Smart Use of Data Mining is Good Business and Good Government

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"This article is written for management from the perspective of an auditor, who has seen firsthand the power that forensic auditing holds in advancing government accountability. The techniques used by auditors are equally applicable to management, who should always be the first line of defense against fraud, waste and abuse." Those were the words in an article published in the Summer 2008 edition of AGA's *Journal of Government Financial Management,* titled "Forensic Auditing: A Window to Identifying and Combating Fraud, Waste and Abuse."[1] They are even truer today than they were in 2008, as the stakes for managing the cost of government and improving service delivery have grown, with all levels of government facing extremely difficult fiscal realities.

A central part of the thesis in the 2008 *Journal* article is that management owns the information that auditors data-mine to assess an agency's performance. Why then are agencies not more aware of their own issues? Why do they wait for auditors to identify their problems? Would it not be better to use readily available techniques like data mining to both focus on issues before they become problems while managing the enterprise and potentially driving down costs?

The last four years have shown a profound change in the adoption and wider applicability of data mining by agencies in day-to-day management and longer-term decision-making. Data mining supports ever-more advanced continuous monitoring and continuous auditing programs, expanded forensic and recovery auditing capabilities, and more sophisticated data analytics and business intelligence tools—all of which mine information. This article explores the value of data mining and how the government can make smart use of these analytic tools to improve performance and operational efficiency and reduce costs.

The Benefits of Data Mining Go Much Deeper Than Traditional Fraud, Waste and Abuse

In its simplest form, data mining provides automated, continuous feedback to ensure that systems and internal controls operate as intended and that transactions are processed in accordance with policies, laws and regulations. It can provide management with timely information that can permit a shift from traditional retrospective/detective activities to proactive/preventive activities. Data mining can put the organization out front of potential problems, giving them an opportunity to take action to avoid or mitigate the impact.

Before the explosion of information technology and the development of automated monitoring tools, management had to sort through reams of paper containing top-line data based on statistical sampling to get a sense of where they stood and identify anything outside the norm. With data mining, they can look at 100 percent of the data on a real-time, continuous basis, and they can drill down into detail as needed. The level of management assurance is greatly increased.

Data mining can produce "red flags" that help identify root causes of problems to allow actionable enhancements to systems, processes and internal controls that address systemic weaknesses. Applied appropriately, data mining tools enable organizations to realize important benefits, such as cost optimization, adoption of less costly business models, improved program, contract and payment management, and process improvement.

Data Mining Offers Four Important Direct Benefits:

- Greater efficiency, since less time is spent on error correction and payment recovery, freeing up more time for value-added analysis;
- Earlier information to reduce surprises and facilitate root cause analysis of problems;
- Enhanced controls through automated prevention and detection activities and the ability to monitor internal control gaps; and
- Reduced complexity, providing greater insight into processes and facilitating process standardization and simplification.[2]

Figure 1[3] depicts some of the benefits that organizations commonly experience in using data mining to continuously monitor operations.

A common data mining application is to pre-screen contract payments. The Defense Finance and Accounting Service reports it has been able to stop more than $3 billion of potential improper payments over the past several years through its Business Activity Monitoring system.[4] Automated, continuous monitoring tools, such as sophisticated analytical tests, cross-matching and relationship identification can highlight possible problems often undetected by traditional management review techniques. In this way, management can continually evaluate the effectiveness of internal controls and quickly identify suspicious trends, relationships, unusual transactions and activities that can

FIGURE 1: What are the Benefits of Implementing Continuous Monitoring?

Continuous monitoring offers a broad range of potential benefits…

GREATER EFFICIENCY

- Reduction of work duplication
- Increased use of automation
- Enhanced ability to identify and correct errors
- More time for value-adding analysis instead of error correction
- Reduced travel costs by automation of testing and remote monitoring

ENHANCED CONTROLS

- Corrections of errors moved closer to the "source"
- Automated controls
- Control gaps and deficiencies can be monitored for circumvention and/or exploitation
- ERP system and/or business process limitations and deficiencies can be addressed
- Automated fraud prevention and detection activities

EARLIER INFORMATION

- Improved speed of information delivery to agency management
- Reduced surprises, problems do not build up
- Better information for decision-making
- Ability to perform root cause analysis for errors, policy violations, fraud, abuse and misconduct

REDUCED COMPLEXITY

- Greater visibility into how processes are functioning
- Appropriate setting and consistency of thresholds
- Legal and regulatory compliance can be monitored
- Ability to standardize process measures across locations
- Demonstrate good governance— use leading-edge approach

…which results in more focused time to add value to the mission operations.

suggest improper activity, preferably before the activity takes place.

