

BY PROFESSIONAL QUALIFICATIONS, ISCA

FORENSIC DATA ANALYTICS

No Longer Just A Supplementary Tool

IN TODAY'S TRANSNATIONAL WORLD WHERE THERE IS ACCELERATED ADOPTION OF DIGITALISATION, financial criminals are increasingly leveraging sophisticated technology to execute fraudulent schemes, making it more challenging for investigators to detect their illicit activities. Equally, digitalisation and advancements in technology have also presented new opportunities for financial investigators to counter the schemes effected by fraudsters.

Forensic data analysis (FDA) – one of the branches of digital forensics – uses appropriate statistical tools to uncover patterns of fraudulent activity by scrutinising structured data found within computer application systems. FDA employs technologies such as robotic process automation and artificial intelligence

to aid organisations in achieving both accuracy and speed in their analyses of data. In light of these developments, FDA is also becoming an essential tool for financial crime investigations.

USE OF FORENSIC DATA ANALYTICS TOOLS IN FINANCIAL INVESTIGATION

For financial crime patterns that have not yet been identified, exploratory analysis may be performed to unearth patterns and spot abnormalities using data at the preliminary stage. Using this risk-based approach, investigators can prioritise their resources more efficiently by focusing their investigation on higher-risk areas.

Examples of commonly employed FDA capabilities include:

- **Anomaly detection**
Based on past cases and repetitive fact patterns, business rules are

created over time. Anomaly detection techniques such as statistical outlier detection and cluster analysis highlight relationships, behaviours and events that deviate from the standard. This allows investigators to target transactions which display indicators of potential fraud.

- **Social network analysis**
Social network analysis (SNA) is an analytical approach used to present a holistic view of the fraud network. It uses big data sets and advanced techniques to map out linkages and relationships between persons, which allows investigators to uncover sophisticated networks and hidden relationships behind criminal syndicates.
- **Predictive modelling**
Predictive modelling uses machine learning techniques to identify patterns and behaviours of higher fraud risk based on past data (example, past compliance records). Predictive models are used to assist investigation bodies in allocating their resources effectively by prioritising cases and calibrating their investigation approach based on the varying risk levels of identified cases.

In today's business world, even as syndicates adopt tactics to obfuscate their fraudulent transactions, the growing use of digital tools in financial investigations is providing an effective counter.



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Table 1 IRAS' tax recovery statistics (investigation)

Financial Year	No. of cases	Tax and Penalties Arising from Investigation (\$'000)
2018	155	37,528
2017	243	35,371
2016	120	20,869
2015	121	18,545
2014	261	23,749

Source: IRAS

Table 2 IRAS' tax recovery statistics (audit)

Financial Year	Tax Type	No. of cases	Tax and Penalty Arising from Audit (\$'000)	Total (\$'000)
2018	Corporate	3043	103,814	351,136
	GST	3145	195,839	
	Individual Income Tax	3958	51,483	
2017	Corporate	3554	89,334	348,989
	GST	2858	219,544	
	Individual Income Tax	4071	40,111	
2016	Corporate	3597	96,605	310,733
	GST	3113	168,821	
	Individual Income Tax	3796	45,307	
2015	Corporate	4115	131,534	392,649
	GST	3201	211,590	
	Individual Income Tax	4013	49,525	
2014	Corporate	4960	216,213	433,523
	GST	3407	173,731	
	Individual Income Tax	4238	43,579	

Source: IRAS

REVOLUTION OF INVESTIGATION PROCESSES: A TAX AUTHORITY'S PERSPECTIVE

When it comes to tax investigations, the most common picture we have will be of tax officers sieving through stacks of physical documents, manually searching for red flags of potential tax fraud. While that may have been the case 10 to 15 years ago, the nature of tax investigation has evolved. Changes to regulatory, social, political and technological advancements are radically altering businesses and operating models which in turn, directed the need

for tax administrations to adopt digital technologies. With rapid advancements in technology and changes in the business environment, Inland Revenue Authority of Singapore (IRAS) keeps itself abreast of technological developments in the business environment to stay one step ahead in detecting fraud and enforcing tax compliance effectively, to ensure that everyone pays their fair share of taxes. In Financial Year 2018/19, IRAS audited and investigated 10,301 cases and recovered about \$389 million in tax and penalties (Tables 1 and 2).

IRAS uses FDA tools extensively



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in its compliance operations to detect and review high-risk cases of tax non-compliance. As an organisation that embarked early on automating work processes and digitalisation, IRAS recognises the potential of FDA to enhance the efficiency and effectiveness of its compliance operations and had incorporated data analytics in its processes as early as 2008.

