



# Tax & Digital Transformation

## Stream 3: Business Process Reengineering, Assessing risks and detecting non compliance

8 March 2022



INLAND REVENUE  
AUTHORITY  
OF SINGAPORE

# Speaker Introduction



- Mr Pek Zhiyu (Zander)
- Director in Goods and Services Tax Division in Inland Revenue Authority of Singapore (IRAS)
- Been in public service for the past 12 years
- Currently oversees a department responsible for end-to-end tax administration of the wholesale trade sector on GST matters
- MSC in Business Analytics from National University of Singapore

# IRAS' Vision and Corporate Goals



INLAND REVENUE  
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OF SINGAPORE

## Our Vision

- The leading revenue authority in the world
- A partner of the community in nation-building and inclusive growth
- A dynamic team of competent and committed people



## Our Corporate Goals

Foster an economic environment that supports inclusive growth

Provide excellent service

**Maximise voluntary compliance**

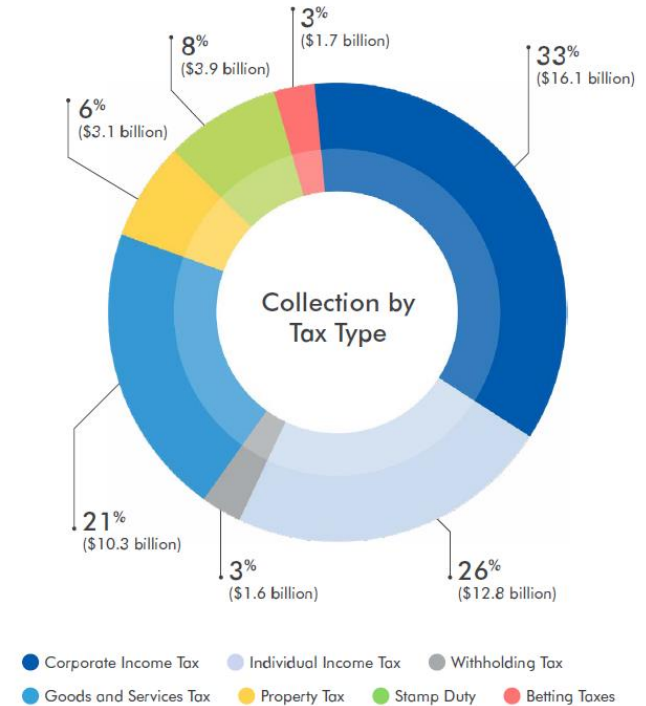
Enhance organisational and staff productivity and agility

Achieve a high level of staff competence, ownership and satisfaction

# IRAS' Revenue Collection

- In FY 2020/2021, IRAS collected a total of **\$49.6 billion** from different taxes, including:
  - Corporate Income Tax (33%)
  - Individual Income Tax (26%)
  - Goods and Services Tax (21%)
  - Property Tax and Stamp Duty (14%)
- This accounted for **73.6% of the government's total operating revenue** in FY 2020/2021.
- Other sources of government revenue include custom duties and vehicle taxes, fees and charges.

Revenue Collection by  
**Tax Type**



Note: Betting Taxes include Betting Duty, Casino Tax and Private Lotteries Duty.

# IRAS' Areas of Work

## 1 Tax administration

Main tax types administered by IRAS

Corporate Income Tax

Individual Income Tax

Goods & Services Tax

Property tax

Stamp Duty

Betting Taxes

Key processes in IRAS' tax administration

Taxpayer Services

Bulk Processing of Data, Forms and Payment

Assessment and Valuation

Compliance (Enforcement, Audit and Investigation)

Policy and Rulings

## 2 Enterprise disbursement

Provide inputs on the policy formulation and design of disbursement schemes

Carry out end-to-end administration of government disbursements to enterprises

# Agenda

1. Trends in Tax Risk Management

2. Risk Assessment Framework

15 mins Break

3. Digital Compliance Tools

15 mins Break

4. Special Focus : GST/VAT Missing Trader Fraud

5. Case Studies from IRAS

# Global Trends

## 1 Digitalisation of business records and transactions

Businesses are leveraging on technology and capturing their records electronically

## 3 Automation of tax processes

Technology is helping businesses ease compliance burden and improve voluntary compliance

## 2 Connecting directly to Taxpayers' natural systems

Technology enables businesses to directly submit tax returns and/or digital records from source

## 4 Digital Tax Administration

The new way for Tax Administrations to interact with Taxpayers

# Global Trends

## Digital Tax Administration: Benefits and Opportunities



### For Taxpayers

- Reduce compliance burden
- Seamless tax filing
- Prevent tax errors



### For Tax Administrations

- Getting tax compliance right from source
- Faster audit turnaround
- Data allows for improved fraud detection and/or risk profiling capabilities



### For Third Parties

- Opportunities for software developers to provide value-added services



# Global Trends

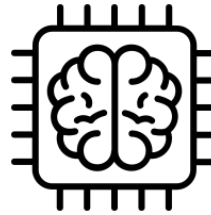
## Tax Risk Management

- a. External Threats** : Increasing sophistication of tax crimes and involvement of criminal syndicates
- b. Internal Response** : Tax administrations moving compliance upstream towards continuous monitoring
- c. Opportunity** : Developments and potential of e-invoicing for Tax administration

# The Future of Compliance



Data collection efforts will only intensify further



Deployment of more advanced analytical techniques



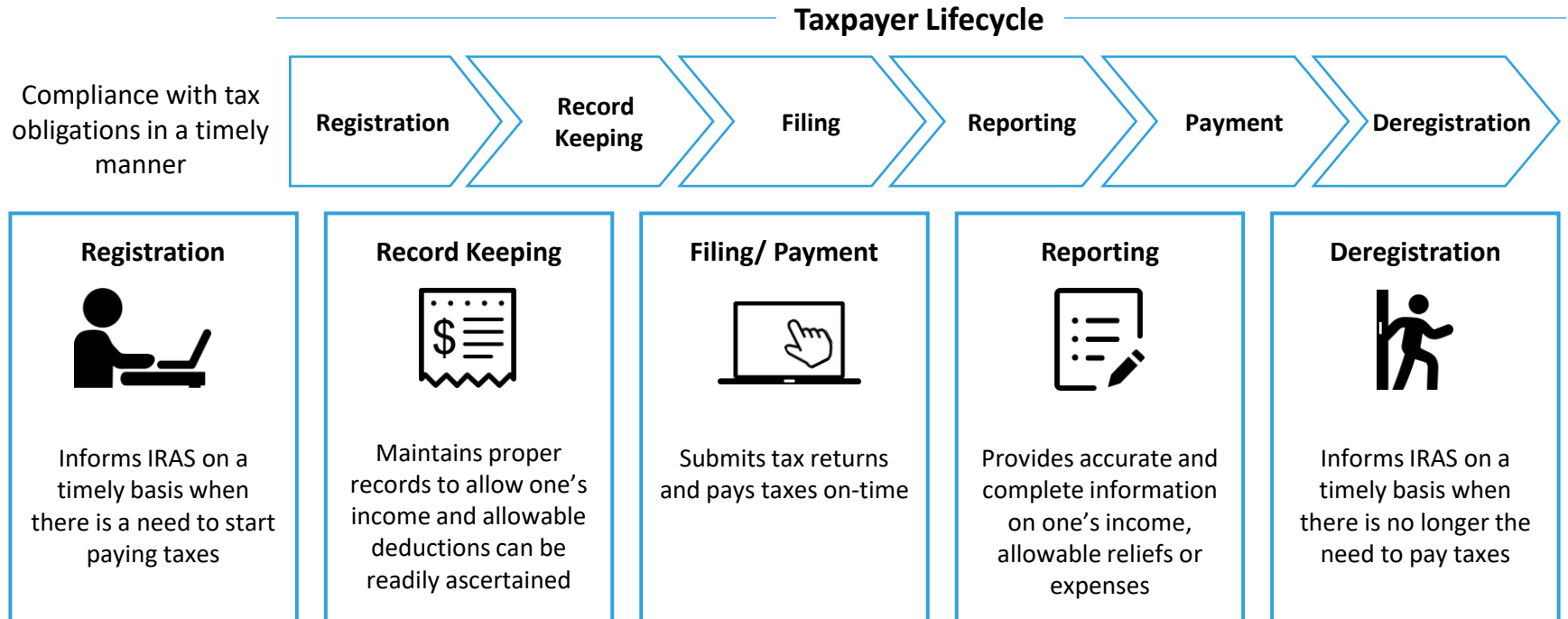
Move towards more timely data collection



Audits will move towards processes and/or systems

# What is Tax Compliance?

Tax compliance refers to the degree to which taxpayers comply with their tax obligations in a timely manner throughout their taxpayer lifecycle.



# Tax Compliance in IRAS

In IRAS, we believe in fostering an environment that makes it easy for taxpayers to comply with their tax obligations, and hard for taxpayers not to. This encourages voluntary compliance and is aligned with our corporate goal to maximise voluntary compliance.

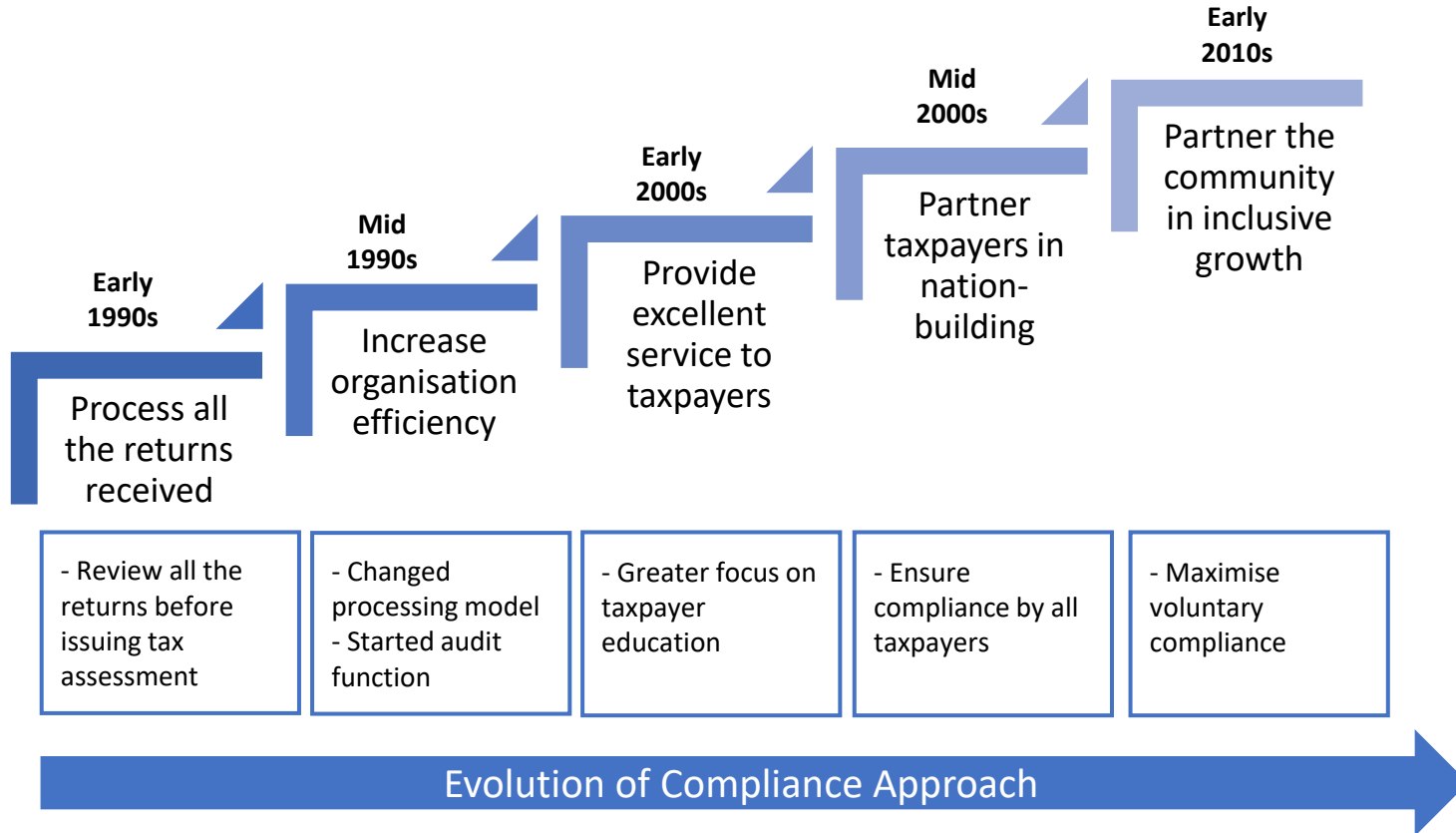


Voluntary compliance ensures that Singapore has a **fair and sustainable tax system** where every taxpayer contributes his fair share of tax.



Voluntary compliance is the **only sustainable means** of ensuring the **overall effectiveness and efficiency of the tax administration** in the long run.

# Evolution of IRAS Compliance Approach



# Beliefs and Principles

## IRAS' Beliefs

- **Taxpayers are generally compliant**
  - Most taxpayers are and want to be compliant. This belief is validated through our consistently high compliance performance indicators and taxpayers' responses to independently-conducted surveys.
  - The large majority of compliant taxpayers exerts an influence on societal behaviour and creates pressure on the minority group of errant taxpayers to turn compliant.

