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TECHNICAL ASSISTANCE REPORT—STRATEGIC CHOICES OF TAX ADMINISTRATION TO ENHANCE TAX COMPLIANCE

February 2020

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F I S C A L A F F A I R S D E P A R T M E N T

Republic of Armenia
Strategic Choices for Tax Administration to Enhance Tax Compliance

Vincent de Paul Koukpaizan, Enriko Aav, John Crotty, and Stuart Hamilton

Technical Report

April 2019

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GLOSSARY

AMD	Armenian Dram (currency)
ATO	Australian Taxation Office
CD	Capacity Development
CRISP-DM	Cross Industry Standard Processes for Data Mining
CRM	Compliance Risk Management
EU	European Union
FAD	Fiscal Affairs Department
GDP	Gross Domestic Product
HQ	Headquarters
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
IOTA	Inter-European Organization of Tax Administration
IT	Information Technology
ML	Machine Learning
MOF	Minister of Finance
OECD	Organization for Economic Co-operation and Development
OLAP	On Line Analytical Processing
PAYE	Pay As You Earn
PIT	Personal Income Tax
RA GAP	Revenue Administration Gap
RDF	Risk Differentiation Framework
SRC	State Revenue Committee
STX	Short-term expert
TA	Technical Assistance
USD	United States Dollar
VAT	Value Added Tax
WCO	World Customs Organization

PREFACE

A Fiscal Affairs Department (FAD) mission visited Yerevan during the period February 6–19, 2019. The mission's main purpose was to advise on strategic choices for tax administration and compliance risk management (CRM).

The mission was led by Mr. Vincent de Paul Koukpaizan (FAD) and included Messrs. Enriko Aav (FAD), and John Crotty and Stuart Hamilton (FAD external experts).

The mission met with Mr. Arman Poghosyan, Deputy Minister of Finance and Mr. Davit Ananyan, Chairman of the State Revenue Committee (SRC). It held productive discussions with Mr. Rafik Mashadyan, First Deputy Chairman of the SRC, Mr. Mikayel Pashayan, Deputy Chairman of the SRC, and several SRC officials.

The mission expresses its sincere appreciation for the cooperation and hospitality that it received from the SRC throughout its visit, with special thanks to Ms. Narine Fahradyan who facilitated the meetings.

Finally, the mission is grateful for the support and assistance provided by the IMF Resident Representative, Ms. Yulia Ustyugova and her staff.

This aide-mémoire consists of an Executive Summary and the following three sections: (I) Vulnerabilities of the Tax System; (II) Strategic Choices for Tax Administration; and (III) Technical Assistance Available.

EXECUTIVE SUMMARY

This mission advised on strategic options to enhance tax compliance in Armenia. It complements the March 2018 tax administration mission, which provided the State Revenue Committee (SRC) with general guidance to develop and implement a compliance improvement framework.[1] At the request of the authorities, this report focuses on the specific issues which continue to hamper effective compliance management, including the tax policy framework and the SRC's business processes.

Armenia's tax policy setting creates challenges for the SRC to effectively manage tax compliance. The Government's tax policy framework is likely to create new noncompliance opportunities and result in revenue leakages. The mission reiterated advice provided to the authorities by a previous IMF tax policy mission,[2] and recommended specific legislative measures to: (1) clarify the tax liabilities of "self-employed persons" who seek to circumvent their pay as you earn (PAYE) obligations; (2) address the use of company loans and similar financial arrangements to arbitrage corporate income tax (CIT) and personal income tax (PIT) liabilities; and (3) withdraw the annual option available to certain taxpayers to switch from the presumptive to the general tax system, or vice-versa.

The SRC should link its business strategies to its major functional operations and ensure that the basic functions of tax administration operate effectively. Strengthened fundamental functions and processes are needed for the delivery of effective tax administration. For example, on average, 35 percent of large taxpayers submitted their value added tax (VAT) returns after the due dates during 2018; instead, good tax administration practices aim to ensure that all large taxpayers file their returns on time. This situation is worrisome and requires immediate attention. Accuracy of the taxpayer register and audit coverage (through diversification of interventions, including issue-based audits) are also areas where the SRC needs to better follow international trends, and SRC management should pay priority attention.

Two issues raised in the 2018 tax administration mission report need to be highlighted again. They concern: (1) the concessional treatment of voluntary disclosures made up to and including the conduct of an audit; and (2) the advance publication of the names of taxpayers included in the annual audit program. These approaches undermine SRC's efforts to improve tax compliance and need to be discontinued.

The SRC's business model for tax administration, as described in its draft strategic plan for 2019-2022, relies excessively on extensive and fully automated data matching. The model envisages a "closed system" where all business transactions, regardless of size and risk, must be

[1] Refer to Koukpaizan et al. *Improving Tax Compliance Risk Management,* May 2018.

[2] Refer to Grote et al. *Growth-Friendly Rebalancing of Taxes*, October 2018.

captured. The mission stresses that detailed transaction level monitoring does not prevent systemic non-compliance. Models that attempt to manage tax compliance through bottom up control over all business transactions are costly and could drive transactions into the informal economy. SRC needs to better segment the compliance management approach by risk and taxpayer size, as recommended in the May 2018 and reinforce in this report.

The SRC needs to enhance its analytic capabilities to improve tax compliance, including by developing a better understanding of their potential. The mission provided an analysis of SRC case selection and advised on the adoption of analytical tools to achieve better results. The SRC's current additive risk rule scoring approaches need to be supplemented by predictive modeling giving better predictions and prioritization of the likelihood and potential consequences of noncompliance—the use of such model is envisaged in the SRC's draft strategic plan.

The SRC data management and information use for decision-making need strengthening. Modern tax administrations rely on information to predict, monitor and improve their performance. Basic SRC operational data (e.g. filing) were not available until late in the mission. This may indicate that basic operational information is not being used effectively to drive tax administration decisions.

Finally, integrity of SRC processes is also important. Acknowledging the priority the Government is giving to the fight against corruption across all sectors in general, and in tax administration in particular, the mission emphasized the need to invest in modernizing the SRC and building greater legitimacy in the collection of revenues. It also highlighted the key features of good governance to reduce vulnerability to corruption and promote integrity in revenue administration.

A FAD capacity development (CD) program will support the SRC CRM plans. A new 24-month European Union (EU)-funded project (launched in January 2019) will help with the design and implementation of analytical tools to enhance the SRC compliance and risk management, as well as improving tax auditing. This CD program will be delivered through headquarters (HQ) mission, and staff and short-term expert (STX) visits. System and skill requirements will be discussed during the first STX visit planned for June 2019. This CD will require timely provision of requested data to be successful.

The main recommendations of the mission are summarized in Table 1.

Table 1. Summary of Recommendations

Short-Term Measures

- Set up formal CRM processes for planning, executing, and monitoring SRC activities to improve tax compliance. These include developing a compliance strategy that defines the main compliance risks and SRC responses to these risks, governance arrangements for the implementation of the compliance strategy, and measurement of the impact of SRC activities on tax compliance.
- Initiate targeted actions, including strong sanctions and other disincentives to deter late filing. Develop a performance management process that monitors and ensures that SRC units effectively achieve on-time reporting and full payment of tax obligations by the registered taxpayers.

Medium-Term Measures

Vulnerabilities of the tax system

- Reduce the complexities of Armenia's tax policy setting, given revenue leakages, the impact on taxpayer compliance costs, and the challenges for SRC in managing taxpayer compliance under this system.
- Withdraw the annual option available to certain taxpayers to switch from the presumptive to the general tax regime, or vice-versa, to take advantage of tax minimization opportunities.
- Consider the need for legislative changes to clarify the tax liabilities of "self-employed" persons who seek to circumvent PAYE withholding obligations.
- Consider the need for legislative changes to address the use of company loans and similar financial arrangements to arbitrage CIT and PIT liabilities.

Strategic and operational choices for tax administration

- Use the framework provided in this report as a reference to reduce vulnerabilities to corruption and increase taxpayer confidence and trust in the tax system.
- Establish procedures for the ongoing regular cleansing and updating of the taxpayer register.
- Discontinue annual publication of the list of taxpayers selected for audit.
- Eliminate preferential treatment for voluntary disclosure of underreporting after initiation of an audit.
- Engage with taxpayers through a more targeted segment-oriented approach and use compliance campaign approaches where appropriate to 'break through' entrenched non-compliance.
- Develop an estimate of the relative tax gaps associated with strategic compliance risks, using a consistent measure by industry to prioritize compliance efforts.

I. VULNERABILITIES OF THE TAX SYSTEM

1. This section discusses the risks to revenue and challenges to the State Revenue Commission (SRC) that would arise from Armenia tax policy framework.

A. Critical Challenges for Tax Administration

Main Issues

2. Recent Fund advice has highlighted a range of complex, inequitable, and distortionary aspects of Armenia's tax policy framework[3]. These problems which arise, inter alia, because of corporate income tax (CIT) preferences, special tax allowances, and tax rate differentials within and across different sectors of the economy, present major compliance management challenges for the SRC.

3. Special or presumptive tax regimes for small business operators add further layers of complexity and inequity to the tax system. While a key objective of the patent fee, turnover tax, self-employed individuals, and special family company regimes is to ease compliance burdens on small businesses, differential categorizations of businesses and differential tax rates provided through these regimes undermine the fundamental tax policy principles of simplicity and fairness. Some limited rationalization of these regimes is planned to commence in 2020, including the establishment of a new regime for micro-businesses that would cover the current family company regime and self-employed persons. To encourage the development of these micro-businesses without the burden of tax liabilities, any earnings below 24 million Armenian Drams (AMD) would be exempt from income and turnover taxes.

4. Armenia's tax policy framework creates challenges for the SRC to effectively manage tax compliance in the business sector. The turnover tax, in particular, may encourage understatement of income and/or income splitting to remain outside the general tax system with its higher rates and greater compliance burdens of the profits tax and VAT.[4] The proposed new regime that will provide micro-businesses with an exemption on earnings below 24 million AMD is likely to exacerbate this situation. In addition to tax obligations, it is recognized that the onerous accounting requirements of the International Financial Reporting Standards (IFRS) can contribute to income under-reporting by small-medium businesses as they seek to avoid being required to use it.[5]

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[3] Grote 2018, op. cit.

[4]The VAT threshold for 2018 was AMD 115 million but has been reduced to 58.3 million in 2019. The government plans to reverse the reduction of the VAT threshold in the forthcoming tax reform package.

[5]"Responses of Firms to Tax, Administrative and Accounting Rules: Evidence from Armenia", Zareh Asatryan and Andreas Peichl, CESifo Working Papers, November 2017.

5. The right of qualifying taxpayers, by February 20 of each year, to opt for taxation under a special/presumptive or alternatively under the general tax regime creates tax planning opportunities. Switching from a special/presumptive regime to the general tax regime in a particular year requires a taxpayer to comply with all of the accounting and record-keeping requirements of the general tax regime in that particular year. Presumably, the principal reason why a taxpayer would switch from a special/presumptive basis of taxation to the general regime would be that the general tax regime would result in a lesser amount of tax being payable than that imposed under a special/presumptive regime. The availability of this option to qualifying taxpayers is problematic from both a tax policy and a tax administration perspective since this class of taxpayers can, through aggressive tax planning, arbitrage the tax system by selecting the tax base that minimizes their tax obligations.[6] Tax regime switching complicates SRC's industry benchmarking and case selection making subsequent CRM much more difficult.

6. The tax treatment of employed persons who shift their status to self-employment provides opportunities for tax minimization and the erosion of Armenia's personal income tax (PIT) withholding collections by employers. Shifting to self-employed/small medium enterprise (SME) status for tax and social security contribution purposes is a world-wide problem that tax administrations in both developed and developing countries are currently facing. Discussions with senior SRC officials indicate that this is already a problem in Armenia, presenting risks of serious degradation of the tax base. The proposed new regime for micro-businesses (with its exemption for earnings below 24 million AMD) will provide an additional incentive for individuals to assume a self-employed status. Self-employed persons are also not required to make social security contributions and are not being audited at this time. This further increases the incentive to disguise employment income as business income. The risk of abuse remains high, though a range of professional service providers may be excluded from the proposed micro-enterprise tax regime.

7. Legislative changes may be required to address this problem. Since the question of whether or not an individual is an employee generally involves legal issues of both the form and substance (that is, facts) of a particular relationship, tax administrations across the world have found that addressing the problem on a case-by-case basis is both difficult and costly. Consequently, legislative remedies to define the employer-employee relationship in broad terms have often been enacted. For example, in some countries, legislation has deemed the existence of an employer-employee relationship and the imposition of pay as you earn (PAYE) withholding and social security obligations in cases where a "self-employed" person derives a predominant amount (say, 90 percent) of his or her income from a single economic group for personal services rendered.

8. Proposed changes to the CIT rates may open up further opportunities for tax arbitrage (for example, substituting loans for dividends) and require a legislative response.

[6] Grote 2018, op. cit.

Policy makers are considering a reduction of the CIT rate to 18 percent while the PIT rate will remain at 23 percent. Tax rate differentials (in particular, where the corporate tax rate is lower than the personal tax rate) present compliance challenges for many countries. In Armenia, it is argued that any distribution of company profits by way of a dividend will attract a 5 percent tax which, when combined with the proposed 18 percent CIT rate, will broadly represent a 23 percent rate on distributed profits of a company. What is not clear is how the Armenian tax law treats, for example, the provision of "interest-free or low interest" loans to company shareholders and executives where such loans are made out of the undistributed profits of a company. Would such loans be considered "dividends" in the hands of shareholders and "income" in the hands of company executives? To address this risk the CIT laws of some countries include special deemed dividend and presumptive interest rate provisions.

