The Study of the SOA Enabled ERP Systems Implementation in Service Industry: Case Study[†]

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Abstract   The primary objective of this research is to explain how to implement the Service Oriented Architecture (hereafter SOA) enabled Enterprise Resource Planning (hereafter ERP) system successfully for service industries. An implementation of the ERP system help many organizations to alleviate the difficult job of supporting inflexible or legacy systems that in most cases result in cost increases, data redundancy and inaccuracy, and various inefficiencies.   However, the ERP system is losing its market share rapidly to the cloud computing system which utilizes the Software-as-a-service (hereafter SaaS) and SOA. The SOA is an approach to integrate various types of IT resources to leverage existing ERP system, while at the same time building an infrastructure that can readily respond to new business environment and offer new dynamic applications. The companies that implement this system have less of a need for the kinds of all-in-one ERP system that have dominated the back office for decades and can move freely to best-of-breed applications.   This research will identify the benefits and costs of the SOA enabled ERP system through case studies and its impact on competitive priorities such as cost, quality, delivery, and flexibility.

Key Words : ERP (Enterprise Resource Planning), SOA (Service Oriented Architecture), BPM (Business Process Management)

1. Introduction

According to Technology Evaluation Center research [20], ERP system can be defined as "Software that helps to integrate management, staff, and equipment, thereby combining all aspects of the business into one system in order to facilitate every element of the manufacturing process." This system also integrates many traditional management functions such as accounting, human resources, manufacturing, and customer relationship management into a coherent whole. By sharing the database, ERP system aids in the control and communication of business transactions, such as efficient handling of sales and purchasing order processing. This system therefore, synchronizes departmental activities to monitor share, and track information throughout the organization [20]. Without the synchronization, the inflexible legacy system could result in cost increases, data redundancy and inaccuracy, and above all, various inefficiencies in most cases.

The implementation of the ERP system in the global market is on the rise and is likely to continue through 2012, with SAP, Oracle and Microsoft Dynamics leading the revenue stream

[50]. This growth trend impacts many global organizations to redefine their current ERP platform and to take the global ERP route for implementing global E-business solutions. Having a centralized global ERP system, these firms are able to operate as a total entity and manage their global transactions [2]. Although the growth of the ERP system in the global market reshapes the market share of the ERP industry, the market is facing another major technology transition phase. The growing relevance of SOA will have a disruptive influence on the ERP market. The SOA is a computer system's architectural style for creating and using business processes, packaged as services, throughout their lifecycle. A simple example of this can be interacting with a hotel's reservation system even though you are doing so from an airline's reservation system [7]. SOA is one such architecture that it unifies business processes by structuring large applications as an ad-hoc collection of smaller modules called services. These applications can be used by different groups of users both inside and outside the company. The variety of new applications built from the global pool exhibit greater flexibility and uniformity. The standardized uniform architecture is required to support the connection of various applications and the sharing of data [5].

AMR's report, titled "Market Analytix Report: Enterprise Resource Planning, 2004-2009," indicated that "the SOA system may have the same kind of disruptive effect that the shift from mainframe computers to mini-computers had in the 1980's or the emergence of client-server systems had in the early 1990's" [79]. The pace of acquisitions is still on the rise. Vendors like Sage Group, SSA Global, Infor Global Solutions, and Epicor have all been very active in the Merger and Acquisitions after Oracle's recent purchase of Retek. Besides, many upper tier ERP vendors provide customers with configuration services through SOA system that allow organizations to incorporate their own business rules and processes [3].

Many organizations now tend to license the system based on the user seats or to implement the system incrementally based on the SOA system rather than implementing fully integrated on-premise ERP system in order to minimize risk of failure from implementation. This trend is clear indication that the SOA will shake up the ERP industry and replacing the system with the SOA. However, some researchers describe the SOA implementation as risky, or even more painful than ERP. In other words, the SOA system would not be necessary if the ERP system is well-integrated and implementing the way organization wanted [53]. Indeed, the SOA system does not provide the magic pill to solve the problems of ERP implementation. But, the service from the SOA is much cheaper and easier to implement than the ERP system. The SOA system provides multiple modules of business processes toward the service layer and subscriber can accesses those capabilities through the form of interfaces on the Internet. The SOA system is needed in order to advance the information system architecture and to compete in the web based technology environment. This SOA system will modify enterprise's monoliths information system so its ERP system can integrate and restructure the entire value chain and enable a higher level of information system integration and improve its operational processes among partners within the value chain. If SOA system has been adopted as a fundamental premise of the enterprise, then ERP modules need to be treated as central services that can be used immediately to support the SOA objectives. The SOA system does not replace the ERP system. The SOA system helps to resolve the problems of ERP implementation. This system is called as 'SOA enabled ERP system (hereafter SOA-ERP)'.

To examine the new trend that ERP will evolve

with SOA technology, this research explores the current implementation status of the SOA-ERP system. While the importance of service industries is being recognized as a dominant engine within the global economic growth, this research found that the service firms can achieve competitive advantage by implementing SOA-ERP system. This SOA technology has been the better application for the service industry and its detail implementation status and future direction of the SOA-ERP System need to be researched through case studies.

