

Next Gen Internal Audit Analytics: Continuous Monitoring & Predictive Analytics



The Institute of
Internal Auditors
Chicago

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Speaker Bios



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Polling Question One

Question: How many session participants have ventured into continuous monitoring?

Question: Do you plan to integrate continuous monitoring analytics into your 2024 audit plan?



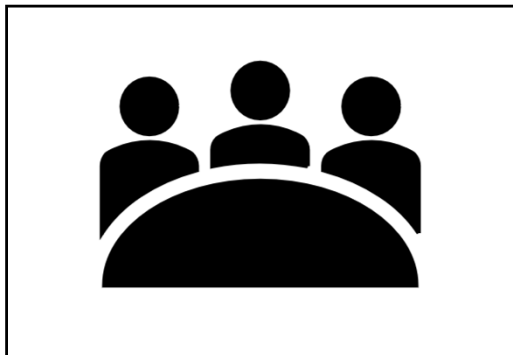
Learning Objectives

1. Provide a **roadmap of the internal audit analytics transformation** from historical analysis to risk sensing predictive analytics for attendees to apply within their organizations.
2. Offer **practical insights into key stages of the analytics lifecycle** while sharing actionable tips, strategies, and methodologies to enhance the effectiveness of internal audit analytics.
3. Showcase **real-world examples illustrating successful applications of historical analysis and predictive analytics** to demonstrate the impact on decision-making processes for internal audit and the business.
4. Explore the historic and predictive analytics **insights that arise from tapping into the collective intelligence of today's participants** to effectively leverage the diverse expertise within our field.

Establishing Foundations: “Crafting Vision and Purpose”

An analytics function is more than just the technical scripting and data analysis.....it is important to establish ‘why’ and ‘what’ for your existence

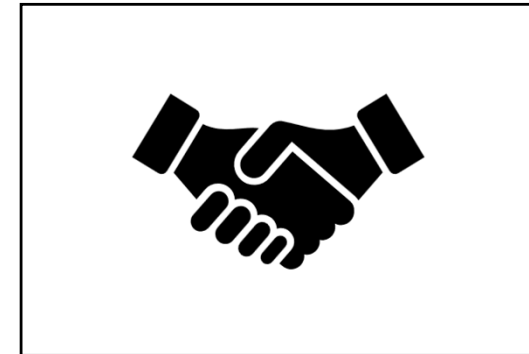
Cultivate a vision for IA analytics that emphasizes:



Cross-Functional
Collaborations



Position as Trusted
Advisors to Business



Aligning Vision with
Business Goals

Then, establish purpose through a mission and corresponding objectives

Establishing Foundations: “Crafting Vision and Purpose”

Internal Audit Automation Program Mission & Objectives

Mission Statement

Internal Audit aims to further leverage technology in support of auditing tactical areas of the business to provide smarter and more comprehensive audit results while freeing resources for strategic and enterprise-risk focused auditing.

“WHY”

Key Program Objectives

Efficiency

- Engagement of audit in key tactical areas with **increased frequency/breadth (full population)** and with limited impact to resources
- **Free up resources from tactical audits** to more strategic & top-risk areas

“WHAT”

Value

- Engage **real-time risk evaluation** for specific areas to drive business conversation and/or future audits
- Provide for **third-line of defense** based on historic activity
- Audit full populations of data and **smarter sample** selections
- Shift audit to the **predictive space**

Establishing Foundations: “Technical Proficiency in Data Management”

Investing in effective data management practices promotes reliability and informs decision making.

Data Infrastructure

Governance

Policies and procedures for collection, storage, and usage

Team roles and responsibilities

Compliance with governing standards

Quality Assurance

Process to assess and improve quality

Identify and rectify inconsistencies and errors

Establish cadence

Security and Compliance

Robust security measures to protect sensitive data

Regulatory requirements and best practices

Regular audits to ensure compliance

Mapping

Understand data relationships

Visual representations to illustrate the flow of data

Consistency and accuracy of formatting and relationships

Continuous Improvement

Culture of continuous learning and improvement

Stakeholder feedback to identify areas for enhancement

Emerging technologies and trends



Developing Organizational Excellence: “How We Will Execute”

Long term, sustainable results depend on having a methodology that is transparent, all-encompassing and repeatable

Develop a multi-staged methodology with:

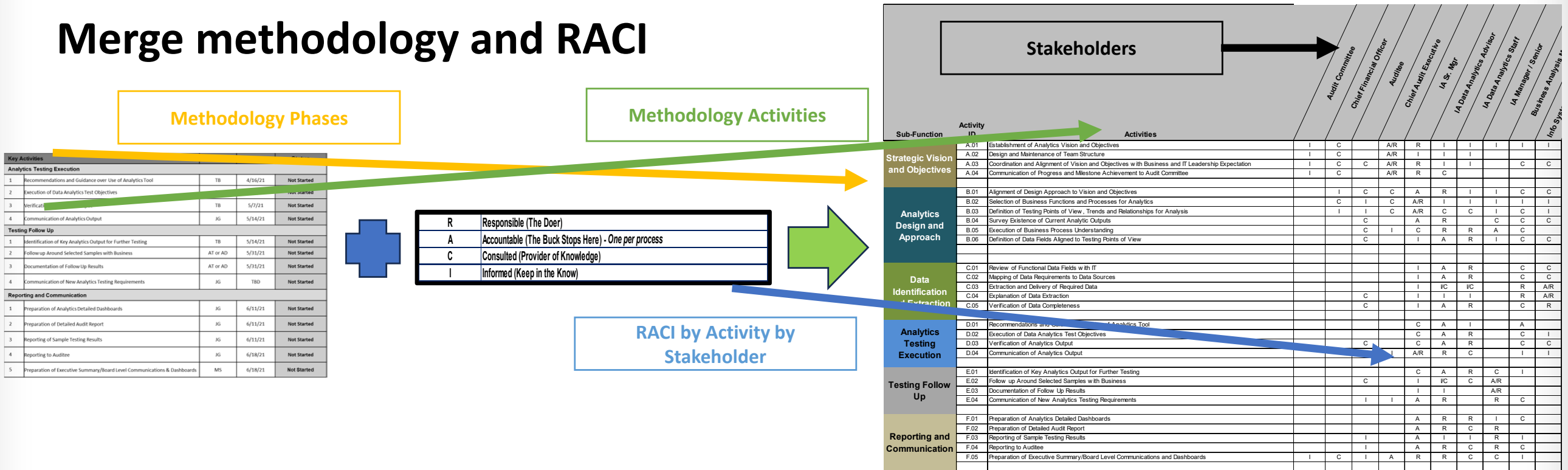


Key Activities		Owner	Due Date	Status
Analytics Testing Execution				
1	Recommendations and Guidance over Use of Analytics Tool	TB	4/16/21	Not Started
2	Execution of Data Analytics Test Objectives	TB	4/30/21	Not Started
3	Verification of Analytics Output	TB	5/7/21	Not Started
4	Communication of Analytics Output	JG	5/14/21	Not Started
Testing Follow Up				
1	Identification of Key Analytics Output for Further Testing	TB	5/14/21	Not Started
2	Follow up Around Selected Samples with Business	AT or AD	5/31/21	Not Started
3	Documentation of Follow Up Results	AT or AD	5/31/21	Not Started
4	Communication of New Analytics Testing Requirements	JG	TBD	Not Started
Reporting and Communication				
1	Preparation of Analytics Detailed Dashboards	JG	6/11/21	Not Started
2	Preparation of Detailed Audit Report	JG	6/11/21	Not Started
3	Reporting of Sample Testing Results	JG	6/11/21	Not Started
4	Reporting to Auditee	JG	6/18/21	Not Started
5	Preparation of Executive Summary/Board Level Communications & Dashboards	MS	6/18/21	Not Started

Developing Organizational Excellence: “Who Does What”

Realization of mission and objectives is dependent on identifying, defining and communicating stakeholder engagement and responsibility

Merge methodology and RACI



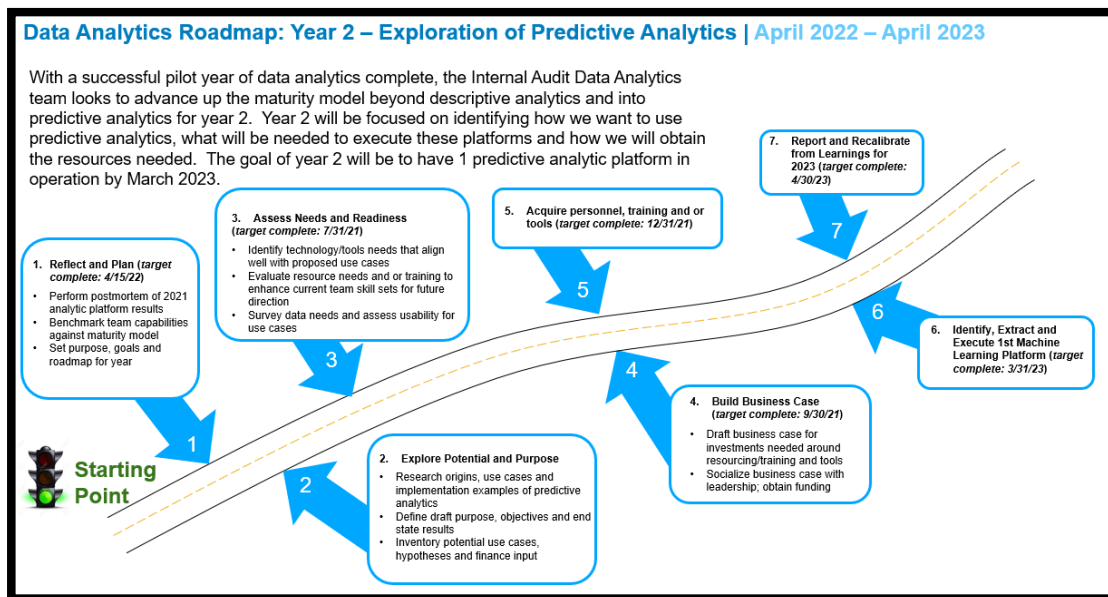
Developing Organizational Excellence: “Who Does What”

