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Implementing Service-Oriented Architecture Governance

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Abstract for

Implementing Service-Oriented Architecture Governance

Service-Oriented Architecture (SOA) adoption is growing, with increasingly more technology departments in the US and Europe either deploying SOA solutions or engaging in proof of concept projects (MarketWatch, 2007). The purpose of this study is to identify the implementation phases of a SOA governance program (Windley, 2006A), including the information technology management and business goals for each phase. A roadmap is provided for technology managers preparing to implement a SOA governance program.

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CHAPTER I – PURPOSE OF STUDY

Brief Purpose

The purpose of this study is to identify the implementation phases of a Service-Oriented Architecture (SOA) governance program (Windley, 2006A), including the information technology management goals that each phase of a SOA governance program aims to address (Willoughby, 2006). Information technology managers today are faced with embracing SOA technologies and the complexity that they bring (Baseline, 2007).

SOA is defined in this study as a “business strategy that enables a company to more closely align and reuse existing technology to achieve business goals” (IBM, para. 2). According to Windley (2006A), SOA offers the potential for technology teams that support enterprise applications “to increase code reuse, reduce integration expense, better security, and — the big payoff— greater business agility” (p. 29). Since its inception, SOA has been met with some skepticism and confusion from technology managers and technology architects who view SOA as having the potential to introduce management problems related to security, cost, and complexity (Aziz, 2006). However, the momentum has shifted and SOA adoption is increasing, with recent surveys in the US and Europe identifying that 30% of technology departments in enterprise environments are either deploying SOA solutions or engaging in proof of concept projects (MarketWatch, 2007). MarketWatch (2007) advises that if enterprise technology teams have not begun to explore the use of SOA, they soon will.

This study is designed as a literature review of SOA governance, in which data from selected works related to information technology management are “[evaluated], [organized] and [synthesized]” (Leedy & Ormond, 2005, p.77). The collected literature is limited to materials published between 2000 and 2007, with the exception the governance document provided by Cobit that was published in 2000. The material is also limited to SOA governance (Moore, 2006C) and the management of SOA programs (Bednarz, 2006).

The literature selected to comprise the data set for data analysis is synthesized using a conceptual analysis approach (Palmquist, et al., 2005). Conceptual analysis is one form of content analysis. Leedy (2005) describes content analysis as a method that allows the researcher to uncover “patterns, themes and biases” within a particular body of material (p.142). According to Palmquist (2005), conceptual content analysis involves selecting a concept “...for examination, and the analysis involves quantifying and tallying its presence.” For the purposes of this study, the eight step conceptual content analysis defined by Palmquist is leveraged. Given the fact that this study is attempting to describe the implementation phases in a SOA governance program which are defined across a number of selected textual references, a conceptual analysis approach is the most appropriate approach to content analysis.

The conceptual analysis is conducted to identify first the phases of a SOA architecture governance program and then the IT management goals inherent in each phase. Results of the data analysis are presented in a series of tables that address each identified SOA

governance program implementation phase and the reported information technology management goals. These tables are designed to support the potential alignment of IT management goals with business goals, as represented in each governance program implementation phase, and as revealed in the literature examined.

The primary outcome of the study is a SOA governance roadmap based on the identified implementation phases of a SOA governance program. The roadmap is designed for information technology managers, who often need a starting point when implementing SOA governance within their own organizations (Bieberstein, Bose, Fiammante, Jones, & Shaw, 2006). The roadmap serves as general overview and guide for these managers just beginning to implement SOA in their organizations.

The audience selected for this study is the information technology manager. The responsibilities of the technology manager as defined by Luftman (2004) encompass the areas of 1) planning and budgeting, 2) organizing and staffing, and 3) controlling and problem solving. Technology managers who are tasked with implementing SOA strategies need to apply each of these areas to SOA governance programs to ensure successful implementations. As noted by Padmanabhuni, Anand, and Dayasindhu (2006), designing an effective governance mechanism presents challenges for information technology managers who decide to implement a SOA architecture and is “essential to implementing and operating a successful SOA” (para. 1). While the management of multitier applications is traditionally focused on the management of single self contained applications (Stack, 2006), the management of SOA applications is focused on an

alignment between IT (information technology) and business goals (Moore, 2006B).

According to Kobiellus (2006), there is a tendency among IT groups to proliferate SOA “junk services” unless proper SOA governance programs are instituted. This movement to SOA presents difficult governance challenges for technology managers, who are used to “approaching SOA from the bottom up, attempting to fuse disparate service initiatives with no guiding set of rules or principles – governance – around impact analysis, change management, policy management and contract management” (McKendrick, 2006, para. 1). Fortunately, as noted by Moore (2006B), “governance tools seek to tame this environment” (para. 2).

Full Purpose

SOA Management Challenges

SOA has only recently gained acceptance, with 35% of executives in a 2007 AMR Research Study stating that “their companies had implemented one or more projects using SOA” (Violino, 2007, p.54). As it is still a relatively new approach that will serve as a “permanent replacement for the now-prevailing monolithic [even if technically distributed] systems” (Violino, 2007, p.54), according to Stack (2006), “the transition to SOA will not be easy” (p.44). Transitioning to SOA is not simply a matter of reigning in the “the proliferation of Web services” (Moore, 2006C, p. 89), but rather requires the development of a structured approach that promotes alignment of SOA strategy and business goals to “...ensure that your SOA doesn’t go sideways (McKendrick, 2006, para. 3).

Of all the challenges facing the IT manager, the number one enemy is complexity (Goldberg, 2005, p. 33). Goldberg (2005) notes that IT departments are hard-pressed to meet the demands for business alignment, not because IT staffs are incapable or poorly trained, but because so many IT resources are devoted to keeping their overly complex infrastructures running (Goldberg, 2005, p. 33). SOA is frequently touted as the "silver bullet" for solving complex IT integration problems, and as such has gained popularity as a way to address the goals of alignment between technology and business (Knights, 2007). Linthicum (2007A) makes the claim that SOA can provide this “ability to change IT infrastructure faster and adapt to shifting needs of the business. This provides a huge

strategic advantage and can give the business a better chance of survival in the long-term” (p.32).

Once an organization selects SOA as a viable strategic direction for their technology and business, they must meet new challenges associated with managing a SOA environment. One of the critical challenges facing information technology managers when implementing SOA is designing an effective governance mechanism (Padmanabhuni, Anand, & Dayasindhu, 2006). While moving toward a SOA often means drastically altering the internal software architectures that exist within organizations, “some of the most vexing issues associated with a SOA are not technical issues but rather challenges managing people and policies during the shift” (Havenstein, 2006, p.6). SOA is about aligning business with IT, and successful SOA starts with governance (MacVittie, 2006). “Top-performing enterprises succeed where others fail by implementing effective IT governance to support their strategies,” and SOA governance is no different (Weill & Ross, 2004, Overview section, para. 5).

Definitions of SOA

Information technology managers can come across a myriad of definitions for SOA depending on whom they ask and where they look (Spratt & Wilkes, 2004). For the purposes of this study, SOA is defined as “a computing architecture that lets companies make applications and computing resources, such as databases, available as services” (Moore, 2006A). Such services should then be grounded in “. . . a business strategy that

enables a company to more closely align and reuse existing technology to achieve business goals” (IBM, para. 2).

It is widely accepted that SOA is changing the way in which business and technology interact. According to MarketWatch (2007), definitions that touch on both the business perspective and technology perspective reflect the impact that the focus on alignment as a key concept within SOA has on both groups (MarketWatch, 2007). The fact that SOA is both a business strategy and a technology strategy is summed up well by Seeley (2006), who states that "with SOA we're seeing more collaboration upfront between the business and IT...You get a business strategy influencing a business architecture that you actually plan. The business strategy and IT strategy are aligned and they serve each other” (para. 18).

The Concept of Alignment

Strategic alignment between technologies and the business goals that they support is both a matter of survival and the source of competitive advantage in the market place (Cassese, 2006). According to Luftman (2004), “one of the most important missions for IT management in the 21st century is to be architects of alignment, linking business and IT” (p.25). SOA takes a new approach to developing technology solutions in an effort to overcome the shortcomings of more traditional approaches (Linthicum, 2007A).

According to Stack (2006), “The complexity and rigidity of traditional systems results in the too-familiar misalignment between IT and the business” (p. 44). SOA is in effect a new strategy for delivering value to the business through technology and requires that

both the business and technology align properly in order to deliver technology solutions based on a service based architecture in such a way that reduces risk and solves business challenges (McKendrick, 2006). In fact according to Moore (2006B), successful SOA implementation begins with alignment and ensures that the business and technologists architecting the SOA systems are communicating to ensure alignment of objectives and deliverables.

SOA Governance

SOA governance is the mechanism by which organizations ensure that their SOA implementation is built around the best possible alignment between the goals of the business and IT (Weill & Ross, 2004, Overview section, para. 5). A key objective in IT Governance is that the alignment of the business and IT goals must lead to the achievement of business value through IT (Van Grembergen, 2004). “The overall objective of IT governance, therefore, is to understand the issues and the strategic importance of IT, so that the enterprise can sustain its operations and implement the strategies required to extend its activities into the future. IT governance aims at ensuring that expectations for IT are met and IT risks are mitigated” (ITGI, 2003, p.7).

