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Predictive Analytics and Budgeting Accuracy in Public Sector Agencies in Kenya

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ABSTRACT

Budget accuracy remains a major challenge with many government agencies deviating significantly from their original allocations. Predictive analytics may enable dynamic budgeting by continuously monitoring financial performance and forecasting future needs. The current study sought to find out the relationship between predictive analytics and budgeting accuracy in public sector agencies in Kenya. The study used a descriptive survey design. Government agencies in Kenya were the unit of observation while their finance managers were the units of analysis. A sample of 93 respondents was used. Data was collected using a short structured semi-structured questionnaire. Descriptive and correlation analysis were used to analyse data with the help of Statistical Package for the Social Sciences. The study found that most (59.7%) of the respondents agreed that predictive analytics are used to support budget planning. A significant majority (76.6%) acknowledged that audits had identified budgeting accuracy issues, while 53.2% reported experiencing cost overruns in the previous five years. Correlation analysis showed that predictive analytics had a strong positive and significant association ($r=0.909$, $p<.001$) with budgeting accuracy. The study concluded that public sector agencies that systematically implement predictive analytics achieve significantly higher budget accuracy. There is therefore a need for public sector organisations to increase their investments in predictive analytics for budgeting accuracy and other financial management processes.

Keywords: Budgeting, budget accuracy, budget forecasting, predictive analytics

INTRODUCTION

The term budget refers to a plan, quantified in monetary terms, prepared and approved by appropriate authorities prior to the defined period of time usually showing planned income to be generated and/ or expenditure to be incurred during that period and the capital to be employed to attain a given objective (Gallagher, 2022). Budgeting, the process of creating and implementing this plan, involves forecasting income, allocating funds to various needs, and monitoring financial performance. Budgeting as a tool in financial management regularly prepares performance plans and budget requests that describe performance goals, measures of output and outcomes in various activities aimed at achieving performance goals (Tresch, 2022). This helps in the sense that annual plans set forth in measurable terms form the levels of performance for each objective in the budget period.

Budget accuracy refers to the degree to which projected figures in a budget align with actual financial outcomes (Cropper & Cowton, 2025). It is essential for finance teams to preserve financial health and mitigate risks via the use of precise budget forecasting. Businesses may prepare for these risks by establishing financial buffers and contingency plans via the use of an appropriate budget (Harimurti, 2021). Accuracy in budget preparation may be assessed by comparing actual and budgeted figures in terms of dollars and units. The budgeting process's trustworthiness is contingent upon the precision of data. Precision is obtained by making reasonable assumptions, meticulously examining evidence, and making continuous modifications to account for changing situations. McQuestin et al. (2021) indicate that a 0.6 percent decrease in technical efficiency is associated with a 1 percent increase in the inaccuracy of expenditure.

Public sector budgeting is a little like the private sector but with greater focus on their relation to policy development, performance measurement and legislative objectives (Lee et al., 2020). Public budgeting focuses on the distribution of government finances to meet social needs, usually guided by political and regulatory systems rather than by profit. It is a multidisciplinary process with many stakeholders, including the legislature and citizens, with an emphasis on public interest and equity instead of profit (Robert et al. 2023). Strategic financial planning for coordinating policy requirements with expenditure and enabling effective implementation and control are the primary objectives. The budget process provides a ritual method of sanctioning some expenditures as well as setting guidelines for fee and charge collection. Furthermore, budgets serve as a formal mechanism of ongoing financial control and legislative compliance. Under sound budgeting, organizations can strategically plan resources, manage finances, and have transparent financial management procedures that coincide with broader governmental objectives (Khan, 2024).

Despite the importance of budgeting in governance, evidence shows that countries are grappling with budgeting issues and inaccuracies. Institute of Economic Affairs (2025) shows that the majority (75%) of European and central Asian countries have more accurate budgets than their African (39%) counterparts. Lakin and Kinuthia (2019) documents that budget accuracy in Kenya's counties is severely compromised, with evidence showing that there

is systematic over-estimation of expenditures and revenues during the approval stage in Kenya. Poor budgeting has also been exposed in studies within government institutions. A study by Barngetuny (2024) identified a troubling discrepancy between budget intention and actualization, attributing mismanagement driven by a lack of transparency and poor oversight structures. Non-compliance with budgets can lead to misallocation of funds, including underfunding of key programs or over-spending in lower priority domains. This undermines public trust because citizens expect that government funds ought to be efficiently utilized on infrastructure, health, and education.

