

# Some Practical Experiences in Data Governance

Zeljko Panian

**Abstract**—If managed correctly, data can become an organization's most valuable asset, helping it to remain competitive and agile, to proactively meet customer needs, and to keep costs in check. Companies and government organizations of all sizes are striving to manage data as an enterprise asset, to be shared and reused across multiple software applications and systems, business processes, and users throughout the organization. They're finding that they need to establish standards, policies, and processes for the usage, development, and management of data. They recognize that creating the right organizational structure and developing the technology infrastructure to support the governance of their data is also critical.

**Keywords**—Information technology (IT), corporate governance, data, data governance.

## I. INTRODUCTION

**A**LTHOUGH their value is not represented on the balance sheet, data are one of the most important assets in an organization. Data represent an organization's customers, employees, and suppliers; its activities and transactions; and its outcomes and results.

As a practice with roots in corporate and information technology (IT) governance, data governance is defined as the processes, policies, standards, organization, and technologies required to manage and ensure the availability, accessibility, quality, consistency, auditability, and security of data in an organization.

The goals of data governance are to:

- Ensure data meets the needs of the business
- Protect and manage data as a valued enterprise asset
- Lower the costs of managing data

While achieving these goals is attractive in theory, putting data governance into actual practice requires a compelling business driver. This paper explores the most common business drivers of data governance initiatives, which are:

- Growing revenue by increasing cross-sell/up-sell rates and improving retention among existing customers with a deep understanding of their existing customers.
- Lowering costs by increasing operational efficiency with business process automation and eliminating redundancy.
- Ensuring compliance with external regulations and internal governance policies by streamlining the collection of reporting data and increasing auditability.

Zeljko Panian, Ph.D. is professor at the Faculty of Economics and Business, University of Zagreb, Croatia (phone: 385-1-238-3217; fax: 385-1-233-5633; e-mail: zpanian@efzg.hr).

## II. EVOLUTION OF DATA GOVERNANCE

To understand how data governance is evolving as a practice today, its roots should be reviewed in the broader context of corporate and information technology (IT) governance.

### A. Corporate and IT Governance

An established discipline for many years, corporate governance is defined as "the set of processes, customs, policies, laws, and institutions affecting the way a corporation is directed, administered or controlled" [1]. One of the practice areas under corporate governance is IT governance, defined as "the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives" [2].

Like corporate governance, IT governance is also a mature discipline. Industry bodies, such as the IT Governance Institute and International Organization for Standardization (ISO), have established detailed IT governance standards and processes, which many companies and government organizations have put into practice.

However, many of these IT governance practices have evolved in a pattern based on common IT organizational structures and deployment architectures, which traditionally have centered around software applications such as enterprise resource planning (ERP) or customer relationship management (CRM). From mainframes to client-server architectures to Web applications, IT departments have focused on the applications and the user interfaces to those applications, rather than on data that drives the applications [3]. Typically, data are managed in the context of how they serve a particular application, rather than how they serve the strategic interests of the overall organization.

As a result, IT governance practices are designed primarily around an organization's applications – not its data. In most organizations, there are clearly defined owners, processes, and policies in place to manage enterprise software applications. For example, when a company implements a complex and far-reaching ERP system like SAP, the SAP implementation is typically managed and governed by an SAP program office which has clearly delineated responsibilities for managing and developing the SAP environment, both from a business and an IT perspective [4]. However, many organizations lack an equivalent governance structure for their most valuable core data assets, such as customer, employee, or product data.

### B. The Rise of Data

An application-centric approach to IT governance no longer serves the best interests of today's rapidly evolving business and IT environment. As shown in Fig. 1, organizations are striving to align their IT systems with their business processes, rather than force-fitting business processes to the constraints of existing applications or systems. As most business processes span multiple applications, IT groups as well as software vendors are busily decomposing applications into components or services that can be mixed and matched in a flexible way to support business processes [5].