In the wake of the Sarbanes-Oxley Act of 2002, IT governance has begun to play a more prominent role in the eyes of executives (McCollum, 2006). As SOA “mature[s] into sizable components of firms' IT infrastructures, new challenges of management and coordination come to the fore,” making SOA governance in particular a key factor in successful implementation of SOA (Trombly, 2006, p.19). “Good governance reduces the

risk of mismatched services and redundant development efforts. Uncontrolled development, on the other hand, can lead to redundant code” (Moore, 2006C, p. 108).

Governance is an integral part of the success of SOA and should be one of the first things that an organization should set up before they launch into SOA (McKendrick, 2006). The purpose of this study is to identify the implementation phases of a SOA governance program (Windley, 2006A), including the relevant SOA management goals in each phase. As a way to do this, the study is designed as a literature review of SOA governance, in which data from a variety of sources related to SOA implementation and governance are “[evaluated], [organized] and [synthesized]” (Leedy & Ormond, 2005, p.77). According to Leedy & Ormond (2005), the function of literature review “is to ‘look again’ (re + view) at what others have done in areas that are similar, though not necessarily identical to, one’s own area of interest” (p. 64). Literature from books, trade journals, industry web sites and industry magazines, searched through academic databases, are collected from materials identified in the following areas:

- IT Alignment – Literature concerning IT alignment is collected in order to identify the key elements of IT alignment.
- IT Governance – Literature concerning IT governance is collected in order to consider IT governance goals along side SOA governance goals.
- SOA – General literature concerning SOA is collected in order to best define the term in the context of governance.
- SOA Governance –Literature concerning SOA governance is collected as it relates to management’s ability to implement SOA strategies.

- SOA Governance Deployment –Literature is collected on SOA implementation in order to identify the typical individual phases of implementation.

After the literature search and collection phase is complete, the selected literature is analyzed using a conceptual analysis approach to data analysis (Palmquist, et al., 2005). A conceptual analysis is selected due to its ability to conduct “thematic analysis” within a selected body of literature (Palmquist, et al., 2005). The goal of this study is to present implementation phases of SOA governance and the related management goals. Conceptual analysis (Palmquist, et al., 2005) allows for the identification of words and phrases that are representative of implementation phases and management goals, as these are framed in the selected literature. Key words and phrases selected for the initial approach to coding during the conceptual analysis are: SOA governance; SOA implementation; and SOA governance management. Additional pertinent phrases are added as these emerge through the analysis process.

The results of the conceptual analysis process are compiled in the following tables:

- The first table organizes the literature selected as the data set for content analysis into five high level content categories: general SOA; SOA governance; IT governance; SOA deployment; and IT alignment.
- The second table lists the implementation phases of SOA governance and the supporting references as identified through the coding process. Patterns are

identified by cataloguing the existence of particular words or phrases in the literature that map to a specific implementation phase

- The third table lists the management goals and the supporting reference information that are related to each identified implementation phase.

The information contained in these tables is synthesized into the final outcome of the study, which is an implementation roadmap that can serve as a SOA governance implementation guide for technology managers. Technology roadmaps are useful guides for technology managers and serve the purpose of helping them coordinate all the activities involved in adopting new technologies (cited in WikipediaB, para. 2). This tool is intended to be used by information technology managers as a guide to either 1) map out a new SOA governance program based on the identified implementation phases and management goals of this study or 2) compare against an existing governance program to identify areas for potential improvement.

Limitations

The technology implementation details around SOA are numerous and complex, with web services being only a part of the whole technology picture (Bednarz, 2006). There are a number of new technologies that aim to help organizations implement SOA based architectures. “Designing, deploying and managing services-based applications is a different animal from working with traditional multitier applications,” and as such require new technologies to manage and implement (Bednarz, 2006, p.36). This study does not

aim to address SOA implementation and management technologies, but instead focuses solely on SOA governance implementation phases and management goals.

As SOA is a recent development, the literature collected for this study is limited to literature between 2004 and 2007, with the exception the governance document provided by Cobit that was published in 2000. Prior to 2004, the amount of literature available on the subject of SOA is not substantial enough to support a study of SOA governance.

IT governance is an expansive topic. IT governance “aims at ensuring that expectations for IT are met and IT risks are mitigated” across the whole expanse of an organization (ITGI, 2004). This study is limited to SOA governance and not IT governance covering all parts of an organization.

The phrase ‘implementation phases’ when used in conjunction with a new technology often leads readers to assume that all phases of technology implementation are covered. This study is limited solely to the implementation phases of SOA governance. This excludes SOA implementation phases such as: prototyping, web services, enterprise service bus, messaging and vendor specific SOA solutions.

With any new technology, every vendor seems to advertise that they have all the necessary components to make your implementation go smoothly (Knights, 2007). Given the heavy influx of vendors into the SOA market place, this study excludes the following

from its literature review: vendor penned white papers, vendor website information and vendor supported studies.

Web services are often used interchangeably with SOA, but "...while service-oriented architecture (SOA) is associated with Web services, the technologies are not interdependent" (Hall, 2007, p. 11). This study focuses on the implementation phases related to SOA governance faced by IT managers during SOA governance implementations. It is not limited to a particular kind SOA implementation involving any particular technology, as they can take the form of many technologies such as web services, an enterprise service bus or CORBA (Hall, 2007).

Problem Area

Plummer states, "SOA is not something you chose to do. It will happen to you whether you chose it or not. . . . When you buy your next upgrade you will have SOA in it. It is just a matter of how you chose to use it" (cited in Nally, 2006, para. 3). In the US and Europe, 30% of technology departments in enterprise environments are either deploying SOA solutions or engaging in proof of concept projects (MarketWatch, 2007).

Moreover, web services, a key technology in the implementation of SOA, is finally maturing and gaining in importance, as more and more firms adopt web services (Gonsalves, 2004).

Goldberg (2005) believes that increasing IT complexity is forcing IT departments to spend more time building applications that are important to the business and less time adding business value. SOA is also brings complexity to IT infrastructures, which makes proper SOA governance all the more important. According to Jake Sorofman, “While SOA has the promise of delivering very compelling business benefits, and helping companies to achieve higher degrees of flexibility and agility, it comes with a cost, and that cost is the complexity it creates” (McKendrick, 2006, para. 1).

The passage of the Sarbanes-Oxley Act of 2002 also raises the importance of IT governance as the federal government increases its oversight of financial reporting and the technology that drives it (McCollum, 2006). A goal of IT governance is to ensure that the resources of an organization are being distributed responsibly with regards to technology (ITGI, 2004). Linthicum (2007B) predicts that in the coming years SOA will see a huge surge in spending and increasingly become an ongoing cost to organizations. As a result, Violino (2007) is probably correct when he says that SOA governance will play an important role within organizations to ensure that SOA implementations deliver value and are measured accordingly (Violino, 2007).

A number of companies have already experienced the pain of not implementing a good SOA governance program early on. Ricadela (2006) recounts that executives may need to manage SOA development strategies in different parts of their organizations at the same time. He believes that a lack of good SOA governance can result in SOA implementations that fall prey to any of the following outcomes:

- Multiple internal groups creating similar SOA solutions;
- Adding more complexity to infrastructure;
- Not providing the integration between business units;
- Spiraling implementation costs.

CHAPTER II – REVIEW OF REFERENCES

Literature used to support the development of the purpose of this study as it relates to SOA governance implementation phases and the management goals that are relevant to each phase are selected from sources that include academic search databases, books, industry websites, and trade journals. These sources yield a sub-set of literature that serves as the foundation for this study, described as key references.

SOA governance implementation is comprised of a number of sub topics, which include IT Alignment, SOA and IT Governance. The references that provide the foundation for SOA governance are presented first, as the context that these foundational works provide lays the groundwork for the study of SOA governance. This study is based on key references from the following six areas. References are presented in alphabetical order in each area:

- IT Alignment – The references in the area of alignment between business and technology provide support for discussion of all the strategies, technologies, results and outcomes that are presented in this study. Literature in the areas of SOA, SOA Governance, IT Governance and SOA Implementation has roots in IT alignment.
- IT Governance – Like SOA, IT governance is another foundational layer in the literature that needs to be covered before SOA governance can be appropriately discussed. IT governance aims to place a governance framework around new strategies and technologies such as SOA to ensure that they align

with business goals. The convergence of SOA and IT governance results in the body of literature that is at the heart of the study – SOA Governance.

- SOA – SOA is a core strategy and technology whose complexity spurred the need for SOA governance. The references related to SOA provide a foundational step before moving on to the discussion of SOA governance.
- SOA Governance – The references in this section provide the basic framework for understanding SOA governance and the management goals that SOA governance aims to achieve.
- SOA Governance Deployment - This section of references provides the majority of insight into the detailed deployment phases of a SOA governance program and is the most appealing to the audience of information technology managers who is the target for the final outcome of this study.
- Methodology – This study outlines a method plan based on literature review and content analysis.