Predictive analytics (PA) offers tools to cure some of the organisational financial and budgeting issues. It uses statistical techniques, machine learning and data mining to develop predictive models from historical and live data (Olagoke, 2025). The process, as posited by Akanni (2024), involves data collection, cleaning and modeling in building predictive systems that provide likely estimations with measurable accuracy. These systems facilitate organizations in predicting risks, maximizing functions, and tailoring strategies to likely consequences. Forecast accuracy is a function of data quality, model selection, and validation steps, with the result being both actionable and statistically valid.

The emergence of predictive analytics is one of the most significant changes in financial services, according per Indriasari et al. (2019). PA employs a variety of algorithms to identify a variety of patterns in the big data environment that have the potential to provide additional value for enterprises, such as banks. The models find a variety of connections that allow firms to forecast cash flows, examine credit risks, and do budget modelling (Elbatal et al., 2025). For instance, linear regression is used to predict future sales based on past performance and economic conditions, while logistic regression helps in analyzing loan default risk. Quantifying the relationships using this makes it possible for companies to make rational decisions, redistribute resources, and cater to financial uncertainties. Akanni (2024) further asserts that prediction using regression strengthens auditing processes using the detection of anomalies and irregularities to promote compliance and reduce fraud risks. The strategic application of these models strengthens financial planning with a systematic approach to forecasting outcomes and refining strategic decision.

Studies conducted in other countries show the important role predictive analytics plays in financial management including budgeting. Bergmann et al. (2020) discovered in a research of German enterprises that the use of business analytics correlates favourably with satisfaction with the budgeting process. Labro et al. (2023) discovered that predictive analytics resulted in more precise objectives and stronger correlations between employee awards and assessed performance in the USA. Chowdhury et al. (2024) assert that predictive analytics is essential for discovering, evaluating, and alleviating possible financial concerns. By using predictive analytics, financial institutions may improve their risk management strategies and address uncertainties with more confidence and resilience (Pala, 2023). However, despite the importance of predictive analytics, very few studies have been conducted in its use in improving budgeting. In addition, studies conducted in developing countries like Kenya are scarce. It was for this reason that the researcher sought to carry out a study to find out the relationship between predictive analytics and budgeting accuracy in public sector agencies in Kenya.

MATERIALS AND METHODS

The study used a descriptive survey design. Descriptive survey is a quantitative research strategy employed in collecting data from a population or from a sample that is representative of the population to describe attributes, opinions, behavior, or conditions at a specific point in time (Walliman, 2021). The design facilitated the collection of data directly from finance managers, who were conversant with budgeting activity and analytics practices within their organizations. The study targeted government agencies in Kenya. Finance managers in government agencies were the respondents in the study. Financial managers were the most appropriate respondents in this study because they were directly responsible for planning, executing, and managing budget processes within their respective public sector organizations. Their roles placed them at the forefront of financial decisions, making them capable of providing informed responses regarding the use of predictive analytics as well as the accuracy of budgeting outcomes.

Kenya's government has 121 agencies that oversee various sectors. These include the Kenya Revenue Authority, which collects taxes, the Kenya Bureau of Standards, which maintains standards, and the Kenya Investment Authority, which promotes investment. Slovin's formula was used to calculate a sample

$n = N / (1 + N e^2)$

where "n" represents the sample size, "N" represents the population while e is the margin of error. Therefore, in a population of 121 agencies,

$n=121/(1+121*0.05^2) =92.89$

The study therefore used a sample of 93 respondents. Respondents were selected using a random number generator. The method involved assigning a unique number to each potential respondent in the sample frame, after which a computer-powered random number generator was used to select the sample. The method prevented selection bias and enabled representativeness of the sample by precluding systematic patterns or researcher effects at the selection process (Ghanad, 2023).

Data was collected using a short structured semi-structured questionnaire. The questionnaire was pretested in 9 small and new agencies which did not take part in the study. The questionnaire was then administered electronically using Google forms. The question link was sent using official email addresses so that only the intended respondents could view and complete the form. A brief introduction containing the purpose of the research, voluntary response, and promises of confidentiality was typed at the top of the form prior to sending it out to obtain informed consent. The questionnaires may be completed at a respondent's convenience which limited logistic constraints and maximized response rate (Walliman, 2021). Data collected was analysed using descriptive and correlation analysis with the help of Statistical Package for the Social Sciences (SPSS). Results were presented in form of tables.