The tools can analyze larger volumes of transactions than previously possible and continually look for obscure or hidden relationships among people, organizations and events that may indicate an improper payment. The DFAS success story example illustrates why both the Presidential Executive Order—Reducing Improper Payments and Eliminating Waste in Federal Programs[5]—and the Improper Payments Elimination and Recovery Act (IPERA)[6] call for the use of data mining tools to avoid "pay and chase" situations, first, as a means of prevention, and after the fact, detection.

In Its More Complex Form, Data Mining Can Be Used To:

- Inform decision-making,
- Provide predictive intelligence and trend analysis,
- Support mission performance,
- Improve governance capabilities,
- Enhance oversight and transparency by targeting areas of highest value or risk for increased scrutiny,
- Reduce costs especially for areas that represent lower risk,
- Improve operating performance and
- Help create greater value.

For most organizations, the primary use is for business applications, but the trend is toward much broader uses as the tools and capabilities continue to evolve and the ability to correlate unstructured data into business intelligence expands. For example, in the federal government, the intelligence and defense communities and law enforcement have been for many years using robust, high-powered data analytic tools to mine and correlate vast amounts of diverse information. The data paint a picture of what is going on, helping management better anticipate risk and act accordingly.

A 2010 *MIT Sloan Management Review*/IBM[7] study of business analytics, which included a survey of 3,000 executives and analysts, found that leading organizations "…put analytics to use in the widest possible range of decisions, large and small. They are twice as likely to use analytics to guide future strategies and twice as likely to use insights to guide day-to-day decisions. They make decisions based on rigorous analysis at more the twice the rate of lower performers."

Making the Most of Data Mining

Leading organizations tend to take a measured approach initially when embarking on a data mining initiative, starting small and focusing on particular "pain points" or areas of opportunity to tackle first—such as whether only eligible recipients are receiving program funds. Through this approach, organizations can deliver quick wins to demonstrate an early return on investment and then build upon success as they move to more sophisticated data mining applications. Now let's examine two applications of data mining that would be common to most government organizations—procurement analytics and purchase card analytics.

Procurement Data Analytics

Figure 2 illustrates the use of procurement forensic data analytics to key on "red flags" tied to schemes or indicators of potential fraud, waste and abuse related to government procurement.[8] Through data mining, management would focus on a range of situations that have been shown to indicate a potential problem, such as hidden links between employees and vendors, unusual or heightened activity outside of the normal business cycle, and unusual trends in volume, activity or value.

Purchase and Travel Card Data Analytics

The aforementioned 2008 AGA *Journal* article talked about the use of data mining to continuously monitor government purchase and travel card usage. This has been a priority of the Office of Management and Budget (OMB) since early 2002,[9] and

FIGURE 2: Approach to Procurement Analytics

Forensic Data Analysis	Approach or Red Flag	Scheme or Indicator
MATCHING	• Trace transactions from ordering to payment and identify inconsistencies • Duplication of invoices • Hidden links between employees and vendors (for example, on bank accounts)	• Over payment for or under delivery of goods or services • Duplicated invoices or payments • Collusion between staff and suppliers • Fictitious vendors
TIMING	• Timing of transaction creation, approval and payment (for example, by time of day, day of week or non-business day) • Volume/value patterns	• Periods of time prone to fraudulent activity (for example, outside of business hours) • Unusual heightened activity out of correlation to business cycles
AMOUNT & VALUE	• Statistical numerical distribution (including Benford's Law) • Duplicate amounts or endings (99, 44, 000) • Identification of clustering of expenses around unusual values • Identification of expenses which are outside the norm for a given employee	• Number "invention" or manufactured transactions • Concealment of transactions through splitting of amounts to defeat approval limits • Unusual volume/activity/red flags indicating discovery of a new fraud scheme
VENDOR ACTIVITY	• Quantity of invoices • Identification of suspicious key words within specific text • Unit price/volume clustering • Discounts not taken	• Ghost vendors • Falsified volume or pricing • Collusion—invoices below approval limits • Collusion—discounts earned but 'refused'
USER ACTIVITY	• Unusual trends in volume, activity or value • Unauthorized users • Segregation of duties breaches	• Users operating outside of authorized roles • Unauthorized activity • Unmonitored activity