2. Purpose of Research

As many different type of computing devices proliferated in business industries, many organizations now need new integration approach that leverages existing ERP system. The system which provides flexibility to keep up with changing business and information technology (IT) needs is the SOA system. It is architecture to integrate various types of IT resources and deliver new dynamic applications to help existing ERP system. At the same time, it builds an infrastructure that can readily respond to new business pressures. The process of integrating the SOA into the existing ERP system is much harder and more complicated than ERP system alone even though the concept of the SOA supposed to make the implementation process much easier and simpler. In other words, the service firms need to properly deploy implementation plan strategically to ensure the whole integration processes do not fail.

Although using the service through the SOA system sounds simple and easy, this SOA system is not something you can just go out and purchase from the shelves. Having said that, it is critical for organization to figure out how to fit its business processes with the SOA system before any part of the implementation strategy begins. The most common reason why firms fail the ERP implementation or integration with the SOA system projects is the incompatibility of the ERP system with its key business processes. To rectify the problem, the key business processes must be either changed to accommodate the ERP system or revamp their business strategy. The former approach may avoid the possible disaster during the ERP implementation and often provide an opportunity to improve the current business processes. Alternately, the service firms may adopt the latter approach by integrating their strategic goals into the ERP implementation process. This approach requires restructuring their organization structures to succeed the ERP implementation process.

Of the many areas related to SOA-ERP system implementations, the ability of implementers to understand different strategies of technology implementation in different scenarios may be necessary and is important, especially for those who may go on to manage such implementations. By getting to know what actually has happened in the industry, it becomes possible for implementers to learn to plan and avoid those mistakes and as well as follow and adopt the successful strategies that has been told. For that reason, this research needs to examine many case studies to find out the type of implementation strategy that works in the SOA-ERP environment. This will help implementers to understand what should be done and what should not be done so they can apply knowledge of implementation to make the SOA-ERP system successful. Several SOA case studies that show success and failure stories in integration and implementation issues will be analyzed to summarize proper integration and implementation process.

3. Evaluation of ERP Implementation Strategy

The introduction of information technology,

especially enterprise systems such as ERP systems, is a common way of implementing organizational change today [48]. Such enterprise system implementations frequently come with new software systems and business processes that substantially alter workflow and jobs [6] [47] [68]. Research indicates that the annual investment of several billion dollars in ERP systems is faltering and more than half of those implemented systems fail [69] [70]. It is not uncommon to observe such failures even in highly competitive organizations such as Hershey and Nike [33] [34]. Without any doubt, those organizations that successfully implement ERP systems have indicated greater efficiency and effectiveness at the individual employee and organizational levels. One of the primary causes of failure is the inability of managers to effectively manage their processes reengineered [13] [48].

Some organizations such as Cisco have utilized big-bang implementation strategy where all modules of the ERP system are implemented simultaneously within a short period time. When the implementation strategy ignores organizational environment and cultural factors, the result can be catastrophic for firms [78]. Consequently, the organization may go out of business as a result of a failed ERP implementation (e.g., Rich-Con Steel). Many research findings also show that the success of ERP systems depends on when it is measured and that success at one point in time may only be loosely related to success at another point in time. The research findings also suggest that organizations will do well to adopt broad definitions and multiple measures of success and pay particular attention to the early identification and correction of problems. According to Markus [46], the definition and measurement of success depend on the many different dimensions and point of views from which you measure it. The implementation success can be viewed in technical, economic, financial or strategic business terms. Also it can be viewed by the adopting organization's managers, employees, customers, suppliers, and investors [47][48][49].

Another important issue in the measurement of success concerns the time when one measures it. The implementation can be assessed at three different points in time such as project phases which ERP software is configured and rolled out, shake down phase which the company makes the transition from 'go live' to 'normal operations and onward / upward phase which the company captures the majority of business benefit (if any) from the ERP implementation and plans the upgrade for better technology implementation [49]. There are several other researchers who also have developed distinct phases for ERP implementation. The Bancroft has five phases – Focus, As-Is, To Be, Construction and Testing. The Ross also has five phases – Design, Implementation, Stabilization, Continuous Improvement and Transformation. Regardless of these different phase definitions, the bottom line of measuring the ERP implementation success utilizes the following metrics.

- Project cost relative to budget.
- Project completion time relative to schedule.
- Completed and installed system functionality relative to original project scope.
- Short-term changes occurring after system 'go live' in key business performance indicators.
- Length of time before key performance indicators achieve 'normal' or expected levels.
- Short term impacts on the organization's adopters, suppliers and customers.
- Achievement of business results expected for the ERP project.
- Ongoing improvements in business results after the expected results have been achieved.
- Ease in adopting new ERP releases, other new ITs, improved business practices, improved decision making, etc., after the ERP system has achieved stable operations.

In order to measure how well the ERP system implements, the organization should measure not only its performance (e.g. accuracy, reliability and response time), but also how well people in the organization know how to use, maintain and upgrade the ERP system and how well the business improves its performance with the ERP system. This measurement question raises two issues here. First, organization needs to understand the relationship between the measures of success at different points in time. Larsen and Myers [33] found that an ERP experience could be an early success and a later failure. But can an ERP experience be an early failure yet a success later? How important is it for organizations to be successful at all three phases of the ERP experience cycle? And how often do organizations push through initial failure to achieve an ultimate measure of success [39].

