

Effective Governance During SOA Lifecycle - Theory and Practice

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Abstract. This research provides a theoretical conceptualization of SOA governance aspects that can be used to assess SOA governance practices and provide guidance to improve them. The review of IT and SOA governance shows that there are conflicting claims and inconsistency in the literature concerning the role of SOA governance. Moreover, there is no empirical evidence on the implications of the governance frameworks used for SOA and how they are working in the most effective ways. As a result, there is confusion in practice as the issues of SOA governance have not been successfully addressed. Based on an extensive analysis of major governance frameworks, a comprehensive list of key SOA governance aspects is proposed. This research will focus on the assessment of the importance of SOA governance aspects by finding the role of the governance framework during the different activities of SOA lifecycle and outlining the discrepancies between theory and practice.

Keywords: Service-oriented · IT governance · SOA governance · SOA governance model · Governance aspects · Governance processes · Service lifecycle

1 Introduction

Service Oriented Architecture (SOA) governance has become a topic of high interest for both academics and practitioners. While the academic literature is focusing on the technical aspects associated of SOA [1, 2] and the major software vendors are putting huge efforts to promote the growth of SOA adoption [1], there has been a lack of empirical evidence about SOA governance and SOA governance models. CIOs are recognizing the need to align business and IT in meaningful and measurable ways [3, 4]. However, no common understanding of SOA governance exists [5]. This research focuses on drawing the main aspects of SOA governance from previous work and examines the role of these aspects in building effective SOA governance.

Section 2 of this paper provides a literature review on the major aspects of SOA governance. Section 3 discusses the research approach, methodology and design used to achieve the aims of this study while Sects. 4 and 5 address the preliminary results and future work respectively.

2 Literature Review

2.1 SOA Governance Standards

The difference between SOA and IT architectures is its emphasis on Information Systems (IS) agility which enhances business agility [6]. Unlike other architectures, the SOA paradigm creates an IT view from a business process perspective. It allows these business processes to be constructed, analyzed, and modified much more easily [7].

Researchers agree that organizations planning to broadly adopt SOA should start with governance [8–13]. Organizations need to decide how to implement governance over the SOA implementation in the organization. Technology adoption alone is not enough to enable business or IT transformation [4] - for the fact that decisions made in the information system affect and are affected by the impact that IT has on business processes [14]. When organizations choose to treat integration as just another technology implementation, experiences show zero to minimal reuse, minimal improvement in business responsiveness or flexibility, and higher IT costs over time [4]. Therefore, we see that SOA governance is extending out of IT and merging with business considerations [15]. This comprehensive SOA governance will provide additional strength to the overall information management policies, and aid in maintaining the authenticity and integrity of the corporate information assets [16].

In order to address the existing challenges and successful SOA adoption, organizations need exact definition of processes and relationships, control mechanisms, SOA metrics and enforcement of policies that are defined in an SOA governance framework. The role of an SOA governance framework is defining the set of processes, organization structures, policies, solutions and technologies that can help to manage complex SOA deployment in an effective and efficient manner [17].

2.2 SOA Governance Framework Aspects

There is a general consensus in the literature that there are many different aspects of SOA governance. These aspects vary across different authors and vendors. To identify the existing SOA governance aspects, an extensive literature review on major IT and SOA governance frameworks has been conducted.

Review of Major IT Governance Frameworks

The IT Infrastructure Library (ITIL) mainly deals with IT process definition [12]. It supports implementation of processes related to delivery and support of IT and details establishment and maintenance of service level agreements and operation level agreements.

The basis of COBIT is that accountability of the IT systems is achieved by the use of a set of audit control processes [18]. The framework provides a definition of IT governance consisting of four domains and 34 processes. Each process contains a number of IT governance maturity indicators, such as activities, documents, metrics, and support for role and responsibility assignment. These 34 reference processes are

defined as control framework, more tightly aligned with the business objectives of the organization than with operational issues [12, 19].

