Automated Analytics

How to improve audit performance

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Analytics Automation: Enabling More Powerful and Sustainable Audit Analytics

Challenges

Analytics have gained strong adoption and acceptance within the audit community. What is less accepted is the automation of analytics. Automation of analytics (aka continuous auditing or monitoring, continuous risk assessment) is recognized for its potential value, but there continue to be unfulfilled expectations.

CAE's have numerous questions about this field:

- **Choices:** What are the options?
- **Implementation:** How do we successfully implement automation?
- **Maintenance:** What are the requirements for maintaining automation?
- **Technology:** How do we manage the rapid pace of technological change in this area?
- **Team:** What capabilities are lacking in our team and how do we bring them up to speed?
- **Resources:** How do we ensure continuity in an era of rapid staff turnover?
- **Management:** How do we cope with rapid organizational change that might affect management support for automation?

What is meant by the term automation in the context of analytics can vary. For the purpose of this paper, automated analytics includes those that are scheduled to run on a recurring basis.

Automation gives audit departments an opportunity to "bake" both internal and external subject matter expertise into their analytics, offering a number of key benefits:

- Analytics can now be used in a broader and more consistent way
- The team can reuse and repurpose by drawing from a repository of analytics successes
- Continued development of expertise in the analytic will reduce the vulnerability caused by turnover

Dr. Sam Gallaher from the City of Denver sees automated analytics as a growing field for audit. "At the city we use automated analytics for both finding new ways

Automation gives audit departments an opportunity to "bake" both internal and external subject matter expertise into their analytics, offering a number of key benefits.

to identify risk and also new ways to achieve effective controls tests."

"We may look at p-card purchases made at merchants (MCC codes) that are not typical or purchases made at different times a day. There are often very good reasons for all of those anomalies, but they are riskier. So, while this is not a control test, we might consider that type of repeatable or automated analysis as a way to apply risk profiles of p-card users."

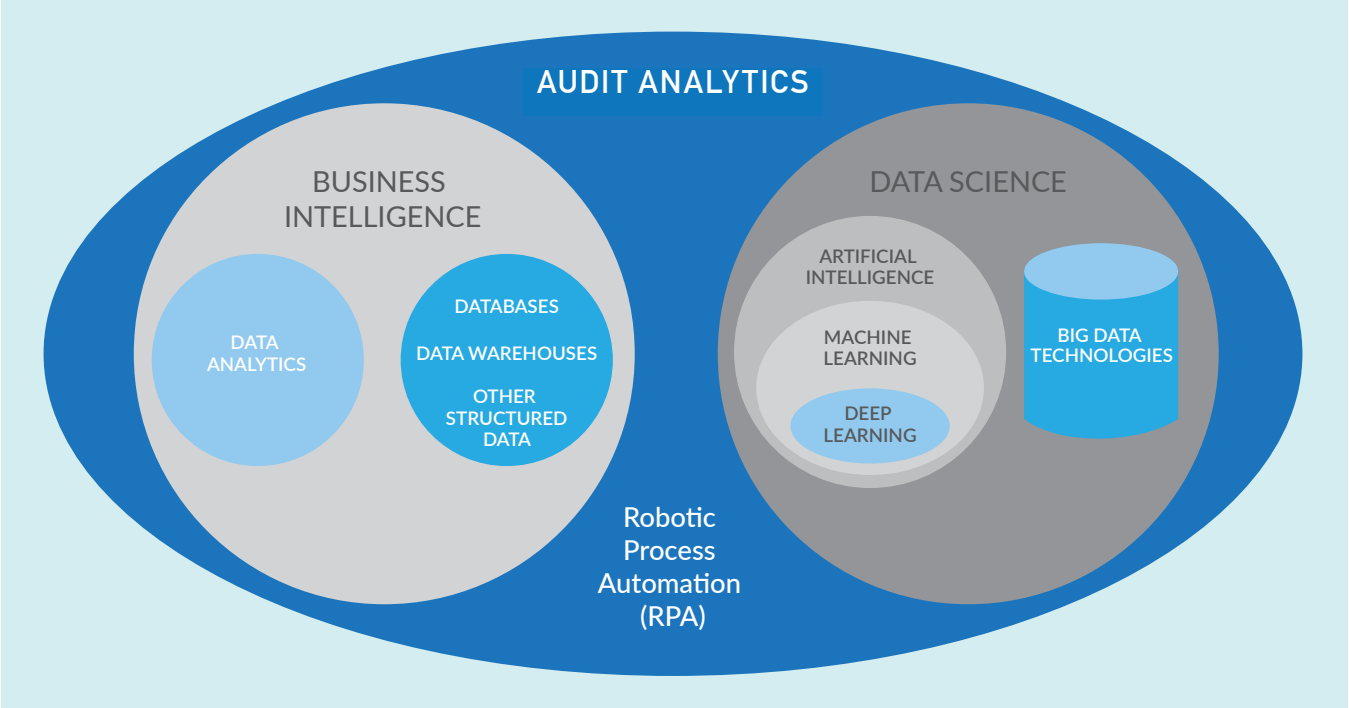
"A good example of an automated controls test is within our tax system. If there is a tax amount that is not collectible, it can be requested to be written off. The city has a rule that says the person requesting the write-off cannot be the same person that accepts the write-off."

