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From Manual to Automated: A Process-Centric Case Analysis of RPA Adoption in Local Government Operations

[1] Joyce Meman Dizon, [2] Amando Jr Pimentel Singun
[1] Saint Paul University Philippines, Tuguegarao City, Philippines
[2] University of Technology and Applied Sciences, Muscat, Sultanate of Oman

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Corresponding Author: **Amando Jr Pimentel Singun**

Abstract
This study examines the main operational business activities in a local government unit of the Philippines (the Tuguegarao City Assessor's Office). It presents how Robotic Process Automation (RPA) can improve its property assessment workflow.
A qualitative, process-based approach was used. Data were gathered through structured questionnaires, process walkthroughs, and document reviews across the key business CAO subprocesses. A Phase-1 prototype was also developed in UiPath Studio to test automation logic for data extraction, validation, and computation within the FAAS generation process. The Appraisal and Assessment stage, where the Field Appraisal and Assessment Sheet (FAAS) is prepared, contains the most repetitive and error-prone tasks. Manual transcription from property titles/eTitles, calculation of values, and multiple rounds of data encoding and cross-checking make this the most time-consuming part of the process. Preliminary simulations indicate an estimated 75–85% reduction in FAAS processing time, translating to approximately 3,600 man-hours saved annually across key appraisal and encoding tasks.
The UiPath prototype proved that automating property data extraction, valuation computation, and structured data encoding can produce standardized, audit-ready valuation records from the start. The RPA solution helps reduce human error, shorten processing time, and improve the accuracy and timeliness of the city's revenue forecasts. These improvements support better fiscal planning and enhance the city's ability to fund local public services.
This study provides a practical and governance-aligned model that shows how an LGU can use RPA not only to make processes faster but also to connect legacy systems with new national data standards.

Keywords: Robotic Process Automation, Business Process, Automation, Digital Transformation, UiPath, Process-Centric Case Analysis, Case Study

Introduction

Tuguegarao City serves as the regional capital of Cagayan Valley (Region II) and the provincial capital of Cagayan, positioning it as a key hub for public administration and local service delivery in Northern Luzon of the Philippines (NEDA Region II, 2023; World Bank, 2017) [6, 14]. This rapid urban growth and constant population increase place significant fiscal and administrative pressure on the city's service delivery systems (World Bank, 2017) [14]. One of the most affected and vital areas is real property assessment and taxation—a foundational function that directly determines the city's financial stability (Republic Act No. 7160 | GOVPH, 1991) [8].

For local government units (LGUs), efficient real property administration is essential, as the Real Property Tax (RPT) serves as a major source of locally generated revenue (Congressional Policy and Budget Research Department (CPBRD), 2023) [2]. The accuracy and timeliness of property assessments are key to ensuring revenue performance and maintaining taxpayer confidence. National laws affirm this principle: Republic Act No. 12001, or the Real Property Valuation and Assessment Reform Act (RPVARA), promotes a "just, equitable, and nationally consistent" valuation system to strengthen LGUs' fiscal autonomy (Republic Act No. 7160 | GOVPH, 1991; Republic Act No. 12001, 2024) [8, 9]; while the Local Government Code of 1991 (Republic Act No. 7160 | GOVPH, 1991) [8] authorizes LGUs to assess and collect property taxes and maintain the Schedule of Fair Market Values and Field Appraisal and Assessment Sheets (Republic Act No. 7160 | GOVPH, 1991) [8].

Within Tuguegarao City Hall, the City Assessor's Office (CAO) is legally responsible for maintaining the official roll of real

properties, conducting appraisals, and issuing key assessment documents, including Tax Declarations (TDs) and Notices of Assessment (NOAs). These comprehensive records ultimately serve as the foundation for the city's revenue forecasts, which ensure budget funding for local services and infrastructure (Republic Act No. 7160 | GOVPH, 1991) [8].

Despite its critical importance, the property assessment process faces persistent, long-standing issues that undermine both efficiency and data accuracy. Across the country, many LGUs struggle with outdated, paper-based systems that slow down assessments and reduce transparency (Ramos and Liwag, 1996) [7]. Studies have shown that poor RPT collection rates are often directly linked to incomplete or outdated property rolls that are not fully computerized (Congressional Policy and Budget Research Department (CPBRD), 2023) [2]. Furthermore, limited access to consolidated digital data and minimal use of modern digital tools have led to systemic valuation inconsistencies (Canares, 2016; Ramos and Liwag, 1996) [1, 7].

Locally, the Tuguegarao CAO still depends heavily on manual data entry and physical documents. The paper-based workflow and manual transcription of property details from source documents (like eTitles) make the process error-prone and severely time-consuming. This manual dependency lengthens turnaround times, complicates audit tracking, and makes maintaining the required accuracy and consistency exceptionally difficult. These challenges are particularly pressing in a fast-growing regional center like Tuguegarao, where rapid urban development requires assessment operations to keep pace.

