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JOURNAL OF INFORMATION SYSTEMS APPLIED RESEARCH

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The Potential Reality of Service-Oriented Architecture (SOA) in a Cloud Computing Strategy

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Abstract

The constraints of the current economy continue to affect business firms investing in information systems. This paper analyzes the extent of implemented initiatives in Service-Oriented Architecture (SOA) that may be impacted by limited investment in technology. Derived from an earlier study of SOA published in 2008, the findings from a literature survey and a case study in the current paper disclose that few firms identified in the earlier study have advanced noticeably to enterprise integrated and matured processes enabled by SOA, though the bulk of the firms continue investment in projects of SOA. The implications however indicate that continued investment in the projects may facilitate a foundation for initiatives in cloud computing. This paper might benefit educators considering expansion of SOA in curricula of information systems, and it may help practitioners considering increased investment in SOA as a potential strategy to be positioned to take advantage of cloud computing.

Keywords: cloud computing, program management methodology, service-oriented architecture (SOA), service-oriented computing (SOC), service-oriented enterprise (SOE)

1. BACKGROUND AND DEFINITION

Service-Oriented Architecture (SOA) is currently defined in the literature as an enabled framework of technology:

"[that] … aims to enhance … agility and cost-effectiveness of an enterprise while [lessening] the burden of Information Technology on the overall organization" (Erl, 2009) and

"that allows all interested systems, [internal and external to a business firm], to expose and access defined services, and information bound to those services, that may be further abstracted to process layers and composite applications for developing [solutions] (Linthicum, 2010, p. 5)".

Essentially SOA, or Service-Oriented Computing (SOC), is focused on the notion of services as a factor for development of software solutions (Brogi, Corfini and Popescu, 2008). SOA furnishes benefits for firms investing in flexibly improved business processes and solutions, as frequently indicated in practitioner (Smith, 2008 and Watson, October, 2008) and prior scholarly literature (Vom Brocke, 2007). The goal of firms investing in SOA is to be a fully deployed Service-Oriented Enterprise (SOE) in integrating

internal and external processes and services – processes of the firms as services (Gens, 2009) – in larger and matured business unit–to–business unit and internal firm–to–external firm "on demand" solutions, based on a business strategy (Lawler, Benedict, Howell-Barber and Joseph, 2009). Most firms in industry cite deployed, developmental, experimental or anticipated investment in SOA, as indicated in Figure 1 of the Appendix, attesting to an apparent inevitability of SOA as a strategy. This inevitability may not be a reality.

The number of business firms deploying or further deploying SOA is indicated in the literature to be less in 2008-2009 than in 2007 (Taft, 2008). Less investment in SOA is indicated as an effect of the downturn in the economy (Thibodeau, 2008, p. 12) – even in financial firms that have historically invested in new methodology and technology (Sausner, 2009). Though more than half of firms investing in SOA have had anticipated or more than expected benefits, less than half have had less than expected benefits or have not deployed it on operational systems, as indicated in Figure 2. Initiatives in SOA are costly investments. Benefits of SOA are frequently hyped by technology firms, instead of the complexity of deploying SOE into the infrastructure of business firms.

The inevitability of SOA is countered by a perceived reality that SOA may be dead as a proposition:

"SOA met its demise on January 1, 2009 … by the catastrophic impact of the [economy] … a failed experiment – at least for most [business firms] … except in rare situations SOA failed to deliver promised benefits … systems are no better than before [SOA] … [firms have] to accept reality ... [they have to remove it] from [their] vocabulary" (Manes, 2009).

Others contend that SOA may fade into software-as-a-service (SaaS) (McKendrick, 2008), or into cloud computing. The condition of SOA in 2009 may not be as dire however as presented by pundits, and may be myopic (Woodhull, 2009), especially as they might better inform readers of the bona fide benefits of SOA in improving business processes in a business strategy (Linthicum, 2009), if not in an eventual cloud computing strategy.

Firms are investing reasonably in services of SOA as a methodology for the benefits of improving processes in a business strategy (Watson, December, 2008), as further indicated in plans for 2009 in Figure 3 (D'Auria, 2009). The problem of SOA is investing in initiatives on a path of internal and external business unit and firm processes that leads to an SOE, or SOEA - Service-Oriented Enterprise Architecture (Brooks, 2009), – in firms, a path that integrates processes as services in more business units on more projects with more technical and business staff, but on a path of a business strategy, not a technology strategy (Lawler, Raggad and Howell-Barber, 2008). SOA is a costly and exhausting program, but it enables foundation of a platform of "on demand" services for cloud computing (Krill, 2009), a perceived cost savings strategy, which might inherently be the inevitability of an SOA strategy (Linthicum, 2008). Cloud computing is defined in the literature as below:

"any resource [of Information Technology] … including application services … that exists outside of the firewall that may be leveraged by enterprise Information Technology over the Internet;" (Linthicum, 2010, p. 7)

"… a strategic technology." (Thibodeau, 2008, p. 14)

Cloud computing is also described in groups of infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS) (Yachin and Patterson, 2009), in Table 1 of the Appendix. SOE might be helpful in facilitating the formation of a platform of internal or external processes as remote services, the interfaces to the platform that extend into cloud computing resources, and the standards. Study of firms that are effectively maturing to SOE and enabling cloud computing might benefit practitioners considering further investment in SOA, as a strategy to take advantage of the movement to cloud computing technology, if not educators considering further inclusion of SOA in curricula of information systems.