Although many organizations wanted to implement their ERP project as quickly and cheaply as possible, they ended up spending more money and time for the ERP implementation. Furthermore, they experienced moderate to severe business disruption and processes failures during the implementation [67]. Some of them preferred to terminate the ERP project. They had difficulty diagnosing problems and they had difficulty recovering from them. According to the Standish Group, not only over 50% of projects do not see the light of day, but when it comes to ERP system implementation, its failure rates are much higher than any other IT projects. Over 90% of ERP implementations have ended up over time and over budget, even the ones that are considered to be successful. For instance, Kmart had to write off $130 million on an ERP investment, for their implementation had never even been close to success [44]. The case of Fox Meyer's bankruptcy could be blamed on a number of reasons, yet its

implementation project is easily the one responsible for its business failure. Even when the ERP system was retained, there was great unwillingness to upgrade to 'enhanced' versions of the ERP system [37].

Because of those failed ERP projects were designed in much more integrated fashion, these organizations were planning for multiple ERP installations in most cases. The multiple installations on business processes required tighter integration among multiple business processes. Those integrations provided many of the challenges and problems that were hard to recognize and diagnose due to multiple interacting causes and varying symptoms and effects. These difficulties led to the question of why exactly an ERP project poses such significant problems of implementation and project failure. The most succinct explanation for this is given by Davenport, who explained that, "An enterprise system imposes its own logic on a company's strategy, culture and an organization." Furthermore, Markus and Tanis[46] present a list of the following reasons why ERP adopters have faced problems with its implementation such as:

- Not first improving business processes where this needs doing
- Lack of top management support
- Cutting end-user training time and expense
- User's resistance against the system
- System integration
- Approaching ERP implementations from an excessively functional perspective
- Problems with product and implementation consultants
- Turnover of project personnel
- Inappropriately cutting project scope
- Software modifications or customization
- Inadequate testing of interfaces, modifications, integrations and exceptions.
- Underestimating data quality problems and

reporting needs
- Unknown business results unreasonable expectations
- Migration issues - technical and people oriented

Among the reasons suggested above, the fact that businesses processes are not improved primarily imposes the most significant problem during the implementation. Process improvement requires the reengineering of the organization's structure. According to Mintzberg [51], structure reflects natural work and communication flows and some are imposed artificially although most structures represent real needs of the organization. As the needs of the organization change, its structure also needs to match these changes with employees interfering with the established patterns of behavior [32]. The formalization of this behavior is the parameter by which the processes of the organization are standardized and where an ERP implementation can be directly influential [12].

Therefore, the reengineering of an organizational processes and culture change among employees need to be prioritized as a top endeavor in order to implement ERP system successfully. These steps simply cannot be viewed as part of the system development or software implementation for a set of IT people [3]. If the company had the ability to start operations with ERP implementers or consultants who would build the system from the ground up, there would be no significant problems with any ERP system implementation. However, this is seldom the case. This research will address obstacles of process reengineering that might arise during the organizational change to make an ERP implementation successful.

4. Reengineering of Business Process

Despite the fact that the ERP system continues to be a popular and high profile choice among many

organizations, organizations will have to make significant changes in the business processes throughout the enterprise to avoid implementation failure and to guarantee maximum return. There is general agreement that when organization is able to deliver the same products or services on time as competitors but at a lower cost with better quality, it indicates that the firm achieves its competitive advantage. Although well managed legacy systems may still provide those possible strategic benefits for the organizations, the pressure from competitors to improve processes by using technologies is higher than ever. The most common method to improve the processes in order to obtain the competitive advantage is known as 'Business Process Reengineering' (BPR). The BPR can be defined as 'the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed...' [39]. Some research indicated that the BPR integrates with the ERP system and other research indicated that the BPR just concept supports the ERP system.

However, once BPR is aligned with business strategy and ERP system, BPR concept becomes an integral and necessary part of the business, and directly affects the competitive stance of the organization, giving it an advantage against the competitors. It is the system concept where its advantages listed below can be best realized through the integration of the ERP system.

- Deliver a product or a service at a lower cost.
- Deliver a product or service that is differentiated.
- Focus on a specific market segment.

However, many BPR projects never get beyond the internal efficiency stage of process improvement. The number of companies that attempted and failed to reengineer their processes was much more than

those who were successful at it. This failure typically occurs when there is not enough commitment of time and effort from the top management. Another reason for the failure is the lack of detailed and comprehensive process analysis so organizations really do not know how to improve which processes radically and innovatively. This may be caused by time pressure, inexperience of the implementers, fear of change or a lack of awareness by employees. The result is missed opportunities rather than radical process redesign and process improvement as the BRP concept originally intended [76].