Recommendations (medium term)

- Reduce the complexities of Armenia's tax policy, given revenue leakages, the impact on taxpayer compliance costs, and the challenges for SRC in managing taxpayer compliance under this system.
- Withdraw the annual option available to certain taxpayers to switch from the presumptive to the general tax regime, or vice-versa, to take advantage of tax minimization opportunities.
- Consider the need for legislative changes to clarify the tax liabilities of "self-employed" persons who seek to circumvent PAYE withholding obligations.
- Consider the need for legislative changes to address the use of company loans and similar financial arrangements to arbitrage CIT and PIT liabilities.

II. STRATEGIC CHOICES FOR TAX ADMINISTRATION

9. This section advises on key areas of focus when developing tax administration strategies. It highlights the critical role of core tax administration processes in achieving effective CRM.

A. Fundamentals of Tax Administration Strategies

10. The SRC has prepared a draft strategic plan to guide tax administration reforms in 2019–22.[7] This plan aims to reduce informality and achieve sustained tax revenue growth through: (1) improved taxpayer services; (2) effective communication with the taxpayers; (3) enhanced IT systems; and (4) enhanced human resources. Although it covers some key

[7] The mission was provided the draft strategy plan but was not able to discuss it with the SRC management during its stay.

strategic areas, the plan does not inform on the SRC's strategic direction to compliance management.

11. Improving the effectiveness of the core tax administration functions should be the basis for defining performance standards. Most modern tax administration reform strategies are closely linked to the major functional operations and aim to improve revenue collection, process information more rapidly, ensure all taxpayers comply with their obligations, and deliver services to taxpayers more effectively. The developments below describe the key strategic choices available to modern tax administrations, and in particular to the SRC.

12. The SRC faces a strategic choice as to the direction it would like to take in building its tax administration operations and compliance management. Every tax administration has to make this choice. Some more advanced administrations arrive at a decision relying on knowledge-based decision-making processes and articulate these approaches in their strategic and policy documents. Other administrations do not rely on a disciplined research-based approach and develop their operational practices in a less formal way. The choice of approach for a tax administration can also depend on a range of environmental factors, including expectations of the government, the culture of the public service and of the country, availability of resources, human capacity, and the level of access to information on good practices.

13. Tax administration approaches to compliance management can be viewed as a continuum ranging between voluntary (unenforced) compliance and coerced (fully enforced) compliance. Administrations that rely to a greater extent on voluntary compliance develop practices where taxpayers are motivated and able to meet their obligations with minimal interference from the authorities. Compliance activities are risk-oriented and low/no-risk taxpayers are usually left alone. The tax system operates in the environment of mutual trust and cooperation between the authorities and most taxpayers, and its costs are significantly lower compared to a coerced approach. In coerced compliance, the thrust of compliance initiatives is quite different—the tax administration seeks to apply extensive controls over each taxpayer's transactions by investing in technology and mandating taxpayers to use devices or software designed to effect close monitoring over all of the taxpayer's activities. This approach proceeds on the assumption that a taxpayer will not comply voluntarily and thus requires a higher level of investment in monitoring capabilities and tools of the tax administration. Box 1 describes the features of each approach.

Box 1. Different Approaches to Ensuring Compliance

VOLUNTARY COMPLIANCE	COERCED COMPLIANCE
⟵ ⟶	
TRUST	NO TRUST
NO DETERRENCE	DETERRENCE
Enforcement perceived as:	
• Supportive • Legitimate • Fair	• Controlling • Threatening • Unfair
Some key features:	
• Self-assessment of taxpayer obligations; • Risk-oriented, non-intrusive tax administration; • Emphasis on informing and supporting taxpayers to prevent non-compliance; • Volumes of information on taxpayer limited to strict needs of tax administration; • Ensuring a low compliance burden is one of the key performance objectives of tax administration; • Cooperative relationship between representatives of industries/taxpayers and tax administration; • Lower costs.	• No self-assessment of tax obligations; • Tax administration seeks to capture data on all transactions; • Emphasize on full monitoring and punishment; • No trust between taxpayers and tax administration; • Taxpayers burdened with requirements that distort their business operations; • Sizeable cost of investments in tax administration technology and operations.

14. All tax administrations' compliance management approaches are located somewhere along this "trust-no trust" compliance risk continuum. Current SRC practice aiming at capturing information on all transactions of all taxpayers leans further in the direction of a coerced compliance approach. SRC's future direction regarding compliance strategies could benefit from a good understanding of the features described above.

15. It is good practice for developed tax administrations to establish formal CRM processes. These processes, already discussed in the 2018 FAD mission report, include: detecting compliance risks, planning, executing and monitoring activities to address those risks. Formal governance arrangements should guide these processes. The mission did not identify the existence of formal CRM processes during its discussions with the SRC. Appendix 1 provides further details on strategic planning cycle for compliance risks.

Recommendation (short term)

- Set up formal CRM processes for planning, executing, and monitoring SRC activities to improve tax compliance. These include developing a compliance strategy that defines the main compliance risks and SRC responses to these risks, governance arrangements for the implementation of the compliance strategy, and measurement of the impact of SRC activities on tax compliance.

B. Ensuring the Integrity of Revenue Administration

16. Rooting out corrupt practices from public administration, including revenue administration is one of the top declared priorities of the new government. This objective is highlighted in the draft government program presented recently to the Parliament.

17. A critical strategic objective of a revenue administration is to ensure the ongoing integrity of their operations. Given the nature and span of its work, revenue administration is frequently vulnerable to corruption. A country's revenue administration's work can affect the economic interests of both businesses and individuals through its interactions with most members of a society. It is responsible for safeguarding significant government revenues; its officials are vested with broad powers; and it often operates in remote and isolated border areas. This can create vulnerabilities to corruption on several fronts, which must be decisively addressed by government. Revenue administration is often seen as a public face of the government due to its frequent interactions with taxpayers and traders. Any evidence of unethical behavior by revenue administration officials risks being imputed to the rest of the public service and the political leadership of the country.

18. Revenue administration integrity is also impacted by the country's overall stance on this issue. Corruption in revenue administration is deeply influenced (and can be encouraged) by broader environmental factors and the ethical norms of a country. If corruption is widespread throughout public institutions and society, this will be reflected in the revenue administration. It is then very difficult, indeed almost impossible, to clean out corruption from revenue administration to build an "island of integrity in a sea of corruption". This is why tax reforms in countries with a broader culture of corruption are often less successful—corrupt decision makers are not interested in transparent, efficient, and effective public services that are designed to achieve equal treatment for all citizens; and those citizens feel less compelled to pay their taxes and duties.

19. A lack of integrity in revenue administration puts significant government revenues at risk. Since taxes are the principal source of government revenues, corruption in a revenue administration will invariably be accompanied by evasion and low levels of taxpayers' compliance resulting in significant revenue losses, thus limiting the financing available to implement priority government policies. Low levels of compliance, enabled by corrupt revenue administration

officials, will, in turn, facilitate the development of the informal economy, worsening the overall well-being of a society.

20. Therefore, given the revenues at stake, governments need to invest in modernizing tax administration and building greater legitimacy in the collection of revenues. This will help reduce vulnerabilities to corruption and promote integrity. A broader approach (whole-of-government) will also be crucial to create an environment conducive to greater integrity. Box 2 describes the key features of good governance in revenue administration to reduce vulnerability to corruption and promote integrity.

Box 2. Key Features of a Good Governance Framework in Revenue Administration to Reduce Vulnerabilities to Corruption

Good governance in revenue administration[8]	How these features reduce vulnerabilities to corruption
Sound Policy and Legislation	
1. Revenue policy designed based on principles of equity, efficiency/neutrality, simplicity, and transparency.	1. Raises revenue in non-distortive manner; creates a revenue system that is easily understood and harder to avoid or evade.
2. A common set of administrative and procedural laws that are simple and reliable for different tax types.	2. Provides common basis for administration of all taxes regardless of tax types, thus promoting fairness and ease of understanding and application by tax officers.
3. Legal framework provides appropriate balance between rights of taxpayers and powers of revenue administration, supported by effective dispute settlement procedures (e.g. independent tribunal/court or tax ombudsman) and legal safeguards against the improper exercise of powers by revenue administration (e.g. opportunity for taxpayers to pay overdue taxes before forced sale of property seized through distraint).	3. Supports the building of society's trust in revenue administration.
4. A system of tax self-assessment is in place promoting voluntary compliance by taxpayers.	4. Minimizes intrusion of revenue officials in the affairs of compliant taxpayers.
5. Clarity and stability of law, rules, and processes. including minimal discretionary power vested in the revenue administration, and where discretion is unavoidable, clear conditions on how discretion will be exercised.	5. Increases transparency; provides certainty to avoid disputes; reduces discretion that can be misused by dishonest officials.
6. Legal and human resource frameworks allow for firing of officers behaving unethically and provide a suite of appropriate sanctions for cases of lower culpability, with prosecution for criminal activities.	6. Provides basis for effective human resource practices to curb corruption.

[8] While the term revenue administration covers both tax and customs administrations, some of the information in this Box is more specific to the features of tax administration.

Good governance in revenue administration[8]	How these features reduce vulnerabilities to corruption
7. Legislation allows for adoption of modern systems, processes and technology in revenue administration and sets out key aspects of organization and management (including relationship between Ministry and the revenue administration), including express legislative requirements for revenue administration to provide and publish reports on its operations and financials on a regular basis.	7. Provides legal basis for effective administration to minimize interference and opportunities for corruption.
Modern Systems and Processes	
8. Revenue administration work plans, budget, performance objectives, and outcomes are regularly publicly reported.	8. Increases transparency and public accountability of revenue administration.
9. Collection systems and procedures are streamlined to secure timely revenues without imposing undue compliance cost and inconvenience to the business.	9. Minimizes intrusion of revenue officials in the affairs of compliant taxpayers, avoiding rent seeking behaviors.
10. Service-oriented approach ensuring taxpayers have the information (quantity, quality, comprehensiveness) and support they need to meet their obligations voluntarily.	10. Empowers taxpayers; reduces interactions with officials; reduces vulnerability to corruption by dishonest officials making unlawful demands.
11. Availability of a tax rulings function with clear and straightforward rules to avoid distinct tax treatments that deviate from the general rules and pose transparency concerns.[9]	11. Provides certainty for tax treatment of transactions; empowers taxpayers in discussions with revenue officials.
12. A general risk-based approach is adopted in the administration aimed at detecting and acting on taxpayers who present the greatest risk to the revenue system.	12. Removes discretion, minimizes intrusion of revenue officials in the affairs of compliant taxpayers.
13. Special programs using modern and transparent approaches to manage the compliance of the largest contributors, including large businesses, high-wealth individuals, and high-income earners. They have complex tax affairs with a high amount of revenue at stake and opportunity to undertake aggressive tax planning.	13. Focuses resources on highest risks to revenue; helps preserve the integrity of the tax system by ensuring that the wealthy in society pay their fair share.
14. Effective and impartial dispute resolution process is available and publicized.	14. Protects taxpayers from unsubstantiated or corrupt tax assessments.
Streamlined Organization and Management	
15. Revenue administration is established with independence from political direction, e.g., reports to Minister of Finance who has overall fiscal	15. Reduces political interference in taxpayer affairs; increases ability of revenue administration to act independently in enforcing the laws.

[9] For more information on the legal design of an advance tax ruling regime, see Waerzeggers, Christophe and Cory Hillier, 2016, "Introducing an advance tax ruling (ATR) regime—Design considerations for achieving certainty and transparency," Tax Law IMF Technical Note Volume 1, 2/2016, IMF Legal Department.

Good governance in revenue administration[8]	How these features reduce vulnerabilities to corruption
responsibility, rather than to the Prime Minister or President.	
16. A function-based organization design with separation of duties and appropriate numbers of staff assigned to each function based on workload.	16. Removes one-to-one relationship between taxpayer and official; reduces under-employment and risk of corrupt behavior.
17. Strong headquarters function providing oversight and uniform operations across the field network.	17. Helps reduce vulnerability by establishing nationwide clear standardized processes and monitoring of operational performance of field offices.
18. Streamlined field operations and organizational alignment to key taxpayer segments.	18. Improves quality of professional interaction with taxpayers; focuses resources on highest risks to revenue.
19. Effective internal audit and investigation/anti-corruption units established, with relationships and cooperation with public service wide anti-corruption activities and bodies.	19. Creates effective processes to identify and curb corruption.
20. Strong oversight of revenue administration by external bodies (General Audit Office, Ministry of Finance) focused on monitoring performance but not allowed to interfere in specific taxpayers' affairs.	20. Increases accountability of revenue administration.
Extensive Use of Technology	
21. Revenue administration processes are digitalized and automated to the extent possible.	21. Reduces face-to-face interactions; minimizes intrusion of revenue officials in affairs of compliant taxpayers.
22. Robust automated system of internal control checks and monitoring of processes, with access controls/audit logs.	22. Ensures integrity of decisions, allows review and audit of actions taken by revenue officials.
23. Automated risk assessment and case selection is in place.	23. Removes personal influence and staff discretion.
24. Technology supports notification of citizens about their obligations and correct procedures for revenue administration.	24. Increases transparency and accountability of revenue administration.
25. Technology supports collection of feedback from the public on interactions with revenue administration staff, including reporting unethical behavior, e.g., through a dedicated integrity hotline.	25. Supports detection and prevention of unethical and unprofessional behaviors.
Leading People Management	
26. Human resource policies and processes assure merit-based selection, appointment, appraisal, and promotion of revenue officials.	26. Improves quality and professionalism of staff.
27. Senior management of revenue administration is appointed for a fixed period (tenure).	27. Reduces vulnerability to cronyism.