2. INTRODUCTION TO STUDY

In this new study, the authors analyze business firms that have invested in SOA as first movers in 2005 – 2007 and matured on a path to SOE that integrates processes as services in a business strategy. This study is based on an earlier study of the firms published by the authors (Lawler and Howell-Barber, 2008, pp. 61-170). Findings from the earlier study indicated that business firms that led initiatives in SOA with business criteria had more benefits in effective processes from SOA than firms that

led projects with purely technical dimensions (Lawler and Howell-Barber, 2008, pp. 171-180), confirming an even earlier study of other firms on services (Lawler, Anderson, Howell-Barber, Hill, Javed and Li, 2005). Findings from the 2008 study further indicated that business firms had more benefits from SOA if the initiatives were not 'low hanging fruit" projects but solutions of strategy. Management of SOA as a business strategy was indicated in the studies to subordinate technology hyped by technology firms to the practitioner vision of SOE. The management of initiatives on a path to SOE was analyzed by a program management methodology applied in the studies that might even facilitate implementation of a cloud computing strategy.

The program management methodology is defined as a disciplined Methodology for Enabling Service-Oriented Architecture (MESOA) (Lawler and Howell-Barber, 2008, p. 27-59), akin to business process management (BPM) in analyzing and continually enhancing fundamental activities of the operation of business firms (Wisner and Stanley, 2008). This methodology is complimentary to project management methodologies already established in firms and is both technology firm and technology neutral. It is depicted in Figure 4, and described in frameworks of best practices of governance, communication, product realization, project management, architecture, data management, service management, human resource management and post implementation, for business, corporate and technical staff on initiatives or projects of SOA, in Table 2. The frameworks are coupled or related steps for the staff in managing projects of SOA. These steps are top-down from business strategy and bottom-up from technology strategy, favorable in mitigating the risks of SOA. The frameworks of the methodology evolve as SOA matures in iterative phasing and incremental movement towards SOE, in a manner similar to established methodologies in the literature (Tiba, Wang, Ramanujam and Capretz, 2009).

The program management methodology was applied in the 2005-2007 period of the earlier study (Lawler and Howell-Barber, 2008, pp. 61-170) in an economy not as constrained as in 2009-2010. The benefits of the new study will be in evaluating the progress or non-progress of initiatives of SOA in a constrained economy and furnishing guidance, inasmuch as continued investment in progression of SOA might facilitate later opportunities (Walker, 2009). Investment in projects of SOA may be crucial in progression of services towards SOE that might facilitate a foundation for a cloud computing strategy if business firms follow best practices of SOA. Practitioners may be hesitant however about further investment in SOA (Currier, 2009), because of complexity of functionality or because of benefits not fast enough for funding justification, though SOA leads to savings (Castro-Leon, 2008). Educators may be hesitant about inclusion of SOA as a discipline or even as a foundation for cloud computing in the curricula of information systems if firms do not continue investment in it. The reality or non-reality of SOA is important to study, and the results of this study will furnish input to educators and practitioners.

3. FOCUS OF STUDY

The focus of this study is to analyze the extent of implemented initiatives of SOA that might be impacted by limited investment in technology, due to the more constraining economy of 2009-2010. The initiatives are analyzed for maturity of SOA from the aforementioned frameworks of the program management methodology in Table 1 that were developed in the earlier published research study of the authors (Lawler and Howell-Barber, 2008, pp. 27-59). The frameworks of the methodology are applied to new initiatives and to new levels of maturity of SOA in the business firms identified in the initial study of SOA. Such firms were innovators of SOA during the less constraining economy of 2005-2007 and were a model in that study. This study analyzes evidence of initiatives of cloud computing concurrent with the analysis of SOA, but the focus is on the investment progression or non-progression of SOA in the current economy.

4. RESEARCH METHODOLOGY

The research methodology of the study consisted of a literature scan of 15 Fortune 10 – 1000 business firms, in the automobile (1), banking (3), energy (1), health (1), insurance (2), manufacturing (1), technology (2), telecommunications (2), training (1) and travel and leisure (1) industries, that were analyzed for current initiatives in SOA during the more constraining economy of 2009.

The firms of the study were identified as innovators in the initial study of the authors (Lawler and Howell-Barber, 2008, pp. 61-170). Each of the 15 firms was analyzed from a

practitioner publication survey in March – June 2009 by a graduate student in an Independent Project Study of Service Oriented Architecture (SOA), at the Seidenberg School of Computer Science and Information Systems of Pace University. This student was under the direction of the first author of this study. The initiatives of the firms were analyzed collectively by application of the frameworks of governance, communication, product realization, project management, architecture, data management, service management, human resource management, and post implementation of the program management methodology described in the earlier section. The frameworks were evaluated on a four-point scale of high enablement (3), intermediate enablement (2), low enablement (1), and no enablement (0) of SOA.

