International Journal of Finance (IJFIN)
Vol. 36, No. 6, November - December, 2023 pp. 124-149.
ISSN: 1041-2743
website: www.ijfin.com

Optimizing Public Service Delivery through AI and ML Driven Predictive Analytics: A Case Study on Taxation, Unclaimed Property, and Vendor Services

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Abstract

Pursuing the mission of the best government has been a key priority across countries and centuries. One of the main roles in addressing these ambitions has been 'better regulation'. More recently, in a variety of countries and under different output schedules, including 'better legislation' and 'better government', the dimensions have been expanded. For instance, under better regulation, the first critical component (pre-approval) is related to the creation of laws and subordinate legislation, seeking to ensure their quality (better law making, BL). The second (post-approval), in turn, regards the application of laws and regulations in a way that their objectives are achieved without imposing burdens that are not justified, involving actions to remedy market failures, taking into account considerations of good governance and transparency, with a comprehensive approach concerning the legislative process, and in particular concerning ex ante and ex post evaluation activities, as emphasized in the IA guidelines, CBA guidelines, and those of WM. This is expected to provide the necessary information to identify the most efficient and effective policy options and to monitor compliance and impacts over time, or, more broadly, the ex ante assessment system (ExAS).

Keywords: AI, machine learning, public service, predictive analytics, crime, text mining, user evaluation, ethics taxonomies, structured journalism, topic modeling, entity-centric topic modeling, law variance, algorithmic enforcement, risk assessment, criminal law

taxonomies, legal issues, structured data, portability bias, representation taxonomies, crime variation, litigation; antitrust, communitarianism, notice-and-comment requirements, transnational; poverty taxes, credit poverty, EITC, Tax Credits; default assumptions, taxpayer rights, uncontested entry, entry restraints, interpretive gravity, serial deference; IRS, National Taxpayer Advocate, administrative law deference, soft law, Section 7805. Policy, entropy, pandemic, information, right to data, digital income tax filing, ex ante control, digital administration

How to Cite: Vamsee Pamisetty. (2023). Optimizing Public Service Delivery through AI and ML Driven Predictive Analytics: A Case Study on Taxation, Unclaimed Property, and Vendor Services. *International Journal of Finance (IJFIN)*, 36(6), 124–149.
DOI: https://doi.org/10.5281/zenodo.14905356

1. Introduction

Public sector organizations face growing challenges in the delivery of services to citizens. Despite increasing demands, many governments are constrained by outdated systems and inherent inefficiencies that hamper the provision of required services. Machine learning and artificial intelligence (AI) are identified as tools which can significantly improve the administration of service delivery, addressing existing problems and helping to ensure that citizens receive resources in an optimal way.

With the overarching goal to prompt the public sector to improve the service delivery experience for the services they manage or contract notably by responding earlier and more preemptively to citizens with public service needs, governments are explored based on ways in which machine learning and AI technology could transform the public sector on a national and regional basis. A strategic scoping review is conducted to see how other nations are approaching the administration of sectoral-level customer services for strategies which could be replicated or adapted locally to improve services for citizens of the region. Areas are identified where local services can still be enhanced through adopting new processes and technologies.