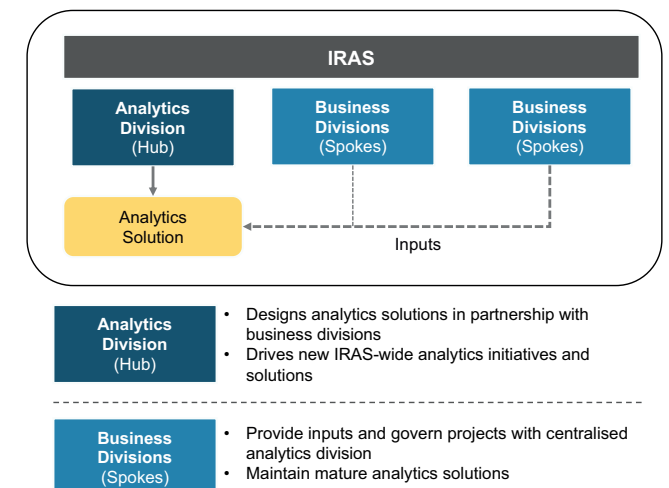
IRAS adopts a hub-and-spoke model in the deployment of FDA solutions across the organisation (Figure 3). This model is built on a centralised analytics division which comprises data scientists and is complemented by teams of officers from various business divisions who are trained in the usage of data analytical tools. The centralised analytics division acts as a hub by developing FDA tools with its expertise in data analytics,

while the business divisions lend their operational experience in their respective business domains to refine the solutions and ensure their relevance to business needs.

Applications of FDA in case detection for tax fraud

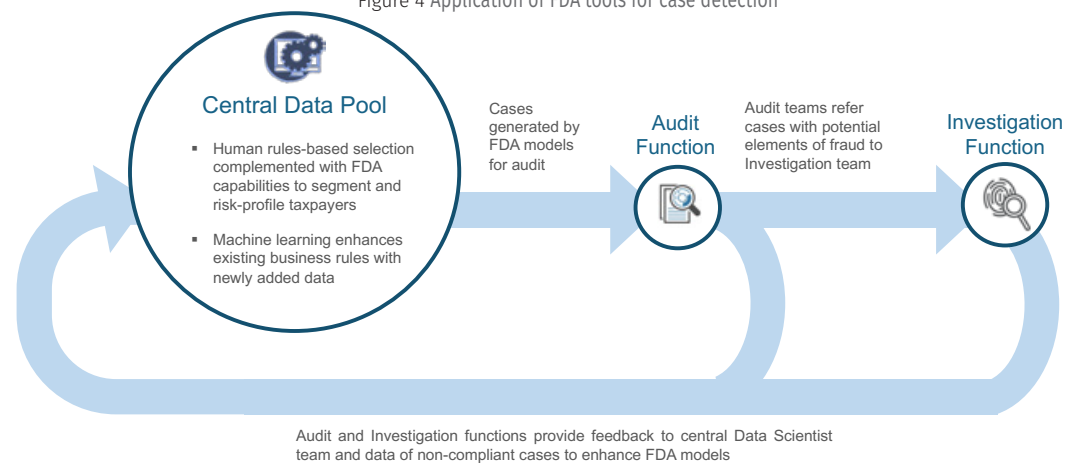
IRAS faces the challenge of managing a growing taxpayer base without a corresponding increase in resources. As such, IRAS invests heavily in its data management infrastructure and FDA to automate the selection of cases for audit, using analytics to improve its focus on high-risk cases. As FDA can effectively run through massive troves of data to identify patterns of risks – something which is nearly impossible using manual effort – it can provide more comprehensive risk-detection coverage.

Figure 3 IRAS' hub-and-spoke model



Source: IRAS

Figure 4 Application of FDA tools for case detection



Audit and Investigation functions provide feedback to central Data Scientist team and data of non-compliant cases to enhance FDA models

Source: IRAS

Forensic Data Analytics: A Case Example

In 2016, five individuals were convicted of offences relating to fraudulent Goods and Services Tax (GST) claims under the electronic Tourist Refund Scheme (eTRS). They were also found guilty of money-laundering offences by taking the cash obtained from the fraudulent GST refunds, amounting to approximately \$167,253, out of Singapore.

The accused persons masqueraded as “tourists” and paid local customers for their jewellery invoices. With these invoices and using their passports, the “tourists” then obtained eTRS tickets from the respective shops and claimed eTRS GST cash refunds at a port of departure.

These cases were detected by IRAS using anomaly detection and network analysis techniques. By modelling eTRS claims based on certain data variables (example, frequency and value of claims), IRAS was able to identify high-risk cases for targeted attention. IRAS also used network analysis to uncover more complex relationships indicative of syndicated fraud. These techniques enabled IRAS to uncover fraudulent schemes involving both the claimants and the retailers which are part of the scam.

Audit cases that are found to have suspicious indicators of tax evasion are referred to IRAS’ investigation function for fraud investigation. As about half of investigation cases in IRAS arise from such referrals, the application of FDA tools in the upstream processes plays an important role in IRAS’ efforts to detect tax fraud.