Val IT takes IT governance onto a higher level of abstraction by providing general directions on how to manage IT from a business point of view. The high level of abstraction is however also a limitation, as Val IT purely focuses on the interface between IT and the business and lacks the support to represent e.g. the processes of an IT organization [20]. Val IT takes on where COBIT ends, and the two frameworks complement each other well [21].

While COBIT processes manage all IT related activities and Val IT best describes how to progress and maximize the return on investment, the role of Risk IT is enhance risk management. Risk IT was published in 2009 by ISACA [22]. It is the result of a work group composed by industry experts and some academics of different nations, coming from organizations such as IBM, PricewaterhouseCoopers, Risk Management Insight, Swiss Life, and KPMG. Risk IT is a framework based on a set of guiding principles for effective management of IT risk [22].

The COBIT 5 framework is the successor to the COBIT 4.1, with the Risk IT and Val IT frameworks integrated as well. Where principles, policies, frameworks, culture, ethics and behaviour were mentioned in a few COBIT 4.1 processes, COBIT 5 is based on a revised process reference model with a new governance domain and several new and modified processes that now cover enterprise activities end-to-end, i.e., business and IT function areas. COBIT 5 consolidates COBIT 4.1, Val IT and Risk IT into one framework, and has been updated to align with current best practices, e.g. ITIL [23].

Weill and Ross [24] have identified six interacting components for the effective design of IT Governance in their framework. Their main focus lies in the use of IT metrics and accountabilities to influence behaviour. The goal is to create target-oriented incentives in order to evoke specific desirable behaviour. However, their model does not cover SOA lifecycle [12].

SOA Governance Frameworks Proposed in the Research Literature

Numerous models for SOA Governance have been proposed so far. Most of them are motivated by software providers that offer SOA business solutions and closely align their SOA governance perspectives with their products [12]. They differ extensively in scope and capability and many remain abstract. They emphasize on different aspects, e.g., service lifecycle management or organizational change.

Bieberstein et al. [25] propose an SOA Governance Model in which they identify six governance processes and three steps for launching the SOA governance model. They found that SOA strategy and SOA objectives should be defined in such a way that both the business and IT units have a clear understanding of such objectives. Accordingly, policies defined by governance positions should form the basis for any decision. Their model is made complete by a set of best practices.

Derler and Weinreich [26] propose a framework that deals mainly with services. They looked at the governance issues from a technical side. They provided two main tools: the Service Repository Console and the Service Browser. They stated that their model is to support service reuse and service lifecycle activities.

Kuang-Yu et al. [27] developed their own framework because they could not find any suitable on the market that could meet their special requirements for Chunghwa Telecom (CHT). The main functions of their system which they called Service Oriented Bus (SOBUS) are: (1) Managing the applications and registrations of the services on Enterprise Service Bus (ESB). (2) Managing and monitoring the web services and messages services. (3) Analysis of services performance.

Varadan et al. [4] enlightened in their framework on the added benefits of an SOA documented vision and how it can drive the scope towards an SOA governance. They cited four governance processes that must be included in the framework: compliance, vitality, exceptions and appeals and communication. They argued that the use of Enterprise Service Bus is essential for SOA adoption and how using it with a registry can increase business benefits.

Neimann et al. [12, 28] propose an SOA governance framework that consists of two parts: the SOA Governance Control Cycle and the SOA Governance Operational model. According to them, the first represents the overall steering process that controls the operation of the SOA system and it consists of four phases: planning, design, realization and operation. The operational model describes the activities and competencies. They argued that the two parts interact with each other.

de Leusse et al. [29] propose an SOA governance framework based on requirements that underline the need for policy and process management, policy administration, resource life-cycle management, resource adaptation, resource visibility and resource contextualization. They made a distinction between the operational, data and management models. In the operational model, they listed: business capability, infrastructure capability, access control, identity management, message interceptor, metadata repository, policy management, profile management and service registry. In the Object model, they listed the policies and processes. In the management model, they listed profile management, capability management and governance layer base.

