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Face the Future with Confidence

DATA ANALYTICS AND PROCESS MINING IN INTERNAL AUDIT

St. Louis Institute of Internal Auditors (IIA)

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INTRODUCTIONS AND HOUSEKEEPING

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Housekeeping:

• Remember to participate in the polling questions throughout the presentation – required to earn CPE credits (2 CPEs for this 100-minute session)

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OVERVIEW OF TODAY'S PRESENTATION

Describe the vision for **data analytics** within Next Generation Internal Audit

Understand the **top priorities and challenges** faced by internal audit in implementing data analytics

Introduce emerging **process mining** technology changing the audit process

Provide live demonstration of **Celonis** process mining tool

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DATA ANALYTICS IN INTERNAL AUDIT

Data → Insight → Decision Making → Action → Unlock Value

Developing a **repeatable** decision-making process
that **leverages data** through **logical reasoning**
and **analytical methods** to turn insights into **tangible business outcomes**

Increase Efficiency and Effectiveness	**Increase Breadth and Depth of Coverage**	**Continuous Monitoring, Real-time Response**	**Discover Unknown Unknowns**

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NEXT GENERATION INTERNAL AUDIT

Competencies, qualities and components to effect change

Machine Learning (ML)
Artificial Intelligence (AI)

Process Mining

Robotic Process
Automation (RPA)

Advanced Analytics

Continuous Auditing

High Impact Reporting

Enabling Technology

Next-Generation Internal Audit

Governance

Methodology

IA Strategic Vision

Organizational Structure

Resource & Talent Management

Aligned Assurance

Dynamic Risk Assessment

Agile Audit Approach

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WHAT DOES NEXT GENERATION IA LOOK LIKE?

Emerging Business Issues REQUIRE Innovative Approaches

Next Generation Internal Audit	Emerging Business Risks

Governance

- Prospective Strategy
- Aligned Enterprise Assurance
- Streamlined Structure
- Aligned & Evolving Skills
- Applied Technical Acumen
- Flexible Resourcing

Methodology

- Dynamic Risk Assessment
- Real-time Risk View
- Analytics Driven
- Agile & Scalable Execution
- Engaged Stakeholders
- Simplified and High Impact Reporting

Enabling Technology

- Ubiquitous Data
- Automated Processes
- Advanced Analytics
- Process Mining Insights
- Machine Learning
- Artificial Intelligence

ETHICS INTEGRITY STRATEGY RISK TRANSFORMATION CONDUCT DATA EMERGING COMPLIANCE AI ROBOTICS QUALITY CLOUD CULTURE ML RPA EXTERNAL DIGITAL

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DATA ANALYTICS POLL QUESTION #1

Does your IA department currently have a dedicated D&A function?

A Yes

B No

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DATA ANALYTICS POLL QUESTION #2

What is the size of the analytics function within your Internal Audit department?

A   Doesn't exist

B   1-2 resources

C   3-5 resources

D   6+ resources

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DATA ANALYTICS COMPLEMENTS INTERNAL AUDIT

Analytics can benefit several aspects of a traditional internal audit – primarily by increasing risk coverage, attaining broader and more accurate testing results, utilizing fewer resources during an audit, and automating the overall testing process.

	Audit More Effectively
	Audit More Efficiently
	Identify Risks Timely

	Sample Testing	Test Case Sourcing	Audit Testing	Result Reporting	Continuous Monitoring
Traditional Audit Techniques	**Sample** In a traditional corporate audit, a sample selection of about 5-10% of the total population is used for testing.	**Auditee Fatigue** Test case sourcing is typically provided from the client side.	**Manual** Typical audit tests are completed manually, by cross referencing documents and data sources. This allows for greater chance of human error.	**Manual** Reports on testing results are also manually compiled in a traditional audit.	**Manual** The continuous monitoring of testing progress and results are done manually in a typical corporate audit.
D&A Integrated Techniques	**Population** With D&A capabilities, full populations can be tested. This allows for more coverage and greater insights into testing.	**Self-Service** D&A allows for direct access to test case sourcing, which reduces the auditee workload and automates the testing process.	**Scripted** Analytics automates several aspects of typical audit testing, reducing the margin of error and time spent on testing.	**Automated** With D&A, reporting results can be generated through a variety of analytics software suites, increasing automation and reporting accuracy.	**Streamlined** Continuous monitoring can be both automated and scheduled (i.e. dashboarding) with D&A methods.

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ANALYTICS AND THE INTERNAL AUDIT PROCESS – A FRAMEWORK

Governance	Strategic objectives Multi-year roadmap Roles & responsibilities Resources Technology		

Risk Assessment	Audit Planning	Audit Execution	Audit Reporting
• Key Risk Indicators • Quantitative and qualitative inputs • Trend analysis across business lines and geographies	• Coverage determination and focus points • Identification of changes in the control environment • Understanding of data and systems supporting a process	• Full population testing • Re-performance of automated controls and/or reports • Identification of outliers for further investigation • Code review • Data acquisition	• Visual graphics • Historical views

Issue Validation & Monitoring	Visualizations of current state	Historical Analysis	Trend Analysis & Monitoring
Stakeholder Reporting	Issue & risk trending	Visualizations of key risks	Project Status Monitoring & Analysis
Continuous Improvement	Quality Assurance reporting	Trending across audit teams	Metrics on Value of Internal Audit
Continuous Auditing	Re-use data acquisitioning	Re-use test scripts	Re-use reporting shells

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DATA ANALYTICS POLL QUESTION #3

In which area are you finding the most success in leveraging D&A in your audit processes?

A   Risk Assessment (KRI's, quantitative/qualitative analysis, trending)

B   Audit Planning (scoping, sampling, etc.)

C   Audit Execution (testing, reperformance of automated controls / reports, data acquisition, investigation of outliers, etc.)

D   Audit Reporting (visual graphics, historical views)

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DATA ANALYTICS POLL QUESTION #4

What are the key challenges that you face today when implementing an analytics function within IA?

A Data availability

B Infrastructure / licensing

C Skills

D Cost / budget concerns

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COMMON CONSIDERATIONS & CHALLENGES

Protiviti has identified several common challenges facing the Internal Audit teams and impacting their ability rollout analytics programs.

1	**Technical Infrastructure**	The Internal Audit team doesn't have access to some many enterprise production databases. In the current state, there is not an environment (sandbox) to utilize for data mining / exploration or development of continuous auditing projects. Limited use of desktop products such as MS Excel are used by the teams. At the enterprise level, tools may be available for data integration, transformation and analytics that may be leveraged.
2	**IA Data & Analytics Program Governance**	There is not a formalized playbook that lists procedures to follow on an analytics projects. There is a need to standardize the analytics program across audits, set policies to manage data requests, demand, data quality, and finalize procedures to operationalize continuous auditing projects on future supported Internal Audit production environments.
3	**Data & Analytics Program Templates and Documentation**	The Internal Audit team does not retain robust documentation during an analytics project. Business requirements, technical requirements, data process, transformation rules, and other details are not be documented in a consistent manner. There is an opportunity to develop an "analytics playbook" for both analytics engagement in planned audit support (i.e., discreet audits) and new capabilities such as Risk Assessments and Continuous Auditing / Monitoring.
4	**Resource Constraints and Continued Training**	There are no resources within Internal Audit who are dedicated and assigned to data & analytics projects. There are some capabilities within a small team (working group) and others with limited experience in analytics. Internal training documentation should be developed to assist additional team members during projects. Additional training options (internal or external) should be considered to train the resources on required skills as needed as the program grows.
5	**Segregation of Duties**	Without established protocols to push data or access to pull data, the Internal Audit team spends a lot of time sourcing and collecting data for their audit needs when trying to apply analytics. This is sometimes serviced through IT and other times through the Business. IA doesn't have access rights to query most production data. There is no access to an enterprise data dictionary that can increase understanding of available data and minimize the effort in collecting appropriate data necessary for analytics.

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THE ROAD TO ANALYTICS AND AUDIT INTEGRATION

Traditional Audit Steps

Confirm audit objectives & scope

Develop enhanced audit scope

Audit commences

Test key hypothesis

Communicate results

Integrated Analytics Steps

Identify potential analytics

Extract, transform, and load data

Analyze data; compare, profile, visualize

Brainstorm with audit team and develop testing hypothesis

Audit commences

Population testing, continue to support and iterate on hypothesis

Visualize and story board results

Continuous Issue Validation & Monitoring

Continuous Auditing

● Key collaboration step

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SUCCESSFUL DATA ANALYTICS

For success, factor in process changes, have the right resources, and obtain the right data

Building Blocks of Data Analysis

Are people with the right skill set available or can they be trained?

PEOPLE

PROCESS

How will the audit process be changed to effectively incorporate analytics?

What tools do we need?

Is an adequate tool already available?

TECHNOLOGY

DATA

What is the most efficient way to obtain and prepare the correct data?