IRAS has been able to employ anomaly detection effectively as it can establish norms with the large data pool available. For example, IRAS can establish the profit margins of industry peers and use them to flag irregularities. Coupled with predictive modelling, IRAS can establish plausible relationships between different variables, which allows for more effective risk profiling and segmentation of taxpayer base. The models are frequently updated with new data, such as from completed cases, so as to enhance the effectiveness of assessing the non-

compliance risk of entities. With more accurate risk profiling, audits and investigations conducted by IRAS are more targeted, thus optimising its use of resources (Figure 4).

Applications of FDA for combating syndicated tax fraud

In recent years, IRAS has observed an increase in incidences of criminals operating in syndicates to fraudulently extract monies from public revenue using complex schemes. Such schemes are usually perpetrated with the use of multiple individuals who are paid nominal fees to register companies and submit tax applications in their names, so that the masterminds can create additional layers to avoid detection.

To address this challenge, IRAS’ investigation and audit teams have employed SNA tools to augment its audit and investigation capabilities. This tool allows IRAS to uncover hidden relationships in complex networks through exposing obscure

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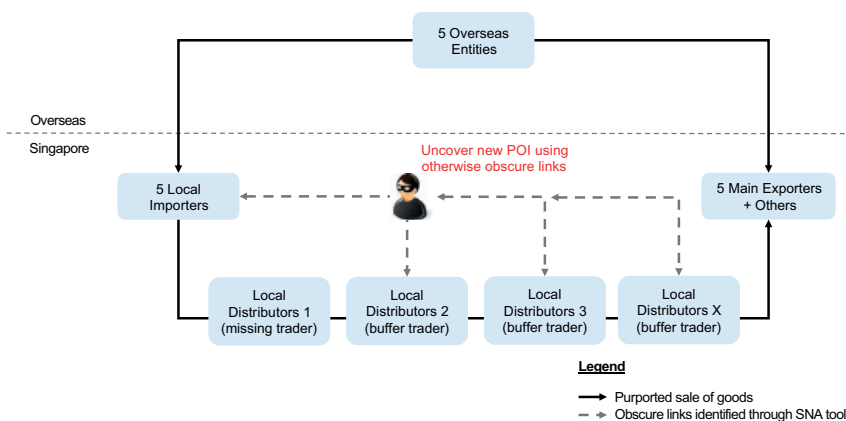


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Figure 5 Application of SNA tools in tax investigation: A case example

Brief Background of Operation Wand

- Suspected GST refund fraud case
- More than 20 entities/individuals in cluster
- Complex network and transactions



Source: IRAS

linkages within the IRAS databases and generating new leads that are otherwise not obvious to the human eye. Relationship networks can be generated automatically and instantaneously with little manual effort. With these tools, IRAS can identify key persons behind the syndicates and conduct its operations effectively (Figure 5).

In addition to SNA, predictive modelling has also been applied in tracing transactional relationships between entities through information obtained from different sources. By deciphering transactional patterns, predictive modelling tools can identify probable patterns of transaction flows within large networks of entities.

FUTURE SKILL SETS OF INVESTIGATORS: APTITUDE AND DIGITAL SKILLS

In today's business world, even as syndicates adopt tactics to obfuscate their fraudulent transactions, the growing use of digital tools in financial investigations is providing an effective counter. Compliance bodies and

law enforcement agencies may also leverage multiple data touch points with their stakeholders to obtain data for timely detection of new fraud methodologies. However, the use of digital tools is not limited to financial investigations – they are also useful to derive insights into the public's view towards certain compliance issues with FDA tools, such as text mining of enquiries and correspondences.

Financial investigators today are expected to be versatile in incorporating technology and analytics into investigation work, giving rise to the need to develop data analytics capabilities. As financial investigations commonly involve the handling of vast amounts of data, the prevalent use of FDA tools is now the keystone in investigation processes. However, the incorporation of technology and data analytics in tax investigations should be coupled with individual experiences and other technical skills to harness the full potential of technology adoption. As financial investigations often involve poring over huge

amounts of accounting documents and data that are usually cluttered and unorganised, good accounting knowledge and business acumen remain key competencies of a financial investigator. These technical skills will enable the investigator to pick out incongruities such as accounting discrepancies and questionable accounting entries or data, as well as recognise loopholes in testimonies that are crucial to the investigation.

Besides the relevant technical skills, aptitude and attitude are key attributes of financial investigators. Individuals are required to handle a wide range of duties from researching and planning to piecing together of evidence in support of case theories for prosecution; they should also have the ability to handle the high-pressure environment from confrontational investigation subjects. Notwithstanding the dynamic business environment, resilience and an inquisitive mind are critical qualities an effective financial investigator must have – in addition to passion, ethics and integrity. ISCA

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