Supporting Business Processes for Collaborative Alliances of Software Service Providers

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HAL Id: hal-01437914
https://inria.hal.science/hal-01437914

Submitted on 17 Jan 2017

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Abstract. Software sector has become a very important and increasing competitive sector, being mostly composed by SMEs. Enhancing partnerships at a more valuable business level can help companies to attend to wider markets in a more sustainable and agile way taking advantage of assets that they would not have if working alone. One strategy to reach this is via collaborative networks. However, companies should be prepared for that. One of the first issues is to understand more deeply what working collaboratively actually means in businesses and how to support it. This article presents the set of business processes that need to be handled in a collaboration among software service providers throughout its lifecycle. Final results are discussed at the end.

Keywords: Collaboration, Business Process, Software Services.

1   Introduction

The software industry has nowadays become a very important and increasing competitive sector. In Europe, for instance, there are more than fifty thousand SMEs within the ICT (Information and Communications Technology) sector [1], being mostly composed of small and medium-sized enterprises (SMEs). SMEs, however, usually have much difficulties to engage general conditions to be competitive, lacking more advanced and sustainable models [2].

In the software sector, SOA (Service Oriented Architecture) [3] has arisen as a prominent paradigm for wider and more sustainable business models. It has introduced a new outlook on system design, implementation, integration and agile partnerships, and has been increasingly adopted (as services-based applications) by software developers and customers in general [4]. SOA and services-oriented market is already very representative and can reach up to US$22 billion in the next years [5].

In SOA, all system's features are regarded as independent and self-contained software modules – called *software services* or just *services* – that jointly form a virtual single logical unit to create software products and processes [3]. SOA is an architectural style that supports loosely coupled software services to enable business agility and flexibility. These services are made available by *software services providers* (SSP), which are independent organizations that own and provide software services' implementations and descriptions as well as the respective technical and business support throughout a given SOA solution's life cycle [3]. *Web services* are one of the most currently implementing technologies for SOA [3].

Regarding their intrinsic nature and goals, SOA projects are very complex, risky and costly. A big operational or strategic mistake in a given SOA project may even hazard the SME survival.

An alternative to decrease these obstacles but keeping companies' sustainability is to work collaboratively with other SSPs, as a network [6]. Collaborative Networks (CN) [7] leverages many competitive advantages. They allow its members to overcome individual limitations and to maximise the utilization and sharing of resources and assets (of many types) while risks and costs are shared, so as to better achieve common/compatible goals regarding the different members' culture [7] [6].

In order to support the envisaged collaborative scenario among disparate SSPs, two types of CN are of particular importance in this work: VO (*Virtual Organization*) and VBE (*Virtual organization Breeding Environments*). A VO is characterized as a temporary alliance formed by autonomous and heterogeneous organizations that join their complementary core-competences and resources to better attend to a given demand. VOs are originated from long-term alliances, the VBE. A VBE can be defined as a long-term association of organizations (companies, etc.) which have the willingness and enough pre-conditions to collaborate towards creating VOs with the most adequate partners in a more agile and trustful way [7].

In the CN scenario, working collaboratively means a practice to be introduced by companies in their daily routines. Focusing on the *business process* perspective, this work identifies and synthetizes which business processes are required to support the collaboration among SSPs that are members of VBEs. In general terms, it is assumed that a VO will be formed to represent every collaboration initiative among SSPs no matter its purpose (e.g. joint innovation, joint training, joint marketing, joint development of services-based software solutions, etc.).

Related works have proposed reference models and processes for creating and managing VBEs and VOs. However, they are (on purpose) generic and not devoted to any particular sector (although most of them have been based on manufacturing setor). Besides that, the scenario envisaged in this paper deal with "extended" VBEs, a "federation alliance", which logically embraces different VBEs (although can be applied to single VBEs), other alliances, individual companies and even independent professionals which develop and share their software services in a governed and collaborative cloud-like shared services repository [6] [8].