MINDSET   **DATASET & TOOLSET**   **SKILLSET**

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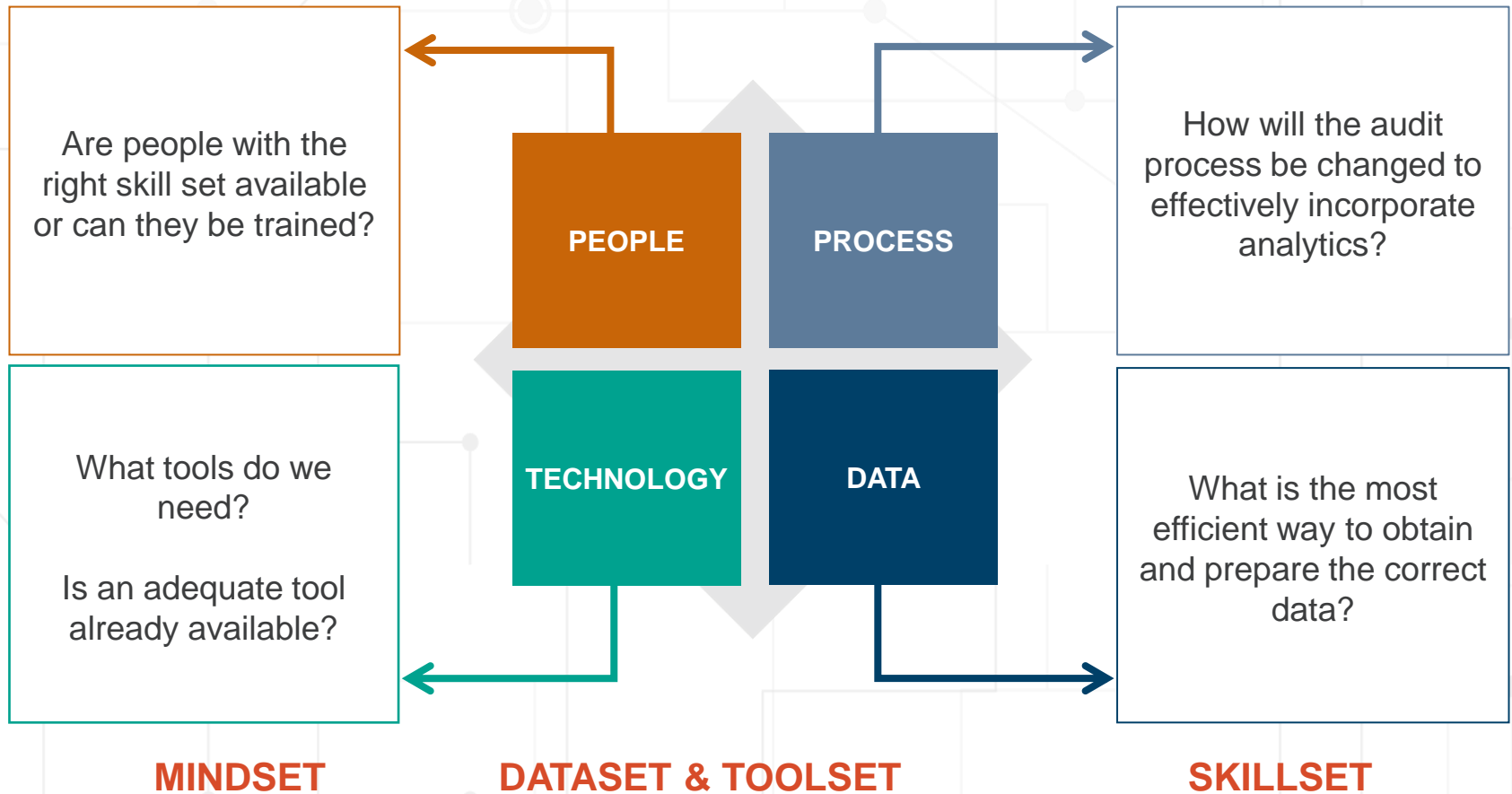
WHERE TO START…

Top Down or Bottom Up?

From the top… What business questions are you trying to answer? What business insights are you trying to derive?

From the bottom… What data exists? Where is it, and in what forms? How accessible is it?

Both! To be successful and move beyond routine, point-analytics you need to have answers to the top-down and bottom-up questions.

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BUILDING BLOCK: PEOPLE

Are people with the right skill set available or can they be trained?

Considerations	Challenges
• Do we need new skill sets? • How will we train individuals? • Will analytics be performed by a dedicated individual? • Do we need to engage other departments?	• Availability of skilled resources • Time required for training • Time required to maintain the analytical queries and tools

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BUILDING BLOCK: TECHNOLOGY

What tool requires minimal support? Is an adequate tool already available?

TECHNOLOGY

Considerations	Challenges
• What capabilities are needed? • How can we most effectively collaborate with IT? • Is there a business analytics tool already supported by IT? • What kind of technical support is available? • Is the tool scalable and will it fit the long-term analytics strategy?	• Selecting a tool • Obtaining support from IT • Integrating the tool with databases and systems • Training • Initial and ongoing costs

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DATA ANALYTICS POLL QUESTION #5

What tools are you utilizing to implement D&A within IA? (select all that apply)

A Galvanize

B R/Python

C Tableau

D Power BI

E Others

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BUILDING BLOCK: PROCESS

How will the audit process be changed to effectively incorporate analytics?

Considerations	Challenges
• How will analytics change our approach and work program? • What kinds of audits can be improved by using analytics? • What steps need to be taken to ensure success? • How can a repeatable process be designed?	• Obtaining an agreement and consensus on changing the audit process • Attempting to do too much at once • Measuring and communicating success

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BUILDING BLOCK: DATA

What is the most efficient way to obtain and prepare the correct data?

DATA

Considerations	Challenges
• What data is needed?	• Availability
• Where is the data sourced from?	• Accessibility
• How do we obtain and link the data?	• Quality
• Is the data accurate and reliable?	• Format
• What validation and cleansing will be required?	• Number of sources
	• Security
	• Privacy

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ANALYTICS MATURITY AND JOURNEY PATH

We've identified key priority focus areas for the Analytics plan and have outlined some "stretch" goals for higher maturity capabilities and operations within the Internal Audit Analytics function.

Internal Audit Analytics Roadmap…It's a Journey

Higher Maturity Opportunities

Advanced Analysis Capabilities
- Continuous improvement
- Process Mining
- Predictive analytics
- Risk assessments

Full Program / Methodology Integration
- Continuous analytics / audits
- Fully integrated analytics program
- Standardized reporting packages
- Enterprise access to analytics reports
- Established data governance and quality

Integrate Analysts
- Broaden organizational use
- Fully embed analytics into all audits
- Move towards quality controls
- Mature analytics champions

Year 2 Expand Coverage
- Train analytics champions
- Integrate ad-hoc analysis
- Establish KPI's
- Formalize and normalize data ingestion
- Identify opportunities to embed more analytics
- Establish more robust reporting and analytics environments for Internal Audit

Year 1 Foundation Building, Exploration, Pilot Cases and Analytics Reusability
- Define objectives and strategy
- Define data access model
- Identify enabling tools
- Identify team champions
- Train staff and develop capability
- Prove value (e.g., pilots, PoCs)
- Establish KPIs
- Establish knowledgebase / reusable scripts

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THE (MODERN) IA TOOLKIT

Range of tools available from traditional to emerging… all with IA utility

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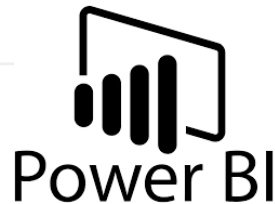
DA ROLES & RESPONSIBILITIES

In order to properly integrate data analytic capabilities into the traditional audit methodology of scheduled corporate audit projects, roles have been defined and fulfilled by appropriate Corporate Audit team members.

"Auditor of the Future": Acting as Data Champion or Audit Team member with new skill/tool sets noted below

Role	Responsibility
Core DA Team	Provide technical expertise on sourcing data, extracting, transforming, and loading data, administering access to data. Support audit teams end-to-end through the entire audit life cycle with data quality, analysis, reporting, and planning audit procedures. Train auditors on how to use various analytics tools and when to use them. Conduct complex data analysis routines and prepare visualizations using specialized data analytics toolsets.
LOB Data Stewards	Governance and steering body for the data analytics program. A steward will generally each represent a line of business (LOB) or audit client. Understand the value of how data analysis can enhance audit procedures. Evangelize the use of data analytics on audits. Solicit ideas and feedback from teams on how and where to apply analytics. Identify repeatable analytic opportunities. Own the responsibility for identification of audit projects that will use data analytics on their teams.
Data Champions	Subject matter experts on self-service analytics projects and audit techniques that use data analytics. Advanced knowledge of tools such as ACL and Tableau that are typically used by the audit team. Primary technical POC for audit teams during fieldwork.
Audit Team	Perform data analysis on audit engagements using tools such as Excel, ACL, and Tableau. Understand basic data analysis, data quality, and information management principals. Identify opportunities to enhance quality and efficiency on audits by introducing analytics procedures.