Unlike BPR which focuses on improving processes by radically redesigning it, Business Process Management (BPM) is the tools that can be applied part by part to the whole enterprise at a time, by adopting much more manageable and smaller changes in the process. The BPM have taken the advantage of the BPR experience and conceptually are more flexible in terms of expanse and intensity. This way, the investments, risks and amount of change are minimized but at the same time the tangible impact is much more modest than what was a possibility with BPR. Yet BPM tools for automating processes have their basis on the fundamental concepts that are emphasized by BPR such as:

- Simple processes delivering on the metrics of quality, service, and flexibility
- Focus on eliminating non-value adding activities
- Decisions becoming integral part of the process

The following compares the difference between BPM and BPR. If BPM is system software, then BPR is a method. If BPR can enable enterprises to reform from deep within, and create a new organization structure, then BPM is a concept built internally in an enterprise that continuous to manage business processes [56]. It starts from a group of dependent processes to establish standardized business processes and integrate internal resources to link each department, enabling the organization to become an integrated unit. Although the BPM has a higher degree of risk for enterprises since it involves the whole enterprise and includes basic organization structures in its large modifications, the BPM approaches should be the strategy to be considered if organization is interested in integrating the ERP system with the SOA. That strategy will enable its operational processes more agile and flexible to better meet today's technology oriented global environment [61].

5. Integration between BPM and SOA

Most researchers in the ERP field proves that the ERP is the system that has a great influence on any organization's competitiveness and is therefore important to implement the ERP system properly [2]. On the other hand, some researchers argue that it takes a long time to put in place and it's too painful to rip out once it's in. To compensate these problems, there are other players in this ERP market such as open source offerings-Apache OFBiz, Sugar CRM, Tiny ERP, and Compiere [35]. Many large ERP vendors such as SAP or Oracle also have been active in the hosted / SaaS space as well [54]. The Microsoft is not an exception by offering mid-size ERP system such as Dynamics GP and AX [50]. If these services have also been adopted as a fundamental premise of the enterprise, with respect to its architectural goals, then the ERP modules need to be treated as central services that can be used to support the service oriented information system architecture which is known as 'SOA'[21]. As the number of SOA related implementation project increases in the ERP environment, significant amount of confusion still exist regarding what constitute service-oriented architecture. Some may consider an SOA project as

either simple Web services technologies or Web-centric variation of object-oriented design. Although many people have the tendency to equate service-oriented architecture with web services, SOA has less to do with technology than it does with culture [45].

SOA is a new way to design systems, and it is more about culture than it is about technology. SOA is not something it buys or builds. It is something you do. This style enables businesses to increase flexibility and agility. But in order to achieve these advantages, an organization must accept the fact that the SOA changes the lifestyle of the organization. The implementation requires a different mindset, and an organization must establish discipline through a strong governance program [43]. This is the point where the BPM concept plays a significant role in implementing the SOA properly. There is obvious gap between BPM and SOA in the minds of both organization and SOA vendors. The most common difference between BPM and SOA can be described as BPM is 'Business-driven' whereas the SOA is 'IT-driven' [55].

Usually, the BPM solution expects to deliver some benefits in key business processes by utilizing existing applications and infrastructure without significant IT change. Similarly, the SOA turns all their systems into services by utilizing low re-use figures and maintenance costs with little prospect of further savings [46]. However, many IT professionals consider the BPM tools as unnecessary and many CIOs got frustrated by the lack of business improvement gained from their SOA investments. Although both the BPM and SOA approaches reduce its credibility and its real business benefits remain out of reach, some business case demonstrated the solid benefits from BPM and SOA integration. The IBM has gained significant synergy by getting BPM and SOA working together effectively. Besides the

challenges that they had to secure the benefits of using both BPM and SOA from conflicting or misaligned objectives, they spent significant effort to work out an effective strategy to map the two together. Indeed, the integration of BPM and SOA has been seen as primarily as one of technical complements. BPM makes it easier to create composite applications from services, and SOA makes it easier to integrate automated processes with existing applications, systems and data sources [58].

6. Integration between SOA and ERP

Most of organizations see real value in integrating the BPM and SOA through the increased flexibility gained by a deeper understanding of the key processes that define their business, along with the necessary services and application functionality required to deliver high quality customer service at minimum cost. Although these benefits are potentially significant, there are a number of potential hurdles to overcome such as governance, language, interfaces and logic [27]. None of these hurdles is impossible to overcome, but it does require continuous monitoring of both BPM and SOA, therefore the improvement of the business processes can be maintained by reducing the gap between the hurdles. Each organization needs to develop the Process Improvement Roadmap that helps to bridge the gap. By working to align the business and technology tracks, the delivery of the combined BPM and SOA benefits should manifest itself as an integrated program [24].

For maximum return, organizations will have to make significant changes throughout the enterprise by implementing the ERP system in conjunction with SOA. The products the vendors provide such as SOA won't make your systems-service oriented. These SOA technologies are simply tools. It's up to

the system designers to figure out how to use them properly. SOA will obviously impact the organization's operations and accounting. And it will require a new level of collaboration across unfamiliar departmental boundaries [28]. Change is disruptive, and most people naturally resist it until they understand the benefit that they personally will derive from it. At the same time, they need to understand that the SOA promises to deliver powerful business benefits such as increased flexibility and better alignment between information technology (IT) and business [63].

The bottom line to take the full advantage of the SOA is the ERP system. ERP remains unbeatable to provide real time end-to-end visibility of the information and data on the most of the processes. SOA helps ERP system with its capability to knit together the architecture into a flexible Internet web environment or business network on the Internet. The ERP is the best friend of the SOA. And that's the way you should treat both systems. Both system has to be fully integrated and compliments each other. They should be maintained and monitored together and keep them current. SOA will gently push ERP to become leaner, more open (SOA enabled), but not less efficient. In summary, SOA-ERP system enables all decision makers to share information through SOA and this system still remain unbeatable, leveraging flexible composites to develop truly differentiating system [72].