Good governance in revenue administration[8]	How these features reduce vulnerabilities to corruption
28. Management process built on minimal management layers with appropriate spans of control, and internal control is one of the core management functions.	28. Ensures close monitoring of operations; reduces opportunities for corrupt behavior.
29. Salaries set at a sufficient and competitive level.	29. Reduces incentive for corrupt behavior.
30. A formal rotation policy supports staff development, with a cycle to allow staff to build expertise and contribute to the respective function's performance.	30. Increases officials' performance incentive and knowledge and expertise across all levels; increases taxpayer trust/satisfaction.
31. Ongoing staff training programs delivered so officials know their duties, conditions of service, and sanctions for wrongdoings.	31. Informs staff of required behaviors and risks of non-compliance.
Institutionalized Promotion of Integrity	
32. Staff is regularly informed about and supported in adopting positive behavior; corporate practice, including through an enforced Code of Conduct, strongly signals zero tolerance towards low staff integrity.	32. Management leads by example; creates a positive organizational culture and fosters "esprit de corps"; supports the prevention of unethical behaviors.
33. Technology solutions to detect unethical behavior are routinely used.	33. Detects and prevents unethical behavior.
34. Legal sanctions are effectively applied on each detected corrupt behavior and publicly announced.	34. Addresses and prevents unethical behavior; instills greater public confidence in revenue administration.

Recommendation (medium term)

- Use the framework provided in this report as a reference to reduce vulnerabilities to corruption and increase taxpayer confidence and trust in the tax system.

C. Tax Administration Processes and Compliance Management

21. Critical to the management of taxpayer compliance is the development of core tax administration processes. It is vital that tax administrations ensure the basic functions of tax administration—in particular, taxpayer registration, filing, and payment of taxes operate effectively. If any of these core functions do not work properly, revenues that are due from taxpayers will not be fully secured. For example, if taxpayers are not registered, they are likely to operate outside the tax net as part of the informal economy.

22. While SRC is eager to implement modern approaches in tax administration (including artificial intelligence and other sophisticated technologies), it must maintain a focus on core tax management processes. Modern analytic approaches are only effective if SRC has in place robust processes to ensure that taxpayers comply with their basic registration, filing, and payment obligations.

23. Efforts to update the taxpayer register should continue and measures to deregister inactive taxpayers should be encouraged. A taxpayer register cleanup was undertaken in 2018. As the tax law does not allow taxpayer deregistration,[10] the SRC moved inactive taxpayers out of the active taxpayers' register. If SRC receives information that these taxpayers are not inactive they can be restored as active. However, it appears that no procedure has been established to ensure regular updating of the taxpayer register. The one-off cleanup exercise was a worthwhile initiative, but the SRC should have procedures in place for the ongoing regular cleansing and updating of the taxpayer register.

24. If the tax administration cannot ensure high levels of filing and payment compliance, taxes due will not be fully reported and paid on time. For the SRC it should be a worrying signal that filing compliance of the large business segment is low. The SRC's VAT filing data (Table 2) indicates that, on average, 35 percent of large taxpayers were regularly late with the submission of VAT returns during 2018. Good tax administration practices focus on ensuring all large taxpayers file their VAT returns on time.

Table 2. VAT Returns Submitted by Large Taxpayers during 2018

	On time	Late	Total	% of late filings
January	850	581	1431	40.60
February	911	523	1434	36.47
March	883	553	1436	38.51
April	592	847	1439	58.86
May	984	468	1452	32.23
June	1007	449	1456	30.84
July	1001	428	1429	29.95
August	1053	376	1429	26.31
September	753	675	1428	47.27
October	1162	271	1433	18.91
November	1262	169	1431	11.81
December	745	687	1432	47.97

Source: SRC.

25. Current provisions permitting the voluntary disclosure of underreported taxes seriously undermine the effectiveness of SRC's audit program. Those provisions encourage taxpayers to delay disclosure of their under-reported obligations until after an audit has been initiated since no penalties apply when such a disclosure is made. While intended as a business-friendly mechanism to reduce the burden of audit, it provides a systemic incentive for noncompliance, effectively an ongoing compliance amnesty, and is counter-productive to SRC's efforts to improve taxpayer compliance, especially when audit coverage in Armenia is limited.

[10] Except as an outcome of bankruptcy procedure or liquidation of a business entity.

26. Publication of the list of taxpayers selected for inclusion in SRC's annual audit plan on its website limits the effectiveness of SRC's efforts to improve tax compliance generally. The purpose of the publication of the list of planned audits is, of course, to promote transparency and integrity. Nonetheless, publication of a taxpayer's name on a list will provide up to a year's advanced notice to a taxpayer during which that taxpayer may hide or alter business records to align with already declared tax obligations. Moreover, taxpayers not targeted under the audit program may perceive a positive incentive for underreporting since their names are not included on the list. The public listing of taxpayers who will be audited may also cause them serious reputational damage. Those taxpayers will have no redress even if SRC subsequently determines that their tax affairs are in order. The listing requirement also reduces the ability of the SRC to dynamically address emerging compliance risks.

Recommendations

Short term

- Initiate targeted actions, including strong sanctions and other disincentives to deter late filing. Develop a performance management process that monitors and ensures that SRC units effectively achieve on-time reporting and full payment of tax obligations by the registered taxpayers.

Medium term

- Establish procedures for the ongoing regular cleansing and updating of the taxpayer register.
- Discontinue annual publication of the list of taxpayers selected for audit.
- Eliminate preferential treatment for voluntary disclosure of underreporting after initiation of an audit.

D. Analytic Capabilities for Effective Compliance Risk Management

27. This sub-section discusses the use of analytics to improve tax compliance. The 2018 FAD mission report advised on broad operational risk management issues, including compliance case selection, acquisition of high-value third-party data and the required administrative tools.[11] The SRC has upgraded its additive risk scoring system to improve audit outcomes, but could have achieved higher compliance levels with predictive and risk differentiated approaches.

[11] Koukpaizan 2018, op. cit.

Analytic Methods

28. Armenia makes relatively high use of transaction level monitoring. Compliance monitoring can be considered at a number of levels: transaction / taxpayer / industry. At each of these levels monitoring can be census based (everything/everyone gets monitored) or risk based (only certain transactions, taxpayers or industries get monitored). Armenia uses a census approach, with all products and cash register transactions being monitored. The Armenian tax system and its administration provide for detailed monitoring at a transaction level using both unique product identifier (labels) as well as cash register monitoring. Such an approach involves collecting and matching enormous amounts of data. For example, the SRC matched some 14.5 billion transactions in an economy of roughly 3 million people and GDP of about 6,083 billion AMD (12.4 billion USD). By way of contrast the Australian Tax Office (ATO) matched 650 million transactions in a population of 25 million and a GDP of 1.5 trillion USD. The more risk based Australian approach matches data only on certain problematic transaction types across the economy (e.g. dividends and interest) and there is additional reporting and monitoring placed on higher risk industries (e.g. transport) and certain higher risk taxpayers (e.g. the most tax aggressive of the banks).

29. Detailed transaction level monitoring does not prevent systemic non-compliance. As mentioned earlier, the level of significant tax system concessional carve-outs (in particular agriculture and micro businesses), while reducing the informal economy *de jure*, can result in significant taxpayer noncompliance when they inappropriately claim to be in the agricultural sector or pose as micro businesses. This kind of noncompliance is difficult to detect and address. The ability of many taxpayers to effectively self-select their tax regime annually complicates the SRC monitoring and enforcement process.

30. There are costs as well as benefits from such a detailed level of monitoring. This monitoring reduces the opportunity for transactional noncompliance, but this comes at a cost for compliant taxpayers and places an administrative burden on the SRC. As set out in the SRC draft strategic plan, the continued streamlining and digitalization of transaction monitoring processes will be an important part of reducing compliance costs and administrative burdens in the future. With such a high level of transaction monitoring and matching the SRC appears to have very good pre-filling and On Line Analytic Processing (OLAP) capabilities over much of the economy (with certain carve outs). Nonetheless, the SRC notably lags in the development and use of analytical modeling (ML) approaches to make the best use of its vast data holdings.

31. The SRC needs to make a determined commitment to enhance its analytic capabilities. As identified in the SRC draft strategic plan, ML approaches need to be developed and deployed to enhance the SRC's CRM.[12] Existing additive risk rule scoring approaches need to be supplemented by predictive modeling giving better predictions and prioritization of the

[12] See Appendix 2 for details on the different types of ML.

likelihood and potential consequences of non-compliance.[13] Sufficient audit data exists now to build much improved audit selection systems.

32. Technical concerns about analytics generally relate to software and data management. Sophisticated software is often expensive, and tax administrations are frequently reluctant to make significant investments in "tools" when the expertise to use the tools is unidentified, and the expected outcomes are also unclear. In this regard, the mission suggests the use of open-source software that is also free. Furthermore, administrations must actively manage their data to ensure they are suitable for analytical purposes. Administrations that wish to exploit fully the opportunities presented by advanced analytics must do more than record and store large volumes of data. They must reassess the way they collect, evaluate, manage, and disseminate those data. Rather than seeing data as an end-product of operational activities, administrations need to ensure they are viewed as a key input into the analytical process, and therefore an asset that requires careful and active management. This means that Information Technology (IT) departments have a key role in laying the foundations for advanced analytics.[14]

33. The SRC should initially consider analytical software packages with low-entry barriers. One example being the open-source package KNIME®, this package comes with substantial online material and the possibility to attend courses across the globe.[15] The SRC should promote the analytics unit as a high prestige talent program in which employees will face a steep learning curve, build the future direction of SRC data usage, and obtain a valuable skillset.

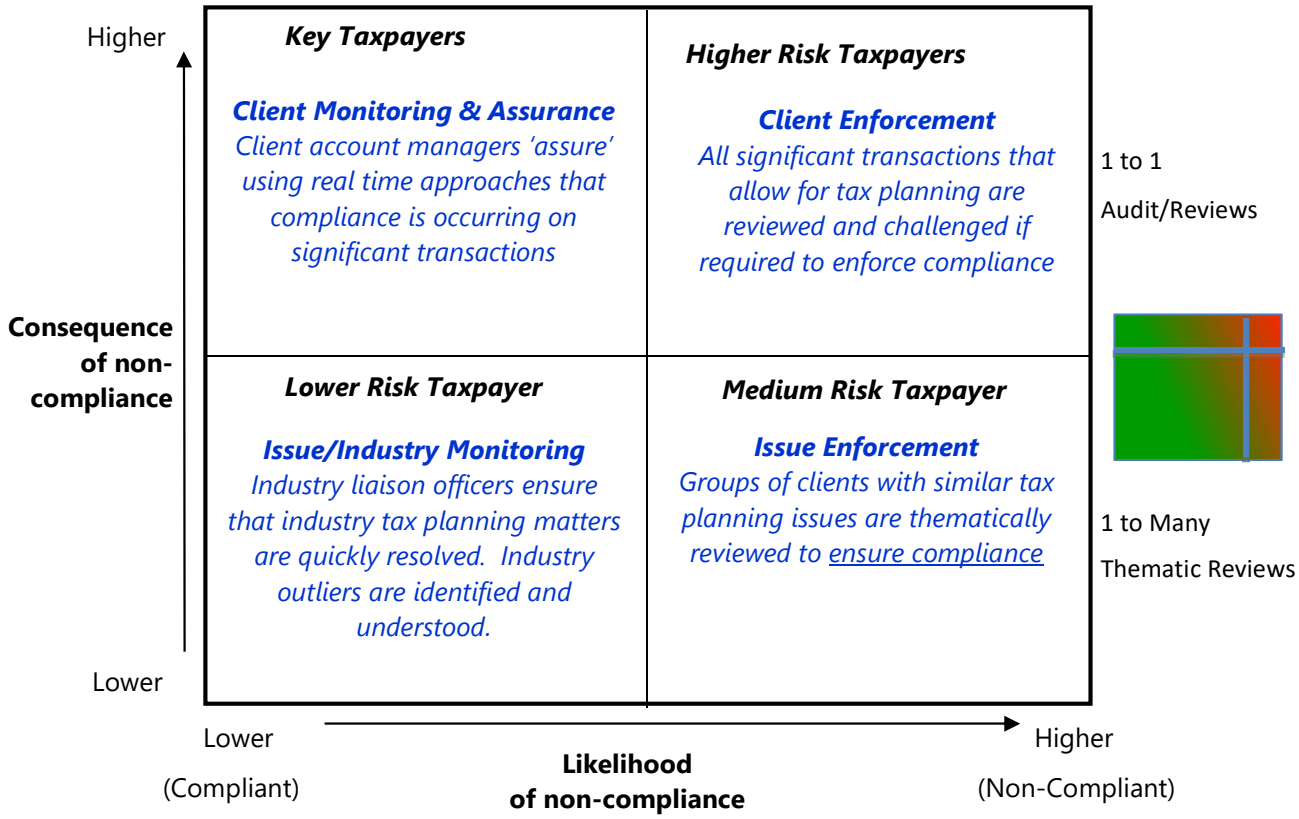
34. Risk-differentiated approaches should be pursued at the SRC. The use of advanced analytics needs to be coupled with better risk-based approaches that lower the compliance burden on compliant taxpayers while maintaining an appropriate focus on potential non-compliance. While the structure of the SRC (e.g. the Large and Medium Inspectorate) provides a basis for risk-differentiated approaches, vigilance is necessary to avoid falling into inappropriate one-size-fits-all responses. Effective CRM of the diverse Armenian taxpayer base requires a variety of appropriately tailored compliance approaches. A risk-based framework for differentiating compliance and service approaches to taxpayers was put forward in the IMF May 2018 Report. Figure 1 illustrates these approaches.