## Motivators of Taxpayers' Compliance

- **Taxpayers are motivated to comply when:**



Tax rules and system are **simple to understand** and navigate



They find it **easy to fulfil their tax obligations**



They have trust and confidence that our **tax system is fair**



They perceive that **people around them are compliant**

# Integrated Compliance and Service Framework

## Vision

The leading revenue authority in the world  
A partner of the community in nation-building and inclusive growth  
A dynamic team of competent and committed people

## Service and Compliance Corporate Goals

Provide Excellent Service

Maximise Voluntary Compliance

## Our Belief

Taxpayers are generally compliant

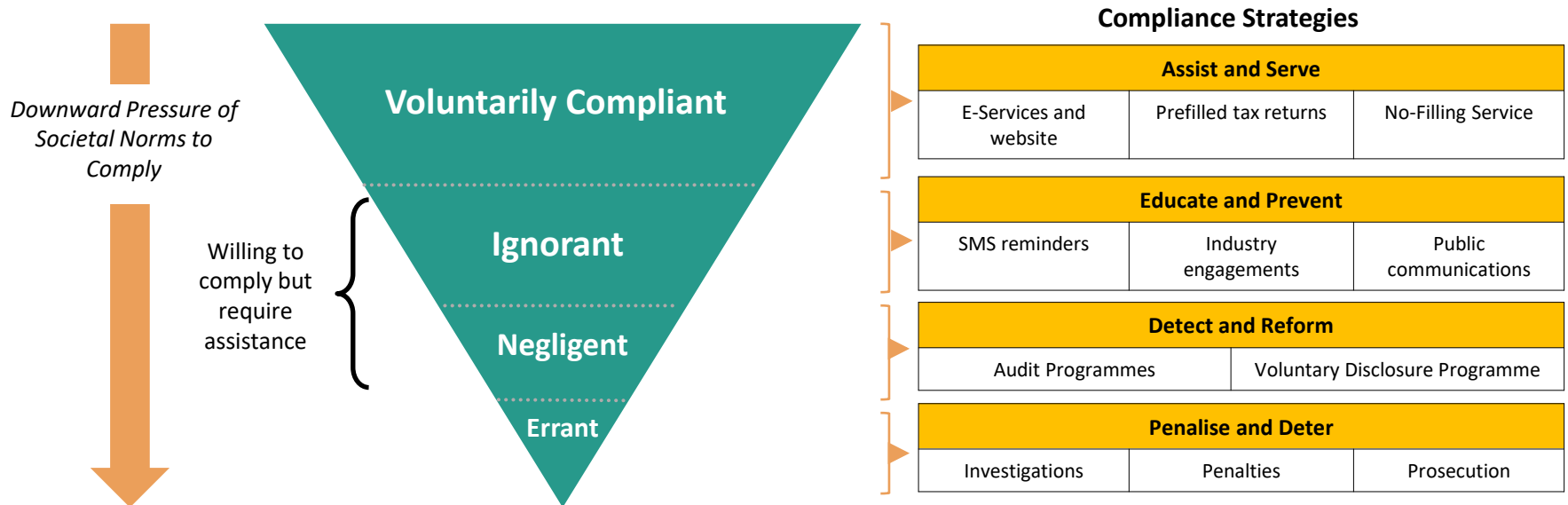
## Strategic Elements

Create a taxpayer-centred experience by considering their needs, behaviours and circumstances

Right Design from the Start	Right Service to Meet Taxpayers' Needs	Right Actions at the Right Time	Right Taxpaying Values
<p><b>"No need for service is the best service"</b>.</p> <ul style="list-style-type: none"><li>• Tax policies and processes are designed to be <b>simple and clear</b>.</li><li>• Tax is <b>integrated</b> into taxpayers' life events or natural systems to minimise compliance burden.</li></ul>	<ul style="list-style-type: none"><li>• Taxpayers have easy access to <b>customised and timely assistance/ information</b> to facilitate their tax compliance.</li><li>• IRAS carries out <b>early interventions</b> to encourage compliance as early as possible.</li></ul>	<ul style="list-style-type: none"><li>• IRAS takes <b>effective, calibrated and timely compliance actions</b> (i.e. deterrence, detection and enforcement) to maintain trust and confidence in the tax system.</li></ul>	<ul style="list-style-type: none"><li>• IRAS partners the community to <b>shape social norms</b> that embrace the value of taxpaying.</li></ul>

# Majority of Taxpayers are Voluntarily Compliant

- IRAS' compliance strategies are built on the fundamental belief that the **majority of taxpayers are compliant**.
  - For the voluntarily compliant, IRAS facilitates their compliance by making it easy for them to comply.
  - For the non-compliant, IRAS takes effective and calibrated actions to detect and prevent future non-compliance.





# What Each Strategic Element Means

## Right Design from the Start

**"No need for service is the best service".**

- Tax policies and processes are designed to be **simple and clear**.
- Tax is **integrated** into taxpayers' life events or natural systems to minimise compliance burden.

## Right Service to Meet Taxpayers' Needs

- Taxpayers have easy access to customised and timely assistance/information to facilitate their tax compliance.
- IRAS carries out early interventions to encourage compliance as early as possible.

## Right Actions at the Right Time

- IRAS takes effective, calibrated and timely compliance actions (i.e. deterrence, detection and enforcement) to maintain trust and confidence in the tax system.

## Right Taxpaying Values

- IRAS partners the community to shape social norms that embrace the value of taxpaying.

## Right Design from the Start

### 1. "No need for service is the best service"

#### a) Tax policies and processes are designed to be simple and clear.

- Communicate policy rationale and tax principles
- Provide greater certainty of tax treatment
- Simplify tax rules while ensuring the necessary data remains available to IRAS

#### b) Tax is integrated into taxpayers' everyday lives/ natural systems to minimise compliance burden.

- Facilitate the automated transmission of information/ tax declarations from taxpayers' natural systems to IRAS (and vice versa, where applicable)
- Obtain data from viable third party sources to alleviate taxpayers' compliance burden

# What Each Strategic Element Means

## Right Design from the Start

- “No need for service is the best service”.
- Tax policies and processes are designed to be simple and clear.
- Tax is integrated into taxpayers’ life events or natural systems to minimise compliance burden.

## Right Service to Meet Taxpayers’ Needs

- Taxpayers have easy access to **customised and timely assistance/information** to facilitate their tax compliance.
- IRAS carries out **early interventions** to encourage compliance as early as possible.

## Right Actions at the Right Time

- IRAS takes **effective, calibrated and timely compliance actions** (i.e. deterrence, detection and enforcement) to maintain trust and confidence in the tax system.

## Right Taxpaying Values

- IRAS partners the community to **shape social norms** that embrace the value of taxpaying.

## Right Service to Meet Taxpayers’ Needs

### 1. Taxpayers have easy access to customised and timely assistance/information to facilitate their tax compliance.

- Deepen customer insights through analytics to understand taxpayers’ profile and preferences
- Customise service delivery based on analysis of available data

### 2. IRAS carries out early interventions to encourage compliance as early as possible.

- Calibrate compliance intervention according to a holistic assessment of risk posed by each taxpayer
- Implement measures to prevent compliance risk from materialising ahead of risk detection and treatment

# What Each Strategic Element Means

## Right Design from the Start

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- IRAS takes **effective, calibrated and timely compliance actions** (i.e. deterrence, detection and enforcement) to maintain trust and confidence in the tax system.

## Right Taxpaying Values

- IRAS partners the community to shape social norms that embrace the value of taxpaying.

## Right Actions at the Right Time

### 1. IRAS takes effective, calibrated and timely compliance actions to maintain trust and confidence in the tax system

- Higher risk cases are selected for in-depth review, audit or investigation
- Risk treatment is calibrated based on the severity of the offence, as well as the objective to reform the non-compliant, and penalise and deter the errant

# Example: Right Actions at the Right Time

## Examples of initiatives embarked by IRAS



### Development of Entity Risk Profile (ERP)

- ERP is intended to determine the risk profiles of taxpayers at an entity level, based on their compliance behavior across tax types and tax obligations.
- This will enable the prediction/ identification of tax compliance risks posed by each taxpayer, and allow for early intervention by IRAS.

1 CURRENT – High			
2	Filing -- Low	Reporting -- Med	Payment -- High
CIT – Med	Low	Med	High
GST – Med	3 Low	Med	High
IIT – Med	Low	Med	Med
PT – Med			Med

- 1 **Current** overall compliance risk is assessed to be **High**
- 2 The overall risk can be broken down to the respective tax type & tax obligation.
- 3 The risk can be further broken down to each tax type + tax obligation – e.g. **current** risk for GST filing is assessed to be **Low**.

1 FUTURE – High			
2	Filing -- Med	Reporting -- Med	Payment -- High
CIT – High	Med	Med	High
GST -- High	3 Med	Med	High
PT -- Med			Med

- 1 **Future** overall compliance risk is predicted to be **High**
- 2 The overall risk can be broken down to the respective tax type & tax obligation.
- 3 The risk can be further broken down to each tax type + tax obligation – e.g. **future** risk for GST filing is predicted to be **Med**.

*Prototype view for a single corporate entity*

# What Each Strategic Element Means

## Right Design from the Start

- “No need for service is the best service”.
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## Right Service to Meet Taxpayers’ Needs

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## Right Actions at the Right Time

- IRAS takes effective, calibrated and timely compliance actions (i.e. deterrence, detection and enforcement) to maintain trust and confidence in the tax system.

## Right Taxpaying Values

- IRAS partners the community to **shape social norms** that embrace the value of taxpaying.

## Right Taxpaying Values

### 1. IRAS partners the community to shape social norms that embrace the value of taxpaying

#### a) Partner the community to build positive attitudes towards taxpaying, such as by:

- Working with tax intermediaries to encourage compliance
- Co-creating and co-delivering initiatives with various stakeholders in the ecosystem

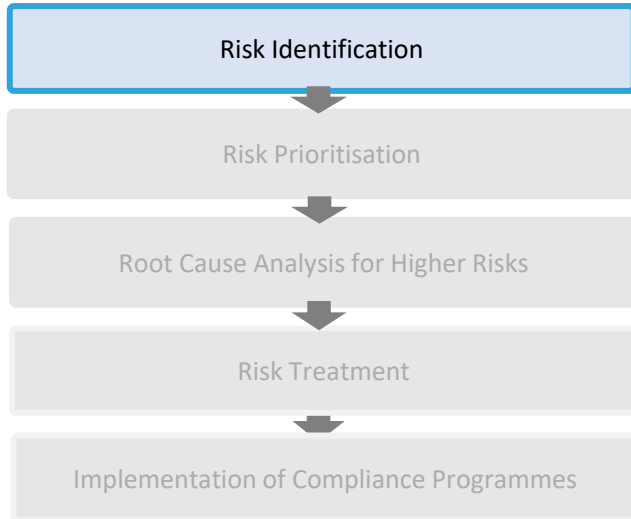
#### b) Leverage every interaction to promote socially responsible attitudes and behaviour, such as by:

- Engaging the public on the importance of taxes through various modes, e.g. website, seminars, mailers
- Proactively identifying opportunities in each interaction to incorporate / convey messages that establish good taxpaying behaviour as social and personal norms



# Compliance Risk Management Process

## Compliance Risk Management Process



## Risk Identification

- IRAS takes both top-down and bottom up approaches to ensure a holistic view is taken when identifying compliance risks.

