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SERVICE-ORIENTED ARCHITECTURE & DATA MANAGEMENT

SERVICE-ORIENTED ARCHITECTURE ADOPTION IN A PORTUGUESE COMPANY: A CASE STUDY

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Abstract

Organizations are constantly facing new challenges that require increasing response and adaptation capabilities. Seeking for agility and flexibility, companies have found in Service Oriented Architecture (SOA) an alternative to integrate legacy systems with emerging technologies and put back the focus on the business by aligning processes and technology. In this article, we present a study about the adoption of SOA in the medium company of North Portugal, more specifically in a manufacturing company. This company is characterized by a number of difficulties for the adoption of SOA, like organizational, cultural and technological factors. However, the use of Business Process Management initiated by the implementation of the ISO 9001 (Quality of Service) it will facilitate in one hand the definition of processes and therefore the services of the future SOA architecture and in other hand, alert the company's administration for the potential adoption of SOA. We conclude that in spite of the difficulties encountered in the diagnostic phase and according to the business context of this company, the adoption of SOA can be a challenge for organizations but they have to ensure a set of structural and organizational requirements.

Keywords: SOA, BPM, Integration, Services

1 INTRODUCTION

In the globalization era, companies have to deal effectively with business pressures and therefore have to become agile, responsive and adapt rapidly to the constant changes they face. The companies seek for profitability and efficiency relies on innovation, but beyond the product and services innovation, the competitive key advantage starts to focus in the business processes innovation, which requires the alignment of business and Information Technologies towards common objectives, processes that will allow companies to differentiate themselves. The focus has to remain on the business agility. If a business process has to adapt rapidly to the environment changes, so too must the systems that support it. The seek for performance requires the acquisition of information technology that supports the company business strategy. Generally, the companies technological infrastructure relies on legacy systems [IBM,2006], that include many of the competitive advantages essential to their success, supporting the core business processes and providing crucial information for the operations. However, it results in a rigid architecture with a lack of flexibility and costly to maintain. There are common options to transform legacy systems and make them more responsive to new business needs such as: rewrite code, replace aged or obsolete systems, options that can involve significant costs in custom developments, investment in a new system, including implementation and training costs. But those approaches do not move Information Technology (IT) and business closer to the agility they need. A Service Oriented Architecture Mark,2006, Krafzig,2004 allows the integration of the organizations

disperse systems and applications as well as the adoption of emerging Technologies and the interactions between those elements. This approach allows to:

- Align business processes and technology to make the company more competitive and responsive to change;
- Improve customer service, satisfaction and loyalty;
- Reduce the total cost of ownership of Information Technologies, freeing resources for the investments strategic to the business;
- Increase operational speed and efficiency, user productivity and organizational flexibility;
- Consolidate and modernize operations;
- Provide enterprise information in a timely and accurate manner;
- Establish secure and real-time communications with partners and customers;
- Help manage efficiently suppliers, partners and distribution channels;
- Reduce the development and time-to-market life cycles;
- Create, enable and optimize new opportunities to generate long term revenue;
- Extend the useful life of existing investments;
- Enable a greater Return on Investment (ROI) IT costs reduction and better management of IT resources;
- Reduce the business risks.

SOA is more than an IT solution, it is a change in paradigm or an alternative, which removes the focus from IT and put it back to the business. SOA makes the technological architecture better prepared to implement the organization strategic decisions, through the integration and update of the business processes. Instead of replacing legacy systems [IBM,2006], the SOA architecture makes the businesses agile by creating, integrating, reuse of existing and new solutions, as a result the architecture is designed to achieve operational efficiency, safety and performance. By connecting systems and applications, it facilitates the access to the information critical to the business.

We present in the second section the conceptual definition of SOA, the importance of SOA governance, and we compare two approaches to SOA adoption, as well as we list several critical success factors. In third section we refer the association between SOA and Business Process Management to assist in the identification and management of business processes that will be materialized in services adopted by the SOA concept. In the section four we identify the more critical factors to the adoption of SOA in Acco Brands [ACCO,2009], a medium company in the north of Portugal, following in the section five the conclusions of the first phases of the SOA adoption in this company.