The methodology also consisted of a case study of 3 of the 15 firms. Each of the 3 firms was analyzed individually in May-June 2009 and October-November 2009 by an experienced industry practitioner, under the direction of the first author. The initiatives of the 3 firms were analyzed internally by application of the aforementioned frameworks of the methodology and evaluated on the aforementioned scale, separate from the survey. The evolution of the new initiatives of the 15 firms to new levels of maturity of SOA were concurrently evaluated in summary by the practitioner for deployment of Web services based on SOA; deployment of services, integration of process and services architecture and restructuring of organizations and staff; and deployment of services based on SOE, in comparative evaluation to the earlier study.

The methodology included evaluation in summary of the 15 firms for evidence of cloud computing initiatives in groups of infrastructure as a service (IasS), platform as a service (PaaS), and software as a service (Saas) (Yachin and Patterson, 2009), which was performed by the first author from the accumulated documentation on the 15 firms.

Finally, the research methodology of the study further included descriptive statistical interpretation by the second author of this study.

5. ANALYSIS AND DISCUSSION OF FINDINGS

The analysis of the data from the literature scan of the 15 business firms in 2009 disclosed that few of the firms migrated noticeably in maturity of SOA since the earlier study of 2005 – 2007 of SOA, as is indicated in Table 3 of the Appendix.

Firms 1, 2, 3, 4 and 9 advanced from low to intermediate enablement of maturity of SOA, but firms 5, 6, 7, 8, 10, 11, 12, 13, 14 and 15 continued to be low or intermediate in enablement of SOA. No firm advanced to full or highest enablement of maturity of SOE (Service-Oriented Enterprise) from the limited investment of SOA.

The analysis of the data from the detailed case study of 3 of the 15 firms in 2009 was consistent essentially from the findings of the literature scan, as indicated in Table 4. Firms 1 and 3 advanced from low to intermediate enablement of SOA. Firm 7 continued to be intermediate in enablement of SOA. Firms 1, 3 and 7 indicated that due to the economy investment was limited to business benefits that might be derived on projects of SOA. Forecasts for investment on new projects in 2010 were indicated to be low.

(Figure 6 of the Appendix indicates levels of maturity of SOA from Web services to SOE.)

The analysis of the data from the literature scan of the frameworks of the 15 business firms disclosed improvement but not noticeably into high maturity of SOA, as indicated in Table 5.

Communication, service management and post implementation advanced from low to intermediate enablement of SOA; governance, product realization, project management, architecture and data management continued to be intermediate or low; and human resource management declined from intermediate to low enablement. No framework moved to full or highest enablement of maturity of SOA.

The analysis of the data from the detailed case study of the frameworks of Firms 1, 3 and 7 were consistent with the findings of the literature scan.

The final analysis of the data from the literature scan of the 15 firms and the case study of the 3 firms disclosed essentially low investment in cloud computing initiatives during the 2009 study, as indicated in Table 6.

Firms 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 15 in the literature scan were low or non-existent in indication in investment in cloud computing projects. Firms 4 and 13 in the scan were intermediate in investment migration, and Firms 1, 3 and 7 in the detailed case study were

low or non-existent in investment on the projects, as in the literature scan. Firms 1, 3 and 7 indicated that investment was low or non-existent on the cloud computing projects due to the economy and to hesitancy in the technology, but project managers in the firms perceived existing investment in SOA as a favorable foundation for future cloud computing projects. Forecasts for new projects in 2010 were undetermined or low.

(Figure 7 indicates levels of maturity of cloud computing in the firms.)

In summary, the analysis is disclosing that few of the business firms have advanced significantly to a high maturity of an SOE. Encouraging however is the finding that the other firms in the study have continued disciplined expenditure of investment in projects of SOA on a path potentially to SOE, albeit at intermediate to low levels. They have continued enablement of the projects in the frameworks of program management methodology. This investment may facilitate migration to cloud computing once the firms decide to move to the cloud.

6. IMPLICATIONS OF STUDY

Expenditure for SOA was clearly affected by the constraining economy. Few of the business firms in the current study of 2009-2010 migrated SOA into SOE in a significant manner since the earlier study of 2005-2007 of SOA. They focused on less important initiatives that limited progression to enterprise integrated and matured processes of an SOE. However, they focused on projects having discernable business benefits of SOA (SOA Manifesto, 2009) so that these projects might enable an incremental progressive strategy towards SOE, not sacrificing the strategy to short-term goals (MacSweeney, 2009). Though expenditures for technology in firms in industry are limiting investment in larger projects of SOA (Banerji, 2009), firms in the current study were noted to be on the path of an SOE strategy but not significantly.

Initiatives of the firms in SOA were clearly aligned with business goals. All of the chief information officers (CIO) in the firms of the study were apparently cognizant of investment in SOA as a business strategy. They collaborated generally on a portfolio of projects of SOA with executive vice presidents who were frequently executive sponsors of SOA. Executive sponsorship is indicated in the literature to be critical in a progressive strategy (Kavis, 2008). Though investment in SOA was limiting the number of projects, the leadership was noted to be cautious that projects contributed to a bona fide business strategy.

Projects of SOA were clearly disciplined in the firms by evidence of the frameworks of the program management methodology of the study. Frameworks of governance and service management enabled especially a progressive SOA strategy. Governance is indicated in the literature to be a key ingredient in an SOA strategy (Berry and Van Alst, 2009, Lundquist, 2009 and Worthington, 2009). Service standards were a key ingredient in the reusability of services in the strategy. The management of the projects by the methodology was noted to be critical in ensuring SOA structure.