These references are presented in alphabetical order and are reviewed based on the following criteria:

- Identification of the areas in the reference that are relative to the purpose of this study;
- Identification of the sections of the study that reference the work, including how the reference supports the content of the study and if the reference is used in the data analysis section of the study;
- The criteria used to determine if the reference is a credible source.

Foundation of IT Alignment

Cassese, V. (2006). Natural alignment. *Computerworld*. 40, 31-32. Retrieved May 5, 2006, from Business Source Premier database.

Cassese's work on strategic technology alignment provides a prescriptive method for eliminating the divide that can exist between technology teams and business goals. The reference lays out a simple five step technique for attaining strategic technology alignment. On the heels of an article entitled "Does IT Matter," that shocked many in the industry, her article responds with the opposite idea that IT alignment with the business is a matter of survival.

Cassese is referenced in the Full Purpose section of the study. Her work is used to underscore the importance that strategic alignment plays in the overall SOA framework.

Cassese is the vice president of global business technology for Pfizer Global Pharmaceuticals. Her group is responsible for the information technology that supports more than 50,000 Pfizer employees. She has authored numerous articles in magazines in websites such as CIO, CIO Insight and Computerworld. She is also a frequent presenter at industry conferences in the area of strategic alignment.

Luftman, J. (2004). *Managing the information technology resource: Leadership in the information age*. New Jersey: Prentice Hall.

Luftman's book *Managing the Information Technology Resource: Leadership in the Information Age* is a seminal work in the area of strategic alignment between business and the information technology teams that support the business. Since its publication it has served as a handbook for CIOs and executives of small and large companies alike. This book introduces the concept of strategic alignment maturity which holds that strategic alignment is the "key framework for creating effective IT strategies" (Luftman, 2004, p. 24). Along with strategic alignment, the book also covers the general role that IT governance should play within an organization.

Luftman is used as the main source for the important role that strategic alignment plays between business and technology. Strategic alignment serves as a foundational tenet in the study of SOA governance. The Luftman text is used in the brief purpose and the Full purpose to frame the study and is included in the introduction to the topic, and as a way to describe the intended audience and frame the perspective of study.

When Luftman began writing in the 1990s, "IT professionals were confined to their departments and regularly had to go begging to fund their projects" (CIO Insight, 2004, p.80). As these professionals moved into the business seeking alignment, Luftman was a key author in helping technology managers answer these new questions of how to align better with the business that they support. Luftman worked at IBM for twenty years and

then took a position as a Professor of the Wesley J. Howe School of Technology Management of Stevens Institute of Technology. He is a frequent contributor at industry training events and is frequently requested as a mentor to executives. He has published three books and dozens of articles of the course of his career.

Foundation of SOA

Bieberstein, N., Bose, S., Fiammante, M., Jones, K. and Shaw, R. (2006).
Service-Oriented architecture compass: business value, planning, and enterprise roadmap. Indianapolis, Indiana: IBM Press.

SOA is still relatively new in the field of information technology, so such a voluminous work on the subject makes this reference a key foundational work in the area of SOA.

This book has a number of chapters related to the areas of strategic alignment, general SOA technologies and the business value of SOA.

The book is used in the Full Purpose section of the document as a reference for how to construct a technology roadmap. Moreover, it is used as a high level reference for SOA in general.

The authors of *Service-Oriented architecture compass: business value, planning, and enterprise roadmap* collectively have a number of different accolades and accreditations that demonstrate the credibility of the reference:

- Collectively 100 years of experience in the IT industry;
- A solution architect for IBM Enterprise Integration team;

- Contributions to multiple technical trade journals and magazines on topics ranging from SOA to e-business. These publications include CNN, Network World, Java World, NC World, Windows Tech Edge, and Linux World;
- Contributions to industry specifications and standards.

Moore, J. (2006B). SOA success: five actions you should take. *CIO Insight*, 74, 103-111
Retrieved April 9, 2007, from Business Source Premiere database.

This article focuses on the impact that SOAs can have on the businesses that use them and the technologists who implement them. The author outlines a set of action steps that technology managers should take when implementing SOA into their organizations. The article informs the overall understanding of SOA in the study and outlines a set of SOA governance procedures that SOA implementations should implement in order to ensure SOA success.

Moore is used extensively in the Brief Purpose and Full Purpose sections of the study for references to the importance of strategic alignment through SOA and the need to implement SOA governance as a part of any SOA implementation. The work is utilized as a reference in the set of materials selected for coding during data analysis in both the identification of management goals and SOA governance implementation phases.

Moore has been writing in the information technology sector for the past 15 years. He has served as an editor at Smart Partner, Computer Systems News and Federal Computer Week, a newspaper that covers information technology at the national level.

Foundation of IT Governance

ITGI. (2004). *Board briefing on IT governance*. Retrieved March 28, 2006 from http://www.itgi.org/Template_ITGI.cfm?Section=Best_Practices&CONTENTID=15994&TEMPLATE=/ContentManagement/ContentDisplay.cfm.

The Information Technology Governance Institute provides this board briefing as a comprehensive overview of all concepts related to IT governance. It is meant to be tool for information technology managers to aid them in starting to understand how to implement SOA governance within their own organizations. In particular, this sources references pertaining to strategic alignment and performance measurements are utilized in laying the foundation for this study's understanding of SOA governance within the framework of general IT governance.

ITGI was established in 1998 as a resource for IT governance and aims to provide information technology leaders with original research in order to ensure that value is derived from the information technology resource. It is recognized in the industry as a quality resource for IT governance.

Weill, P. & Ross, J.W. (2004). *IT governance: How top performers manage IT decision rights for superior results*. Boston, Massachusetts: Harvard Business School Press.

This reference is a key source for demonstrating the manner in which SOA governance realistically plays out in information technology departments and how it impacts the day-to-day operations of technology departments. Weill and Ross also support the idea that IT

governance has roots in strategic alignment, a key concept of moving SOA from a confusing technology to one that ties the business together.

This reference is used in the Brief Purpose and Full Purpose sections of the study to frame the role that IT governance plays as a foundational structure for SOA governance to take place.

Peter Weill is Director of the MIT Sloan School of Management Center for Information Systems Research and a MIT Sloan Senior Research Scientist (Weill & Ross, 2004). Weill cowrote the bestselling book *Leveraging the New Infrastructure: How Market Leaders Capitalize on Information Technology*, which was published by the Harvard Business School Press. Jeanne W. Ross is a Principal Research Scientist at the MIT Sloan School of Management Center for Information Systems Research (Weill & Ross, 2004). She has been published in books, articles, and case studies.

Foundation of SOA Governance

Marks, E.A. & Bell, M. (2006). *SOA: A planning and implementation guide for business and technology*. Retrieved March 25, 2007, from <http://books.google.com/books?hl=en&lr=&id=fQFpEVCTP6cC&oi=fnd&pg=PP5&sig=VsbPzopCajmKmHY46DRmOxQ6so&dq=%22SOA+strategy%22>.

Marks and Bell provide a comprehensive framework for understanding what SOA is, how it can aid the business, technically what is involved in the implementation and how to ensure success with SOA governance. It is a handbook for SOA implementations from concept to implementation. While it is only quoted in the definition section of this study

to define SOA Governance, it is a formative work for informing the study's overall understanding of how SOA governance fits into the overall SOA implementation cycle.

The book is used in the definition section for defining what SOA governance is and in the data analysis section for identifying management goals of SOA governance.

Marks is President and CEO of AgilePath Corporation, and firm specializing in SOA implementations. He is an author and frequent speaker at IT conferences. He also lectures at Syracuse University and contributes articles for Computerworld in a regular basis (Marks & Bell, 2006). Bell is the founder of Methodologies Corporation, another firm specializing in SOA implementations. He has worked on projects for such firms as JPMorgan, Chase, Citibank, American Express, and UBS PaineWebber (Marks & Bell, 2006).

Foundation of SOA Implementation

Windley, P. (2006). SOA governance: rules of the game. *Info World*, 28 (4), 29- 35. Retrieved March 27, 2007, from Business Source Premiere database.

This article is referenced throughout the study due to its comprehensive treatment of the SOA governance lifecycle. This reference begins with a general overview of the benefits of SOA, but quickly moves into the difference between developing software in the traditional manner and with SOA. The work discusses the full SOA governance lifecycle, covering the roles of information technology managers, business managers and software developers.

This work is referenced in the Brief Purpose and Full Purpose sections of the study. It is also used as one item in the data set for coding, in the data analysis section as a key reference for identifying the different implementation phases of a SOA governance program.

Dr. Philip J. Windley is an Associate Professor of Computer Science at Brigham Young University. Prior to being a professor at BYU, Windley was the CIO for the state of Utah. He is also a published author through O'Reilly Press, a leading technology publisher.

Foundation of Methodology

Leedy, P. D. & Ormrod, J. E. (2005). *Practical research: Planning and design.* Merrill/Prentice Hall: New Jersey.

Leedy and Ormond's sections covering content analysis as a research strategy and literature review as a key step in the research process are consulted to support the research design of this study. This reference is utilized in the Brief Purpose, Full Purpose and Methods sections of the study.