2 APPROACHES TO SOA ADOPTION

2.1 SOA

SOA [Krafzig,2004] is a style of software architecture based on main principle which determines that the functionalities implemented by applications or systems are made available as a service. From the SOA point of view, a service is a function of a computer system made available by another system. A service has to operate independently from the status of other services and needs a well designed interface. Usually, the communication between the client system and the one that make the service available is performed through Web Services [Deitel,2002], like SOAP (Simple Object Access Protocol) [Scribner,2000], REST (Representational State Transfer) [Fielding,2000] e WSDL (Web Services Description Language) [Christensen,2000]. The applications and procedures are made available as

services in a computer network (internet or intranets) in an independent manner and built on open standards. They are frequently organized through an Enterprise Service Bus (ESB) [Chappell,2004 that makes available interfaces or contracts, through Web Services or any other form of communication between applications. The ESB provides an infrastructure element that enables the distribution of services within the network. The user of the service is only aware of the function he is performing, but not of the details of how this function is implemented.

Typically the SOA Architecture defines several layers [Krafzig,2004. The operational or legacy systems, that identify the business functions, reside at the lowest layer of the architecture; their components are made available to the next layer of services components. Those components are organized into services and exposed to the upper layers of the architecture, where they are sequenced to perform the business processes, this process is called orchestration. The SOA architecture provides an inventory of structured and reusable services performing a unique function that can then be orchestrated to build up the business processes. With this model based on service, it is easy to implement new features or modify existing processes simply adding the necessary services to meet the needs of innovation or improvements to the model of business processes, as well as connect with customers and partners [IBM,2006].

2.2 SOA Governance

The SOA architecture requires efficient governance in terms of operations and technology to ensure that IT efforts meet business needs. Also, it is a way to monitor the services distributed and how they are used. SOA Governance is an extension of IT governance that deals with issues related to the life cycle of services and composite applications, taking into account people, processes, information and the organization assets. SOA Governance allows largely offset the risks inherent to the implementation of such architecture and thereby to maximize the benefits for business. Establishes responsibility for decisions, defines the appropriate services, allows the management of assets, and measures the performance and value achieved for the business. Basically, the effective SOA governance enables define, plan, facilitate and measure and helps therefore to answer questions such as:

- What services are needed?
- What services can be shared, with what rules and in what circumstances?
- Who makes the decision on which service can be accessed by other applications?
- Who is the owner of the information, is there an agreement to allow service access to information?
- Who should build the shared service? Who owns the service?
- Who is responsible for initiating and approving requests for changes?
- How does the business promote the reuse of assets and shared services?
- How to measure the value of business achieved by the creation and reuse of services?

Thus, key decisions need to be made regarding the following items:

- Portfolio of applications
- Portfolio business services
- Investments in infrastructure, tools and applications
- Projects
- Architecture
- Operations in the implications that involves the sharing of services across departments
- Incentives to the reuse of services

- Security
- Credibility / Trust
- Performance

Marks and Bell [Marks, E., Bell,2006], presents that an SOA Governance model defines the various governance processes, organizational roles and responsibilities, standards and policies that must be adhered in the SOA conceptual Architecture. Effectively, SOA Governance is one of the critical elements to the success of SOA architecture, because SOA requires changes and changes happen through decisions and policies.

2.3 Approaches to SOA adoption

Over the years, organizations based their daily activities through the use of information systems. With the evolution of the technology, these systems will be built on technology layers to support various types of services and activities of the organization. Appears increasingly the need to integrate these systems in order to improve the performance of the various departments and align their activities with business goals. But this integration is difficult to be implemented. Two consensual solutions can be adopted to make the integration of systems: it can be to rip out all the legacy applications and replace them with modern ones, or to rewrite the legacy systems for modern applications server platforms. However the disadvantage of these solutions/approaches is the facts that are too expensive for the organizations and difficult to implement specially by the complexity of the platforms and the difficult in integrate the architectures. The SOA presents a simple concept of services that permit isolate areas or elements of the platforms (or architectures) enabling the flexibility of reusable services. In order to begin the process of implementing SOA an organization must begin thinking about its IT capabilities as a body of services [Mark,2006]. The process of identifying services in an organization focuses on process domains or business units. In other and, these process domains provide a focus and scope for services identification and analysis. Marks and Bell, present a collection of models required to implement SOA like: Business Modeling, Technology and Services Integration Model, Service Reusability Model, Architecture Organizational Model and Business Case and Return on Investment Model. Although, these models are generic and quite detailed and their applicability varies depending on the organization type. These guidelines are followed primarily by companies that provide tools to help efficiently the adoption and implementation of SOA. This is the case of IBM and Oracle. Accordingly, the next two chapters we will discuss with some detail the concepts adopted by these two companies and present a brief comparison.