"We were able to show through our analysis there was a time period where the same person was requesting and approving the write-off. The recommendation was made by audit to segregate those duties. By looking at the two fields containing the requestor and approver, we created a simple control test that we can now automate and just have that running to make sure that SOD control continues to be in place. I would say that we probably do a 60/40 split on risk assessment versus control testing in our automated analysis. We continue to build our portfolio of automated analytics for controls testing and risk assessment."

The field of audit is seeing a growing convergence of the technologies used by the analyst and data scientist. For example, artificial intelligence and machine learning (technologies of the data scientist) are opening up new possibilities within audit analytics. For some, it is also creating some confusion or unrealistic expectations about the role these technologies can play within audit analytics.

Technology landscape that supports automated audit analytics

It is important to give context to the various technologies that support automation of audit analytics.



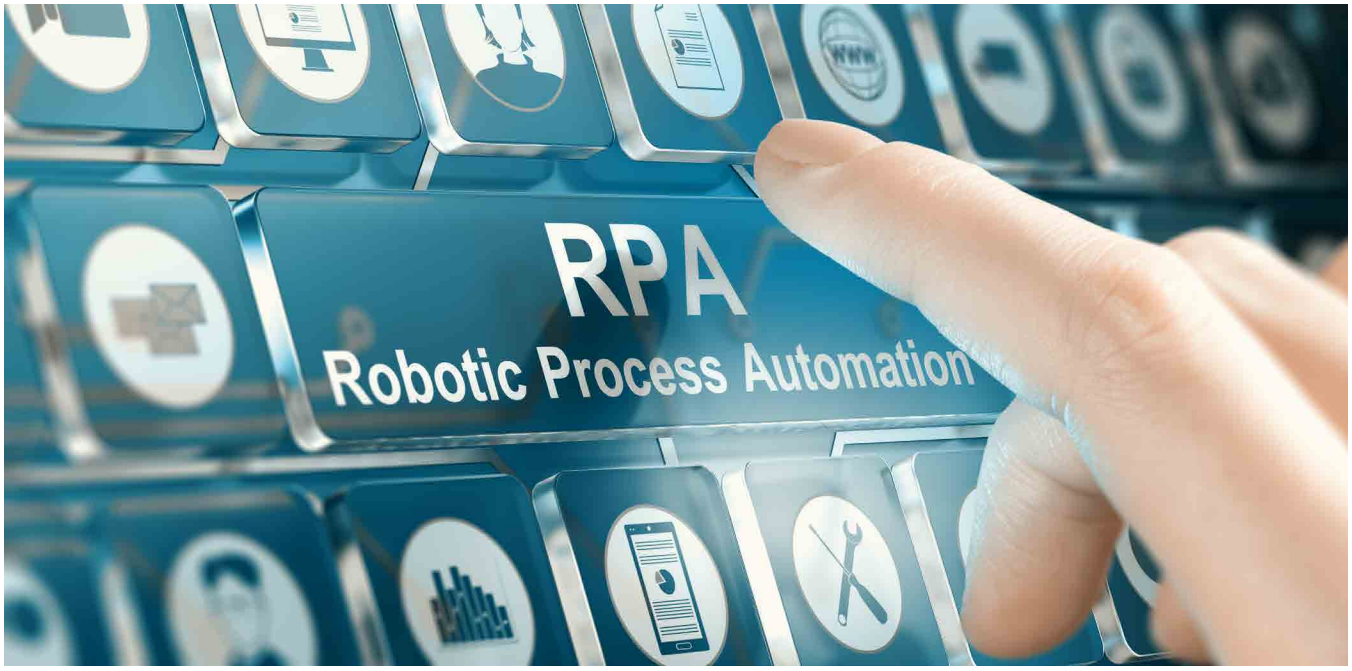
Audit analysts are familiar with the standard business intelligence tools available to their profession. Software such as Arbutus™, Galvanize™, IDEA™ and others were designed with auditors in mind. Other tools such as SQL, Python, R, SAS and Toad are in widespread use as well.