Sub-Function	Activity ID	Activities	Audit Committee	Chief Financial Officer	Auditee	Chief Audit Executive	IA Sr. Mgr	IA Data Analytics Advisor	IA Data Analytics Staff	IA Manager / Senior	Business Analysis Manager	Info Systems / Financial Systems Leader
Strategic Vision and Objectives	A.01	Establishment of Analytics Vision and Objectives	I	C		A/R	R	I	I	I	I	I
	A.02	Design and Maintenance of Team Structure	I	C		A/R	I	I	I			
	A.03	Coordination and Alignment of Vision and Objectives with Business and IT Leadership Expectation	I	C	C	A/R	R	I	I		C	C
	A.04	Communication of Progress and Milestone Achievement to Audit Committee	I	C		A/R	R	C				
Analytics Design and Approach	B.01	Alignment of Design Approach to Vision and Objectives		I	C	C	A	R	I	I	C	C
	B.02	Selection of Business Functions and Processes for Analytics		C	I	C	A/R	I	I	I	I	I
	B.03	Definition of Testing Points of View, Trends and Relationships for Analysis		I	I	C	A/R	C	C	I	C	I
	B.04	Survey Existence of Current Analytic Outputs										
	B.05	Execution of Business Process Understanding			C	I	C	R	R	A	C	
	B.06	Definition of Data Fields Aligned to Testing Points of View			C		I	A	R	I	C	C
Data Identification and Extraction	C.01	Review of Functional Data Fields with IT					I	A	R		C	C
	C.02	Mapping of Data Requirements to Data Sources					I	A	R		C	C
	C.03	Extraction and Delivery of Required Data					I	I/C	I/C		R	A/R
	C.04	Explanation of Data Extraction			C		I	I	I		R	A/R
	C.05	Verification of Data Completeness			C		I	A	R		C	R
Analytics Testing Execution	D.01	Recommendations and Guidance over Use of Analytics Tool					C	A	I		A	
	D.02	Execution of Data Analytics Test Objectives					C	A	R		C	I
	D.03	Verification of Analytics Output			C		C	A	R		C	C
	D.04	Communication of Analytics Output			I	I	A/R	R	C		I	I
Testing Follow Up	E.01	Identification of Key Analytics Output for Further Testing					C	A	R	C	I	
	E.02	Follow up Around Selected Samples with Business			C		I	I/C	C	A/R		
	E.03	Documentation of Follow Up Results					I	I		A/R		
	E.04	Communication of New Analytics Testing Requirements			I	I	A	R		R	C	
Reporting and Communication	F.01	Preparation of Analytics Detailed Dashboards					A	R	R	I	C	
	F.02	Preparation of Detailed Audit Report					A	R	C	R		
	F.03	Reporting of Sample Testing Results			I		A	I	I	R	I	
	F.04	Reporting to Auditee			I		A	R	C	R	C	
	F.05	Preparation of Executive Summary/Board Level Communications and Dashboards	I	C	I	A	R	R	C	C	I	

Developing Organizational Excellence: “Set Milestones; Keep Accountability”

Ensure success by charting an incremental path and schedule regular touchpoints with management (i.e. CFO, CAE, VPs, etc.) to report status of program progress

Timebound tasks on a roadmap



Dashboard status and broadcast accomplishments

**Continuous Auditing & Analytics Program
Program Status Dashboard**

Continuous Monitoring Platforms				
	Planning (Objectives & Data Extraction)	Execution (Analytics Testing & Follow-up)	Reporting (Summary & Dashboarding)	Status/ Due Date
P-Card	[Progress bar]			Complete
Accounts Payable	[Progress bar]			Complete
T&E	[Progress bar]			Off Track 10/2021 01/2022
Distributor RA DB	[Progress bar]			On Track 02/2022
Wires				Not Started 2022
Inventory				Not Started 2022

Operational Audit Analytics

Cloud Governance

- Utilized Purchase Card CM Platform source data and automated analytics to focus on IT related expenses
- Noted IT software asset purchases made outside of the approved processes.

Anti-Corruption

- Utilized T&E and AP CM Platforms source data and automated analytics to support testing.
- Noted resellers located in high risk countries on the corruption perception index.

Other Accomplishments

- IA Risk Assessment 2022
- User Access Review Automation
- Time Reporting Analytics and Status Dashboard
- EMEA Conference (Robotics and Machine Learning)
- Data Analytics Process Infrastructure
- Ongoing collaboration with CoE (J. Kriz)

Embed Continuous Improvement: “Lookback, Assess and Adjust”

Drive year over year progress through postmortem analysis; have a vision for your analytics' program maturity and set goals and action plans accordingly

Leverage a maturity model to help frame analytics program current state vs. desired state on multiple dimensions

Internal Audit Analytics Maturity Model

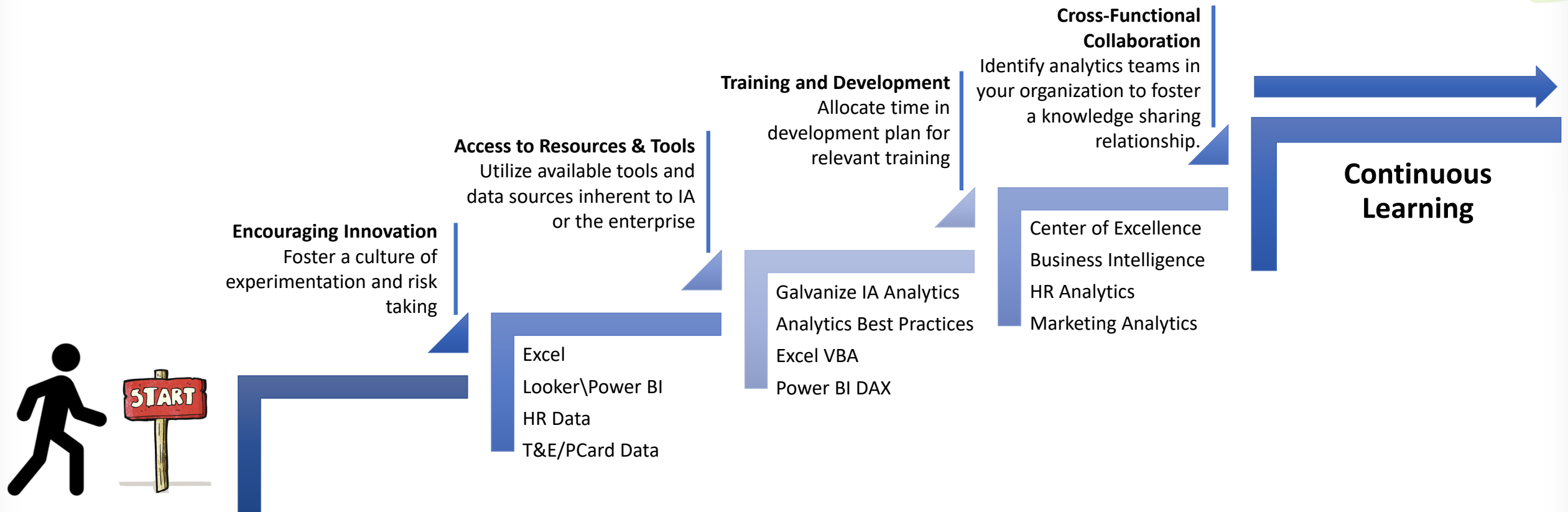
Use the Maturity Model below to assess Internal Audit Analytics performance and identify priorities for improvement opportunities. Overall, ZIA data analytics team scores at or slightly above industry practices with strong capabilities in strategy, structure, people and technology with opportunities to improve in risk assessment, audit planning and continuous monitoring.