Leedy and Ormond's *Practical research: Planning and design* is recommended by the University of Oregon's Applied Information Management program as a credible resource for research methodology.

Palmquist, M., Busch, C., De Maret, P., Flynn, T., Kellum, R., Le, S., Meyers, B., Saunders, M., White, R. (2005). *Content analysis*. Retrieved April 8, 2007 from <http://writing.colostate.edu/guides/research/content/>.

Palmquist serves as the primary resource for this study's basic understanding of conceptual content analysis. The eight steps of conceptual content analysis outlined by Palmquist et al. are noted in the Full Purpose of the study and frame the approach taken to data analysis, described in the , Data Analysis section of the Method chapter.

Palmquist is a professor of English at Colorado State University. His works have "...appeared in journals including *Computers and Composition*, *Written Communication*, *IEEE Transactions on Professional Communication*, *Journal of Engineering Education*, *Kairos*, *Council of College Teachers of English Studies*, and *Social Forces*, as well as in edited collections" (Palmquist). This resource is also recommended by the University of Oregon Applied Information Management Master's Degree Program as a credible resource for conceptual content analysis.

CHAPTER III - METHOD

As SOA continues to gain ground as a business strategy with technological implications, SOA governance should be one of the first things that an organization plans before implementation (McKendrick, 2006). Literature review frames the research design of this study in order to create "...an account of what has been published on a topic by accredited scholars and researchers" (Taylor & Proctor, 2005, para. 1). Additionally, according to Leedy & Ormond (2005), literature review uncovers "previous research findings regarding the problem at hand" for the purpose of gaining a deep perspective related to your topic (p. 64). This study uses literature review in order to frame a new perspective on an existing body of literature. In this case that new perspective defines the role of SOA governance at each phase of SOA governance implementation.

Literature Collection

The literature collected for use in this study is searched within the following high level areas of content:

- IT Alignment
- IT Governance
- SOA
- SOA Governance
- SOA Governance Deployment

The following search engines are used as an initial resource in order to understand the main contributors to the SOA governance field, reveal new sources and uncover ideas

and perspectives that had initially not be taken into consideration, based on the initial five high level content areas: (Leedy & Ormond, 2004, p.64)

- Google
- Google Scholar
- Search Web Services

After using online search engines to uncover common synonyms of SOA governance, identify prominent experts in the field and uncover useful bibliographies of works related to SOA governance, the search next turns to academic and professional search databases and websites as a source for works related to SOA governance. The following databases are utilized for the study:

- Computer Source
- Lexis Nexus
- Academic Search Premiere
- Business Sources Premiere
- IEEE
- Books 24X7
- Safari Books Online
- Harvard Business Review
- Information Technology Governance Institute

A number of different search techniques are used on these databases including:

- Boolean searches

- Keyword searches based on document titles
- Keyword searches based on document text
- Exact phrase searches based on titles
- Exact search phrases based on document text

When searching the online search engines and electronic search databases, the following search terms evolved: SOA, service oriented architecture, web services, SOA and web services, SOA implementation, enterprise service bus, SOA bus, SOA strategy, SOA alignment, SOA web services strategy, SOA governance, SOA design time governance, SOA run time governance, IT governance, web services governance, SOA pitfalls, SOA benefits, IT strategic alignment. After a preliminary review of search returns, the following search terms are identified as the most successful search criteria related to the research question: What are the phases of SOA governance implementation and the management goals that are relevant to each implementation phase?

- SOA Implementation
- SOA Enterprise Service Bus
- SOA Strategy
- SOA Web Services Strategy
- IT Governance
- SOA Governance
- Web Services Governance
- SOA Governance Policy
- SOA Application Architects

- SOA Benefits

Results of this strategy are vetted for inclusion into the study based on the following set of criteria:

- The included work is published in the year 2004 or later, unless it is a seminal work in the field;
- The included work falls into one of the five high level categories of SOA, SOA Governance, IT Governance, SOA Implementation, and IT Alignment;
- The included work is sourced from a reputable journal, website, author or organization.

Data Analysis

Data analysis is conducted using the eight step process outlined by Palmquist (2005) on the CSU Writing Lab website. The selected literature included in the data analysis are separated into three parts:

- Literature falling under one of five high level content categories – IT Alignment, IT Governance, SOA, SOA Governance and SOA Governance Deployment;
- Literature that addresses SOA governance implementation phases – the data analyzed are those categorized under SOA, SOA Governance and SOA Governance Deployment;
- Literature that addresses management goals – the data analyzed are those categorized under the IT Alignment, IT Governance, SOA, SOA Governance and SOA Governance Deployment.

This literature is coded in a three step process in order to 1) categorize the literature pertinent to SOA governance into five high level groups 2) identify the implementation phases of a SOA governance program and then 3) identify the technology management goals associated with these phases. The coding process is designed, based on the Palmquist model whereby “...the text must be coded into manageable content categories” (Palmquist, 2005, Methods of Conceptual Analysis section, para.1).

According to Carley, “the researcher must make his/her coding choices with respect to the eight category coding steps indicated by Carley” (cited in Palmquist et al., 2005, Methods of Conceptual Analysis section, para. 3). The following section describes the eight analysis steps in detail as they are applied in this study.

Step One: Level of Analysis - The first stage of analysis consists of “determining which word, set of words, or phrases will constitute a concept” (Palmquist et al., 2005). Analysis for this study consists of two stages; the analysis of SOA governance implementation phases and the corresponding management goals with each phase. Both of these stages of analysis involve identification of key phrases related to ‘SOA governance implementation’ and ‘SOA governance management goals’ in particular and synonyms for these phrases.

Step Two: Concepts to Code - This analysis plan is framed in two stages and each one address a key concept. The first stage relates to the key concept of implementation phases of SOA governance and the second stage with relates to the key concept of the

management goals that are relevant to each SOA governance implementation phase. As coding proceeds, sub-concepts are defined in each key area.

The study provides flexibility for uncovering synonyms of the key concepts during the course of the analysis as outlined by Palmquist (2005), which states that analysis is free “to add relevant categories not included in the set” as appropriate (Decide How Many Concepts to Code For section, para. 1).

Step Three: Existence - Once the coding terms are established, the phrases and synonyms are coded for existence. Coding for existence entails noting the existence of a key phrase or synonym only once, regardless of how many times it appears in the literature (Palmquist et al., 2005).

Step Four: Distinguish Among Concepts - In order to accommodate the fact that SOA governance has yet to establish a set of standard terminologies, the content analysis process designed for this study allows for like and similar phrases to be coded into the same category.

Step Five: Coding Rules - In order to ensure that errors in coding are eliminated and enforce consistency, categorization and coding is handled through a database. The main phrases are set up in a structure at the highest level as coding categories. As new phrases are identified throughout the analysis, these new synonyms are tagged as metadata to the

original high level category. Duplicated entries are flagged as invalid duplicates if they are incorrectly input into the system. This allows new search phrases as they are identified to automatically update the result set dynamically. The relationships are as follows:

- For the purposes of coding, all high level categories must be unique;
- Within each high level category, each synonym must be unique. For instance, design time governance (a high level category) could have a synonym of developer governance. If developer governance was entered as a synonym for another high level category, the categorization system would raise an error to the use and disallow that entry.

Step Six: Irrelevant Information - For the purposes of this study, it is assumed that literature that has been vetted through the data collection stage is pertinent to the study.

Step Seven: Code the Text – According to Palmquist (2005), text can be coded by hand or by using computerized systems. This study utilizes a database structure to code the text into the appropriate categories. This ensures that text are coded once and not duplicated in other sections. Figure 1 provides a template for the structure of the coding database and the relevant coding categories.

Category Table	Synonyms Table
Columns	Columns
Category ID	SubCategoryID
CategoryName	CategoryID
	SubCategoryName

Figure 1 - Coding Template

Data Presentation

Step Eight: Analyze the Results - The results of the conceptual analysis process are compiled in a series of three tables that present: 1) the data set selected for coding, organized in five high level categories, 2) the identified implementation phases of a SOA governance program along with detailed descriptions of each phase, and 3) the identified management goals that each phase supports along with a bibliography for each management goal. The first stage of analysis consists of grouping all literature into the following five high level categories: general SOA; SOA Governance; IT Governance; SOA Implementation; and IT Alignment. These high level categories form the basis for framing the study in the larger content of information technology management. Appendix A (see Figure 2 below for the design template) serves as a reference guide for information technology managers who want to further research SOA governance in its larger information management context.

Reference Category		
Description:		
Author	Source	Category

Figure 2 - High Level Category Template

The Implementation Phases section in Chapter IV presents the different implementation phases of SOA governance identified in the literature. Implementation phases are coded by grouping together like words and phrases that result in the identification of patterns in the literature. These patterns make up the implementation phases as supported by the

literature. The template used is designed to present the implementation phase, definitions, particular words or phrases that serve as synonyms in the literature and the source in which it exists (see Figure 3 - SOA Implementation Phase Template below). The following template is used to present the results of each implementation phase.

