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Soa Readiness Assessment, a New Method

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Abstract
One of the initial steps to implement Service Oriented Architecture is organization's readiness assessment for acceptance and utilization of this architecture. Organization's readiness assessment is a method that taking advantages of it investigated various organization aspects and each part of organization preparation for acceptance of service oriented architecture can be measured. Because the implementation of Service Oriented Architecture is a key and large scale project in organizations and organizations are faced with many problems in SOA adoption process. Taking advantage of organization readiness assessment to assess organization readiness is necessary to implement Service Oriented Architecture. In this paper a review on SOA and its adoption and implementation challenges performed. Some researches and tools for service oriented architecture readiness assessment are introduced. A new method for SOA readiness assessment is proposed. Main approach of this method is facilitating SOA implementation by assessing organization readiness to implement this architecture in order to decrease spending time and resources. Most important features of proposed method are that it is based on standards and principles of readiness assessment to implement Service Oriented Architecture and consist comprehensive view on the identified factors to assess organizational readiness.

Keywords: service oriented architecture, readiness assessment, SOA governance, SOA adoption, SOA implementation.

I. Introduction

Due to the rapid development of information and communication technologies, organization requirements are also increasing rapidly. Rapid changes in the business environment and the ubiquitous presence of the Internet in these areas, leads to the necessity of using an independent platform, web-based technologies and establish standards for integration between systems. Appropriate solution to meet these requirements is using appropriate software architecture in development and implementation of such systems. Service Oriented Architecture is not new concept and has existed since 90s, but what is new is the ability to implement and realize it. One of the initial steps to implement Service Oriented Architecture is organization's readiness assessment for acceptance and utilization of this architecture. Organization's readiness assessment is a method that taking advantages of it investigated various organization aspects and each part of organization preparation for acceptance of service oriented architecture can be measured. Because the implementation of Service Oriented Architecture is a key and large scale project in organizations and organizations are faced with many problems in SOA adoption process, and probably despite spending too much time and resources and many investments make in the field of service oriented architecture, deviated from right path and fail; Taking advantage of this tool to assess organization readiness is necessary to implement Service Oriented Architecture.

In this paper, service oriented architecture and its adoption challenges in organization are studied and organization readiness assessment is reviewed. Some tools and methods for organization readiness assessment are investigated and a new method for SOA readiness assessment is proposed. Main goal of this research is proposing a method which an organization's readiness for service oriented architecture implementation can be assessed.

This paper is organized as follows. Section 2 defines service oriented architecture and its adoption and implementation challenges. Section 3 reviews SOA readiness assessment for service oriented architecture implementation. Section 4 presents a literature review of existing SOA readiness assessment methods and tools. Our new method for SOA readiness assessment are presented in Section 5. Section 6 concludes the paper.

II. What is SOA?

Service-oriented architecture (SOA) is defined in a number of ways, but not all definitions are equal, and not all definitions are complete. While there is no standard or official definition for SOA, we found that IBM's definition of SOA (given below) an adequate one in the context of this section:

Service Oriented Architecture (SOA) is a business-centric IT architectural approach that supports integrating your business as linked, repeatable business tasks, or services.

Bieberstein, Bose, Fiammante, Jones & Shah [2] define SOA in the following way:
A service-oriented architecture is a framework for integrating business processes and supporting IT infrastructure as secure, standardized components (services) that can be reused and combined to address changing business priorities.

2.1 SOA adoption problems

The adoption of service-oriented principles is a complex process with the aim of creating a service oriented architecture. It consists of many projects and has a scope of many years. When adopting SOA, different areas inside a company are affected [3]: organizational structure, people, workflow processes and technologies. Challenges in SOA adoption can be classified and put into three categories. These three categories are People, Process, and Technology that shown if fig 1 [4].