Regarding the massive SME nature of SSPs, the relevance of knowing more precisely these processes are: i) processes are many and SMEs managers are usually not aware of them; ii) managers can more properly evaluate how prepared they are to indeed start collaborating more effectively and so which measures should be put in place for that; iii) processes have interdependencies and different levels of implementation complexity and practices; this process list helps SSPs' managers to plan their gradual introduction in this larger scale collaborate scenario regarding current maturity level and priorities.

This article is organized as follows: Section 1 has introduced the problem and intended contribution. Section 2 explains the adopted methodology. Section 3 presents the state-of-the-art review. Section 4 presents the set of collaborative processes. Section 5 discusses about the current main findings of this research.

2   General Methodology

In order to gather a coherent and comprehensive set of business processes to support collaboration among SSPs this research was conducted as action-research, qualitative and applied work, strongly grounded on literature revision.

The literature review was mainly conducted applying the SLR (*Systematic Literature Review*) methodology [9] over the *IEEExplore, ACM Digital Library, Compendex/Engineering Village* and *ScienceDirect* scientific databases, collecting papers published in journals and conference proceedings in the period of 2002:2013 on long-term and more formal enterprising strategic alliances. 308 works were initially retrieved and a subset of that was considered as relevant for the purpose of this research was selected. A special attention was given on trying to identify the works which dealt with SMEs and software and services sectors.

Five steps were carried out to achieve this research's results. First, gaps and existing knowledge in the state-of-the-art about supporting processes for VBE-like alliances were identified (see next section). Second, applying an inductive approach, 28 papers were selected as the basis to generate an initial generalized list of business processes. Considering that there are too few VBE alliances already deployed over the world, more "classical" and very studied long-term alliances (namely clusters) were analyzed in terms of how (processes and actors) they have been created, managed and sustained. Due to space restrictions, these 28 papers are not shown in the references. Third, regarding that classic clusters do not handle some VBE process, a second study (upon other 14 selected papers) was executed to complement and adapt that list for the VBE context in a first step, and for the software services in a second step. Fourth, this list was compiled and refined by a working group, composed of some experts in the involved areas. Fifth, the list was finally evaluated by those experts and evaluated by some users, applying a questionnaire over the Internet (*expert panel* technique).

3 State-of-the-Art Review

The goal of this review is twofold: to identify gaps, and to gather and take advantage of existing models and processes to generalize and adapt to the envisaged scenario.

After evaluating related works it was observed that none of them have dealt with processes to the software services sector. On the other hand, several works have provided important related outcomes. For example, Afsarmanesh et al. [10] proposed a VBE reference model identifying a comprehensive list of required elements, but without identifying which business processes should be considered to support them. Romero et al. [11] identified a list of processes along the collaboration life cycle, but at a too generic level. Rabelo [12], Krogstie [13], Franco et al. [14] and Camarinha-Matos et al. [15] [16] adopted the VBE concept as a wider and logical federation of providers to cope with that wider services-based digital business ecosystems, but also without identifying the required business processes. Cancian et al. [17] have elicited the processes and practices for SSPs that want to develop a joint SOA solution, but just assuming that companies would come from a federation. Other works have proposed processes for dealing with collaboration but focused on single issues. For example, Danesh et al. [18] focused on services management; Haines et al. [19] on how to glue different services in cohesive SOA solution; Svirska et al. [20] on the supporting services infrastructure; Santanna-Filho et al. [21] on innovation among SSPs; BS 11000 British Standard only handles collaborative bidding processes [47]. In terms of EU funded projects, for instance, ECOLEAD [6] DBE [22], COIN [23] and GLONET [24] have developed platforms and visions to support collaboration among (also) software providers, but without identifying which more concrete processes are necessary to support when creating and maintainingthe alliance.

4 The Collaborative Processes

After the analysis and generalization (as described in section 2), a list of 22 business processes has been identified, reflecting the processes that are involved in a collaboration among SSPs throughout the VO life cycle. Therefore, it is not related to the processes involved in the creation, management and dissolution of VOs, but rather how collaboration activities span along this.