[13] See Appendix 3 on potential uses of prediction modeling in tax administration, and Appendix 4 on practical tips regarding predictive model use.

[14] Advanced Analytics for Better Tax Administration: Putting Data to Work, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264256453-en

[15] https://www.knime.com/ Other examples of open-source packages are: WEKA, ANACONDA, and RATTLE.

Figure 1. Risk Based Differentiation



Audit Case Selection

35. Despite the apparent increase in audit assessments, median case results show no improvement. Initial analysis shows the return from audit efforts in the period 2017-18 significantly increasing over that in 2015-17. The average result increased from 9.8 million AMD to 16 million AMD. A deeper analysis of the distribution of results shows that the median case outcome actually declined slightly from 2.25 million AMD to 1.9 million AMD. This indicates the impact of a few extremely large cases on the average result for 2017-18, something that cannot be relied upon in the future.

36. SRC management needs to better understand the potential gains to be achieved via improved analytic approaches—Appendix 5 provides an analysis of SRC case selection. It is important to understand the difference between standard business intelligence tools, often based on OLAP that 'slice and dice' data and then present the results back to the user in summary tables or charts for the human operator to make any associative connections, and

modern ML approaches where computer algorithms such as Self Organizing Maps[16]or Random Forest analyze the data to 'discover' clusters or 'detect' associations that better predict outcomes.

Recommendations (medium term)

- Develop an estimate of the relative tax gaps associated with strategic compliance risks, using a consistent measure by industry to prioritize compliance efforts.
- Engage with taxpayers through a more targeted segment-oriented approach and use compliance campaign approaches where appropriate to 'break through' entrenched noncompliance.

III. TECHNICAL ASSISTANCE AVAILABLE

37. FAD will help to enhance SRC's CRM through an IMF-EU capacity development (CD) program which runs from January 1, 2019 to December 31, 2020. The main focus of this project is to strengthen Public Finance Management systems and fiscal governance in the Eastern Partnership countries.[17] For Armenia, this CD aims to improve revenue mobilization through strengthened tax compliance risk management. It will build on previous FAD advice and this mission's recommendations to provide practical support, including the development of a modern, sophisticated compliance planning model and related tools to enable structured analysis of risks and intelligent allocation of resources to achieve high levels of compliance.

38. The delivery of the CD program will combine strategic advice from FAD HQ with on the-ground capacity building. Tentative dates and CD contents and outcomes are provided in Table 3. The SRC has requested further detailed discussions about the analytical tools and requirements (IT systems, software packages and staff skills). A FAD short-term expert visit in June 2019 will describe the risk differentiation framework (RDF) and provide hands-on advice to the compliance risk management team and agree on plans for its implementation. Given the analytical nature of this CD activity, timely communication of comprehensive data and the full collaboration of the SRC will be required.

[16] See Technical Glossary (Appendix 6).

[17] Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

Table 3. Tentative Plan for FAD CD Activities in SRC for 2019–20

Date	Topic	Activity	Outcomes that activity will support
June 2019	CRM	Expert visit	Corporate priorities are better managed through effective risk management.
September 2019	Follow up	HQ staff visit	Support the SRC's CRM program and support of STX's work
September 2019	CRM	Expert visit	Corporate priorities are better managed through effective risk management
November 2019	CRM	Expert visit	CRM continued.
January 2020	Tax administration core processes	HQ staff visit	Audit and other verification programs more effectively ensure accuracy of reporting
March 2020	Follow up	HQ mission	Follow up and review of progress in tax administration CRM. Plans for further FAD CD program.
May 2020	Tax audits	Expert visit	Audit and other verification programs more effectively ensure accuracy of reporting
September 2020	CRM	Expert visit	Corporate priorities are better managed through effective risk management

39. In response to the Minister of Finance (MOF)'s request for technical assistance, FAD has agreed to help assess the VAT gap under the IMF's Revenue Administration Gap Analysis Program (RA-GAP)[18]. As for the development of a modern compliance planning model and tools, a thorough review of all the data components used in assessing the tax gap needs to be conducted to ensure the estimate is as accurate as possible. Timing and modalities of delivery of this CD will be discussed at a later time.

40. If requested, FAD could consider providing further technical assistance to the SRC to assist with its reform program. The IMF-EU CD program to support CRM in Armenia is a pilot project. If necessary, and subject to its successful implementation evidenced by the achievement of the sought outcomes and a request for further support from the authorities, its scope could be expanded.

[18] See MOF's November 1, 2018 request and FAD's response dated December 4, 2018.

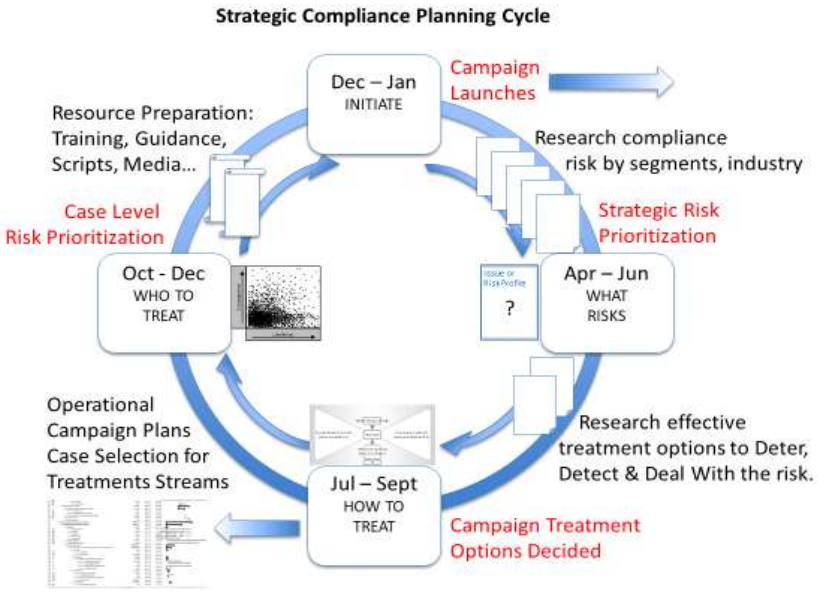
Appendix I. Strategic Choice in Compliance Planning

'If everything is important then nothing is.' Dwight Eisenhower.

Running CRM in a reactive, 'business-as-usual' mode is not effective. Prevention of significant non-compliance through strategic interventions is usually far more cost effective in improving long-term compliance. Business-as-usual compliance is the expected day-to-day compliance interventions undertaken at an operational level because a taxpayer has 'hit' some risk rule in the system – for example VAT high-risk refund rules or mandatory audits for liquidating companies etc. Left to themselves operating areas will 'fill' their workload to capacity with such work. The operating system evolves into a relatively steady state equilibrium and it is difficult to dramatically improve compliance doing what you have always done.

Strategic CRM is a deliberate choice by the tax administration executive to invest in future compliance by deploying resources from operational work into strategic projects targeted at a particular risk, region or industry segment with a view to making a significant change in compliance levels.

Often strategic compliance interventions will entail a campaign approach – the considered use of multiple compliance approaches, preventative and corrective, service and enforcement, to the target risk population. It may involve the use of media awareness campaigns, industry seminars and lower rates of penalties for those non-compliant taxpayers that come forward within particular timeframes before ramping up enforcement efforts. Ideally 'before and after' research audits will be used to identify changes in underlying compliance levels. Planning and designing these specific interventions takes time and this needs to be built into an annual strategic planning process.

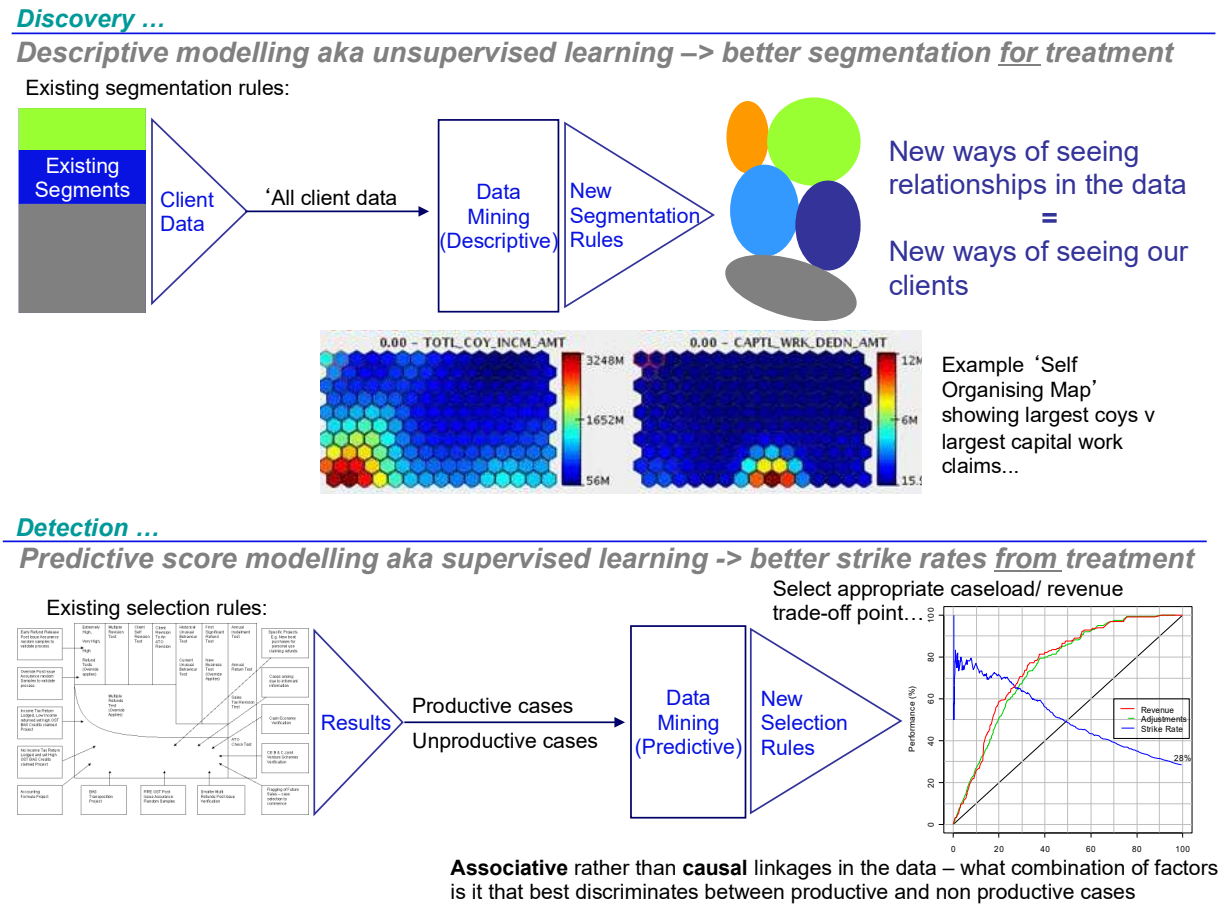


Appendix II. Types of Machine Learning

Types of Machine Learning

ML approaches can be broadly grouped into two categories: Supervised learning or predictive data mining – a detection process where the machine 'learns' against a target variable to correctly detect and classify cases, and unsupervised learning or descriptive data mining – a discovery process where the machine looks for associations and clusters in the data.

Both data mining approaches are useful in tax administration.



Associative rather than **causal** linkages in the data – what combination of factors is it that best discriminates between productive and non productive cases

Appendix III. Potential Uses of Predictive Modeling in Tax Administration

As the OECD[19] and others[20] point out, the emergence of advanced analytics, with its ability to examine data or content using sophisticated approaches such as pattern recognition, outlier detection, cluster analysis, experimental design, network analysis, and text mining, has opened new opportunities for the use of intelligence across all aspects of revenue administration. Other applications (apart from case selection) for advanced analytics include:

Registration

- ✓ Predict who should be registered.
- ✓ Predict revenue associated with a non-registered person.

Filing

- ✓ Predict who will file late before the event.
- ✓ Predict who will file once they are late (self-finalize).
- ✓ Predict revenue associated with late or non-filing.

Reporting

- ✓ Predict who is non-compliant (likelihood) for each tax type.
- ✓ Predict size of potential adjustment (consequence).
- ✓ Predict high risk refunds.
- ✓ Predict who will object to an amended assessment.
- ✓ Support text and social network mining in audit cases.

Payment

- ✓ Predict who will pay late before the event.
- ✓ Predict who will pay late but before intervention (self-finalize).
- ✓ Predict who will pay given alternative interventions (phone, mail, visit, court action etc.).
- ✓ Predict capacity to pay and propensity to pay.
- ✓ Predict business viability (see BVAT[21] model on the ATO website).