Emerging technologies in the realm of data science are beginning to interest audit analysts, yet there is some clarity needed in the terminology.

- **Artificial Intelligence (AI)** relates to the practice of embedding of human thought processes in computer-driven procedures.
- **Machine learning** is a subset of AI that leverages algorithms to identify complex data relationships. These algorithms are capable of autonomous learning. Most types of machine learning rely on structured data. For example, such a system could be presented with multiple photos of cows and elephants that are clearly labelled. It would "learn" how to distinguish the two animals based on the cumulative intelligence derived by viewing the labelled photos.
- **Deep learning** is a class of machine learning algorithms focused specifically

on building "deep" (multi-layered) neural networks, a form of AI widely used in fraud detection. This is a very powerful type of machine learning that can process unstructured data. The neural network layers would collectively process and identify the unlabeled photos of the cows and elephants based on multiple identifying features at each level. This more closely mimics the way human brains operate.

- **Robotic Process Automation (RPA)** is an emerging form of business process automation technology based on the notion of metaphorical software robots or artificial intelligence (AI) workers. RPA is most frequently deployed to automate repetitive tasks, such as performing complex calculations, moving data, and triggering dependent activities.



Examples of Solution Providers

- Robotic Process Automation (RPA) (Automation Anywhere™, UiPath™)
- General Analytics (Alteryx™ Server, Trifacta™ Enterprise)
- Audit Analytics (Arbutus™ – Enterprise Edition, Galvanize™ AX, Caseware IDEA™)
- Exception Management (Arbutus™ Exception Manager, Caseware™ Monitor, Highbond™)
- Specialized query languages (SQL, R, Python)
- Artificial Intelligence/Machine Learning (Mindbridge™, OSP Labs™)

In addition to the technology landscape, it is critical to understand the skills and experience that are needed to set up and maintain automated analytics.

Skills and experience needed for automation

- Project Management
- Data Acquisition and Manipulation
- Analytics / Data Science
- Visual Reporting Techniques
- Communication
- Audit/Business Process Domain Expertise
- Change Management

Audit teams should identify what resources they have and where gaps exist. Next, they should determine if the resources will be filled from inside the department, outside department or outside the organization. Ideally the plan for sourcing resources should be a structured, documented process.

Dr. Gallaher shared, "As I showed management a timeline and plan of what could be accomplished with analytics, they recognized that we needed a team, not just one person. We currently maintain a group of three to four people. Even as we have people promote out of our group or take on different jobs, we are able to maintain continuity with a core group.

"Another thing we do, as other people get interested in learning more about data analytics, we will tie them to the group for a shorter period of time to do some one-off projects to gain skills and experience."

While the list of skills for successful automation is well established, where the skills come from has much more flexibility:

- Fully outsourced, which can include professional services firms and/or technology providers
- Fully in-sourced (within the department or within the broader organization)
- Varying combinations of insourced and outsourced

As I showed management a timeline and plan of what could be accomplished with analytics, they recognized that we needed a team, not just one person.

- Dr. Sam Gallaher from the City of Denver

The integration process

Automating analytics changes the game plan for previously restricted audit teams. The focus of continuous analytics is set by the audit team after determining the high-risk, high-priority areas of the business. Once key risks and controls are identified and tested, audit teams can monitor these risks and controls long-term to make sure the risks are effectively managed and mitigated.

Finally, audit departments can evaluate and substantiate what they've seen and create an ongoing monitoring solution to periodically assess the identified risk or control. Over time, audit teams can track those risks and if they end up spiking, these risks become an input into future assessments. If set up properly, today's follow-up monitoring control can inform tomorrow's risk assessment.

Technological building blocks to automation include:

- Pre-built apps/scripts
- Specific connectors to data sources
- Development helpers, such as visual scripting, auto-create apps from results, and specialized commands

As part of the automation ramp-up process, audit teams can establish continuous testing on areas that may not be high-risk or high-priority but instead allow for easy "wins." In such cases, access to the data is relatively straightforward and the analytic lends itself well to being executed continually. The implementation team needs to ensure that the easy win(s) don't reduce the momentum for pursuing the

As part of the automation ramp-up process, audit teams can establish continuous testing on areas that may not be high-risk or high-priority but instead allow for easy "wins."

more challenging but ultimately more material testing.