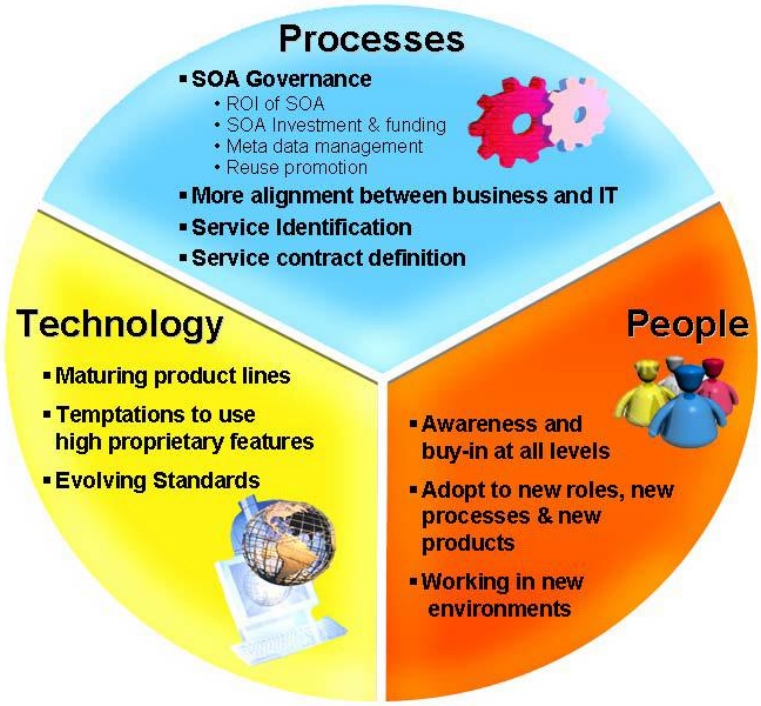

Figure 1. SOA adoption challenges [4]

2.2 SOA implementation challenges

While implementing a service-oriented architecture, a company faces up to eight key challenges [5].
Service identification. What is a service? What is the business functionality to be provided by a given service? What is the optimal granularity of the service?

- Service location. Where should a service be located within the enterprise?
- Service domain definition. How should services be grouped together into logical domains?
- Service packaging. How is existing functionality within legacy mainframe systems to be re-engineered or wrapped into reusable services?
- Service orchestration. How are composite services to be orchestrated?
- Service routing. How are requests from service consumers to be routed to the appropriate service and/or service domain?
- Service governance. How will the enterprise exercise governance processes to administer and maintain services?
- Service messaging standards adoption. How will the enterprise adopt a given standard consistently?

III. Organization readiness assessment for SOA implementation

In this method, organization readiness in managerial and organizational, human resources, structure, process, technical, infrastructure and cultural aspects for service-oriented architecture adoption is determined. Using the output of this tool can identify imperfections in the field of architecture adoption and plan and took action to fix them. Implementing Service-Oriented Architecture requires significant costs and time and affects different aspects of organization. This architecture has been some impact on organizations that provided the

growth and development of some organizations in the business and for some organizations has bankruptcy and the business end. Hence, readiness assessment studies before implementation architecture is very important and is raised as a key success factor for the system implementation. In this regard, it is essential that organizations before any action to implement Service Oriented Architecture perform assessment and feasibility study in order to implement this architecture that the architecture has been implemented based on the current facts and consist organization possibilities and constraints. During the readiness assessment studies, Prerequisites for the successful implementation is determined and organization readiness to implement the architecture is assessed. Service Oriented Architecture readiness assessment studies by primary data collection, create research framework, collect the required detailed data and data analysis is done using standard management tools. The output of this study and analysis express organization readiness to adopt service oriented architecture. Also challenges, problems and key success factors in the architecture implementation is determined at this stage. In addition, some solutions for improving organization state of for the adoption of the architecture is presented.

IV. Related works

In this section some related works are surveyed.

4.1. IBM SOA readiness assessment tool [6]: This tool presents you with a short series of questions based on IBM's SOA maturity model to assess your SOA capabilities and take stock of where you are and where you would like to go with SOA. This tool consists 16 question in 4 categories: process, infrastructure, application and architecture which each category contains 4 question.

