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Enabling an Agile Information Supply Chain in Service Oriented Architectures with Web Services

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ABSTRACT

The Information Systems (IS) leadership in enterprises share common pervasive agility issues associated with corporate data management, such as providing access when and where needed, data validation and integrity issues, analyzing data housed in disparate systems, and reporting consolidated data to applicable parties. To address these problems some organizations are employing Service-Oriented Architectures (SOA) as a paradigm, which is enhanced by the use of web services, to provide a lightweight means of leveraging resources. The Federal Financial Institutions Examinations Council (FFIEC) is one such organization and we use the traditional systems analysis and design (SAD) approach to frame how the FFIEC employed SOA as a new paradigm of conducting business with web services. We provide lessons learned that are concerned with initiating SOA with web services in order to achieve an agile information supply chain.

Keywords

Service-oriented architectures (SOA), Systems Analysis and Design (SAD), agility, information supply chain.

INTRODUCTION

"For the past 30 years IT was spelled 'IT' with the focus on the technology. Going forward, it will be spelled 'It' with the focus on the Information" (Mulcahy, 2006). The Information Systems (IS) leadership in enterprises share common pervasive agility issues associated with corporate data management, such as providing access when and where needed, data validation and integrity issues, analyzing data housed in disparate systems, and reporting consolidated data to applicable parties. The IS leadership is therefore striving for flexible, yet parsimonious, way of overcoming these information process problems and more effectively planning for just-in-time services and enabling rapid deployment of IS across the enterprise, which is characteristics of an agile business environment. Agility affords the organization the ability to sense and respond more effectively and efficiently to the information delivery and processing for interaction between organizational stakeholders.

To address the aforesaid issues with achieving agility, organizational are employing service-oriented architecture (SOA) with web services to bring about increased business efficiency (Koch, 2006; Kumar et al., 2007; Lim and Wen, 2003). One definition of SOA is that it is a conceptual business architecture where functionality is accessible to organizational users/consumers as shared reusable services on an IT network... 'Services' in an SOA are modules of business application functionality with exposed interfaces and invoked by messages using a number of web-based protocols (Marks and Bell, 2006)." Essen. SOA is a complex concept that surfaced over 10 years ago with a description of a utopian state of enterprise flexibility in information delivery and software development (Natiz, 2003). Internet based technologies and protocols have matured to make SOA a reality; however, there is still surmountable ambiguity as to its definition and components (Rotem, 2006). One prominent misconception is that SOA is interchangeable with web services (platform-independent, open-standard, XML-based self-contained applications that afford information exchange between disparate, distributed systems (Gopalan et al., 2006). SOA is simply the architecture or method in which agility can be facilitated by loosely coupling disparate systems to deliver information and perform a routine process/function, which are typically services provided for a stakeholder like delivering the most up to date inventory levels to various supply chain members that need to use that information to complete their portions of a business process. As a result of the confusion of what SOA (e.g., different

definitions have different value propositions that might not be realized as common across all organizations), there is confusion as to how to create then and why should an organization even employ SOA.

While the application of B2B or B2E Web services is becoming more commonplace as an instrument to disseminate and consume corporate data in the information supply chain (Glaser et al., 2007) it does not mean that an organization is employing SOA. SOA does not mean simply mean that an organization provides a collection of web services but some make this claim (Lomow and Newcomer, 2005). Simply having web services alone, without enfolding them as agents enabling efficiencies in SOA, does not make the business environment agile. Once again this could be due to the lack of a keen methodology for implementing a service-oriented architecture (SOA) model (Shing-Han, 2007; Teti, 2006; Marks and Bell, 2006). To overcome this problem, applying traditional systems analysis and design (SAD) principles to the service-oriented architecture (SOA) context can be a fruitful approach for selecting appropriate standards and establishing governance structures (Maurizio et al., 2007).

The intent of this paper is to provide a methodological guide that augments the traditional objectives of structured systems analysis and design principles in the context of SOA employing web services. In this paper we demonstrate how a service-oriented architecture (SOA) that includes web services can help to address pervasive problems of data access, validation, analysis, and reporting so as to lead to an agile information supply chain. We use components of the traditional systems analysis and design (SAD) approach to frame how one organization, the Federal Financial Institutions Examinations Council (FFIEC), employed a service-oriented architecture (SOA) as a new paradigm of conducting business facilitated by a specific XML technology variant (eXtensible Business Reporting Language (XBRL) for creating web services dealing with business financial information. We also provide lessons learned that are concerned with initiating SOA in order to achieve an agile information supply chain.