Hojaji and Shirazi [17, 30, 31], developed an SOA governance framework based on COBIT 4.1. Their framework consists of a set of service lifecycle processes governed by governance processes. They stated that their framework contributes to SOA governance needs by: promoting the alignment of business and IT, organizing service lifecycle and governance processes, defining the management control objectives, providing SOA reference architecture and infrastructure, and providing metrics and maturity models to measure achievement of defined goals.

Vendor-Based SOA Governance Frameworks

The SOA governance approach proposed by Oracle consists of nine ‘key areas of interest’, that are combined with a structured set of best practices. It is completed by an SOA adaptation model which defines a cycle of six steps that supports continuous improvement of the SOA [32].

Software AG [8] identifies maturity and governance levels. Their maturity model is consisted of six levels and they also defined an SOA service lifecycle which incorporates services, artifacts and roles. They provided a five-step SOA adaptation plan and a set of best practices [28].

Before being acquired by Software AG in 2007, the SOA governance approach at WebMethods consists of two parts: Architecture Governance and Service Lifecycle

Governance. The latter is divided into design-time, run-time and change-time Governance. Architecture Governance deals with issues such as corporate technology standards, the definition of an SOA topology and the determination of an SOA platform strategy. Service Lifecycle Governance focuses on the regulation of design, etc. of services through its respective policies and enforcement mechanisms [28, 33].

Authors at IBM - have defined SOA Governance as an extension of IT Governance that focuses on the service lifecycle and composite applications [28]. The IBM SOA Governance model comprises a service lifecycle and an SOA governance lifecycle, both consist of four phases [34–36]. They also advocated a best practice approach for performing SOA governance called SOA Governance and Management Method (SGMM). SGMM focuses on the three main aspects: people (including governance organizational structures and the concept of a Center of Excellence), process (the governance processes used to govern the SOA) and technology. The SGMM reference model defines concepts in terms of principles, organizations roles and responsibilities, infrastructure and tools, and governing and governed processes.

In conclusion there are many IT and SOA governance frameworks, either proposed or vendor-based. The next section will show which aspects are recognized by each of frameworks reviewed above.

2.3 Summary of SOA Governance Aspects

Based on an extensive analysis of governance frameworks described above, a comprehensive list of key SOA governance aspects is proposed. This paragraph will define each of these aspects, set them up in a table to compare them against different proposed frameworks, and discuss the research issues. The aspects could be classified into the followings two categories:

SOA Business Aspects

- **SOA vision:** This element shows to which degree implementing an SOA governance model can provide a clear SOA vision for the enterprise. Its role is to make sure SOA is compliant with the governed processes.
- **SOA roadmap:** Is one of the most important aspects of the framework; its major role is in the Planning phase as well defining an ‘SOA Strategy Plan process’ [17].
- **SOA maturity:** Is a method of evaluating the organization that creates an understanding of the maturity level of SOA within the organization and its readiness to ensure that framework is defined in an appropriate level for the organization [30].
- **Service lifecycle management:** Is the key component of an SOA governance framework [37]. It includes the processes to produce and manage services. It comprises main processes to design, develop, deploy, manage and retire services [30].
- **Service Portfolio Management:** Is the main process of the service strategy involved determinant control objectives and measurement metrics [17].
- **SOA Business capabilities:** When implementing SOA organizations should be able to realize business capabilities to gain increased visibility across the IT landscape.

- Governance processes: Includes the governance processes to manage service life-cycle activities.
- Organizational change management: Companies that build strong SOA governance and change management capabilities — in tandem with their SOA technology and processes — are poised to reap significant improvements in business agility and speed to market [38].
- SOA Governance Board (or Centre of Excellence - CoE): This is referred to the board of people who govern SOA.
- Open service market-place management: The governance framework should go over geographical boundaries [12].