2.3.1 IBM approach

According to IBM [Sandy,2007], the SOA approach should be focused on business and should consider the following entry points: people, processes and information (figure 1). Thus, the aim is to identify the area where the organization should focus on, what means the area that is crucial and a key competitive advantage as it acts a differentiator for the business. When focused on people, the approach should seek innovation in interaction and collaboration through services, usually with the implementation of portals, allowing the integration of employees, customers and suppliers. To meet the challenges of business, companies need to boost the way the employees and partners communicate with each other. When focused on process as the entry point, the innovation of the business model is achieved by treating tasks as modular services, integrating processes and aligning the business and IT needs to gain flexibility and agility in the business, facilitating the implementation of BPM (Business Process Management) [Smith,2003]. When focused on information, innovation is the provision of information as a service to improve decision making. However, the combination of these elements in the SOA architecture approach can have a multiplier effect for the organization, creating more value [Sandy,2007].

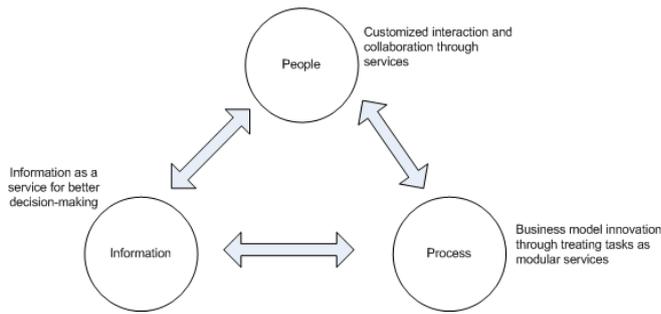


Figure 1: SOA approach focused on business (Source: IBM Global CEO Survey, 2006)

The SOA architecture allows connecting people, key processes and critical information in a flexible and dynamic way. In its approach, IBM identifies [Sandy,2007] five stages in the SOA lifecycle that support and promote best practices for the modernization of legacy systems into a SOA architecture, as illustrated in the figure 2. The first phase is to define the Strategy, i.e. a set of goals and objectives in terms of business and IT, performance indicators (KPI - Key performance indicators) [Parmenter,2007], to develop a map of what is sought and strategies to achieve it, plan and establish priorities for initiatives, monitor the plan. It is a critical stage to properly align the business objectives with the IT goals in a SOA long term approach. The Model stage consists of decomposing the business processes and constructing a service model that aligns with the business process goals and requirements. It involves the assessment of the current environment of business and IT as well as to establish a model of the desired end state, identifying the services required by business processes. The model designed has to be easily understood by the business experts and the technicians. The Assemble phase is to build services and orchestrate the business processes. This phase involves designing and building low-level services from the service components that can be technical or functional.

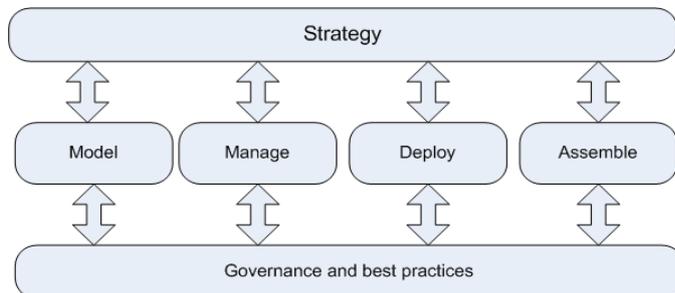


Figure 2:– IBM approach to application modernization in a SOA architecture

The functional services provide the features required for the business while the technical services provide operational features such as access to the database, authentication, authorization, etc. During Deployment, the constructed and renovated components and services are released into the production environment. The Manage phase should ensure that the SOA architecture continues to deliver the value the business needs and expand the model of services as business needs evolve. At this stage, the operational environment and the policies expressed in the assembly of composite services deployed have to be maintained. The management phase also involves measuring the performance of services through KPIs and making the necessary adjustments to meet the business objectives [IBM,2006].