LITERATURE REVIEW

Much of the research regarding SOA addresses more granular technical issues of development and implementation of web services, which may be a result of the aforementioned misconceptions. Few papers (e.g., Papazoglou and Georgakopoulos (2003)) deal with the much larger problem of defining what SOA means to the organization and how this definition should then provide the guidance for the development of components to meet business information needs (Teti, 2006). The IT adoption literature regarding targeting a methodology for development says that there are five categories of factors influencing the decision (i.e., environmental, organizational, individual characteristics, technology, and task (Kwon and Zmud, 1987). These same principles apply for SOA development (Haines, 2007). We now discuss three fairly well known SOA models that attempt to embody some or all of these categories of factors.

For example, Teti (2006), an industry analyst, provides a methodology, which entails creating a vision, construction, and execution (see figure 1). He suggests that this model is applicable to many projects but specifically addresses SOA. The vision creation is driven by a number of inter and intra organizational issues that define tasks important to the individuals and the firm (i.e., the constituency), the construction addresses the technology required to accomplish the tasks, and execution seeks to ensure that SOA will facilitate information exchange in the environment.

Digital Strategy Governance Constituency SOA Business Case	Tools WS-* Standards meta-data ESB BPEL	Routing Transformation Orchestration Integration
Vision	Construction	Execution

Figure 1. SOA Methodology (Teti, 2006)

Zimmerman et al. (2004), IBM IT architects, provide yet another model that integrates, business process modeling (BPM), enterprise architecture design (EAD), and object oriented analysis and design (OOAD) as a methodology for SOA (see Figure 2). The authors argue that in this model BPM, EAD, and OOAD provides a starting point for defining SOA and determining a holistic view of the business processes or tasks are ongoing in the organization, the type of environment within

or across do these processes occur, that will help to define the needed architecture, and the design of reusable components that share common elements across the enterprise.



Project Lifecycle Phase

Figure 2. SOA Methodology (Zimmerman et al., 2004)

Bell (2008) provides a service-oriented modeling framework for SOA that takes a more technical approach. It professes that all software can be considered services that are designed based on the informational tasks of the organization, configured for transmission in the working environments, constructed with available technologies, and deployed for use by individuals. The model represents a conceptual structure brings together distributed services based on the functionality (Bell, 2008) (see figure 3).



Figure 3. SOA Methodology (Bell, 2008)

While all of these models address the major categories that traditional IS literature says influences methodology adoption decisions, the actual guidance for answering the basic questions regarding why SOA in the first place, how do you actually get their based on the needs of the organization, and what are the likely outcomes are still lacking. We argue for a need to decrease the complexity and reliance on a familiar and well-proven methodology that can be adapted for SOAs that employ web services. Thus, we propose the relevance of basic systems analysis and design (SAD) principles.

BACKGROUND ON AGILITY ISSUES AT THE FEDERAL FINANCIAL INSTITUTIONS EXAMINIATIONS COUNCIL (FFIEC)

The Federal Financial Institutions Examinations Council (FFIEC), comprised of the Federal Deposit Insurance Corporation (FDIC), the Office of Comptroller of the Currency (OCC), and the Federal Reserve System (FRS) are charged with assessing the financial performance of all federally regulated financial institutions and publishing standards for how banks conduct business as well as report fiscal activity. These tasks hinge on collection of Call Reports, (i.e., a quarterly data series about a financial institution's condition and income, consisting of approximately 2,600 variables from all 8,200 FDIC-insured banks and all FDI-supervised savings banks). These banks produce the report via specialized vendor software that often requires data extraction from multiple internal legacy systems. Reports are electronically submitted to the FFIEC call agencies. The FFIEC uses the call reports to develop the Uniform Bank Performance Report, which publicizes the risk and financial health of the entire U.S. banking industry (Wisnieski et al., 2006). When electronically submitted, the data validation for the call reports falls upon the FFIEC/FDIC agency staff.