SOA Technical Aspects

- Enterprise Service Bus (ESB): The Enterprise Service Bus role is to simplify the integration of business components using a standards-based, service-oriented architecture.
- Service performance analysis: This includes the cost to build a new service, elapsed time to build a new service, service utilization, cost to run the service, governance costs and mainly Return on Investment (ROI).
- Policy management: This is the role of the governance Board or (Centre of Excellence). Policies should define clearly the role and responsibility of who will manage, change, and use the service.
- Best practices deployment: Organizations should use best practices and guidance related to SOA and service management especially for determining control objectives and measurement metrics [17].
- SOA Governance Technology: Controls and policies should be introduced enforced in the SOA service lifecycle [17].
- Infrastructure capability: Organizations need to assure that their infrastructure is ready to launch a service.
- Process monitoring and evaluation: is being considered part of the governance lifecycle and the service operation of the service lifecycle [17].
- Service transparency control: Through the registration and discovery mechanism, SOA should provide service location transparency, which allows clients not to know about where a component or service is actually located.
- Service security control: Organizations need to assure their services are secure enough to use.

Table 1 classifies the SOA governance aspects and shows how these aspects are addressed by the IT and SOA governance frameworks discussed previously.

In conclusion, there is no empirical evidence on the implications of the governance frameworks used for SOA and how these frameworks are actually working in the most effective way. There is so much that is not known and not researched and there are many claims made in the literature that are not substantiated by empirical evidence. As a result there is confusion about the usage of SOA governance, and hence the aspects of SOA governance have not been successfully addressed.

Table 1. SOA governance aspects

Implies aspect was not addressed

Implies aspect was addressed

Implies aspect was addressed in details

Frameworks categories	
Framework	
SOA Aspects	

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2.4 The Research Problem

Numerous IT and SOA governance frameworks have been proposed. However, there are no guidelines to adopt these frameworks and no evidence regarding their implications and their success rate. What emerges as a critical issue in any adoption of SOA governance is not which governance framework to choose, but more importantly to identify and focus on SOA particular aspects that need to be addressed irrespective of the framework. This research therefore first examines a range of aspects of SOA governance that are of key importance when an organization adopts an IT or SOA governance framework, and then validates these aspects in the real world of SOA. What are the key business and technical aspects of SOA governance that are critical for its effective implementation remains an important research problem.

On the other side, there have been many SOA governance frameworks proposed. Most of them are based on theories and they do not provide guidelines on how to be applied by the organizations. There is a need to have a conceptual list of aspects to be used to assess the effectiveness of SOA governance practices [12, 13, 16, 28, 39]. As it is unclear what organizations are doing in practice, what is needed beyond the current research is a study of the real-world adoption of SOA across the enterprise and the aspects of SOA governance that aid such adoption. This is critical for a better understanding of this popular architectural concept that is being rapidly adopted by industry organizations [2]. Studies of the aspects of SOA governance are crucial as the number of SOA implementations grows. Therefore, we need to know if IT and SOA governance efforts are well integrated with overall corporate governance arrangements in the organization; and how effective are IT and SOA governance arrangements within the organization [25, 40–42]. This proposed research could well provide executives with some guidelines on how to practice effective governance (directing and controlling of IT resources).

2.5 Research Aims

The paper aims to contribute to knowledge about effective implementation of SOA governance in organizations that adopt either IT or SOA governance frameworks. It provides a conceptual list of aspects – to be verified in practice – that contribute to effective SOA governance. As a result the research will make the following contribution to literature and practice. The contribution to literature will consist of the list of aspects used to assess the effectiveness of SOA governance practices in selected organizations. The focus will be on the assessment of the importance of these aspects as listed in Table 1 and the identification of new aspects that have not been considered. Practically, this research will find out what organizations are doing in practice to address SOA governance, it will investigate whether and how IT or SOA governance frameworks are used and will also provide insights into the ways these frameworks are being used by organizations in practice and what problems they face as a result. Moreover, the list of SOA governance aspects will provide guidance for organizations to improve SOA governance.