2.3.2 The Oracle approach

Another approach of one of the largest organizations in information technology is the concept defined by Oracle [Davies,2008]. Oracle recommends seven key steps for effective SOA adoption, highlighting best practices for SOA implementation, based on real-world SOA implementation experiences. These steps are: the Portfolio Services, the Connectivity and messaging step, the Process Orchestration, workflow and rules, the User Interfaces, the Business Activity Monitoring step, the Security and

Management and the Performance and scalability. The Portfolio Services mentioned that it is important to define very early in the development process which interfaces to services and systems are required, in order to avoid instability. It is also recommended to establish a registry of the services in a common directory. The Connectivity and messaging consists in determining the protocols that will be used to connect the services. There are several alternatives such as SOAP, Web Services Invocation Framework based on the WSDL standard. Protocols should be selected taking into account the needs of performance, scalability, quality of service and interoperability. In the Process Orchestration, workflow and rules step should be defined which applications and business processes around those services. Oracle recommends the Business Process Execution Language (BPEL) [Harish,2006] that allows the definition of the business processes and workflows in a standard format. It also highlights the advantage of defining the business logic in external business rules through rules engines. The treatment of exceptions should be considered taking into account the performance required, sometimes contradictory requirements. At this stage, testing is critical and important as complex for the asynchronous processes orchestrating many external services.

Oracle strongly encourages the development of a testing framework and the use of testing tools that support the SOA standards. In the User Interfaces step several options should be considered, such as Web GUI interfaces, portals. Early in the SOA design process, it is essential to define Key Performance Indicators (KPI) which monitor the transactions of the business and thus provide information relevant to the processes improvement. These KPI characterizes the Business Activity Monitoring step. In the context of the Security and Management step, the security has become increasingly critical, with the amount of information that proliferates over the networks, with the legal changes and the need for data protection to preserve confidentiality and privacy. Thus, standards emerge such as WS-Security to enable the secure exchange of information between processes and services, even when different technologies are involved. The WS-Security standard provides a standard mechanism for authentication and access control for services as well as full or partial encryption of the message data. The Security Assertion Markup Language (SAML) provides a mechanism for role-based access control and centralized identity. It is also important to define external security policies and change them dynamically without needing to modify services or clients that call them. In the Performance and scalability step and to avoid surprises (or difficulties in the SOA implementation), Oracle suggests performing a performance test at an early stage of the development an even at a design stage, in order to get realistic figures on the size of the systems needed to achieve the expected loads. The completion of these tests during the prototyping and design stages will help identify potential bottlenecks in performance when there is still time to change the key design decisions. Another good practice in terms of performance is a careful selection among asynchronous and synchronous service interfaces [Shaffer,2009, Shaffer,2009].

2.3.3 Approaches comparison

These two approaches are complementary. While IBM provides a generic methodology for implementing SOA architecture, Oracle, in the seven steps it defines, focuses more specifically on technical issues to be addressed in the model and assemble phases identified by IBM in its approach. The initial phase of strategy definition is addressed by Oracle in the assessment it recommends based on its Level 5 SOA maturity model. This model allows an organization to identify existing capabilities, essential to a successful SOA implementation as well as future goals. Determine the SOA maturity level, requires an organization to take into account the current state of SOA capabilities and the level it want to achieve. It enables the organization to set goals and objectives and address key decisions and policies that are required to address the major capabilities that need to be put in place to ensure success and incorporate all these elements in the plans to implement SOA. Each maturity level defines a vision and a strategy and the associated benefits. To set the level of maturity, the following key elements shall be assessed:

- Architecture through the planning of architecture including the planning of the portfolio of services, setting standards, guidelines on the development of reusable services, service management policies, performance and safety Architecture of Information;

- Management of people (training and organization), processes and development;
- Strategy and vision;
- Infrastructure;
- Architecture through the architecture planning, including the planning of the services portfolio, definition of standards, guidelines on the development of reusable services, service management policies, performance and security;
- Information architecture;
- Governance that should consider decision-making and policies;

The model identifies 5 levels [Chappel,2004]:

- Opportunistic: limited experience, simple projects to get experience;
- Tactic: SOA is applied to existing projects including the integration of customer's data and the implementation of some reusable services;
- Strategic: strategic automation and transformation of business processes and systems integration;
- Enterprise: automation has been largely implemented and the focus is now on monitoring and measuring toward continuous improvement of business processes;
- Level 5: the IT infrastructure is SOA, business and IT go hand in hand to deliver continuous automated business improvement.