The FFIEC needs to be agile in its information supply to (1) provide timely guidance to the banks so that they can correctly perform daily operations regarding funds management, (2) receive timely and less error prone from the banks in the form of reports, and (3) identify problems with the data or banking procedures and guidance to the banks on how to correct the errors. Prior to implementing an SOA paradigm, the FFIEC faced the following problems that constrained agility to sense and respond appropriately: (1) a lag time in delivering quarterly updates in sufficient time to allow banks to prepare Call reports with new standards resulting in the FFIEC's receipt of outdated reports , (2) 80% of all Call reports having serious errors as a result of banks using out of date standards or miscalculations, and (3) and overbearing task for analyst to identify and correct errors of severely backlogged Call reports. All of these issues contributed to extremely late Call reports and late or outdated publication of the fiscal assessment for the banks by the FFIEC. Thus, prior to the SOA implementation, the FFIEC spent excessive amounts of time and resources on the issue, still resulting in poor data quality overall.

In addition to the development examining the development of the SOA paradigm at the FFIEC, we examine the FFIEC's use of the eXtensible Business Reporting Language (XBRL), an XML-based technology for financial reporting that is technique for services (Wisnieski et.al, 2006). XBRL promotes information interoperability between disparate data repositories through standardized formats and data structures expressed in taxonomies (e.g. standards for tagging data elements to define its purpose, structure, and use) (http://www.xbrl.org/WhatIsXBRL/). XBRL uses various taxonomies for the structuring of data across and within enterprises, in which Web services facilitate transmission. The current taxonomies used in XBRL are specifically for financial data and reporting processes. However, taxonomies' structures are flexible enough to support data from other contexts requiring extraction, consumption, manipulation, and validation. XBRL was developed—and is maintained— by XBRL International, a not-for-profit consortium of 450+ organizations involved in international business information supply chains (http://www.xbrl.org/WhatIsXBRL/).

METHODS

We used a case study methodology and interview and document analysis as the primary techniques. We interviewed the project manager for the SOA initiative at the FFIEC, four business functional managers, three data analysts responsible for report error correction, and the outsourced consultants responsible for the technical development. We reviewed the project documentation and case reports completed by the consultants. All data were collected post implementation one year after the SOA paradigm had been adopted. We analyzed the data by applying SAD and coded data according to its categories. The following sections detail how we applied SAD to examine and explain the SOA implementation at the FFIEC. The questions that we present as being relevant to answer in each phase for SOA implementation resulted from reading literature regarding SOAs as well as from asking the FFIEC and outsourced consultants what were the pertinent issues they are addressed during each phase.

Applying System Analysis and Design (SAD) Principles to SOA Iniatives

Traditional systems analysis and design approaches differentiate between four phases in any IT project: planning, analysis, design, and implementation (Dennis and Wixom, 2002). Each of these phases has its own objectives and auxiliary tools. For example, the objective of planning is to determine why an organization should pursue a project (or not) by using tools such as feasibility analyses. The great value of traditional SAD is that it has been successfully used across a wide range of industries and IT projects. Even though specific instruments within the SAD methodology can differ (e.g., to accommodate for a specific context), enterprises still obey its generic principles for the implementation of IT projects. As most IT projects thus far are "iT" rather than "It", in nature, the SOA environment poses a new set of challenges by moving the focus from technology to information (Mulcahy, 2006).

We use the planning, analysis and design phases to frame a discussion on conceptualizing agility issues in the information supply chain that commonly exist in organizations. The resulting guidelines are posed in the form of questions that extend the standard components organizations should evaluate during each phase. The questions and our assertions derive from (1) existing literature on an organizational effort to implement SOA based processes, noting what was considered in augmenting the traditional questions asked during planning, analysis, and design, (2) actual interview of personnel (i.e., the project manager at the FFIEC, primary vendor for the SOA solution, analysts, and bank representatives) involved in the implementation effort, and (3) our insights about the maturation of SOAs across industries. Our contribution is the uncovering of questions that—when sufficiently answered in the context of implementation—should help provide a methodological basis for approaching SOA initiatives. Additionally, the lessons learned promote visibility of issues that enables increased data integrity and transparency, leveraging of IT resources, easier methods of governance, and more streamlined inter- and intra- organizational communication. We will first provide some background information about the organization involved in this study before continuing with details of their planning, analysis, and design phases.

Planning Phase in Service-Oriented Architectures (SOA)

In traditional structured systems analysis and design (SAD) approaches, the planning phase entails identifying why an organization should pursue the project. More specifically, it entails analyzing a project's economic feasibility (i.e., costbenefit analysis, or cost of not implementing), technical feasibility (i.e., does the technology exist, and what are the necessary resources for building the system), and organizational feasibility (i.e., will the system be effectively utilized if implemented) (Dennis and Wixom, 2002).