Moreover, it is becoming increasingly clear that enterprise data – such as customer, employee, or product data – also need to be shared across multiple applications and business processes, rather than being tied to one specific application. Therefore, to get the most value out of their enterprise data, organizations need to pay greater attention to the data itself and how to manage them as an asset.

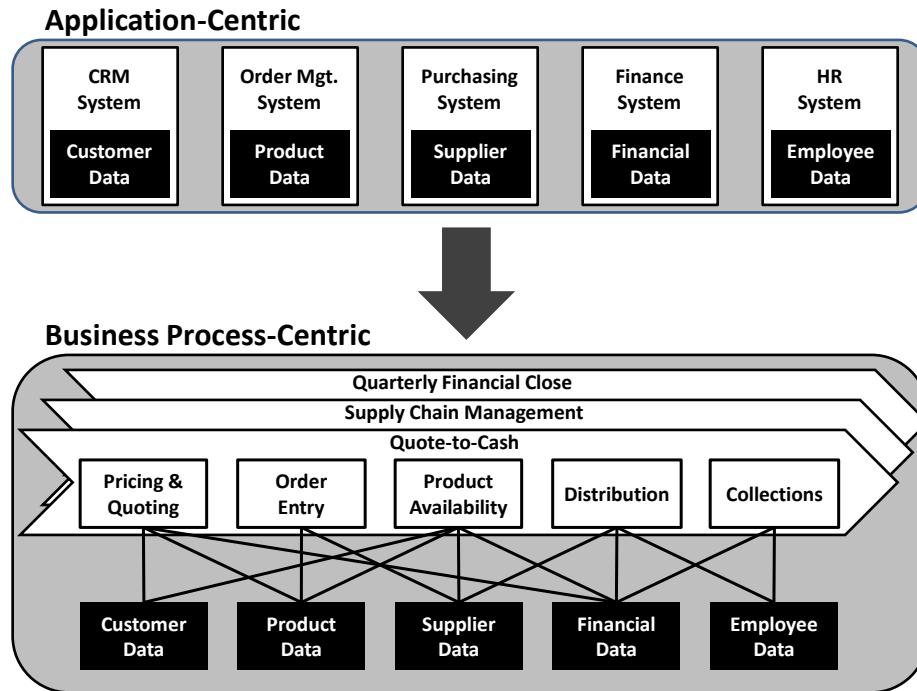


Fig. 1 Application-centric vs. business process-centric data management

Data are one of the most important assets in an organization, even though their value is not represented on the balance sheet. Data are really a manifestation of the business – data represent an organization's customers, employees, and suppliers; its activities and transactions; and its outcomes and results. Data are also the ultimate reusable asset – if they are managed correctly.

For example, data on the profitability of a particular customer can be used in multiple business contexts. This data can drive day-to-day decisions regarding how to prioritize a customer's call in a customer service center. They can feed analyses of product or customer segment profitability. They can drive how the marketing group designs loyalty and retention programs. And they can feed into the finance department's reconciliation of margins and earnings.

To remain competitive and agile, to proactively meet customer needs, and to keep costs in check, companies and government organizations of all sizes are striving to manage

data as an enterprise asset, to be shared and reused across multiple applications, users, systems, and processes [6]. This is sometimes part of a broader enterprise information management (EIM) initiative, which is a strategy for improving the accuracy and integrity of information assets to better serve a company's technical, operational, and business objectives.

To increase the value of data as a business asset, companies and government organizations need to establish standards, policies, and processes for the usage, development, and management of data, to create the right organizational structure, and to develop the supporting technology infrastructure. Thus, data governance has emerged as an important discipline in its own right. The goals of data governance are to [7]:

- Ensure data meets the needs of the business.
- Protect, manage and develop data as a valued enterprise asset.

- Lower the costs of managing data.

A recent survey conducted by The Data Warehousing Institute (TDWI) highlights the increasing number of organizations investing in formal data governance initiatives. Eight percent of the 750 responding organizations have deployed a data governance initiative; 17 percent are designing or implementing one; and 33 percent are considering it. The results also make clear that data governance is an emerging practice area – most governance efforts are in the early phases, and many organizations are still working to build the business case for data governance [8].