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CONSIDERATIONS: STANDARDS, POLICIES, DELIVERABLES/TEMPLATES

There are many considerations in this area to reach an efficient, compliant audit analytics program. Here are a few examples that have to be defined:

Consideration	Description
Data Acquisition Standardized Process	Repeatable standardized process for acquiring source system data, loading into the data lake and presenting to Auditors
Standardized wrangling and profiling	Controls and procedures to merge acquired data, detect issues in the data loading process and also issues in the source system data that implicate testing and reporting (example: False Positives)
Data Retention	How long should data be archived once collected by audit? Will GDPR impact this?
Data Security	What members of the audit can view data (and which data) in the data lake. Who can update?

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EXAMPLE ANALYTICS

SAMPLE T&E DASHBOARD

T&E Population Overview

Showing Concur Transactions from: 1/1/2015 - 12/31/2016

Expense Amount v Number of Transactions by Employee
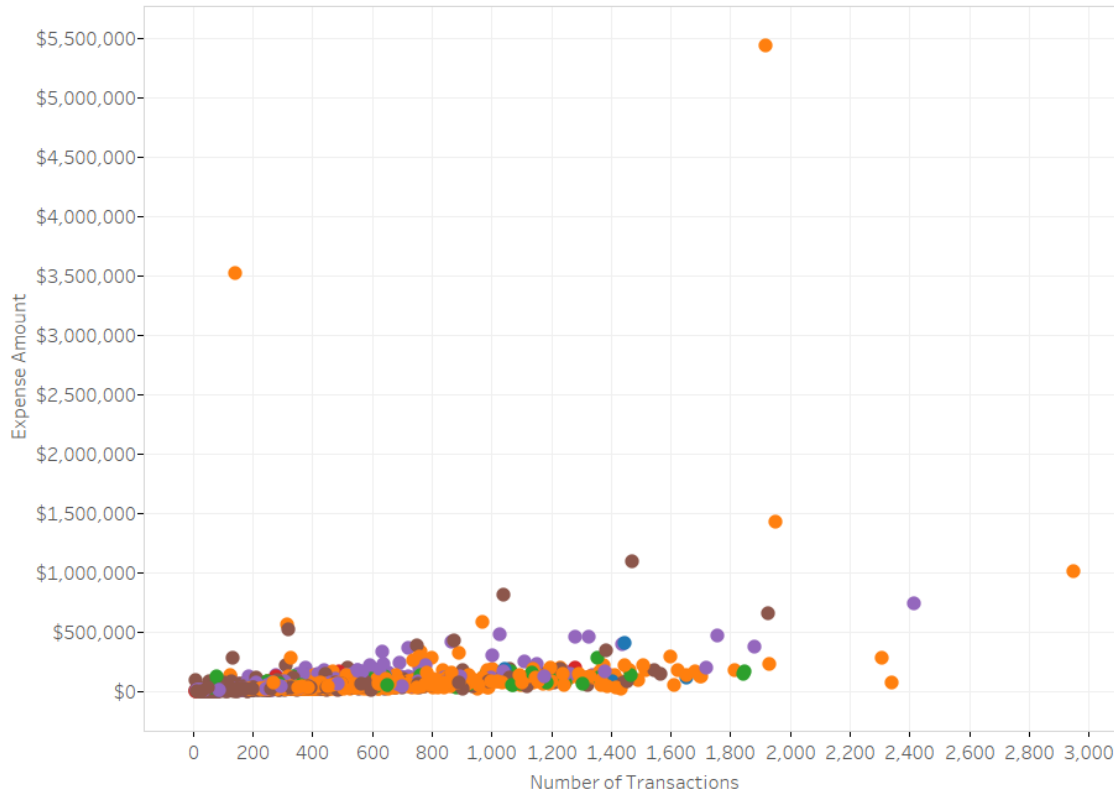
Transaction Date
1/1/2015 — 12/31/2016

Show Top Spenders
20%

Airlines and Hotels
Show

Company Name
(All)

Job Level
(All)

Filter Terminated Users
(All)

Filter Personal
(All)

Filter Payment Type
(All)

Search by Name
michael, ma
Michael, Mary Chi

Legend:
- Subsidiary 1
- Subsidiary 2
- Subsidiary 3
- Subsidiary 4
- Subsidiary 5
- Subsidiary 6

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SAMPLE T&E DASHBOARD

Employee Names | **Subsidiary 5 | Sr Dir Global Clinical Development CNS**
1,880 Transactions | **$373,422** Total Spend | Date Range **1/8/2015** to **12/20/2016**

Personal Transactions

$14
0%
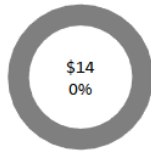
ITUNES.COM/BILL ITUN CUPE..	$11
MTA MVM*42TH STREET NE..	$3

Out-of-Pocket Transactions

$5,232
1%
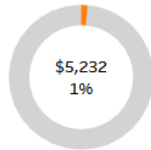
Hotel	$458
Hotel	$458
Travel - Other	$329
Lunch (travel/offsite)	$100
Ground Transportation	$91
Laundry/Tips	$91

Weekend Transactions

$54,504
15%
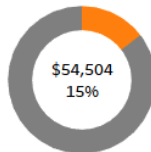
SAN FRANCISCO MARRIO SAN..	$4,777
EXECUTIVEGIFTSHOPPE. 845-..	$4,266
LOEWS HOTELS MIAMI B MIA..	$3,333
SAN FRANCISCO MARRIO SAN..	$2,256
HOTEL SOLAMAR (2) 00 SAN..	$2,199
AMERICAN AIRLINES DALLA..	$1,604
BOCA RATON RESORT F& ROC..	$1,527

Gift Transactions

$4,828
1%
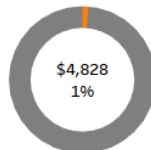
Meeting in NY and CA	$4,266
alliance meetings	$318
Site Visit	$77
meeting	$48
Site Visit	$28
Meetings	$24
Conference and F2F Meetings	$22

Spend by Merchant Category Code

LODGING HOTELS	$164,024
AIRLINES AND AIR CARRIERS	$78,919
EATING PLACES AND RESTAURANTS	$35,155
TAXICABS AND LIMOUSINES	$32,255
MEMBERSHIP ORGANIZATIONS NOT ELSE..	$9,030
CIVIC	$8,517
SCHOOLS AND EDUCATIONAL SERVICES - N..	$5,878
Cash Payment / Unmatched Transaction	$5,232
PASSENGER RAILWAYS	$4,612
GIFT	$4,375

Spend by Supplier

UNITED AIRLINES	$66,635
TOC CHAUFFEURED TRANSPORT	$25,845
MHR SAN FRANC MARRIOTT	$22,041
AUTOGRAPH ALGONQUIN FRONT	$12,752
BOCA RATON RESORT WALDORF ASTORIA	$9,181
UNITED ELEC TICKETNG	$8,987
HARVARD CLUB OF NY CITY	$8,517
LOEWS MIAMI BEACH HOTEL	$7,793
FIG & OLIVE	$7,215
FAIRMONT SCOTTS LODGING	$6,841

Spend by Expense Category

Hotel	$145,409
Travel - Other	$44,062
Airfare/Rail	$42,749
Airline Fees	$41,677
Dinner (travel/offsite)	$36,751
Ground Transportation	$33,157
Conference/Seminar	$6,099
Hotel Taxes/Other	$5,567
Lunch (travel/offsite)	$4,576
Laundry/Tips	$3,596

Selected Transactions

Select a MCC, Expense Category, or Supplier in the charts to the left to view all transactions within that selection.