Implementation Phase Concept: Establish IT Alignment	
Definition:	
Synonyms:	
Key Quotes	
Author	

Figure 3 - SOA Implementation Phases Template

Appendix B is designed to present the IT management goals relevant to SOA governance phases that are identified in the literature (see Figure 4 - Relevant IT Management Goals Template below). This appendix consists of a selected bibliography for each of the management goals. The following template (Figure 4) is used to present the results of the IT management goals data analysis.

Management Goal	
Author	Bibliography

Figure 4 - Relevant IT Management Goals Template

The results of the conceptual analysis are reframed and presented in the form of a roadmap that serves as a SOA governance implementation guide for technology managers. Technology roadmaps are familiar to information technology managers as

they distill complex implementations into a single easily digestible document that identifies implementation phases in chronological order (Theuerkorn, 2007). Technology roadmaps can consist of a number of different components, based on the specific content being described and the amount of content to synthesize. For the purposes of this study the outcome roadmap is structured into the following three sections (see Figure 5 - SOA Governance Phases Roadmap template below):

- High level governance implementation phases as identified in the literature;
- Sub-phases identified for each high level governance implementation phase. These sub phases are categorized under the appropriate high level implementation phases; and
- Management goals identified for each sub implementation phase.

High Level Implementation Phases			
S U B P H A S E S	Sub Phase 1	Sub Phase 2	Sub Phase 3
M A N A G E M E N T G O A L S	Management Goal	Management Goal	Management Goal

Figure 5 - SOA Governance Phases Road Map Template

CHAPTER IV – ANALYSIS OF DATA

Phase 1 - High Level Categorization

As described in the Methods chapter, content analysis serves to identify thematic relationships within selected references. Content analysis is performed on a set of forty five sources selected as the coding set, using an eight-step process known as conceptual analysis (Palmquist et al., 2005). Sources are initially categorized based on a set of five predefined content categories – IT Alignment, IT Governance, SOA, SOA Governance and SOA Governance Deployment, using a relational database (Capstone.mdb). The categorization of these sources and their definitions is defined in a set of tables presented in Appendix A -- Categorization of 45 References, Selected for Coding, Into Five Larger Categories.

The sources included in these tables are meant to serve as a reading for technology managers in need of learning about SOA governance, its history, and its potential impact on organizations. The first two tables in Appendix A, IT Alignment and IT Governance, frame SOA governance in the larger context of information technology management. The next table, SOA, lists sources that provide technology managers with an exhaustive overview of SOA as a business strategy. The final two tables, SOA Governance and SOA Governance Deployment, serve as a directory of references that discuss the discrete phases in a SOA governance deployment.

Phase 2 –Implementation Phases

Utilizing the data analysis plan discussed in Chapter 2, the thirty seven sources categorized under three of the five the high level categories of SOA, SOA Governance and SOA Governance Deployment are analyzed in order to identify the implementation phases of a SOA governance program as identified from the references. All thirty seven sources are read through completely, and concepts related to SOA governance implementation phases are recorded in a database. The following are the seven implementation phases identified in Phase 2 of the conceptual analysis:

- Establish IT Alignment
- Evaluate IT Department
- Establish Centers of Excellence
- Design Time Governance
- Run Time Governance
- Enforce Governance Policies
- Track Progress

Table 1 – Implementation Phase Counts lists the number of times each of the seven identified implementation phases appears in the coded texts. This table is followed directly by a set of tables (Tables 2, 3, 4, 5, 6, 7 and 8) that contain the Implementation Phase Descriptions, which provides the contextual description of each of these implementation phase entries.

Implementation Phase	Number of Times Concept Appears in Literature
Establish IT Alignment	26
Evaluate IT Department	2
Establish Centers of Excellence	4
Design Time Governance	7
Run Time Governance	7
Enforce Governance Policies	8
Track Progress	11

Table 1 - Implementation Phase Counts

Table 2 - Implementation Phase #1: Establish IT Alignment	
Definition:	The integration of business functions and IT functions (Luftman, 2004).
Synonyms:	business collaboration, strategic alignment, strategic alignment maturity, define strategy, define business objectives
Key Quotes	
Lithicum, 2007	“First you should understand your business objectives and define success.”
MacVittie, 2006	“First, SOA governance should start early--in the requirements-gathering phase, with documentation stored as artifacts in the repository to verify alignment with business goals.”
Seeley, 2007	"With SOA we're seeing more collaboration upfront between the business and IT," Michelson said, summarizing the executives' point of view. "You get a business strategy influencing a business architecture that you actually plan. The business strategy and IT strategy are aligned and they serve each other because there's a lot of technology advances that influence what your business strategy might look like and your IT strategy influences your enterprise architecture. Your business architecture and your enterprise architecture need to relate strongly."

Table 3 - Implementation Phase #2: Evaluate IT Department	
Definition:	SOA and SOA governance require a steep learning curve, and require that technology managers assess their readiness for it. This might mean addresses shortcomings within the skill sets of their own groups.
Synonyms:	Retool IT department, evaluate it department, training, retraining, paradigm shift
Key Quotes	
Havenstein, 2006	“Steve Wolf, senior enterprise architect at Marriott International Inc., for example, said one of his company's biggest hurdles is retraining developers to think of composing applications as an iterative approach rather than using the traditional waterfall method, where the development process lacks collaboration and is highly compartmentalized. "The hardest part is we're talking about an entirely unfamiliar development environment, and you can't be using a waterfall approach," Wolf said. The entire development process, including gathering requirements, testing and managing IT operations, has to be revised to support an SOA, he added.”
Moore, 2006B	“Organizations need to take a hard look at their IT shops before taking on service-oriented architecture projects. Developers will likely require retraining, and the department may need to rethink the way it assigns development responsibilities.”

Table 4 - Implementation Phase #3: Establish Centers of Excellence	
Definition:	SOA centers of excellence are groups of SOA strategists and developers who establish the ground rules for how SOA and SOA governance will be integrated into organizations.
Synonyms:	center of excellence, centers of excellence, COEs, group of practice, groups of practice
Key Quotes	
Seeley, 2007	"You start with a center of excellence, a handful of people with architectural roots," Michelson said in explaining the view from the top. "They start your SOA program and your blueprint. They define the initial infrastructure services. They do some early business services. They do some pilot projects."
Margulius, 2006	"We're just now scratching the surface around SOA," says Griggs, who oversees workflow, imaging, and integration technology in the company's business process modeling 'center of excellence,' a group that provides enterprise-wide ground rules and guidance.

Table 5 - Implementation Phase #4: Design Time Governance	
Definition:	Design time governance focuses on the governance processes put in place in the development phase of SOA. This covers all phases of the software development lifecycle.
Synonyms:	Design time, design-time
Key Quotes	
MacVittie, 2006	"Design-time governance focuses on the SDLC, providing a framework in which service developers can discover, deploy, document and reuse services in a collaborative environment. Validation, de-duplication, versioning, and enforcing processes like business and technical reviews are within the realm of design-time governance products."
Moore, 2006B	"Registries fall under the general heading of design-time governance, software and best practices that help enforce corporate design standards for services."

Table 6 – Implementation Phase #5: Run Time Governance	
Definition:	Run time governance focuses on how the SOA operates in the production environment, such as the performance benchmarks of the SOA. They manage the available services that are deployed.
Synonyms:	Design time, design-time
Key Quotes	
Coticchia, 2006	“Run-time tools not only manage access to deployed services, but also gather and present information about the performance and availability of those services, typically via integration with Web Services management and fabric tooling.”
MacVittie, 2006	“Run-time governance deals with policies that regulate access, security and the performance of services that may be consumed by internal and external clients.”

Table 7 - Implementation Phase #6: Enforce Governance Policies	
Definition:	SOA governance policies need to be enforced in order to comply with IT governance best practices. It is not enough to implement governance rules, they must be enforced.
Synonyms:	SOA enforcement, SOA governance enforcement, enforcement of policies, policy enforcement
Key Quotes	
Ricadela, 2006	“As companies' code bases reach hundreds or thousands of components slated for reuse, and Web services extend beyond company walls, having the right tools to manage them is critical. Technology companies, including BEA Systems, HP, and IBM, are trying to met the need here, making acquisitions intended to shore up their software products with technology that can produce and enforce hard and fast rules about which services have access to which data and business logic.”
Windley, 2006A	“To succeed, an enterprise SOA demands an enforceable set of policies for building, deploying, and managing services. SOA (Service Oriented Architecture) promises enterprises endless advantages: increased code reuse, reduced integration expense, better security, and — the big payoff— greater business agility. Whether you achieve those benefits, however, probably has more to do with your policies and procedures than the quality of your code.”