### III. BUSINESS DRIVERS BEHIND DATA GOVERNANCE

While companies and government organizations may want to achieve the goals of data governance in theory, they have difficulty justifying the effort unless it has a practical, concrete impact on the business. Putting data governance into real practice requires a compelling business driver. The business driver highlights the importance of data to the business, and motivates both the business and IT to invest in the development of their data.

The most common business drivers of data governance initiatives are:

- Growing revenue
- Lowering costs
- Ensuring compliance

While these are among the most basic goals of any business, it's useful to examine them in more detail and review the integral role data governance can play in achieving these goals.

#### A. Growing Revenue

One of the most important goals of almost any business is to grow revenue. And one of the most effective ways to grow revenue is to increase cross-sell/up-sell rates and improve retention among existing customers. To do so, organizations need a broad and deep understanding of their existing customers. They need a "single view of the customer" to be able to provide superior service, and to better target campaigns and offers based on a specific customer's needs.

The most often complaints and observations sound something like:

- "We don't know which products or services to cross-sell to our customers because records of what our customers have purchased and when are spread across six different systems."
- "If a customer logs an issue in our support system, it takes a few hours to show up in the customer service reps' system in the call center. So when talking to our customers, our service representatives don't have really up-to-date customer information, and that can really frustrate both the customer and the representative."
- "We lose track of some customers, while others we repeatedly barrage with the same offers. Our customer data are unreliable. Sometimes information is missing, and other times there's conflicting information."

- "Our sales, marketing, and service organizations all define 'customer' differently, so we can't get a global view of our customers across all three functions."
- "We have profitability calculated for each customer, but there's no documentation on it, so no one trusts or uses the information."
- "We're worried about security. Our reputation, our image and our competitive position would suffer if an unauthorized person were to access or change any customer data."

Customer data are often scattered across dozens or even hundreds of different business systems. To resolve these data issues, companies must address the underlying organizational, process, and technical issues related to the data. Data governance provides the framework for addressing complex issues such as improving data quality or developing a single view of the customer at an enterprise level.

#### B. Lowering Costs

As the pressure to lower costs is intensified, increasing operational efficiency becomes a major priority for most organizations. One of the important ways organizations can reduce costs and increase operational efficiency is to automate business processes [9].

For example, organizations may automate their procurement processes to lower purchasing and administration costs. While business process automation increases efficiency, problems with enterprise data prevent companies from capitalizing on the full potential of operational efficiency initiatives. Streamlining business processes across multiple financial, human resource, sales, and other business systems requires that the structure and meaning of data be reconciled across those systems – a task that has often been an afterthought in operational efficiency initiatives.

Companies and government organizations of all sizes suffer from data-related problems commonly seen in operational efficiency initiatives, including:

- "It's hard to negotiate effectively with our vendors because we have trouble getting at the vendor data from our Asian subsidiary. It's housed in an arcane legacy mainframe system that we can't access easily."
- "We're burdened by stock-outs and excess inventory because we can only run our global inventory reports weekly. They take a whole weekend to process."
- "Our procurement analysts have to spend hours and hours manually reconciling purchase orders and invoices because the data coming from our suppliers are riddled with errors and incomplete information."
- "Our suppliers all have different product codes, so we can't get a global view of our supply chain. It's hard to forecast inventory levels or predict delivery schedules."
- "Sales sends us forecast data, but no one knows how they arrived at the numbers, so we can't rely on them."
- "We need to carefully control which data can be seen by which supplier, so that they don't accidentally see information on one of their competitors."

The need to lower costs is driving projects such as supplier or product master data management, which enable companies to streamline core business processes such as inventory and supply chain management by rationalizing, cleansing, and sharing key master data elements. Data governance plays a critical role in the success of such projects, providing a structure for addressing the organizational and process issues around master data.