The key elements to sustaining automated analytics are as follows:

- Management support for resources and planning
- Dashboard/visualizations. Audit teams that present data analytics results via dashboards achieve more management support. Organizations recognize both the real and perceived value of compelling dashboards as the face of automated analytics.
- Automation platform should be straightforward to implement and maintain
- User interface that has good user adoption
- Performance of analytics on large data sets
- Reliability of the technology
- Training
- Comprehensive documentation

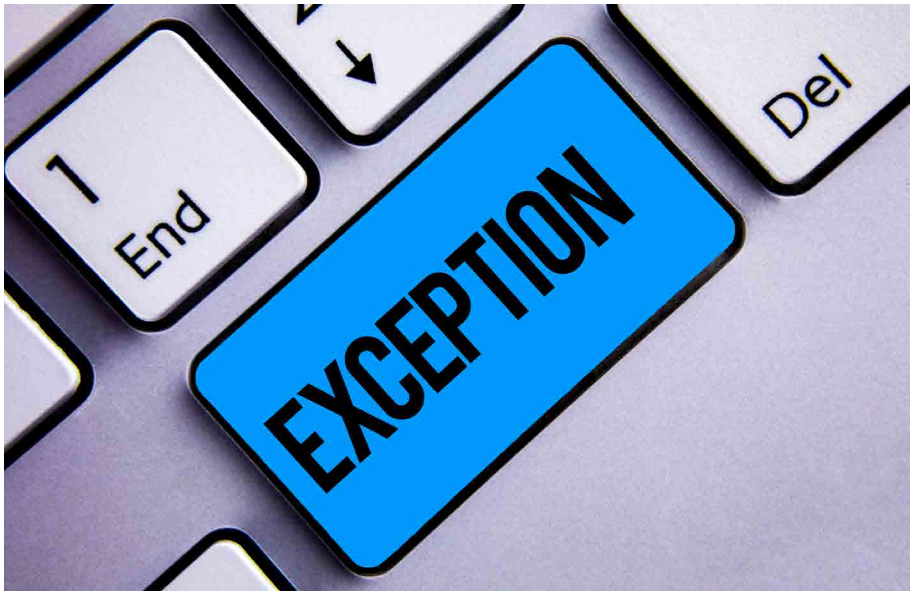
Conclusion

Audit as a profession has relegated automated analytics to a silo for too long, limiting its scope. Audit of the future has analytics constantly assessing risks and controls. These analytics will speak for themselves: they will tell a story, update dashboards, mitigate risks, and manage exception remediation. With clear focus and management support for analytics in more areas of the audit plan, CAEs will make better decisions with resources and achieve better quality results in a timely and efficient manner.

Automated Analytics: Integrating Exception Management

Exception management is an established discipline to centrally monitor and manage business-critical exceptions. As audit teams progress toward automated/continuous analytics testing, they will need a more integrated, systematic approach to managing exceptions. This need stems from the expectation that automated analytics will produce an increase in actionable findings and therefore will require more powerful and efficient ways to manage those exceptions.

There is growing acceptance of the perceived value of adopting an exception management system (EMS). However, realizing the value of such systems has proven to be more challenging than many audit teams expected. This paper is intended to provide ideas and insights regarding the deployment and use of an exception management system.



EMS Features and Benefits

In the early days of audit automation, organizations typically built ad-hoc systems to manage exceptions. These "homemade" systems were capable of managing the relatively small number of exceptions that were detected. However, as more powerful analytic tools came onto the market, the weaknesses of the ad-hoc systems with regard to the volume of exceptions became painfully evident.

Today, Audit focused automated EM solutions continue to improve and gain acceptance. The more robust tools share the following capabilities:

- Real-time access to all aspects of audits, including status, findings, and remediation
- Structured workflows for identifying open items, sending follow-up emails, documenting status, and other critical steps
- Stakeholder reporting capability
- Tools to manage staff resources tasked with resolving exceptions
- High-volume data capacity

As with automated analytics, the automation of exception management allows an audit team to "punch above its weight". Some of the benefits are:

- Greater efficiency in addressing increased numbers of detected exceptions
- Greater visibility through reporting and dashboard outputs
- Effective root cause analysis—a powerful but underused benefit of exception management
- Vendor-provided user support and customization

Skill Requirements

It is critical to identify what skills and experience are available internally and what skills may be needed from outside the organization.