Expense Type	
Airline Fees	$10,717.40
Airfare/Rail	$6,821.56
Airline Fees	$6,652.60
Travel - Other	$6,583.83
Airline Fees	$5,897.70
Airfare/Rail	$4,800.16
Hotel	$4,776.56
Airline Fees	$4,520.03
Travel - Other	$4,266.00
Dinner (travel/offsite)	$4,236.79
Airline Fees	$3,750.24
Airline Fees	$3,750.24

Geographic Dispersion

© OpenStreetMap contributors

Home Office: Princeton

Population Dashboard

Employee Expenses

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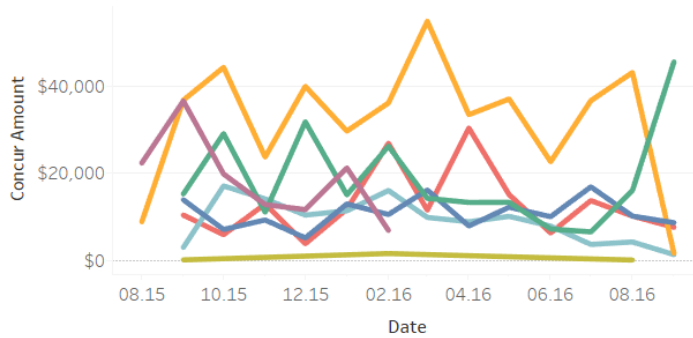# SAMPLE T&E DASHBOARD

Focus Group Spend Analysis
Applied Filters: Cost Center Name: **All** | Employee Name: **All** | Merchant Name: **All** | Entry Transaction Date: **08.01.15 to 09.01.16**
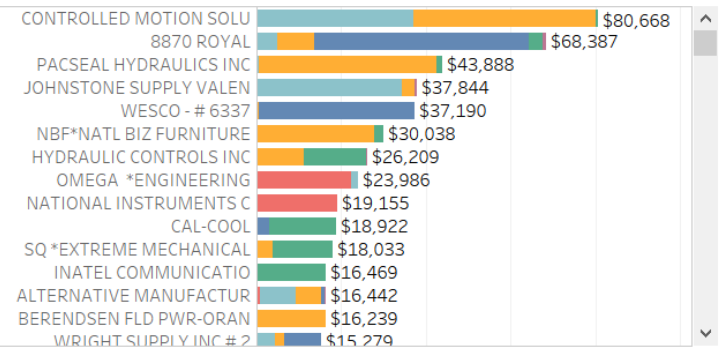
Select An Employee

Employee Names

Spend by Employee Over Time
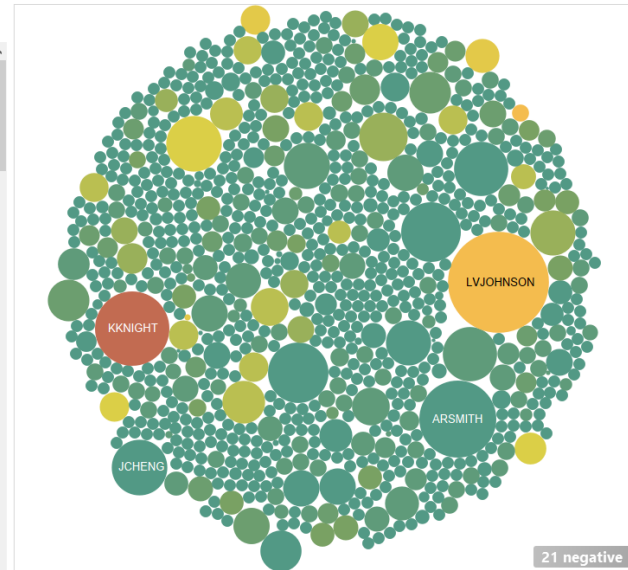*click a point to filter*

Spend by Vendor
click a vendor to filter

Vendor	Amount
CONTROLLED MOTION SOLU	$80,668
8870 ROYAL	$68,387
PACSEAL HYDRAULICS INC	$43,888
JOHNSTONE SUPPLY VALEN	$37,844
WESCO - # 6337	$37,190
NBF*NATL BIZ FURNITURE	$30,038
HYDRAULIC CONTROLS INC	$26,209
OMEGA *ENGINEERING	$23,986
NATIONAL INSTRUMENTS C	$19,155
CAL-COOL	$18,922
SQ *EXTREME MECHANICAL	$18,033
INATEL COMMUNICATIO	$16,469
ALTERNATIVE MANUFACTUR	$16,442
BERENDSEN FLD PWR-ORAN	$16,239
WRIGHT SUPPLY INC # 2	$15,279

Employee Name	Cost Center Name	Report Name	Entry Description	Entry Trans..	Merchant Name	Expense Type	
Grand Total							$1,253,179
Employee Names	Equipment Services	AUGUST EXPENSES	AIR REGULATOR FO..	8/26/2015	ABRASIVE WHSE & EQUIP	EQUIP. MAINT. & REPAIR	$155
			AIR SOLENOID VAL..	8/26/2015	TORNOS TECHNOLOGIES	EQUIP. MAINT. & REPAIR	$887
			AMPHENOL CONNE..	8/11/2015	ALLIED ELECTRONICS INC	EQUIP. MAINT. & REPAIR	$63
			ATC PARTS FOR BI..	8/5/2015	SELWAY MACHINE TOOL-SR	EQUIP. MAINT. & REPAIR	$2,876
			BEARINGS FOR FO..	8/12/2015	UNITED GRINDING	EQUIP. MAINT. & REPAIR	$1,758
			BEARINGS FOR FO..	8/12/2015	UNITED GRINDING	EQUIP. MAINT. & REPAIR	$1,758
			BEARINGS FOR ST..	8/31/2015	UNITED GRINDING	EQUIP. MAINT. & REPAIR	$1,758
			BELTS FOR STUDER..	8/28/2015	UNITED GRINDING	EQUIP. MAINT. & REPAIR	$318
			COOLANT SOLENOI..	8/19/2015	HYDRAULIC CONTROLS INC	EQUIP. MAINT. & REPAIR	$255
			COVER FOR MX-50H	8/26/2015	GOSIGER MACHINE TOOLS	EQUIP. MAINT. & REPAIR	$544
			CREDIR FOR CORE ..	8/26/2015	FANUC FA AMERICA CORP	EQUIP. MAINT. & REPAIR	($1,026)
			FAN FOR JDAM CH..	8/5/2015	JOHNSTONE SUPPLY VALEN	HEATING, VENTILATION, AI..	$192
			FAN MOTOR FOR J..	8/25/2015	INT*WRIGHT SUPPLY INC	HEATING, VENTILATION, AI..	$126

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SAMPLE T&E DASHBOARD

SAMPLE AP DASHBOARD

Top 40 Vendors

Vendor Name	Po Amt Ttl	Invoice Amount	Paid Amount	Discount Offered	Discount Taken	2% Discount
MEDIACOM WORLDWIDE INC	$96,423,413	$88,531,497	$88,531,497	$0	$0	$1,770,630
RR DONNELLEY	$55,766,895	$79,464,920	$79,437,449	$27,471	$27,471	$1,589,298
T ROWE PRICE RETIREMENT PL..		$36,172,907	$36,172,907	$0	$0	$723,458
MOORE COMPANIES, INC	$2,167,312	$18,995,172	$18,995,172	$0	$0	$379,903
JONES LANG LASALLE AMERIC..	$63,667	$18,304,539	$18,304,539	$0	$0	$366,091
GMMB INC	$17,784,059	$15,684,375	$15,684,375	$0	$0	$313,688
HCL AMERICA INC	$2,826,249	$14,964,936	$14,964,936	$0	$0	$299,299
DAVIS GILFORD CONSTRUCTIO..	$5,350,894	$14,477,164	$14,477,164	$0	$0	$289,543
DIAMOND MARKETING SOLUT..	$2,386,532	$14,120,595	$14,120,595	$0	$0	$282,412
MERKLE INC	$35,235,718	$13,539,773	$13,539,773	$0	$0	$270,795
PARADYSZ INC	$9,563,126	$11,320,232	$11,320,232	$0	$0	$226,405
GOOGLE INC	$15,013,781	$11,257,137	$11,257,137	$0	$0	$225,143
ALPINE ACCESS INC		$9,797,843	$9,797,843	$0	$0	$195,957
SHAPIRO AND DUNCAN INC	$4,895,000	$8,627,018	$8,627,018	$0	$0	$172,540
HOWROYD-WRIGHT EMPLOY..		$8,478,513	$8,326,744	$165,293	$151,771	$169,570
FGS-WI LLC	$8,750,989	$8,160,261	$8,160,261	$0	$0	$163,205
R-GA MEDIA GROUP INC	$2,087,425	$7,841,350	$7,841,350	$0	$0	$156,827
DISTRICT OF COLUMBIA GOVE..		$7,820,317	$7,820,317	$0	$0	$156,406
D EXPOSITO & PARTNERS LLC	$8,536,234	$7,445,010	$7,445,010	$0	$0	$148,900
OUTBRAIN INC	$8,046,981	$7,299,336	$7,299,336	$0	$0	$145,987
CIBER INC	$1,039,075	$6,985,839	$6,966,896	$29,522	$18,944	$139,717
HMS HOLDINGS LIMITED PAR..	$24,600	$6,849,600	$6,849,600	$0	$0	$136,992
GREY GLOBAL GROUP	$7,191,106	$6,835,942	$6,835,942	$0	$0	$136,719
THE CONSORTIUM INC	$6,869,966	$6,818,398	$6,748,620	$69,778	$69,779	$136,368
OTIS ELEVATOR COMPANY	$4,944,700	$6,031,089	$6,031,089	$0	$0	$120,622
SIMPLIFIED APPWORKS LLC	$3,396,996	$6,011,400	$6,011,400	$0	$0	$120,228
TENSION ENVELOPE CORPORA..	$4,787,939	$5,634,820	$5,634,820	$0	$0	$112,696
SYPARTNERS LLC	$7,766,054	$5,587,996	$5,587,996	$0	$0	$111,760
TRANSCOM WORLDWIDE NOR..		$5,530,927	$5,530,927	$0	$0	$110,619
INTERNATIONAL BUSINESS M..	$2,918,672	$5,590,771	$5,590,771	$0	$0	$111,815
G&G OUTFITTERS INC	$4,423,410	$5,404,574	$5,404,574	$0	$0	$108,091
COMMERCIAL CARD SOLUTIO..		$5,300,943	$5,300,943	$0	$0	$106,019
DIAMOND GRAPHICS INC	$4,966,513	$5,214,145	$5,214,145	$0	$0	$104,283
360I LLC	$4,737,000	$4,673,838	$4,673,838	$0	$0	$93,477
PRICE MODERN LLC	$1,631,594	$4,612,706	$4,612,706	$0	$0	$92,254
BAC F STREET LLC		$4,368,017	$4,368,017	$0	$0	$87,360
ACUMEN SOLUTIONS INC	$1,138,630	$4,363,080	$4,358,052	$5,028	$5,032	$87,262
SQUARE 407 LIMITED PARTNE..		$4,272,783	$4,272,783	$0	$0	$85,456
FACEBOOK INC	$6,175,000	$4,174,924	$4,174,924	$0	$0	$83,498
AT & T		$4,002,556	$4,002,556	$0	$0	$80,051