By business processes it is generally meant as the set of inter-related activities and resources involved in the accomplishment of organization's goals. Each process is expressed in a table form (Fig.1) identified by its core objective and by an extended description, which was conceived after a refinement of similar definitions and semantic interpretations. Only the most relevant sources of supporting references are presented in the end of each process. Figure 1 shows an excerpt of the *Trust Management* process.

Objective
Management of inter-organizational trust (in terms of e.g. reputation, financial health, performance, competences, etc.) so that the Federation's members, customers and supporting institutions can be confident about the existing transparency, honesty and interpersonal relationship values.
Extended Description
Considering that a federation is a long term alliance and independent of its aiming sector and size, one of the aspects to be discussed is the trust management. In order to provide the trust between partners in a Federation some elements should be managed. Those are transparency, honesty and interpersonal relationship values […].
The trust is defined as an expectation that others will behavior in a not opportunistic way […], or in a committed way not only with their tasks, but with the group […]. The trust management deals with the management of trust between organizations, including either a basic evaluation level of individual trust or between members of different organizations […]. Partners need to trust to each other enough in order to allow and/or to facilitate the collaboration. A low level of trust increases the "transactions costs", requiring an additional set of protection actions against unknown partners. In order to measure the level of trust a careful evaluation analysis criteria is necessary. (...)
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Fig 1. Partial example of a process' complete description

Table 1 presents the 22 elicited business processes. Due to space restriction, only their short description (objective) is presented. Their complete and detailed descriptions can be accessed in *https://sites.google.com/site/federationmanagement/*.

Table 1. List of processes

Process	Objective
Trust Management [10, 25]	Inter-organizational trust management of (in terms of e.g. reputation, financial health, performance, competences, etc.) so that the alliance's members, customers and supporting institutions can be confident about the existing transparency, honesty and interpersonal alliance's values
Governance Management [14, 26, 27]	Definition of rules, decision making criteria, responsibilities and autonomy levels that should be set up upon the alliance's members, customers and other supporting institutions regarding current contracts

	and businesses. This process affects all the other ones directly, although with different degrees of intensity.
Quality Management [28]	Management of quality aspects upon the alliance's members of their software services and supporting non-software services. This involves organizational-related aspects (e.g. members' reputation, services trustworthiness and QoS), software maturity models and certifications as means to selecting providers and SLA (Service Level Agreement) specifications, and general quality of supporting institutions.
Legal Issues Management [29]	Management of all legal aspects related to the alliance establishment. It also provides legal support to all issues, conflicts, transactions and collaborative processes that are carried out among the alliance's members, customers, supporting entities and eventual external actors.
Performance Management [11, 30]	Management of the general performance of every alliance's member and supporting institutions by means of qualitative and quantitative indicators, following the specifications indicated in the governance process. It is a basis for some other processes, like membership, competence and knowledge management.
Membership Management [11, 31]	Management of all issues related to the integration, accreditation, disintegration, rewarding, and categorization of members and supporting entities within the alliance.
Collaborative Project Management [32]	Management of collaborative projects that can be done by and among the alliance's members or in connection with supporting entities and customers. Examples of collaborative projects include the creation of virtual organizations, collaborative innovation, collective purchasing, joint training, and shared inventory management. This also involves financial, human resources, project planning, risk management, among many other aspects typical in project management.
IPR Management [33]	Management of the rights, duties, rewarding, royalties, etc., related to intellectual property rights (IPR) associated to innovations (of any type), licenses, patents, etc., developed inside the alliance environment
Competence Management [30, 31, 34]	Management and permanent updating of information about technical and human capabilities and capacities of each member and supporting entities. It can also have an active role, feeding the strategic management process with such information for strategic plan feasibility analysis.
Financial Management [26, 35]	Management of the activities to rise, allocate and use monetary resources over the alliance, regarding risk analysis and strategic plan. It also includes cash flow, accounting, tributary planning, general payments, invoicing and other financial related actions.
Contract Management [36]	Management of all contractual documents and legal issues to support the formal entrance and exiting of members, customers and supporting entities to/from the alliance. It also involves the establishing, reviewing and cancellation of all current SLAs (Service Level Agreement) associated to all members' software services as well as related negotiations among its members, customers and supporting entities.
Information Management [37]	Management of all information (and their life cycle) that is generated, stored and made available inside the alliance as a support to all other processes. This information can be used by the members, customers and other supporting institutions according to the governance process.
Knowledge Management [38]	Management of all knowledge (and their life cycle) that is generated, stored, organized, combined, and made available inside the alliance as a support to all other processes. This knowledge can be used by the members, customers and other supporting institutions according to the