4.2. Oracle SOA readiness assessment tool [7]: Oracle have just made available an online SOA Readiness Assessment, It asks you a few questions focused around the 8 areas in Oracles SOA maturity model as mentioned bellow and then provides a report.

- **Business & Strategy:** Contains capabilities that provide the high-level constructs that allow the SOA initiative to proceed. This includes such things as business motivation, expected benefits, guiding principles, expected costs, funding model, etc.
- **Architecture:** Contains capabilities concerning the definitions of the overall architecture and guidelines for various practitioners to ensure adherence to the architecture.
- **Infrastructure:** Contains capabilities concerning the service infrastructure and tools that provide the technical foundation for the SOA initiative.
- **Information:** Contains capabilities concerning the information aspects of SOA, e.g., providing Information as a Service (IAAS). This includes shared data models, message formats and schemas, master data management, content management, etc.
- **Projects, Portfolios & Services:** Contains capabilities concerning the planning and building of services and the service usage guidelines of service consumers.
- **Operations, Administration & Management:** Contains capabilities concerning the post deployment aspects of solutions based on a service-oriented architecture.
- **Organization:** Contains capabilities concerning the development of corporate competency around SOA including the organizational structure and skills development.
- **Governance:** Contains capabilities concerning the governance structures and processes that support and guide the SOA efforts. Maturity and adoption of adequate amount of governance is a leading factor of the overall SOA success.

  The assessment is obviously very lightweight, but it is worth taking for several reasons.
- It gives you some reasonable suggestions about what steps to take next.
- It provides an initial SOA maturity assessment and compares it to your peers.
- It provides links to a number of helpful resources inside and outside Oracle.

4.3. Sandro Geriü et al. [8] analyses necessary set of prerequisites which should be fulfil by organization attempting to implement SOA. The authors mentioned Service-oriented architecture (SOA) is a set of principles for designing extensible, federated and interoperable services, and it represents a new evolutional spiral in the program-applications development and in the evolution of the information systems concept. Since SOA implementation requests significant organizational changes such set of prerequisites should comprise not only from technical prerequisites but should take into account data architecture, system integration and compatibility, security and legislative requirements, business requirements and organizational prerequisites. This set of prerequisites can be defined as a Service-Oriented Architecture Maturity Model and used to evaluate the possibility for successful utilization of SOA in specific organization. The author also concludes that besides the technical standards and solutions that are necessary for SOA implementation, an organization has to full field a

set of different criteria in order for SOA implementation to be successful. It is not easy to define a unique set of criterion, or prerequisites that organization has to full field in order to successfully implement SOA. The ability for organization to adopt service oriented architecture can be estimated by service oriented architectures maturity models (SOAMM). Different service-oriented architecture maturity models exists, and analysis that we conducted in this paper has shown that they define very similar maturity levels, and a very similar set of prerequisites that organization has to achieve in order to increase its maturity level in the context of SOA implementation. Authors based on that conclude that is possible to define a basic set of criteria, as a necessary set of prerequisites that an organization has to establish if it wants to establish successful SOA implementation. Which criteria should be used in this set, and what are the differences and additional prerequisites for some specific domains (e.g. public administration, manufacturing, retail, financial institutions, etc.) are the elements of further research in this area.