### Top-down

*Understanding the External Environment*



Environmental Scanning



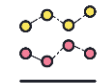
Strategic Intelligence Studies

### Bottom-up

*Identifying Risks Observed on the Ground*



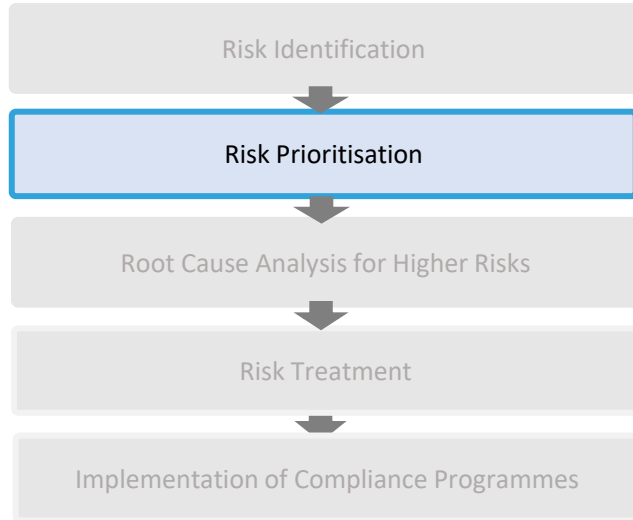
Annual Risk Register Exercise



Data Analysis

# Compliance Risk Management Process

## Compliance Risk Management Process



## Risk Prioritisation

- Identified compliance risks are then consolidated and prioritised according to:



Financial  
Consequence



Reputational  
Consequence

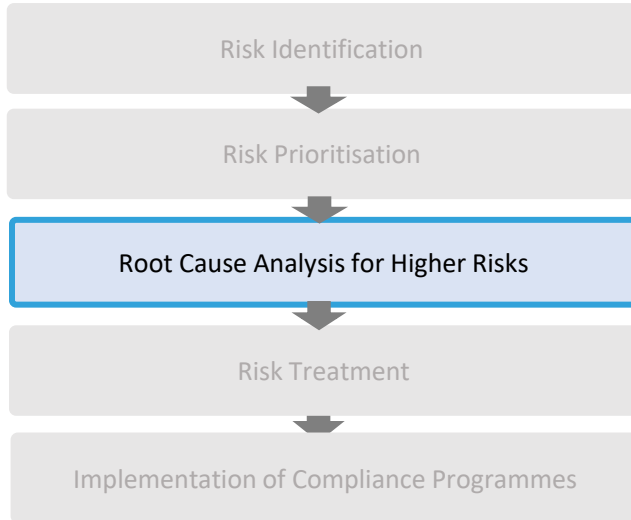


Likelihood of  
Occurrence



# Compliance Risk Management Process

## Compliance Risk Management Process



## Root Cause Analysis

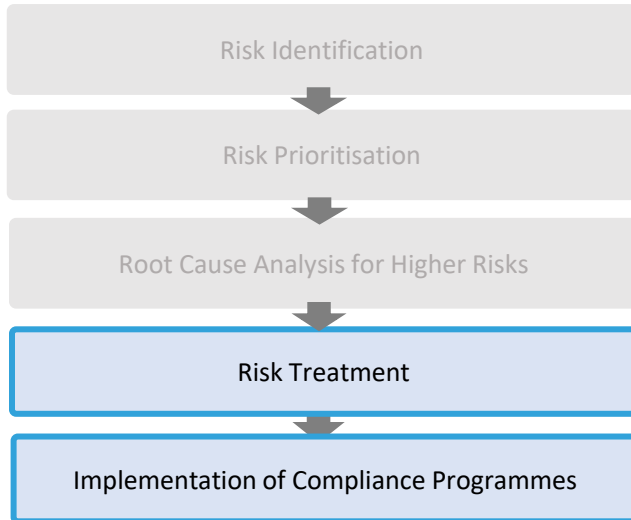
- Through this analysis, we will be able to better understand the underlying factors leading to the non-compliant behavior.
- This helps in coming up with more effective risk treatment.



- For instance, if the root cause is that taxpayers are ignorant of their tax obligations, we will strengthen our education efforts in that particular area.

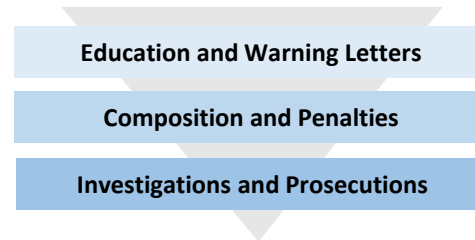
# Compliance Risk Management Process

## Compliance Risk Management Process



## Risk Treatment and Implementation of Compliance Programmes

- The risk treatment will be customised according to the root cause analysis and calibrated according to the level of risk:

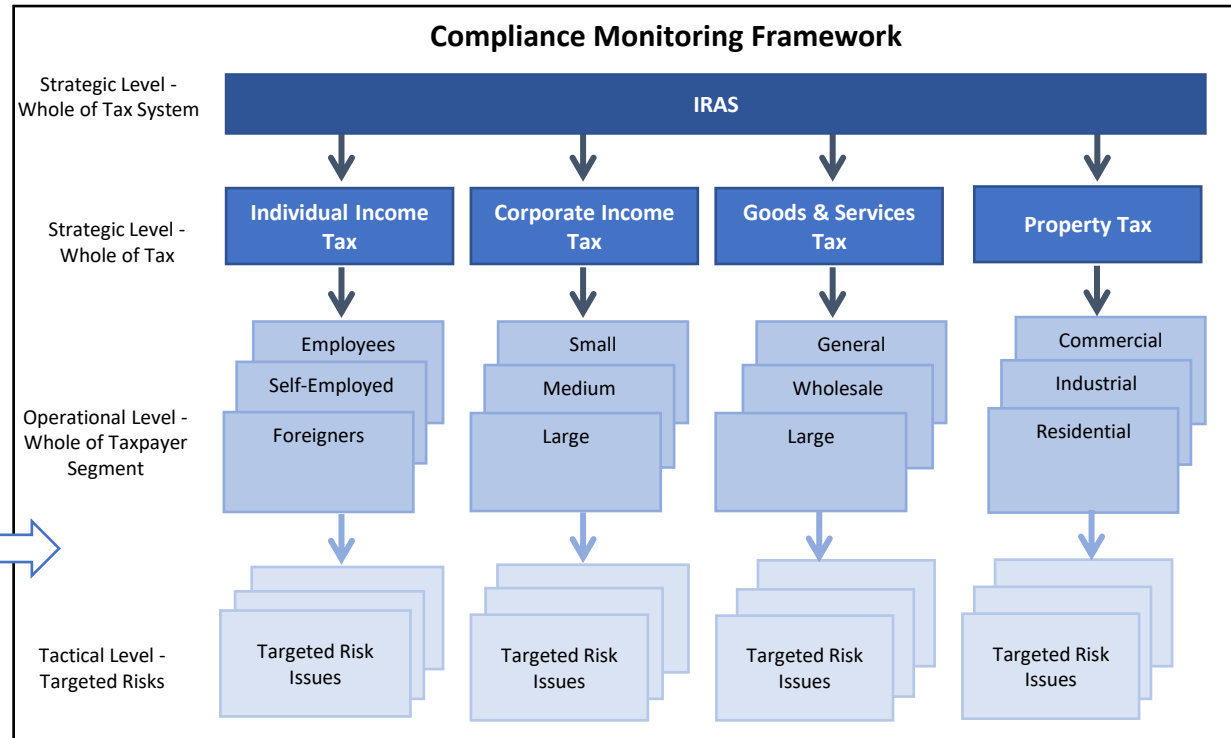
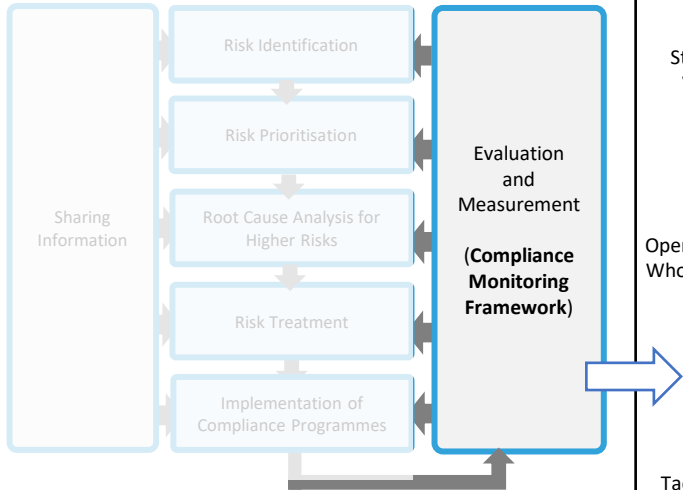


- Finally, we will develop and implement IRAS-wide compliance programmes and plans to address the risks.

# Compliance Monitoring Framework

The Compliance Monitoring Framework allows for the measurement and evaluation of IRAS' compliance performance and activities.

## Compliance Risk Management Process



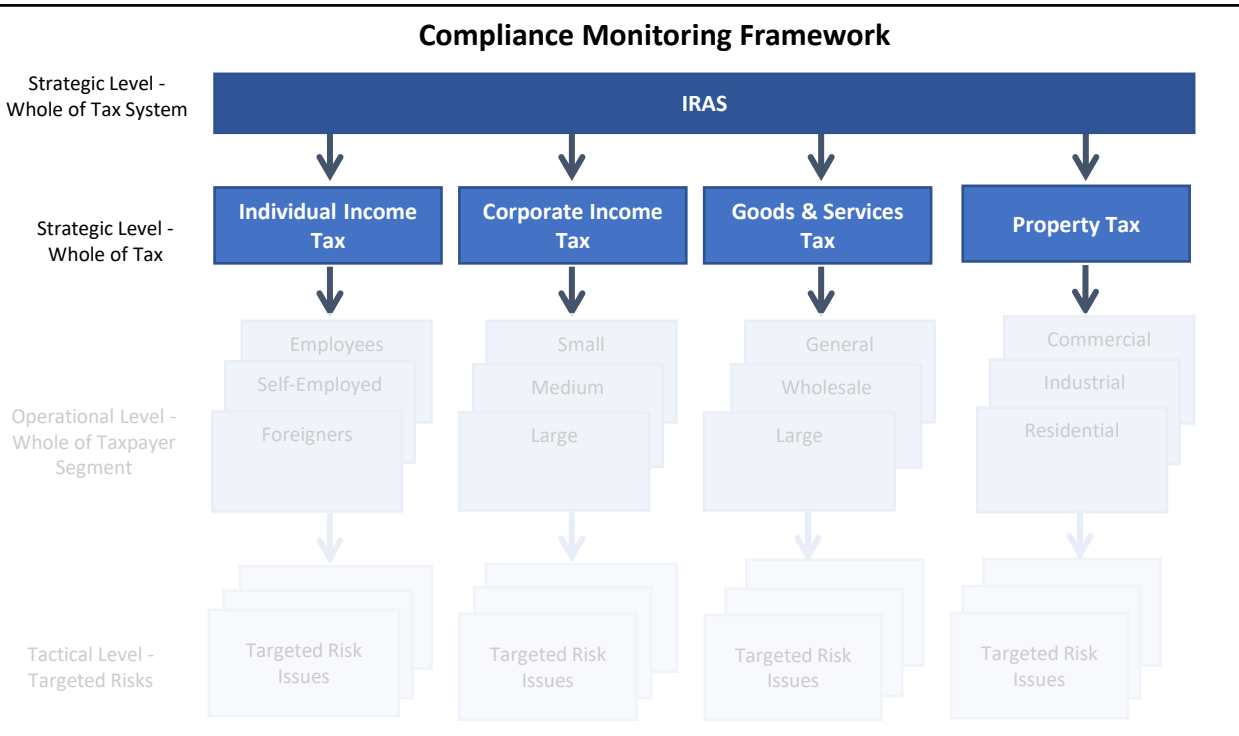
# Compliance Monitoring Framework

The Compliance Monitoring Framework allows for the measurement and evaluation of IRAS' compliance performance and activities.

## Strategic Levels

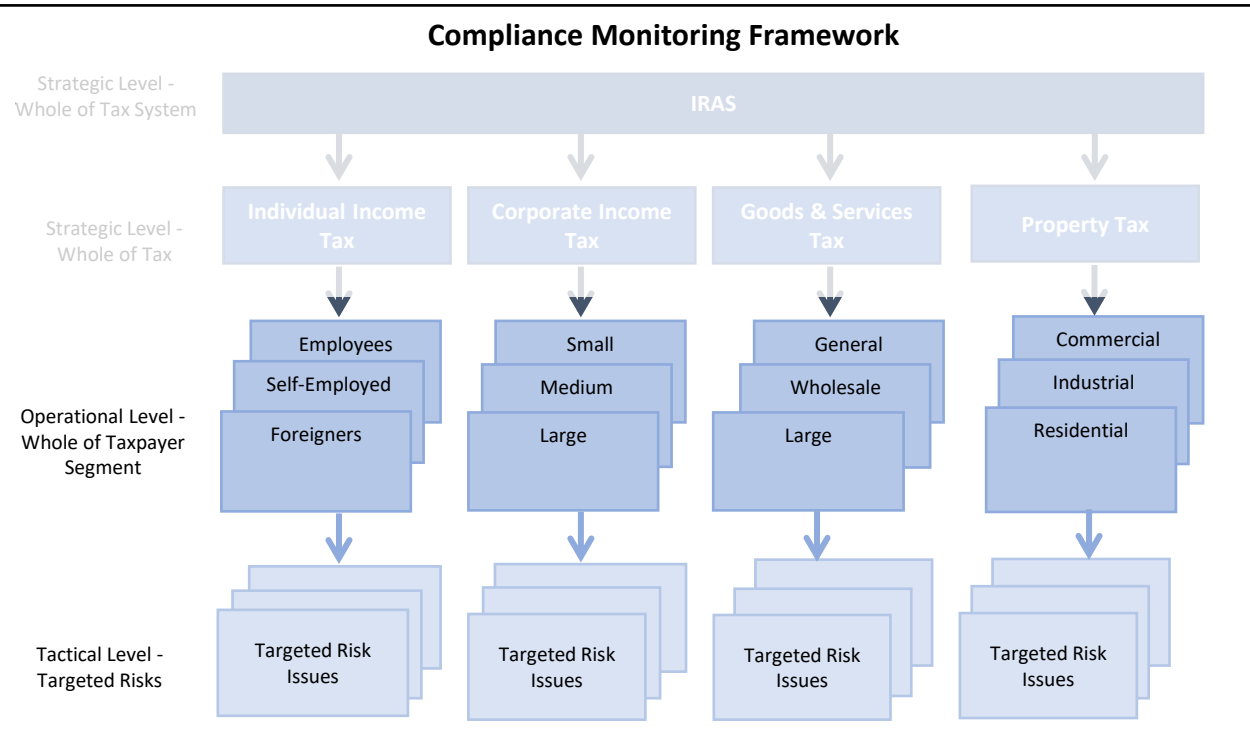
IRAS monitors the extent to which:

- (i) taxpayers comply with their tax obligations, for e.g. on time filing/ payment rates
- (ii) taxpayer's compliance behaviour and perception of tax compliance in Singapore through the biennial Taxpayer Survey



# Compliance Monitoring Framework

The Compliance Monitoring Framework allows for the measurement and evaluation of IRAS' compliance performance and activities.