	Below Industry Practices	At Industry Practices	Leading Practices	IA Assessed Maturity Level
Strategy	Priorities dictated by surprises Reactive to business needs Limited measurement of processes	Priorities dictated by immediate business needs Moderate anticipation of analytics needs Limited measurement of processes, targets not set	Clearly defined strategy and roadmap Metrics in place to track performance Integrated on a global basis	Current IA Skill Set
Organizational Structure	Duplicated & fragmented Unclear roles and responsibilities Small span of control	Organizational Structure overlaps Roles and responsibilities understood but not documented Moderate span of control	Centers of Excellence leveraged Integrated coordination & management Roles and responsibilities clearly defined	
People	Narrow skill base Limited development; ad-hoc learning Limited analytics understanding	Narrow skill base Functional training and development Uneven expertise across functional audit areas	Strong analytics mindset Staff rotations & leadership programs Deep technical skills & understanding	
Technology	Limited integration / no data governance Manual data collection processes Extensive excel-based Access ACL analytics	Multiple and redundant systems and data feeds Limited data acquisition automation Limited advanced tools and information sharing Minimal data governance	Automatic data capture Strong data governance Analytic specific tools and data warehouses	
Process	Fragmented & non-standardized Process inefficiency & duplication Business criticality drives process evolution	Optimized by function and audit area Quality control processes Process inefficiency and duplication Minimal use of workflow and mapping tools	End-to-end process ownership and documentation Standardized process flows and leverage of workflow and mapping tools	
Risk Assessment	Ratings defined through interviews Limited on-going analysis Audit universe only qualitatively analyzed	Metrics from business leveraged Some on-going analysis Universe linked to profit and cost centers	Independent risk metrics Ongoing risk analysis Shared dashboards	
Audit Planning	Scope defined through interviews Data not leveraged to make scope decisions	Some data utilized to understand business Data used to guide some discussions Excel and ACL modeling	Data used for all applicable areas of business Outside metrics leveraged for scoring Shared dashboards	
Controls Testing	Analytics use driven by requests Most analytics used for reconciliations No historical testing libraries	Analytics planned quarter by quarter Multiple analytics techniques utilized Some historical workpapers	Analytics discussion as part of annual planning Spread of multiple techniques	
Continuous Monitoring	Monitoring defined through interviews Limited on-going analysis Manual Processes	Metrics from business leveraged Some on-going analysis Excel trending of metrics	Independent analysis and metrics Shared dashboards Use of external data	

* “Internal Audit Analytics Maturity Model”, 2022, Author Unknown

Establishing Foundations: “Upscaling Team Members”

Unlocking the potential of your team's analytical skills is within reach through...



Polling Question Two

Question: How many session participants have ventured into predictive analytics?