4.4. Julian Eckert et al. [9] mentioned currently, the realization of Service-oriented Architecture (SOA) implementation in the German banking industry varies, whereas some banks are in the adoption phase and others are already in the SOA operations phase. This paper focuses on specific implications concerning the SOA readiness and the SOA maturity of German banks as well as the role of SOA in the context of M&A scenarios. In particular, key findings of the SOA readiness and maturity case study within the German banking industry are presented and discussed. This paper presents the findings of the SOA readiness and maturity case study within the German banking industry. It builds on an already established research framework regarding SOA maturity and SOA readiness. The evaluation of the conducted interviews has shown that SOA readiness is already present in the German banking industry. On the other hand, the maturity levels of SOAs in the observed German banks are very similar to each other: a basic technical platform is established, but a holistic and mature enterprise SOA including a well-established SOA Life Cycle Management could not be found – therefore, all investigated banks are assigned to maturity level two, making progress towards level three. A major issue which hinders higher maturity levels is the missing alignment between management and IT. This results in weak management support in topics that regard SOA and too much responsibility for the IT departments. This issue leads to SOAs which are not process-oriented, since the IT has the responsibility but not the opportunity to align SOA on the business processes, because only poor documentation is available. On the other hand, the business is almost always project-driven only and does not offer business process support. As a result of this issue the granularity of alignment activities represents the independent variable, whereas the maturity of the service landscape is the dependent variable. This model focuses on the maturity of the services and not on the entire SOA, since, as we found out, the functionality of the services gains the highest importance for the interviewees. An initial strategic alignment is required to create a trivial service environment. If additional roles are defined and the organization structure is redesigned according to SOA, the service landscape is able to support the processes. If and only if the business side of the enterprise both creates process documentations and supports the IT by implementing these processes, a process-oriented service environment can be created. The case study shows that SOA in German banks has some room for further improvements.

4.5. Tor-Morten Grønli et al. [10] proposed recent research suggests that companies are exploiting the agile and innovative potential of SOA, but are regarding it as a technical issue. In this article we present and discuss a very successful SOA implementation. We conducted an in-depth case study at an international airline company. Authors presented and investigated a very successful case of SOA implementation, which enabled the company to innovate new services. They found that a flexible IT architecture provides resources on which the business people may innovate. Three success factors were identified by analyzing the relationship between service oriented architecture and the development of new business services in the company: A comprehensive implementation of an enterprise service bus, with the encapsulation of components at the different levels enables IT and business developers to innovate new series quickly. Second, as long as the architecture is kept clean (i.e. adhering to the principles of the SOA), the new services on the SOA not only increase the income of the company, but also increase the spectrum of possibilities for new innovations. Third, the architecture should also govern the organization of developers. We find that the best way to achieve this is to allocate one team per layer in the architecture.

V. Research structure

First researches was conducted on the SOA and then with a review on previous research in the field of organization readiness assessment for Service Oriented Architecture implementation, best methods of organization readiness assessment identified and were placed as basis of this research. Then by using investigations and basic methods, the main factors to assess the readiness of the organization identified and then for each key factor, sub-factors identified and the most appropriate and best factor that have more

comprehensive and more common were selected. In the selection criteria tried to consider all aspects of organization that have role in service oriented architecture implementation. After determining factors each factor were weighted. Based on major and minor determined factors, for each sub-index, a question was raised and after various studies and surveys a fairly comprehensive questionnaire is designed. Cochran's formula to obtain the optimal number of questionnaires were used. Then, designed questionnaire were distributed based on calculated number. In order to assess organization readiness a formula was designed. After collecting the questionnaires, using the set out formula to analyze answers and draw conclusions from them. Research structure shown in Fig 2