7. Case Study

As it was stated earlier, the SOA mainly utilizes the concepts of modularity and the layering of services, which can be easily bundled with more robust services. The SOA differs from the traditional concept of the web services since the service can be shared by multiple applications and organizations. This means that when the

organization wants to reengineer its business processes through the SOA, it can be easily modified with fewer resources required to make the change. Besides, most ERP vendors also provide services by using the SOA approach to the existing organization's ERP systems that enable integration of the ERP and SOA system on disparate technological platforms much easier and less daunting task. Also, it is possible to implement the custom fitted integration in an architecture that was not originally created for SOA. This SOA-ERP system not only improves the interoperability among partners but also enables each partner to make better decision by utilizing shared information available to them [29].

By having data accessible through services, data can be shred and available to all customers along the supply chain as soon as it is needed. This capability of SOA-ERP system not only provides the most efficient ways to obtain information needed from customers but also support top managers to make the good decisions [15]. This concept is mainly driven by the fundamental concept of the Just-in-time that requires all data to be available to decision makers as soon as it is ready through simplification and standardization of the data to be collected [80]. However, many researchers define the SOA-ERP system in many different perspectives with more emphasis on its weakness of data security. Nonetheless, they agree that the organization can improve its competitive priorities as listed below through the use of services that SOA-ERP environment provide [77].

• **Deliver a product or a service at a lower cost:** With the SOA-ERP system, organization is capable of providing the attractive product or service in the marketplace with the lower cost related to the quality. For that, the organization must find the way to produce or provide service more efficiently by improving its processes,

utilizing newer technologies, securing unique access to a large source of lower cost materials, making effective outsourcing and removing non-value added activities.

- **Deliver a product or service that is differentiated:**

With the SOA-ERP system, the organization is capable of providing unique features of product or services that are more attractive in the market much faster than other competitors. To achieve this flexibility, organization must identify which qualitative dimensions are most important to its customers, and then find ways to add dimensions to the product or service [31].

- **Focus on a specific market segment:**

The organization is capable of identifying and creating the new market with the capabilities of SOA-ERP that define, expand, and fill a particular niche or segment market niches that have not been adequately filled [57].

The benefits of competitive priorities improvement listed above can be achieved through the information and data sharing capability of the SOA-ERP environment. Because most of the SOA vendors work hard to improve its quality of the service, vendor strategies and best practices, many service organizations are subscribing the services of the SOA-ERP system. Implementation of new information system requires complicated system development cycle and evaluation processes. Also, perfect integration of multiple modules within the perfect system architecture is the basic requirement to make the implementation succeed [75]. However, SOA-ERP system neither requires tight integration of modules nor system development processes. By reutilizing common services and already existing software modules based on the services it allows many organizations to subscribe the system much

easier, cheaper and faster [25].

The SOA-ERP market is expanding and penetrating across public, private, and manufacturing industry sector. Its capability is improving and most vendors are working harder than ever to remove all wrinkles to reach the maturity state [30]. Although many IT professionals do not think the SOA-ERP system would bring expected return on investment (hereafter ROI) as most of the CEO predicted, Gartner's research indicated that more than 80% of newer system implementations will use SOA-ERP system by 2012. Although the rate of SOA-ERP system implementation is bit higher in Europe than in the U.S.A, the trend will continue to affect vendor strategy and IT environments [74].

One of the ERP modules that are popular and easy to implement for the service industry is Customer Relationship Management (hereafter CRM) module. The CRM system can be 'on-premise' stand alone system or can be a service that organization can subscribe over the Internet. It involves a broad set for improving the performance of customer related business processes. The CRM is supported by multi-module application software that integrates activities in customer life cycle, from customer acquisition, customer relationship enhancements to customer retention. The components of the CRM system consist of CRM system, the process of implementing CRM, users of CRM, business processes streamed by the CRM system and the Internet that integrates these components and have these available online through service architecture [22].

The failure on any of these components will lead to the ultimate failure of a CRM project. For example, if system lacks sharing capability, pertinent data or account information of customers will not be shared. The information silo creates confusion and frustration in the processes and further impacts on the entire business such as lack of effective forecasting, duplicated processes, unorganized reporting and analysis, and forgone

cross selling opportunities. Many service organizations prefer to utilize the CRM system based on the SOA environment to minimize the initial investment and the risk of implementation failures. By implementing SOA-CRM system rather than full blown SOA-ERP system, many organizations still improve flexibility for business requirements and customer relationship easier and cheaper. Several case studies are examined below to understand how service organizations have improved one or more of competitive priorities through SOA enabled CRM system.

• **Marriott International Inc.:**

To better serve its business travelers and to lower operational expenses, the Marriott chain has expanded the Marriott Reward system to include check-in-kiosks. A guest could swipe a credit card or Marriott Rewards card at the kiosk in the lobby and receive a room assignment and keycard from the machine. The kiosk system would be integrated with other systems such as billing and CRM to generate operating efficiencies and enhanced corporate standardization. The kiosks would help the Marriott chains to lower operational expense [60] [62].