Implementation	**Adoption/Sustainability**
• Project management • Change management • Communication	• Ownership • Dashboard design • Communication • Data security management

Implementation

The deployment of automated analytics increases the coverage and cadence of audit testing and potentially creates a large number of exception items that the auditor or process owner would need to investigate. The prospect of reviewing a large number of anomalies, some of which could be insignificant, immaterial, or false positives, could slow the move toward the adoption of an exception management system.

Implementation Challenges	User Adoption/Sustainability Challenges
• Change management • Poor training • Improperly defined processes • Lack of formal oversight • Insufficient technical flexibility	• Challenging to use • Insufficient training • Weak management enforcement • Ineffective workload management • Non-intuitive user interface • System rigidity • Lack of business process owner buy-in

As part of the implementation process, the audit team should solicit input from the rest of the organization. The audit team and stakeholders need to address the following:

- **Tracking**: How outstanding exceptions and then management actions will be tracked.
- **Reporting:** How resolution will be reported and validated.
- **Follow-up:** What further action will be required. High-risk areas may call for more internal audit resources and focus.

Internal auditors should establish a follow-up process to either implement recommendations or clearly articulate the risks of not taking action.

Managing the Exceptions

The analytics will generate exceptions that can be automatically delivered into the exception management system, triggering the structured remediation workflow that links all appropriate stakeholders.

While the system tracks each event, it is essential to have an automated, closed-loop process for capturing information about the corrective actions and for assuring that these actions resolve the underlying issue.

The methodology that defines how exceptions are evaluated and managed thus becomes critical for credibility with the auditee. The handling of exceptions often starts as an iterative process between the auditors and the process owners.

Remediation

Internal auditors should establish a follow-up process to either implement recommendations or clearly articulate the risks of not taking action.

To facilitate the follow-up, an internal audit unit maintains a database on the status

of outstanding audit findings in the EMS. The EMS tracks identifying information about each audit report and close-out letter as well as a summary of each finding, the role responsible for corrective action, and the estimated completion date for said action.

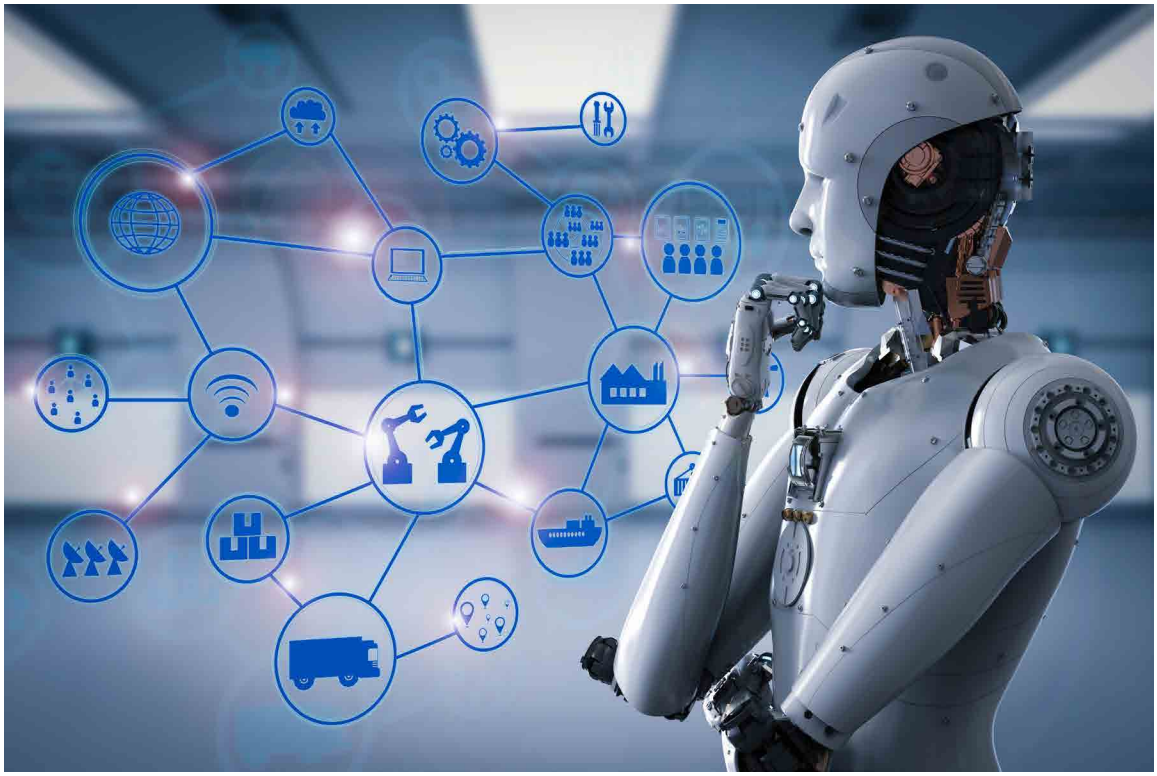
Automated alerts remind the responsible manager of tasks to be completed, including updating the status in the system.