### C. Ensuring Compliance

Doing business today requires compliance with a growing number of external regulations, as well as with internal corporate governance policies designed to increase transparency and prevent corporate malfeasance and fraud. To ensure compliance with regulations such as Sarbanes-Oxley, Basel II, Control Objective for Information and Related Technologies (CobIT), the U.S. Patriot Act, and the U.S. Health Insurance Portability and Accountability Act (HIPAA), as well as with internal policies and controls, companies must streamline the collection of reporting data. For many regulations, they must also document the sources of the data being reported and certify their accuracy, and implement specific governance policies.

Complying with these regulations and policies can burden a company when it comes to how it handles its data. Common concerns include:

- "It's hard to pull together the financial data from the dozens of different sources, from mainframe to spreadsheets, so there's always a lot of IT involvement to pull the data, which slows the whole process down."
- "Our Chief Financial Officer is demanding access to all the information on a daily basis on his computer. We can't do that right now."
- "The data we report to the auditors have to be clean and accurate, and right now it's nowhere close."
- "Our different business units use different charts of accounts, so it takes days for our analysts to reconcile them."
- "A lot of our compliance reporting is done via spreadsheet, which is not going to hold up with the auditors."
- "These are sensitive data. We have to carefully control access to them, or we could face huge fines."

Data governance is an essential foundation for ensuring compliance [10]. It establishes the rigorous data standards, policies, and processes that are required by regulations and corporate governance policies, and helps to automate compliance-related tasks, lowering costs. It also helps ensure accountability for and auditability of the data.

## IV. MARKET TRENDS THAT MAGNIFY THE NEED FOR DATA GOVERNANCE

Beyond these business drivers, two macro business trends are further escalating the need for data governance: an increase in merger and acquisition (M&A) activity, and a rise in partnering and outsourcing non-core business functions.

### D. Mergers & Acquisitions

As merger and acquisition activity picks up, organizations are faced with the need to rationalize and reconcile the IT environments from merged or acquired entities. Typically these IT environments have very different systems, data models, and business processes. Post-M&A, IT organizations are often pressed to meet very tight timelines for integration. The goal is to accelerate the promised synergies from the merger, both in the form of cost reductions by eliminating redundancies, as well as revenue growth from increased cross-selling.

The process of migrating and consolidating the data after a merger or acquisition is a huge task—one that is often underestimated initially. IT groups must deal with unknown systems, resolve quality issues, and provide detailed documentation on how the information has been merged. And the task involves much more than technical integration. IT organizations must reconcile different data definitions and models, and processes must be put in place to ensure alignment of the various entities. A data governance framework provides significant value in managing the organizational and technical complexities of merger or acquisition consolidation and accelerating positive business results.

### B. Partnering and Outsourcing

Another broad market trend is the increasing use of partners and outsourcers to manage parts of the value chain. Organizations are focusing on core competencies and handing off non-core functions and processes to partners and outsourcing providers. For example:

- High technology equipment companies rely on contract manufacturers for production.
- Manufacturers turn to third-party specialized companies for logistics and warehouse management.
- Pharmaceutical companies rely on third-party clinical trials management firms.
- IT departments outsource application development and network management.
- HR groups outsource administrative functions such as payroll or benefits management.

As business processes and IT systems shift to outside providers, the data associated with those processes and systems relocate outside the boundaries of the organization. Organizations must ensure that the data are correctly migrated to the outside provider. The data must be complete and accurate, and they have to be restructured to work in the third-party system. It is important to note that although they have moved to a third party, these data remain a core asset of the organization. Even though they sit outside the firewall, the organization cannot relinquish visibility into and control over that data. A robust data governance framework is critical to managing data that are fragmented across the extended value chain, especially in defining the standards and processes for interaction and collaboration with external partners and outsourcers.