To address this widespread national problem, the government passed the Real Property Valuation and Assessment Reform Act (Republic Act No. 12001, 2024) [9]. This landmark law promotes standardization and data integrity through a unified, market-aligned national valuation system. It requires LGUs to adopt the Electronic Field Appraisal and Assessment Sheet (eFAAS)—the digital version of the FAAS—to ensure consistent valuation data nationwide. Crucially, automating only the final steps, such as the printing of TDs and NOAs, would simply expedite document generation without solving the underlying problem of poor data quality. True modernization requires accurate, standardized, and compliant data at the source.

For this reason, Robotic Process Automation (RPA) is proposed as a practical and strategic solution for Tuguegarao City. Applying RPA directly to the Appraisal and Assessment Process (FAAS generation) ensures that valuation data are standardized and compliant with eFAAS from the moment they are created. This use of RPA serves as a "digital bridge," connecting legacy systems to new national data standards.

In this Phase-1 initiative, a prototype was developed using UiPath Studio to automate selected components of FAAS generation. The automation logic extracts information from electronic titles (eTitles) and performs complex cross-validation by referencing simulated lookup datasets—the Tax Map Control Records (TMCR/GIS) and the Schedule of Fair Market Values (SFMV). The TMCR/GIS tables serve as the official digital property map and record of all lots, while the SFMV tables contain the mandatory, rule-based prices per square meter used for the final valuation computation. Specifically, the prototype calculates assessed values using the mandatory formula: Area × Market Value × Assessment Level. These mock datasets accurately replicate the structure of future live databases, allowing for the validation of automation logic and demonstrating the feasibility of integration once full digital systems become available.

Through this prototype, the study evaluates how RPA can reduce manual workload, as described in Table 5, enhance data accuracy, and strengthen Tuguegarao City's compliance with national eFAAS standards under Republic Act No. 12001.

The proposed automation can effectively handle key bottlenecks in the current process: cross-checking parcel identifiers against tax-mapping records, computing assessed values based on official SFMV rates, and generating data staging tables to feed the FAAS files in the legacy systems or future eFAAS system. This modernization approach supports the national goals of accuracy and accountability, aligning with reforms seen in successful international e-taxation initiatives (Canares, 2016) [1]. Ultimately, Tuguegarao's role as the regional service center means that improved assessments can lead to earlier billing, fewer disputes, and more predictable revenue collections, which strengthens the city's fiscal autonomy.

The remainder of this paper first presents the Methodology, detailing the qualitative process analysis and the design of the UiPath prototype. It then outlines the modeled impact in Key Findings and analyzes the project's Limitations and Implications, culminating in the Conclusion and Final Recommendations for pilot implementation and scalable governance.

Research Objectives

This project seeks to improve the property assessment workflow of the Tuguegarao City Assessor's Office (CAO), focusing on the generation of the Field Appraisal and Assessment Sheet (FAAS). As the city's demand for faster and more reliable public services increases, the current FAAS process remains predominantly manual. It involves repetitive transcription, computation, and data encoding tasks that often result in errors, inconsistencies, and process delays. To address these inefficiencies, the study is guided by this core question: **(i) How does the implementation of Robotic Process Automation (RPA) in the FAAS generation process influence data accuracy, process turnaround time, and compliance with national standards (eFAAS) in the Tuguegarao City Assessor's Office, compared to traditional manual workflows?; and (ii) What organizational, technical, and governance factors affect the successful adoption and scalability of RPA solutions for property assessment workflows in local government units, and how can these be optimized to ensure sustainability and regulatory compliance?** The study analyzes the end-to-end property assessment process to identify the stage with the greatest potential for automation. The Appraisal and Assessment phase, where FAAS generation takes place, was determined to be the most suitable focus because it involves the highest frequency of manual data entry, cross-referencing, and computation activities.

Scope and Delimitation

This study covers the end-to-end real property assessment workflow of the CAO and analyzes six subprocesses: (1) Taxpayer Submission, (2) Appraisal & Assessment, (3)

Taxmapping, (4) Recording, (5) Administration/IT (Encoding), and (6) City Assessor's Final Approval. Specifically, it aims to: (1) Map core inefficiencies (manual steps, rework, error-prone tasks) in the CAO assessment process; (2) Determine the optimal RPA target aligned with the eFAAS mandate (RA 12001); (3) Propose an RPA solution for FAAS generation to improve efficiency and data accuracy and reduce end-to-end turnaround time; and (4) Analyze organizational, technical, and governance requirements to sustain the solution.

The Phase-1 RPA prototype scope is limited to the Appraisal and Assessment subprocess—specifically, the automation of Field Appraisal and Assessment Sheet (FAAS) generation through data extraction, validation, and computation. The following boundaries apply:

Included: Extraction of parcel data from eTitles, cross-validation with TMCR/GIS and SFMV tables, computation of assessed values, and export of standardized Excel data output for eFAAS integration.

Excluded: Manual document intake (Receiving Section), physical tax-mapping or survey updates, record archiving, IT encoding of TD/NOA in legacy systems, and final approval or signing by the City Assessor.