RESULTS

A total of 77 finance managers of government agencies responded which represents a response rate of 83%. Majority of the parctipants were male respondents (68.8%) while female respondents accounted for 31.2% of the sample. Age distribution revealed that the majority of respondents were between 41 and 50 years (42.9%), followed by those aged 51-60 years (29.9%). Younger finance managers, aged 21-30 and 31-40 years, constituted smaller proportions at 11.7% and 15.6%, respectively. In terms of education, most respondents held a master's degree (50.6%), while 33.8% had a bachelor's degree and 15.6% possessed a doctorate. Work experience varied, with the largest group (41.6%) having 21-30 years of experience. Those with 11-20 years and over 30 years of experience accounted for 24.7% each, while only 9.1% had 1-10 years of experience.

Table 1 Demographic Characteristics of the Respondents

	Categories	**Frequency**	**Percent**
Gender	Male	53	68.8%
	Female	24	31.2%
Age	21-30 years	9	11.7%
	31-40 years	12	15.6%
	41-50 years	33	42.9%
	51-60 years	23	29.9%
Level of education	Bachelor's degree	26	33.8%
	Master's degree	39	50.6%
	Doctorate	12	15.6%
Woking experience	1-10 years	7	9.1%
	11-20 years	19	24.7%
	21-30 years	32	41.6%
	Over 30 years	19	24.7%

Predictive Analytics

The researcher investigated predictive analytics on the basis of current state of data and analytics, data infrastructure and technology, human capital and skills, governance, ethics, and trust as well as challenges and successes. Results in Table 2 show that most (59.7%) of the respondents agreed that predictive analytics are used to support budget planning. Majority (68.8%) indicated that the use of predictive analytics has improved budget accuracy in the past. The results show that all (100%) respondents confirmed that their organisations have access to reliable and up-to-date data. However, only 63.6% stated that data is stored in an integrated digital system, while 31.2% disagreed. Majority of the respondents (64.9%) reported that their organisations do not have a dedicated data analytics officer. Furthermore, most (57.1%) indicated that staff involved in budgeting are not trained in data analytics. Over half (53.2%) agreed that a lack of technical skills limits the use of predictive analytics in budgeting. However, 68.8% of the respondents disagreed that their organisations have policies guiding the use of predictive analytics. Similarly, a slight majority (51.9%) indicated that there are no clear procedures to ensure the ethical use of data in analytics. However, a majority (66.2%) stated that predictive analytics results are trusted by management. The results therefore suggest that while most of the respondents acknowledged that predictive analytics had improved budget accuracy, challenges such as a lack of technical skills and insufficient policies were prevalent.

Table 2 Descriptive Analysis of Predictive Analytics

	Agree	**Uncertain**	**Disagree**
The organisation has policies that guide the use of predictive analytics.	31.2%	0.0%	68.8%
Predictive analytics are used to support budget planning.	59.7%	0.0%	40.3%
The organisation has access to reliable and up-to-date data.	100.0%	0.0%	0.0%
Data used for analytics is stored in an integrated digital system.	63.6%	5.2%	31.2%
The organisation has a data analytics officer.	35.1%	0.0%	64.9%
Staff involved in budgeting are trained in data analytics.	42.9%	0.0%	57.1%
There are clear procedures to ensure ethical use of data in analytics.	48.1%	0.0%	51.9%

	Agree	Uncertain	Disagree
Predictive analytics results are trusted by management.	66.2%	7.8%	26.0%
Lack of technical skills limits the use of predictive analytics in budgeting.	53.2%	5.2%	41.6%
The use of predictive analytics has improved budget accuracy in the past.	68.8%	3.9%	27.3%

Budget Accuracy

To assess budget accuracy in the organisations, the researcher posed questions regarding budgeting process and planning, data and forecasting, variance analysis and reporting, challenges and improvements as well as accountability and governance. An overwhelming majority (100%) of respondents confirmed their organizations-based budget forecasts on reliable historical data, while 79.2% indicated their budgets generally reflected actual financial outcomes. Data and forecasting practices showed that 63.6% of participants believed their organizations maintained adequate contingency planning for sudden policy shifts, though 28.6% disagreed with this assessment. Variance analysis and reporting mechanisms appeared moderately established, with 57.1% reporting systems for monitoring budget deviations and 59.7% observing positive results from budget-to-actual variance analyses. A significant majority (76.6%) acknowledged that audits had identified budgeting accuracy issues, while 53.2% reported experiencing cost overruns in the previous five years. The results showed nearly equal division regarding supplementary budgets, with 51.9% indicating these were not frequently required versus 48.1% reporting regular use of supplementary allocations. Service delivery impacts emerged as a notable concern, as 64.9% of respondents confirmed that inaccurate budgeting had adversely affected organizational service delivery in past periods. The widespread audit findings of accuracy issues, combined with frequent cost overruns and service delivery impacts, indicated systemic difficulties in maintaining fiscal precision despite robust historical data usage.