Use Slider to Choose the Number of Top Vendors

Total Amount Paid	Total Discount Offered
$510,294,257	$297,093

Total Discount Taken	Total Potential Discount
$272,997	$10,211,345

Map of Vendors

© OpenStreetMap contributors — 74 unknown

Discount Taken? ○ False ✳ True

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SAMPLE AP DASHBOARD

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VULNERABILITY MANAGEMENT

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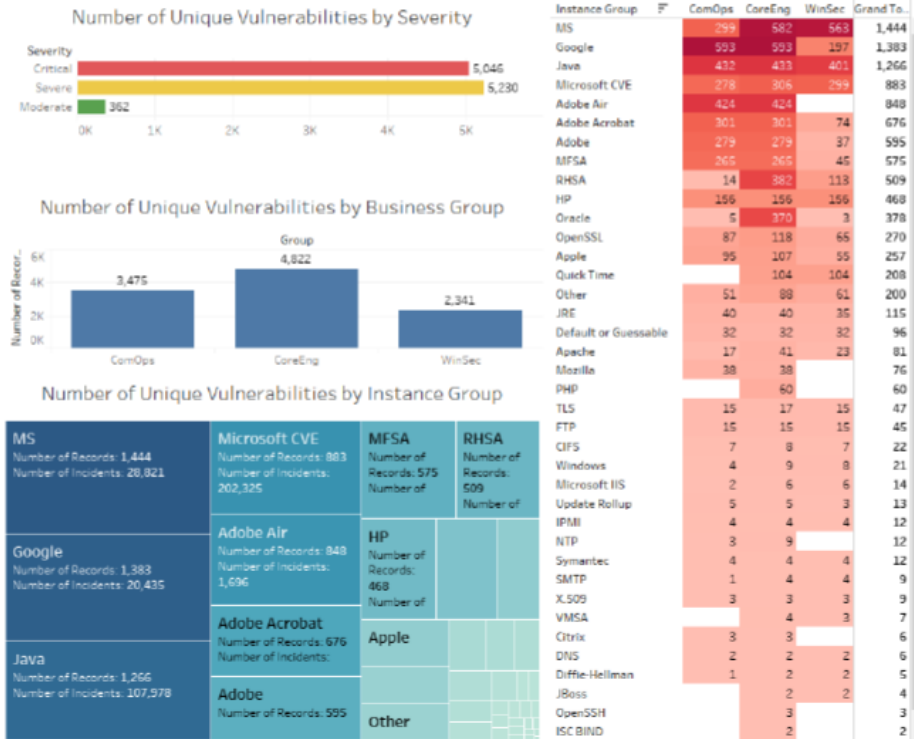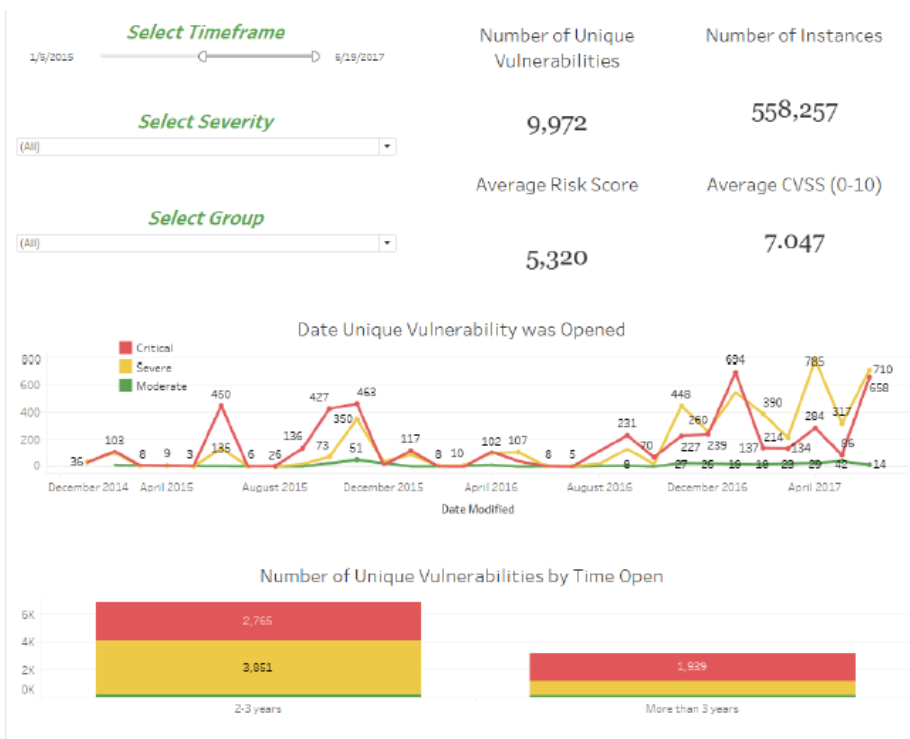
AUDIT MANAGEMENT

Avg. Number of Audit Findings vs Actual Hours
by Risk Category

by Key Enterprise Risks

R1	Capital Availability
R4	Accounting & Financial Reporting
R6	Ethical Behavior (Incl. Anti-Corruption)
R7	Legal / Regulatory
R8	Management Fraud
R9	Third-Party Fraud
R11	Employee Fraud
R12	Privacy
R13	Cyber / Information Security
R14	Health & Safety
R15	System / Process Availability
R17	Business Interruption (Incl. Natural Disaster)
R18	Crisis Management
R19	Sourcing
R22	Infrastructure (IT)
R32	Owner Issues
R35	Technological Innovation

Priority Description
- Med. / Low
- Medium
- Med. / High

Velocity
- Low
- Medium
- High

 # Findings

 # Closed Findings

11

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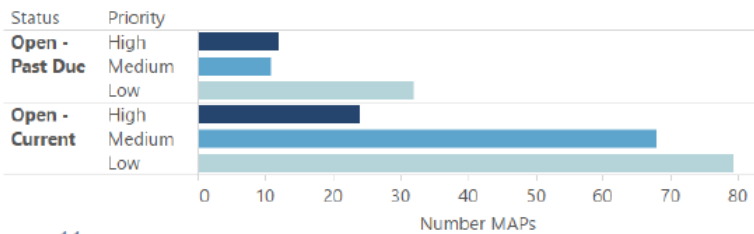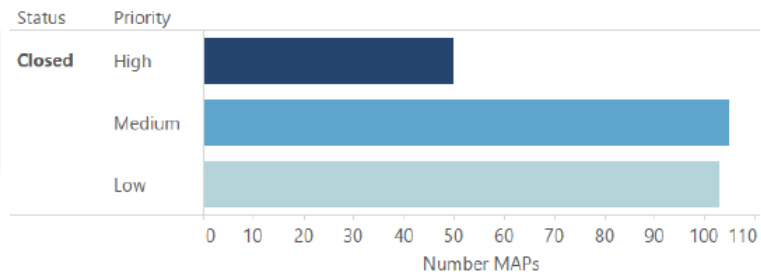
AUDIT MANAGEMENT

