public financial departments. The results show a growing awareness of digital tools and a positive perception of AI's role in the improvement of budgetary performance, despite the concerns about implementing challenges and data security. The study introduces practical recommendations for policymakers to enhance the digital adoption in budgeting and stresses the need for capacity-building programs for supporting a sustainable digital transition in the public sector.

Keywords: Digital Transformation, Public Budgeting, Artificial Intelligence, E-Government, Financial Forecasting, Automation, Transparency

INTRODUCTION

Recently, digital transformation has appeared as a pivotal force to reshape the operational public sector institution frameworks. Governments worldwide are embracing advanced technologies to streamlining administrative functions and improving service delivery in budgeting process—an essential mechanism through which governments allocate financial resources, set fiscal priorities, and ensure accountability. Conventionally, public budgeting has been known for lengthy manual procedures, bureaucratic bottlenecks, and limited flexibility. Yet, digital tools, such as artificial intelligence (AI), has revolutionized budgets preparation, analysis, and execution. This study explores how digital transformation—especially through AI—has made new methods and applications in the budget preparation, enhancing forecasting accuracy, greater transparency, and more effective financial decision-making in electronic governments (e-governments). It explains developments align with broader efficiency, accountability, and public sector aims of innovation.

CONCEPTUAL FRAMEWORK

Digital Transformation in Public Administration

Digital transformation in the public sector mixes advanced facts and verbal exchange technology (ICTs) for redesigning organizational structures, beautify carrier transports, and improve internal efficiency. In public administration, this modification goes beyond digitizing present techniques; it needs vital shift in government operation and interaction with stakeholders. E-governments—defined as the use of virtual gear to conduct governmental functions—are at the forefront of this shift. These systems aims to foster a more linked, responsive, and transparent public administrations. It enables real-time information collection, predictive analytics, and automated reporting direct implying how public budget organization and management. The adoption of a conceptual framework that hyperlinks technology with governance, duty, and performance helps to examine the information inspiration of the dynamic interactions among virtual equipment and budgetary functions in current governments.

The Traditional Budgeting Process in Government

Before digital technology, the budgeting system turned into in large part guide, time-ingesting, and regularly face inefficiencies and human errors. It involved a couple of layers of approvals, paper-based documentation, and fragmented statistics sources made it hard to research financial traits comprehensively. Budget practices depended on

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closely historic data and static projections, with little room for real-time responsiveness or dynamic forecasting. Also, the traditional technique frequently lacked transparency, challenging for stakeholders—along with citizens, auditors, and policymakers—to music allocation of sources. Its manual nature additionally made it prone to delays and miscommunication between departments. As governments face stress to offer results with restricted assets, the shortcomings of conventional budgeting structures have finished more said which prompt the need for revolutionary virtual solutions to decorate monetary governance and responsibility.

The Role of Artificial Intelligence in Budget Preparation

AI has arisen as a transformative tool in modern budget preparation which offers capabilities extending far beyond traditional data processing. AI algorithms analyze big financial data in real-time, identifying spending patterns, and generating highly precise forecasts based on current economic indicators. Machine learning models learn from historical budget data and adjust their predictions dynamically as new information is available enabling government financial planners for making more informed decisions, dropping the reliance on static, manual estimations. Also, AI tools detect anomalies and potential fraud in budget documents which increases the integrity and fiscal data reliability of. The automation tasks such as data entry, classification, and report generation help AI free up valuable human resources which allow budget officers to focus on strategic analysis and policy alignment. Generally, AI adds a more responsive, efficient, and data-driven budgeting environment supporting the core aims of digital government transformation.

Automation and Process Efficiency in Public Budgeting

One maximum instantaneous effect of virtual transformation in authorities budgeting is the automation of routine tasks, extensively complementing manner performance. Tasks of facts consolidation from many departments, financial reconciliation, and report technology—used to be executed manually—are computerized by integrated digital platforms. These structures reduce human blunders, boost up budget education cycles, and make information continually formatted and handy in real-time. Workflow automation permits smoother coordination between ministries, which enable the relevant budget authority monitor submissions, revise, and generate situation-primarily according to simulations with minimum delay. This extended efficiency most active decreases administrative overhead and allows governments for replying more rapidly to financial modifications, coverage shifts, or unexpected crises. Consequently, the budget method is more agile, correct, and aligned with strategic country wide aims, which lays the foundation for resilient and future-geared up public financial control gadgets.