• **Ritz-Carlton:**

The CRM system called "Class" captures information of guest's preferences such as wines, a hometown newspaper, or a sunny room. Each Ritz Carlton employee is expected to promote personalized service by identifying and recording individual guest's preferences. By querying "Class" system to learn more about individual guest's preference, the catered service can be provided to each guest to improve the customer service [52].

• **Alaska Airlines:**

The Alaska Airlines implements the Siebel Business Analytics system to tie together customer data from numerous sources and ultimately, to design marketing programs to drive customer loyalty. The integration between SOA and CRM system provides the ability to be more proactive in marketing and to be more customized in the service operation. This integration helps the Alaska Airlines to seek more effective ways to analyze customer data and to provide an even better and more relevant customer experience [4][9][17].

• **Lufthansa Airlines:**

The Lufthansa Airlines implements the CRM architecture based on PeopleSoft Enterprise system. The SOA system is integrated with its CRM to provide comprehensive data warehouse, a central customer database, and readily available customer information. With this integration, Lufthansa Airlines can manage all customer data through one intuitive interface, and users can see changes to customer records in real time. This system ensures that its customers get a faster and more accurate response to their needs [10][42].

• **TESCO, UK:**

TESCO has implemented the CRM system to send 10 million customers on 4 million variations of coupons based on individual customer purchase history, generating annual incremental sales of £100 million. The CRM system has enabled TESCO to expand beyond groceries to books, CDs, DVDs, consumer electronics, flowers, and wine [11][71].

• **ABN AMRO Bank:**

ABN AMRO Bank, an international bank with more than 4,500 branches in 53 countries, improves customer service by implementing the PeopleSoft Enterprise CRM solution [1]. To continue its leadership, they have integrated the CRM with SOA to allow its millions of clients to contact the bank and do banking in any way the client want to. They allow clients to access real-time, reliable information about clients' account. The system provides flexibility

to add new services and communication channels for both clients and firm [8].

These case studies are examples of how the SOA system is helping service organizations to improve its competitive priorities through the CRM system. Because of the flexibility of the SOA system, it can be implemented in many different methods and integrated with multiple models across a multi-organizational enterprise. For example, the Synovus Financial provides commercial and retail banking to 35 banks throughout the southeast U.S., as including investment services by using SOA techniques. The Starwood Hotels and Resorts Worldwide Inc., firm has migrated its reservation system from its legacy system to the SOA-based system.

Verizon has also implemented the SOA design to reduce its IT budget by eliminating redundant systems inherited from the merger of Bell Atlantic and GTE. Citigroup's governance structure has implemented layered SOA approach to define the service portfolio, policies, change management, risk management, and conflict resolution. Motorola has utilized and refined an SOA framework with maturing service orchestration for its governance guidelines, and an ROI model. The U.S. Federal Government has published the Practical Guide to Federal Service Oriented Architecture to provide a comprehensive roadmap for SOA planning, implementation, and governance. The U.S. Army also implements the SOA system to optimize investment and build enhanced capability for portfolios support and services [68].

These case examples have clearly demonstrated that the SOA system does not replace ERP systems as many IT professionals have concerned. It certainly has stimulated the interest of many IT professionals and business professionals to learn and research this field of IT. By implementing properly, the SOA system utilizes the ability of SaaS that provides organization capability to orchestrate cross

functional business processes and projects more easily by improving the integration of ERP and non-ERP systems across a network. Loosely integrated SOA environment should deliver high-quality services without the expensive set-up and maintenance costs of an on-premise solution. In addition, this integrated SOA and ERP system also provides attractive benefits to many organizations to control, manage projects listed below [75].

Quick access to information – The sharing capability of the SOA-ERP system improves visibility among partners so they are able to provide better grasp of projects that are going on, to take into account multiple projects, to keep track of their progress, to be able to allocate adequate funds to support the respective projects.

Improved workflows – With all reports from the multiple projects captured and available to partners without any delay, organizations ensure that the projects are given adequate resources for their projects.

Lower administrative and operational costs – With the benefits listed above, the organization can improve its flexibility of managing resources for the projects. The administrators are able to optimize the capabilities of its resources and workforce so they can adjust the resources based on their needs without any delay.

A more flexible and scalable architecture – Because the information architecture is based on the SaaS or service oriented, the system is now more capable and ready to take on more improvements and applications and projected addition of a thousand new users in the near future.

8. Costs of SOA-ERP System

Many organizations have claimed successful implementation of the SOA-ERP system as

indicated on the case studies above. Likewise, many organizations also have reported its failures as well. Implementing the integrated SOA-ERP system in any organization requires significant amount of time and effort as it requires proper training of all employees regarding how to use web services for integrated applications. The question is how can we differentiate success from failure in implementing the SOA-ERP system? Typically, most of the benefits that this paper listed are supposed to provide the positive ROI in financial terms. If that happens, is it considered a success? When the CIO or upper IT managers initially propose the SOA-ERP system, they might have promised faster return or other intangible benefits if their implementation would be succeeded. However, it is not easy to quantify those intangible benefits such as improvement in communication or flexibility of organization. Without proper methods to quantify those intangible benefits and take those factors account into the ROI, the proper justification of the investment on the SOA implementation might not be valid.