Service

- ✓ Taxpayer channel use to inform design decisions and identify self-service opportunities.
- ✓ Improve service delivery using proactive messaging, calling, and other interventions.

Border protection

- ✓ Predict likelihood of smuggling contraband, drugs etc.
- ✓ Predict behavior of traders and passengers.

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[19] *Advanced Analytics for Better Tax Administration: Putting Data to Work*, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264256453-en .

[20] IOTA (2017), *Good Practice Guide – Applying Data and Analytics in Tax Administrations,* IOTA, Budapest; and WCO News (February 2017), *Data Analysis for Effective Border Management,* WCO, Brussels.

[21] Business Viability Assessment Tool. https://www.ato.gov.au/calculators-and-tools/business-viability-assessment-tool/ .

Policy

- ✓ Tax gap measurement.
- ✓ Assessing or forecasting the impact of changes in tax policy.

Appendix IV. Practical Tips Regarding Predictive Model Use

Practical Tips regarding predictive analytical model development and use:
Use a formal process, such as CRISP_DM to document data mining efforts for better analysis, consistent reuse and learning.

Data:

- Where possible have/use **categorical** data rather than free text fields.
- Where possible use **ordinal** data (categories that have an order) rather than categorical data
- Where possible use **interval** data (numeric with meaningful spacing) rather than ordinal data.
- Manipulate and transform mirror data sets - not the original data.
- Save SQL scripts for consistent data retrieval, reuse and process documentation.
- If faced with extremely large data sets, use representative sampling to reduce the size analyzed.
- If the target variable is rare (e.g. <10%) consider oversampling the target, under sampling the negative class or generate additional 'synthetic' examples using the SMOTE[22] node in KNIME.
- Always review the data and understand the distributions involved, particularly of target variables.

Modeling / Mining

- Use a good 'out of the box' algorithm, such as Random Forest' initially. As expertise develops explore the use of other modeling approaches to see if they can improve predictions over part of the data. (It is usually hard to beat Random Forest in practice.)
- Use ensemble approaches (taking the best predictions from multiple models) when appropriate.
- To reduce 'noise' evaluate and then eliminate variables that don't provide predictive ability. (The Meta Node provided for Random Forest 'variable importance' indicates the relative use of variables in the random forest.)
- Some modeling approaches work best with normalized interval data. Explore whether such transformations improve the predictions. (KNIME Normalizer node.)
- To reduce the number of low value cases selected iteratively raise the threshold for a 'strike' and evaluate the results until a suitable balance between strike rate and caseload is obtained. (The median strike value is often a good starting point.) If the threshold reduces the target percentage below ~10% consider over / under sampling or SMOTE (synthetically generating targets using a SOM clustering algorithm) to rebalance the data set.

[22] https://nodepit.com/node/org.knime.base.node.mine.smote.SmoteNodeFactory

Deployment

- Once a robust predictive model has been built and evaluated, for the deployment build push the 'training partition' to 100% and re-execute the learner node to maximize the deployed models' predictive ability.
- Use a single regression tree (CART) to provide a broad explanation of what the more accurate 'black box' model is doing. It won't be exact nor always 'correct' but should provide a useful indication.
- A model's predictive ability degrades over time as the underlying economy changes. Revisit models every six months with additional data to see if they need to be rebuilt or enhanced.
- Use a small **random component** (using stratified random sampling) to maintain intelligence on **new risks** and monitor model performance over time. A random component also assists in estimating tax gaps and prioritizing compliance campaigns.

Appendix V. Analysis of SRC Case Selection and how to improve it

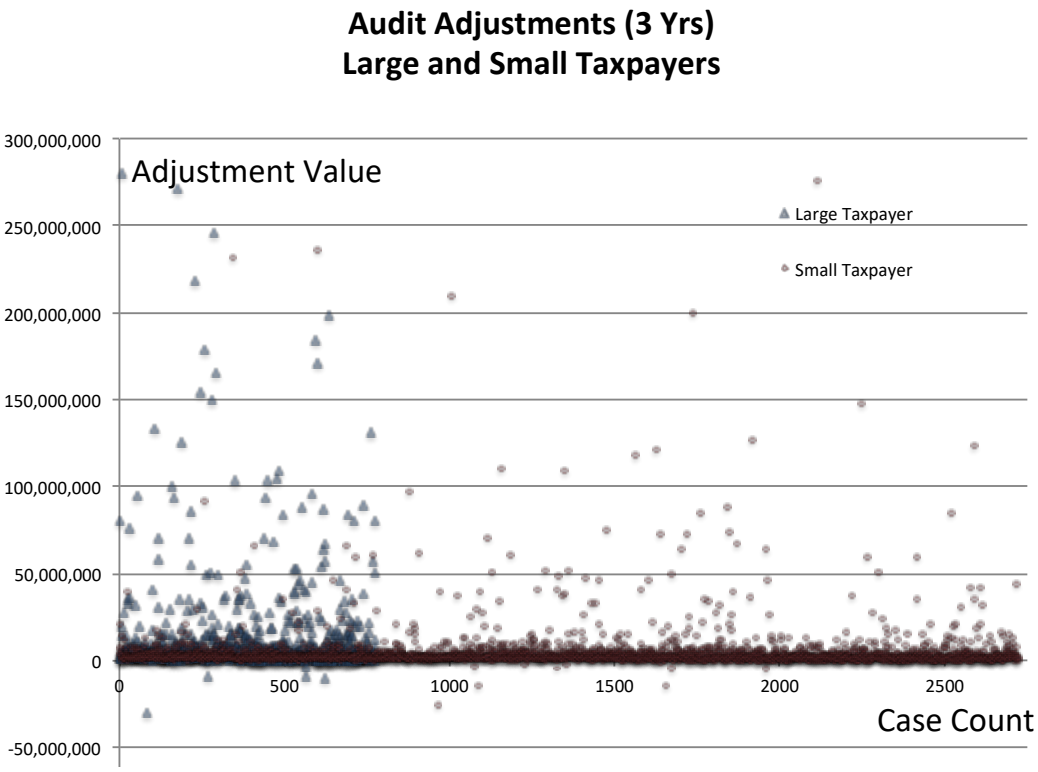
Improving SRC CRM

Effective and efficient tax compliance relies on having the majority of taxpayers 'ready, willing and able' to comply with their tax obligations so that the tax administration can then focus its efforts on the few who have not complied. Taxpayers have to 'know what' the Tax Administration considers is *compliance* with a particular law, they then have to 'want to comply' with that interpretation of the law, and they also must have the 'ability to comply'. If any of these three elements are deficient, then there will be compliance issues to be examined and if necessary corrected or enforced via active compliance measures.

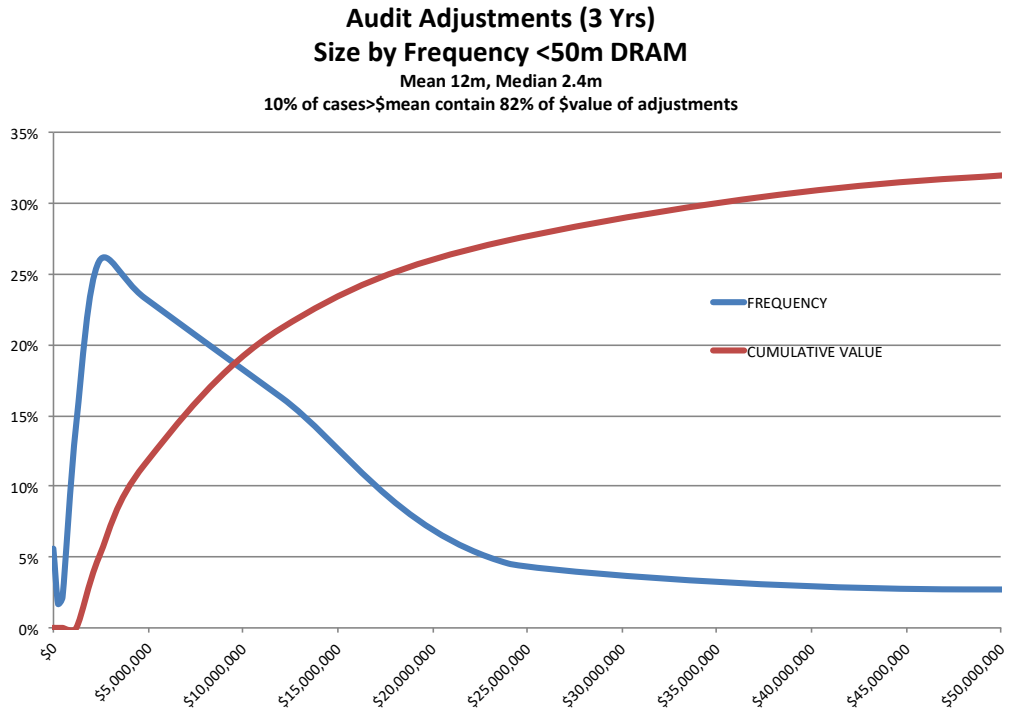
The SRC uses both comprehensive audits and thematic reviews in its compliance enforcement activities. While no tax administration can 'audit its way to compliance', timely, effective and efficient enforcement is an important part of the CRM toolkit. The SRC uses a weighted additive risk scoring approach for its comprehensive audit case selection. A series of 'risk rules' have been defined and approved by a senior working group and taxpayer data is periodically parsed against each of these rules and a score is given.

These scores are then aggregated and those taxpayers with the highest score are considered to be the most 'risky'. This is of course only true to the extent that the aggregate risk score actually approximates the likelihood times the potential value of an amendment to produce a risk adjusted value. While this might be true for a single risk rule score, it is highly unlikely for an aggregate score to reliably approximate the overall risk adjusted value. That is: the risk adjusted value of Risk A and Risk B and Risk C is not indicated by Risk Score A plus Risk Score B plus Risk Score C.

Audit adjustments over three years 2015-2017



Armenian comprehensive audit results (3 years data) are highly skewed.



If strike rates and average adjustment are used to evaluate the SRC comprehensive audit selection system, then on the surface the risk rules produced (over the period 2015_17) a 93% adjustment rate with a mean adjustment of 9.8m AMD. However, the strike rate falls dramatically once reasonable thresholds are considered to remove low value adjustments that consume most of the SRC audit resources. For example: if the modal adjustment threshold of 1.5m AMD is used the strike rate obtained over three years was 68 percent, if the median adjustment threshold of 2.5m AMD is used the strike rate is 47 percent and if the average (mean) adjustment of 9.8m AMD is used the strike rate was just 13 percent.

A deeper analysis, regressing the aggregate risk scores in the pool of audited cases against various threshold levels (mode, median and mean), shows that the aggregate risk scores used for the three years had essentially no predictive capability for indicating larger size adjustments. It was effectively random within the case results over the period 2015-17. Thus, it is unlikely that cases were being appropriately prioritized using the additive risk rules that were in place when these cases were selected, and hence scarce audit resources are not being used as effectively and efficiently as they could be.

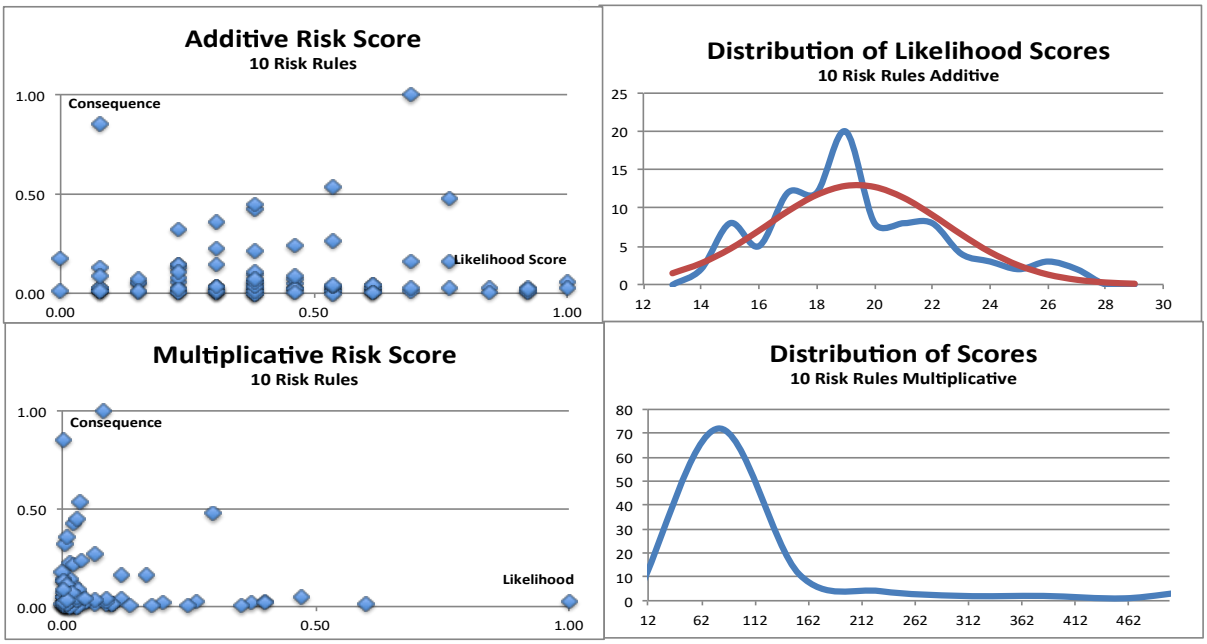
It is therefore questionable whether the risk score is selecting the riskiest taxpayers in the population given the inability of an aggregate risk score to reasonably predict the size of the adjustment and an estimate of its likelihood. Indeed, it is unlikely to be the case. That is not to say that individual risk rules do not indicate the likelihood of 'some' risk. Indeed, the high initial strike rate indicates that the existing risk rule set does detect some 'risk' but does not then subsequently rank cases appropriately. Given the low potency of the additive risk rules it might be better to rename the resulting number from a 'risk score' to an 'indicator of concern' as it was clearly not prioritizing the 'riskiest' taxpayers appropriately.