Audits & Budgeted Hours

Ref	Project	Avg. Priority Score
A19	IT Policy Review	4.00
A30	Call Center GCR	4.00
A32	Customer Data Flow & Management Review	4.00
A38	Underwriting Policy Compliance	4.00
A18	Pre-Implementation Review - Fin. System 1	3.67
A21	Pre-Implementation Review - Fin. System 2	3.67
A22	Pre-Implementation Review - Fin. System 3	3.67
A23	Pre-Implementation Review - Fin. System 4	3.67
A13	Corporate System / Process Realignment	3.50
A15	T&E Reporting & Continuous Monitoring	3.50
A24	Regional Office GCR	3.50
A26	Technology Innovation - Security Assessment	3.50
A31	Hotel Comps & Revenue Assurance	3.50
A35	Timeshare / Loyalty Program Points Inventory Mgmt	3.50
A36	Architecture & Construction Process Design Assessment	3.50
A6	Action Plan Follow-Up	3.50
A17	IT Service Provider GCR - Vendor 1	3.40
A20	IT Service Provider GCR - Vendor 2	3.40
A27	IT Service Provider GCR - Vendor 3	3.40
A4	Hotel / Resort Audits	3.40
A12	AP DA & Continuous Monitoring	3.33
A16	Network Vulnerability Program Assessment	3.33
A1	Prior Year Carryforward Audits	3.00
A25	Vendor Inventory & Risk Assessment	3.00
A28	Construction Audit - Project #1	3.00
A29	Construction Audit - Project #2	3.00
A33	Marketing Partnerships - Inventory & Risk Assessment	3.00
A34	Gaming Audit Governance	3.00
A37	IFRS Readiness	3.00
A9	Business Continuity Management	3.00
A11	Fraud / Anti-Corruption Risk Assessment	2.75
A2	Financial SOX Compliance	2.75
A3	IT SOX Compliance	2.75
A39	Loyalty Program Reimbursements Process / Controls Ass..	2.75
A5	Investigations / Special Projects	2.75
A8	Hotel / Resort DA & Continuous Monitoring	2.75
A14	SSAE 16, SOC1 Testing & Advisory	2.50

AUDIT MANAGEMENT

Audit Plan to Risk Mapping

Project	Financial		Legal / Compliance						Operational							Strategic	
	Accounting & Financial Reporting	Capital Availability	Employee Fraud	Ethical Behavior (Incl. Anti-Corruption)	Legal / Regulatory	Management Fraud	Privacy	Third-Party Fraud	Business Interruption (Incl. Natural Disaster)	Crisis Management	Cyber / Information Security	Health & Safety	Infrastructure (IT)	Sourcing	System / Process Availability	Owner Issues	Technological Innovation
Action Plan Follow-Up	🟧						🟥		🟧	🟧	🟥				🟥		
AP DA & Continuous Monitoring	🟧													🟧	🟥		
Architecture & Construction Process Desi..	🟧														🟥		
Business Continuity Management									🟧	🟧							
Call Center GCR															🟥		
Construction Audit - Project #1	🟧	🟧															
Construction Audit - Project #2	🟧	🟧															
Corporate System / Process Realignment	🟧														🟥		
Customer Data Flow & Management Revi..							🟥				🟥						
Financial SOX Compliance	🟧		🟧		🟧	🟧											
Fraud / Anti-Corruption Risk Assessment			🟧	🟧		🟧		🟧									
Gaming Audit Governance					🟧												
Hotel / Resort Audits	🟧								🟧	🟧			🟥		🟥		
Hotel / Resort DA & Continuous Monitori..	🟧		🟧			🟧		🟧									
Hotel Comps & Revenue Assurance	🟧														🟥		
IFRS Readiness	🟧																
Investigations / Special Projects			🟧		🟧	🟧		🟧									
IT Policy Review							🟥				🟥				🟥		
IT Service Provider GCR - Vendor 1							🟥	🟥			🟥		🟩		🟥		
IT Service Provider GCR - Vendor 2							🟥	🟥			🟥		🟩		🟥		
IT Service Provider GCR - Vendor 3							🟥	🟥			🟥		🟩		🟥		
IT SOX Compliance	🟧		🟧		🟧	🟧											
Loyalty Program Reimbursements Process..	🟧		🟧			🟧		🟧									
Marketing Partnerships - Inventory & Ris..	🟧							🟧									
Network Vulnerability Program Assessme..							🟥				🟥		🟩				
Pre-Implementation Review - Fin. System ..	🟧										🟥				🟥		
Pre-Implementation Review - Fin. System ..	🟧										🟥				🟥		
Pre-Implementation Review - Fin. System ..	🟧										🟥				🟥		
Pre-Implementation Review - Fin. System ..	🟧										🟥				🟥		
Prior Year Carryforward Audits	🟧												🟩		🟥		
Regional Office GCR	🟧														🟥		
SSAE 16, SOC1 Testing & Advisory	🟧															🟩	
T&E Reporting & Continuous Monitoring	🟧														🟥		
Technology Innovation - Security Assess..							🟥				🟥				🟥		🟩
Timeshare / Loyalty Program Points Inven..	🟧														🟥		
Underwriting Policy Compliance															🟥		
Vendor Inventory & Risk Assessment														🟧			

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QUESTIONS?

Data Analytics in Internal Audit

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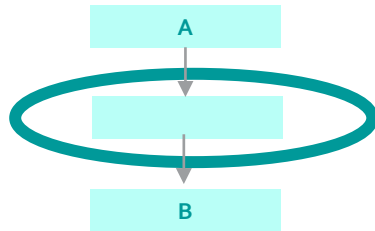
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PROCESS MINING

The Push Toward Advanced Analytics

STOP INEFFICIENCIES

Run your business in a more efficient way, and spot deviations which may represent non-compliance to policy or process…

How things should be

"business as designed"

simple, standardized, fast
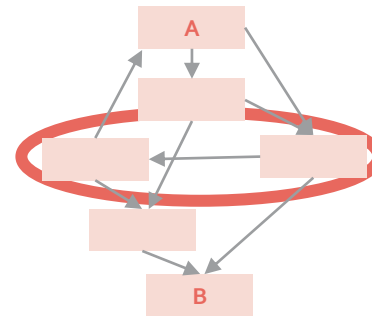
How things really are

"Day-to-day" reality

complex, inefficient, slow

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QUESTIONS FOR EXECUTIVES AND AUDITORS

When choosing a process optimization approach, some useful questions to ask are…

How do we detect and resolve harmful **bottlenecks**, costly **inefficiencies** and **compliance** issues?

How **fast** do we get **insight** into our processes?

Have process owners paid close attention to whether the organization's **control environment is functioning effectively?**

Do we know the root causes well enough to **tackle the issues successfully?**

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WHAT IS PROCESS MINING?

Process Mining uses AI and machine learning to extract existing data from an organization's systems to visually reconstruct how processes actually perform. The data shows what is **actually** happening and creates a **complete** process map.

Process mining is a process management technique that supports the analysis of business processes.

Process mining can analyze your process **from an end-to-end perspective.**

You do not need to have a process map to analyze the process flow – **Process Mining uses historical data from your IT systems.**

Your IT system currently records all steps of your process in execution. With process mining, you get a process map based on that data.

This way, **your real process** and actual business rules can be discovered automatically.

Organizations

Logging of Events

IT Systems

Process Mining

Actual Process Map

1 → 2 → 3

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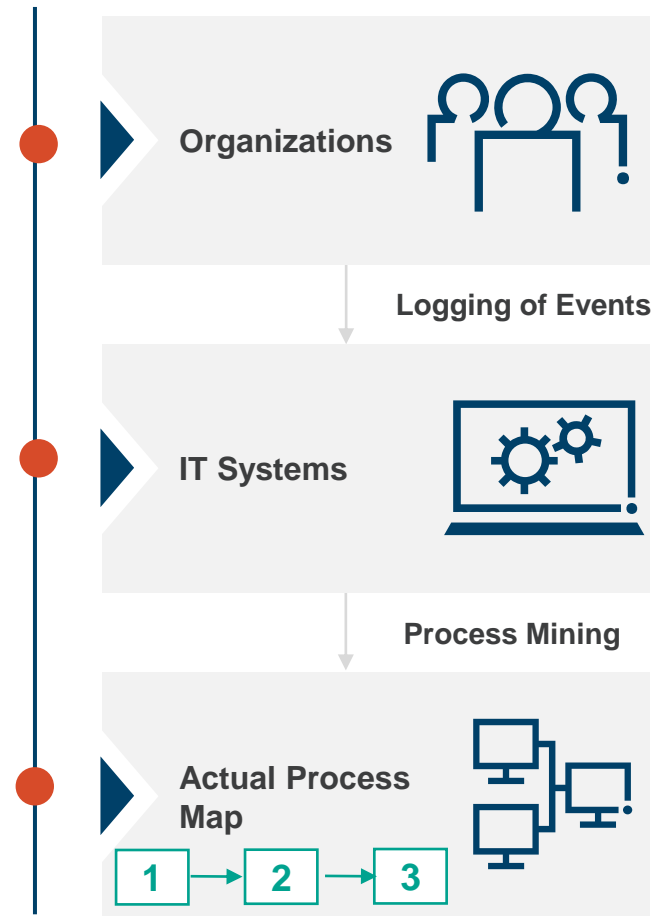
HOW DOES PROCESS MINING WORK?