	governance process.
Inheritance Management [10, 39]	Management of activities related to gathering, storing, refining, integrating and re-using information and knowledge from/about/along all actions and transactions among members, customers and supporting institutions for future usage and continuous improvement.
Strategic Management [40, 41]	Management of the alliance's value system, bylaws, sustainability and competitiveness via e.g. SWOT analysis and BSC. It also comprises activities related to KPI and general performance indicators (seeing the alliance as a business); evaluation of members' alignment; strategic liaisons with supporting entities, new customers and markets; alliance's life cycle management, its metamorphosis and even its closure.
Innovation Management [21, 42, 43]	Management of activities, resources and results throughout the innovation life cycle developed in the scope of the alliance by its members and partnerships in terms products/services, processes, marketing and business.
Marketing and Commercial Management [11]	Management of the activities related to all commercial practices derived from the strategic and marketing plans considering the alliance as a business organization. Marketing acts as a process over the commercial activities to help the alliance to achieve its business goals.
Bag of Assets Management [11]	Management of the activities responsible to handle the access and maintenance of all existing alliance's assets (e.g. information, knowledge, practices, partners' profiles, customers' information, software services and general tools, etc.). The access to it from certain members, supporting institutions, customers and other external actors depends on the governance process and bylaws.
Interoperability Management [23, 30]	Management of all levels of interoperability (data, applications, processes and models) required to support a proper communication among the members, customers and other supporting institutions so as to better conduct businesses, covering the many involved perspectives (organizational, legal, accounting, technological, etc.).
Infrastructure Management [12, 44]	Management of the activities related to the ICT infrastructure, human staff, physical facilities and other general infrastructures to administrate the alliance.
Services Management [34, 45]	Management of all kind of software services (at application, communication, infrastructure, integration, orchestration, security, etc., levels) provided by or under responsibility of the alliance, its members and supporting institutions. It includes services' life cycle and SOA governance management, and the management of the non-software-based services provided by supporting institutions.
Security Management [46]	Management of all access, communication and security policies involved in the general transactions among members, customers and supporting entities.