3 Problems, Research Approach, Methodology and Design

3.1 Problem Statement

We can conclude that frameworks have been created but most of them address the technical aspects, others were satisfied with the abstract design guidelines and some others focus on specific management aspects [3]. We don't know to which degree SOA governance frameworks and processes have been adopted; there is also a gap in the literature related to the experience in using SOA governance frameworks and processes and how these models are related to SOA adoption. Therefore, the problem to be addressed in this research paper is that of assessing the level of adoption of SOA governance frameworks and processes in practice and to identify correlations between the level of adoption of SOA governance framework and that of SOA in general.

3.2 Methodologies and Design

Since the research problem statement is concerned with determining a common understanding of what SOA governance means in practice by highlighting the aspects of SOA governance frameworks, and since the number of organizations that have adopted SOA governance framework is likely to be small, this research uses an interpretive qualitative research methodology based on interviews as a first phase and in-depth field-study in the second phase, to address the research problem. Following a long tradition in qualitative, interpretive research in IS, Goldkuhl [43] claims that scientific knowledge should be based on the meanings and knowledge of the studied actors and also co-constructed through inter-subjective meaning by the actors and researchers making during the empirical study. Given that the focus of this study is the practice of SOA governance in real-life contexts and that the aim is to find out whether and how different SOA and IT governance frameworks are applied in practice so as to create an understanding of the discrepancy between theory (how frameworks should be applied) and the practice, an interpretive methodology is adopted involving a particular research design, discussed next.

Phase I – Interviewing Experts – An Interpretive Study

The first phase involves conducting interviews with experts who have experience with SOA governance in multiple companies and who participated in several SOA projects. The role of the interviews is to acquire a broad view of SOA governance issues at the time the study is done. The interviews will focus on the aspects of the governance frameworks used in practice. The expected outcomes of these interviews are the verification of relevant aspects of SOA governance found in the literature (as presented in Table 1) and the identification of new elements. The interviewees will be selected and recruited through professional networks of SOA/IT governance experts. The interviews will take the form of face-to-face personal interviews.

Phase II - In-Depth Field Study

The second phase – a field research study – will consist of an in-depth study of two organizations. One that has been highly successful with SOA governance and another

one that attempted and failed to implement SOA governance. The selection of two cases will enable the identification and analysis of SOA governance aspects present in both, and those present in one of them. By contrasting SOA governance effectiveness in the two cases and the ways individual aspects are implemented will provide grounding for the development of substantive theoretical claims regarding the importance and role of SOA governance aspects. The aim is not to generalize empirically but to generalize conceptually and provide an account of SOA governance aspects. This phase will allow having direct, in-depth contact with organizational participants, particularly through interviews and direct observations of activities. Data collection in this phase relies on observing, listening to members, taking notes, getting involved sometimes, and running field interviews.

3.3 Data Analysis

Data analysis will be conducted during and after each phase. The interview transcripts in Phase I will be analyzed using Thematic analysis [44]. The empirical material collected in Phase II – including filed notes, interviews, and various documents – will be analyzed during the field work thus enabling raising new questions and directing the study towards interesting emerging aspects. Analysis of texts in both phases will proceed following Thematic analysis by first coding interesting ideas, topics, and concepts and then organizing them into themes and identifying links among them. Coding in Thematic analysis helps the researcher to build a systematic account of what has been observed and recorded [44]. The thematic analysis will proceed in three steps: The first step of data analysis will involve coding and categorizing the textual data often called an open coding. The codes will be described and all related texts compared and analyzed. As the codes take shape, looking for relationships between these codes comes next. This is called axial coding. Axial coding allows certain codes to be subsumed under broader headings and some abstract codes to be seen more crucial than others. The last step is called theoretical coding (or selective coding). It will involve the identification of the core category around the analysis focuses. It will ideally identify the core code or codes allowing a central story to be developed. Theoretical coding usually occurs later when major themes emerge; the core categories will be verified and revised after checking the data [44].