Several of the firms in the study initiated cloud computing projects that were enabled by an earlier foundation of service orientation. Further investment may escalate progression to integrated processes of SOE that might facilitate cloud computing strategy. Though practitioners in the firms in the study might be hesitant about further investment in SOA (Preston, 2008), they might increase investment as they learn of, if not realize, the cost savings of a cloud computing strategy that takes advantage of SOA. The interdependence of cloud computing and SOA was clearly noted to be a feature of the few cloud computing projects that were progressing seriously in the several firms. This was noted to be a proposition of value.

The reality of SOA was clearly evident in the firms of the new study despite constraining investment. Schools of computer science and information systems might be comforted in integrating the methodology of SOA into curricula. They might consider integrating cloud computing and SOA to be current with enterprise architecture methodology (Nash, 2009). They might inform students of enterprise architect positions (Gibson, 2008) required for shifting to SOE that might facilitate a cloud computing strategy. Those in schools of information systems might instruct students in methodologies that matter in SOA strategy.

7. LIMITATIONS AND OPPORTUNITIES IN RESEARCH

The findings of the current new study were derived from an essentially small number of firms in industry, limiting extrapolation to a larger population. The firms were generally

innovators in SOA identified in the initial study (Lawler and Howell-Barber, 2008, pp. 61-170), and not included in the sample were non-innovators or subsequent innovators since the studies. The investigation of the initiatives of SOA was subject to the confidentiality limitations of the organizations.

The next research steps will be in increasing the number of firms in the sample and the scope of firms investing not only in SOA but also and especially in cloud computing methodology and technology. These steps will be initiated in 2010-2012 in a continued study of SOA.

8. CONCLUSION

The paper analyzed initiatives of SOA affected by the constraining economy in 2009-2010. The findings indicated that few of the business firms in the model of the paper have advanced significantly to the highest of integrated and matured processes of an SOE. However, the bulk of the firms in the study have continued investment in SOA, although less than in the economy of 2005-2007. The paper in fact indicated that investment is facilitating implementation of cloud computing initiatives that might contribute to cost savings not perceived in initial investment in projects of SOA. Though further research will continue on the reality of SOA, the findings of the recent study encourage instructors to continue including SOA in the curricula of information systems, and encourage manager practitioners to continue investing in SOA as they migrate to cloud computing initiatives.

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APPENDIX

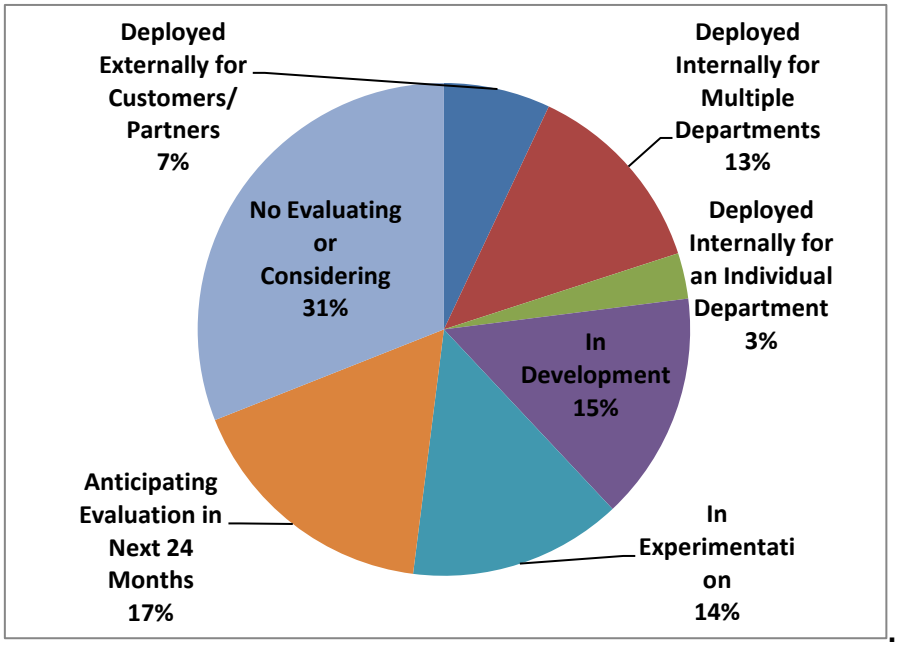

Figure 1: Deployment of SOA

Source: Smith (2009) "Trouble Ahead, Trouble Behind: Is SOA on Track for Recovery, or Has This Technology Been Permanently Derailed by the Economic Downturn?" Information Week, Information Week Analytics, State of SOA Survey, February 23, p. 28 [Adapted].