Table 8 - Implementation Phase #7: Track Progress	
Definition:	All responsibilities under the auspices of IT governance require that they be measured and monitored for performance, and SOA governance policies are not different.
Synonyms:	measure activity, measure performance, track performance, performance measurement
Key Quotes	
Cobit, 2000	Effective enterprise governance focuses individual and group expertise and experience where it can be most productive, monitors and measures performance and provides assurance to critical issues.
Barry, 2007	“Superior IT governance equates to greater profits: Firms with superior IT Governance have more than 25% greater profits than firms with poor governance. The firms with the return had custom-designed governance processes aligning IT decisions with monitors for performance and accountability”

Phase 3 –Management Goals

SOA governance aids organizations in ensuring that their technologies are meeting the goals of the business. The same thirty seven sources analyzed in phase 2 are used to analyze management goals in phase 3 of the conceptual analysis process. All sources are read once again to identify the management goals that the sources identify as being met with the implementation of SOA governance programs. Seven management goals are identified, one to align with each of the seven implementation phases, including:

- Reduced Complexity
- IT Alignment
- Compliance Regulation
- Ensure Best Practice
- Code Reuse
- Lower Total Cost of Ownership

- Performance Measurement

Table 9 – Management Goals Counts, notes the number of times each of the seven identified management goals appears in the coded texts Appendix B: Management Goals Bibliography, provides the bibliographic list of sources for each management goal.

Management Goal	Number of Times Concept Appears in Literature
Reduced Complexity	14
IT Alignment	16
Compliance Regulation	19
Ensure Best Practice	7
Code Reuse	7
Lower Total Cost of Ownership	8
Performance Measurement	12

Table 9– Management Goal Counts

CHAPTER 5 – CONCLUSIONS

SOA Governance Roadmap

The purpose of this study is to identify the implementation phases of a SOA governance program and the information technology management goals that are inherent in each phase in order to provide a set of tools for technology managers to use in adopting SOA into their businesses. To that end, this study examines literature from a total of forty five sources to 1) provide a reading list for technology managers looking to implement SOA governance programs, contained in Appendix A; 2) identify the seven implementation phases of a SOA governance program and its supporting reference information, contained in the data analysis section and 3) provide a list of the seven management goals related to SOA governance, which can be found in Appendix B with its corresponding reference information.

SOA is a strategy that is gaining ground as a means to tackle the ever increasing complexity of today's information technology infrastructures (Goldberg, 2005), and while SOA is only recently beginning to take hold in enterprise environments it will serve as a completely new method for integrating technology into the business. In the future, SOA will serve as a means of increasing the strategic alignment between the business units and the technologies that support them (Violino, 2007).

In light of the fact that technology managers are frequently required to navigate the complex waters of a SOA governance program, the final outcome of this study in a SOA

governance roadmap, designed to provide technology managers with a description of implementation phases to a successful SOA governance program as identified in the literature of the study, termed a roadmap. Transitioning to SOA is not simply a matter of reigning in the “the proliferation of Web services” (Moore, 2006C, p. 89), but rather requires the development of a structured approach that promotes alignment of SOA strategy and business goals to “...ensure that your SOA doesn’t go sideways (McKendrick, 2006, para. 3).

The final outcome of the study integrates two sets of data – SOA implementation phases and related management goals -- into a usable SOA governance roadmap (Table 10) marked by the three high level phases and seven related sub-phases, as presented in the roadmap. A discussion of Table 10 follows.

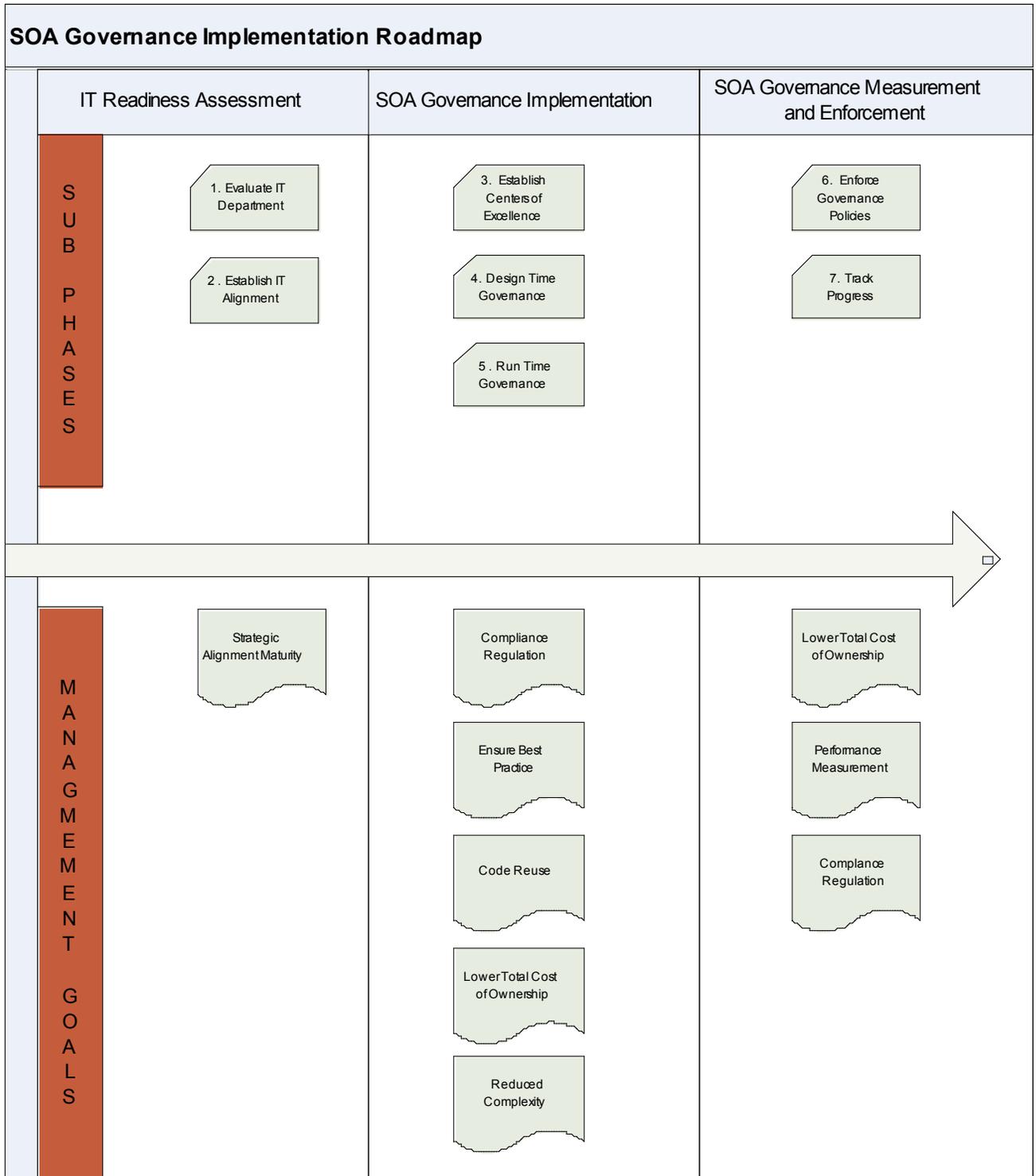


Table 10– SOA Governance Roadmap

Phase 1 - SOA Readiness Assessment

A successful SOA governance program is based on the foundation of a strong connection between technology and business. SOA governance begins with real collaboration between the technology teams and business units to ensure that the program being put into place correctly reflects the business processes that SOA is attempting to mimic (Margulius, 2006). If your technology team is not properly aligned, then the SOA governance implementation will not succeed. For this reason, before an implementation of SOA governance can begin, an organization must engage in an internal assessment phase to ensure the foundation is in place for successful SOA governance.

• Management Goal of Phase 1: Strategic Alignment Maturity

The key management goal in Phase 1 aims to measure the readiness state of the organization. The manner in which readiness is gauged is through establishing what Luftman (2007) describes as strategic alignment between technology and business.

Sub Phase 1: Evaluate IT Department

The initial phase of SOA governance preparation involves the evaluation of the IT department charged with implementing a SOA governance program. According to Moore (2006B), “organizations need to take a hard look at their IT shops before taking on service-oriented architecture projects” (p. 104). The key management goal at in this step is to assess the IT department’s ability to implement as SOA architecture by using Luftman’s model of strategic alignment maturity (Luftman, 2004). Understanding how to implement a strong SOA governance programs means that the IT department needs to understand its own readiness for SOA as measured by its alignment to the business. Often that means retraining the staff to understand how to develop and then govern a new

technology with new sets of principles and best practices. Before step one of implementation can occur, it is imperative that the group responsible for implementing and governing the infrastructure know the platform that they are moving to. “The entire development process, including gathering requirements, testing and managing IT operations, has to be revised to support SOA” (Havenstein, 2006, p.6).

Sub Phase 2: Establish IT Alignment

The second step in the first phase of the SOA governance roadmap lays the groundwork for a successful SOA governance implementation. The foundational goal of a successful SOA governance program is to increase the strategic alignment between technology and business, and a successful SOA and SOA governance program has its roots in proper alignment. According to Luftman (2004), all good technology should begin with good alignment between technology and business, and Margulius (2006) states that SOA implementations are no different. It is at this stage that the gap between where your technology team is and where it needs to be is addressed.