This initial phase of the study has a few important limitations. First, it does not include quantitative time-and-motion data, such as the exact average cycle time for each step in the process. Although the qualitative findings clearly show that manual errors and rework consume significant time and resources, the report relies on simulated projections and industry benchmarks to estimate the expected improvements and Return on Investment (ROI). Second, the prototype uses mock datasets instead of live databases. The lookup tables for the Tax Map Control Record (TMCR/GIS) and Schedule of Fair Market Values (SFMV) were created only for simulation. As a result, the automation's validation accuracy is limited to these controlled data conditions. In future phases, the system must be connected to the City Assessor's actual databases via secure APIs to enable real-time data validation and ensure full compliance with the Bureau of Local Government Finance (BLGF) valuation standards. Third, the automation's reliability is subject to source document variability and the efficacy of Optical Character Recognition (OCR). The successful data extraction from the eTitle relies on the quality of the input file: while searchable (text-layer) PDFs allow for deterministic data extraction, image-only scans require OCR, which is inherently susceptible to errors from poor image quality, faded text, or handwritten annotations. This variability directly influences the target Straight-Through Processing (STP) rate and is the primary driver of the high initial 15–20% exception ceiling. Mitigating this limitation requires continuous training of the OCR engine and template tuning throughout the pilot phase.

Despite these limitations, the study remains aligned with national modernization and compliance goals. The identified constraints are acknowledged and transparent—all simulated metrics are clearly marked in the Results and ROI sections, pending calibration during the pilot stage.

Literature Review

The importance of the Real Property Tax (RPT) as a key revenue source for decentralized governance is well established (Congressional Policy and Budget Research Department (CPBRD), 2023; Department of Finance, 2022) [2, 4]. Historical analyses show that administrative inefficiencies—such as fragmented records, paper-based workflows, and inconsistent data quality—continue to hinder fiscal performance in local governments (Congressional Policy and Budget Research Department (CPBRD), 2023; Ramos and Liwag, 1996) [2, 7]. These systemic challenges have motivated national policy reforms toward data-driven valuation and assessment. The Real Property Valuation and Assessment Reform Act (Republic Act No. 12001, 2024, p. 120) [9] institutionalize a unified valuation system and mandates the adoption of the Electronic Field Appraisal and Assessment Sheet (eFAAS) as the new national standard. Compliance with this mandate requires not only digitization but also automation at the point of data creation to ensure accuracy, integrity, and interoperability across Local Government Units (LGUs).

To operationalize this automation mandate, emerging digital technologies such as Robotic Process Automation (RPA) offer a practical and scalable means of enforcing valuation rules and standardizing assessment workflows within the eFAAS environment. Globally, RPA has emerged as a strategic digital-transformation technology capable of enhancing efficiency, accuracy, and compliance monitoring of rule-based administrative processes (Willcocks *et al*., 2015) [13]. Its non-invasive and low-code design enables integration with legacy systems without major redevelopment, making it ideal for public-sector modernization initiatives (Canares, 2016; Hofmann *et al*., 2020; Vollenberg *et al*., 2024) [1, 5, 12]. Empirical literature consistently documents that RPA improves data consistency and reduces processing time when applied to repetitive validation, encoding, and compliance-driven tasks (Costa *et al*., 2022) [3]. These traits are especially relevant for LGUs, where valuation processes involve high-volume, rule-based computations guided by official standards such as the Schedule of Fair Market Values (SFMV). Evidence from international implementations further substantiates RPA's suitability for public-sector use. The U.S. General Services Administration (GSA) reported measurable improvements in administrative efficiency after deploying bots for credential and compliance verification (U.S. General Services Administration, 2023; Willcocks *et al*., 2015) [11, 13]. Likewise, the (U.S. General Services Administration, 2025) [10] documented sustained reductions in manual workload across U.S. federal agencies following the deployment of unattended data-collection and reporting automations. The U.S. Department of Agriculture's Supplemental Nutrition Assistance Program (SNAP) similarly demonstrated how automation enhances auditability and data accuracy while reducing repetitive verification tasks (Wroblewska *et al*., 2023) [15]. Collectively, the case studies listed in Table 1 confirm that structured, compliance-oriented government processes are well-suited for RPA adoption—delivering

quantifiable efficiency gains and improving reliability in data-driven operations.

Table 1: Summary of international public-sector RPA case studies

Study / Source	Sector / Organization	Wage
(U.S. General Services Administration, 2023; Willcocks *et al*., 2015) [11, 13]	U.S. Federal – General Services Administration	Credential and compliance verification; records handling
(U.S. General Services Administration, 2025) [10]	U.S. Federal Multi-Agency (Digital.gov)	Unattended data collection and reporting
(Wroblewska *et al*., 2023) [15]	U.S. Department of Agriculture, Food & Nutrition Service	Benefits case processing and data handling

Gaps in Current Literature

While global literature provides substantial evidence that RPA can improve efficiency and auditability in administrative workflows, most existing studies remain focused on operational performance rather than compliance assurance, as presented in Table 2. The (U.S. General Services Administration, 2023) [11] and the (U.S. General Services Administration, 2025) [10] demonstrated the capability of automation to streamline credential and reporting tasks, but neither addressed how RPA could be embedded to enforce domain-specific valuation or fiscal-compliance rules. Likewise, the U.S. Department of Agriculture's SNAP RPA initiative (Wroblewska *et al*., 2023) [15] focused on case-processing efficiency within social services, not on statutory valuation or taxation frameworks.