The problem of using additive risk scoring approaches

While additive risk scoring approaches are often an important first step towards an objective and improved case selection system, they can only take a tax administration so far on the journey to improve CRM. With the advent of ML approaches, additive risk scoring is now a relatively dated approach. Risk rules and additive risk scoring approaches are in practice a fairly crude way of forming a view of the likelihood of an adjustment and the potential size of the adjustment.

The intrinsic problem with additive risk scores is that even if an individual risk score did produce an approximate ranking of risk adjusted value, the subsequent aggregation of risk scores effectively degrades this predictive ability. By its nature additive scoring approaches produce a 'normal' or Gaussian distribution of risk scores whereas the true underlying distribution of tax compliance risk is almost always highly skewed and best approximated by a log-normal distribution.

Example - additive risk scores produce a 'normal distribution' that does not appropriately reflect the underlying distribution of tax risk.

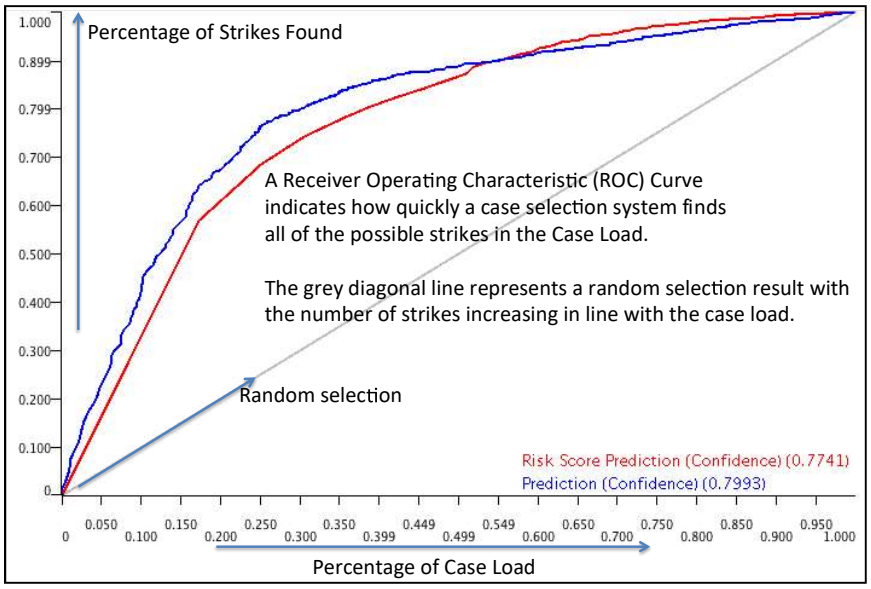


The case for using predictive modeling for case selection

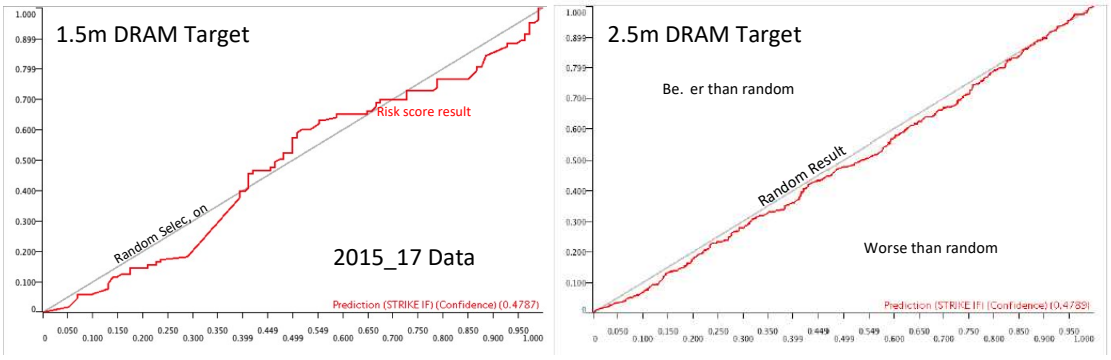
Predictive data mining approaches can provide a more robust overall view of the likelihood of an audit adjustment. To do this a ML algorithm, such as Random Forest, essentially regresses the provided data set for a set of taxpayers against the target variable of whether there was an adjustment of size X, e.g. 1.5 million AMD.

While data was not available to this mission to build a predictive selection model, a view of the effectiveness of the aggregate risk scores used during the 2015-17 period was examined. To this data a new column 'Strike Y/N', the target variable for the predictive data mining exercise, was appended using a KNIME rules engine node with the code: *$Adjustment$ >= 1500000 => "Y"* to test if the Adjustment was greater than the modal adjustment of ~$1.5 million AMD and the resulting data was partitioned 50/50 into a training and verification data set and then the training set was parsed through a Random Forest learner. The resulting predictive model was then used to predict the result found in the verification data set. The efficacy of the 2015-17 aggregate risk score was then examined using a standard Receiver Operating Characteristic Curve approach.

Evaluating predictive models using ROC Curves

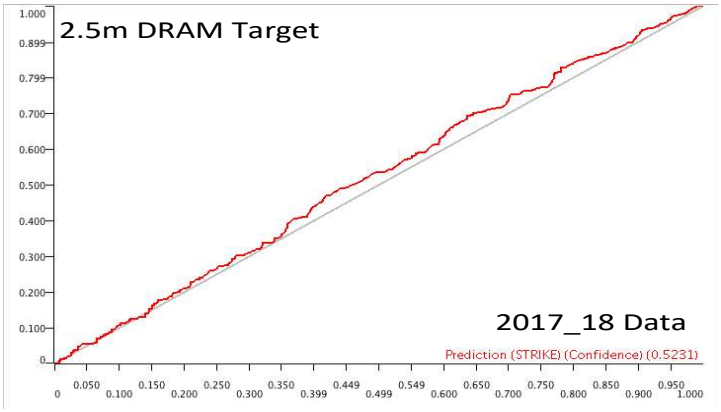


Predictive ability via risk scores for a modal adjustment of 1.5 million AMD and of a median adjustment of 2.5 million AMD for the period 2015-17



The additive risk scoring system was upgraded during the 2017-18 period however an analysis of the audit results against the aggregate risk scores still shows no predictive ability for an adjustment of 2.5 million AMD.

Prediction via risk scores for a median adjustment of 2.5 million AMD 2017-18

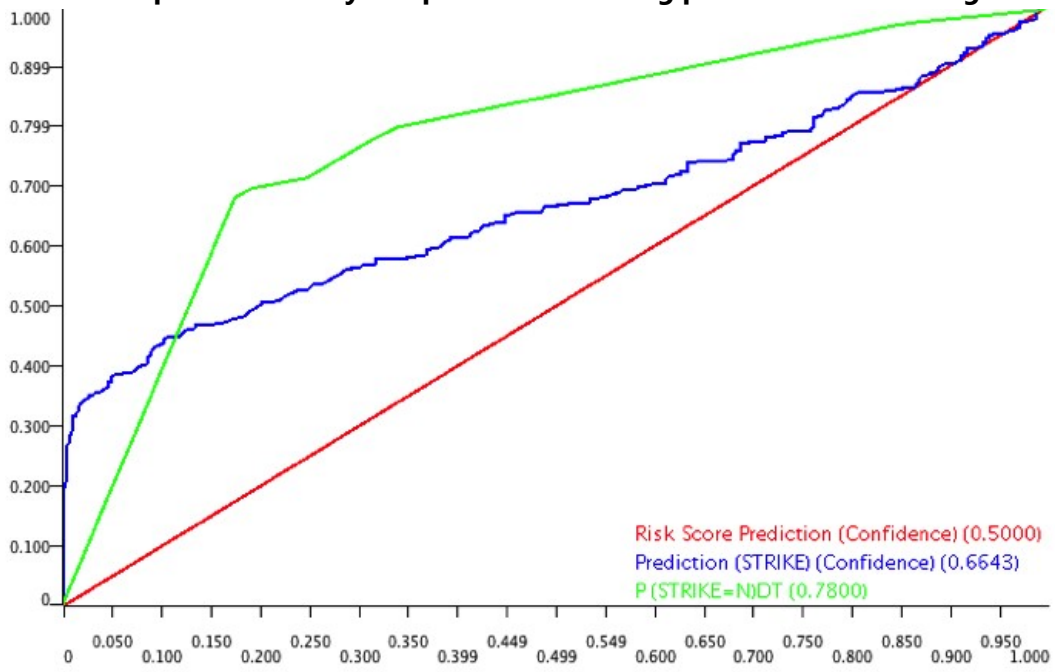


Essentially there was <u>no</u> relationship between the size of the aggregate risk score and the likelihood of selecting a case within the audited pool and obtaining the median or modal audit result over the period 2015-18.

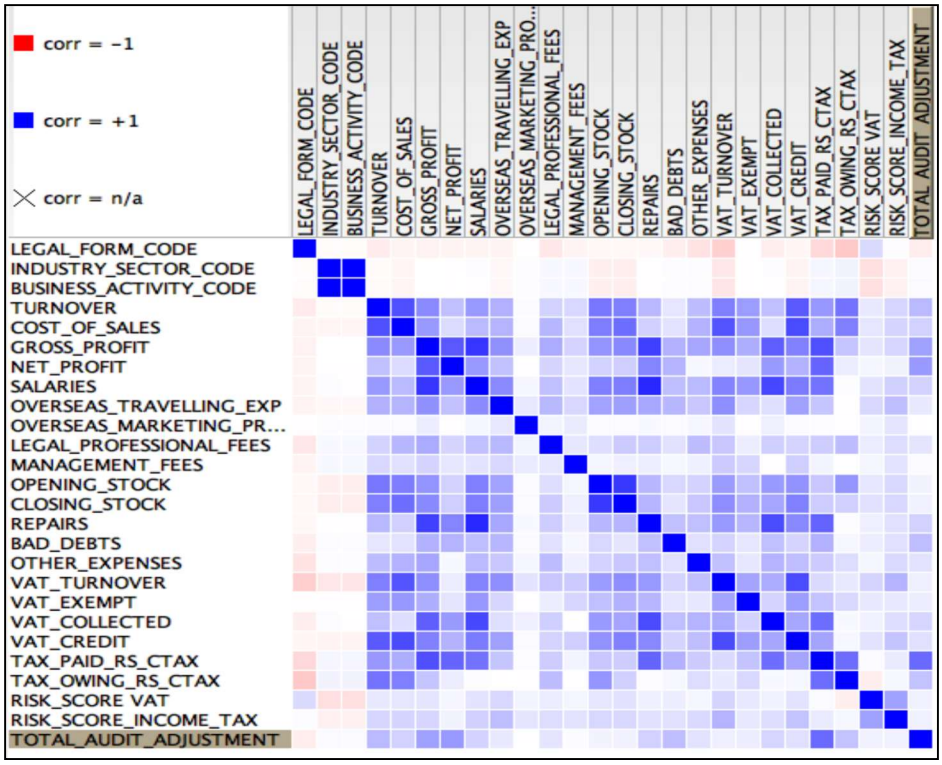
Improving case selection – a comparator country example

By comparison to Armenia, in a comparator country using a data set described below, the following ROC curves were obtained using two different data mining approaches. It indicates a significantly better case selection paradigm was being achieved.

Comparator country risk prioritization using predictive data mining



Example of a data set used in comparator country – correlation matrix



The data set used in the comparator country for case selection for audit had demographic, interaction, financial and risk score data.