Phase 2 - SOA Governance Implementation

Once the readiness of the organization has been established, the second phase of the SOA governance roadmap consists of the actual implementation steps. This includes establishing centers of excellence, which gets the SOA governance program off the ground by prototyping and establishing best practice patterns and principles for the rest of the organization to follow. It then sets up the governance structures that dictate how SOA is

developed, deployed and maintained to ensure compliance with governance standards of the organization and that the goals of the SOA program are met.

• **Management Goals of Phase 2: Compliance Regulation, Ensure Best Practice, Code Reuse, Lower Total Cost of Ownership, Reduced Complexity**

The management goals in the second phase of the SOA governance roadmap aim to ensure that the technology goals of SOA are being met by holding the software developers and architects accountable to following the guidelines set up by the SOA governance program. Like any IT governance program, SOA governance implementation looks to hold accountable the technology teams instituting the SOA architecture by meeting the management goals stated below.

Sub Phase 3: Establish Centers of Excellence

Once the preparation of Phase 1 is complete, the organization should be ready to begin the work of Phase 2. The first step is to set up a center of excellence (or center of practice), which refer to groups of people dedicated to supporting SOA governance and who are prepared to start to implement the first parts of a SOA architecture. These groups set up the SOA governance program and establish the blueprint of standards for the organization to move forward by defining the initial infrastructure services and best practices around the development of the SOA platform (Seeley, 2007). Windley (2006A) sums up the role of a center of excellence when he states that “an effective COE provides the guidance and education that holds your governance effort together” (p. 30).

However, SOA development and governance will not stay in the center of excellence for the life of the SOA program. Eventually, a center of excellence transforms into a SOA

governance body and the ongoing development work takes place outside of this group as the whole organization begins developing in the new SOA environment (Seeley, 2007).

Sub Phase 4: Design Time Governance

As the center of excellence begins to transform into a governance organization, all parts of an organization will begin to develop SOA based software. It is at this point that design time governance must be implemented to ensure that business units building software based on the SOA architecture are conforming to standard practices. These best practices and patterns ensure compliance with the larger goals of the SOA, such as code reuse and reduced complexity. “Design-time governance focuses on the SDLC (Software Development Life Cycle), providing a framework in which service developers can discover, deploy, document and reuse services in a collaborative environment (MaVittie, 2006, para. 8). Policy driven control of this kind in the development cycles ensures that only compliant services are released for use in the organization (Kobielus, 2006A). It is this prospect of code reuse and compliant development throughout the organization that provides a lower total cost of ownership in the long run.

Sub Phase 5: Run Time Governance

This step of Phase 2 of implementation ensures that the proper governance policies are identified and enforced in the production environment. Compliance of a deployed SOA architecture is the goal of run-time governance. Once deployed into a production environment, SOA based software must be actively managed to ensure compliance with governance policies as it relates to deployed services (Coticchia, 2006). Put more succinctly by MacVittie (2006), “run-time governance focuses on controlling deployment through approval processes and on applying run-time access-control policies to services”

(para. 10). Prior to SOA, compliance to policies was all but impossible to measure, and if done would be time consuming and expensive. SOA governance provides a single place across the organization to monitor compliance, this providing the added benefit of lower the cost of maintaining software services across the organizations.

Phase 3: SOA Governance Measurement and Enforcement

SOA governance provides an organization with the ability to monitor software across application and business lines as never before (Moore, 2006B). To ensure that the SOA is realizing its business objectives, the last phase of the roadmap aims to provide business and technology managers feedback as to how the SOA program is providing value.

• Management Goals of Phase 3: Performance Measurement, Compliance

Regulation

The third phase of the SOA governance roadmap aims to ensure that the business goals that SOA is supposed to meet, namely lower costing and more flexible technology, are being realized by the business.

Sub Phase 6: Enforce Governance Policies

A key tenet of IT governance in general, and SOA governance in particular is the enforcement of these design time and run time policies. Once SOA governance polices are in place, Phase 3 implementation engages the next step, which is to ensure their ongoing enforcement. According to Marks and Bell (2006), policies must be enforced during the development phase (design-time) and the deployment phase (run-time).

Enforcement should take the form of policies that are enforced through “technology that can produce and enforce hard and fast rules about which services have access to which data and business logic” (Ricadela, 2006). Enforcing policies in an automated fashion

using technology solutions is essential for SOA policy enforcement (Marks & Bell, 2006).

Sub Phase 7: Track Progress

If organizations are going to use SOA governance to ensure that their investments in SOA are paying off, tracking the progress of their SOA infrastructure is a key last phase in the SOA governance implementation life cycle. Daly (2007) has found that successful SOA implementations have SOA governance “processes aligning IT decisions with monitors for performance and accountability (Daly, 2007, para. 8). This meets the business goals of measuring the performance impact of the SOA policies instituted in Phase 2. “Some benefits, such as improved customer service, might be difficult to quantify. But others, like increased productivity and cost savings, can and should be measured” (Violino, 2007).

APPENDICES

Appendix A

Categorization of 45 References, Selected for Coding, Into Five Larger Categories

Reference Category – IT Alignment		
Description: References related to IT alignment serve as the basis for implementing a SOA and SOA governance practices.		
Author	Source	Category
Cassese, V.	Cassese, V. (2006). Natural Alignment. Computerworld. 40, 31-32. Retrieved May 5, 2006, from Business Source Premier database.	IT Alignment
Goldberg, A.	Goldberg, A. (2005). Simpler IT, better IT. eWeek, 33. Retrieved October 15, 2006, from Academic Source Premiere database.	IT Alignment
Luftman, J.	Luftman, J. (2004). Managing the information technology resource: Leadership in the information age. New Jersey: Prentice Hall.	IT Alignment

Reference Category – IT Governance		
Description: References in this category describe the over arching framework under which SOA governance operates.		
Author	Source	Category
CobiT	CobiT. (2000). Executive Summary. Retrieved April 2, 2007, from https://www.sco.idaho.gov/web%5Cbsa.nsf/8A32010CDD98989687256AE90050BD41/\$FILE/execsum.pdf .	IT Governance
Daly, K.	Daly, K. (2007). IT governance joins the priority list. Directorship, 33 (2), 76. Retrieved April 25, 2007, from Business Source Premiere database.	IT Governance
ITGI	ITGI. (2004). Board briefing on IT governance. Retrieved March 28, 2006 from http://www.itgi.org/Template_ITGI.cfm?Section=Best_Practices&CONTENTID=15994&TEMPLATE=/ContentManagement/ContentDisplay.cfm .	IT Governance
McCollum, T.	McCollum, T. (2006). Bridging the Great Divide. Internal Auditor. 1. 49-53. Retrieved April 15, 2007 from Business Source Premier database	IT Governance

Weill, P. & Ross, J.W	Weill, P. & Ross, J.W (2004). IT governance: How top performers manage IT decision rights for superior results. Boston, Massachusetts: Harvard Business School Press.	IT Governance
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Reference Category – SOA		
Description: References in this category describe SOA at a general level, such as benefits, definitions and technologies. These works provide a general background to understand what SOA is and its impact on organizations; as well as the problems that it presents for governance.		
Author	Source	Category
Annesley, C.	Annesley, C. (2006). IT directors skeptical about benefits of SOA. Computer Weekly. Retrieved March 28, 2007, from Business Source Premiere database.	SOA
Aziz, S.	Aziz, S. (2006). Service oriented architecture: look beyond the myths to succeed. Infosys. Retrieved April 7, 2007, from http://www.infosys.com/services/systemintegration/white-papers/SOA-look-beyond-myths-to-succeed.pdf	SOA
Barry, S.	Barry, S. (2007). An enterprise process framework defined and delivered with IBM rational method composer. Retrieved April 28, 2007, from http://www-128.ibm.com/developerworks/rational/library/feb07/snyder/	SOA
Baseline	Baseline. (2007).SOA: a look ahead. Baseline, 69, 60-61. Retrieved April 7, 2007, from Business Source Premiere database.	SOA
Bieberstein, N., Bose, S., Fiammante, M., Jones, K. and Shaw, R.	Bieberstein, N., Bose, S., Fiammante, M., Jones, K. and Shaw, R. (2006). Service-Oriented architecture compass: business value, planning, and enterprise roadmap. Indianapolis, Indiana: IBM Press.	SOA
Britt, P.	Britt, P. (2007). Service-oriented architecture evolves. KM World, 16(2), 14-25. Retrieved April 15, 2007, from Business Source Premiere database.	SOA
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Havenstein, H.	Havenstein, H. (2006). SOA upends development traditions. ComputerWorld, 40 (38), 6. Retrieved April 9, 2006, from Business Source Premiere database.	SOA
Keller, E.	Keller, E. (2006). Get ready for SOA . ManufacturingBusiness Technology, 24(11), 50-52. Retrieved April 11, 2007, from Business Source Premiere database.	SOA