Academic works such as those of (Willcocks *et al*., 2015) [13], (Hofmann *et al*., 2020) [5], and (Vollenberg *et al*., 2024) [12] have examined RPA through the lens of corporate governance, IT adoption, and process-automation maturity. However, these frameworks stop short of exploring how RPA can be integrated into government assessment systems where data integrity, rule-based computation, and regulatory compliance are central. Similarly, Philippine studies on digital governance (Canares, 2016) [1] discuss modernization efforts at the systems level but do not extend to task-level automation for property valuation and assessment.

Table 2: Summary of identified gaps in existing RPA literature

Reference / Case	Primary Focus of Study	Identified Gaps / Limitations
(U.S. General Services Administration, 2023) [11]	RPA for credential and compliance verification	Focused on operational efficiency; no domain-specific valuation or fiscal-compliance application.
(U.S. General Services Administration, 2025) [10]	Multi-agency reporting automation and governance	Addressed coordination and time savings, but not integration with statutory or rule-based valuation systems.
(Wroblewska *et al*., 2023) [15]	Benefits of processing and audit improvement	Social-service context only; lacks linkage to fiscal assessment or taxation data environments.
(Vollenberg *et al*., 2024; Willcocks *et al*., 2015) [12, 13]	Theoretical and enterprise-level RPA adoption frameworks	Addressed general process-automation maturity; did not explore integration with valuation systems or rule-based fiscal compliance
(Canares, 2016) [1]	Philippine e-governance and digital transformation	Discussed system-level modernization; lacked task-level automation or valuation-workflow analysis in LGUs.

This study fills a key gap by showing how RPA can improve efficiency while ensuring compliance with Republic Act No. 12001. The prototype integrates data validation, SFMV calculations, and cross-checking within the FAAS-generation process. It demonstrates how RPA can act as a "digital bridge" that supports both accuracy and transparency in local government valuation. This framework lays the groundwork for the next section, which describes the design and testing of the RPA prototype in the City Assessor's Office.

Research Methodology

The authors chose to employ a qualitative case study method to validate the use of RPA in the digital transformation of a local government operation by analyzing a specific case within its real-world context. Specifically, it employs a qualitative, process-centric case analysis focused on the Tuguegarao City Assessor's Office. The methodology involved: (i) Process Mapping - Determining the CAO's current business flowchart.; (ii) Data Collection - Analysis of the Survey Form titled Data Collection File submitted by key CAO personnel, covering the entire end-to-end workflow (Taxpayer Submission, Appraisal, Tax mapping, Recording, Administration, and Final Approval); (iii) Critical Task Identification - Using data points numbers 3 through 9 from the Data Collection File, manual activities, decision points, software systems, and rework cycles were identified. This focused the analysis on the most manual, rule-based, and error-prone steps that offer the highest return on RPA investment (ROI); and (iv) Strategic Alignment - The identified inefficiencies were cross-referenced against the non-negotiable compliance requirement of RA No. 12001 (eFAAS) to determine the optimal strategic target for automation. The outputs of mapping and role-based collection (see Appendices) inform the Data Analysis and design choices in Results.

Data Collection

Data for this study were gathered through structured interviews and process mapping sessions with key personnel from the Tuguegarao City Assessor's Office (CAO). These activities focused on documenting how each part of the property assessment process works—from the sequence of steps and decision points to the systems and documents used. The goal was to understand how often staff performs manual tasks such as data entry, verification, and cross-checking, and how long these steps typically take.

This qualitative information was then used to define the study's "automation scope"—that is, to identify which tasks are high-volume, repetitive, and rule-based (Costa *et al*., 2022) [3]. These are the activities most suitable for Robotic Process Automation (RPA). The six role-based data collection files, each representing a different function within the CAO, served as the qualitative baseline for the Data Analysis section that follows.

Because the City Assessor's Office has not yet fully digitized its Tax Map Control Records (TMCR/GIS) and Schedule of Fair Market Values (SFMV) databases, the

study used simulated lookup datasets to replicate these sources. Two mock tables were created in comma- separated value (CSV) format and integrated into the UiPath environment: (1) The TMCR_Lookup table contained key identifiers such as Property Identification Number (PIN), Owner's Name, Barangay, and Title Number (TCT/eTitle); and (ii) The SFMV_Lookup table included data fields like Classification, Sub-class, Rate per square meter, and Assessment Level.

These simulated datasets made it possible to test how the automation performs data validation and value computation under realistic conditions. They also demonstrate how the RPA logic can connect with real-time databases in the future—once the city's digital transformation and BLGF modernization programs under the Local Government Code of 1991 (RA 7160) are fully implemented (Canares, 2016; Republic Act No. 7160 | GOVPH, 1991) [1, 8].

Participants' Demographics

The participants of the study were key personnel from the Tuguegarao City Assessor's Office (CAO) who are directly involved in the six core subprocesses of property assessment: Taxpayer Documents Submission, Appraisal/Assessment, Tax mapping, Recording, Administration, and City Assessor's Approval. Six distinct structured data collection files were gathered, each corresponding to one of these functional areas. These files captured the operational perspectives, routine tasks, and pain points experienced by the staff, providing a detailed view of the entire end-to-end workflow. As shown in Fig 1, the insights drawn from these participants formed the qualitative foundation for identifying automation opportunities and validating the "as-is" process mapping used in this study.