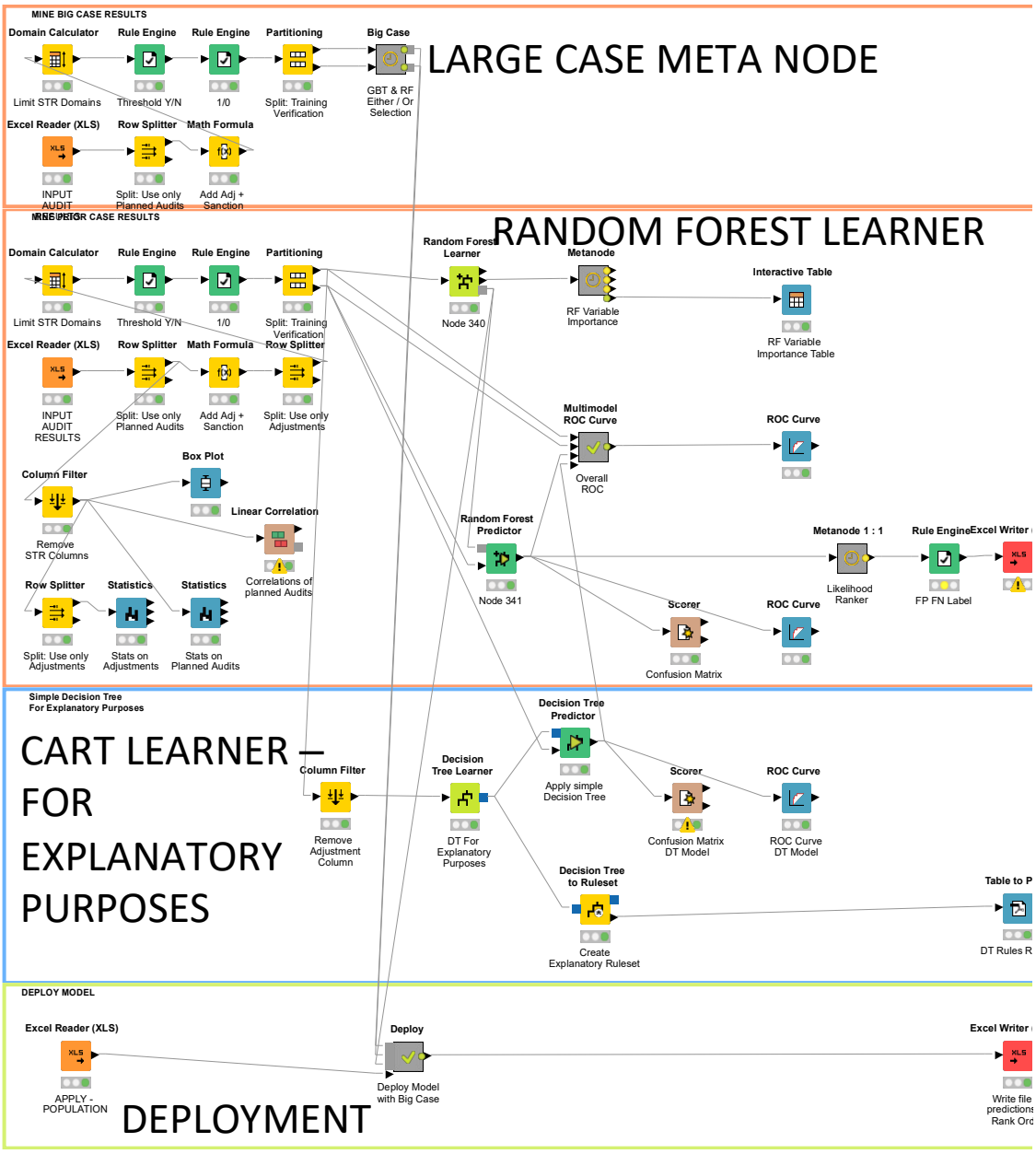
Typical predictive model data set – each type may have multiple columns

Identifiers (Not used)	Demographic Data	Interaction Data	Financial Data	Risk Data	Adjustment	Penalty
TFN & Name	Region & Industry	Files O/S Debt late Last audit	VAT & CIT P&L & Balance Sheet	Score for each risk rule & overall	Amount	Amount

A relatively simple KNIME workflow (no programming needed - just link the appropriate nodes) was used to take the data from an Excel spread sheet and parse it through a Classification Learner/Predictor set (Random Forest[23] used)

[23]Random Forest – a ML algorithm was used to create multiple decision trees (the Forest) that essentially 'vote' on the appropriate classification. The Random Forest algorithm is good 'out of the box', tolerant to missing data, uses both numerical and categorical data and is resistant to over fitting.
https://en.wikipedia.org/wiki/Random_forest

Example KNIME data mining workflow



The first part of this model takes the data set and separates out large taxpayers for more intensive analysis and after partitioning into training and verification data sets then flows the data through a Random Forest Learner/Predictor pair and evaluates the result using various techniques such as ROC Curves and Confusion Matrices (an evaluation of the true positive/false positive/true negative/false negative outcome).

The next part of the model reports on statistics for the data set and produces a simple decision tree (CART) for explanatory purposes.

For most candidate cases the single decision tree would provide a broad selection rationale in a relatively explainable manner. E.g. "$Sales Exempt$ >766473.0 AND $Expenses Exempt$ <= 2746069.5 AND $Expenses VAT$ <= 5583015.5 AND $Sales Exempt$ <= 4.6373646E7 AND $Sector$ IN ('G', 'I') AND $Industry$ IN ('0099', '0018','0020', '2231','0226', '0011','0073', '0045' etc.) => "Y" probability 0.722. It should be noted that this 'simple' decision tree risk rule, one of many, derived directly from the data is much more complex and accurate than any of the simple additive risk scoring rules that were manually developed by the tax administration.

While this single decision tree risk rule looks somewhat complex, it is much simpler than the random forest model. With a Random Forest several hundred decision trees (the forest), each produced by repeatedly random sampling the data set with a sample size of roughly the square root of the data set, essentially vote on whether a candidate case is a positive or negative.

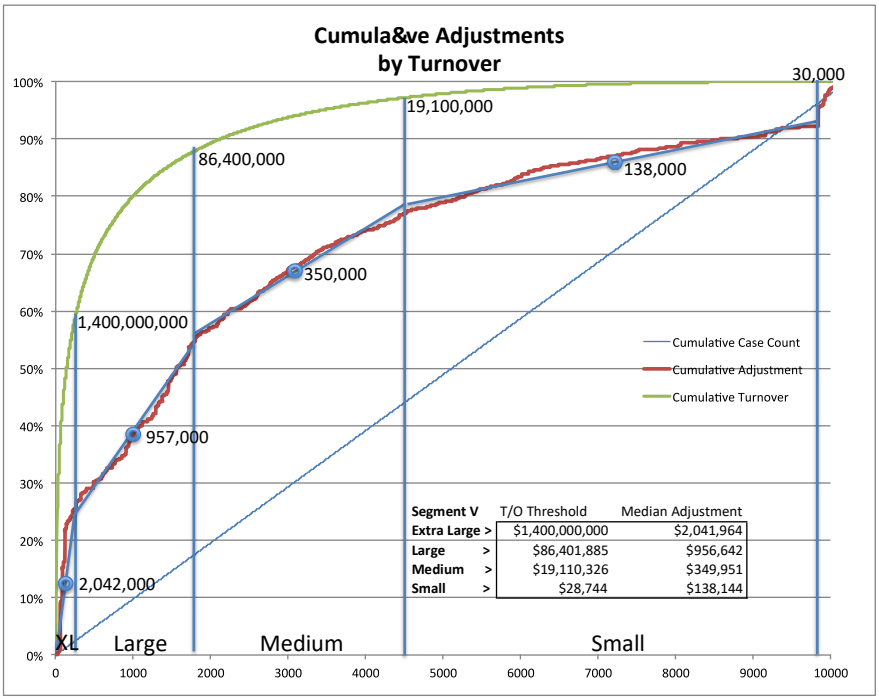
Tracing the selection reasoning through the several hundred or so decision trees commonly used in a random forest, each tree essentially voting on each candidate case, is much harder to explain (a 'black box'), but also often much more accurate than a single tree model. Importantly, using such an approach produces a more robust likelihood of adjustment value (L) that can then be used in the risk adjusted value calculation (R=LxC) to more appropriately prioritize casework.

Calculating a value for potential audit Consequence (C)

There may be cases where the potential adjustment is quite well defined, such as from data matching processes where third-party information indicates a discrepancy. In other cases, industry sector benchmarking may provide a reasonable view of the size of the potential consequence, albeit with a considerable degree of uncertainty.

Finally, there are cases where the only real informative indicator of the size of the adjustment is the size of the business. In these cases, a cumulative curve analysis can indicate several median expected adjustments by turnover size that can be used as a proxy for potential consequence.

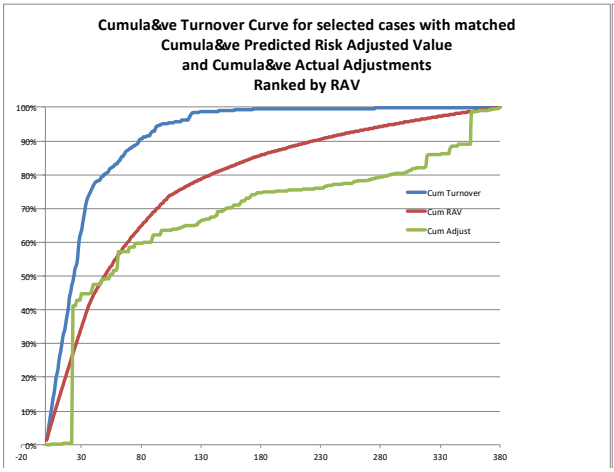
Example Turnover / Median adjustment sets

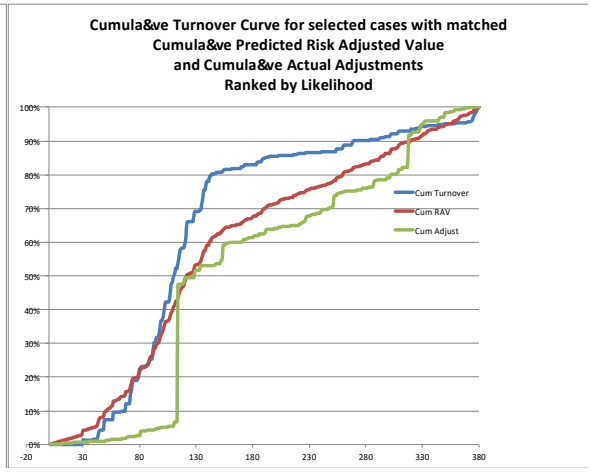


Having obtained a view of the likelihood of an adjustment (L) and the potential size of that adjustment (C), the two aspects can be multiplied (LxC) to produce a figure for Risk Adjusted Value (RAV). Audit ranking (case prioritisation) should be by RAV to maximise the long-term return on investment.

In skewed populations, as most are in tax, prioritisation using RAV will usually produce a significantly superior revenue result to ranking by likelihood (strike rate) or to that obtained via cyclical auditing (e.g. once every three years).

Prioritization – Ranking via Risk Adjusted Value v ranking via Likelihood





The resultant case selection models created in the comparator country demonstrated a potential for somewhere between a 9% and 68% percentage point improvement in revenue if audit caseloads were maintained. Audit capability would be a key factor and the final outcome is thus more likely to be towards the lower end of the range.

Evaluating predictive models – comparator country - changed outcomes

BASE RESULTS - WHAT WAS ACHIEVED WITHOUT DATA MINING- AVERAGE OVER THREE RUNS			
Min	- 3,076,544		The minimum adjustment
Interquartile 1	3,883		
Median	50,430		The median including negative and zero results
Interquartile 3	273,027		
Average	738,434		The average including negative and zero results
Max	255,759,792		
Median adjustment	87,586		The median excluding negative and zero results
Count +	4,161	**84%**	The strike rate in the verification data
Count -	29	1%	
Count 0	761	15%	
Count all	4,951	100%	
Sum +	3,663,604,142		The sum of all positive adjustments in the verification data
Sum	3,655,987,368		
Sum -	- 7,616,774		

POTENTIAL	MODEL 0 > 1000		MODEL 1 > 10000		MODEL 2 > 50000	
THRESHOLD = X	1,000		10,000		50,000	
Count > X	4,040	82%	3,366	68%	2,467	50%
Sum > X	3,655,921,758	100%	3,652,901,171	100%	3,629,833,695	99%
Median > X	95,197		149,446		273,552	
ACHIEVED - WHAT THE MODEL ACHIEVED COMPARED TO THE BASE						
Sum Pred	3,573,564,442	98%	3,482,656,314	95%	3,074,305,739	84%
Ave per case / Inc %	774,656	5%	893,498	21%	1,152,953	56%
Caseload / Decr %	4,451	-10%	3,841	-22%	2,799	-43%
Median / Inc %	65,306	29%	91,644	82%	149,784	197%
TRUE POSITIVES	3,919	97%	3,087	92%	2,025	82%
FALSE POSITIVES	532	4,451	754	3,841	774	2,799
FALSE NEGATIVES	121	4,040	279	3,366	442	2,467
TRUE NEGATIVES	379		831		1,710	
	4,951		4,951		4,951	
Strike Rate	**88%**		**80%**		**72%**	
Miss Rate	3%		8%		18%	
POTENTIAL REVENUE GAIN IF CONSTANT CASELOAD						
Using Median > X	32,653,000	1%	101,724,840	3%	322,335,168	9%
Using Average > X	387,327,973	11%	991,782,687	27%	2,481,155,049	68%

Appendix VI. Glossary of Technical Terms

Audit
A process used to establish whether the correct amount of tax has been assessed. It involves formal evidence gathering to establish the facts and then the application of relevant law to those facts. The time and resources required to appropriately audit a taxpayer depends upon the matter and materiality being audited and one size audit does not fit all. For example, a VAT refund audit generally involves simple fact checking, while at the other extreme an Income Tax transfer pricing audit may involve information exchanges with other tax jurisdictions, taking several months just to establish the functional analysis facts.

CART
Classification and Regression Tree. A decision tree data mining software algorithm. Usually not the optimal data mining method, with a tendency to 'over-fit' the training data, it has the advantage of not being a 'black box'. The single decision tree rules are explainable.

Case Selection
The process (e.g. via data-mining or subject matter expert rules) used to initially identify a set of taxpayers (positives) that may have compliance risks. Ideally should produce a listing of taxpayers prioritized (ranked) by predicted revenue risk = likelihood multiplied by AMD consequence [aka Risk Adjusted Value].