However, in spite of the definition of structural models for its implementation, the successful implementation of SOA depends on several factors: service ownership, the business and IT relationship, budgeting practices, organizational, cultural and process issues. Marks and Bell [Marks, E., Bell,2006], presents that if an enterprise plan to achieve SOA it have to begin to analyze the behavioral, cultural, and other organizational factors that will lead to SOA success and then architect the modeling to implement SOA. Additionally to the issues involved in the process of change is necessary [Marks, E., Bell,2006] take into account a number of important questions: How to organize the enterprise architecture functions and roles to support SOA, how to organize the developer resources to help ensure the realization of the goals and performance of SOA initiative; what is the optimal IT structure for an SOA.

2.4 Critical Success Factors for SOA

To begin the study of the SOA adoption, several critical success factors must be taken into account, such as behavioral, cultural and other organizational. Besides the organizational structure to allow the viability of the project, the administration of organizations must be sure that the strategic objectives will improve with the adoption and implementation of SOA. Moreover, there is a need to involve employees in particular those who are less receptive to the process of change. Other challenges are found in the successful adoption of SOA as service ownership, business and IT relationship and budgeting practices. Marks and Bell [Marks, E., Bell,2006] presents a set of questions, allowing architects to evaluate SOA the adoption of SOA (in more technical terms), such as: how to organize the enterprise architecture functions and roles to support the SOA? How to organize the developer resources to help ensure the realization of the goals and performance of the SOA initiative? What is the optimal IT structure for an SOA? What are the skills, roles and competencies of your organization architecture that will facilitate migration to SOA and attainment? Indeed, the adoption of SOA is a set of challenges that must be taken into account in particular the organizational and cultural factors. Thus ensure the control of these factors, the planning and implementation of SOA should follow models [IBM,2006, Marks, E., Bell,2006, Deitel,2002] to guide the whole process of planning and implementation.

3 SOA AND BUSINESS PROCESS MANAGEMENT

As we mentioned, for the implementation of SOA oriented integration is necessary to examine the interaction between people, processes and information. In turn, to identify services (defined in the concept of SOA) there is a need to analyze existing processes at various levels of the organization, business, technological and organizational. In spite of the importance of these three types of levels, the business level is one that has special significance as it reflects the activity of organizations and the main objective that is based on: business. In other hand, the Business Process Management (BPM) [Smith,2003] is characterized as the practice of improving the efficiency and effectiveness of an organization by automating the business process organizations. The BPM solutions are delivering some benefits in enabling business functions to understand and partially automate the key business process for the different areas to the organizations. In general terms the use of BPM, the business processes are expressed by a set of services that are orchestrated to compose the business process. In this context, the relationship between SOA and BPM is a value for organizations in terms of specification and layout processes, as well as implementation of SOA in particular in the identification and management of business processes that will be materialized in services.

For Ould Ould,2005 a process is a coherent set of activities carried out by a collaborating set of roles to achieve a goal. It presents a BPM method called Riva to address the major emerging technology of Business Process Management that is business-focused. It is a method for designing, modeling, analyzing and recording business processes.

Marks and Bell [Marks, E., Bell,2006] presents a model to identify, analyze and design the services. Give special attention to the identification of potential services that offer value for the organization should be evaluated based on reuse, business impact and organizational value, and then analyzed and designed in order to implement them. After the identification of these potential services it will proceed into a more formal design procedure to a physical map and solution services.

Slack Slack,2009 presents a methodology based on the analysis of logical processes (phase methodology) that defines four stages in the processes management in particular for use in the BPM. These four stages are: Process management, Discovering, Assessment, Redesign and deployment. The advantage of this methodology focuses on the fact that it is simple to understand and apply enabling handling large-scale process redesigns and permits view by Weighing Desires against the organization's competitive realities.