An essential step in the planning stage is identifying core processes that require interchanging data between disparate environments and assessing the adequacy of the available information—ultimately making the business case for economic feasibility. Here, applying the SOA model does not call for exposing *all* services to Web services, but for many organizations it is prudent to consider B2B and B2E functionality as potential objects (Teti, 2006). With traditional business solutions like an ERP system, the focus is on enterprise data which represents a largely historical view, whereas an SOA model can also afford cost effectiveness in accessing information to provide a more market oriented view. For example, Cartesis, a finance and performance management software provider, enables an SOA model with Web services, extracting data from internal resources as well as external resources, such as Edgar Online (Business Wire, 2006). It allows the application of business logic, as defined in an organization's taxonomy, to analyze the data and to report not only the organization's financial standing, but also competitive data for benchmarking and assessing market competitiveness. In this case, the SOA model in the planning phase should not simply be regarded as a technology player, but rather as an effective instrument to exchange the information contained within systems, thus providing more flexibility and agility in addressing future information needs that are both enterprise and market oriented.

Some augmenting questions for assessing the business value for SOA in the planning phase are geared towards identifying overarching deficiencies in the supply chain. In the following, we will pose questions and discuss how the FFIEC addressed issues related to the planning of their SOA that incorporated web services.

Planning at the Federal Financial Institutions Examinations Council (FFIEC)

(PQ1) Is there an inability to meet the information needs of the organizational stakeholders (e.g., has a business partner asked for more accessibility to data, are lag-times in data exchange slowing throughput, etc.)

Stakeholders that were directly impacted from the FFIEC's consolidated financial institution assessment report sought timelier access to the data. Banks also requested a notification of errors and updates as well as a more streamlined method for providing these updates to the FFIEC.

(PQ2) What is the need for interactive data across the enterprise and amongst the organizational partners? (PQ3) Are the same types of data being disseminated among multiple partners, internal or external customers, or across the supply chain with identifiable duplicative effort?

The FFIEC regulators experienced a wide range of challenges in their reporting functions. For example, securely obtaining data from the banks that could be entered automatically without manual re-keying or re-formatting in a timely and less error prone manner presented a major challenge. Also, reducing costs through the automation of repetitive tasks as well as validating, analyzing, and comparing data more efficiently were desirable objectives to achieve error free reports (Wisnieski et al., 2006).

(PQ4) What is the mission criticality of the services currently being provided, indicating a prioritization sequence

for correcting the deficiencies?

Due to the increased potential for streamlining data manipulation, economic savings could be derived from enabling FFIEC analysts to take higher case loads. Mostly, the FFIEC needed to shift their efforts from a data manipulation focus to a focus on analysis and decision making. They decided to resolve these challenges through a large scale XBRL solution for the quarterly call report process (Wisnieski et al., 2006).

(PQ5) What is the propensity for using open standards for application development? In other words, how can security of the information delivery be a constraining factor?

Due to their apprehensiveness of employing open standards for the underlying application, there was little propensity to not using the XBRL taxonomy. However, the FFIEC assured all technical enabling parties that a high level of secure transmission was guaranteed at every information entry and delivery point in the architecture. The essential requirements were noted as follows (Wisnieski et al., 2006): (a) sender and data authentication as well as role-based access (i.e., no one financial institution could review another's information or file documents), (b) data confidentiality during delivery and storage, and (c) data integrity to ensure no inadvertent or unauthorized deliberate modifications.

(PQ6) What are the capabilities of supply chain information stakeholders to access and consume the data via Web services in an SOA?

All stakeholders were deemed to have sufficient technical capabilities for participating in the information delivery process enabled by XBRL.

(PQ7) Is SOA viewed as a tactical solution as opposed to an enterprise-wide strategic solution that can capitalize on existing technological resources? (PQ8) Is there upper management support to pursue an enterprise-wide strategic solution as opposed to an incremental plan such as developing Web applications as needs arise?

The FFIEC recognized a need for a central data repository in order to meet their core business function, i.e., the production of call reports, more efficiently across the plethora of subordinate work flows. Consequently, the FFIEC actively pursued an enterprise-wide solution.