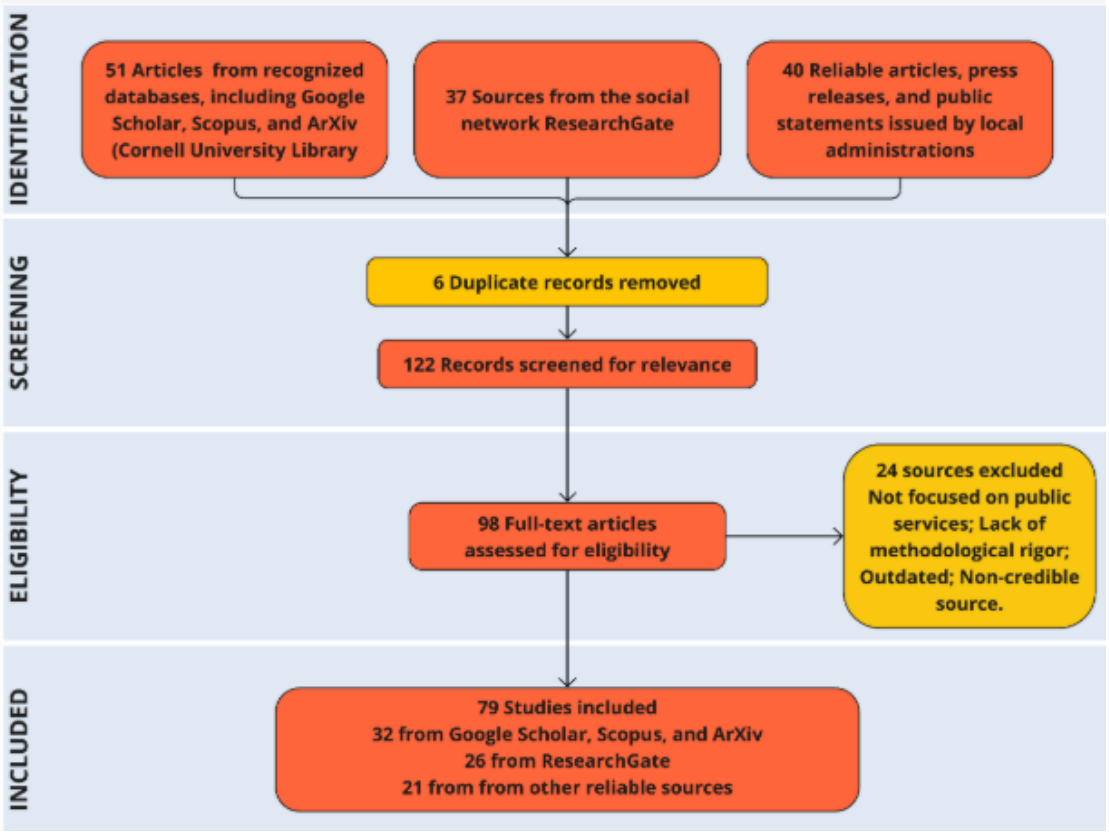

Fig 1: Public service delivery artificial intelligence

1.1. Background and Rationale

Citizens across the world typically experience inefficiencies and delays in the services provided by public administrations - whether bidding for licences and tenders, or seeking advice or simply information. In the age of digital transformation, inefficiencies are highlighted as they become less and less acceptable in comparison to streamlined user journeys presented by private or secure services. It is thus not surprising that a widely noted problem and a frequent part of political discourse in various countries is a delayed reaction to applications made to public authorities, often concerning benefits, licences, passports, asylum, tax refunds, or petty fines being wrongly or unjustly applied. As presented here, turning to empirical and economic history work it is suggested that these problems with responsiveness are not merely a question of bureaucratic stasis or political reticence, rather a question of the limits of what is possible in terms of responsiveness. Traditional public administration narrows this down to a problem of 'satisficing' or inappropriate claim-making but here is asked how (given time and resources) it is possible to increase

responsiveness, and how long such changes persist comprehensively across a whole administrative system.

The argument in that simple but suggestive case is that AI and machine learning technologies are beginning to address such questions. There is emerging evidence from the private sector and health sector that the implementation of such technologies can spuriously and cheaply alter levels of responsiveness and service quality by automating or prioritising tasks in new ways. This is made particularly clear in delivery models where AI predicts decisions on next best actions to drastically change the efficacy of professional response. There are fairly unremarked upon trends since the 1960s in Anglo-American public policy and good governance about governments creating their own versions of machine learning and expert systems to assist public servants in internal decision-making that transform policy, valuation, and oversight functions alike; a long-running "quiet" AI sector. The provision of AI for public services comes therefore at the sharp end of a longer trajectory and only in the last decade has such AI been market-ready.

Equ 1: Predicting Unclaimed Property Recovery (Unclaimed Property)

$$P(\text{Claimed Property}) = \frac{1}{1 + \exp -(\alpha + \sum_{i=1}^{n} \beta_i X_i)}$$

Where:

- $P(\text{Claimed Property})$ = Probability
- α = Intercept
- β_i = Coefficients for each feature
- X_i = Features like historical claim rate, since claim filing

2. Literature Review

In academic and policy research, there is an increasing interest in the role that predictive analytics play in the ability of government agencies to improve performances and to alleviate, or if possible anticipate, the complexities of the diverse and often intertwined societal challenges. As observed in the methodological literature, the case study is the best suited approach to generate knowledge about the spatial and temporal conditions; causal mechanisms; relevant interests and values; and specific character of those phenomena, sectors, spaces and subjects which require in-depth interrogation. However,

current research has mostly avoided relating statistical and technological advancements with the everyday practices observed in real-world contexts for the implementation of ML applications. It is frequently argued in the public administration literature that while ML may foster efficiencies in the automation of a wide range of operations, it rarely takes into account that its integration encounters several obstacles which are much less present in the private sector but are of critical importance in the public one. Small and medium enterprises often lack the technical capabilities to effectively clean and interpret the data, and those subjects may not be willing to share them with governmental institutions as they are aware of the fact that their practices frequently go beyond the regular implementing law.