## V. FRAMEWORK FOR DATA GOVERNANCE

### A. Six Key Data Attributes

Earlier in this paper we examined typical data challenges associated with business goals, such as increasing customer cross-sell or ensuring regulatory compliance. By examining the challenges that arise over and over again across organizations, it is clear that enterprise data must have the following six attributes:

- *Accessibility*: Ensuring that all enterprise data can be accessed, regardless of their source or structure.
- *Availability*: Ensuring that data are available to users and applications, when, where and how needed.
- *Quality*: Ensuring the completeness, accuracy and integrity of data.
- *Consistency*: Ensuring the meaning of data is consistent and reconciled across all systems, processes, and organizational units.
- *Auditability*: Ensuring there are controls and an audit trail on the data.
- *Security*: Ensuring secure access to the data.

Data governance manages and develops these key data attributes, enhancing the overall value of the data as an asset to the organization.

### B. Four Components of Data Governance

To ensure that enterprise data are all of the above – accessible, available, of high quality, consistent, auditable, and secure – an effective data governance framework involves four key components:

- *Standards*: A key function of data governance is to establish the standards for data in an enterprise [11]. Companies need to establish data definitions and taxonomies, define master data, develop enterprise data models, and enforce development and technical standards related to data.
- *Policies and Processes*: Establishing and enforcing policies and processes around the creation, development, control, management and audit of data is the foundation of an effective data governance practice. Companies need to define data and data-related business rules, control access to and delivery of data, establish ongoing monitoring and measurement mechanisms, and manage changes to data.
- *Organization*: Arguably the most important issue that companies must address when launching a data governance initiative is how to design the organizational structure. Companies need to define the roles and responsibilities within the organization that are accountable for the data. The organization may include several different roles at different levels, involving both business and IT personnel – from executive councils to day-to-day implementers, such as data stewards and data analysts [12]. Addressing training and organizational change management issues is also critical if data

governance programs are to succeed.

- *Technology*: Hypothetically, companies could embark on a data governance initiative without an underlying technology infrastructure. Indeed, many organizations launch their initial data governance programs using manual tools – spreadsheets, Visio, and Word documents – to capture data definitions and document processes. However, most quickly realize that this kind of manual approach is severely limited. It is difficult to ensure high data quality and availability, security is at risk given the ad hoc nature of the approach, and maintaining detailed documentation is an almost insurmountable task. Indeed, it is nearly impossible to achieve the ultimate goals of data governance using a manual approach. Technology can help automate and scale the development and enforcement of data governance standards, policies, and processes. Specifically, a data integration technology platform that provides built-in capabilities to access, cleanse, transform, deliver, and monitor data is ideal for data governance. Just as a business process management solution helps to streamline business processes, a data integration platform helps to automate data-related processes.

Fig. 2 shows the building blocks of an effective data governance framework. Such a framework takes into account the standards, policies and processes, organizational structure, and technology infrastructure required to make data accessible, available, of high quality, consistent, auditable, and secure across the enterprise.

## VI. ORGANIZATIONAL ISSUES AND TECHNOLOGY APPROACHES TO DATA GOVERNANCE

In this paper, we shall examine two of the four data governance components – organization and technology – in more depth.

### A. Organizational Success Factors

Organization is one of the most important aspects of data governance. To achieve the goals of data governance, ownership of the data must be assigned, standards must be defined, and policies must be enforced – all of which can trigger tricky political situations and fierce territory battles. This paper does not attempt to propose an ideal organizational structure to implement or support data governance. However, certain organizational principles are consistent across companies with successful governance programs:

- *Clear definition of roles and responsibilities*: A fundamental requirement for any type of governance program – corporate, IT, or data – is clear roles and responsibilities. Companies need to be rigorous about defining roles and assigning specific responsibilities to individuals involved in data governance to enforce accountability [13].