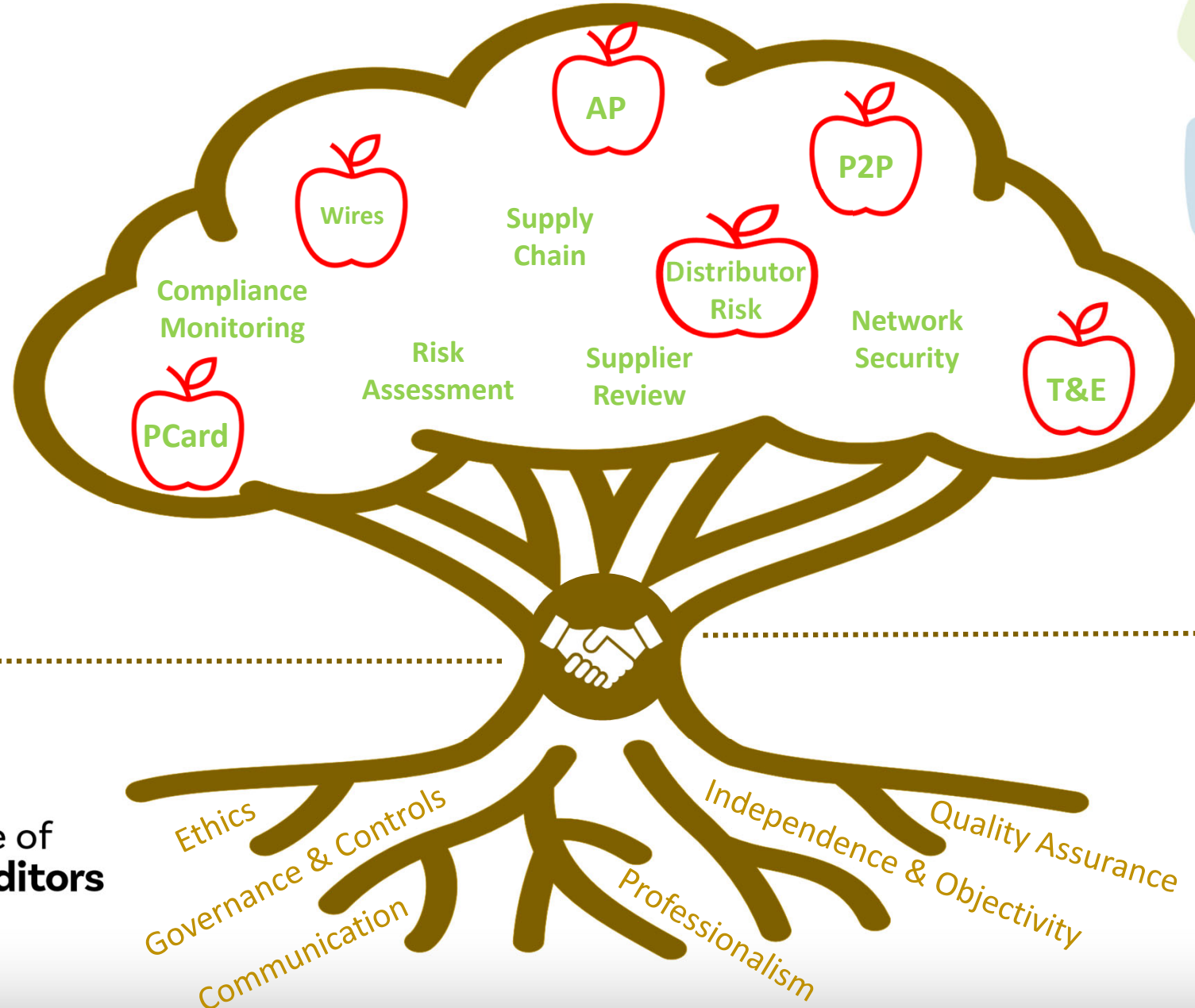
Strategic Analytics Partnerships

Becoming a trusted advisor through internal audit continuous monitoring analytics involves demonstrating expertise, providing valuable insights, and building strong relationships with stakeholders.

Develop Expertise: Stay updated with industry trends, best practices, and emerging tools in data analytics and audit methodologies.

Understand Business Objectives: Understand the key risks, challenges, and opportunities faced by the business to tailor your analytics initiatives accordingly.

Collaborate with Stakeholders: Engage stakeholders in the audit process, solicit their input and feedback, and address their concerns proactively.



Provide Actionable Insights: Focus on delivering value-added insights that help improve business processes, enhance controls, and optimize performance.

Communicate Effectively: Tailor your message to the audience's level of understanding and priorities. Use data visualization techniques to convey complex information effectively.

Build Trust and Credibility: Establish trust and credibility with stakeholders through transparency, integrity, and professionalism. Demonstrate your commitment to objectivity, independence, and ethical conduct in all audit activities.

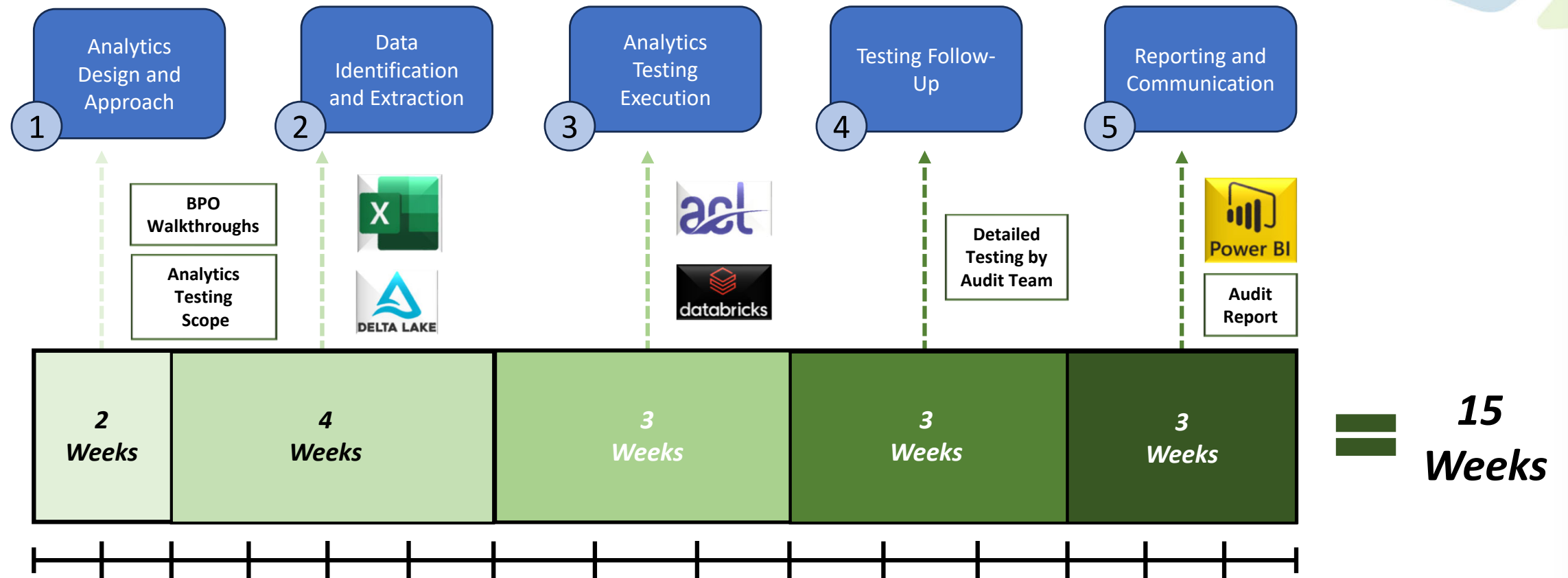


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Becoming a Trusted Advisor through Continuous Monitoring: “Continuous Monitoring Platform Lifecycle”

Building the bedrock of our continuous monitoring program in support of internal audit and the business.