Table 3 Descriptive Analysis of Budgeting Accuracy

	Agree	Uncertain	Disagree
The organisation’s budgets often reflect actual financial outcomes.	79.2%	0.0%	20.8%
Budget forecasts are based on reliable historical data.	100.0%	0.0%	0.0%
Budget contingency planning to sudden policy shifts is adequate	63.6%	7.8%	28.6%
The organisation has run into cost overruns in the last 5 years	53.2%	3.9%	42.9%
Audits have found budgeting accuracy issues	76.6%	0.0%	23.4%
Supplementary budgets to cater for changes are frequent	48.1%	0.0%	51.9%
There is a system in place to monitor and report budget deviations.	57.1%	0.0%	42.9%
Results of budget-to-actual variance analysis are positive	59.7%	0.0%	40.3%
Inaccurate budgeting has affected service delivery in the past.	64.9%	0.0%	35.1%

Predictive Analytics and Budget Accuracy

Correlation analysis was conducted between scores of predictive analytics and those of budget accuracy. Pearson's R correlation coefficient of 0.909 ($p < 0.001$) indicated a very strong positive linear relationship between the two variables, with the asymptotic standard error of 0.018 suggesting high precision in this estimate. The strength and consistency of these correlation results suggest that predictive analytics adoption and implementation quality substantially co-vary with budget accuracy performance in public sector agencies.

Table 4 Correlation of Predictive Analytics with Budget Accuracy

		Value	Asymptotic Standard Error [a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.909	.018	18.868	.000[c]
Ordinal by Ordinal	Spearman Correlation	.889	.027	16.833	.000[c]
N of Valid Cases		77			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

DISCUSSION

The study sought to find out the relationship between predictive analytics and budgeting accuracy in public sector agencies in Kenya. The study found that predictive analytics had a strong positive and significant association with budgeting accuracy. This suggests that organisations that employ predictive analytics in the budgeting process are highly likely to achieve budget accuracy. This aligns with findings of Wang and Jobarah (2021) who found that predictive analytics enhances the precision and reliability of budgeting processes. The results of the study support findings of Pamisetty (2023)that highlighted that AI and ML tools, when integrated into financial governance systems, could support more informed and responsive budgeting practices, despite challenges related to model training and the dynamic nature of fiscal variables. The result agrees with Farinde (2025) results that integrating predictive analytics alongside machine learning and scenario-based forecasting enhanced precision in budget planning and improved resource allocation outcomes. It agrees with Akanni (2024) who affirmed that predictive analytics enhanced the precision, adaptability, and responsiveness of budgeting and forecasting processes. Similarly, Faheem et al. (2021) also demonstrated that AI-driven predictive analytics significantly enhanced the accuracy of financial forecasting across varying market conditions. This is attributable to the ability of predictive analytics in being capable of leveraging past data, trends, and statistical models to be able to predict future financial outcomes. When predictive models are used in budgeting, they enable making better assumptions and better estimation of revenue and expenditures. This reduces the gap between budgeted and actual financial figures. Predictive analytics increases the accuracy of budgeting by minimizing speculation and using facts rather than guesswork to make projections. Predictive analytics enables finance managers to account for factors that have historically affected budget performance, such as seasonal variations, policy changes, or economic conditions. Predictive analytics also enables it to model scenarios and budget for potential shifts in financial requirements or revenue streams.

CONCLUSION

The study concludes that predictive analytics have a strong positive and significant association with budgeting accuracy. Public sector agencies that systematically implement predictive analytics achieve significantly higher budget accuracy, transforming unreliable fiscal planning into data-driven decision-making. However, this only happens when supported by skilled personnel, integrated data systems, and strong governance frameworks. There is therefore a need for public sector organisations to increase their investments in predictive analytics for budgeting accuracy and other financial management processes. Such technological upgrades should be accompanied by the development of clear governance frameworks, including formal policies that standardize predictive analytics applications while ensuring ethical data use and management accountability. However, the study was limited to government agencies. Future studies could therefore study other organisations such as county governments, banks and health facilities. In addition, the study was purely quantitative. In future studies, quantitative insights could be sought to deepen our understanding of the utilisation of predictive analytics, opportunities and challenges.

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