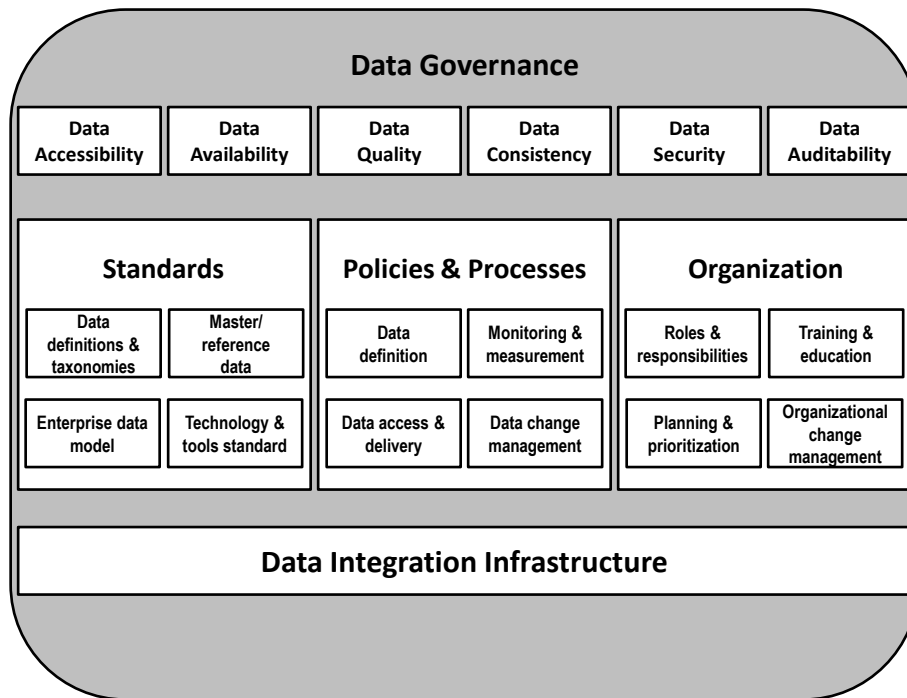


Fig. 2 Building blocks of the data governance framework

- **Business and IT involvement:** A common factor among companies with successful data governance initiatives is that executives and staff from both the line of business and the IT department are involved. In most cases, the business assumes ownership of the data and takes the lead in driving data governance. This is appropriate, since the data ultimately exist to serve the business, and the business is the primary beneficiary of effective data governance. IT then partners with the business to implement the technology aspects of the data governance program. IT and the business collaborate to establish specific business metrics associated with the data governance program and track them over time. Demonstrable business benefits are critical to the success of the data governance program, raising visibility of and increasing support for the program throughout an organization.
- **Executive sponsorship:** As a corollary to the principle above, successful data governance programs are sponsored, ideally, by a senior business executive. Senior executives must recognize the value of a data governance program in managing data as an asset and be able to tie the program to specific, concrete business goals. Many organizations establish a cross-functional data governance executive council or steering committee, which includes both business and IT executives representing various business and organizational units, as well as functions.
- **Integration competency center (ICC):** Successful data governance initiatives frequently involve the creation of an integration competency center, or center of excellence,

to support the data integration technology that sustains data governance. Integration competency centers are an organizational approach designed to increase agility and reduce implementation costs by promoting reuse, sharing best practices and resources, and establishing common processes and standards for integration. An ICC becomes a shared resource for the entire organization, defining the technical standards and processes around data integration and data governance, and providing a pool of highly skilled technical resources that can support specific project and program implementations.

#### B. Technology Success Factors

A data integration technology infrastructure helps to deliver on the goals of data governance by automating the data integration lifecycle.

Data integration is not a linear, one-time occurrence. Data integration is an ongoing, iterative process that constantly seeks to improve upon the key data attributes, such as quality and availability. And as such, when considering data integration technology, organizations need to take a holistic approach.

There are seven key steps in the data integration lifecycle, schematically shown in Fig.3:

- **Access:** All data are accessed, regardless of their source or structure. This includes extracting data out of arcane mainframe systems, as well as relational databases, applications, XML, messages, and even documents such as spreadsheets.
- **Discover:** Data sources particularly poorly documented, or unknown sources, are profiled to understand their

content and structure, infer patterns and rules implicit in the data, and to flag potential quality issues and problems with the data.

- *Cleanse*: Data are cleansed to ensure their quality, accuracy, correctness, and completeness. This may include addressing errors or omissions, enforcing adherence to data standards, validating values, and eliminating duplicate data entries.