Our Methodology



Becoming a Trusted Advisor through Continuous Monitoring: “Continuous Monitoring Platform Scoping: Purchase Card Program”

Policy Compliance

1. Spend over Credit Limits
2. Split Transactions
3. Missed Capitalization
4. Significant Credit Limit Changes
5. **Inclusion & Diversity Statistics**

*Beneficial Analytics per the Business Group

Fraud, Waste, and Abuse

6. Higher Risk Merchant Classification Codes (MCCs)
7. Expenses by Terminated Employees
8. **Expenses by class of transaction, function**
9. **Expenses by merchant, MCC (possible lost volume discount opportunity)**
10. Duplicate Transactions (including w/ T&E)
11. Weekend / Holiday Transactions,
12. Unusual P-Card Expense Locations
13. Average Monthly Spend Compared to Credit Limit
14. **Dormant and/or Seldom Used Cards**
6. Significant Spend Increases (MoM and QoQ)
7. Ghost Cards

Cardholder Administration

15. Terminated Employees w/ Active PCards
16. Credit Limits Not in Line w/ Employee Role
17. Duplicate Cards, Multiple Cards per Employee
18. Employees Who Also Hold a T&E card.
19. Shared Cards
20. **Missed PCard Rebate Opportunities**

Becoming a Trusted Advisor through Continuous Monitoring: “Navigating Limitations”

Your team's adaptability and agility hold the keys to overcoming inevitable limitations.



Managing Disinterest

- Understand Business Goals
- Define Key Performance Indicators
- Communication and Collaboration
- Focus on Delivering Value and Driving Tangible Outcome for the Organization



Optimizing Resources

- Consistency and Completeness of Data and Process Mapping
- Project Pipeline (Effort/Complexity/Value)
- Auditor Assistance Part Time
- Identify Inefficiencies in Process

 **Business Disinterest**

Data Disparity & Access



Resource Bandwidth Constraints



Enhancing Accessibility

- Centralized Data Repository
- Data Catalogue
- Data Standardization
- Identify Established Analytics Teams Across Organization to Share Mature Data Sources



Becoming a Trusted Advisor through Continuous Monitoring: “Key Learnings in Continuous Improvement”

Annual post-mortems of methodology are vital for insightful forward planning, ensuring alignment with the evolving maturity of capabilities, and optimizing future strategies.

The Evolution of Our Methodology

Initial acquisition and disparity of data required the addition of 2 weeks to phase

2021

Analytics Design and Approach

Data Identification and Extraction

Analytics Testing Execution

Testing Follow-Up

Reporting and Communication

Continuous Monitoring Cadence

Balancing our bandwidth to sustain established CM projects and continue to innovate

2022

Concentrate on a narrower set of tests to enhance our ability to execute them effectively.

2022

To prioritize stakeholder alignment and reduce rework in the reporting phase, additional readouts were added between phases

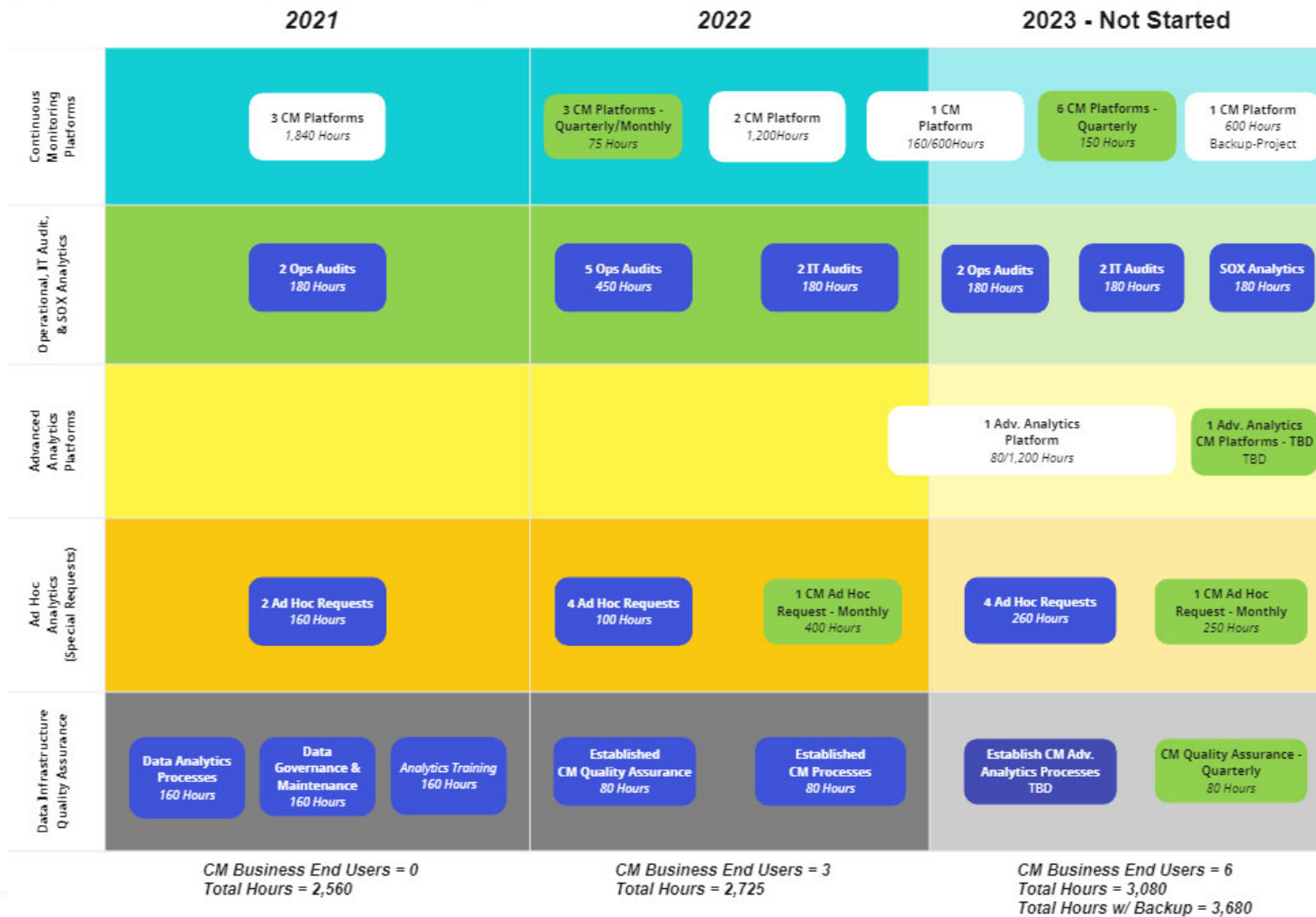
2021

To reduce the reporting phase timeline, investigating the use of generative AI

2023



Becoming a Trusted Advisor through Continuous Monitoring: “Key Learnings in Continuous Improvement”



Maintenance

Balancing our bandwidth to sustain established CM projects and continue to innovate

Innovation



Introduction to Predictive Analytics: Grey Market Sales Prediction

Shift auditing perspectives from being artifact and historical driven to forward looking insights that help a company anticipate and plan for risk

What is Grey Market?