Scheduled reminders prompt the auditor to contact the operational owner and other involved parties to monitor progress and determine if further testing is required. Where needed, internal audit management can review significant actions and determine if there is sufficient evidence to support the closure. The auditor can use the exception management system to flag the time needed to re-test actions as needed.

Monitoring action plans may be integrated into wider performance reporting. In this approach, management also takes responsibility for the related reporting, up to and including reporting to the audit committee. The report highlights whether recommendations are pending, in progress, or complete in the form of a dashboard for senior management and committee use.

As the use of automated analytics widens, there are also benefits to having management view the exception management and remediation results within a dashboard. These dashboards can comprise a summary of numbers of control points and transactions examined, the number and severity of exceptions identified, and the resolution status.

While evaluations of individual exceptions and control failures are important, organizations should also aggregate audit evidence and remediation efforts in order to develop the big picture of the organization's current risk exposure. The resulting dashboard can provide a real-time aggregate view of company-wide control issues to support deeper root cause analysis.



Conclusion

A well-built, vendor-supported EMS can greatly enhance the quality and efficiency of an audit team. Take stock of your needs and internal skills to ensure a good match before you make your purchase decision. Solicit feedback from all stakeholders to drive acceptance.

Automated Analytics and Enhanced Root Cause Analysis

Root Cause Analysis (RCA) is a structured, problem-solving methodology that helps identify the underlying factors or causes of undesired or unexpected outcomes. There are many types of root cause methodologies in use, such as "5 Why's" and the Fishbone diagram. Root cause analysis is becoming more widely adopted within the audit function to improve the quality of remediation activities and recommendations.

This paper will discuss how to derive more value from exception management systems in support of better-quality root cause analysis through the application of automated analytics.

Background

The International Forum of Independent Audit regulators states:

> "(We) view robust Root Cause Analysis and implementation of responsive actions to be fundamental to improving audit quality. It is critical that firms have processes in place that enable a timely, thorough assessment to identify recurring root cause issues—whether positive or negative—and to take appropriate actions."

Root cause analysis in audit is typically performed on a data set that is limited to specific time periods. Root causes are identified and remediations are developed in an iterative process involving the auditors and the clients. Additional data is generated in the form of emails and other text communication between the parties.

Currently for most audit teams this exception management process is heavily dependent on prompt, substantive responses to emails and on the use of spreadsheets to share exception information. This open-loop process is unstructured and can lead to items that are not followed up in a timely and comprehensive manner. It relies on the parties remembering to search for and respond to emails; they may also mistakenly rely on outdated exception spreadsheets. Clearly, this is a high-risk process.

An email notification with a spreadsheet attachment will usually become the process because of the apparent simplicity and flexibility.

What may also be overlooked are long-term trends in exceptions that span multiple periods. Additionally, the communications may contain valuable information that

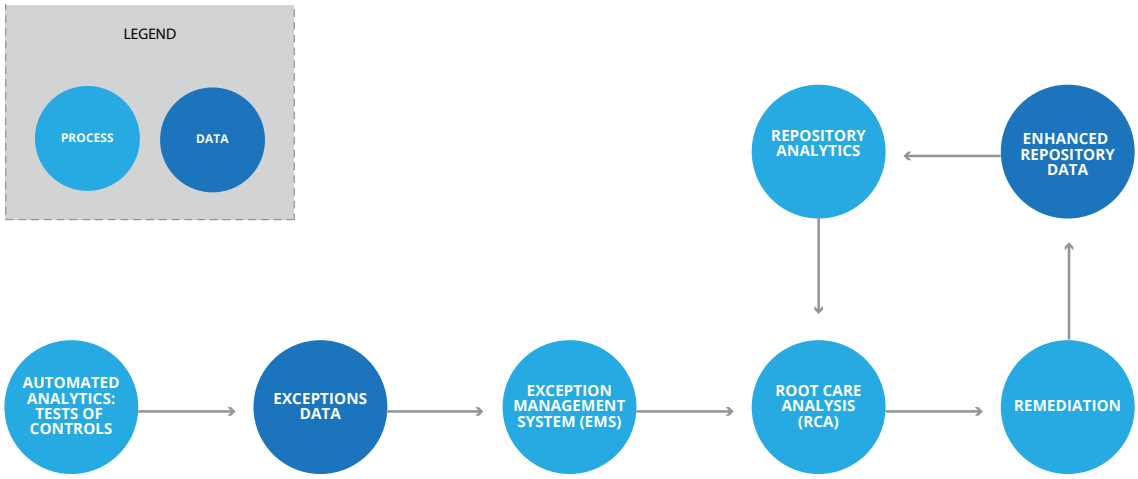
An email notification with a spreadsheet attachment will usually become the process because of the apparent simplicity and flexibility.