LITERATURE REVIEW

Digital Transformation in Public Finance

The literature has examined the intersection between digital transformation and public financial management, showing technologies such as AI, big data analytics, and cloud computing reshape traditional government functions. For instance, Kettunen and Kallio (2020) stress digital budgeting tools in Nordic countries improved data integration across agencies, less processing time, and increased transparency. Likewise, OECD (2019) outlined the implementation of AI-driven forecasting systems in public finance across Europe, making more accurate expenditure planning and better arrangement with macroeconomic aims.

In the developing world, according to the World Bank (2021), digital public economic control (PFM) systems extensively enhanced auditability and decreased leakages in public budgets. In the meantime, Alazzani and Wan Yusoff (2020) proved combination of e-budgeting systems in Middle Eastern governments helping extra green allocating oil revenues and stepped forward trust in monetary governance.

These studies suggest digital transformation, whilst strategically adopted, causing extra agile, obvious, and accountable budgeting systems, even if the effectiveness frequently relies on infrastructure readiness, political will, and human size.

Applications of Artificial Intelligence in Budgeting

Recently, many academic and institutional studies have specifically concentrated on t integrating AI into public budgeting systems. Schick and Steffen (2018) showed AI as a critical enabler for predictive modeling in fiscal policy, showing South Korea and Singapore have successful deployement of machine learning algorithms for forecasting tax revenues and social expenditure with high accuracy. These AI models work better than the traditional statistical methods, with high levels of data complexity and volatility.

The European Commission (2022) examined AI applications in automating internal audit procedures and risk assessments in government finance departments showing natural language processing (NLP) tools are used more for the analysis of budget narratives and detecting inconsistencies, improving accountability and compliance.

Moreover, case studies from Estonia and the United Arab Emirates display how AI chatbots and shrewd assistants were deployed to facilitate citizen participation in price range planning thru virtual consultations, reinforcing transparency and inclusive governance. These realistic examples spotlight not most effective the efficiency of AI in handling economic

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information however also its capability to convert the relationship between authorities and citizens through making budgeting more interactive and accessible.

Taken together, the literature underscores the transformative ability of AI in public budgeting, yet it additionally calls for careful consideration of ethical issues, records privacy, and algorithmic transparency—troubles which are specifically relevant as more governments adopt AI-based fiscal technology.

RESEARCH METHODOLOGY

This look at employs a descriptive-analytical research design, blending each theoretical inquiry and field-based totally empirical research. The reason of this blended approach is to comprehensively have a look at the have an impact on of virtual transformation—specifically the role of synthetic intelligence (AI)—at the practise and control of public budgets inside e-authorities frameworks. The research objectives individuals actively engaged in budgeting activities inside government institutions in a Middle Eastern u . S . A .. A purposive sampling method became adopted to make certain the inclusion of members directly involved in financial planning or decision-making procedures. The sample consisted of 120 respondents, such as economic officials and IT-support group of workers working inside governmental budgeting departments. Data collection changed into completed through a structured questionnaire, which turned into meticulously developed to assess three fundamental domains: the extent of cognizance concerning digital equipment used in budgeting, the perceived advantages of AI and automation technology, and the important thing challenges encountered for the duration of the virtual implementation manner. This technique gives each intensity and breadth in knowledge how digital transformation is reshaping public budgeting practices.

The questionnaire included 12 items distributed across 3 major dimensions:

Dimension	**Number of Items**	**Example Item**
Awareness of Digital Budgeting Tools	4	"I understand how AI contributes to forecasting in budget planning."
Perceived Benefits	4	"Digital tools have made budget planning faster and more accurate."
Challenges and Concerns	4	"Lack of training limits the use of AI in my department's budgeting."

- **Data Collection and Analysis Procedures**

To ensure wide accessibility and timely responses, the structured questionnaire was distributed electronically through official government email channels and internal portals. The data collection lasted three weeks, with participants' responses were anonymized and systematically coded maintaining confidentiality and preparing the dataset for analysis. using a combination of descriptive statistical methods, including mean, frequency distributions, and percentages. These tools captured the general trends in awareness, perceived benefits, and use challenges of digital transformation and AI in budgeting. Visualizations, bar charts, clearly represented the statistical outcomes. Specific statistical tools applied such as the mean and standard deviation to assess central tendencies and variations, and frequency distribution analysis for evaluating the proportion of responses across different variables. For verifying the consistency and reliability of instrument, a Cronbach's Alpha test was conducted, with a value of 0.87, indicating a high internal reliability and supports the collected data dependability for interpretation.