Mathias Weske Mathias,2007 presents a methodology where the BPM is divided into five phases: business strategy, goals, organizational business processes, operational business processes and implemented business processes. According to this author, the business process consists of a set of activities that are performed in coordination in an organizational and technical environment. These activities jointly carry out the business goal. Each business process is enacted by a single organization, but it may interact with business processes performed by other organizations.

Several methodologies can be adopted to identify and manage business processes. As we mentioned, the identification of these processes will serve to identify the basic services to the SOA architecture and thus the relationship between SOA and BPM becomes an asset for the definition of services and contribute to the successful implementation of SOA architecture.

4 CASE STUDY – ADOPTION OF SOA IN A PORTUGUESE COMPANY

Increasingly, organizations need to be competitive and devise business strategies to cope with competition, increase their levels of profitability and efficiency. In the north region of Portugal are located more than five thousand small and medium enterprises operating in various fields of activity including trade, production and services. These companies are typically grouped in industrial parks [CEVAL,2009], they are characterized by the existence of various internal sectors (e.g. production, logistics and commercial) typically having with independent information systems but requiring

interconnection. Despite the diversity of activities, the vast majority of those small and medium businesses handle and execute, in their daily activity, various business processes (supported by manual processes or by independent information systems) which they could optimize and restructure to increase commercial, financial and manufacturing efficiency.

Given the reality of the organization and the reality of small businesses in North Portugal, the adoption and implementation of SOA will be a change because it would: align the business processes and technology to make the company more competitive and responsive to change; improve customer service, satisfaction and loyalty; reduce the total cost of ownership of Information Technologies, freeing resources for the strategic investments to the business, increase operational speed and efficiency, user productivity and organizational flexibility; consolidate and modernize operations, help manage suppliers efficiently, partners and distribution channels, create, optimize and enable new opportunities to generate long term revenue and enable a greater Return on Investment, IT costs reduction and better management of Information Technology resources.

Based on this reality, taking into account the potential of this type of architecture and considering all the benefits highlighted above, would SOA architecture be applicable at Acco Brands Portuguesa [ACCO,2009]. After analyzing the critical factors, we found several problems in the adoption of SOA, and we conclude that its implementation can be achieved if a set of requirements are guaranteed.

4.1 Behavioral, cultural and organizational factors

In organizational terms this manufacturing company, owned by an American company, leader in the Office Equipment and Products business, is located in Arcos de Valdevez [ARCOS,2009], Viana do Castelo [VIANA,2009], where the facility produces binding machines. Typically the Administration company in the Portuguese Country shall remain for short periods of time (normally 2 or three times a year). The local company has any power of autonomy at the local level, however, technological and strategic decisions may be decided at the headquarters of the company, may be adopted restructuring or adopting new technology layers. Considering the culture of innovation in the organization and training of most staff, to be receptive to the process of change and thus are involved in a positive way in the adoption of SOA. However, the organization is still not oriented to process (and specially to process management) that might hinder a future implementation of SOA. This feature may not show organizational management to the administration of the potential adoption of SOA. However, with the implementation of ISO 9001 (quality of services) which are defined business processes and organizational processes, it will facilitate the task of guiding the processes. For the process entity and in order to implement this process management approach as a discipline, a pilot project is being conducted in the Supply Chain Management area, using the Business Process Management methodology of Slack S. Slack,2009. The objective is to acquire know-how in implementing such approach. To begin this survey we analyze the organizational, business and technological processes. We start the first phase analyzing the main processes and prioritize them. This work was helped by the fact that the company is preparing a certification of its services, implementing the ISO 9001 standard [ISO 9001,2001]. This standard is a family of standards specifying the quality management systems. In terms of documentation it requires the specification of organizational processes (and business) which will help in the task of identification and management processes. In fact, top management has already identified the implementation of a quality system based on a process approach and ISO9001: 2000 standard as a requirement, so the plant can be identified as a strategic manufacturing location in the global supply chain among the group. Achieve the ISO9001: 2000 certification is seen as a competitive advantage to ensure that the plant receives new activities and products. Today, the processes are supported by BPCS, Business Planning and Control System - the ERP provided by Infor [Infor,2009], an international software house. Based on the backbone of BPCS, there is locally a full integration of the various functions of the company. However, BPCS does not support all the activities. Thus, still many manual tasks can be identified due to missing work flows supported by technological tools that would enable the implementation of automated processes, typically in the approvals processes, as well as missing

automated information flow that would enable the share of information with business partners, whether they are suppliers or customers, the group's distribution centres around the world.