Findings

The real property assessment workflow at the Tuguegarao City Assessor's Office (CAO) is a sequential, document-intensive process spanning multiple functional units and culminating in the issuance of Tax Declarations (TDs) and Notices of Assessment (NOAs). Through detailed process walkthroughs and staff interviews using the Data Collection Files, the analysis revealed major inefficiencies rooted in manual, linear procedures for capturing, encoding, computing, and validating property data derived from electronic titles (eTitles). This heavy reliance on manual handoffs contributes to frequent encoding errors, redundant rework, and extended processing times.

The assessment process remains largely paper-based, fragmented, and dependent on the Field Appraisal and Assessment Sheet (FAAS) as the primary instrument for data recording and inter-office routing. While the procedural flow is logically structured, its manual execution results in bottlenecks, inconsistencies, and delays across units.

Summary of the CAO Workflow

As shown in Table 3, the current workflow follows a linear path encompassing six distinct subprocesses across corresponding functional units. The physical FAAS serves as the central document for capturing, transferring, and validating property assessment information throughout the transaction chain.

Table 3: City assessor's office workflow

Subprocess	Functional Unit	Core Activities
Document Requirements Submission	Receiving/Officer-of-the-day	Completeness check and validation of taxpayer documents.
FAAS Preparation	Appraisal/Assessment	Drafting the FAAS, transcribing data (eTitle to FAAS paper form), validating classification, and calculating assessed value (using SFMV).
Tax Mapping / Technical Update	Taxmapping Operations	Assigning the Property Identification Number (PIN) and updating technical records (Taxmaps/TMCR).
Record Keeping and Archiving	Records Operations	Logging, numbering, and physical filing of the approved FAAS; releasing the approved Tax Declaration (TD) and Notice of Assessment (NOA) to the taxpayer.
Data Encoding and Document Generation	Administrative/IT	Manual data input from the paper FAAS into the legacy Real Property Assessment System to generate the TD and NOA.
Review and Approval	City Assessor	

Baseline Performance and Automation Readiness

The analysis of current performance provided a qualitative baseline, as no formal time-and-motion data were available. Staff observations suggest that the end-to-end processing from submission to TD/NOA issuance averages three weeks, although complex cases can take longer. The main sources of delay are the data extraction from the eTitle, to cross-checks and verification steps involving the Tax Map Control Roll (TMCR), physical survey documents, and the Schedule of Fair Market Values (SFMV).

To strategically select the automation target, an evaluation matrix, as shown in Table 4, was used to score each subprocess based on three Robotic Process Automation (RPA) suitability dimensions: (a) rule-based logic, (b) data structure/system accessibility, and (c) transaction volume/frequency.

Table 4: Process - RPA suitability matrix

Process	Rule-Based	Data Structure	Volume/Frequency	Suitability
Taxpayer Submission	Medium	Semi-structured	High	Moderate
Appraisal & Assessment (FAAS generation)	Very High	Structured	Very High	Excellent
Taxmapping	Medium	Paper-based survey docs	Medium	Moderate
Recording	Low	Paper-based	Medium	Low
Administration/IT	High	Structured	Low	Moderate
Final Approval	Low	Unstructured	Low	Not feasible

The evaluation matrix clearly demonstrated that the Appraisal & Assessment (FAAS generation) process has the highest overall suitability, scoring "Very High" on rule-based logic and transaction volume/frequency, making it the most strategic target. Consequently, based on this clear evidence of high automation readiness and strategic impact, a decisive solution focused on Full RPA implementation was formulated.

Recommended Solution and Expected Outcomes

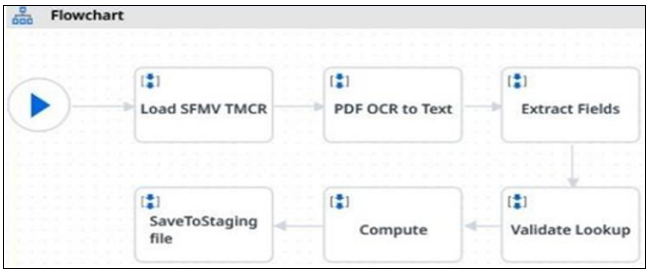
Based on the analysis of inefficiencies and high RPA readiness, the recommended path is RPA implementation focused on FAAS generation. This approach involves automating data extraction from PDF eTitles, cross-validation against property records (TMCR/GIS), valuation computation using SFMV, and generating an Excel format staging data table that contains key FAAS data for future integration into the Real Property-Field Appraisal Assessment System (RP- FAAS) or the future eFAAS. This strategy is superior to manual optimization or partial digitization as it directly ensures eFAAS data-quality assurance.

The Phase-1 prototype, as shown in Fig 1, developed in UiPath, simulated this logic by cross-referencing extracted eTitle data against mock TMCR and SFMV lookup tables, computing the Assessed Value with the formula: Assessed Value = Area x Market Value x Assessment Level.

