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INTEGRATING DATA ANALYTICS AND GIS FOR IMPROVED EFFICIENCY IN LOCAL TAX AUDITS: EVIDENCE FROM SAMUI CITY MUNICIPALITY

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Are performance auditors, professional level. Both auditors participated in the Advanced Data Analytics Capacity-Building Project. This project aims to develop advanced data analysis competencies among auditors and supporting staff, enabling them to perform their tasks more effectively. As a result, they applied data analytics techniques to analyze the Vaccine Procurement Programs for the prevention and control of the COVID-19 outbreak across local governments in Thailand.

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INTRODUCTION

In the current age of rapid technological change and increasing demands for government transparency, supreme audit institutions (SAIs) face the dual challenge of maintaining audit quality while responding to increasingly complex and data-rich environments. One of the most promising responses to this challenge is the adoption of data analytics (DA) in public sector auditing. By enabling auditors to extract insights from large and complex datasets, DA enhances the effectiveness of audits in terms of scope, depth, and timeliness. This paper presents an in-depth case study of the audit conducted by the State Audit Office of the Kingdom of Thailand (SAO) on the property tax system of Samui City Municipality. The case demonstrates how innovative applications of data analytics can



improve tax governance, identify systemic weaknesses, and inform actionable recommendations.

AUDIT METHODOLOGY

Samui City Municipality, located in Surat Thani province, is one of the largest and most economically significant local governments in Thailand due to its prominent role as a global tourism hub. The audit focused on the management of land and building taxes for the fiscal year 2023, following the implementation of Thailand's Land and Building Tax Act B.E. 2562 (2019). This law transferred responsibility for property tax administration to local governments, many of which have struggled with accurate data collection, taxpayer compliance, and transparent valuation practices. The SAO's audit aimed to examine the completeness, accuracy, and effectiveness of Samui Municipality's property tax collection process, and to do so, it employed advanced analytics tools to assess the quality of land and building data, tax assessments, and actual tax collection outcomes.

To conduct the audit, the SAO used a multidisciplinary methodology that combined machine learning, geospatial analysis, and business intelligence software. Specifically, tools such as KNIME, Power BI, QGIS, and Google Earth Engine were deployed to analyze structured and unstructured datasets, integrate satellite imagery and cadastral data, and develop predictive models. Machine learning techniques such as decision trees, random forest algorithms, and logistic regression were applied to identify patterns of tax non-compliance and to predict the likelihood of



future tax delinquency. The analytics workflow also included extensive data cleansing, transformation, and normalization processes to ensure data quality and compatibility across different sources.

AUDIT FINDINGS

The results of the audit were striking. The SAO discovered that Samui City Municipality's tax registry (known as "Admin Smart Samui") contained over 18,000 missing or unmatched records. Specifically, 1,505 land parcels, 17,101 buildings, and 17 condominium units listed in the physical asset database had not been incorporated into the official tax assessment system. This discrepancy led to a significant under-assessment of property tax obligations. Furthermore, geospatial comparisons revealed that over 4,000 land parcels had incorrect area measurements or misclassified land use categories, which led to systematic undervaluation of taxable assets. In another critical finding, over 900 plots of land owned by public agencies but leased or used by private entities were not recorded for tax assessment, despite their taxable status under the law. Beyond issues of completeness, the audit also identified problems with tax assessment accuracy. The assessment forms used by the municipality were not consistently based on verified survey data. Instead, outdated or manually updated records were often used, leading to errors in valuation, application of tax rates, and determination of exemptions. In some cases, agricultural land exemptions were granted without adequate verification of actual use, contrary to regulations issued by the Ministry of Finance. The SAO further noted that over 3,000 tax objections were filed in 2023 alone,



many of which were related to inaccurate land use classifications and miscalculated tax bills. These findings underscored the need for robust data governance and more systematic enforcement of tax rules.

LESSEN-LEARNED AND CHALLENGES

The use of data analytics in this audit provided several key advantages. First, it enabled auditors to process and cross-validate millions of records from diverse sources such as cadastral maps, treasury valuation tables, local survey data, and satellite imagery. Second, predictive modeling allowed the SAO to identify clusters of high-risk taxpayers who were likely to default, enabling targeted enforcement strategies. Third, data visualization dashboards built with Power BI provided stakeholders with clear, intuitive summaries of tax compliance trends across subdistricts and land use categories. This improved the municipality's ability to communicate audit findings and mobilize corrective actions across departments.

One of the most valuable aspects of this case is the set of lessons it offers for other SAs and local governments. First, the case demonstrates the necessity of interoperable data systems. Fragmentation between local, provincial, and national databases led to duplication, omissions, and inconsistencies. Establishing data-sharing agreements and common standards for land and tax data can greatly enhance auditability and transparency. Second, the case illustrates how investment in analytics capacity can yield high returns. The audit uncovered millions of baht in potential tax revenue that would otherwise remain uncollected. Third, the



findings underscore the importance of institutional coordination. Effective tax governance requires collaboration between land offices, treasury departments, local councils, and digital infrastructure providers. Fourth, the case highlights the role of audit institutions not only as oversight bodies but also as catalysts for reform. By revealing systemic weaknesses and proposing data-driven solutions, SAIs can help governments build smarter, more equitable public finance systems.

However, the audit also faced several challenges. One of the main limitations was the quality and availability of data. Despite technological tools, the audit depended on raw inputs from local agencies that were often incomplete, outdated, or inconsistently formatted. Another challenge was resistance to change within the audited entity. Some departments were hesitant to adopt new data-sharing protocols or revise established assessment practices. Finally, sustaining data-driven auditing requires ongoing investments in skills, infrastructure, and cross-agency collaboration, which may not always be prioritized in annual budgets.

To address these challenges, the SAO recommended several forward-looking reforms. These included the establishment of a centralized municipal data center, regular integration of satellite-based land use verification, leveraging unmanned aerial vehicles or drones, adoption of machine learning tools for early detection of non-compliance, and a public-facing or executive dashboard to monitor the performance. Additionally, the SAO proposed that staff be trained in geospatial analysis and data ethics, and that protocols be established to ensure data quality control and audit traceability. These recommendations aim to



institutionalize the gains of the audit and ensure that the use of data analytics becomes a permanent feature of local tax governance.

CONCLUSION

In conclusion, the audit of Samui City Municipality serves as a compelling example of how innovative approaches can transform public sector auditing. By integrating data analytics, machine learning, and geospatial technologies, the audit not only enhanced accuracy and accountability in property tax collection but also generated broader institutional learning. It demonstrated that modern auditing is not merely about checking compliance—it is about enabling better governance through evidence, technology, and collaboration. As SAIs around the world seek to adapt to digital-era challenges, the Samui case offers both inspiration and a practical roadmap for leveraging innovation in the public interest.