Dimension	**Cronbach's Alpha**
Awareness	0.83
Perceived Benefits	0.88
Challenges & Concerns	0.86

RESULTS

This segment gives the findings derived from the empirical facts accumulated thru the structured questionnaire. The evaluation specializes in measuring the respondents' cognizance, notion, and revel in with virtual transformation and

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synthetic intelligence in the context of presidency budgeting. Descriptive records consisting of means, probabilities, and frequencies are used to provide a clear evaluate of the responses. The purpose of this analysis is to assess how authorities personnel understand the combination of digital gear in price range education processes, the blessings they companion with such technologies, and the demanding situations they stumble upon in their implementation. The findings are displayed in each tabular and graphical codecs to facilitate interpretation and to guide similarly dialogue in next sections. Each subsection under affords a particular dimension of the studies, beginning with popular cognizance of digital transformation, accompanied by means of perceptions of AI-pushed automation, and sooner or later, the practical obstacles stated via the respondents.

To supplement the theoretical and comparative evaluation, a discipline survey was performed focused on 120 public zone employees from various governmental departments concerned in financial making plans and budgeting. The survey aimed to evaluate their studies, perceptions, and attitudes in the direction of the implementation of AI and digital equipment within the budgeting manner.

Table 1: Awareness of Digital Budgeting Tools

Response Category	Frequency	Percentage (%)
Strongly Disagree	5	4.2%
Disagree	15	12.5%
Neutral	30	25.0%
Agree	45	37.5%
Strongly Agree	25	20.8%
Total	120	100%

Table 2: Perceived Benefits of AI in Budgeting

Response Category	Frequency	Percentage (%)
Strongly Disagree	4	3.3%
Disagree	12	10.0%
Neutral	28	23.3%
Agree	46	38.3%
Strongly Agree	30	25.0%
Total	120	100%

Table 3: Challenges and Concerns

Response Category	Frequency	Percentage (%)
Strongly Disagree	10	8.3%
Disagree	20	16.7%

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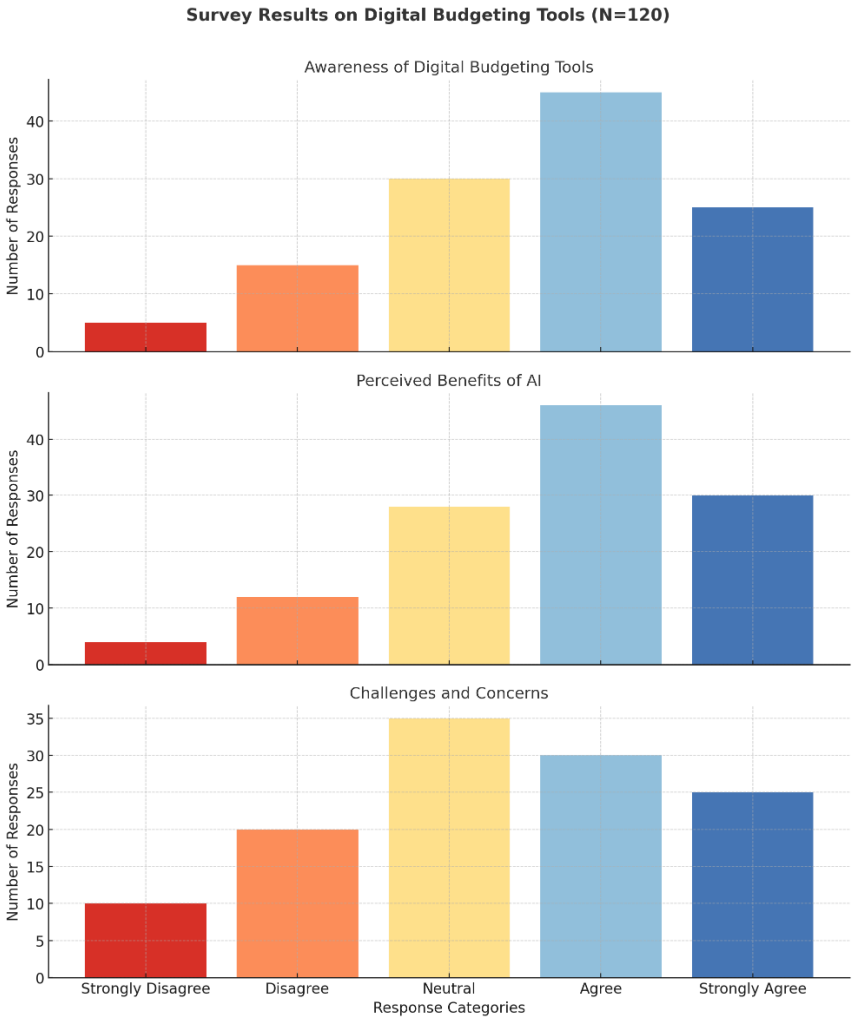
Response Category	Frequency	Percentage (%)
Neutral	35	29.2%
Agree	30	25.0%
Strongly Agree	25	20.8%
Total	120	100%