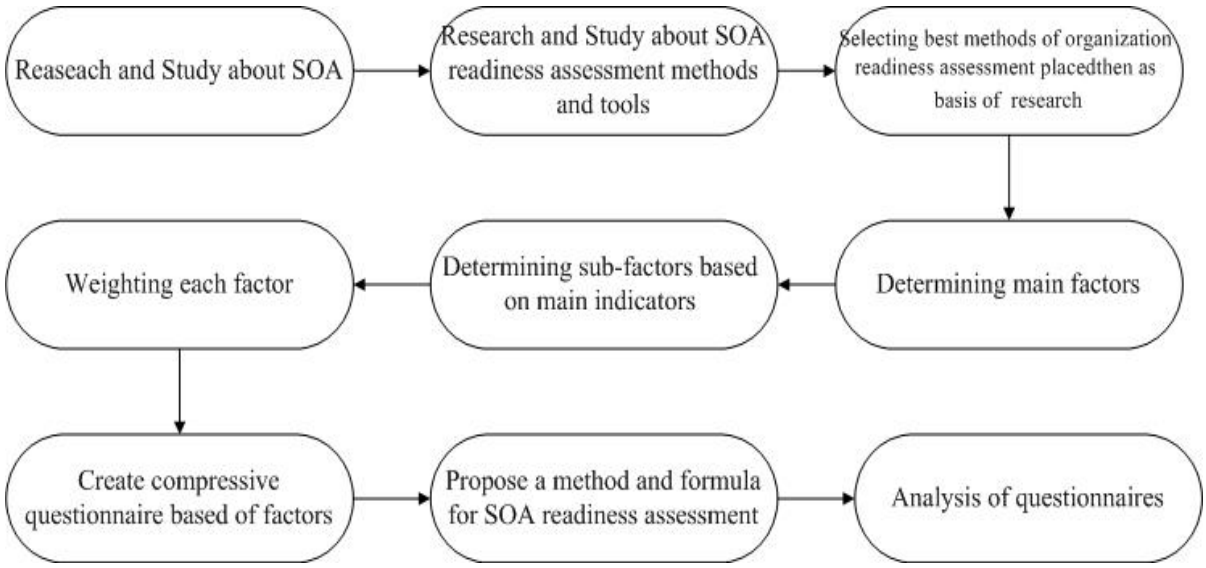

Figure 2. Research structure

5.1. Questionnaire

This research questionnaire consisted of 48 items. We use Likert scale in order to scaling responses. The format of our five-level Likert item shown in table 1.

Table 1. Questionaries' scoring

Very low	Low	Middle	High	Very high
0.2	0.4	0.6	0.8	1

In this study, in order to ensure the validity of data collection tool questionnaire information was shared to the experts and according to their views necessary changes were applied.

In this study, Cronbach's alpha was used, so the researcher to evaluate the reliability of the questionnaire a sample of 40 sets of questionnaires have been distributed among the statical population and by using SPSS software Cronbach's alpha was measured and 0.978 was obtained for the questionnaire. Since the reliability of tool is higher than 0.70 we can trust the results of the study and collected data.

Table 2. Reliability test and Cronbach's alpha for the sample

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.978	.978	47

5.2. Statistical population:

The research has included various managers and experts of IT organizations in Iran. Questionnaires were distributed among the people familiar with Service Oriented Architecture. In this research Cochran's formula used to obtain the optimal number of questionnaires.

5.3. Data analysis and assumptions testing method:

Data analysis was done Based on the descriptive statistics by using SPSS software. Data from the research tool entered into SPSS statistical program, based on the type and purpose of the research, appropriate statistical tests and analyzes were performed.

VI. New method process

This section describes the process of new method for SOA readiness assessment.

6.1. Factors determination

According to the studies We made base IBM and Oracle organization readiness assessment methods and "Prerequisites for Successful Implementation of Service-Oriented [8]", "Readiness and Maturity of Service-oriented Architectures in the German Banking Industry [9]", "A Successful Implementation of Service Oriented Architecture [10]" and then initial factors identified based on these researches. Six main factors shown in Fig 3.

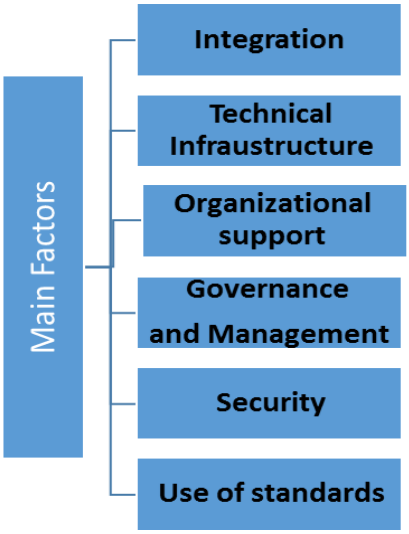

Figure 3. Main Factors

Initial factors consists all main factors and sub factors shown as follow:

- **Integration**

F1. Organization's application integration
F2. Harmonized and coordinated information flows
F3. Dynamic Architecture
F4. Integration across the organization
F5. Connect internal services with external services
F6. Orchestration Service to manage processes
F7. Supply chain integration
F8. Connection between business processes and services
F9. Integration across business functions
F10. Support of heterogeneity and distributed systems
F11. Process Integration
F12. Organization's use of a services layer to facilitate shareable services
F13. Organization's degree of flexibility for service oriented computing

- **Technical Infrastructure**

F14. Layered Architecture
F15. Proprietary point to point connections
F16. Enterprise wide IT transformation
F17. Organization ability to reuse existing applications
F18. Organization existing Service-oriented capabilities
F19. Infrastructure ability to support service oriented computing
F20. Organization's ability to create new applications from existing services
F21. Architecture ability to support advanced interactions and connections between applications
F22. Finely tuning of infrastructure

- **Organizational support**

F23. Start of changing corporate culture
F24. Organization's experience in SOA
F25. Developers learn service development skills
F26. Service oriented business view of IT
F27. Organization and employees support of new functionality
F28. Business stakeholders' current perception of SOA

- **Governance and Management**

F29. Modular exposure of functionality
F30. Self-organized enterprise
F31. Automated business processes
F32. Extend business processes to external organizations
F33. Specify policies for SOA
F34. Specify policies for creation or modification of business processes
F35. Governance using policies and service definitions
F36. Organization degree to measure business process performance and react to the data

- **Security**

F37. Implement cross enterprise security
F38. Enterprise infrastructure's security capabilities
F39. Organization strategy for deploying security around service oriented solutions
F40. Application access security
F41. Application security

- **Use of Standards**

F42. Communications through interfaces and contracts
F43. Specify technology standards for SOA
F44. Proprietary protocols and glue code is replaced by standards
F45. Organization's technique for identification and design of services
F46. Degree of using SOA governance model
F47. Organization's development technique to expose services

6.2. Feature selection

After initial organization readiness assessment factors identification, In order to select key factors from initial defined factors excluded indications that was not a major influence in organization readiness assessment, the feature selection algorithm was used which exist in SPSS Modeler software. For this, after entering data set to software and selecting filters and set special settings, Feature Selection and CHAID algorithm was used. Key factors after feature selection shown in figure 4.

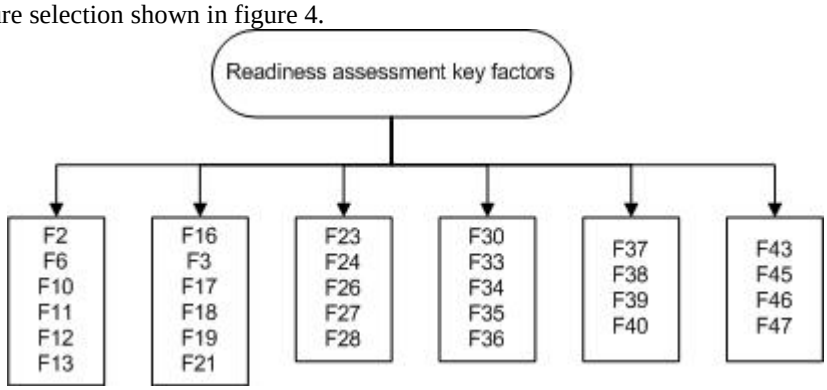

Figure 4. Key Factors after feature selection

6.3. Weighting factors:

After selection features each of them were weighted that weights is based on the principles of research and respondents.