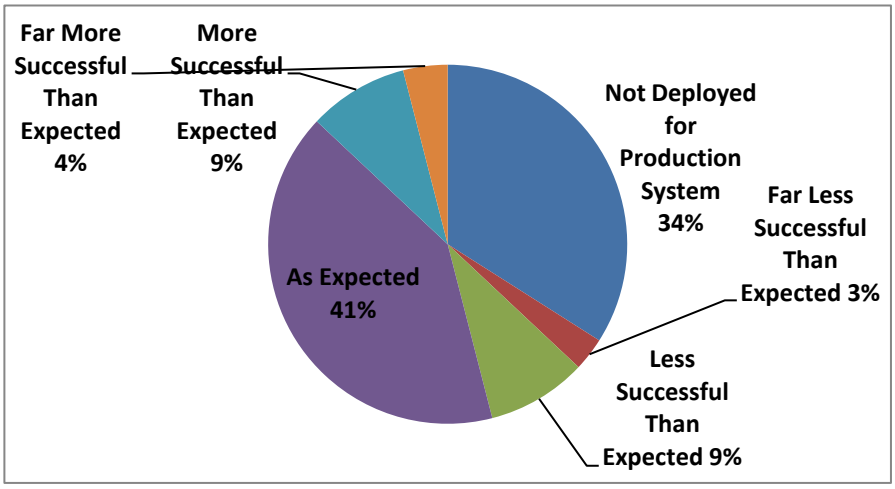

Figure 2: Impact of SOA

Source: Smith (2009) "Trouble Ahead, Trouble Behind: Is SOA on Track for Recovery, or Has This Technology Been Permanently Derailed by the Economic Downturn?" Information Week, Information Week Analytics, State of SOA Survey, February, p. 29 [Adapted].

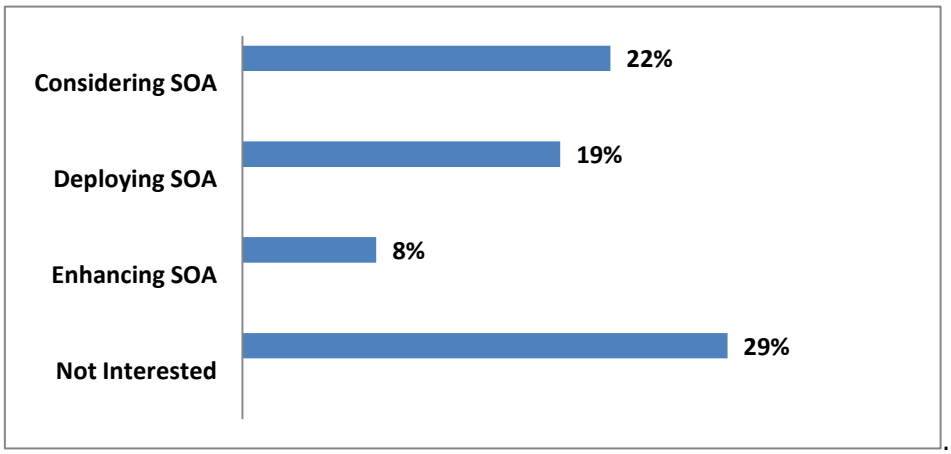

Figure 3: Investment of SOA

Source: D'Auria (2009) "Datapoints: SOA Intentions", CIO, CIO Research, February 1, p. 52 [Adapted].

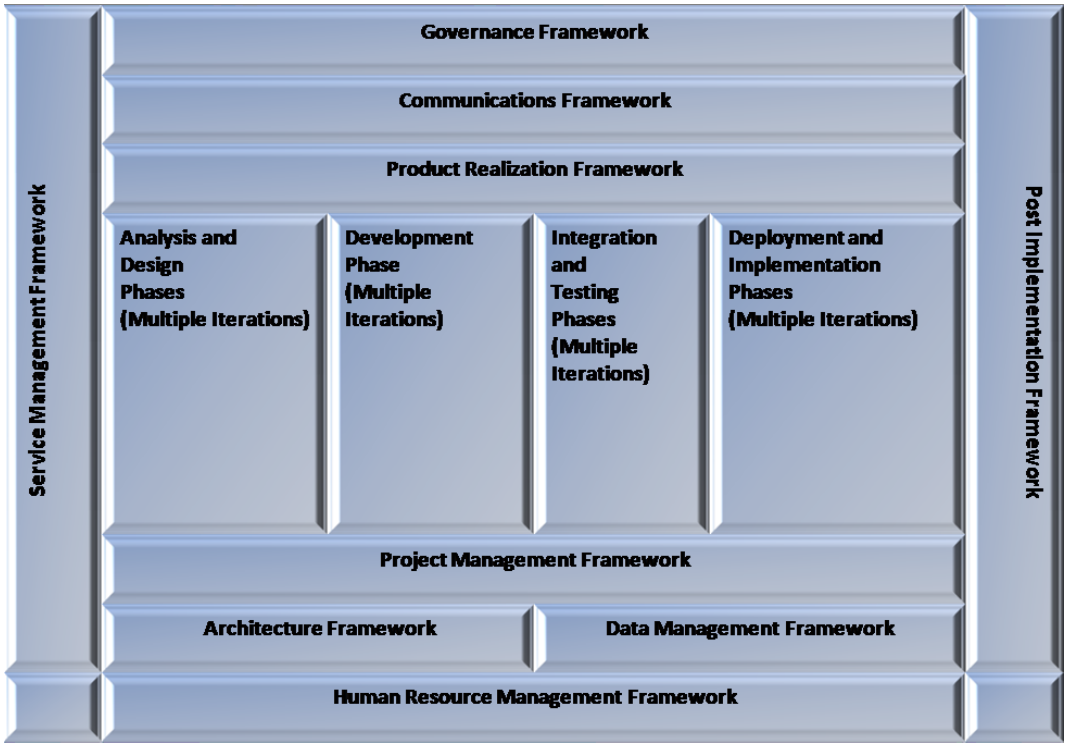

Figure 4:

Source: Lawler and Howell-Barber (2008) Service-Oriented Architecture: SOA Strategy, Methodology, and Technology. Taylor and Francis Group, Boca Raton, Florida, pp. 27-59.