## Operational/ Tactical Level

Divisions monitor the level of compliance efforts/ work and its effectiveness, for e.g.

- % of tax base audited (audit coverage)
- Number of audit cases with tax recovery
- Strike rate for audits

# What pitfalls can you think of in the application of digital technology and analytics?

Feel free to 'unmute' or type your responses in the chat



IRAS has progressively built up our analytics capabilities to streamline work processes, gain new taxpayer insights and detect high risk areas and cases.



# Predictive Analytics

**Problem statement :** Identify tax returns with high likelihood of reporting error



Historical Data

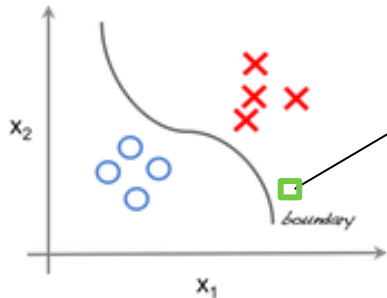


Machine Learning



Tax returns with high likelihood of reporting errors

- Past compliant/non-compliant returns
- Tax return information
- Taxpayers' compliance history
- Business/domain indicators
- Other derived indicators e.g. ratios, industry profiling



*Classify this return as X or an O*

- X = Past return with reporting error
- O = Past compliant return
- = New unclassified return



# Use of Data and Analytics within IRAS

Data is the **key asset** that aids IRAS in its **risk-based approach** towards ensuring GST compliance

## 2011 – 2013

### Forge into data analytics

- Cross-Referencing System
- Fraud Detection Model
- Visual Analytics

## 2014 – 2017

### Expand analytical capabilities

- Post Refund Analytics Model
- Social Network Analysis (SNA) Tool
- Text Mining for email topics

## Prior to 2011


### Data for risk assessment and case selection

- Mandatory GST e-filing since 2007
- Refund claims assessed by linear business rules
- Computer Assisted Audit Techniques employed
- Datamining team supports audit needs

## 2018 – Present

### Integrate analytics and pilot API technology

- Fraud Profiling Project
- Embedding Analytics into GST Refund Process
- API submission for GST Return and Transaction Listings



"If you do not know  
how to ask the  
right question,  
you discover  
nothing."

W. Edward Deming

# When Predictions Fail: Crash Course Statistics #43

"When Predictions Fail: Crash Course Statistics #43" on YouTube



<https://youtu.be/5l60dMUhY5o>

- The video looks at examples of **when predictions fail** (e.g. 2008 financial crisis) to understand why we make **inaccurate predictions** and how we can **make better ones**.
- *“Creating a model to predict things we are trying to use data, math and statistics to approximate how the world works”*
- Common reasons
  - ✓ Too little data
  - ✓ Inaccurate data
  - ✓ Biased models

# 4 Mistakes In Predictive Modelling

1. No clear business and prediction objective
2. Skipping the data exploration stage
3. Not validating the models on a 'blind sample'
4. Leaping into deployment without planning

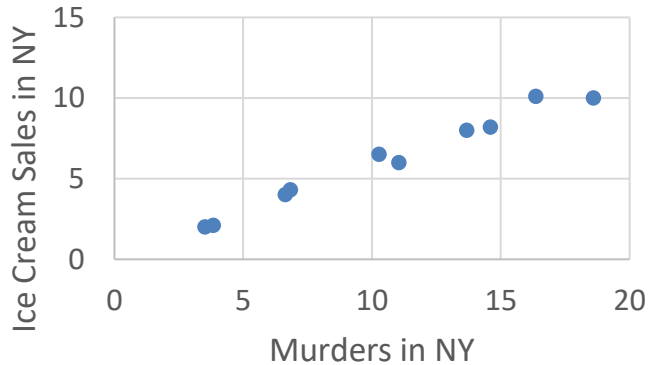
Source: Eric Siegel (2019 October), 3 common mistakes that can derail your team's predictive analytics efforts, Harvard Business Review

# 1. No clear business and prediction objective

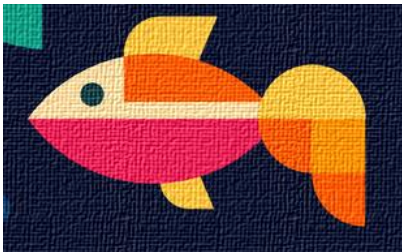


- What do I want to predict?  
Example : Recovery > \$X
- What do I want to do with the prediction?  
Improve Audit selection? Pre-emptive reminders?  
  
What's the business value?
- What is the right data?

## 2. Skipping the data exploration stage

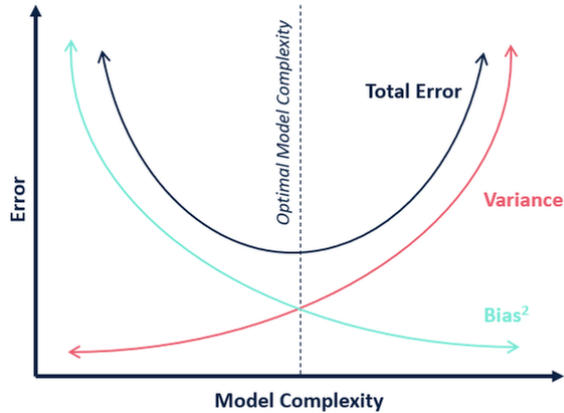


- Correlation  $\neq$  Causation
- Beware of Red Herrings!  
Be suspicious of “Perfect” predictors (correlation  $\sim 1$ ), be clear what are the right predictors for the outcome you are predicting.
- Look before jumping in, check back against collective intuition



***“If it’s perfect, it’s probably wrong”***

### 3. Not validating the models on a 'blind sample'

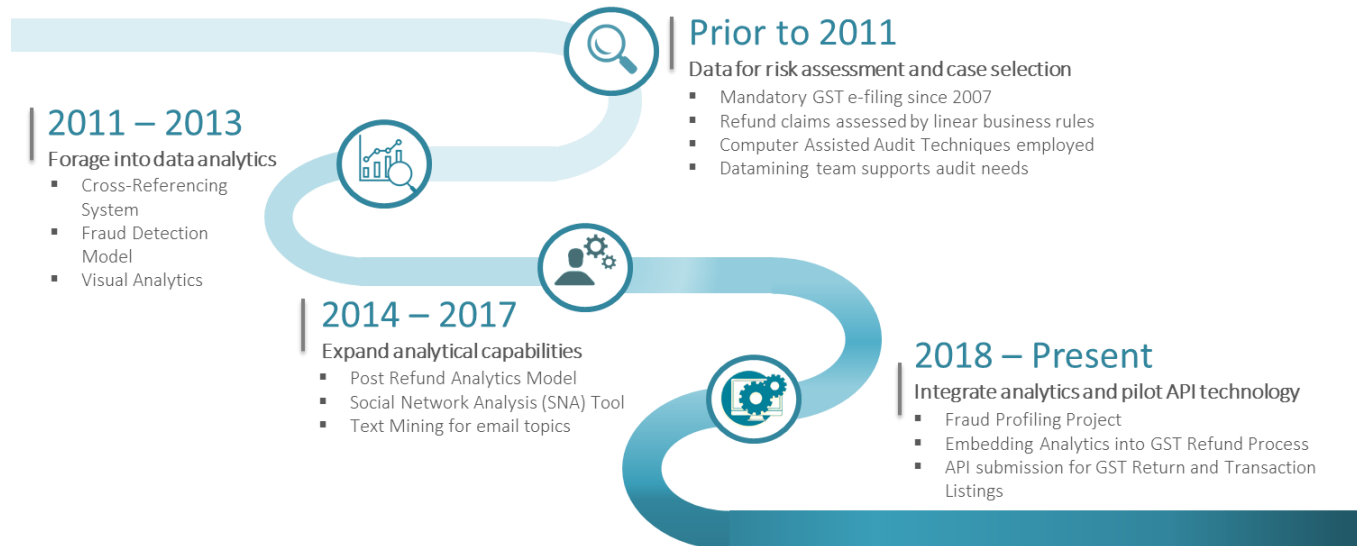


- Overfitted models.  
“Good” results on past data, poor results in new predictions  
  
Bias-Variance Tradeoff
- Is the data used to train the model very different from what it will be expected to predict next?
- It's about finding the right pair of guest slippers that can accommodate the most guests



## 4. Leaping into deployment without Planning

- Have the end in mind before taking the first step. A model can only be effective if it is used.
- It's a long journey that require several change management and Behaviour Insights and Change Management interventions along the way





# IRAS Computer Audit Package ("ICAP")

**IRAS Computer Audit Package**  
MAIN MENU

Welcome to i-CAP3!  
If you are importing a new set of trader's data please click setup application.

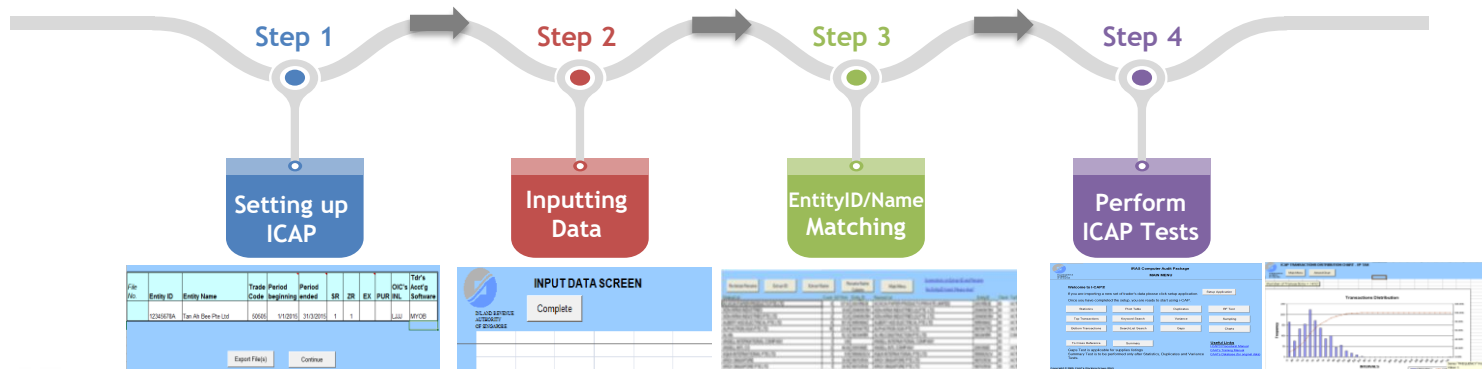
Once you have completed the setup, you are ready to start using i-CAP.

**Useful Links**  
[i-CAP3 Procedural Manual](#)  
[CAATs Training Manual](#)  
[CAATs Database \(for original data\)](#)

Gaps Test is applicable for supplies listings  
Summary Test is to be performed only after Statistics, Duplicates and Variance Tests.

Copyright © 2009, CAATs Working Group, IRAS  
Version 3.0 [1 Fix\_Xref]

- First developed in 2009, a Computer-Aided Audit Tool (CAAT) based in excel that can be used to perform standard audit tests.
- Meant to help tax auditors sense-make business records (e.g. invoice data) obtained from taxpayers to identify common tax errors













# Enhanced ICAP

The screenshot shows a web application interface with a navigation bar at the top containing six tabs: 1. Setup, 2. Column Pairing, 3. Data Cleaning, 4. Trend Analysis, 5. Risk Indicators, and 6. Further Analysis. The main content area is titled "Entity Information" and contains several input fields: "Entity Name", "Entity ID", "Accounting Start Date", and "Accounting End Date". Below these fields are three rows of "Purchase Spreadsheet" and "Supply Spreadsheet" with "Browse" buttons and "No files selected" text. At the bottom, there is a "VAT Files" section with a "Browse" button and "No files selected" text. A "Submit" button is located at the bottom right, and "Previous" and "Next" buttons are at the bottom center.

- **Revamped in 2021 into a Web-based application** presented using dashboard-style.
- Developed using **multiple open source programming languages** - Python/HTML/JavaScript.
- Facilitates the **analysis of compliance checks on transactional information automatically** to identify discrepancies within the transactions and against other tax declarations
- More **seamless** experience and **easy to use**.