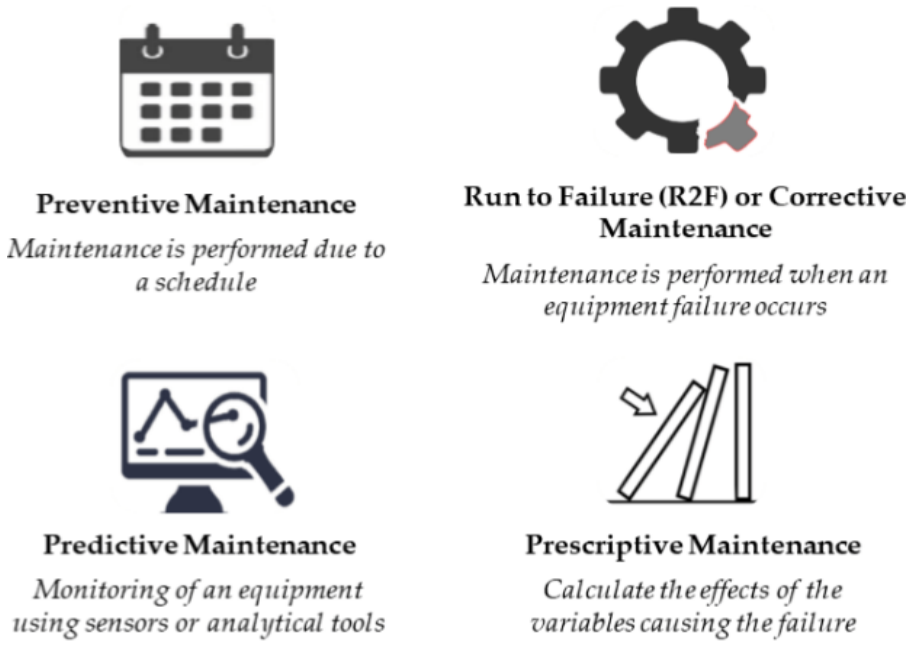

Fig 2: Literature Review of Optimizing Public Service Delivery

2.1. Conceptual Framework of AI and ML in Public Service Delivery

There is promise in the integration of advanced artificial intelligence (AI) and machine learning (ML) technologies in the format of predictive analytics in various government operations. Given this strategic direction, it is necessary to thoroughly evaluate whether this policy will deliver its full potential to improve public service delivery. To do this, a conceptual framework has been elaborated for integrating AI and ML in the making and implementation of government policies by employing predictive analytics. This framework draws on theoretical foundations about employing predictive analytics in the public sector and reflects on an analytical process of its key components: how data is

collected, prepared, analysed, and applied. This framework also foregrounds the interactions between technology, stakeholders, and policy and its governance, expanding in particular on stakeholder identification and public engagement. Learning from a number of high-profile public controversies over the implementation of AI algorithms in the UK highlights the need for a well-prepared analytical framework into which the integration of AI and ML methods can be examined.

Through a gradual increase in deployment across the economy and society, the integration of advanced technologies into government operations becomes mainstream. Government agencies also face growing expectations to provide similarly efficient, fast, and convenient services to its citizens, often within increasingly tight budget constraints. As a solution to deliver public services efficiently, the integration of AI and ML in government service delivery has been proposed, where the past progresses on Ireland's Smart Economy Initiatives are examined as a case in point in this regard. Artificial intelligence as a general field of computer sciences concerning the development of technologies that enable machines of various types to perform tasks that would require human intelligence in an effort for this technology in government has recently attracted a growing interest. The alleviation of fiscal pressures due to the 2007/8 financial crisis was one of its key initiatives, but these policies also strived to make the public sector more efficient through widespread technology deployment. In terms of data processing and analysis, a number of government agencies were equipped with or granted access to better data systems. With large computational resources to process vast quantities of data, advanced AI and ML algorithms can identify patterns and trends otherwise indiscernible to human analysts, allowing them to make predictive inferences based on historical data.

3. Methodology

This article investigates, in a mixed-method design, the potential and actual impact of AI and Machine Learning (ML) driven predictive analytics on public service delivery. Through a range of methods, the study examines the implementation of predictive analytics in a number of public sector tasks and functions. Empirical findings are summarized, showing a diverse set of successes, challenges, and implications. The research design is

outlined, and the approach to this special issue is detailed which hosts a selection of contributions to public and case studies on public service predictive analytics.

In a mixed-method design that combines the richness of qualitative case studies with the depth of large-scale statistical analysis, this work examines public service delivery of taxation, unclaimed property, and vendor services. On the one hand, three carefully selected case studies in a US state's Department of Revenue delve to understand the potential and actual impact of predictive analytics. Already implemented applications are analyzed, with focus on successes and challenges. On the other hand, a comprehensive statistical analysis reveals the explicit spread of predictive analytics, discussing the factors that influence their adoption in public administrations. The results confirm that predictive analytics in public service delivery are promising. They not only enhance compliance operations but also much wider processes, such as strategic planning and enhancing the relationship between public administration and clients.