Analysis in Service-Oriented Architectures (SOA)

Analyzing systems requirements is simultaneously a business and information technology task (Dennis and Wixom, 2002). Systems failure is most likely due to an inability to adequately address the true business need of all stakeholders that depend on data provided within the system to perform work (Dennis and Wixom, 2002). Traditional questions that are raised during the analysis phase are: What does the current system do and how does it do it? What will the new system do? Where and when will the new system be used?

Analyzing the data requirements encompassed in an efficient SOA model should be more broadly scoped than when just revamping one single system. The benefit of SOA is the synthesis of common business logic for manipulating data that exist across disparate systems without having to modify code or encountering constraints exhibited by the various platforms across the existing architecture. Therefore, the following section discusses how the FFIEC performed analysis.

Analysis at the Federal Financial Institutions Examinations Council (FFIEC)

(AQ1) What data-oriented problems exist that thwart the ability to access current and timely data and reduces visibility of accurate information across the supply chain? (AQ2) What are the most costly, time consuming, and duplicative activities and how can processes be streamlined?

The FFIEC determined the processes in the as-is distributed architecture to be flawed or constrained by data access, validation, analysis, and reporting problems (see Figure 1).



Figure 4: FFIEC's old processes (Wisnieski et al., 2006)

Processes to identify errors and problems with back filings were too time consuming and costly for the regulators—a result of activity-based costing and duration analysis. Therefore, they mandated data quality assessments and error detection responsibilities to be a requirement for the vendor supplied software used by banks to create their filings. Also, they enabled responsible parties to make online corrections to their call report filings as well as created a centralized data repository (CDR) that can be used for call report data interchanges. This enhancement in data collection and validation is known as the Call Modernization project which provides a relatively neutral transparent change to financial institutions' existing practices (i.e., no really burdensome changes for the banks).

(AQ3) What are the common data elements and parent entities currently being used across the services that can be used as central elements and entities to provide a basis for a logical data model and underlying processes for the to-be architecture?

The FFIEC held joint application design sessions that resulted in the to-be distributed architecture as depicted in Figure 2.



Figure 5: FFIEC's new process (Wisnieski et al., 2006)

In the new architecture, the software vendors supply banks with the appropriate applications to create their filings. For that, the FFIEC specified particular data collection requirements to be incorporated into the vendor software, including FFIEC's standard definitions for attributes and entities. These could then be used by XBRL as elements to validate standards relating to specific business logic for aggregating and manipulating data as well as be used as part of Web services. In addition, they would easily enable a financial institution to make needed changes to a document that had already been submitted to the FFIEC's review process. The alternative, i.e., waiting for the FFIEC to return the document, often caused an enormous time lag in processing.

Design in Service-Oriented Architectures (SOA)

The design of a system is only as good as the analysis, and the basic overarching question in this phase is "How will the system actually work?" (Dennis and Wixom, 2002). Since the purpose of the design phase is to establish how to build the system, the majority of the activity is geared towards evolving analysis specifications into design representations (Dennis and Wixom, 2002). SOAs afford data integrity in that there is an abstraction of data from the disparate systems that serves as a logical repository transforming the data into common elements, which can be used across various services. SOAs should also be designed to should allow scalability to account for affording more web services when needed in addition to needed accessibility. The following section discusses the design phase at the FFIEC.

Design at the Federal Financial Institutions Examinations Council (FFIEC)

The primary advantage in the design of a SOA at the FFIEC is its ability for a reusable business logic that is incorporated in tasks performed by internal and external consumers of the data. The designs embed business rules within the application layer that are more effectively managed at the abstracted information or taxonomy layer.

(DQ1) What business systems currently house needed data? And (DQ2) How can XML-based technologies support the extraction and interchange of this data?

Data resides in more than 8000 financial institutions' multiple legacy applications that use vendor software to consolidate source data needed for financial reporting. The FFIEC provided the vendors with an XBRL taxonomy inclusive of (a) element definitions, meta data, and content requirements analogous to a schema or document type definition, (b) business logic in the form of algebraic formulas for data validation purposes with developed use cases, plain English edit messages

that alert the institutions when errors occur, and requirements for inputting each institution's explanation for valid data discrepancies and fluctuations, and (c) a common instance document output add-on for transmission—most often completed via a Web service (Wisnieski et al., 2006). This XBRL taxonomy is published to vendors and consumed as a Web service, which enables easier maintenance as changes occur. Abstracting the business logic and element meta-data that are physically represented in a centralized data repository affords standardization while leveraging current IT resources at the institutions.

(DQ3) Does the existing enterprise security system support standards needed for secure XML-based Web services, if not how will security be enforced?