## Advantages of Enhanced ICAP:

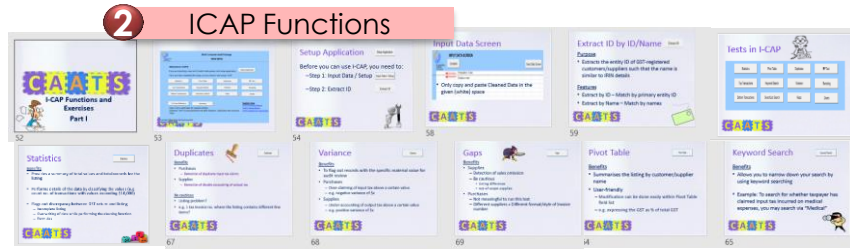
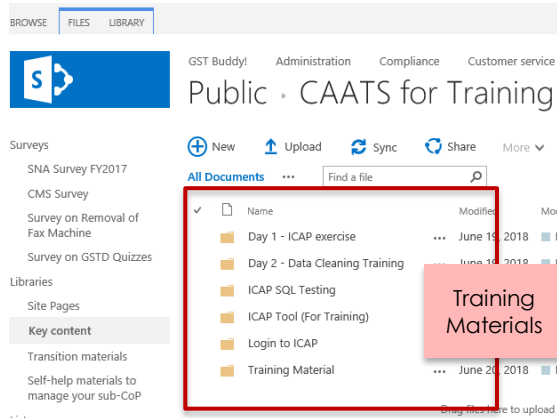
The screenshot shows a "Risk Indicators" section with a blue header. Below the header are five icons representing different risk categories: Duplicate Invoices, Invalid Invoice Dates, Unauthorised GST Collections, Watchlist Companies, and Invoice Gaps. A blue box at the bottom states: "These risk indicators are configurable by users".

 Web Based Approach	 Database Efficiency	 Multiple Data Source	 Automated Column Pairing	 Automated Data Cleaning
 Automated Entity ID / Name Matching	 Automated Discrepancy Check against Listings	 Built-in Copy-Paste Solution	 Automated Risk Indicators	 Automated Report Generation

# CAATs Training on ICAP

## CAATs Training

- Conduct **2 training sessions per year** for new auditors, with **each hands-on learning session held over 2 days**
- Trainings are deliberate kept to a small group and taught by trained tax auditors
- **Demo on test data sets** before letting attendees practice what they have learnt.

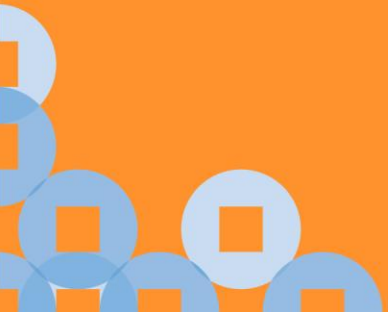


## 3 Practice Exercises

# Agility in Action

- We adopted an **agile approach** when developing the **Enhanced ICAP**
- Gathered **feedback from users before designing prototype**
- **Demonstrated** a minimum viable product (MVP) to **a few auditors via Zoom** to obtain feedback before building more features
- Performed **several rounds of iterations** to arrive at the final product

# Social Network Analysis (“SNA”) Tool



# Introduction to SNA

SNA is not the same as  
Social Media



SNA maps relationships  
between entities



SAS Fraud Framework

The SNA tool that IRAS procured  
which consists of



**Network Generation:**  
link related entities



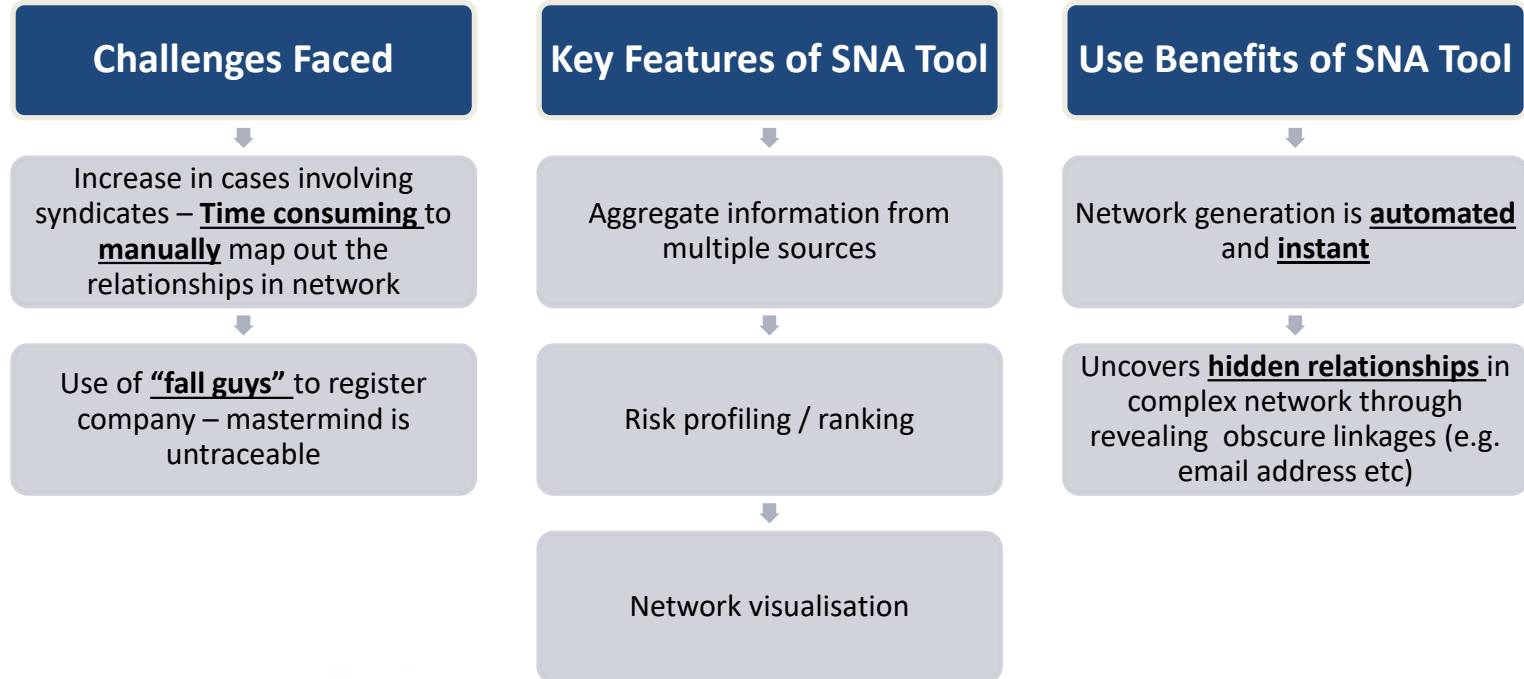
**Scoring:** Score entities /  
transactions / network  
using business rules



**Graphical User Interface  
(GUI) :** Provide network  
visualisation capabilities

# Introduction to SNA

IRAS is among the first in Singapore to invest in enterprise SNA capabilities. Our extensive data holdings is key to successful automation of network analysis



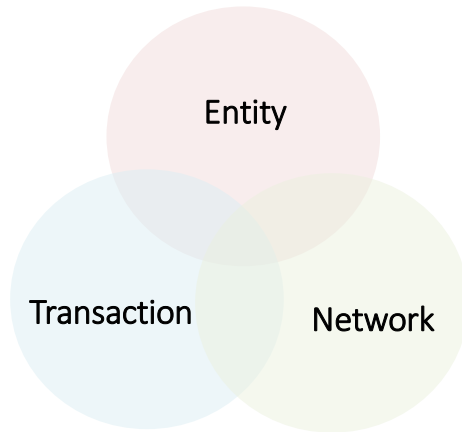
# Introduction to SNA

SNA provides holistic risk assessment from multiple dimensions:

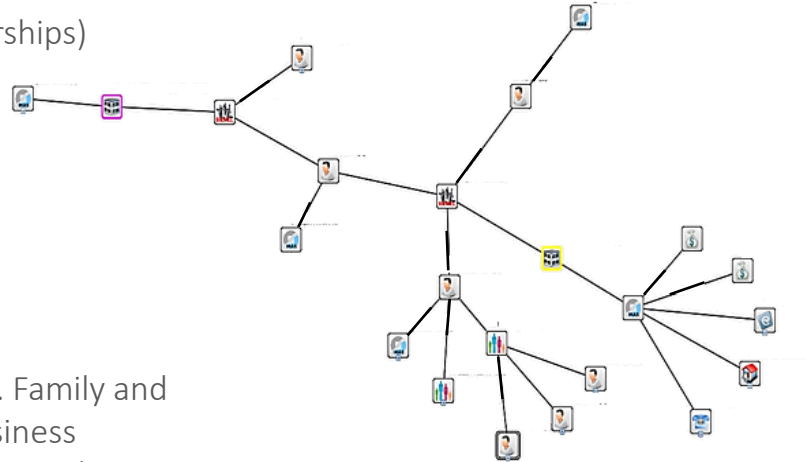
## Entity Types

- Businesses (Company, Sole-proprietorship & partnerships)
- Individuals
- Addresses, Contact Number etc.

E.g. GST Refunds,  
Payouts & Tax  
assessments



E.g. Family and  
business  
relationships



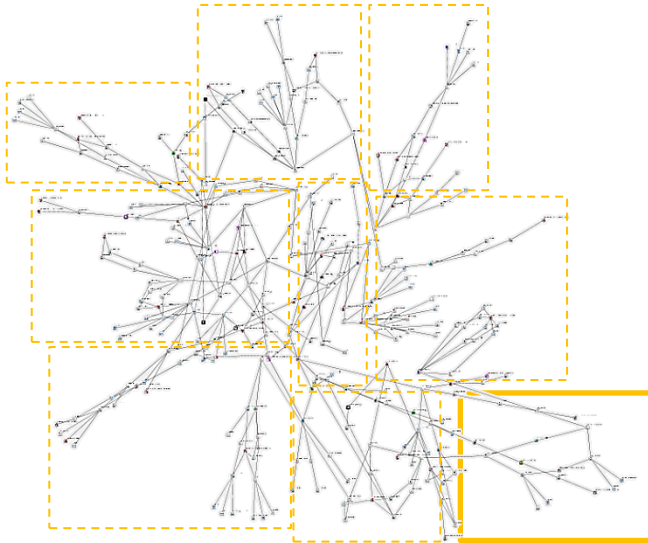
(Example of a network cluster)



# Introduction to SNA

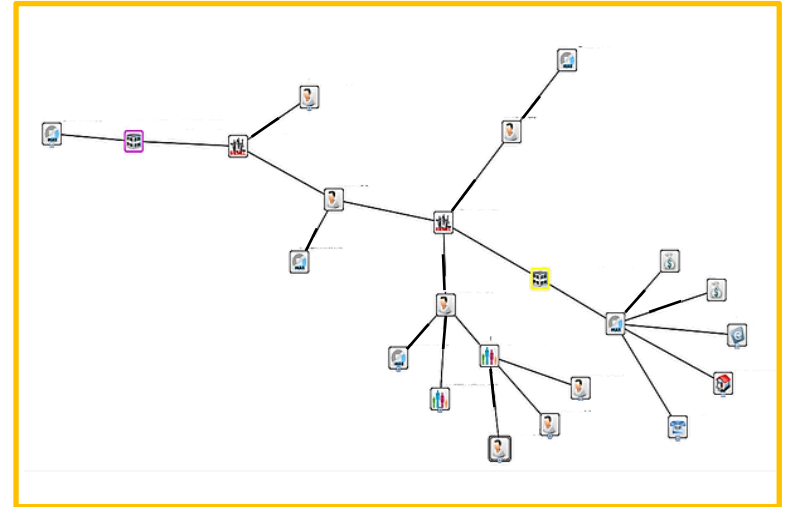
## Breaking down massive network into smaller clusters for targeted program

Raw network may be extremely large and extensive



SNA saves time and effort from mapping relationships manually

Entities within cluster can then be **scored and ranked** according to pre-defined risk aspects (rules)



Allows case work to be more focused and targeted on closely related entities

# SNA Graphical User Interface (GUI)

The first page of the selected entity:

The screenshot displays the SAS Social Network Analysis GUI. On the left, the 'Details' tab is active, showing fields for Entity ID, Name, Trade Code (52101), Description (GENERAL WAREHOUSING), Business Type (CORPORATE), Entity Status (ACTIVE), Entity Status Date (24/3/03), Incorporation Date (24/3/03), Fiscal Year End Date (31-Mar), and Primary Address. The main area features a 'Registration Risk Scorecard' tab, which contains a table with columns for Rule Type, Rule ID, and Alert Severity. The table lists eight entries, including 'Network (5860000)' and 'Entity' types, with corresponding Rule IDs and Alert Severity values. Below the table, it indicates '1 - 8 of 8 results'. At the bottom, the 'Asset Info' tab is active, showing a table with columns for Asset ID, Asset Type, Sub Type, Property Status, Asset Description, Asset Details, Asset Value, and Status. The table contains one entry for Asset ID 4129206P, Asset Type PROPERTY, Sub Type Commercial, Property Status TENANTED, Asset Description, Asset Details Rental per Month \$, Asset Value 1,343.33, and Status Current.