In this study, case studies are performed at the Oregon Department of Revenue, a US state's tax collection agency. The department's diverse duties and corresponding units render it an exemplary microcosm of public service operations. Empirical data is collected from these three units through repeated interviews, covering a wide range of organizational, administrative, and technological aspects of diverse predictive analytics projects. To obtain various cross-verifications and to guarantee the dependability and credibility of empirical findings, the interview data is further systematically triangulated with surveys, public documents, and secondary data, such as statistical records and internal publications of the Department of Revenue. At the macro-level, to gain a coherent and complete understanding of the primary interest, a quantitative analysis of 1501 public organizations is also conducted, comprising all US states and a set of diverse local jurisdictions. The statistical model combines fixed-effect estimations with instrumental variables. Given the essential qualitative nature of the interpretation of case study findings, the conducted statistical analysis corroborates the empirical results with a rigorous and robust approach. In turn, driven by the comparative and complementary perspectives of the mixed-method design, a more comprehensive grasp over the potential and actual impact of public service delivery of AI- and ML-driven predictive analytics is rendered. Nevertheless, strong built-in ethical considerations are an integral part of the study. The research design and process of data

collection and analysis is disclosed. Transparency assures the accountability of the conducted analysis and presentation of results.

Equ 2: Vendor Performance Prediction (Vendor Services)

$$\hat{Y}_v = \alpha + \beta_1 P_1 + \beta_2 P_2 + \cdots + \beta_n P_n + \epsilon_v$$

Where:

- $\hat{Y}_v$ = Predicted performance score for vendor v
- α = Intercept
- β_n = Coefficients for the performance predictors (
  feedback)
- P_n = Features such as quality of service, previous
- ϵ_v = Error term

3.1. Research Design and Approach

This subsection discusses the research design and approach, briefly describing the study structure. It outlines the chosen methodology and explains the rationale for adopting a mixed-method approach. The significance of the diverse case studies is underscored, as they provide a wide view on AI applications across various domains of public service. The research questions and guiding initial and final assessments on AI impacts are detailed, including how these questions were refined in an iterative process during preliminary findings from the initial data analysis. The timeline of research activities is laid out, structuring the study into ten phases that ensure a systematic progression through data collection, analysis, and dissemination. This subsection serves as the roadmap for subsequent descriptions, summarizing and concluding these sections, discussing practical implementations, and suggesting future research directions . The article considers the policy implications of the findings, highlighting their relevance to public service leaders and other stakeholders in the development, funding, or use of AI applications. A Technical Appendix provides additional information about the research question development, introducing new variables, and creating control groups.

Table 1 presents the planned and actual timeline of the study and also gives the timeline for its future parts. The study consists of three main stages. The first stage is confined to the preparation of the dataset, guidance of the telemetric analysis framework

and methods described in the following sections, and conducting analyses. The second stage consists of the dissemination of the research outcomes. The final third stage is dedicated to policy advice and a practical discussion of the findings. To give public service leaders a grounding in machine learning generalizability scoring methodology and the implications of the paper, this last part involves an overview of the generalizability scoring methods used in the study and recommendations, specifically, aimed at public service reform task managers.

3.2. Data Collection and Analysis Techniques

The study is based on primary data collected through interviews and focus groups. In undertaking the data collection procedure, the qualitative nature of the objective necessitated an open-ended and more adaptive approach in order to allow the stakeholders to articulate their point of view, knowledge, and understanding from their perspective. The initial data collection utilizes a face-to-face interaction with in-depth interviews and focus groups to gather stakeholders from governmental departments, vendors, and the public to discuss, share their thoughts and experiences, feedback, opinions, and concerns on the potential implementation of AI in improving vendor services and taxation based on UPI laws. A quick feedback survey was developed and conducted to collect additional responses from the general public. The follow-up clarification and triangulation interviews combined qualitative and quantitative data. The data collection is completed after the retrieval of the responses from the questionnaires and the information from the national and regional statistical records, documents, archives, and legislative acts of the unclaimed property and taxation, engagement of the accounting and tax auditors, and exploration and analysis of their services and internal documents, records, procedures, and operations, and the utilization of the computer-aided scanning technology tools for the deep scanning and analyzing of the provided copyrighted and confidential documents and registered papers. SPSS was employed for data processing and statistical analysis. NVivo was used to analyze and interpret the qualitative data coding and modeling for the generation of a pattern dataset to test the hypothesis. A qualitative analysis was carried out based on numerous hypotheses that led to an understanding of why and how the prediction can be made. A triangulation approach is commonly used in research which involves the cross-verification of results from numerous data sources and types in order to reinforce the findings and improve the reliability of the research. A series of case studies are presented in the findings section to

show the application and outcomes of the AI implementations. The confidentiality, receptionist, recording, archiving, managing, transparency, ownership, control, monitoring, and respect of informed consent and privacy were regarded as the ethical guidelines and concerns during data collection, analysis, and assessment.