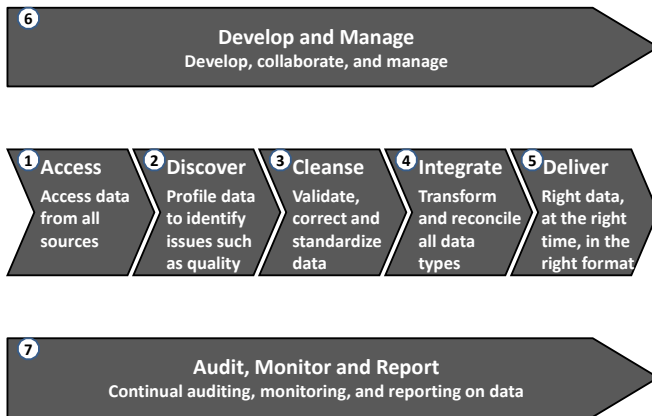


Fig. 3 The data integration lifecycle

- *Integrate*: To maintain a consistent view of data across all systems, data are integrated to bring together fragmented information and transformed to reconcile discrepancies in how different systems define and structure various data elements. For example, the marketing and finance systems may not only have different formats for the "customer profitability" data element; they may have completely different business definitions for "customer profitability," which have to be resolved.
- *Deliver*: The right data are delivered in the right form, at the right time, to all the applications and users who need them. This can range from delivering a single data element or record to support a real-time business operation, to delivering millions of records to enable trend analysis and enterprise reporting. Delivery also includes ensuring that the data are both highly available and secure in their delivery.
- *Develop and Manage*: A high-productivity toolset enables data stewards, business analysts, architects, and developers to collaborate on the implementation and management of data integration rules and processes, spanning Steps 1 through 5 above. It also ensures the reliability, scalability and performance required to run mission-critical enterprise systems.
- *Audit, Monitor, and Report*: Data are monitored, and reports on the data are prepared. This includes ongoing measurement of key metrics such as data quality, with an eye toward steady improvement over time. The goal is to track progress on the key data attributes and flag any new issues so that they can be fed back into the data

integration lifecycle for resolution and continuing improvement. This step also includes auditing – maintaining a robust audit trail on the data helps to maintain visibility and control, as well as to reduce the cost of future change.

By taking a lifecycle approach to data integration, the technical capabilities of the data integration platform are brought to bear as part of the ongoing data governance program, with the goal of continual improvement of and accountability for key data metrics.

Organizations need to address the data integration lifecycle holistically, both from a process and from a technology point of view. Often organizations use a collection of different tools to address different stages of the lifecycle in a piecemeal fashion. Different roles as well as different business units may each select different technologies, optimized to meet their own narrow needs. For example, business analysts may use one tool to profile and understand existing data sources. Data architects may select another tool to cleanse data and improve their quality. IT developers may use yet a different tool to access and deliver data. The net result is a complex web of disparate, inconsistent approaches to dealing with data.

A siloed approach to data integration can quickly derail a data governance program, preventing it from achieving its goals and scaling effectively [14]. The redundant tools and skillsets resulting from these siloed approaches are cumbersome and costly to maintain. But the bigger problem is the inconsistency in the data and the governance processes themselves. Organizations need a unified approach to data across the entire enterprise, and across the data integration lifecycle. This unified approach enforces data governance policies and processes systematically across the organization and, perhaps more importantly, instills confidence that the data they rely on to make strategic business decisions is consistent and accurate.

## VII. CONCLUSIONS AND NEXT STEPS

When everything is clear about the goals, common business drivers, and current market trends behind data governance, as well as the key data attributes and the components of an effective data governance practice, the job is not yet finished – there are some further steps to be taken.

The first step is to identify the critical business objectives for the organization, understand the related requirements for data, and review the data challenges that act as current or potential future barriers to achieving those objectives. Do users have difficulty accessing or finding data? Do they have the data they need to make decisions? Are the data consistent across different functions and business units? Can the validity of the data be certified? If there are data challenges, the extent of the issues and the estimated impact on the business should be documented. This information can provide the justification for investing in a data governance program.