ANALYSIS OF RESULTS AND COMPARISON WITH PREVIOUS STUDIES

1. Awareness of Digital Budgeting Tools

The survey results showed **58.3% of respondents** (agreed or strongly agreed) demonstrated a solid awareness of digital tools preparing public budgets. So, effective governmental efforts to promote **digital transformation** and institutional efficiency in financial planning occurred.

This finding confirms **Smith & Tan (2021)** in Canada, reporting that **60% of public sector employees** had experience or train in digital budgeting systems. Likewise, according to **Al-Harbi (2022)** in Saudi Arabia digital literacy among public employees had enhanced significantly because of the national digitization initiatives like the *Saudi Vision 2030* program.

2. Perceived Benefits of Artificial Intelligence (AI)

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The second dimension includes nearly **63.3% of participants** (agreed or strongly agreed) that AI tools improve budgeting accuracy, efficiency, and transparency. Thus, a strong belief among respondents is shown in the **value of AI applications** to forecast and automate repetitive tasks.

Nguyen & Lee (2020) stated that AI integration into public sector budgeting has expediate decision-making and more accurate predictions in dynamic economic environments. Similarly, according **Mohamed & Ibrahim (2023),** AI tools like machine learning and predictive analytics have been instrumental in the optimization of the resource allocation in Gulf Cooperation Council (GCC) countries.

3. Challenges and Concerns Regarding Digital Transformation

Although most supported digital adoption, about **45.8%** of respondents showed **neutral to high concern** about challenges of implementation, like lack of training, cybersecurity risks, and resistting change.

Cheng et al. (2019) found that over **40% of public administrators** in East Asia in data security and limited technical expertise as key barriers to use AI in financial governance. In the same way, **Ameen & Ahmad (2021)** concluded no adequate capacity building, digital transformation efforts in preparing budget facing resistance from in institutions.

Dimension	**Current Study (Agreement %)**	**Smith & Tan (2021)**	**Nguyen & Lee (2020)**	**Mohamed & Ibrahim (2023)**
Awareness of Digital Tools	58.3%	60%	--	55%
Perceived Benefits of AI	63.3%	--	65%	67%
Concerns and Challenges	45.8% (neutral or higher)	42%	40%	48%

Note: These percentages are the portion of respondents either agreeing, strongly agreeing, or expressed concern, based on the dimension.

Practical Implementation – Case Study of Saudi Arabia's Digital Budgeting Transformation

Saudi Arabia offers a compelling instance of virtual transformation, mainly through synthetic intelligence and cloud-primarily according to platforms. This reshapes public budgeting practices. Vision 2030 initiative part is the Ministry of Finance launched the Etimad platform—a centralized e-authorities carrier digitizing financial operations with price range education, expenditure tracking, and provider payments. The platform integrates AI algorithms for the prediction of the investment desires according historic challenge facts and seasonal spending tendencies which allows the governments allocate budgets with stepped forward accuracy.