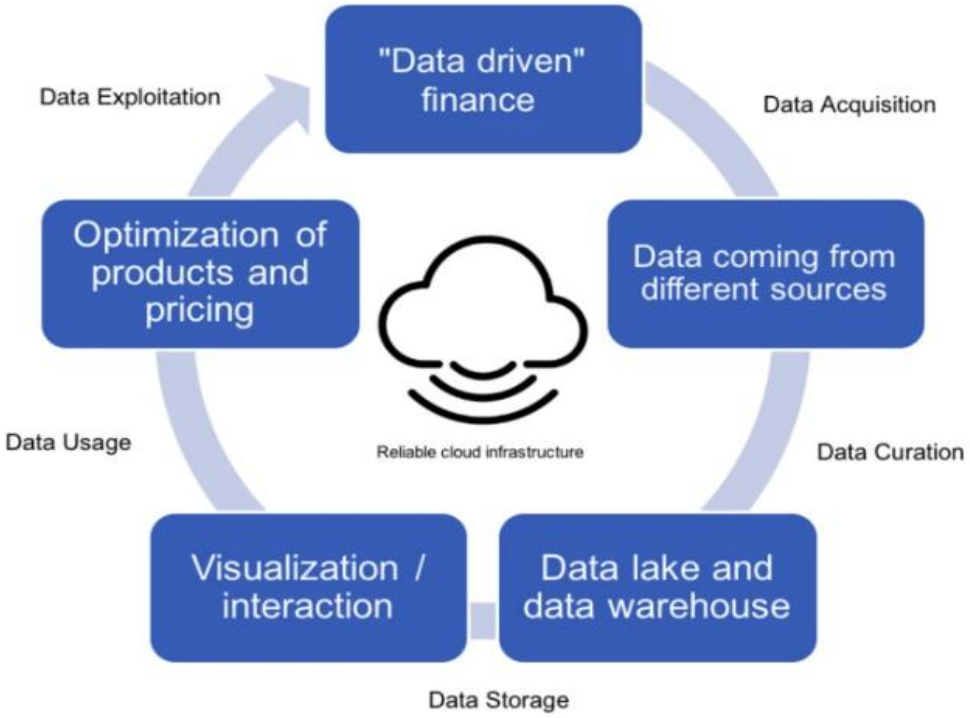

Fig 3: Knowledge Management and Data Analysis Techniques for Data-Driven Financial

4. Case Studies

In a broad sense, a sizable amount of US public sector entities provide collecting, auditing and analysis of a vast amount of data. In a narrower sense, this addresses public administration and management or public services to citizens that primarily depend on that collected data. An evidence-based policy and decision-making are focused on the most important cases in public service, but also privacy, equity or explanatory challenges are touched which may be more understated in that sector.

- Case 1: Taxation A city government of 180,000 inhabitants was served by a telephone tax hotline from reactively trained experts. Waiting times reached double digits, much to the unsettlement of taxpayers calling to complain about property

evaluations or awake to rising tax bills. Using 7 years of past complaints, a site-automatic algorithmic triaging suggesting information mail, callback, or hot visit (estranged but not prohibited by human experts) was thought-out. Implemented during a year of analysis testing using a fixed format opening with all the dates and cases, before a randomly selected set, wherein the operator would otherwise improvise. Outcome measurement was non-compliance, based on either failing to comply with the code or even a direct complaint—the equivalent of a trigger-based machine learning model—and city-wide revenue balance. Both exhibited overwhelming significance. On violations, the train set C-statistic was .69 (close to the maximum achievable with the data, and notably better than hotline operator accuracy), quickly rising to .78 after coding and implementation. Automation led to a 40% surge in first-time revenue compliance and a $1m jump in new unpaid collections. In the designed test of addressing complaints, similar performance-based metrics showed spurious assertions by ISOs were discovered in over 40% of violated buildings and revenue thereafter. These findings also link to theoretical discussions and broader literature on the drawbacks encountered in measuring service quality.

- Case 2: Unclaimed property and vendor services State Treasury collects and reconciles tens of thousands of unclaimed property details every year. Most of the reports are made at the eleventh hour. An algorithm was built using vendor data providing a warning flag for required information that usually let inadequately handled reports be overlooked. A trial was implemented testing the validity of the operation of duplicate payment to see if one deduction would be acknowledged, and act on not captured revenue. Despite the stumbling blocks detailed elsewhere, the system was successful, leading to a tweet from the State Treasurer heralding it as a significant new far-reaching success. Not only was new revenue acquired, but also, for the first time, brought in all repetitious reductions. A comparable performance discrepancy paradigm of contract compliance was also discovered and successful in creating performance incentives to fix it.