4.2 Technological Level Diagnosis

At technological level the company has a set of information systems in which some are properties of the company and others are not. Furthermore, although some relationship between some of the information systems, the task of interconnection may be hampered by the low opening of vendors to provide services in, which may cause some financial burden to be created connectors (Web Services) to make the interconnection of systems. This may limit the applicability and adoption of SOA due to the problems of connectivity between systems and consequently between services that SOA can provide.

4.3 Requirements to adopt SOA

The implementation of SOA at Acco Brands Portuguesa should consider the use of services to meet two complementary requirements. On one hand, the need to build new features based on the existing system, that would implement business rules in an agile and flexible manner without requiring the development of customizations. Furthermore, the need for systems integration with partners is becoming increasingly urgent to achieve faster information flows, hence reducing time and costs and improve effectiveness and efficiency of the logistics chain. This approach to SOA should be focused on two entry points, identified by IBM [1] as differentiators for the business. To help the definition of this access we consider relevant the adoption of the Sandy Carter [Sandy,2007] methodology.

Although requirements have been identified indicating a possible basis for applicability of such approach, many difficulties can be anticipated, based on a basic evaluation. Those issues are related with the following elements:

- **Strategy and vision:** the definition of a set of goals and objectives in terms of both business and IT for the company locally is dependent on the goals and targets established globally for and by the group. A question that the organization Administration needs to respond is: At this juncture of crisis, will top management choose one single integrated system for the whole group or a SOA architecture approach that would enable the integration of all existing systems globally?. If the adoption of SOA is to be followed, the SOA architects will have to answer the following questions: how to organize the enterprise architecture functions and roles to support the SOA? How to organize the developer resources to help ensure the realization of the goals and performance of the SOA initiative? What is the optimal IT structure for an SOA? What are the skills, roles and competencies of your organization architecture that will facilitate migration to SOA and attainment?
- **Enterprise Culture:** the majority of the organizations in the North of Portugal are still not oriented to processes there is a hard work to do in the background through the implementation of BPM to consider a service orientation within SOA architecture. However, in spite of the high level of employees training and the receptiveness to change by these and by the administration managers, the task of establishing procedures (and consequently services) may be aided by the implementation of quality management systems (ISO 9001 standard).
- **Complexity of the technology involved:** the implementation of SOA architecture requires mastering emerging technologies in terms of new protocols, new standards, new languages, new tools, elements that require a large investment in training of IT resources and acquisition of know-how. Also in terms of SOA implementation it will be required a SOA Governance to ensure that Information Technology efforts meet business needs.

While there is ground for an eventual services orientation with the implementation of BPM, the company has not the autonomy neither the capabilities to take a step further towards the implementation of SOA architecture. So, initially the company can start by creating opportunities and gain experience through the implementation of simple and small projects, with a limited scope. Then

later on, the possibility to reach a more advanced level of maturity in SOA could be considered. This implementation will be greatly facilitated by the assessment of all business processes based the ISO 9001 standard and would enable to create system integration between applications based on Web Services.

5 CONCLUSION

The implementation of SOA architecture certainly brings benefits to the business; however due to its complexity, its success has to be based not only on a strong knowledge of the technology involved but also on the use of good practices and the establishment of a good governance. Although it is an alternative for continuous improvement in terms of performance and efficiency of business processes, it represents a great challenge for the small and medium companies of North Portugal. Several problems (structural, organizational and cultural) are found for the applicability of SOA, thus in many cases success is achievable but it must be guaranteed certain requirements. The advantage of the applicability of guidelines for the certification of services (e.g. to ISO 9001) using Business Process Management will help address more clearly the management of business processes, opening new strategic horizons for the managers and decision makers of these small and medium enterprises. SOA is indeed an alternative and in many cases a challenge in terms of adoption.

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