After key factors selection stage, each major and minor factors was weighted based on basic researches and respondents answers. Factors with weight shown in table

Factor	Weight
Integration	**3**
F2	4
F6	1
F10	2
F11	5
F12	2
F13	3
Technical Infrastructure	**4**
F16	4
F3	3
F17	2
F18	5
F19	3
F21	1
Organizational Support	5
F23	3
F24	1
F26	5
F27	2
F28	4
Governance and Management	2
F30	1
F33	4
F34	3
F35	5
F36	2
Security	1
F37	4
F38	2
F39	3
F40	1
Use of Standards	3
F43	4
F45	2
F46	3
F47	1

6.4. Readiness assessment calculation

To calculate the organization's readiness to implement service-oriented architecture, a formula was designed which shown in follow:

$$\frac{\sum_{j=1}^{n}\left(\frac{\sum_{i=1}^{k} q_i * w'_j}{\sum_{i=1}^{k} w'_i}\right) * w_j}{\sum_{j=1}^{n} w_j} \quad (1)$$

Q_i: Points each response based on Table 3.
W_i: each sub-index weight
W_j: each main-index weight

6.5. Proposed method advantages:

- Based on standards and principles of assessment of readiness to implement Service Oriented Architecture
- Comprehensive view on the identified factors to assess organizational readiness
- Business process used as the original source of this method can assess organization readiness
- According to the characteristics and challenges of organizations as the basis of the proposed method.

VII. Case Study

In order to perform the actual evaluation and assessment of readiness for implementing service-oriented architecture an Iranian organization considered as case study and by using questionnaire responses, organization readiness was assessed.

Table 3. Points of case study for Integration Factor and it's sub-factor

Integration			
Question	Group Weight	Factor Weight	Point
1	3	4	0.4
2		1	0.2
3		2	0.2
4		5	0.4
5		2	0.2
6		3	0.2
	Total		1.6

Table 4. Points of case study for Technical Infrastructure Factor and its sub-factor

Technical Infrastructure			
Question	Group Weight	Factor Weight	Point
1	4	4	0.2
2		2	0.4
3		5	0.2
4		3	0.2
5		1	0.2
	Total		1.2

Table 5. Points of case study for Organizational Support Factor and its sub-factor

Organizational Support			
Question	Group Weight	Factor Weight	Earn value
1	5	3	0.2
2		1	0.4
3		5	0.4
4		2	0.2
5		4	0.2
	Total		1.6

Table 6. Points of case study for Governance and Management Factor and its sub-factor

Governance and Management			
Question	Group Weight	Factor Weight	Earn value
1	2	1	0.4
2		4	0.4
3		3	0.2
4		5	0.4
5		2	0.4
	Total		1

Table 7. Points of case study for Security Factor and its sub-factor

Security			
Question	Group Weight	Factor Weight	Earn value
1	1	4	0.8
2		1	0.6
3		2	0.4
4		5	0.8
	Total		2.6

Table 8. Points of case study for Use of Standards Factor and its sub-factor

Use of Standards

Question	Group Weight	Factor Weight	Earn value
1	3	4	0.2
2		2	0.2
3		3	0.2
4		1	0.2
	Total		0.8

Based on our formula readiness percentage of this organization is 37%.

VIII. Conclusions

Service Oriented Architecture is not new concept and has existed since 90s, but what is new is the ability to implement and realize it. One of the initial steps to implement Service Oriented Architecture is organization's readiness assessment for acceptance and utilization of this architecture. In this paper, existing method and tools to assess organization readiness identified and explained. Also in this paper, service oriented architecture and its adoption and implementations challenges in organization was explained and organization readiness assessment reviewed.

We introduce a new method for organization readiness assessment. In order to do this review on previous research in the field of organization readiness assessment for Service Oriented Architecture implementation was conducted and best methods of organization readiness assessment identified and were placed as basis of this research. Then by using investigations and basic methods, the main factors to assess the readiness of the organization identified and then for each key factor, sub-factors identified and the most appropriate and best factor that have more comprehensive and more common were selected. After determining factors, each factor were weighted. In order to assess organization readiness a formula was designed. After collecting the questionnaires, using the set out formula to analyze answers and draw conclusions from them. Main approach of this method is facilitating SOA implementation by assessing organization readiness to implement this architecture in order to decrease spending time and resources.

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