The design is sufficiently secured to ensure a sender's authentication as well as the confidentiality and integrity of data while consumed and submitted via Web services and ultimate stored in the centralized data repository.

Implementation in Service-Oriented Architectures (SOA)

The success of the implementation of a system depends on how well the system is constructed, tested, and turned over to the user in a manner that does not invoke resistance and the basic overarching question in this phase is "How it will be integrated into the organization for use?" (Dennis and Wixom, 2002). The primary questions in this phase are: (I1) How will and who will handle actual construction? (I2) What are the testing requirements? (I3) What are the change management issues? We found these questions to remain applicable in their pre-existing format for SOA.

Implementation at the Federal Financial Institutions Examinations Council (FFIEC)

For I1, the primary advantage in implementation is that the FFIEC partnered with the leading vendors and consulting firm through a consortium that is actively promoting the use of XBRL. The partners in the consortium are considered the leading experts on use of XBRL as the mechanism used to create the services in facilitating SOAs. In this scenario the vendors who previously provided software sanctioned by the FFIEC for banks to use to prepare reports could more efficiently acquire needed meta-data at the time it was published by the FFIEC. Additionally, analyst were provided templates for creating specialized web services needed to extract data from disparate systems and speed up the process for analyzing banking data, In an SOA environment construction is dependent of the services needed. Since the environment is only as good as the data it can provide and the manner in which it does so, testing (referring to I2) at the FFIEC focused on ensuring that data used across services were common and delivered the reliable results when used across services. Data resides in multiple repositories in SOA environments and ensuring integrity is complex. An abstraction of the data from the systems into some logical data model that identifies a crosswalk between like data allowed for standardization without having to implement costly re-engineering of current systems. In answering I3 we refer to the discussion in the Lessons Learned section titled SOA with the Use of Web Services Enables Efficient Use of the Workforce.

LESSONS LEARNED

Though our insights here are contextually based, they can serve to be informative for any organization considering implementing SOAs with web services to promote agility in their information supply chain.

Perform Business Process Modeling to Discern Disjoints and Prime Inefficiencies

At the conclusion of the planning phase, a key lesson learned was that the FFIEC discovered how manually driven and how disjointed their processes were despite having migrated to standardized electronic forms several years prior. Initially the FFIEC only viewed the SOA and web services enabled by XBRL as means to help receive data in a timelier fashion and promote better data quality upon its receipt. The major revelation was that in order for the FFIEC to receive data in that manner, it needed to provide the banks with better and timelier meta-data so that they would be able to create the call reports in accordance with the FFIEC's regulations. Part of the discovery during the planning phase was the understanding of how much the SOA—and specifically XBRL web services—would facilitate knowledge management (e.g., dissemination of instructional guidelines for how to use the electronic forms) across their supply chain partners (i.e., the U.S.-based banks, the Federal Deposit Insurance Corporation (FDIC), and the Federal Reserve Bank (FRB)). The new FFIEC paradigm, to be realized via a SOA and the XBRL solution, became "help them (speaking of the banks) to help us."

SOA with the Use of Web Services Requires More than Data Consolidation

During the analysis phase, a key lesson learned was the disjoint between the two leadership factions in the FFIEC, more specifically between the FDIC as the technology leader and the Federal Reserve Bank (FRB) as the administrative coordinator. These two factions received the same consolidated data from the banks via an electronic version of the call

report, but used the data differently. As a result, each had varying business processes that were best facilitated by the use of different taxonomies applied to virtually the same data. The root cause of the disparity between the two factions was their inability to easily transfer information between themselves and thus to present unified guidelines to the banks. Additionally, the business processes were laden with manual duplicative efforts. For example, the banks transferred the data via electronic forms, generated in specialized software, to the FFIEC at which point the analyst at the FDIC and FRB would often extract data from the forms and re-key data into their respective information systems or data repositories. Part of the discovery process in the analysis phase revolved around how to collapse ways of working together while leveraging the respective IT resources with disjoint platforms and maintaining some autonomy in how the data were used. The technological solution of applying the XBRL and using different taxonomies for each faction was deemed suitable for resolving this issue making the information platform more agile in responding to needs of the constituents.