Authentic product sold out of a low-cost territory to a high-cost territory thereby disrupting distributor business and profits

What is current solution?

Manual “secret-shopper” purchasing that detects (and reacts to) grey market product already in the market.

What are advantages of predictive analytics?

1. Shift the control from being manual and detective to preventive and automated.
2. Insight is now forward looking instead of historical.
3. Tedious manual efforts are eliminated; investigations can be targeted based on analytic output.

Introduction to Predictive Analytics: Grey Market Sales Prediction

Areas that lend well to predictive analytics have a) suspected multiple variables impacting another variable, b) adequate data capture, and c) governance around data input

Step 1: Profile identified instances of grey market through region's manual efforts

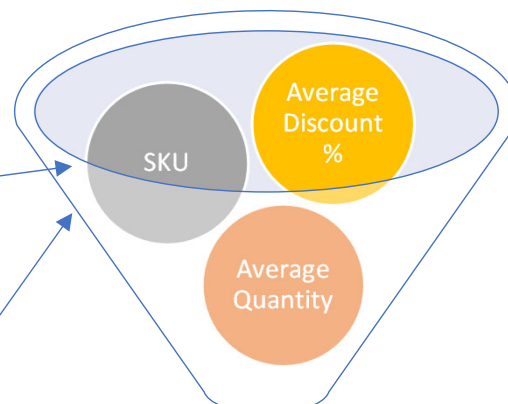
Distributor 1

- sku: TC77
- Quantity: 500
- Discount: 40%
- Country: Poland
- Reseller: A&B Inc.

Distributor 2

- sku: TC77
- Quantity: 200
- Discount: 30%
- Country: Turkey
- Reseller: X&Y AG

Step 2: Assemble statistical model with known model variables



Logit estimates		Number of obs =		200	
Log likelihood = -123.90902		LR chi2(2) =		27.82	
		Prob > chi2 =		0.0000	
		Pseudo R2 =		0.1009	
grey	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
Quantity	.9314488	.0182578	-3.62	0.000	.8963428 .9679298
PC Discount	1.112231	.0246282	4.80	0.000	1.064993 1.161564

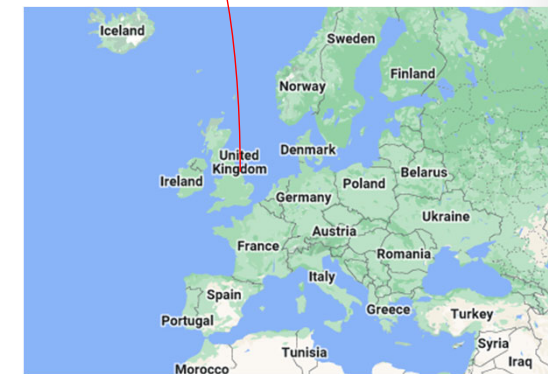
Step 3: Load quarterly sales out and PC data, etc.; execute statistical model

Point of Sale (PoS) Report

End User Report

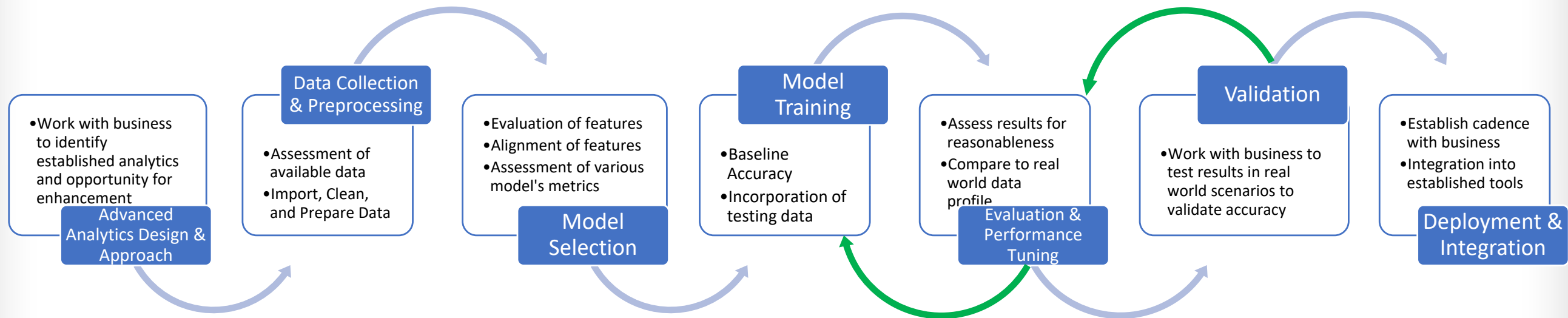
Step 4: Select predicted output for further examination