> Think of process mining as an x-ray machine for your processes, using the data captured by systems to show you what is actually happening, how transactions are actually being processed.

Activity

- Invoice
- Volume
- Purchase Order
- FX rate
- Vendor
- Postings
- Costs
- Contracts
- Etc.

Key Data Elements

- Activity
- Activity ID
- Time Stamp
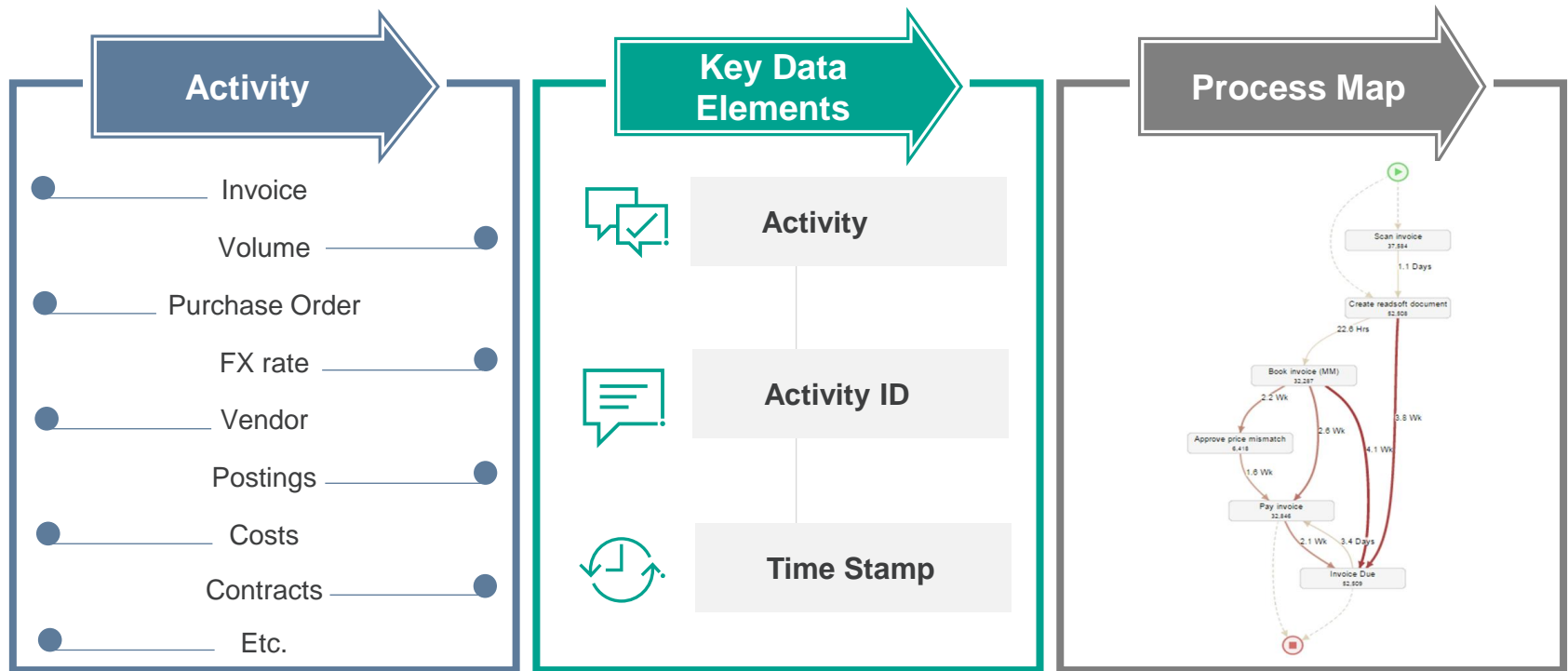
Process Map

IT-based work
Every task supported by IT systems like SAP

Digital Footprints
Process Mining reconstructs digital workflow traces

Full Transparency
Actual process flows are visualized in near real time

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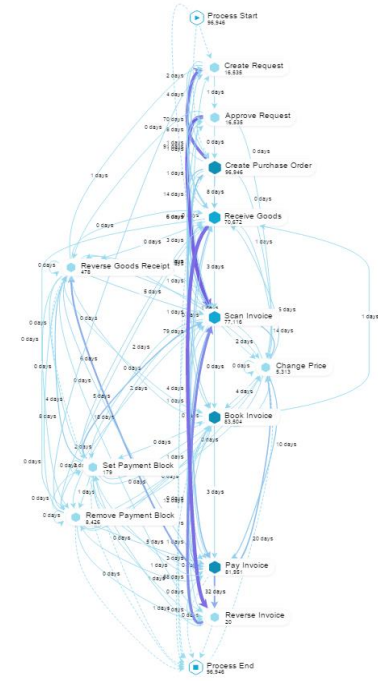# THE REAL PROCESS…

See the happy paths
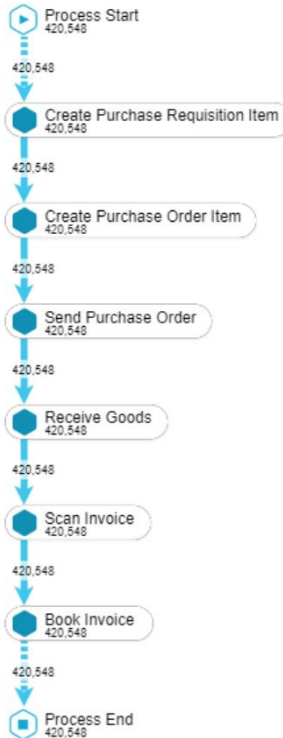
See the core process flow.

Explore deviations
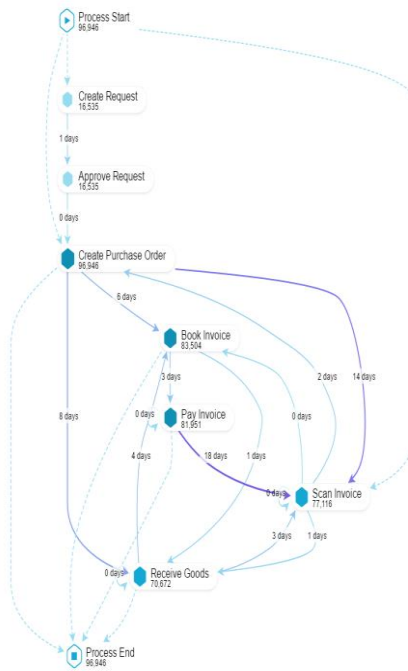
Reveal less common paths and activities. ID non-compliance, and inefficiency

Get the full picture

Data coverage of 100%. Full process transparency.

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PROCESS MINING POLL QUESTION #1

Are you utilizing process mining within Internal Audit? (a. Currently using, b. On our roadmap, c. No current plans to use)
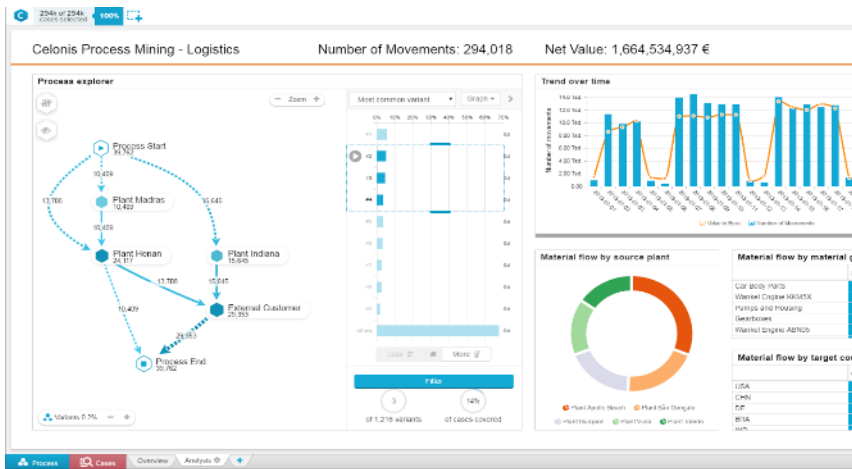
A Currently using

B On our roadmap

C No current plans to use

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WHY PROCESS MINING FOR INTERNAL AUDIT?

Process mining tools can fundamentally change the way that we analyze processes and perform audits.

- **Automate the walkthrough process** – replace interviews with advanced analytics and review process based on 100% populations.

- **Data tells us what is *actually happening*** – automatically identify process variants and complexities, identifying areas that do not comply with intended process design.

- **Support risk assessment** activities – identify "hot spot" areas, drive audit focus

- **Make findings more impactful** by quantifying the impact of non-conformance and benefits of adherence to consistent process.

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FIVE KEY BUSINESS BENEFITS OF PROCESS MINING

Higher quality, with more accurate and valuable results

Reduce cost and variation, become more lean

Find more effective ways to reduce enterprise wide costs without compromising internal controls.