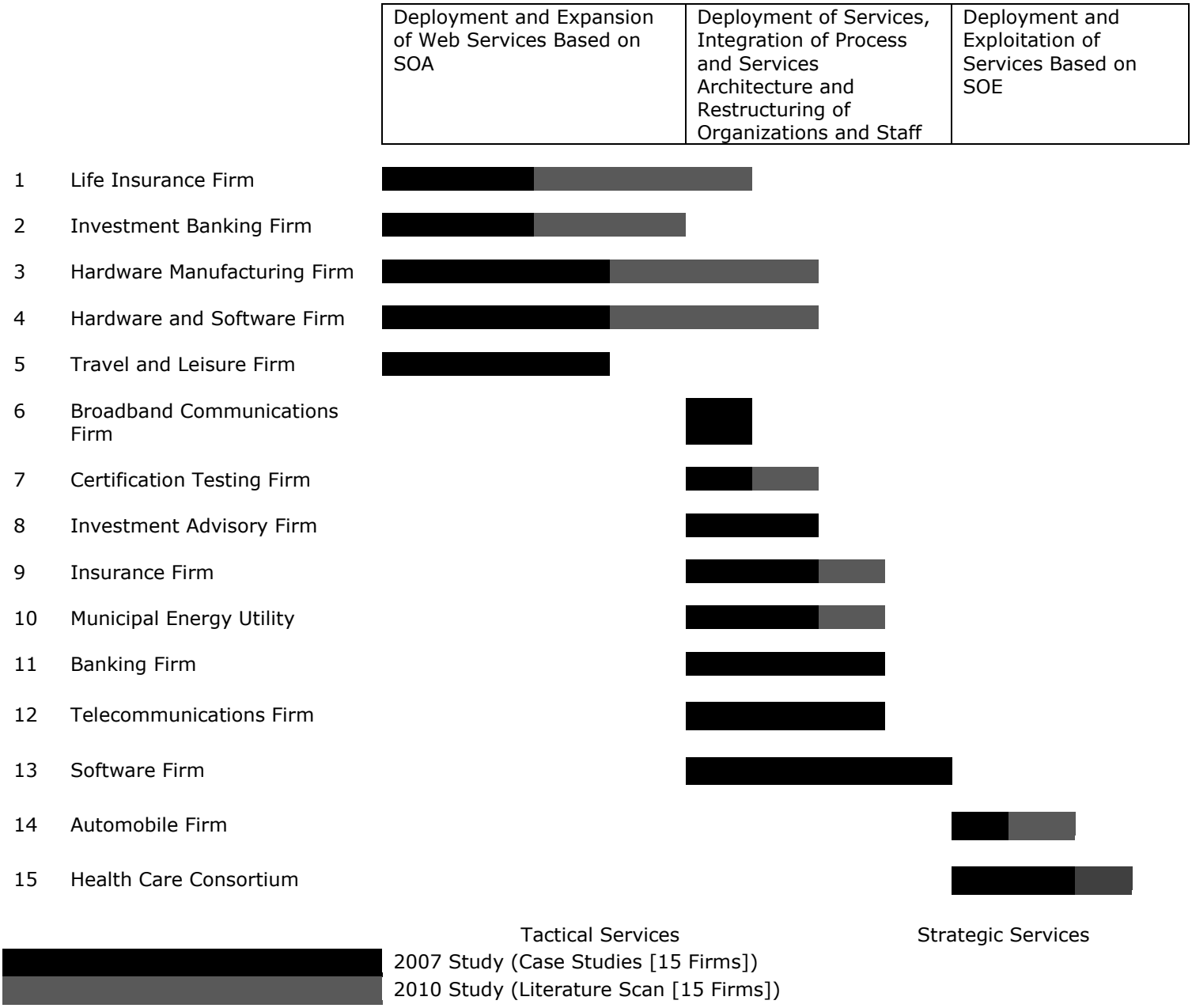

Figure 5: Levels of Maturity of SOA in Firms of the 2010 and 2007 Studies

Note: Figure 5 is an extrapolation of the findings in Table 3 as they affect Web services, deployment, integration and restructuring, and SOE, and is for illustrative purposes.