Deal 123456
Reseller
UK



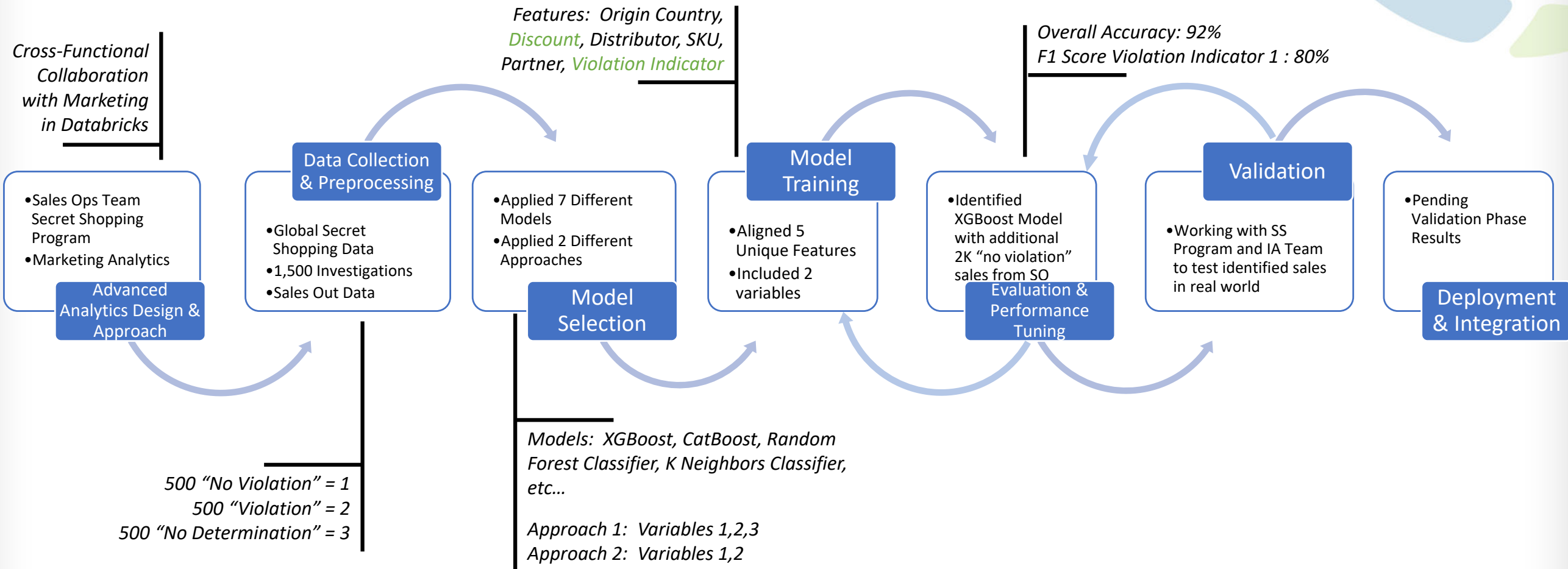
Introduction to Predictive Analytics: Grey Market Sales Prediction

The Evolution of Our Methodology Continues to Adapt : Machine Learning Lifecycle



Introduction to Predictive Analytics: Grey Market Sales Prediction

The Evolution of Our Methodology Continues to Adapt : Grey Market Predictive Platform Lifecycle



Introduction to Predictive Analytics: Grey Market Sales Prediction

Lessons Learned on How to Avoid Pitfalls

K-Fold Cross Validation



Overfitting and Underfitting

Risky models that are either to complex (over) or to simplistic (under)

Training Data Adjustment Based on Reasonableness



Imbalanced Data

Challenge when one variable is significantly more prevalent than other variables

Baseline Accuracy and Feature Importance



Model Complexity

Trade-off between model accuracy and interpretability.
Simplicity vs. Accuracy

Ethical Concerns

Mindful of ethical considerations related to data privacy, bias, and fairness



Introduction to Predictive Analytics: “Grey Market Sales Prediction: Distributor Risk Assessment”

- **Near Term:** Support Zebra’s Internal Audit team in selection of distributor **audits** and subsequent sample transactions for testing
- **Medium-Term:** Support Zebra’s secret shopping team by enabling smarter sample selections
- **Long-Term:** Enable Zebra sales team to identify grey market transactions prior to close of sale/shipment – **Shift efforts from detective to preventive**



Polling Question Three

Question:

Within different industries, what examples would lend themselves well to predictive analytics?

Ideas for Inspiration:

Retail: "In what ways can predictive analytics enhance customer experience and increase sales?"

How can we predict consumer trends or forecast demand more accurately?"

Transportation: "What predictive analytics solutions could enhance logistics and supply chain efficiency?"

How can we predict traffic patterns or optimize route planning?"

Healthcare: "How can predictive analytics improve patient outcomes and optimize healthcare delivery?"

What predictive models could help in early disease detection or personalized treatment plans?"

Telecommunications: "What predictive analytics solutions could enhance network performance and customer satisfaction?"

How can we predict network outages or anticipate bandwidth requirements?"

Manufacturing: "How can predictive analytics optimize production processes and minimize downtime?"

What predictive maintenance models could help anticipate equipment failures?"

Finance: "How might predictive analytics mitigate financial risks and improve investment strategies?"

What models could help detect fraudulent activities or predict market fluctuations?"

Key Takeaways

1. Establishing Foundations

- Craft a clear **vision for IA analytics** that aligns with business goals, emphasizing cross-functional collaborations and the role of audit as trusted advisors.
- Development of a **repeatable and transparent methodology** that encompasses data management and enhancement of auditor capabilities is achievable.

2. Becoming a Trusted Advisor Through Continuous Monitoring

- Leverage analytics to establish **meaningful business partnerships** in support of IA and the business.
- Recognize and **address challenges proactively and allow your methodology to evolve**.
- Maintain a **balance between sustained upkeep** of established continuous monitoring projects **and consistent innovation**.

3. Introduction to Predictive Analytics

- Continued **advancement of auditor capabilities and collaboration with seasoned analytics teams** within your organization is essential.
- **Training data should reflect the real world**, align features, create variables, balance your model between simplicity and accuracy.

Section Break



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