Reduce processing time

Reduce the amount of time spent on routine transaction processing, focusing more on value-add business analysis.

Improve quality and stability

By comparing processes beyond KPIs, and maintain stability when non-routine situations arise.

Be in control and know what is going on

Give ongoing assurance that the organization is in full compliance with complex regulatory requirements and internal controls and policies.

Deeper and faster insights

Provide more insightful, timely information for decision-making in an environment where the volume of data is vast and ever changing.

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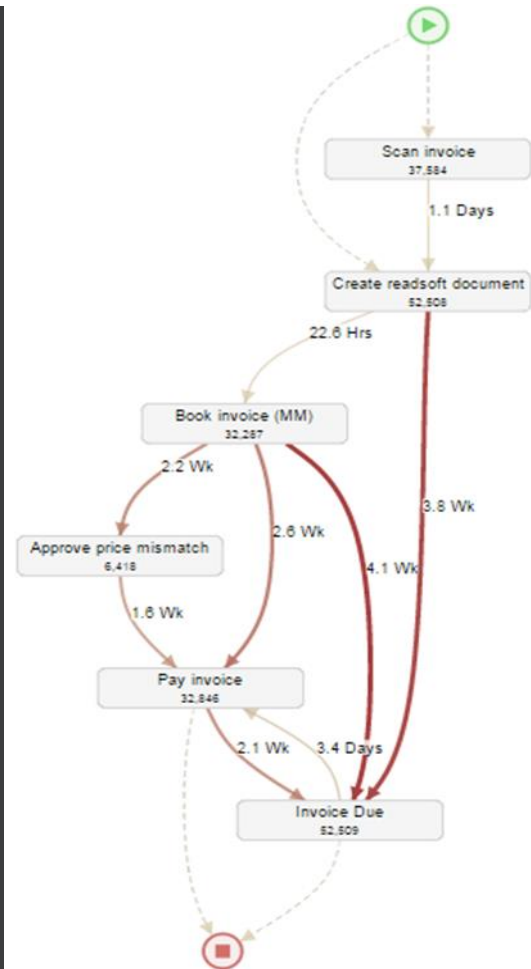
PROCESS MINING USE CASES

Use Cases

- Digitalization
- Process Documentation
- One ERP Harmonization
- Post-Merger Integration

Operational Excellence

- Process excellence is key for best-in-class performance of any customer
- Celonis Process Mining enables projects with full transparency of all processes to quantify inefficiencies
- Continuous tracking and monitoring ensures long-term impact

Internal Audit

- Point by point manual audit of processes risks undetected compliance and fraud issues
- Celonis Process Mining identifies i.a. missing approvals, duplicate payments and maverick buying
- Celonis ensures and monitors segregation of duties and IKS controls

Shared Services

- SSOs have high transaction volumes and are typically very cost sensitive
- They are an ideal target for process standardization and optimization
- With Celonis Process Mining, SSOs continuously monitor global process conformance and efficiency

S4 Hana Migration

- The transition to a S4 HANA system requires profound knowledge of processes and user behavior
- Celonis Process Mining highlights differences and gaps among systems
- This ensures the optimal blueprint for the new ERP system rollout and reduces migration efforts

Robotic Process Automation

- RPA is capable of reducing process costs and increasing competitiveness
- Celonis Process Mining helps to identify weak points in the processes that should be addressed with RPA
- Celonis allows to monitor RPA projects and verifies their cost savings and ROI

Business Process Due Diligence

- Know your client's characteristics is essential prior to moving processes to outsourced environments
- Quality and depth of the due diligence phase is significantly increased, providing fact-based decision criteria that help with sizing and committing towards the client

Process

- Procurement
- Sales
- Accounting
- Logistics
- Production
- IT Service
- Finance
- HR
- Quality

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PROCESS MINING POLL QUESTION #2

Are you aware of process mining's use elsewhere in your organization?
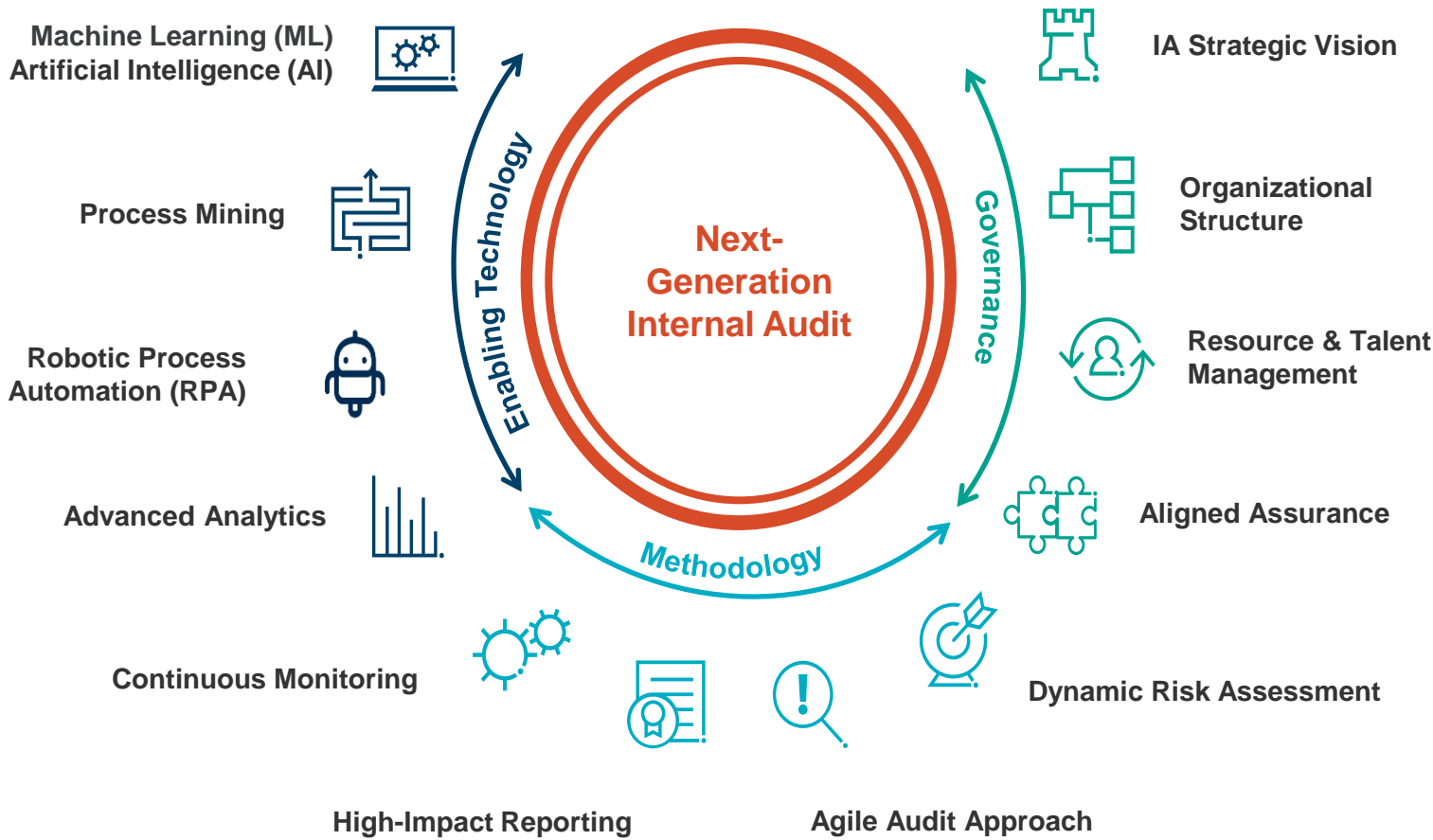
A   Yes

B   No

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PROCESS MINING POLL QUESTION #3

Where do you see the main benefits of process mining in your organization?

A Finance

B Operations

C IT

D Sales & Marketing

E Other

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RECAP

OUR VISION FOR NEXT-GENERATION INTERNAL AUDITING

Machine Learning (ML) Artificial Intelligence (AI)

Process Mining

Robotic Process Automation (RPA)

Advanced Analytics

Continuous Monitoring

High-Impact Reporting

Enabling Technology

Methodology

Next-Generation Internal Audit

Governance

IA Strategic Vision

Organizational Structure

Resource & Talent Management

Aligned Assurance

Dynamic Risk Assessment

Agile Audit Approach

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THE GAME PLAN

Key Success Factors

- Seek quick wins
- Empower your people to innovate
- Establish an agile mindset and integrate adaptability into the design
  - "Have a strong plan, held loosely"
- See the forest

Internal audit functions will soon look and operate very differently than they do today. As the current pace of innovation accelerates, the current challenges internal audit functions confront while delivering on their core mission will only intensify.

By choosing to disrupt their functions proactively rather than waiting passively to be disrupted, future-minded CAEs will boldly take their functions to new frontiers of performance.

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QUESTIONS?

Process Mining

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