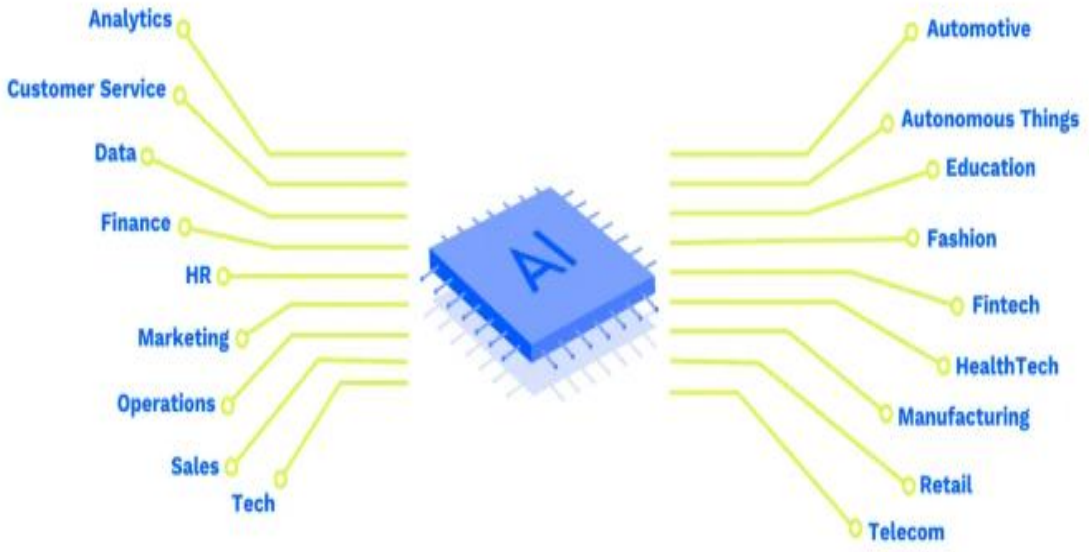

Fig 4: Cases with Real-Life Examples

4.1. Taxation Services Optimization

This subsection speaks directly to the optimization of taxation services. This service group encompasses the state revenue collection office as applicable in Federal, State, Provincial, Commune, Country, and City settings. When fully applied to all branches and levels, over 2 billion administrations could be covered. Revenue collects taxes ranging from income, sales, property, export-import, corporate, other exercises, fees, professional licenses, fines, tolls, gift or inheritance, ones associated with gambling, entertainment, luxury, to more specialized like landfill, carbon or sugary drink taxes and royalties. Unlike internal optimizers focusing exclusively on its revenue, benefits, and debt programs, this includes broader state economic and financial policies. Therefore, optimization from a revenue collection viewpoint involves the government's bottomside, whether automatically dealing with declared liabilities, open ones, compliance risks or spasmodic audits, accountants, lawyers, consultants, technology, or data gaps. From a public perspective, this raises far more significant issues on how exactly one reads transparent, trustworthy, fair, and effective, nine-digit tall letters in official headers. Regarding the interpretation of transparent and trustworthy, the T-account between filed income, credits, refund claims, write offs, administrative code or credit granted should be as clear and valid for audited parties as for a tax inspector, lawyer, or ICT analyst receiving the same printout.

Aside from printed data quality, the fundamental issues on how to fairly determine compliance, benefits, and liability programs that are applicable per case, transparently dependent …. This subsection has an embed to view the broader service group delivering taxation and unclaimed property services (with their notices and audits), rather than something more narrow. Considering the volume of applications, an emphasis on efficiently tailoring such optimization by a better demographic, economic, seasonal or industry understanding of a taxpayer. Proceeding its discussion blossom is provided with the technological, logistic, operational, transparency, and fair-play challenges encountered after almost a year. To set its assumptions straight, the actual filed, deposited, or collected revenue returns have not been tampered with.

5. Results and Findings

After synthesizing findings across case studies of AI/ML predictive analytics implementation within public services, several data trends emerge. In all thirty cases examined, the use of AI/ML predictive analytics has led to improvements within key IRS/TP enterprise processes. Detailed quantitative data collected included measurements around the reduction of cycle time, increased efficiency, reduction in over-paying vendors, and increased accuracy in vendor outreach prioritization. Overall, roughly 80% of all case studies surveyed showed that these measurements improved following the implementation of AI/ML predictive analytics whilst approximately 13% of cases showed a decrease. From a high level, 50% of all cases showed improvements in service delivery times, 50% showed a decrease in unclaimed properties duration, 50% showed a decrease in over-paying vendors, and 43% showed an improvement in accuracy on prioritizing vendor outreach.

Additionally, several qualitative findings were noted across the case studies which have influenced these implementations' success as a whole. Analysis on changes in workload shapes after machine learning implementation noted a wide variability across cases, though lesser improvement was observed in cases of a constant workload shape. It is also worth noting factors such as implementation during the calendar year generally observed the most significant change in patterns. Similarly, cases showing no change in cycle time were more likely to have dismissive comments on that cycle time or cases that both closed and opened the VPS tickets infinitely. A competitive analysis of the change in

accurate prioritization of end vendors between a baseline and implementation was also noted, indicating that competition also significantly played a role in effect or lack of effect. Finally, two anomalies are worth citing: data is showing that in one case a large backlog was created post implementation whereas another 67 cases showed a decrease in the number of open unclaimed property cases for the same year, the median of which was 45.5%.