This evidence suggests that RPA can achieve three critical project objectives: (i) Efficiency Improvement - Significantly reduce end-to-end FAAS processing time by automating repetitive encoding and validation; (ii) Data Accuracy - Eliminate computation and transcription errors through rule-based automation; and (iii) Regulatory Compliance - Support the eFAAS standardization mandate under RA No. 12001, enabling more reliable property data for forecasting and auditability.

The feasibility confirmed by this analysis justifies the development of the RPA prototype, which will be detailed in the subsequent Results section. The following section presents the modeled impact of this recommended solution, adjusted to incorporate realistic constraints and projections.

RPA Scope: The prototype unattended bot automatically (i) extracts key parcel information from the Title or eTitle document, (ii) cross-validates the data against the TMCR/GIS and the Schedule of Fair Market Values (SFMV), (iii) computes the assessed value using the formula Area × Market Value × Assessment Level, and (iv) saves these eTitle key information and assessed values to an Excel data output for future integration into the eFAAS/RP-FAAS system for the creation of Tax Declarations (TDs) and Notices of Assessment (NOAs).



Source: Authors

Fig 1: City assessor's RPA UiPath business process flow

Phase-1 UiPath flow for FAAS data generation (prototype)

The automation utilizes synthetic TMCR/GIS and SFMV lookup datasets to simulate data validation and valuation operations. During runtime, the user is prompted to enter the Classification (Residential, Commercial, etc.) and Property Identification Number (PIN) (any number can do for now). This input step is included only for the prototype version; in the actual production process, classification and PIN assignment are handled during the Tax Mapping stage, which is outside the current automation scope.

Simulated impact and realistic projections

The initial simulated results are promising but require cautious interpretation, as the efficiency gains are based on modeled projections rather than measured pre-automation data. This section adjusts those projections to reflect the real-world friction of dealing with semi-structured inputs, such as scanned documents and data quality gaps common in manual government processes.

Deriving Simulated Projections

The projected performance metrics, the percentage reductions in cycle time, were not derived from formal time-and-motion studies, as none existed. Instead, they are the result of a two-step modeling process: (i) Qualitative Baseline: Staff interviews and process walkthroughs established a qualitative baseline (e.g., the average three-week turnaround time) to identify the duration and frequency of manual tasks (transcription, validation, computation); and (ii) RPA Industry Benchmarking: These manual tasks were modeled for automation by applying industry-standard Robotic Process Automation (RPA) compression rates. Structured, rule-based tasks (like computation and data encoding) typically achieve 70– 95% cycle-time reduction when automated, as a bot performs in seconds what a human takes minutes or hours to do. The projections represent the mid-to-high end of these observed ranges, which explains the significant reported gains.

The immediate goal of the pilot phase is to replace these projections with actual, measured data for a realistic performance baseline. While these projections confirm feasibility, known process challenges necessitate the establishment of adjusted, more realistic performance targets for the initial deployment phase.

Realistic Efficiency and Quality Projections

Based on the known challenges, specifically the reliance on Optical Character Recognition (OCR) for scanned PDFs and potential discrepancies in legacy data sources, the following adjusted targets, as shown in Table 5, provide a more realistic expectation for the initial deployment phase:

Table 5: Efficiency and quality projections

Metric	Original Projection (Optimistic)	Adjusted Projection (Realistic)	Real-World Consideration
Cycle-Time Reduction (Valuation & Encoding)	80–92% reduction	75–85% reduction	Accounts for necessary API latency, system integration checks, and initial bot tuning delays.
Straight- Through Processing (STP)	Target 80%	60–75% initial STP	The major variable. OCR accuracy on low-quality or image-only scanned titles will initially limit the number of cases a bot can handle without human intervention.
Initial Exception Rate	Ceiling 15%	15-20% initial ceiling	Allows for a higher frequency of data mismatches between the extracted eTitle data and the legacy Tax Map Control Roll (TMCR) or GIS records.

The modeled effort savings of ~3,667 man-hours/year remain a valid target, as it is derived from the sheer volume of tasks that will be removed or compressed, regardless of the precise percentage reduction.

Managing Real-world Friction and Exception Handling

The reality of any automation effort is that it creates a new "bottleneck" at the point of exception. Therefore, the success of the RPA solution relies not only on automation speed but on the efficiency of the human review process: (i) Exception Drivers - The initial 15–20% exception rate is expected to be primarily driven by cases where the robot is uncertain, such as low-confidence OCR results, missing critical data fields (anchors) on the property title, or internal data inconsistencies (e.g., area in the eTitle doesn't match the TMCR/GIS record); (ii) The Action Center - These uncertain cases must be routed immediately to an Action Center, ensuring that the median turnaround time remains fast—ideally 1 business day. Slow exception handling negates all automation gains; and (iii) Auditability as Assurance - The core value of the 100% transaction logging is the assurance of regulatory compliance. This logging not only provides an audit trail but also acts as the source of truth for data quality, confirming the rules applied (SFMV rates) and the computed output (Assessed Value).

The simulation confirms the technical feasibility and justifies the investment, but the real-world value will be determined by the ability of the Pilot Calibration Plan to quickly address the initial limitations imposed by data input quality and legacy system alignment.