- **Risk Filter/Risk Rule**

A set of rules used to select cases for a particular risk. Can be created by subject matter experts or from predictive data mining.

- **False positives (FP)**

Taxpayers that initially appear to have a tax compliance risk, but on review are found to be compliant. Opposite of true positives (TP)

- **False negatives (FN)**

Taxpayers that appear to be compliant but are not. The opposite of true negatives (TN)

- **Strike Rate (precision): TP/(TP+FP)**

The ratio of true positives over the number selected. A function of case selection rationale, efficacy and size, auditor detection capability, and the underlying compliance rate.

- **Miss Rate: FN/(TP+FN)**

The ratio of false negatives over the total number of non-compliant. A function of case selection rationale, efficacy and size, auditor detection capability, and the underlying compliance rate.

- **Accuracy: TP+TN/(TP+TN+FP+FN)**

The ratio of correctly determined cases to the total number of cases.

- **Confusion Matrix**

A table setting out True Positives/False Negatives/False Positives/True Negatives from the selection model. Used in case selection model evaluation.

Confusion Matrix example

CONFUSION MATRIX

	Selected	Not Selected			
TP	1538	3885	FN	5423	Non Compliant
FP	1938	11543	TN	13481	Compliant
	3476	15428			

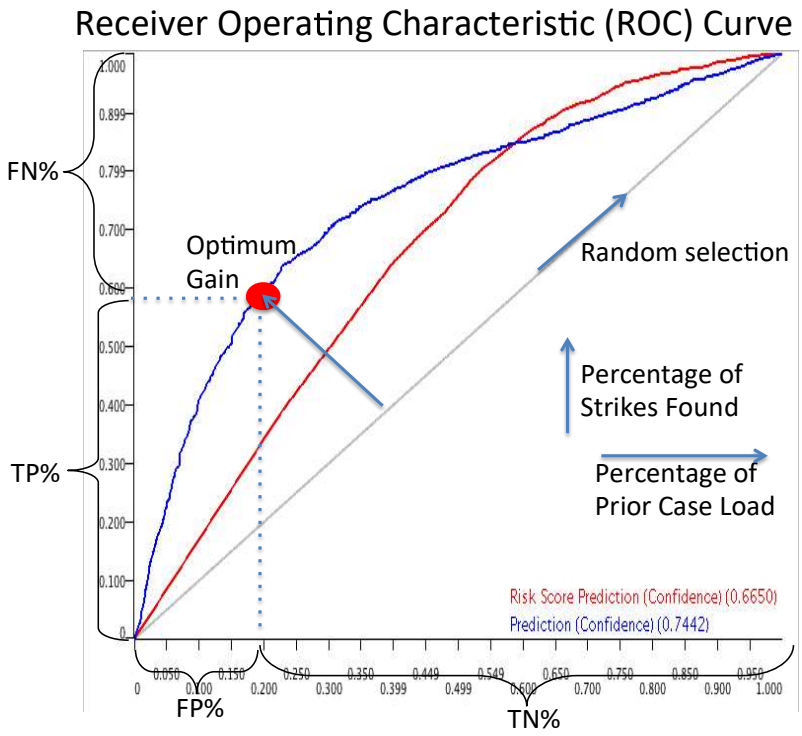
The matrix in figure 2 shows the number of True Positives, False Negatives, False Positives and True Negatives produced by a case selection model being evaluated. It enables the Strike Rate and Accuracy of the selection method to be calculated.

	MODEL	**PRIOR**	Change
Strike Rate	44%	29%	54%
Miss Rate	72%	0%	-72%
Accuracy	69%	29%	141%
Revenue	95%	100%	-5%
Revenue case	977,991	189,602	416%
Caseload	18%	100%	-82%

- **Receiver Operating Characteristic (ROC) Curve**

A plot of how the ratio of True Positives to False Positives (TP: FP) varies over the sample/caseload. The greater the area under the curve the better the selection model. Used in model evaluation.

Receiver Operating Characteristic (ROC) Curve example

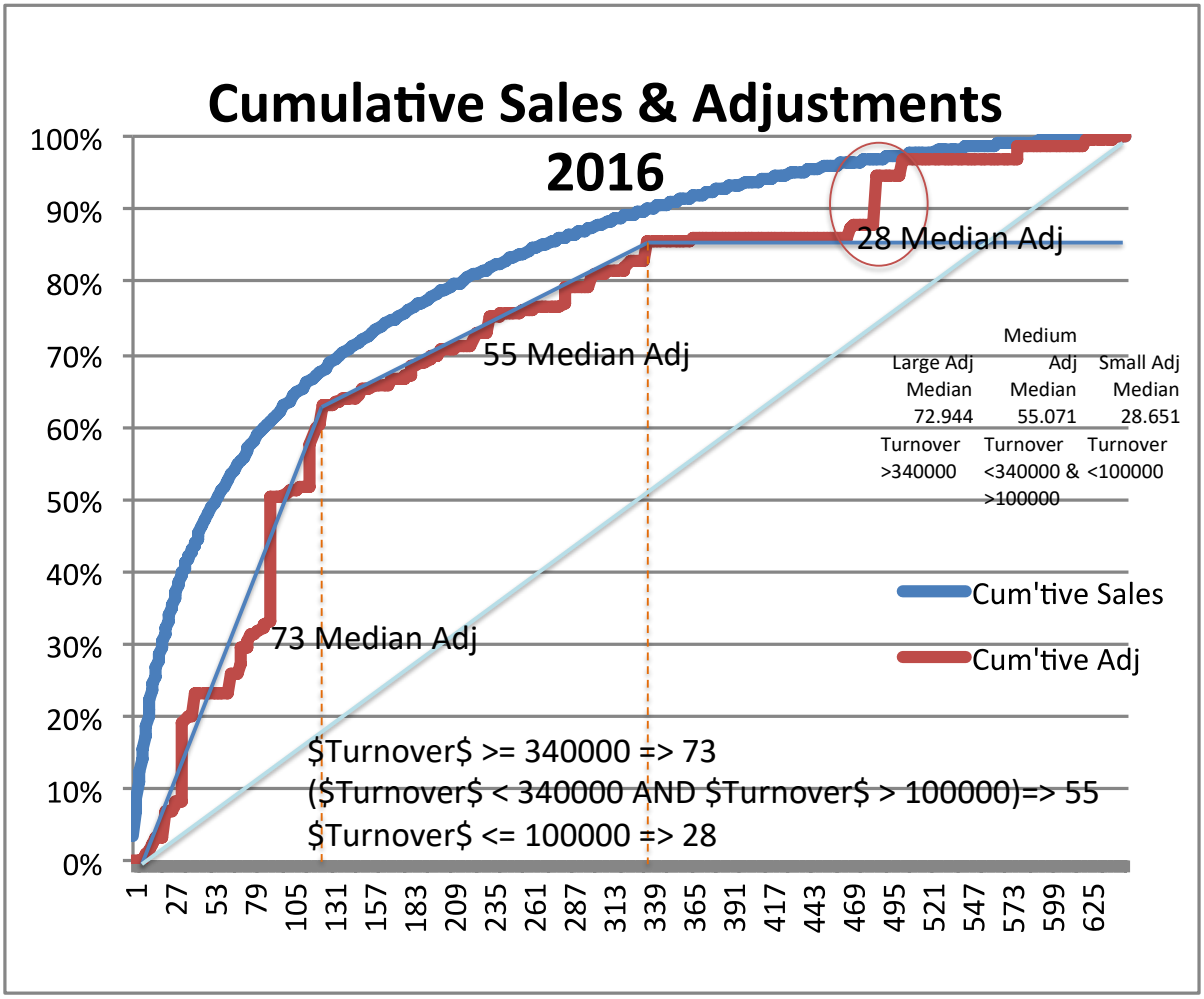


The further the selection models ROC performance line (blue predictive model & red risk score model) is from the random selection line (grey 45 degrees) the better the selection model.

Cumulative Curve Inflection Point Approach

The cumulative curve inflection point approach is a technique that looks for the 'turning points' (or points of inflection) on matched cumulative curves of turnover (to give taxpayer 'size') and the adjusted tax. The median adjustment for the range between turning points is then used as a proxy for consequence in the risk calculation likelihood x consequence for ranking/prioritizing candidate cases. The approach reduces the overestimation of potential consequence (the adjustment size) in highly skewed populations. (e.g. If a single figure such as the mean, median of the adjusted taxpayers was used as a consequence proxy it would overestimate consequence in the majority of cases while if the modal adjustment was used it would underestimate consequence in most cases. By using several consequence proxies based on the differing size of the underlying companies a more accurate stepwise consequence estimate is produced, improving the reliability of case risk-based prioritization.)

Cumulative Curve example



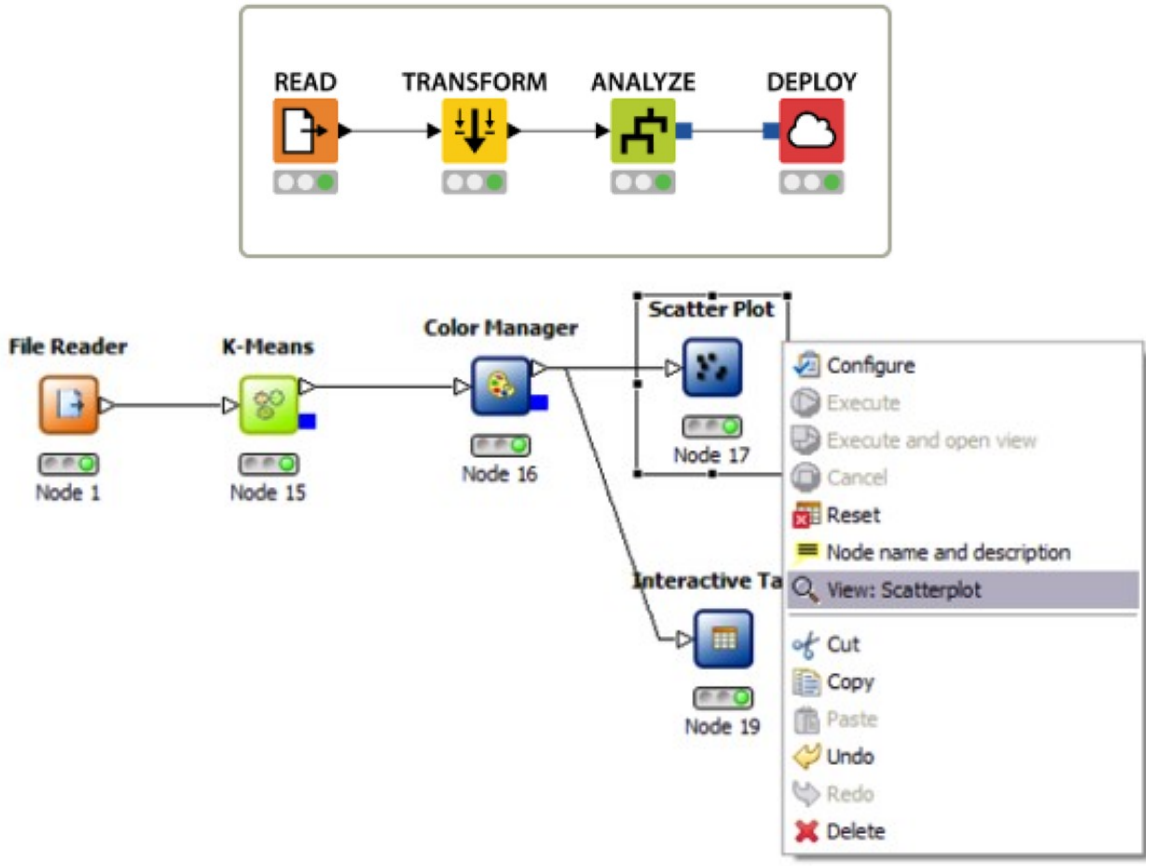
Data mining

The use of computer algorithms (ML programs) to identify patterns and associations (knowledge discovery) in data. Data mining can be descriptive or predictive. Predictive data mining takes a set of historic data and attempts to identify rules that best predict the outcome. Data mining approaches can be contrasted with subject matter expert approaches, where a person (a subject matter expert) defines (imposes) how taxpayers should be categorized or selected for compliance actions.

KNIME

KNIME (KoNstanz Information MinEr, pronounced 'Nime') is an open source data analytics, reporting and integration platform that runs on OS, MS and Linux operating systems. **KNIME** integrates various components for exploratory data analysis and data mining through a modular workflow / linked node concept.

Figure 4: KNIME Node based workflow approach



Meta Node

A user created node in KNIME allowing workflows to be enclosed within it to reduce the complexity of the overall workflow display and enable the easy 'packaging' of reusable processes. In the workflow provided meta nodes were used to simplify the large case and deployment workflows.

Random Forest

A predictive data-mining algorithm that is usually provides good 'out of the box' performance that is close to optimal. Created by repeated (e.g. 500 times) random sampling of the data and building a decision tree each time. The multiple decision trees (the Forest) then 'vote' on the correct categorization of an instance. The multitude of decision trees makes a simple explanation of a decision more difficult to trace through. Relatively fast, copes with missing values and non-numeric data and is resistant to 'over-fitting' the training data set.

Self-Organizing Map

A descriptive data-mining algorithm that computes a 'distance' between every data item and uses this to cluster or group items that are closer to the identified cluster centroids. It can be used to identify taxpayers that deviate from peer group behaviors.

Example Self Organizing Map