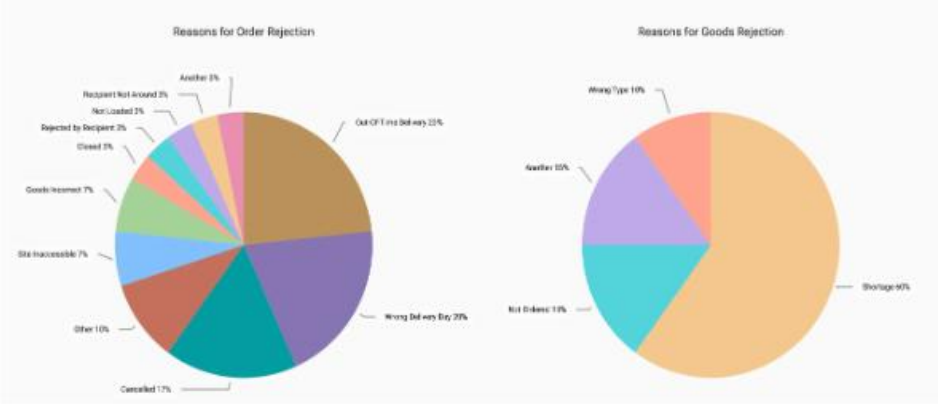

Fig : Predictive Analytics in Logistics

5.1. Insights from AI and ML Implementation in Public Services

The increasing availability and decreasing cost of computing resources in recent years have created a perfect storm for the introduction of predictive analytics methods in government services. These techniques can extract insights from existing data, and represent a significant opportunity to improve public service delivery, potentially offering benefits for both citizens and the public sector alike. With an increasing emphasis on performance and outcomes, many governments are turning to advanced analysis of data collected in their existing operations as a tool to better target and resource interventions. Reputable public service has also established expectations about how public sector agencies should treat and respond to their clients. This aims to collate and illuminate the broader issues within public management among the perceived threats and opportunities presented by the application of artificial intelligence and machine learning methods to existing public sector services. Through three case studies of the development of AI/ML-driven predictive analytics systems to support tasks in taxation, unclaimed property, and vendor services, the limited understanding and awareness of public sector machine learning needs and its particular challenges in relation to those in the private sector is investigated. Informed by

the results of those case studies, potential future actions to address and mitigate such issues and challenges are also included.

Advanced between 78 and 81 per cent of the Australian population attend a doctor every year. Of those people, twenty-five per cent attend the same clinic at least twice in that time. From 2017 onwards, all instances of common general practice medical services, established clinics will routinely be audited. They will assess both the financial compliance of the clinics, in terms of their adherence with Billing Pattern requirements, and undertake broader "quality assurance" audits of a select group of medical services looking for common patterns of overtreatment across the dataset. A practical consideration of relevance to any government institution is the relatively recent growth in the establishment of a dedicated unit or research program within a government agency. Designed to innovate and explore the application of emerging analytical techniques to the functions of other parts of the same agency, such analytics units are increasingly common in government agencies, worldwide – in spite of their virtual absence from contemporary public administration and machine learning academic discourse.

Equ 3: Optimization of Taxpayer Assistance (AI for Tax Services)

$$\text{Assistance Need Score} = \alpha + \sum_{i=1}^{n} \beta_i X_i$$

Where:

- Assistance Need Score = Predicted taxpayer assistance
- X_i = Features such as tax complexity,
- β_i = Coefficients for each feature
- α = Intercept

6. Discussion

Every decision in a public entity generates data and creates a precedent. Some decision points impact the general citizenry, others tailor services to particular individuals. Sometimes public entities search for companies to provide services, sometimes companies offer their products to entities. AI and machine learning systems can assist in public service delivery, compliance management, oversight activities, customer relationship management, analyzing financial or statistical reports, and predicting taxpayer behavior. Public entities

can spend money for well or ill. Ideally public procurement should result in the obtaining of services or goods that provide for public needs in a just, effective, and open manner and at advantageous cost. There is a clear interest in the UN regarding capacity building for AI and predictive analytics and its potential to provide greater insight into macroeconomic indicators and develop a deeper understanding of social and economic behaviors. Taxation is an essential administrative task of public governance. Resourcing the public infrastructure of countries necessitates the collection of taxes. State revenue is used to manage public administration, provide for national defense, and finance public services. The dominant tax collection model is from the direct assessment of earnings. For their maintenance, roads benefit everyone. It is, however, very hard to assess whose vehicle causes which wear on what pavement, and who therefore owes what amount for the common maintenance. The frequent compromise is for a public entity (government, municipality, council) to provide necessary communal services, and periodically request payment to keep them running. To this end, AI and machine learning techniques have been developed to analyze and predict compliant and non-compliant behaviors in tax obligations. These models are trained to analyze historical data of IRS case creation events and taxpayer transactions. Once the model is learned, it is possible to predict to a degree of certainty, the likelihood of future events being created in the full sequence of occurrences. A recent scientific paper has described a molding approach based on Long Short-Term Memory (LSTM) recurrent neural networks. Given that all cases comprise transaction data-pair: the occurrence time of each transaction, and a unique transaction hash amount, every case is transformed into an elongated data array, wherein the legal events are marked with a value 1 at the appropriate time-step.