Key Findings

The simulation validated that a structured, rule-based workflow can accurately transform property data from the electronic title (eTitle) into standardized, eFAAS-ready records. The following are the highlights: (i) Root Cause Verification - Manual data transcription and complex rule-based valuation steps during FAAS preparation remain the principal sources of rework and process delays; (ii) Data Standardization is Key - Focusing automation on FAAS generation directly enforces eFAAS compliance and resolves data-quality issues at the source, a superior strategy to merely expediting downstream document printing; (iii) Automated Validation - The RPA bot's cross-checks against cadastral (TMCR, GIS) and valuation (SFMV) datasets substantially reduce repetitive human verification loops, while human oversight is reserved only for complex exceptions; (iv) Strong Efficiency Gains - Simulation results project a significant 75–85% reduction in processing time for the two longest manual activities and deterministic error rates below 1% for rule-driven computations, figures that will be empirically validated during the pilot phase; and (v) Feasibility Confirmed - Even with synthetic lookup data, the UiPath pilot achieved end-to-end processing with minimal human intervention, confirming that the same logic can scale to higher transaction volumes once real datasets are integrated.

These operational findings on process inefficiencies and data quality gaps align directly with the strategic mandates and documented literature supporting the adoption of RPA.

Discussion

The CAO's projected 3,667 man-hours saved per year is consistent with the (U.S. General Services Administration, 2023) [11] estimate of about 3,000 hours saved annually, showing that the local projection is realistic. Although the overall scale differs, the 75–85 percent cycle-time reduction from the CAO simulation falls within the upper range of 70–95 percent efficiency gains reported in international RPA studies (Costa *et al*., 2022) [3]. (Wroblewska *et al*., 2023) [15] also supports these findings, where automation in benefits validation led to faster processing and better audit traceability—like the CAO prototype's complete transaction logging feature. In addition, the (U.S. General Services Administration, 2025) [10] highlighted the importance of governance structures for sustainable automation. The CAO's plan to create a Micro-Centre of Excellence (Micro-CoE) reflects this best practice, adapted for the Philippine local government context.

Together, these comparisons show that the CAO's RPA initiative performs within the global standards for rule-based administrative automation. Beyond matching international efficiency results, it also expands RPA's role toward ensuring regulatory compliance, an area that remains underexplored in current research.

Comparison with Existing Literature

Building on the findings presented in the preceding sections, the simulated results of the Tuguegarao City Assessor's Office (CAO) RPA initiative were compared with

established international RPA case studies as presented in Tables 6 and 7. The City Assessor's prototype projected a 75–85 percent reduction in FAAS processing time and an equivalent 3,667 man-hours saved annually, as shown in Table 6, across the appraisal and encoding subprocesses. These outcomes confirm that the automation effectively targets structured, rule-based tasks—precisely the operational "sweet spot" identified in prior research (Hofmann *et al*., 2020; Willcocks *et al*., 2015) [5, 13].

Table 6: Estimated return on investment (man-hours saved) for CAO RPA

Activity Eliminated/Automated	Estimated Time Saved per FAAS (Minutes)	Annual Volume (Estimated)	Equivalent Annual Man-Hours Saved
Manual Data Extraction (eTitle)	5	10,000	833
Manual Cross-Validation (RP-FAAS/TMCR)	8	10,000	1,333
Manual FMV/Assessment Calculation	2	10,000	333
Manual System Encoding (RP-FAAS)	7	10,000	1,167
Total Estimated Man-Hours Saved	22	-	3,667
Note: Simulated projections from qualitative step mapping and typical RPA performance ranges; calibrate during pilot using time-and-motion sampling and retrospective error-log review.			

Globally, other RPA implementations in government institutions have demonstrated significant gains in efficiency and cost reduction. Table 7 presents these comparable cases and shows how the CAO's results align with the performance levels reported in prior studies.

Table 7: Comparative alignment of CAO RPA results with published RPA case studies

Study / Source	Reported Efficiency Gains	Key Takeaways / Observed Impacts	Relevance to the Tuguegarao CAO Case
(U.S. General Services Administration, 2023) [11]	~3,000 hours saved per year	Automated credential and compliance verification; improved audit readiness and data integrity.	Confirms that compliance-driven processes—similar to eFAAS validation—yield high measurable returns when automated.
(U.S. General Services Administration, 2025) [10]	~150 hours saved per month (per bot)	Demonstrated sustainable orchestration and inter-agency governance for unattended bots.	Mirrors the need for a Micro-Center of Excellence (Micro-CoE) to sustain cross-unit governance of CAO automation.
(Wroblewska *et al*., 2023) [15]	~1.6 hours saved per case	Reduced manual verification workload; strengthened data accuracy and auditability.	Validates the CAO projection that embedding rule-based validation within the FAAS process can cut cycle time by > 70 %.
Tuguegarao City Assessor's Office (Phase-1 Prototype) – Current Study	75–85 % cycle-time reduction ≈ 3,667 man-hours saved per year	End-to-end automation of FAAS data extraction, validation (TMCR/SFMV), and computation; deterministic error rate < 1 %.	Extends global lessons to the Philippine LGU context; demonstrates RPA as a compliance-assurance tool, not merely a productivity solution.