Processes were positioned along the alliance's life cycle (Fig. 2) so as to help managers in the planning of activities, resources allocation and priority processes, as well as to reason about impacts and implementation time. This placement considered the authors' experience as well as what the set of related papers and other general references on CN talked about. They were empirically categorized into four groups regarding their most intrinsic nature.
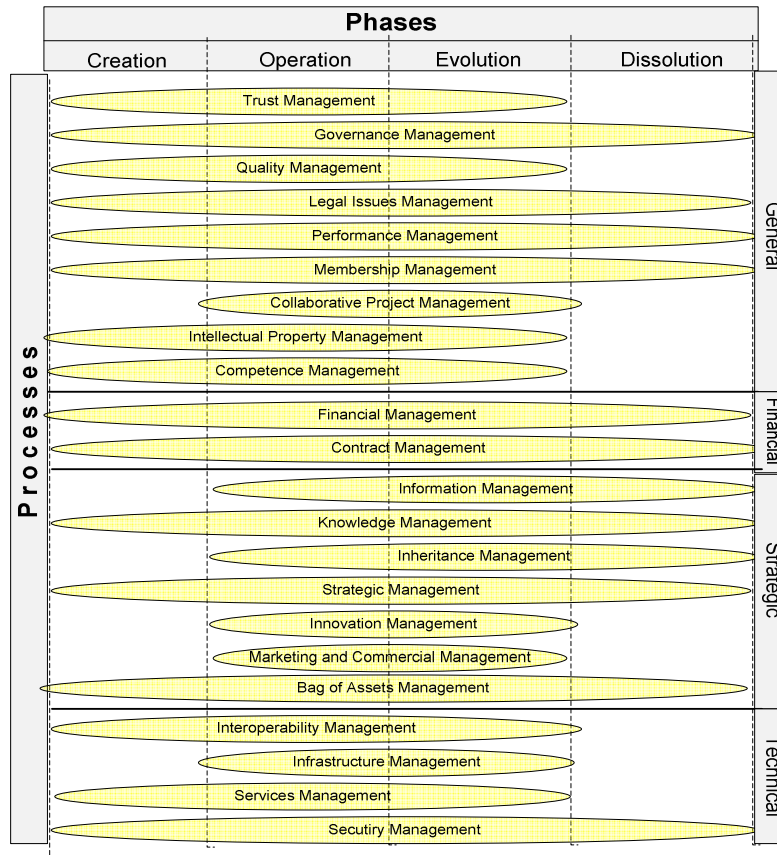
Fig 2. Processes positioning along the alliance's life cycle

5 Conclusions

This paper has presented a list of business processes required to handle when more ample digital ecosystems of SSPs have the willingness to work collaboratively in a more intense, formal and systematic way so as to benefit from the sort of competitive advantages provided by Collaborative Networks.

Each business process was evaluated by a group of experts and some analyses can be made upon such processes. For example, none of the processes were considered as unnecessary by them. For most of the experts the processes related to trust, governance, legal aspects, project management and interoperability/integration are the first ones to be implemented or tackled from a more technical point of view. In terms of implementation complexity by companies, this was quite variable as it depends on local expertizes, "legacy" practices and culture, existing ICTs, and life cycle phase. About if SSPs tend to provide joint solutions in the near future in order to reduce

costs and risks as well as to increase the chances of better addressing the market, around 75% agreed on that. About if more and more ICT companies can become part of larger IT ecosystems in the near future to take advantage of complementarities and additional scale, around 85% agreed on that. Another conclusion is that some processes are in fact similar to the ones found in other alliances, and there are other processes that are more related to software services and the federation scenario.

Although comprehensive and can be used by SSPs' managers as a useful guideline, the listed processes and life cycle positioning should however be taken as a *reference* and not as a definitive or mandatory view instead. Their deployment can vary depending on local factors, existing culture, already deployed processes, current business priorities, customers' needs, financial conditions, etc., as processes are different in terms of complexity, implementation costs and required human resources. One consequence of this is that processes could not be described at activities level as this can vary from one alliance to another. On the other hand, most of the identified processes deal with very known issues to which best practices can be used to more detailed define the usual activities to be supported within each process. For example, when dealing with strategic planning, BSC method can be used as a reference.

A business process-based perspective is only one among some others that should be dealt with by SSPs when working within networks. Therefore, perspectives like the socio-economic, the general business context, organizations' preparedness, among others, should complement the analysis that was done.

The proposed list of business processes was not yet validated in real or near-real alliances, although it has considered published material also about real cases. Anyway, SOA, software-services-based alliances and digital ecosystems are relatively new areas for SMEs, still having many open points and implementation challenges. Actually, there are too few real deployments of VBE-like long-term examples upon which more historical and consistent analysis could be taken as a reference.

Next short-term main steps of this research include a deeper validation activity by world-wide experts and in some real alliances, trying to also getting a more accurate notion of implementation complexity, importance and inter-relation among processes.

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