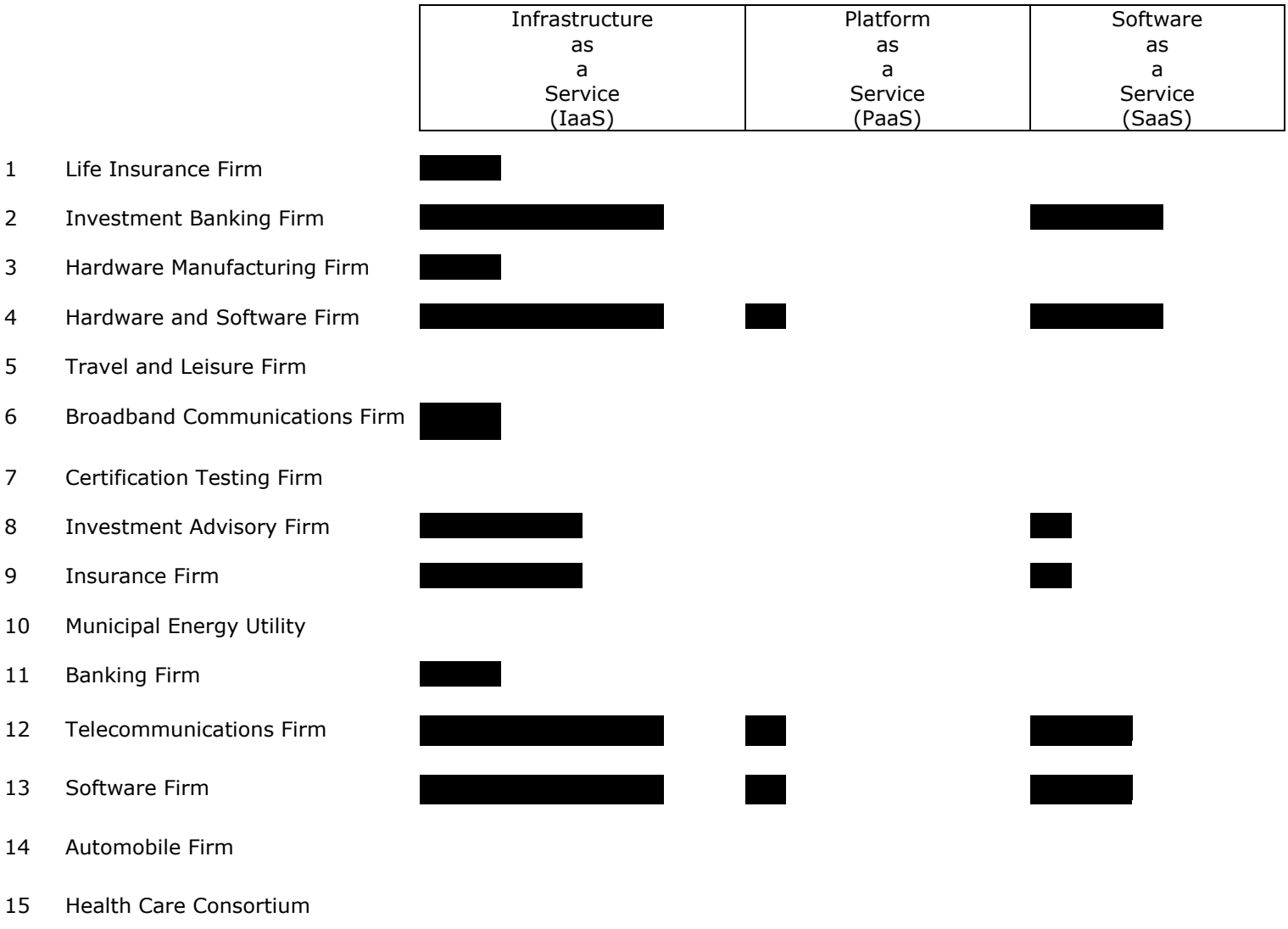

Figure 6: Levels of Maturity of Cloud Computing in Firms of 2010 Study

Note: Figure 6 is an extrapolation of the findings in Table 6 as they apply to IaaS, PaaS and Saas and is for illustrative purposes.

Table 1: Cloud Computing Groups of Resources

Group	Definition
Infrastructure as a Service (IaaS)	Infrastructure Furnishing Services such as CPU, Networking and Storage for Business Firm (e.g. Verizon)
Platform as a Service (PaaS)	Platform Furnishing Services to Deploy, Host and Maintain Systems for Firm (e.g. Oracle)
Software as a Service (SaaS)	Software Furnishing Services to Host Network Systems Accessible to Clients of Firm on the Internet (e.g. Salesforce.Com)

Source: Yachin and Patterson (2009) "Market & Analysis Overview: Cloud Computing." IDC, September, p. 1 [Adapted].

Table 2: Frameworks of Program Management Methodology

Framework	Definition
Governance	Enables Alignment of Processes and Services with Business Strategy and Results in Evolution towards SOE
	Ensures Services Conform to Consistent Corporate SOA Strategy Supporting Business Strategy of Firm
	Facilitates Learning of Program Management Methodology
Communications	Enables Emphasis on Business Criticality of SOA of Business Firm, Articulated by Chief Information Officer (CIO), if Not Chief Executive Officer (CEO)
	Ensures Collaboration of Business and Technical Staff in Continued Plan on Endeavor, Coupled with Other Frameworks
Product Realization	Enables Analysis and Design, Development, Integration and Testing, and Deployment and Implementation of SOA and Is Core of Established Project Management Methodology