it has been the subject of a number of critical reports by the U.S. Government Accountability Office (GAO)[10] and the federal inspectors general, widespread media accounts and congressional oversight hearings highlighting abuses. Similar to procurement analytics, purchase card analytics enable management to target risk and prevent problems on the front end. For example, mining of purchase card data can be used to identify the use of government purchase cards for expenses that are outside the norm for an employee and indicate personal purchases, returns of purchases for cash and unusual trends in volume, activity or value.

10 STEPS FOR IMPLEMENTING A DATA MINING PROGRAM

Now that we have explored the benefits of data mining and how to make the most out of such analytic tools, what are the ingredients of a successful data mining program? Let's focus on 10 steps, which should be helpful to any organization and all levels of government, either in getting started or building on what has been successful in the past.

STEP 1: Accept responsibility for proactively avoiding problems by adopting commonly used data mining approaches and related tools.

This is essentially a cultural transformation for any organization that has either not understood the value these tools can bring, or has viewed their implementation as someone else's responsibility, like the inspector general or GAO. Given the fiscal challenges faced by all levels of government today, it should be easier to convince people of the need to use these tools to prevent problems and to improve the ability to focus on cost-effective means of better controlling costs.

STEP 2: Understand the potential that data mining provides to the organization to support day-to-day management and strategic decision-making.

Understanding—both of the value of data mining and how to use the results—is at the heart of effectively leveraging these tools. The CFO can play an important education and support role for a program that must ultimately be owned by line managers who have responsibility for their own programs and operations.[11] The respective agencies' inspectors general and GAO can also be helpful, given their long history of practical data mining experience.

The work of the Recovery Accountability and Transparency Board[12] emplifies the value of having an in-depth understanding of the value and application of data mining tools. The board, established to oversee spending under the American Recovery and Reinvestment Act of 2009,[13] is composed of federal inspectors general. Early on, the board developed an advanced data mining tool to monitor all Recovery Act spending, seeking to identify unusual spending trends and other indicators of fraud, waste and mismanagement. This highly acclaimed data mining tool has been viewed as so successful that the vice president announced that it will be pilot-tested for government-wide application as part of the administration's "Campaign to Cut Government

FIGURE 3: Approach to Purchase and Travel Card Analytics

Forensic Data Analysis	Approach or Red Flag	Scheme or Indicator
MATCHING	• Comparisons of agency card data to employee-submitted expenses	• Personal purchases • Returns of purchases for cash • Rolling agency card balance
TIMING	• Timing of transactions (for example, by day of week, time of day, or non business day) • Volume/value patterns	• Periods of time prone to fraudulent activity (for example, holidays, weekends, etc.)
AMOUNT & VALUE	• Statistical numerical distribution (including Benford's Law) • Duplicate amounts or endings (99, 44, 000) • Identification of clustering of expenses around unusual values • Identification of expenses that are outside the norm for a given employee	• Employees splitting expenses to circumvent approval levels • Unusual number of expenses or value of expenses to employees
EMPLOYEE ACTIVITY	• Quantity of payments • Expenses to blocked merchants • Review of information submitted for expenses	• Purchases for personal use • False reimbursement submissions • Inflated reimbursement submissions
USER ACTIVITY	• Unusual trends in volume, activity or value • Unauthorized users	• Users operating outside of authorized roles • Unauthorized activity • Unmonitored transactions

Waste."[14] The long history the audit community has had with data mining techniques made the adoption of this tool to help manage Recovery Act spending in real time a natural extension of what they do as auditors and investigators to evaluate a program after the fact. They thoroughly understood the potential of data mining to support day-to-day management and strategic decision-making.

STEP 3: Adopt an ERM program that includes a consideration of fraud risk.