On the other hand, we simply cannot label as 'failure' if their SOA-ERP implementation goes sour. Just simply because they cannot quantify the intangible benefits into the ROI or don't get the positive ROI, it is too early to judge the implementation as failure. For the most implementation, there are some improvements in cost justification and the ROI may be increased in the near future. Yet, why have so many companies failed with SOA-ERP system implementation? Because the successful implementation of the SOA-ERP system relies on two IT systems work in perfect harmony, the SOA-ERP system may fail if one of two systems is not under the control. According to the Web survey done by Information Week in 2007, 278 IT pros expressed skepticism about SOA's promised ROI and 32% of those using SOA said those projects fell short of expectations.

Only about 10% indicated that their implementation results exceeded their expectations [65]. This survey result was sure a sign that many organizations would cut or benched on IT spending. Most CIOs and IT managers had thought seriously about how SOA had affected their IT environment. While many organizations were moving toward SOA, some chose not to pursue because of lack of skills and expertise, expected time and expense, and no viable business case [37] [43].

However, Forrester's new research survey in 2011 from more than 2,100 companies finds the opposite result. The SOA has continued to grow and expand despite of economic downturn and during the tough times. About 900 companies are expanding their SOA system and only one to three percent has cut back on SOA implementation. Forrester's research also finds that 84 percent of Global 2000 enterprises report they are using SOA system now or will be by the end of 2011. The user satisfaction level from the SOA system seems very high. More than 70 percent of SOA users have indicated that it has delivered enough benefit to expand its use. This trend also promotes small to medium-size businesses firms to implement the SOA with adoption rate growing from 34 percent to 44 percent [50].

This is a good sign for the SOA vendors but not so much for IT managers who already have spent enough IT budget and experiencing bitter taste of failures. The reasons why the SOA projects fail are: budget and process. First, most SOA failures are by far due to overspending or mistimed spending. If you spend little to install simple system such as few .NET web services and didn't get the benefits, it may not consider as failure. But, if you spent millions of dollars on SOA or ERP system such as software, infrastructure and consultation without proper benefit justification, it is hard to say the project is under the control. Start SOA system with low costs or with open source [46][76].

Second, one of many reasons why computer technology implementation fails, is that the technology that organization is trying to implement does not support business processes that needs to be re-engineered in most cases. Although there are many challenges to make the SOA implementation success, the CIO or upper IT managers must understand and buy into the theory and philosophy of the technology, methodology and business processes for the successful implementation. Without the proper integration of the BPR or BPM concept with the SOA technology, the processes based on the old legacy system might cause more problems than benefits. Development of flexibility by using the SOA system may slows down other processes, mission critical applications may fail, and key processes may not working properly and IT managers soon finds out that the old legacy system was more agile and more robust even if they did not have the latest and the greatest. That is called implementation failure and defeat the whole purpose of the re-engineering by using the SOA system in the first place [76].

9. Implementation of the SOA-ERP System

This paper already addressed the two reasons that might cause the failure in implementing the SOA system - budget and process. Although avoiding these two reasons can be simple and can be easily fixed, ignoring and therefore repeating these mistake may trigger the whole implementation process fail. According to David Linthicum [40], many of the SOA systems that are totally reliable on the Internet just fail because of many other mistakes that can be avoided. The cloud computing service, for example, which is a set of enabling technologies or technological approach for the SOA system, is required to achieve synergy between SOA and cloud computing. [41][64][73]. The service

providers of the cloud computing also have seen its fair share of outages [59]. The Amazon Web Services goes poof when the cloud vendor's routine configuration change made client's business to a stop [14]. The Sidekick shut down its service for about a week that left users without capability to access their data. The Google Gmail failure had 150,000 Gmail users signing into their accounts only to find blank page [16][19]. The Intuit had 36 hour outage when its cloud-connected services, such as TurboTax, Quicken, and QuickBooks, went offline. The Salesforce slipup and the PayPal fall-down. Like this paper has addressed before, the successful implementation of the SOA-ERP system relys on perfect synergy between the SOA and the ERP system. If one of these two systems operates in disharmony, the implementation of the SOA-ERP system cannot guarantee its success. Gartner has observed 12 most common mistakes in SOA-ERP implementations as listed below. These 12 mistakes can be summarized such as: business, people, and technology [15][16].

9.1. Business (Process)
• Lack of the top management support for the organization-wide adoption of SOA
• Take a giant leap from skepticism into a sudden strategic commitment to SOA
• Ignoring the higher risk of making wrong decisions for newcomers in the SOA
• Micromanaging and unnecessary intrusions on the internal processes of the participants

9.2. People
• Not following business requests of the intended first users of a service
• Not considering differences in SOA knowledge at all levels when developing the SOA system
• Lack of involvement from all participants early and facilitating coordination among divisions of the organization

- Cultural obstacles of employees can derail an SOA reuse effort.

9.3. Technology

- Excessive numbers of services in the SOA may creates confusion and harder to learn.
- Crafting a service model and forgetting the data in the process
- Too much amount of services being shared among users may be sub-optimal.
- Too tight integration based on enterprise-wide SOA backplane may be impractical and hard to manage.