	Is Coupled with Other Frameworks and Ensures Focus of Projects Is on Business Processes to Be Evolved into SOA and Not on Technology
	Program to Be Realized May Be Implemented in Interlinked Iterations of Internal Department Application Projects to External Firm Process Integration Projects
Project Management	Enables Delivery of Projects of SOA
	Ensures Changes in Business Strategy Are Applied as Appropriate on Projects of SOA
	Ensures Processes and Services Are Functioning and Implemented as Planned in Strategy
Architecture	Enables Compliance of Business Processes with SOA Model
	Ensures Evolution from Conversion of Functions into Services, Creation of Component Services and Integration into Composite Services, Integration of Internal Applications, Internal Services and External Services, to On-Demand Services in a Gradual SOE
	Ensures Seamless Integration of Hardware and Software Conforming to Service Standards and Technology
Data Management	Enables Behaved SOA Data Services Not Disruptive of Applications of Firm
	Enables Implementation of Services, Based on Access, Availability, Breath and Accuracy of Data Already in Databases of Applications
	Ensures Consistency of Data
Service Management	Enables Continued Conformity and Coordination of Processes and Services to Business Strategy

	Is Coupled with Product Realization on New Projects of SOA and Ensures Requirements for New Processes and New Services, or Revisions to Them, Are Not Redundant with Existing Processes or Services
	Ensures Reusability of Services
Human Resource Management	Enables Identification of New and Revised Responsibilities and Roles of Business and Technical Staff on SOA
	Ensures Education of Business and Technical Staff on Change in Culture of Service Orientation, and Technical Staff on Technology of SOA, Is Furnished throughout Projects of SOA
Post Implementation	Enables Service and Process Life Cycle Tasks Following Product Realization
	Ensures Availability of Applications and Services and of Technologies, Tools and Utilities of SOA
	Is Formulated in Service Level Agreements (SLA) between Technology Department, Internal Business Departments and Business Units

Source: Lawler and Howell-Barber (2008) Service-Oriented Architecture: SOA Strategy, Methodology, and Technology. Taylor and Francis Group, Boca Raton, Florida, pp. 27-59.

Table 3: Literature Scan of Business Firms – SOA Summary

Firms	Names	2009 Study		2005-2007 Study	
		Mean	Standard Deviation	Mean	Standard Deviation
1	Life Insurance Firm	2.22	0.83	1.44	1.24
2	Investment Banking Firm	2.22	0.83	1.56	1.51
3	Hardware Manufacturing Firm	2.11	0.78	1.56	0.88
4	Hardware and Software Firm	2.44	0.53	1.44	1.33
5	Travel and Leisure Firm	1.22	0.44	1.22	0.44
6	Broadband Communications Firm	1.89	0.60	1.44	1.01
7	Certification Testing Firm	2.33	1.00	2.00	0.87
8	Investment Advisory Firm	1.89	0.93	1.56	1.33
9	Insurance Firm	2.00	0.50	1.89	0.78
10	Municipal Energy Utility	1.67	0.71	1.22	0.97
11	Banking Firm	2.56	0.53	2.22	0.97
12	Telecommunications Firm	2.44	0.73	2.33	0.87
13	Software Firm	2.67	0.71	2.67	0.71
14	Automobile Firm	2.22	0.67	2.11	0.93
15	Health Care Consortium	2.33	0.50	2.11	0.78
		2.15	0.69	1.79	0.99

Legend: High enablement of maturity (3), intermediate enablement of maturity (2), low enablement of maturity (1), and no enablement (0)

Table 4: Case Study of Business Firms – SOA Summary

Firms	Names	2009 Study		2005-2007 Study	
		Mean	Standard Deviation	Mean	Standard Deviation
1	Life Insurance Firm	2.11	0.60	1.44	1.24
3	Hardware Manufacturing Firm	2.33	0.50	1.56	0.88
7	Certification Testing Firm	2.22	0.83	2.00	0.87
		2.22	0.64	1.79	0.97

Table 5: Literature Scan of Business Firms – SOA Detail

Frameworks of SOA	2009 Study		2005-2007 Study	
	Mean	Standard Deviation	Mean	Standard Deviation
Governance	2.20	0.56	2.07	0.70
Communication	2.27	0.80	1.73	0.96
Product Realization	2.20	0.77	2.00	0.93
Project Management	1.93	0.59	1.00	1.00
Architecture	2.60	0.51	2.33	0.82
Data Management	1.87	0.92	1.67	1.11
Service Management	2.27	0.70	1.40	1.24
Human Resource Management	1.93	0.80	2.07	1.03
Post Implementation	2.07	0.96	1.80	1.15

Table 6: Literature Scan and Case Study of Business Firms – Cloud Computing Summary

Firms	Names	Literature Scan		Case Study	
		2009 Study		2009 Study	
		Mean	Standard Deviation	Mean	Standard Deviation
1	Life Insurance Firm	0.33	0.58	0.33	0.58
2	Investment Banking Firm	1.33	1.15		
3	Hardware Manufacturing Firm	0.33	0.58	0.33	0.58
4	Hardware and Software Firm	2.00	0.00		
5	Travel and Leisure Firm	0.00	0.00		
6	Broadband Communications Firm	0.33	0.58		
7	Certification Testing Firm	0.00	0.00	0.00	0.00
8	Investment Advisory Firm	0.67	0.58		
9	Insurance Firm	0.67	0.58		
10	Municipal Energy Utility	0.00	0.00		
11	Banking Firm	0.33	0.58		
12	Telecommunications Firm	1.33	0.58		
13	Software Firm	2.00	0.00		
14	Automobile Firm	0.00	0.00		
15	Health Care Consortium	0.00	0.00		
		0.62	0.35		