**Entity Details:**

- Entity ID:
- Entity Name:
- Trade Code: 52101
- Trade Code Description: GENERAL WAREHOUSING
- Business Type: CORPORATE
- Entity Status: ACTIVE
- Entity Status Date: 24/3/03
- Incorporation Date: 24/3/03
- Fiscal Year End Date: 31-Mar
- Primary Address:

**Registration Risk Scorecard**

Rule Type	Rule ID	Alert Severity
<a href="#">Network (5860000)</a>	16	478
Entity	7	300
<a href="#">Network (5860000)</a>	28	223
Entity	6	215
Entity	45	200
Entity	1	186
<a href="#">Network (5860000)</a>	58	178
Entity	66	25

1 - 8 of 8 results

**Asset Info**

Asset ID	Asset Type	Sub Type	Property Status	Asset Description	Asset Details	Asset Value	Status
4129206P	PROPERTY	Commercial	TENANTED	<input type="text"/>	Rental per Month \$	1,343.33	Current

1 - 1 of 1 results

# SNA Visualiser

- The SNA network is dynamic and may change after each refresh due to:
  - Additional information resulting in additional nodes
  - Certain links are temporarily removed (“Soft-deleting”) to reassess how to trim the clusters down
    - Not all links are good links → Soft deletion of a link means that the connection between the nodes is not used for linking → link still exists but the network building process would not go through the node to expand a network.
    - Soft Delete functions prevents over cluttering of the network display by subsuming a few nodes into a “+” sign

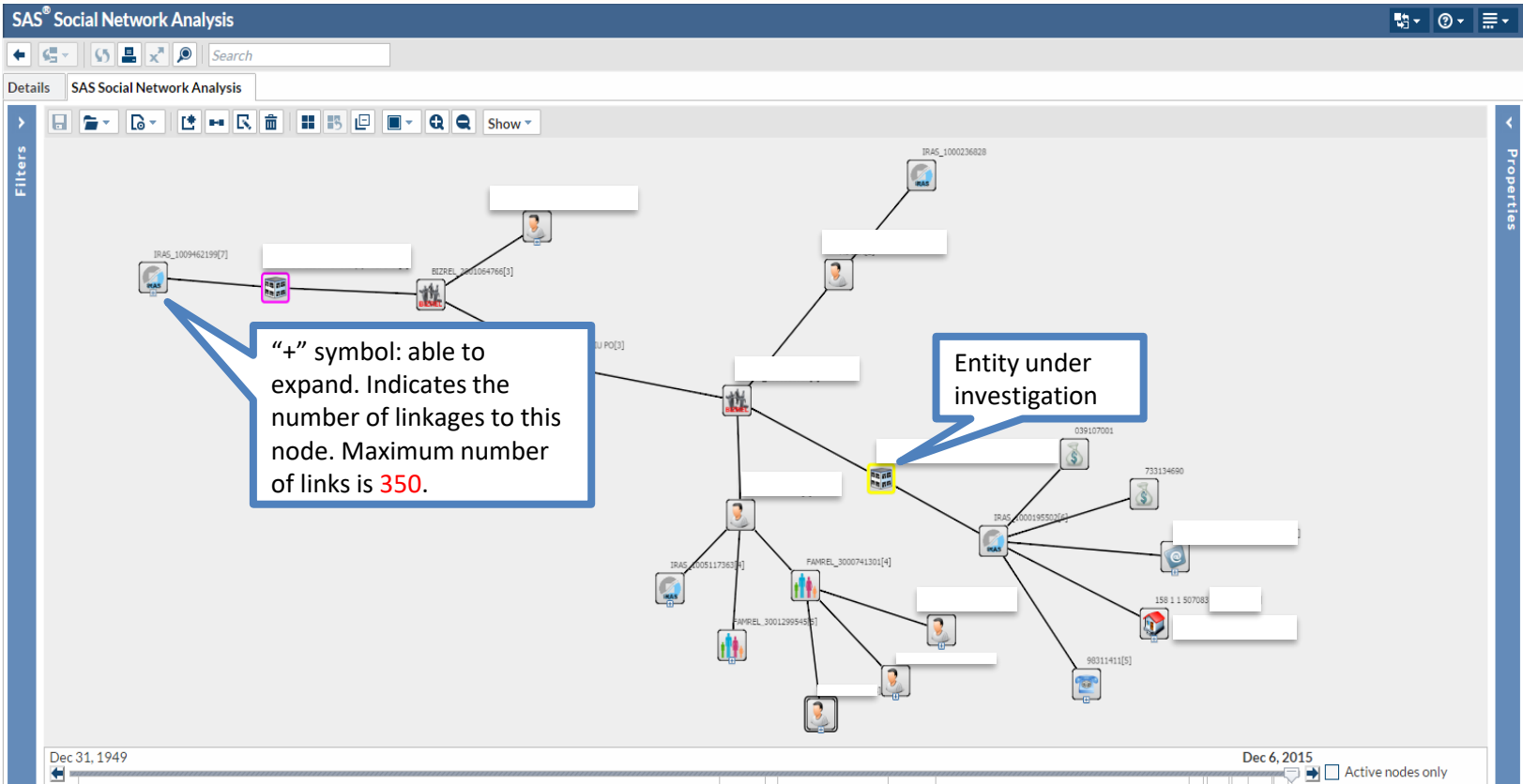


Simply click on the “+” sign to display the soft deleted nodes

- Entities are not directly linked to each other due to the configuration of SAS Fraud Framework

Entities are linked by a node “document, representing the various information e.g. IRAS document (represents IRAS internal information), Business Transaction (represents the transactional relationship).

# SNA Visualiser

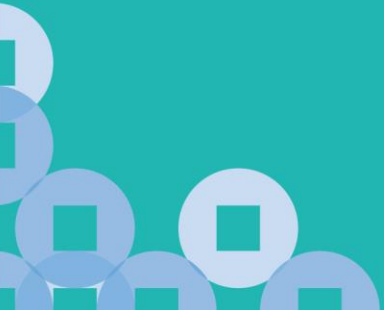


## Discussion 2

What specific tax fraud arrangement do you find most difficult to deal with?

Feel free to 'unmute' or type your responses in the chat

# Special Focus: GST/VAT Missing Trader Fraud



# What is Missing Trader Fraud (MTF)?

**MTF is a fraud scheme used by crime syndicates to defraud tax authorities of GST (or equivalent taxes) and poses a serious threat to public revenue.**

- Under an MTF arrangement, a supplier fails to account for or pay the GST charged on his sales (this supplier is referred to as the “Missing Trader”), while businesses along the supply chain continue to claim credit of input tax or refund of GST on their purchases.

## MTF on a Global Scale

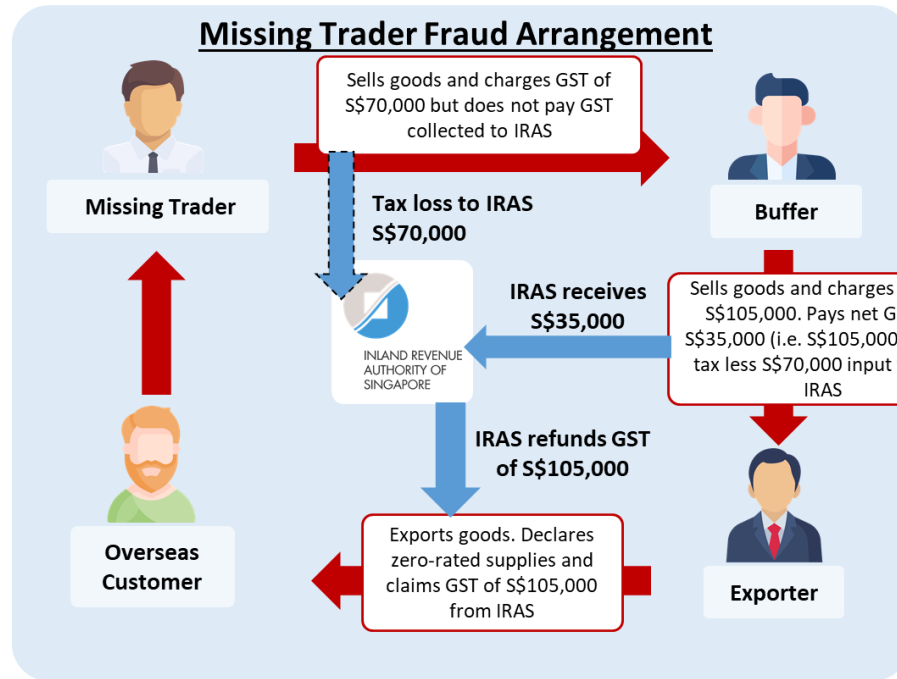


- Estimated that the European Union (EU) suffers almost EUR \$60 billion annually in tax losses from MTF. In the UK alone, it has been estimated that up to 5.5 billion of tax revenues were lost in FY 2005-2006 and up to 2.2 billion in 2008-2009.

# Modus Operandi – Illustration of a simple MTF arrangement

A seller upstream in the supply chain (the “Missing Trader”) fails to account for and pay the GST (i.e. output tax of \$70,000 in this example) charged on goods sold downstream to the intermediary businesses (“the Buffers”).

In doing so, the Exporter is effectively claiming the GST not paid by the Missing Trader. IRAS will suffer a tax loss if it pays the Exporter the input tax claimed.



To ensure that the final sale of goods is not subjected to GST, the goods would ultimately be exported by the last supplier in the supply chain (“the Exporter”) to an overseas customer which is zero-rated (0% GST).

The Exporter then claims from IRAS the GST (i.e. input tax of \$105,000 in this example) which it paid on the purchases of goods from the Buffer.



# Modus Operandi

- Members of crime syndicates make early detection of the MTF difficult, such as by:



Interposing **many businesses as buffers in the supply chain** to add distance between the missing trader and the exporter



Approaching legitimate businesses to be part of the supply chain by passing off fraudulent transactions as “legitimate” offers with attractive business deals that **would sound too good to be true**



Colluding with **employees of businesses** to approve the fraudulent transactions

# Impact of MTF and Efforts taken by IRAS to combat MTF

## Impact of MTF



**Loss of  
Public Revenue**



**Impact on legitimate  
businesses**



**Threat to the genuine  
market**

## Efforts taken by IRAS



**Audit and  
Investigative Efforts**

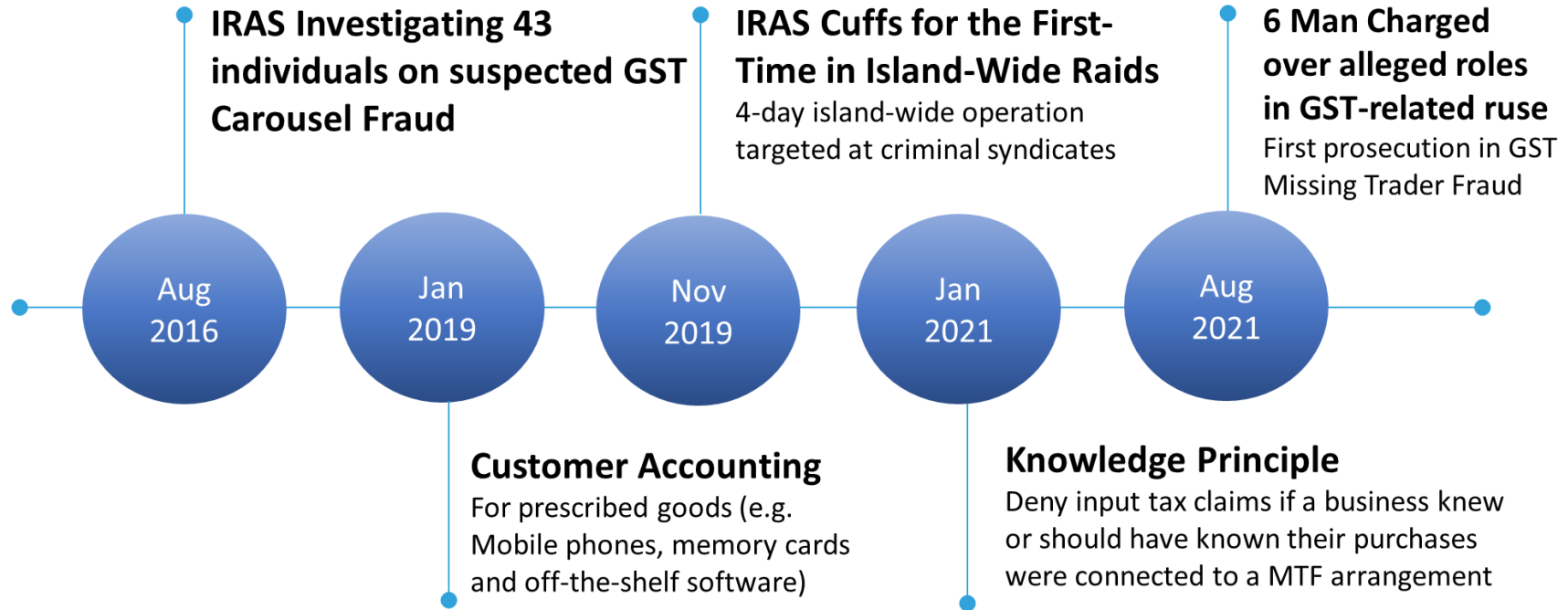


**Educational Efforts**



**Legislative Measures**

# Efforts taken by IRAS



# Profiling of Missing Trader Fraud

"Whistle blow"



1

## TRIGGER

Intelligence Analyst kick-starts with a small group of targeted entities ("seed list")

2

## ANALYSIS

*(Starting from seed list)*  
Intelligence Analyst extract information and map relationship among entities to identify key players of the MTIC clusters.

3

## INVESTIGATION

Raids and interviews conducted on targeted entities to collect data and evidence of fraud. Investigation concludes when there is sufficient evidence for prosecution.