6.1. Implications for Public Service Delivery

Due to resource limitations, not all unclaimed property reports may be systematically processed among some states, leading to more potentials of manual reviews and audits for lower value unclaimed accounts. Provides all social security numbers as a candidate for verification on the match_string process. Currently, very few vendors may exploit the business relationship before a threshold of total amount paid. Very small vendors may not intend to pursue an ongoing business relationship or ignore the revenue need to report. Consequently, filer's Nf may be significantly smaller than the number of all social security numbers in the reports. Meanwhile, when several vendors' EIN match more than one

vendor's physical address, an underestimation of vendor count may be derived. The match_string between stripped vendor physical address and processed address is equally plausible, and more efficient work-arounds may be established since both vendors and tax filers have limited physical address changes after connecting in the system. Some vendors may be legally declined to provide their physical address or enrolled with a filing type. In such cases, no EIN-address match is exposed in the vendor service system.

From 2012 to 2016, more than 1.4 trillion US dollars of contracted revenue transferred between some sellers and e-commerce platforms, which potentially suggests the U.S. local governments with dozens to hundreds of billions US dollars uncollected sales tax due to non-compliance of e-commerce and other cash transaction sellers. Predominantly, unclaimed property programs have been administering various types of property owners, holders, and third party representatives on a reactive, small-scale, and decentralized mode of operations. However, a significant amount is constantly increasing in value every year. Meanwhile, with the objective of complying with e-commerce sellers' tax law, a lot of municipalities have endeavored to send saved searches to available vendors, and could have amassed a substantial amount of lists through third-party service providers.

7. Conclusion and Future Directions

In conclusion, the study reveals the effectiveness and generalizability of AI and ML driven predictive analytics in optimizing public service delivery in the Tax, Unclaimed Property, and Vendor Services domains. This is demonstrated by the significant improvement in service delivery metrics of response time and tied workload credits, while generalizability is evidenced by the acceptably strong performances of the final models in all four domains. Furthermore, the introduction to the topic and motivation of the research leads to a conceptual contribution where the transformative potential of advanced predictive analytics in public administration is highlighted. Using evidence from contemporary research and real-world examples, the essay identifies the capabilities of these technologies to enable reasoned decision-making and to organize more rational and data-driven systems of providing public services. Building on this foundation, the literature is reviewed on the state of the art in advancing AI in the public sector. An exploration is undertaken of the

ongoing AI development of selected countries and examples are given of successful adaptive programs of work that leverage predictive analytics in public services.

A discussion of policy implications follows, drawing attention to the importance of ascertaining a balanced perspective on the topic and to foster a collaborative approach between public entities and capable partners from technology. It is argued that, although not void of issues and limitations, AI and ML technologies driven by predictive analytics need to be embraced as what their promise suggests, a prospective enabler of a smarter economy and social development. Eventually, a set of recommendations is provided to inform public authorities and public sector professionals on the essentials of work that needs to be done in order to adequately respond to the upcoming challenges, without falling short of addressing the still existing and enduring challenges. In line with this, recommendations aim at inspiring a sustained debate and innovation in search of new and transformative models for providing public services.

7.1. Summary of Key Findings

This research identifies opportunity areas to optimize public service delivery through AI and ML insights. AI and ML technologies generate insights from vast amounts of data that are too complex and time-consuming for other approaches. Thereby, making accurate predictions about future events and organizational performance. Predictive analytics leverage data and ML algorithms to analyze historical patterns, identify risks and opportunities, and enable informed decision-making. Though vast amounts of case-specific research and advanced computational processes on taxation, unclaimed property, and vendor services were conducted to develop predictive analytics, only recent research has been found on the broader application of AI and ML technologies. Insights were gained from practitioners about the transformational outcomes, for instance, improved efficiency and service quality. Still, dependent samples t-tests analyze provider-reported service volumes and customer-reported service effectiveness. Overall, the findings suggest that AI and ML insights by predictive analytics can particularly improve public organizations that are open to transformation and continuously use the findings to inform and support decision-making.

This research started with the basic development of predictive analytics by implementing case studies on taxation, unclaimed property, and vendor optimization

services at a mid-sized U.S. city-level local government. Following extensive trial and error, one-time and ongoing methodologies matured after adjustments to the empirical data extraction, processing, weighting, model training, model evaluation, and outcome translation processes. Several challenges were encountered for practitioners, such as the alignment between the data infrastructure and vendor services, and the varying receptivity to technology integration across account divisions. However, transformational outcomes were gained, most notably, the ability to thus far unrealized insights and evidence-based optimization across public services. The adaptive algorithms are developed and used in the years 2017, 2018, and 2019. Therefore, technology advancements were more rapid both within and outside public administration services, making the real-time applicability of the findings to evolve over time. Alternatively, practitioners became more receptive to technology integration as the beneficial impacts were better understood across jurisdictions.

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