contributes to a better understanding of the business processes, the associated controls, and pertinent feedback from the business.

Unlocking the value of this data to enhance root cause analysis

This can be achieved by creating and maintaining a repository in the exception management system that includes historical exceptions and the auditors' notes. In addition to enforcing discipline through automated reminders, having only one instance of the exception data will drive efficiency and coverage.

Furthermore, as the historical data accumulates over time, automated analytics will re-process the data to search for patterns that indicate root causes that had not previously come to light. These new root causes may have been masked in the past by short-term trends or by the lack of sufficient supporting data.



Example: Terminated Employees

Risk - Terminated users' accounts not disabled or removed in a timely manner could expose them to unauthorized use.

Control Description - System access for terminated employees is removed in a timely manner.

Control Objective - Ensure all terminated users' accounts are disabled/removed in a timely manner.

For testing purposes, four business days was established as the policy for timeliness.

During the month of January, 100% of terminated accounts were analyzed as part

of a scheduled, automated analytics controls test. Eight exceptions were found and three were removed from the system within a five to nine day period. Five were 10 days or longer.

[Exception produced by automated controls test based on an established threshold of 4 business days]

Why #1 Why have these terminated employees not been removed from the system in a timely manner?

IT Help Desk failed to read the automatic email notification.

[Exception Reason code – 'IT resource shortage' tagged in EM upon resolution closed by a process owner) (Root Cause: Technology/People)

Why #2 Why wasn't IT timely?

HR did not enter the termination date in the system when notified by LOB manager.

[Exception Reason code – 'Delayed/Nonentry in HR system' tagged in EM upon resolution closed by process owner] (Root Cause: People)

Why #3 Why was the termination date not entered in the system by HR?

HR was notified of termination by phone, not processed by HR (employee forgot to enter termination date in the system)

[Exception Reason code – 'HR not following procedures' tagged in EM upon resolution closed by process owner] (Root Cause: People/Process)

Why #4 Why was the notification done by phone?

The LOB manager was away from the office on vacation and there was no requirement in HR checklist for notification method.

[Exception Reason code – 'LOB not following procedures' tagged in EM upon resolution closed by process owner] (Root Cause: People/Process)

Root Causes

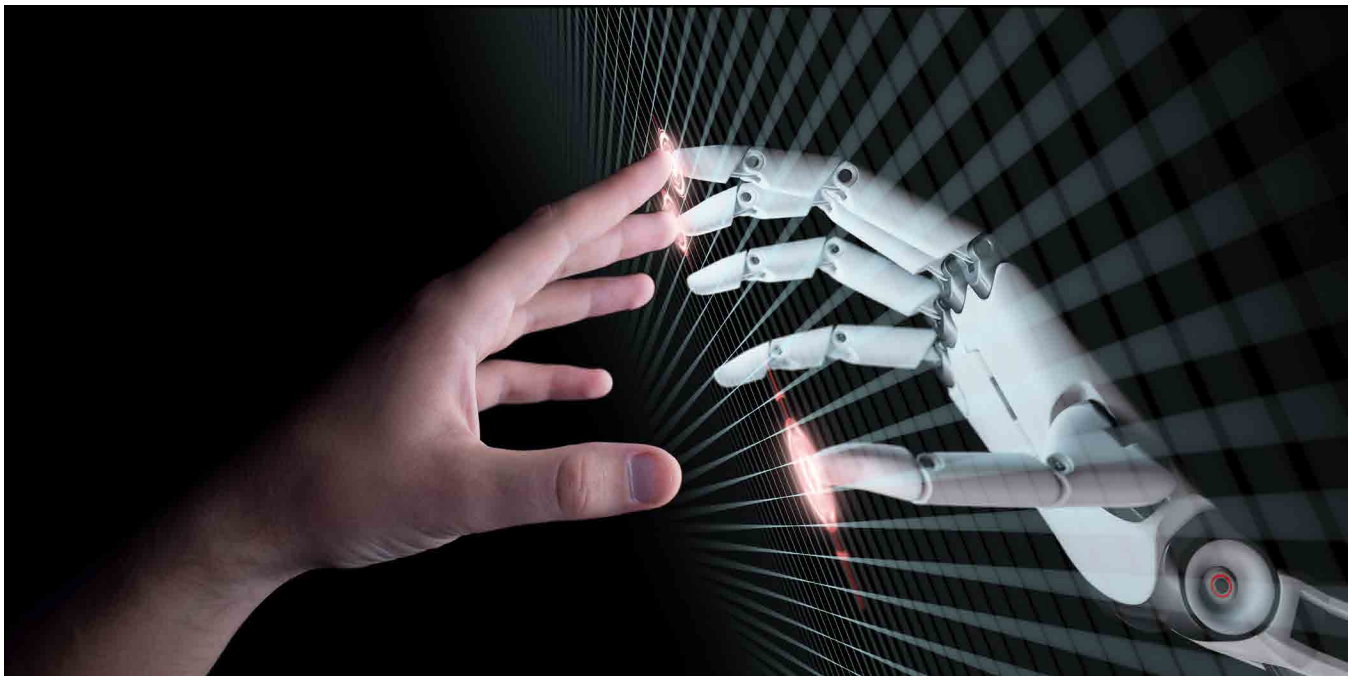
People: The LOB manager can notify via phone but also must follow the process. HR did not provide a termination checklist that specified email notification.