4 Preliminary Findings

4.1 Participants

This study is still at infancy stage. Three face-to-face interviews were conducted as part of Phase I. The interviewees are selected and recruited through professional networks of SOA/IT governance experts. Contacts were made in advance by email and one page summary of the research was sent upon request. Each interview was given one-hour. The interview questions were not given in advance. The participants had a decision-making role in their organizations and their experience with SOA governance varies from 7 to 25 years. They have worked with a minimum of two

organizations and on different SOA projects at different sectors: telecommunication, government, information systems, IT Architecture, IT management, software services and software products. The participants have occupied the roles of Systems Analyst, Project Manager, Technical Architect, Enterprise Architect, and others. Table 2 summarizes the organizations profile and interviewees' roles at their organizations.

Table 2. A snapshot of the organizations interviewed

Firm	Industry sector	Interviewee
1	Software services	Project Manager
2	Government sector	Enterprise Architect
3	Software products	Systems Analyst

4.2 Results

A broad set of questions were asked regarding the participants' background, their experience with IT and SOA governance, the mechanisms used to select a governance framework, the benefits realized from selecting that framework, the aspects considered in the framework, how the aspects were observed, and the lessons learned.

The interviews demonstrate the need to assess and validate the governance aspects. During the interviews, the participants were asked to assess each of the aspects listed in the literature review and to evaluate its importance: Not Very Important, Important and Very Important (Table 3). The interview transcripts were analyzed using Thematic Analysis as mentioned in Sect. 3.3. First, interesting ideas, topics, and concepts were coded, and then organizing and grouping the coded concepts into themes and broader categories and identifying links among them. Finally, the themes were reviewed to identify similar patterns across the data from the three organizations interviewed. All participants have used different SOA governance frameworks at the organizations they have worked. None of them have used an IT governance framework for an SOA project. The participants' view to SOA was based on their own experience. They all agreed that SOA needs a governance framework, but more importantly was their view to the aspects to consider in the governance framework. They selected their governance frameworks based on their organizations' needs. They either modified the framework selected to match with their organizational requirements or built their own one.

As a preliminary analysis based on the three interviews, the most important aspects were: organizational changes, Enterprise Service Bus, process monitoring and evaluation, and service security. This is not to ignore the service performance analysis and infrastructure capability. All three participants discussed in details the Enterprise Service Bus as being critical to their organization's SOA governance framework. One of the participants pointed to a new potential aspect - the interaction with web services - and suggested that it could be as a new aspect rather than being included under "Enterprise Service Bus". The three interviewees conducted were used to adjust the interview questions of Phase I in order to capture additional empirical data and try to achieve the aims of this research.

Table 3. * = Not Very Important, ** = Important, *** = Very Important

	Interview 1	Interview 2	Interview 3		Interview 1	Interview 2	Interview 3
Business Aspects				Technical Aspects			
SOA Vision	*	*	**	Enterprise Service Bus	***	***	***
SOA roadmap	*	*	*	Srv. performance analysis	**	**	***
Centre of Excellence	**	**	*	Policy management	*	*	*
SOA Maturity	*	*	*	Best Practices deployment	*	*	***
Service lifecycle mngt	*	**	**	SOA Gov. Technology	**	*	*
SOA Business cap.	*	*	*	Infrastructure capability	**	**	*
Governance processes	**	*	**	Process monitoring & eval.	***	***	***
Organizational changes	**	***	***	Service transparency control	*	*	**
Service Portfolio mngt	*	*	*	Service security	**	***	***
Open srv. market-place	*	**	***				

5 Conclusion and Future Work

Since the study is still under development and more interviews are to be conducted soon, it is probably too early to comment further on the results. From what has been done so far, we conclude that the literature covers enough about SOA governance and SOA governance frameworks theoretically but there is a gap about the usage of these frameworks by organizations and how the selection and implementation of a framework affects SOA adoption. This research is seeking to complete Phase I by conducting a total of twenty interviews. When Phase I is completed, two organizations will be selected for Phase II: one organization that has been highly successful with SOA governance and another one that attempted and failed to implement SOA governance. Comparing and contrasting the results of the two phases will provide grounding for the development of substantive theoretical claims regarding the importance and role of SOA governance aspects.

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