Governance and Compliance

Collectively, these governance, operational, and fiscal gains confirm that the RPA implementation is not merely a technical enhancement but a strategic enabler of compliance, accountability, and service quality within the CAO.

1. Legal/Compliance - The automation produces standardized, auditable, eFAAS-ready data at the source, directly supporting statutory requirements under Republic Act No. 12001 and ensuring consistent application of the Schedule of Fair Market Values (SFMV). Such data integrity is crucial for aligning the CAO's operations with the official implementing guidelines issued by the Bureau of Local Government Finance.
2. Governance & Risk - Establishing a lightweight RPA governance model—comprising change control, audit logs, and role-based access—will mitigate operational risks and foster continuous process improvement.
3. Operational and Staffing Operational Shift - The reduction in rework loops and the shortened cycle times for FAAS creation will enable strategic redeployment of staff from low-value manual encoding to higher-value exception handling and quality review.
4. Data Quality & Analytics - Structured, validated RP-FAAS entries enhance downstream data reliability, enabling improved reporting accuracy, performance monitoring, and evidence-based forecasting.
5. Stakeholder Experience - Faster turnaround from submission to Tax Declaration (TD) and Notice of Assessment (NOA) issuance will improve taxpayer satisfaction and reduce walk-in follow-ups for status inquiries.
6. Fiscal and Revenue Impact - Revenue Realization. Cleaner assessment rolls and reduced data discrepancies minimize rework and disputes, enabling earlier billing cycles and steadier Real Property Tax realization.

Conclusion

The Tuguegarao City Assessor's Office requires an immediate, strategically aligned modernization effort to comply with the Real Property Valuation and Assessment Reform Act (RA No. 12001).

The analysis clearly demonstrated that the Field Appraisal and Assessment Process (FAAS generation) is the highest-value target for automation. By applying RPA to automate data extraction, valuation computation, cross-referencing, and assessed value computation, the project directly

addresses the root causes of error and delay, ensuring that the resulting property data is standardized, accurate, and ready for the national eFAAS system.

By shifting staff effort from manual encoding to quality review, the CAO can shorten turnaround from submission to TD/NOA issuance and improve the integrity of assessment data. The rule-based, high-volume nature of FAAS work indicates a strong RPA fit, promising sustained operational benefits, eFAAS-compliant data, and a cleaner, auditable tax roll that supports timely, predictable revenue realization.

To translate this confirmed strategic conclusion into actionable change, specific recommendations and a concrete pilot governance framework are defined as expounded in the following section and subsections.

Recommendations and Pilot Plan

To operationalize the conclusion and realize the expected benefits, the following actionable recommendations and pilot governance framework are defined:

Strategic and Technical Recommendations

The following steps outline the critical phases in advancing the FAAS automation initiative, focusing on scope approval, baseline establishment, auditability, and personnel training. These actions are essential to ensure a successful and compliant deployment:

1. Approve Phase-1 Scope - Formally approve the end-to-end automation of FAAS generation, including bot-driven cross-validation and human exception handling.
2. Establish Baseline - Conduct a short (2–3 weeks) time-and-motion study on the two longest steps to calibrate the simulated metrics and establish final acceptance thresholds.
3. Harden Auditability - Mandate 100% transaction logging (inputs, rules applied, decisions, and outputs) per transaction to support compliance and internal QA.
4. Training & Change Management - Upskill existing encoders to exception analysts and publish clear Standard Operating Procedures (SOPs) for exception handling and escalation.

Governance and Scaling

Successfully executing these recommendations and managing the long-term sustainability of the automation requires a dedicated governance structure; therefore, the project mandates the establishment of a lightweight, focused governance body called the Micro-Center of Excellence (Micro-CoE).

1. Stand up a Micro-CoE - Immediately establish a lightweight Center of Excellence (Micro-CoE) composed of representatives from the Assessor's Office, Taxmapping, and IT. This group must own SFMV/rules updates, exception SLAs, and change control.
2. Pilot and Scale - Initiate the pilot in one barangay cluster to measure cycle-time and error-rate deltas against the baseline. Following a successful pilot, the solution should scale in measured waves city-wide, with performance monitored monthly against defined Key Performance Indicators (KPIs).

Pilot Performance Targets and Exception Strategy

As described in Table 8, the initial pilot phase will use the following targets, which will be finalized by the Micro-CoE after Month 1:

Table 8: Comparative alignment of CAO RPA results with published RPA case studies

Metric	Target (Pilot)	Exception Strategy
FAAS Creation Cycle Time	60% reduction	Audit Log Completeness: 100% compliance log.
Initial Exception Rate	15% (trending down)	SLAs: Resolve PIN and SFMV Mismatch exceptions within 3 business days; Geometry/Classification anomalies within 5 business days.
Data Error Rate	< 1% (post-commit corrections)	Routing: Exceptions are automatically routed to the correct functional unit (e.g., Taxmapping for Geometry Conflicts; Assessor-Valuation for SFMV Failures).
Exception Aging	3 days (median)	Escalation: Unresolved cases are escalated to the Micro-CoE Lead or Department Head.
End-to-End Turnaround	Decrease vs. 3-week staff baseline	Hours Saved: Track and convert robot minutes to man-hours monthly.

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Informed Consent Statement

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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