As discussed in the AGA *Journal* article, "Don't Delay—The Time Has Come to Use the Full Potential of Enterprise Risk Management to Reduce Costs and Enhance Program Delivery," an agency has to thoroughly understand its risks and establish a risk appetite across the enterprise.[15] In this way, it can focus on those things of highest value to the organization. An organization should take stock of its risks and ask fundamental questions, such as:

- What do we lose sleep over?
- What do we not want to hear about on the evening news or read about in the print media or on a blog?
- What do we want to make sure happens and happens well?

Data mining should be an integral part of an overall program for enterprise risk management (ERM).[16] Both are premised on establishing a risk appetite and incorporating a governance and reporting framework. This framework in turn helps ensure that day-to-day decisions are made in line with the risk appetite, and are supported by data needed to monitor, manage and alleviate risk to an acceptable level. The monitoring capabilities of data mining are fundamental to managing risk and focusing on issues of importance to the organization. The application of ERM concepts can provide a framework within which to anchor a data mining program.

STEP 4: Determine how you are going to use the data-mined information in managing the enterprise and safeguarding government assets from fraud, waste and abuse.

Once an agency is on top of the data, using it effectively becomes paramount and should be considered as the information requirements are being developed. The previously mentioned *MIT Sloan Management Review*/IBM study of data analytics[17] found that "getting the right data" was cited as being the top challenge by 20 percent of the survey respondents, whereas 40 percent said the top challenge was the "lack of understanding of how to use analytics."Developing a shared understanding so that everyone is on the same page is critical to success.

STEP 5: Get the right data and get the data right.

Yes, the quality of the underlying information—it must be both reliable and relevant—does matter, as does understanding how to use it. The adage "garbage-in, garbage-out" is always at play. Governments have no shortage of data. The key is to understand what is available, what is known about its quality, and how it can be accessed, analyzed and best turned into useful information. That is exactly what auditors do in planning a forensic audit. They learn everything they can about the composition and structure of the available information and how they can apply analytic tools to data-mine the information. In fact, the actual audit

work may be as simple as a series of automated data queries, because the planning and understanding of the data are usually the toughest parts of the job. Management does "own" the information, so theoretically, it should be well positioned to "get the right data and get the data right."

STEP 6: Keep building and enhancing the application of data mining tools.

A tried and true approach is to begin with the lower hanging fruit—something that will get you started and will provide an opportunity to learn on a smaller scale. The experience gained will help enable the expansion and the enhancement of data mining tools. While this may be done gradually, it should be a priority and not viewed as the "management reform initiative of the day." There should be a clear game plan for building data mining capabilities into the fiber of management.

STEP 7: Use the resulting information to manage the agency.

The end game is not to produce data on anomalies for the sake of doing so but to enhance management of programs and operations. How is the information being used to manage the agency? How is management measuring the use of data mining and the impact on reducing costs and preventing fraud, waste and abuse? Has the agency embedded the lessons learned and findings from data mining into the management cycle so that success stories are highlighted and problems are prevented or mitigated? What additional tools are being developed and in the hands of managers, such as dashboards and scorecards?

STEP 8: Use data mining as a tool for accountability.

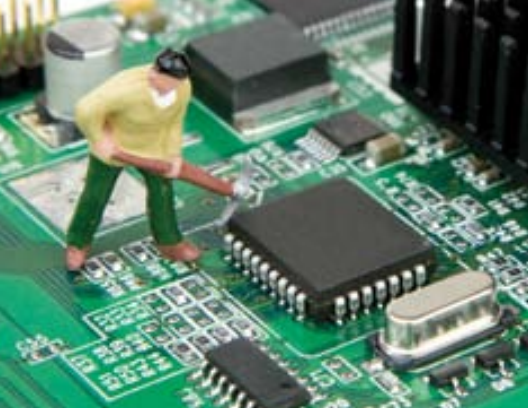
It is important to hold managers accountable for not only instituting robust data mining programs, but for the results of these programs. Has the agency developed performance measures that clearly demonstrate the results of using these tools? Do they reward those managers who are in the forefront in implementing these tools? Do they make it clear to those who don't that their resistance or hesitation are not acceptable?

STEP 9: Freely share experiences and leading practices.