4

## EARLY DETECTION

Learnings from past MTIC fraud translated to business rules/models to pre-emptively detect risk of MTIC fraud

## ANALYTICS SOLUTIONS

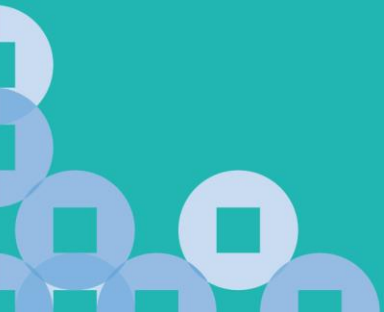
*(Incorporation of MTIC risk indicators into GSTD SAS SNA models – to be taken as a separate project)*

R Network Visualiser

IFD Revised Data Collection Template

Profiling of MTIC network/entities

# Network Visualisation Tool: R- Studio



# R-Studio — Automated Data Extraction & Network Visualisation

## How will the new tools complement the existing review process?

### 1. Start of investigation

- List of suspected entities identified (seedlist)

### 2. Data Extraction & Analysis

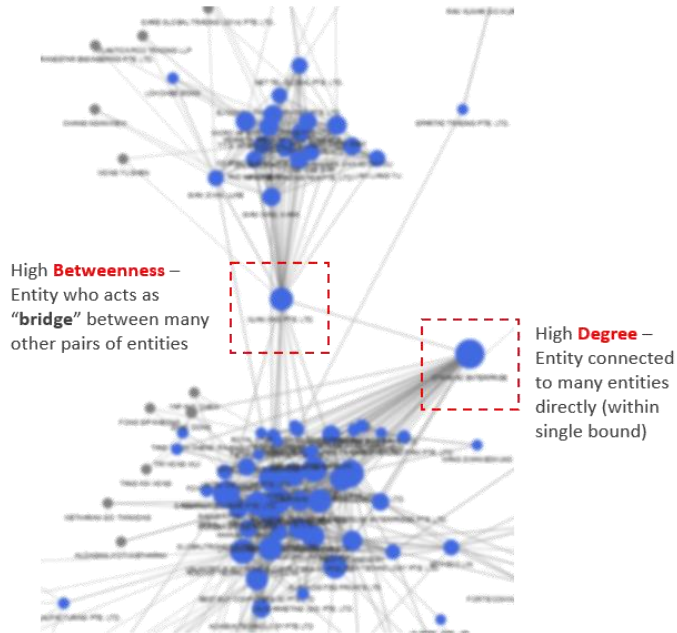
- Input entity list into data preparation flow for extraction of links and entities connected by extended bounds
  - **Productivity gain through bulk extraction of data**
- Visualise and analyse network using R studio network visualiser
  - **Saves effort of manually mapping relationships**
  - **Provides holistic view of interactions between entities -> make better assessment of the case**

### 3. Case allocation & prioritisation

- **Higher risk entities (based on network statistics) can be prioritised for analysis**
- Entities who are closely related can be assigned to the same Intelligence Analyst
  - **More effective and efficient resource allocation and case assignment**

# R-Studio – Network Visualisation

## Identifying high risk entities based on network statistics



Network Analysis   OutputData   Shortest Path   Shortest Path Data   **Statistic**

### 1. Degree Centrality

Measure of number of unique entities connected directly (1 bound) from entity of interest

Entity	Rank
Company A	1
Company B	2

### 2. Eigenvector Centrality

Measure of the influence of a node in a network

Entity	Rank
Company A	1
Company B	2

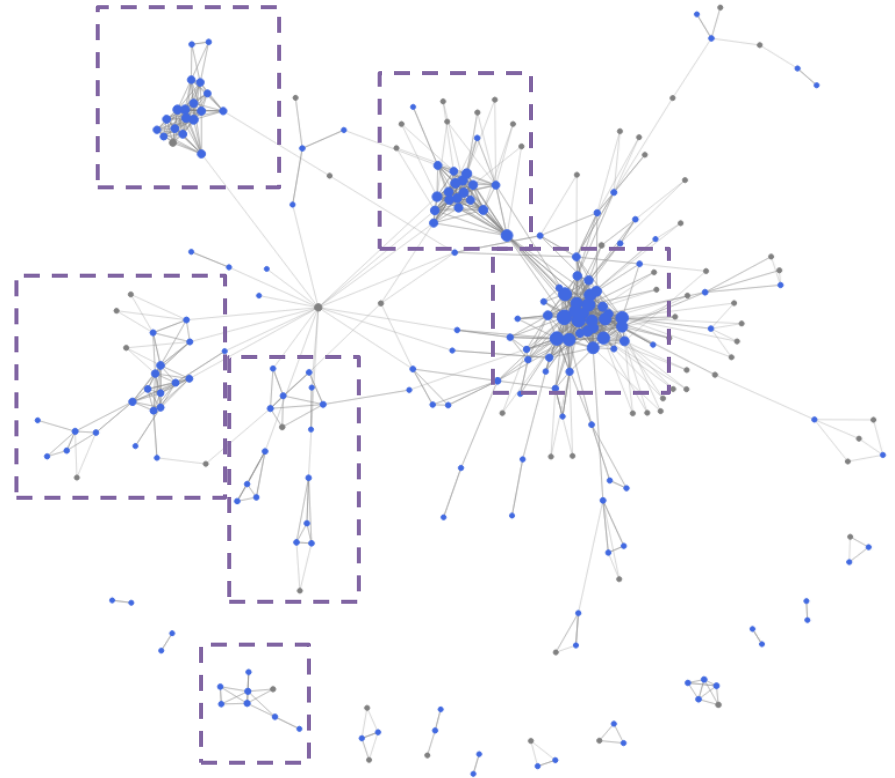
### 3. Betweenness Centrality

Number of times this entity acts as a bridge along the shortest path between two other nodes

Entity	Rank
Company A	1
Company B	2

## Sub-clusters within network

Entities within same sub cluster should ideally be investigated by same (group) of investigators for better oversight and/or prioritised as a whole (as oppose to choosing entities from different sub-cluster)



# Network Statistics and Ranking

## 1. Degree Centrality

Measure of number of unique entities connected directly (1 bound) from entity of interest

Entity	Rank
Company X	1
Company Y	2
STC INTERNATIONAL PTE LTD	3
TRONG THANH BINH	4
ATLANTICAPAC HOLDINGS LTD	5
CHANG CHENG BOND	6
PHOENIX TRADING PTE LTD	7
HO CHI MINH	8
IMPACT TRADING HOLDINGS LTD	9
AGREETA HAP	10

## 2. Eigenvector Centrality

Measure of the influence of a node in a network

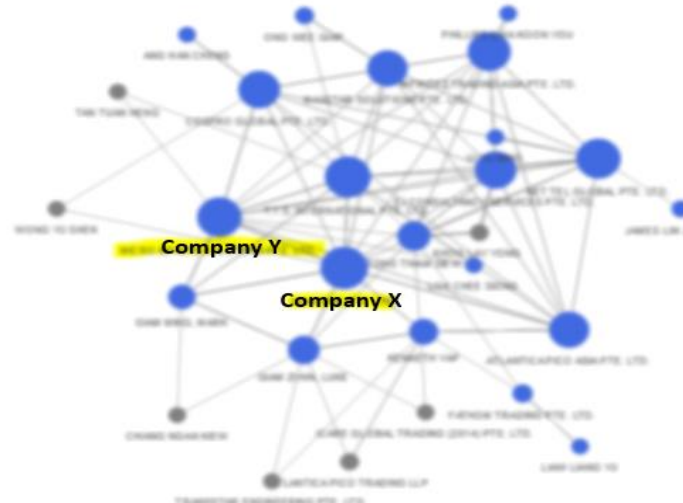
Entity	Rank
Company X	3
Company Y	4
STC INTERNATIONAL PTE LTD	5
TRONG THANH BINH	6
AGREETA HAP	7
IMPACT TRADING HOLDINGS LTD	8
CHANG CHENG BOND	9
ATLANTICAPAC HOLDINGS LTD	10
IMPACT TRADING HOLDINGS LTD	11

## 3. Betweenness Centrality

Number of times this entity acts as a bridge along the shortest path between two other nodes

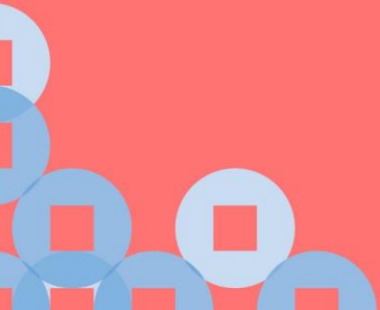
Entity	Rank
Company X	3
Company Y	4
STC INTERNATIONAL PTE LTD	5
TRONG THANH BINH	6
AGREETA HAP	7
IMPACT TRADING HOLDINGS LTD	8
CHANG CHENG BOND	9
ATLANTICAPAC HOLDINGS LTD	10
IMPACT TRADING HOLDINGS LTD	11

Several iterations of **fine tuning** to the extraction of link data were performed to **improve ranking** of high risk entities, e.g. exclusion of employee-employer relationships which are more than 5 years ago etc.



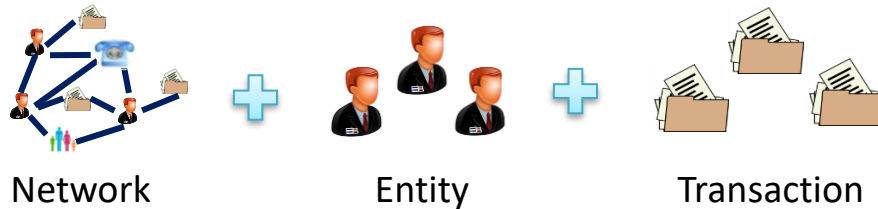


# Case Study 1: Enterprise Network Analysis Tools



# Social Network Analysis Model

Score and Identify entities or transactions (i.e. returns) with higher risk using network data and analytical methods



Network risk is taken into account at the onset

- Systematically and comprehensively evaluate risk areas, not only at **entity** and **transaction** level, but also at **network** level
- Helps detect suspicious activities using a combination of analytical techniques to determine the likelihood of non-compliance

# Social Network Analysis Tool

Having had successes in using SNA since 2010, IRAS auditors now use an enterprise SNA tool for both GST Registration and GST Refund Review processes.

Cases Received



SNA scores and classifies cases into risk bands

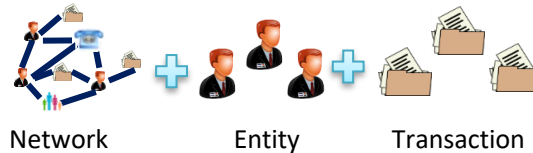


Officers can **tailor** the degree of checks depending on the risk level of each case



Risk Areas

Rule Type	Rule ID	Rule Description	Rule Result	Severity
Entity	7			High
Entity	40			High
Transaction	61			High
Network	272262			High



# Benefits of Using SNA in Compliance



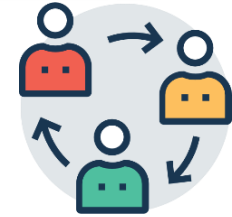
## Holistic view of taxpayer's risk profile

- Form a **complete picture** of taxpayer's risk profile from different perspectives, including network risk
- Auditors are able to distinguish the specific **risk areas** contributing to the overall risk assessment



## Enhanced compliance capabilities

- **Sense-make** voluminous and complex information to **uncover hidden relationships** and detect risky taxpayer 'groups' (e.g. common linkages with high risk entities)

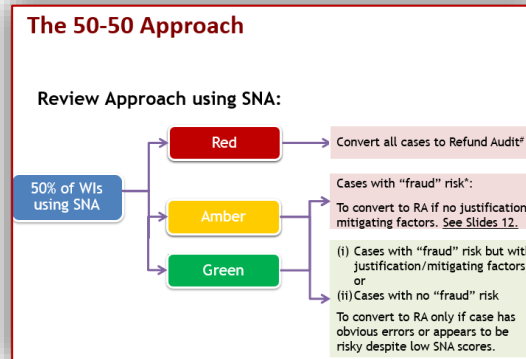
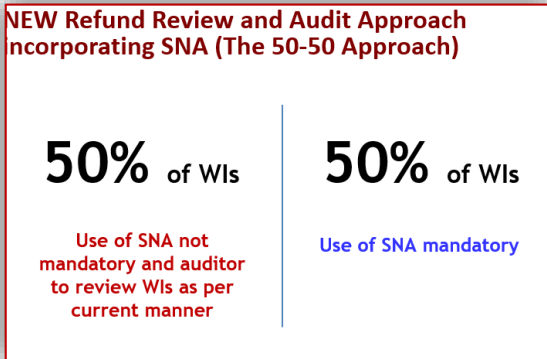


## Improved productivity

- **Reduces time and efforts** to identify complex linkages embedded within several layers of relationships
- **Tailor compliance checks** and adopt a consistent approach according to the taxpayer's risk levels