Margulius, D.	Margulius, D. (2006). SOA planning: sizing up your business processes. Info World, 28 (37), 18-24. Retrieved March 28, 2007, from Business Source Premiere database.	SOA
Marks, E.A. & Bell, M.	Marks, E.A. & Bell, M. (2006). SOA: A planning and implementation guide for business and technology. Retrieved March 25, 2007, from http://books.google.com/books?hl=en&lr=&id=fQFpEVCTP6cC&oi=fnd&pg=PP5&sig=VsbPzopCajmKmHY46DRmOxQ6so&dq=%22SOA+strategy%22	SOA
Marshall, J.	Marshall, J. (2007). Up and away with SOA. Financial Executives, 22(5), 58-59. Retrieved March 28, 2007, from Business Source Premiere database.	SOA
Moore, J.	Moore, J. (2006A). Ameriprise invests in SOA for the long term. Retrieved March 23, 2007, from http://www.cioinsight.com/article2/0,1397,2058779,00.asp .	SOA
Stack, C.	Stack, C. (2006). The future is: service oriented architecture. Network World, 44. Retrieved March 28, 2007, from Academic Search Premiere database.	SOA

Reference Category – SOA Governance		
<p>Description: References related to SOA governance set the framework for understanding all phases of implementing a SOA governance program, the context in which SOA governance operates and the management benefits of implementing a SOA governance program.</p>		
Author	Source	Category
Bednarz, A.	Bednarz, A. (2006). The art of managing SOA. Network World, 23 (45), 36. Retrieved April 7, 2007, from Business Source Premiere database.	SOA Governance
Coticchia, G	Coticchia, G. (2006). Make SOA governance a high priority. Retrieved March 31, 2007, from http://www.agilejournal.com/component/option,com_magazine/func,show_article/id,11/	SOA Governance
Kobielus, J.	Kobielus, J. (2006B). SOA governance: preventing rogue services. Retrieved March 31, 2007, from http://www.networkworld.com/supp/2006/ndc3/062606-ndc-soa-governance.html .	SOA Governance
Kobielus, J.	Kobielus, J. (2006A). Coders gone wild. Network World, 23 (40), 40-43. Retrieved March 23, 2007, from Academic Source Premiere database.	SOA Governance
McKendrick, J.	McKendrick, J. (2006). Its never too early for SOA governance. Retrieved April 7, 2007, from http://www.webservices.org/vendors/hp/it_s_never_too_early_for_soa_governance	SOA Governance
Moore, J.	Moore, J. (2006C). Web services governance. Baseline, 55, 89. Retrieved April 4,	SOA Governance

	2007, from http://www.baselinemag.com/article2/0,1540,1925345,00.asp	
Nally, B.	Nally, B. (2006). SOA governance key at Gartner. Retrieved April 10, 2007, from http://searchwebservices.techtarget.com/originalContent/0,289142,sid26_gci1233109,00.html	SOA Governance
Trombly, M.	Trombly, M. (2006). Web services requires streamlining governance. Securities Industries News, 18 (17), 1-19. Retrieved April 5, 2007, from Business Source Premiere database.	SOA Governance
Willoughby, M.	Willoughby, M. (2006). Get the SOA management picture. Computer World, 40 (39), 36. Retrieved April 5, 2007, from Business Source Premiere database.	SOA Governance
Windley, P.	Windley, P. (2006B). Teaming up for SOA. Info World, 29 (10), 25-28. Retrieved April 30, 2007, from Business Source Premiere database.	SOA Governance

Reference Category – SOA Governance Deployment		
Description: References in this category cover the detailed implementation phases of a SOA governance program from a technology perspective. They do not represent the phases that lead up to a SOA governance program, but are limited to references that cover the deployment phase.		
Author	Source	Category
Carlson, B. & Marks, E.	Carlson, B. & Marks, E. (2006). Architectural, organizational and SDLC implications. Retrieved March 31, 2007, from http://webservices.sys-con.com/read/175376.htm	Deployment
IBM	IBM. (n.d.). IBM SOA governance lifecycle. Retrieved April 2, 2007, http://www-306.ibm.com/software/solutions/soa/gov/lifecycle/ .	Deployment
Knights, M.	Knights, M. (2007). What you need for a successful SOA. Computer Weekly, 42-44. Retrieved March 28, 2007, from Business Source Premiere.	Deployment
Linthicum, D.S.	Linthicum, D.S. (2007). The 5 fundamentals of SOA success. InfoWorld, 29 (3), 31-33. Retrieved April 10, 2007, from Business Source Premiere.	Deployment
MacVittie, L.	MacVittie, L. (2006). Understanding SOA governance. Retrieved March 31, 2007, from http://www.networkcomputing.com/showArticle.jhtml?articleID=191203018	Deployment
MarketWatch	MarketWatch. (2007). SOA to transform the way IT and the organization interact. MarketWatch, 6 (2), 157-158.	Deployment
Moore, J.	Moore, J. (2006). SOA success: five actions you should take. CIO Insight, 74, 103-111.	Deployment

Murray, W.	Murray, W. (2007). Implications of SOA on business strategy and organizational design. Retrieved April 7, 2007, from http://searchwebservices.techtarget.com/tip/0,289483,sid26_gci1240290,00.html	Deployment
Padmanabhuni, S., Anand, S., Dayasindhu, N.	Padmanabhuni, S., Anand, S., Dayasindhu, N. (2006). Building blocks of SOA governance. Retrieved April 2, 2007, from http://webservices.sys-con.com/read/175389.htm .	Deployment
Ricadela, A.	Ricadela, A. (2006). The dark side of. Retrieved April 25, 2007, from http://www.informationweek.com/software/showArticle.jhtml?articleID=192501102 .	Deployment
Seeley, R.	Seeley, R. (2007). Top 5 SOA insights from CIOs and CTOs. Retrieved April 7, 2007, from http://searchwebservices.techtarget.com/originalContent/0,289142,sid26_gci1249065,00.html	Deployment
Violino, B.	Violino, B. (2007). Mastering a new infrastructure. Baseline, 69. 54-56. Retrieved April 15, 2007, from Business Source Premiere Database.	Deployment
Windley, P.	Windley, P. (2006). SOA governance: rules of the game. Info World, 28 (4), 29-35. Retrieved March 27, 2007, from Business Source Premiere database.	Deployment

Appendix B

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Management Goal #1 – Reduced Complexity	
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Weill, P. & Ross, J.W.	Weill, P. & Ross, J.W (2004). IT governance: How top performers manage IT decision rights for superior results. Boston, Massachusetts: Harvard Business School Press.

Management Goal #3 –Compliance Regulation	
Author	Bibliography
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Table Lower Total Cost of Ownership

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Knights, M.	Knights, M. (2007). What you need for a successful SOA. Computer Weekly, 42-44. Retrieved March 28, 2007, from Business Source Premiere.

Table Performance Measurement

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CobiT	CobiT. (2000). Executive Summary. Retrieved April 2, 2007, from https://www.sco.idaho.gov/web%5Cbsa.nsf/8A32010CDD98989687256AE90050BD41/\$FILE/execsum.pdf .

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Appendix C

Glossary of Terms

Alignment: The integration of business functions and IT functions (Luftman, 2004).

Business enterprise: The technology infrastructure that exists in “modern global 2000 companies” (Lithicum, 2007B).

Business goals: “A statement of business intent” (Data Warehouse, n.d.) that are driven by the overall business strategy (Luftman, 2004).

Challenge: In this study, challenges pertain particularly to management challenges of SOA governance as defined by Padmanabhuni et al., (2006).

Enterprise technology team: A team that deals with the technology infrastructure, both hardware and software, within a large organization and typically comprised of software architects, hardware architects, engineers and managers (Tomayko & Hazzan, 2004).

Enterprise Environment: The information systems technology architectures employed within an organization (Barry, 2007).

Implementation phase: The stages involved instituting a program into an organization, with deliverables, roles and responsibilities at each stage of the process (MacVittie, 2007).

Information technology (IT): According to the Information Technology Association of America, information technology is defined as "the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware" (cited in WikipediaA, para. 1).

Information technology manager: A manager as defined by Luftman (2004) whose responsibilities include the areas of 1) planning and budgeting, 2) organizing and staffing, and 3) controlling and problem solving.

IT governance: IT governance is defined as "a structure of relationships and processes to control the enterprise in order to achieve the enterprise's goals by adding value while balancing risk versus return over IT and its processes" (CobiT, 2000, p.3)

IT management goals: A commitment made between technology management and business management (Luftman, 2004).

Multitier applications: These are traditional enterprise applications that are developed within business units without the goal of service reuse (Stack, 2006).

Roadmap: Technology roadmaps are familiar to information technology managers as they distill complex implementations into a single easily digestible document that identifies implementation phases in chronological order (Theuerkorn, 2007).

SOA: For the purposes of this study, IBM's definition is used, which defines SOA as a "business strategy that enables a company to more closely align and reuse existing technology to achieve business goals" (IBM, para. 2).

SOA governance: "Policies and software tools that aim to manage service oriented architecture (SOA), a development approach that employs software reuse to speed application delivery" (Moore, 2006C). Also, according to Marks and Bell (2006), SOA governance defines the "organizational roles and responsibilities, standards and policies that must be adhered to in your SOA conceptual architecture" (p. 3).

Web Services: Web Services are a general model for building applications and can be implemented for any operation system that supports communication over the Internet. Web services take advantage of the best of component-based development (Peiris, n.d.).

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