Management across government needs to share common experiences and leading practices, leveraging the knowledge of others, since fraudsters may use common techniques, especially for similar types of programs. It is important to avoid viewing this in an insular manner, and instead to engage partners at all levels of government and in different communities of practice, such as the audit community. Good government organizations, such as AGA's Partnership for Intergovernmental Management and Accountability, can serve as an effective catalyst for promoting effective data mining programs and sharing tools and experiences.[18]

STEP 10: View this as a continuous process and not a "one and done" exercise.

Risks change over time. Fraudsters are always adjusting their targets and moving to exploit new and emerging weaknesses. They follow the money. Technology will continue to evolve,



and it will both introduce new risks but also new opportunities and tools for management. This management effort to protect against dangers and rectify errors is one that never ends, but also one that can pay benefits that far outweigh the costs if effectively and efficiently implemented.

A Few Final Thoughts

The stark realities of today's fiscal challenges at all levels of government and the need to address service delivery expectations have raised the stakes for managing the cost of government and winning the war against fraud, waste and abuse in government programs. Today's government managers should want to be on top of problems before they become significant, and the strategic use of data mining tools can help them manage and protect their enterprises and save money.

In looking to the future, governments need to both retain and build on past successes and more fully leverage technology through the smart use of data mining analytic tools to help in day-to-day management and longer-term decision-making. The CFO community can also play an important role in assisting program managers to effectively and efficiently adopt data mining tools as an integral part of the management process.

In summary: Use the tools available today—and in the future—to support a government that works better and costs less. Be vigilant and aware of the risks and issues in your agency, and don't wait for auditors to find them. Truly "own your data." It is just good business and good government to do so.

This article represents the views of the authors only, and does not necessarily represent the views or professional advice of KPMG LLP.

End Notes

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7. *Analytics: The New Path to Value, MIT Sloan Management Review and the IBM Institute for Value,* by Steve LaValle, Michael Hopkins, Eric Lesser, Rebecca Shockley and Nina Kruschwitz, October 2010.
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9. OMB Memorandum 03-02, Increased Oversight for Government Purchase and Travel Cards, Oct. 5, 2002.
10. *Internal Control Weaknesses Governmentwide Led to Improper and Abusive Use of Premium Class Travel,* GAO-07-1268, September 2007.
11. The KPMG Government Institute, *The KPMG Executive Guide to High Performance in Federal Financial Management,* June 2009.
12. The Recovery Accountability and Transparency Board is a non-partisan agency created by the American Recovery and Reinvestment Act of 2009 with two goals: to provide transparency of Recovery Act-related funds; and to detect and prevent fraud, waste and mismanagement. The board is chaired by a federal inspector general, and 12 inspectors general from various federal agencies serve on the board. (See *www.recovery.gov.*)
13. The American Recovery and Reinvestment Act of 2009, Public Law 111-5, Feb. 17, 2009.
14. Vice President Joe Biden, June 18, 2010. Also, *Presidential Executive Order—Delivering and Efficient, Effective and Accountable Government,* June 13, 2011.
15. *Don't Delay—The Time Has Come to Use the Full Potential of Enterprise Risk Management to Reduce Costs and Enhance Program Delivery,* by Jeffrey C. Steinhoff, CGFM, CPA, CFE, and Geoffrey L. Weber, MBA, CISA, CISM, *Journal of Government Financial Management,* Winter 2011.
16. *Don't Delay—The Time Has Come to Use the Full Potential of Enterprise Risk Management to Reduce Costs and Enhance Program Delivery,* by Jeffrey C. Steinhoff, CGFM, CPA, CFE, and Geoffrey L. Weber, MBA, CISA, CISM, *Journal of Government Financial Management,* Winter 2011.
17. *Analytics: The New Path to Value,* by Steve LaValle, Michael Hopkins, Eric Lesser, Rebecca Shockley and Nina Kruschwitz, MIT Sloan Management Review and the IBM Institute for Business Value, October 2010.
18. AGA established the Partnership for Intergovernmental Management and Accountability (Partnership) to open the lines of communication among governments with the goal of improving performance and accountability. Comprised of high-ranking officials from the federal, state and local levels of government and higher education, the Partnership is dedicated to identifying and solving some of the most vexing management and accountability issues facing governments today. Learn more at *www.agacgfm.org/intergovernmental/index.aspx.*

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