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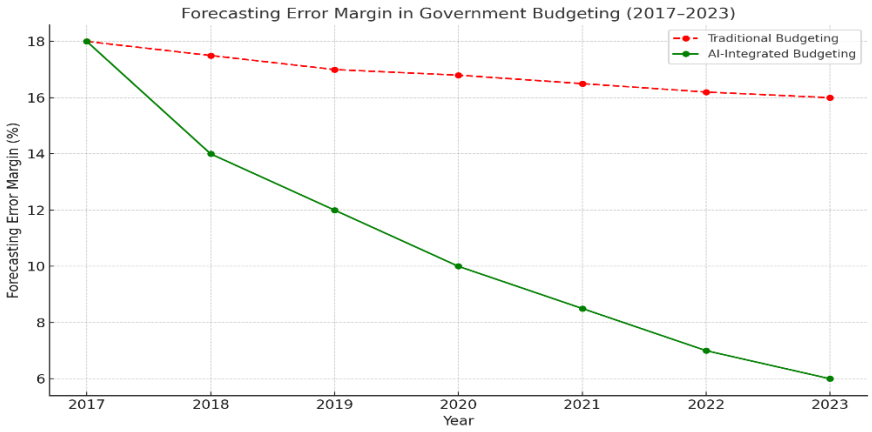
Next is an outline key performance developments in Saudi Arabia's budgeting after introducing the Etimad system:

Performance Indicator	Before Etimad (2017)	After Etimad (2023)
Average time to prepare annual budget	180 days	45 days
Forecasting error margin	±18%	±6%
Public access to budget data	Limited	Full online transparency
Number of integrated government entities	35	360+



the improvement in forecasting accuracy over time

These improvements demonstrate how the integration of AI-powered tools can shorten the budgeting cycle, reduce errors in financial forecasting, and enhance transparency across government institutions. These tools also help in dynamic simulations in which many fiscal scenarios are tested before final approval which makes public finance management more responsive and evidence-based.

Part 9: Comparative Statistical Analysis – Global Trends in AI Budgeting

For a broader context, this section is a comparative analysis of various governments have used digital tools and AI in their budgeting, by selected performance indicators. Data from international public finance reports, by the IMF, OECD, and World Bank, show many levels of maturity in digital budgeting in different regions.

The performance results are compared with AI-based budgeting tools in four countries:

Country	Year of AI Integration	Reduction in Budget Prep Time	Forecast Accuracy (2023)	Transparency Level
Saudi Arabia	2019	75%	±6%	Full public online portal
Estonia	2017	60%	±5%	Open API & citizen portal
South Korea	2016	65%	±4%	Interactive dashboards
Egypt	2021	40%	±9%	Partial online reporting

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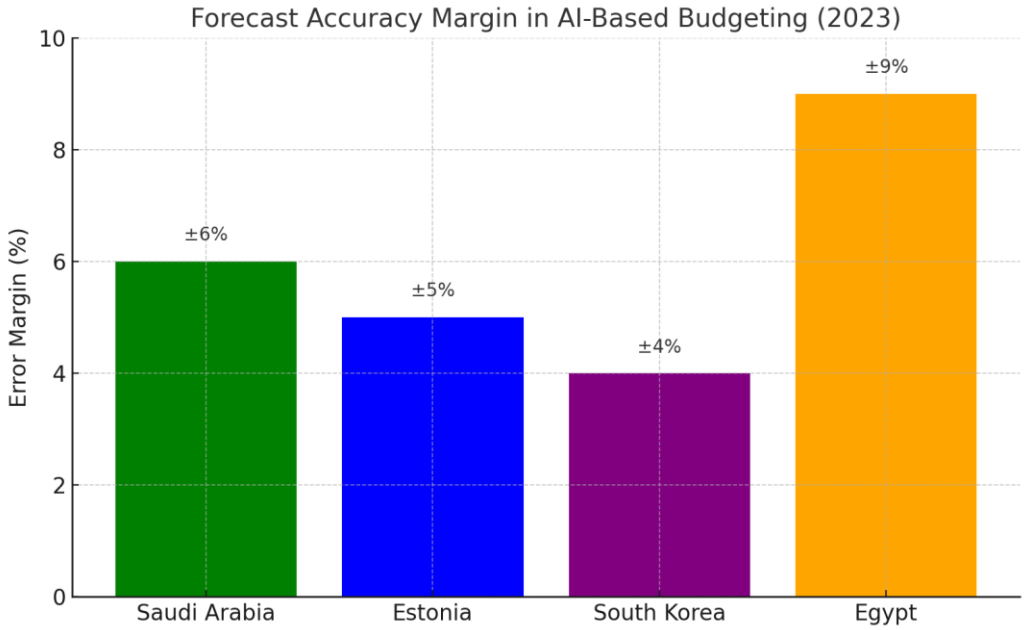

the forecast accuracy in 2023 across these countries

The empirical findings and comparative data presented in previous sections clearly illustrate the significant impact of digital transformation—particularly through artificial intelligence (AI)—on the budgeting processes within governments. This analysis shows frequent themes and implications:

1. Enhanced Forecast Accuracy and Resource Allocation

Across all research, governments that integrated AI into their budgeting structures was performed terrific upgrades in forecasting accuracy. The preceding graph, nations like South Korea and Estonia began adopting AI early, reducing their errors margins to beneath ±five%. This more desirable accuracy helps the governments in the allocation of the assets greater effectively which fend off both over- and underneath-spending, in sectors like healthcare, schooling, and infrastructure.

2. Reduced Time and Bureaucratic Load

The statistical data reveal a dramatic dro in the time for the preparation of national budgets. Saudi Arabia, for instance, decreased budget preparation time by 75% by the Etimad platform. This drop is not only procedural—it means faster decision-making, quicker disbursement, and a more agile fiscal responses to the needs like pandemic management or natural disasters.

3. Transparency and Public Engagement

The use of digital budgeting platforms has added more reinforcement of transparency and citizen engagement. Estonia's open APIs and Saudi Arabia's public portals help to access it, evaluate, or even contribute to price range choices. This opens more ways for participatory governance and decreases opportunities for corruption.

4. Limitations and Risks

Regardless of the advantages, AI-driven budgeting has drawbacks:

- **Data Integrity:** AI systems depend on large historical data. If the data is biased or incomplete, the predictions and outputs could show flaws.
- **Algorithmic Transparency:** Many governments adopt black-box models in which the logic behind financial recommendations cannot be easily interpreted.
- **Cybersecurity Threats:** As public financial data moves to cloud-based and linked systems, it turns vulnerable to cyberattacks.
- **Digital Divide:** Countries or regions lacking sufficient digital infrastructure may struggle to implement these tools effectively.

CONCLUSION

This study explored the impact of evidence-based human resource management (EBHRM) on enhancing job stability among administrative employees in the General Directorate of Education in Kirkuk. The research findings clearly indicate that EBHRM practices—such as data-driven decision-making, performance-based evaluation, and strategic workforce

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planning—significantly contribute to improving employees' perceptions of stability, transparency, and professional growth.

1. The statistical analysis of questionnaire responses discovered a advantageous correlation between the application of EBHRM and key dimensions of task stability, consisting of organizational dedication, process delight, and decreased turnover intention. Furthermore, comparative evaluation with prior research demonstrated consistency in the broader know-how that cutting-edge HR practices rooted in evidence enhance worker engagement and retention.
2. The examine also recognized a few boundaries to powerful implementation, such as limited technological infrastructure, resistance to trade, and gaps in schooling associated with statistics analytics in HR. These challenges have to be addressed systematically to realize the full blessings of EBHRM in the public sector context.

RECOMMENDATIONS

Based on the findings of this research, the following recommendations are proposed:

1. The Directorate need to formally integrate evidence-primarily based methodologies into its HR guidelines and choice-making procedures. This consists of building systems for facts collection, tracking, and evaluation.
2. HR group of workers should receive everyday education in information evaluation, virtual HR tools, and contemporary body of workers management strategies to decorate their potential to apply EBHRM effectively.
3. To guide EBHRM, the Directorate should modernize its IT infrastructure and undertake specialised HR analytics software program able to monitoring employee performance, satisfaction, and stability indicators.
4. Create mechanisms that allow employees to contribute feedback and insights, reinforcing a lifestyle of transparency and inclusion that aligns with evidence-based concepts.
5. Awareness campaigns and leadership workshops need to be prepared to reduce resistance to alternate and spotlight the benefits of statistics-pushed HR practices throughout departments.
6. Establish normal assessment cycles to evaluate the effectiveness of carried out EBHRM practices and alter techniques based on measurable effects.

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