Process: HR should request the LOB manager to send an email request upon termination, which avoids the issue of having HR remember to enter the date.

Exception Management System (EMS) data

Analysis of EMS log data over the 1-year period showed a high number of "Exception Code –Delayed/Nonentry in HR system" as the reason. This led to a review of the HR checklist and finally identified that the HR checklist was not reviewed regularly and updated to require email notification from the LOB manager to HR.

Another exception reason code, "Training Deficiency" was matched with other data. The correlation was found between "Training Deficiency" and certain branch offices. Remediation was a required training regimen for identified employees. Consequently, an additional automated controls test was added that accessed data from the in-house training system. This data was tested to ensure that prescribed training measures were being met.



RCA and the EMS repository

The above example shows how using RCA leads to meaningful adjustments to the ongoing and future application of analytics automation. Reviewing the exception resolutions will help to modify the automated analytics to expand the expected outcome knowledge. This will allow the next phase of analytic tests of controls to include those root causes previously identified in the continuous testing process.

With the purposes of RCA in mind, consideration should be given to what data elements will feed into the repository. This can be done as part of the initial design and as part of the evolving experience and requirements of RCA.

Some areas for root cause analysis in the repository include:

- Identify and define RCA categories. This will be an iterative process. When analytics are first implemented, the exceptions created and fed into the EM system may not fit a known business rule or expected outcome. The exception categories or codes can drive root cause analysis. Through the regular cadence of exception/remediation activities, it may be possible to identify a large number of actions or patterns/trends that are linked in terms of cause.
- Establish and test for benchmarks within the EMS (number of exceptions, days to resolution). For example in IT, what is the average exception (in days) for terminated employees by region or plant), how many terminations occur per period? These can be used to quantify improvements or deteriorations of controls.

When employing exceptions management to improve root cause analysis, teams can define the gaps involved with people, during a process, or with a technology and define the cost to the company in terms of time and money.

- Validate RCA remediation recommendations. Is there improvement? For example, confirm that employee training is being performed and that all the employees involved have attended. Is there a decline in exceptions based on the "Training Deficiency" exception code?
- Provide data for ROI analysis on both analytics and EMS investments. Are controls working? Gather evidence of exceptions being properly reviewed, actioned, and resolved.
- Perform content analytics on explanatory text. Summarize and count all words/terms. Perform keyword identification testing on freeform text.

Conclusion

When employing exceptions management to improve root cause analysis, teams can define the gaps involved with people, during a process, or with a technology and define the cost to the company in terms of time and money. Once the true root cause is uncovered, companies can use EMS data as way to provide additional evidence within a broader RCA initiative, create a better evidence-based methodology with decision making, and create a broader, more complete overview of historical exceptions and issues.

MIS Training Institute
153 Cordaville Road, Suite 200
Southborough, MA 01772
www.misti.com

Arbutus Software
Sperling Plaza 2
Suite 270 – 6450 Roberts Street
Burnaby, BC V5G 4E1
Canada
www.arbutusanalytics.com

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