In order to manage the implementation of the SOA-ERP system, the organization must need IT strategy that will overcome mistakes listed above. It would be great if the top management and CIO have some type of roadmap that tells them what and how to do. There is the roadmap called 'Proven Path'. Most of steps are well defined set of steps which guarantee a highly successful implementation in a short time frame, if followed faithfully and with dedication. Although the concept of the 'Proven path' is bit old to apply for successful implementation of the SOA-ERP system, its fundamental concepts are still valuable and important. This method has been proven in companywide implementation and shown to work in many cases by providing significant improvement in organization's productivity. This path consists of fifteen detail steps to be followed from 'audit assessment' to 'ongoing evaluation'. However, the majority of steps are focused on major change in people, education and process improvement during the implementation.

Once the organization decides to implement the SOA-ERP system, it needs to find solid starting point for the SOA-ERP system. First, selecting the right system can be a challenging task for IT managers. Any company, large or mid-sized, should do a thorough analysis of its business needs prior to research vendors. Each system is different and can provide varying levels of customization. Small or medium size firms should research potential system in regards of 'Fit to business', 'Interconnectivity' and 'Reporting and analysis capability' thoroughly to identify the exact match with their business processes. Once there is a clear understanding of the services needed, it will be easier to determine which system is best suited for the business. Choosing the appropriate system will be a factor in the success of the system implementation as well as the ongoing operational effectiveness of the company.

In the meantime, company should focus on how to improve business processes of the entire organization. Spend little money early and improve processes over time as benefits arrive to pay for them. Keep every employee informed and educated well to understand the goals and objective the reengineering processes. This task is somewhat challenging and overwhelming. But, the employee is the one to lead the implementation success. There might be some pockets of resistance but, these hurdles will be overcome as employees learn and teach each other through peer learning [32]. Just make sure your training and education also includes the philosophy of process improvement, not just the details of technicality of the SOA or ERP system. Once your organization experiences some process improvements, develop champions and invest more money on process and tools to improve further. As your organization walks through the SOA-ERP implementation journey a step by step, the top management will have a better idea on what they really need to do to make the implementation succeed.

10. Conclusion

When the SOA system shakes up the ERP industry, some researchers look at the SOA system as being just as bad, or maybe even more difficult to implement, than ERP. However, most of the researchers soon have discovered that the SOA system can now be integrated with the ERP system for all partners within the value chain. This system is called as 'SOA-ERP system' that will truly help organization to improve its competitive priorities by sharing key data or information among partners for their better and faster managerial decision [23]. Although many organizations wanted to implement this SOA-ERP system to replace their old legacy system as quickly and cheaply as possible, they ended up investing more money and time for the system and were not able to receive any ROI they expected to receive. Although this early failure in the implementation is not tightly linked with later failure and the reasons for the implementation failures are often hard to measure, success in implementation requires setting the reengineering of organization's processes and changes in the organization's culture as top priorities.

Changes like reengineering the processes and culture are disruptive and make the most employees to naturally resist it until they understand and experience the benefit of the changes. Therefore, the top manager must educate and train the employees the real strength and benefits of the SOA-ERP system which delivers powerful business benefits, such as increased flexibility and better alignment between information technology (IT) and business.

Through case examples demonstrated in this paper, the SOA system does not replace ERP systems. The SOA system improves organization's capability to orchestrate cross-functional business processes and projects more easily by utilizing the ability of reusable services. These services also act as middleware to integrate ERP and non-ERP systems across a network. By implementing the system properly, The SOA-ERP system, a union

that provides many organizations attractive benefits to control, is a catalyst for more innovation for the enterprise resource information system to the future.

This paper also addresses some failure cases of the SOA-ERP system. The reasons why the SOA implementation fails are: budget control and process improvement. The most SOA failures are by far due to overspending or mistimed spending. Second, most of the technology that organization is trying to implement does not support business processes. In this case, it is not the technology that has triggered failures; it is the organization's processes that need to be re-engineered. Gartner has observed 12 most common mistakes in SOA implementations that can be summarized as: people, technology, and business or process. Managing the implementation of the SOA-ERP system properly requires prioritizing these strategies that will overcome mistakes listed above.

It would be great if the top management and CIO have some type of roadmap that tells them what and how to do. There is the roadmap that is called 'Proven Path'. This path is well known roadmap to be used by many organizations for its system integration. Most of steps in the path are well defined steps which guarantee a highly successful implementation in a short time frame, if followed faithfully and with dedication. The main points of this path again are education and processes [38].

In conclusion, if any organization decides to implement the SOA-ERP system, it needs to find solid starting point for the implementation. It should focus on how to improve processes of organization. It does not need to invest huge but spend little money early and improve processes over time as benefits arrive to pay for them. Keep every employee informed and educated well to understand the goals and objective the processes improvement. This task is always challenging and overwhelming. But, the top management must understand that the employee is the one who leads and makes the SOA

ERP system implementation successful. Once the organization experiences some process improvements, develop champions and invest more money on process and tools to improve. As the organization walks through the implementation journey a step by step, the top management will have a better idea on what they really need to do to make the implementation succeed.

Although the lack of empirical research on implementation reduces the significance of the research, the findings from thorough literature review and case studies provide enough evidence to indicate that the SOA enabled ERP system help organization to obtain future market growth or to improve competitive advantages by sharing readily available information. Therefore, the finding and information on this research should not receive more weight than is justified.

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