SOA with the Use of Web Services Enables Efficient Use of the Workforce

Despite the differences in the leadership of the FFIEC factions for each organization, there was a high propensity for change and business processes re-engineering, but the underlying architectures and political atmospheres made the transition at the operational level problematic. Even though the leadership envisioned cooperative change, on the operational level the workforce resisted, fearful that the technology would enable downsizing. For example, analysts typically had specialized coding skills and would spend the bulk of their time re-keying data, which was often laden with errors induced by the manual process—ranging from forms and writing queries, to inserting data into other data repositories. In essence, the proposed reengineering would eliminate a whole category of errors associated with double-entry. As part of the organizational change solutions, the FFIEC leadership earnestly attempted to convince the analysts that the business process re-engineering would benefit them in terms of decreasing the amount time to process the data received from the banks and enabling them to refocus their abilities on other truly analytical tasks. Additionally, the FFIEC included the analysts in the implementation process via interactive joint application development sessions. Those analysts who did not conform to the changes were presented with separation packets options.

The group of analysts who were formerly responsible for writing specialized code (e.g., COBOL) to generate queries on the mainframe were allowed to use Web interfaces to make necessary changes in the underlying business logic using an Englishbased user interface. This opened up a variety of opportunities for the remaining analysts who did not have the specialized coding skills before. Compared to only one analyst who would have the skills to work on, for example, the needed changes of a large mathematical algorithm, now several analysts could work various aspects of the algorithm, which were versioncontrolled. The primary insights from this design improvements was that the use of English-based graphical user interfaces enabled better use of the workforce and promoted collaborative efforts for problem solving, which resulted in improved quality for the resulting business logic.

Use Third Parties as Intermediaries

Another insight that emerged during the analysis phase was the need to not disenfranchise the software vendors who were intermediaries between the banks and the FFIEC. The software vendors were the integral components in the supply chain of information that enabled the electronic form generation and data transfer from the banks to the FFIEC. The software vendors and the banks quite often had long standing, highly dependent relationships, and the FFIEC deemed the vendors as ambassadors working on their behalf to smooth the transition for the banks to the new data management paradigm. Prior to the XBRL solution, there was a convoluted and timely process for incorporating needed changes into the proprietary software as FFIEC business logic frequently changed. This problem contributed to the delays in the transfer of the data and the data quality if, for example, the forms were built using outdated logic. The technology partners and consultants to the FFIEC devised the XBRL solution to use Web services that enabled seamless and automatic incorporation of taxonomies or updates in the business logic established by the FFIEC, which contributes to an agile information supply chain.

Meta-Data Concerning how to Submit the Data Improves Data Quality

The key benefit to the FFIEC concerned meta-data management that promoted better quality of data, in light of the FFIECs need to change reporting standards every quarter. The win in the situation was the decrease in the time to receive the reports from the banks, but this was because the FFIEC better communicated the guidelines for producing the reports. This was best realized when the XBRL solution went live, and one of the very first reports received was readily identified as completely erroneous. FFIEC analysts were easily able to identify the issue as the reports generated were based on an outdated taxonomy. They contacted the respective vendor, who accessed the correct taxonomy via a Web service, and was able to enable the bank to re-enter the data and forward the new report within fifteen minutes. Prior to the XBRL solution, the time span between problem identification at the FFIEC and the re-submission by the banks would have been several days. From

the outset of the project, data quality was the surface issue, but the main lesson learned was not so transparent. FFIEC learned that the agility came from enabling technologies that helped to communicate and to educate all of the information supply chain partners about means to produce the desired output, which in essence promotes agility.

CONCLUSION

SOAs are paradigms, not technologies (Knorr and Rist, 2005). SOAs can aid attaining business agility while leveraging current IT assets. Hence, it should not be viewed as a 'new implementation' for 'new implementations', but instead as a way of conducting business (Knorr and Rist, 2005). Since the mere mention of reengineering promotes anxiety amongst supply chain partners, it should be made clear that SOA is not such an effort. Rather, SOA is an endeavor to promote business value in terms of reduction of costly inefficiencies related to data interchange to provide asset visibility specific to core businesses (e.g., visibility of accurate inventory or in the procurement process). Overall, a service-oriented architecture (SOA) is a means to more efficiently couple underlying applications. In an enterprise initiative, ample application of good planning, analysis, and design principles with adequate technical support employing standards can produce smart implementations, 2008; Nerur and Balijepally, 2007). These implementations can promote business agility, better internal controls, and enhance compliance processes overall to lower the costs associated with data interchange (Willis and Eccles, 2006; Willis and Hannon, 2005).

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