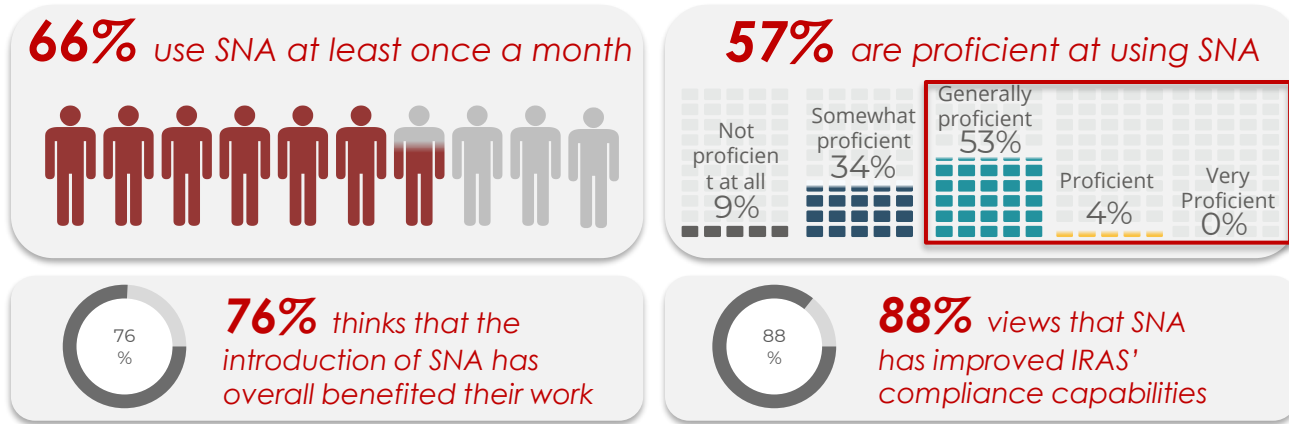
# Social Network Analysis (SNA) Tool

- To **overcome the initial inertia**, we started off with **mandating the use of the tool** at 50%, before **increasing progressively** to 70% (from Oct 2017) and 100% (from May 2019) for key processes.
- This is to give sufficient time for **users to adjust and grow their skills** in using the new tool
- Act as a control group to compare results



# Social Network Analysis (SNA) Tool

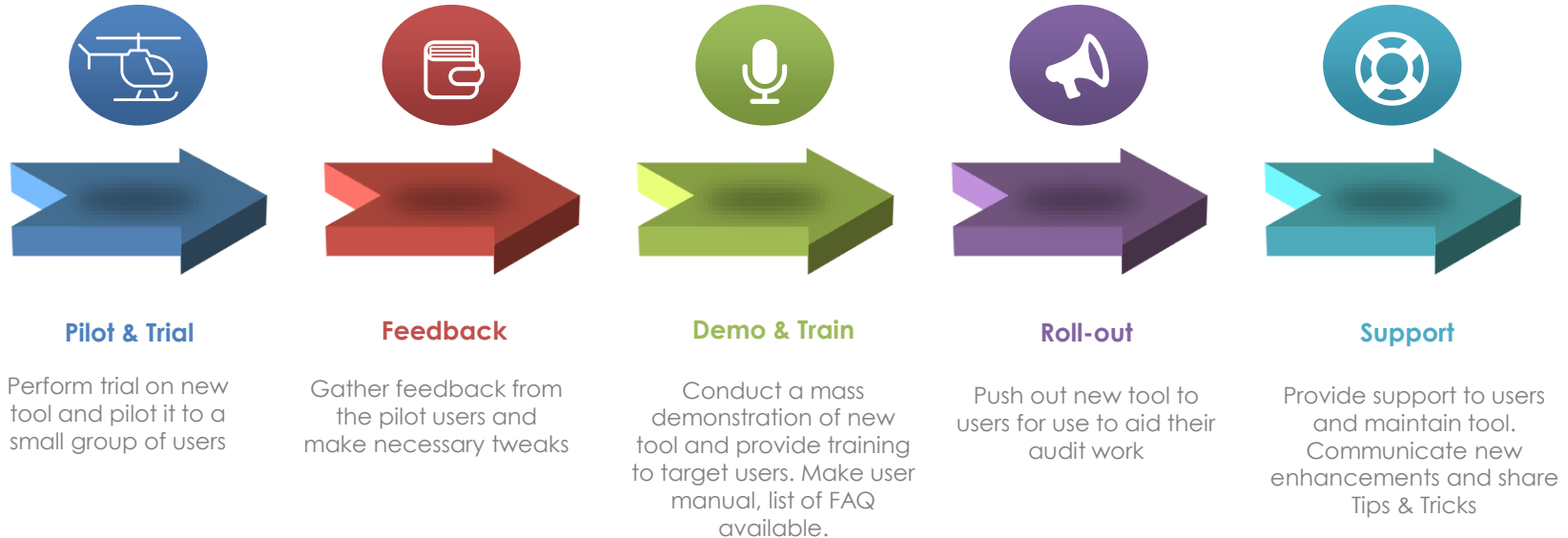
- Surveys were conducted shortly after implementation to **gather feedback to identify gaps and calibrate our approach**



- We put that feedback into action by enhancing our tool annually to **improve SNA's user experience and features**. Some of these enhancements include:
  - **Graphical User Interface (GUI)** to improve user experience
  - **Network Visualization** to sift through information more effectively
  - **SNA Rules** to refine its accuracy and improve understanding
  - **Interfacing with Case Management System** to display key SNA risk info and link to SNA tool

# Supporting Our Auditors In Their Audits

## *Adopting an agile approach when implementing new tools*



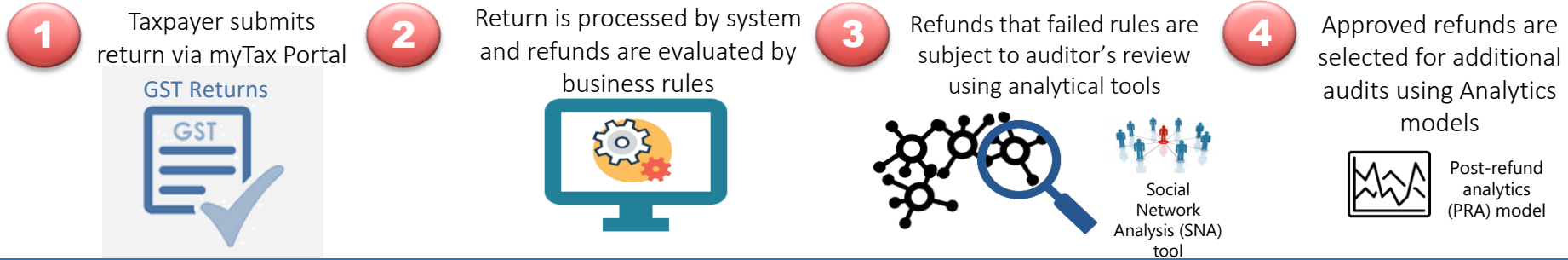
# Case Study 2: Embedding Analytics into GST Refund Process



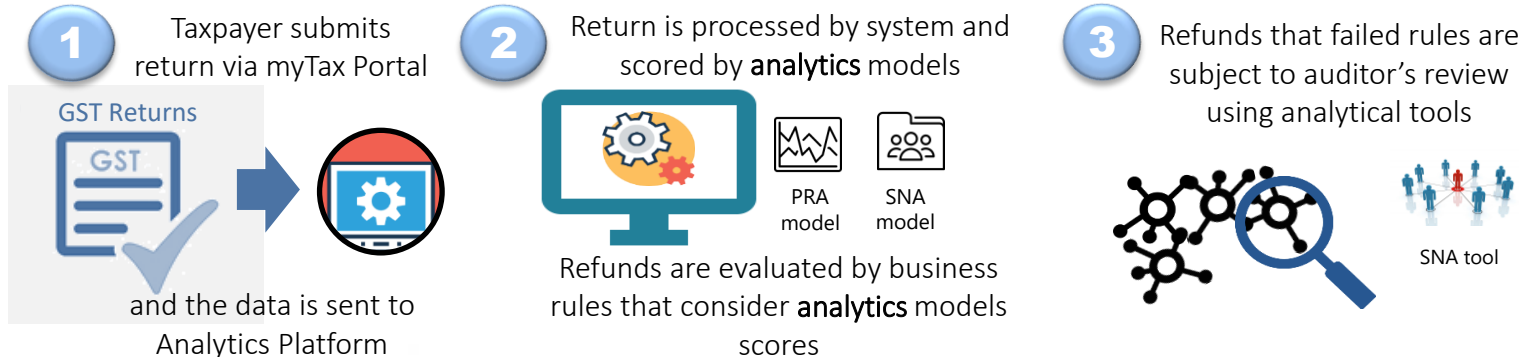


# Previous vs Enhanced Process

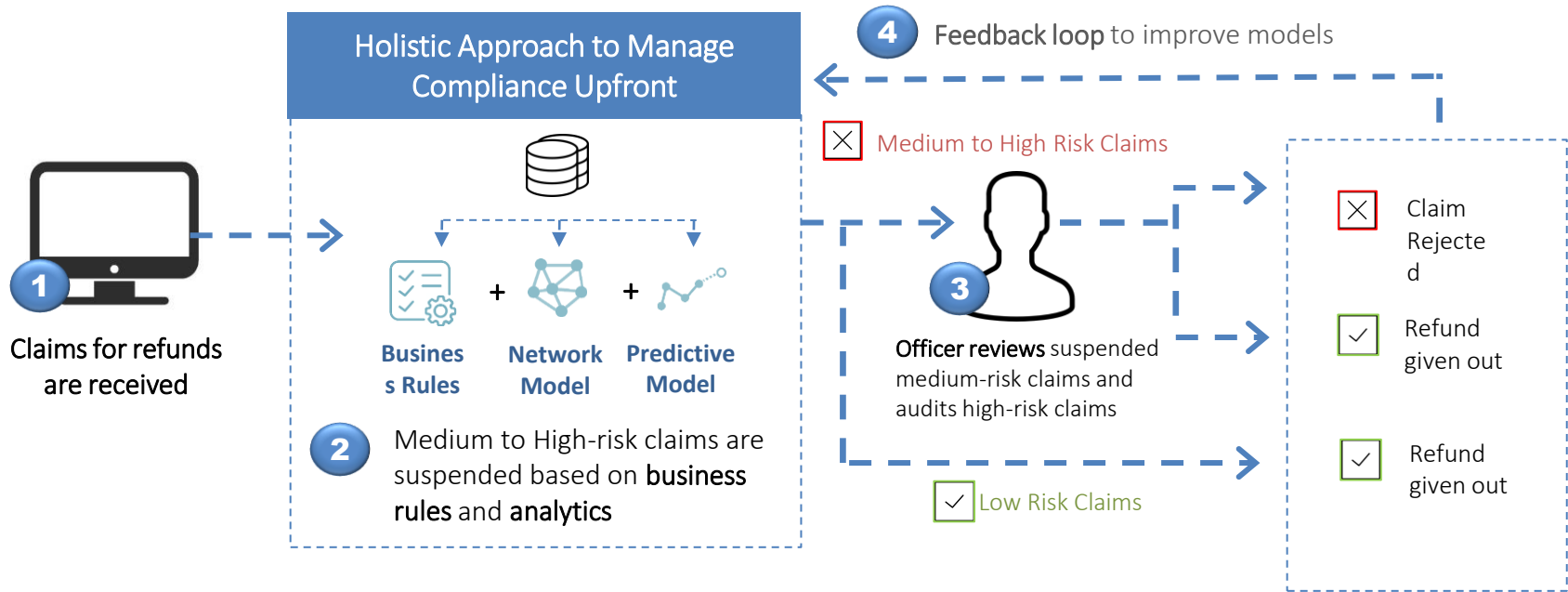
## Previous Process



## Enhanced Process



# Embedding Analytics into GST Refund Process



# Key Benefits and Results

## Better Manage Compliance Risk



### Manage Risk Upfront in Processes

- High risk refunds are detected by analytics models and suspended at the pre-refund stage dynamically, as opposed to using linear business rules in previous model

## Improve Audit Strike Rate



### Reducing false positives

- Enhance existing rules with analytics component
- More robust checks reduces the number of non-risky work items to be worked on

## Improved Productivity



### Saving time and Manual effort

- Analytics deployment process is automated, eliminating manual deployment effort

## Early Results

As at 31 Jul 2019

- Detected more than **500** new high risk refund claims that could only be detected at the post-refund stage previously
- No. of refund claims withheld for auditor's review have fallen by **30%**
- High risk claims identified by analytics:
  - >60%** audit strike rate (for pre-refund model)
  - More tax recovery
  - More potential fraud cases detected

# Embedding Analytics into GST Refund Process

## Implementation Approach

- To enable us to **assess the analytic models' performance**, we set a target to audit all refunds selected by the system in the first year
- With the anticipated **increase in workload**, resources from other teams were redeployed to ensure the evaluation could be completed in time
- **and give team's flexibility**, we formulated clear guidelines to highlight scenarios where mandatory audit may not be required (e.g. low risk cases, recently audited)
- After we have obtained sufficient observation for the Post-Implementation Review, **we adjusted the guidelines to allow** teams to **exercise discretion** to decide the refunds reviewed for audit
- We are always exploring ways to **improve by seeking feedback** from users and **conducting regular refresh** of the model based on new observations

“We are surrounded by data,  
but starved for insights.”

**Jay Baer**

marketing and customer experience expert



# Thank You

The information presented in the slides aims to provide a better general understanding of taxpayers' tax obligations and is not intended to comprehensively address all possible tax issues that may arise. This information is correct as at the date of presentation. While every effort has been made to ensure that this information is consistent with existing law and practice, should there be any changes, IRAS reserves the right to vary its position accordingly.