After understanding an organization's overall business objectives, one key business initiative should be selected on

which to focus. This initiative should be one that faces significant data challenges, but also is expected to have a visible impact on the business. A pilot project for data governance, tied to this business initiative, will increase the likelihood of success for the business initiative, while also proving out the business value of a data governance program. The pilot project is also a good opportunity to build a strong collaborative relationship between business and IT groups, and to gain executive sponsorship.

Another important step the organization can take is to evaluate existing data integration technology infrastructure and its ability to support data governance practices. The technology must address and enhance all six of the key data attributes—accessibility, availability, quality, consistency, auditability and security. To support a data governance program in a scalable and consistent manner across the entire organization, the organization needs a single, unified enterprise data integration platform that offers:

- Broad access to all enterprise data, regardless of type, structure, or source – from mainframe and midrange systems, to XML documents and spreadsheets.
- An open, platform-neutral architecture designed for ever-changing, heterogeneous IT environments.
- A single, unified architecture to simplify and accelerate the entire data integration lifecycle.
- Enterprise-class security, scalability, reliability, and availability.
- An approach based on shared, reusable components and services for transparency, interoperability, orchestration, and flexibility.

If the existing technology infrastructure does not ensure that enterprise data meet the six key attributes and are therefore not ready to support data governance practice, the pilot project is a good opportunity to begin implementing a new, scalable, more robust and reliable data integration technology foundation.

#### REFERENCES

- [1] R. A. G. Monks and N. Minow, *Corporate Governance*, Chichester, England: John Wiley and Sons Ltd, 2008, p. 14
- [2] *Board Briefing on IT Governance*, 2nd ed., IT Governance Institute, Rolling Meadows, IL, 2003, pp. 6-7
- [3] G. Reese, *Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice)*, Sebastopol, CA: O'Reilly Media, Inc., 2009, pp. 46-47
- [4] Run SAP Methodology: How to Implement End-to-End Solution Operations (2008, 04). Available: <http://www.sap.com>
- [5] Angel, M. *Improving Service & Support with Service Resolution Management: Optimizing Knowledge Management with Business Process Support* (2008, 04). Available: <http://www.knova.com>
- [6] Z. Panian. "Data Protection – A Key Issue when Realigning IT with the Business". *WSEAS Trans. on Computers*, Issue 11, Vol. 4, pp. 1556-1563, Nov. 2005
- [7] Z. Panian and M. Spremic, *Corporate Governance and Information Systems Audit*, (in Croatian), Zagreb, Croatia: Zgombic & partneri, 2007, pp. 321-334
- [8] L. L. Briggs. (2009, 07). "BI Trends Point Up Despite Down Economy". *TDWI News*. Available: <http://www.tdwi.org/News/display.aspx?ID=9502>
- [9] J. Jeston, *Business Process Management: Practical Guidelines to Successful Implementations*, 2<sup>nd</sup> ed., Burlington, MA: Butterworth-Heinemann, 2008, pp. 44-45

- [10] J. Bowerman, (2007, 02). "Effectively Auditing and Reporting on Database Activity for Compliance". *DM Review*. Available: <http://www.dmreview.com/editorial/dmreview/>
- [11] T. Fisher, *The Data Asset: How Smart Companies Govern Their Data for Business Success*, Hoboken, NJ: John Wiley and Sons Ltd, 2008, p. 65
- [12] C. Mallory. *The Genesis of Data Quality: The Emergent Data Steward* (2006, 11). Available: <http://www.firstlogic.com>
- [13] J. Wu. (2007, 04). "Empowering the Information Enterprise: Role-Based Performance Management". *DM Review*. Available: <http://www.dmreview.com/editorial/dmreview/>
- [14] S. Hoberman, D. Burbank and C. Bradley, *Data Modeling for the Business: A Handbook for Aligning the Business with IT using High-Level Data Models*, Bradley Beach, NJ: Technics Publications, LLC, 2009, pp. 111-112