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VO breeding environments & virtual organizations integral business process management framework

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Abstract This paper presents a set of guidelines in terms of business process for VO Breeding Environments (VBEs) and Virtual Organizations (VOs) management based-on ECOLEAD Project Results. A detail description of an Integral Business Process Management (I-BPM) Framework, using Business Process Modeling Notation (BPMN) is presented. The I-BPM framework describes a set of process models that depict what happens during each VBE and VO management processes, taking the point of view of an external observer, to provide rationale of activities that should be carried out by a set of VBE actors to achieve the expected business process results.

Keywords Business process management · Collaborative networked organizations · VO breeding environments · Virtual organizations · Membership · Profiling · Competency · Governance · Management · Negotiation · Ontology · Performance · Strategy · Trust · Value systems

1 Introduction

New forces are molding the World Economy, making markets even more global, intensifying competition from new corners of the World, and providing new sources of competition and market opportunities to those capable to challenge a volatile economy in changing market conditions.

Globalization has fundamentally altered the World Economy, and the fast evolution of Information and Communication Technologies have provided a powerful enabler to create new forms of highly collaborative mechanisms and organizational forms capable of supporting the emergency of new business models and practices bases on a continuum of collaboration: networking, coordination, cooperation, collaboration (Himmelman 2001); as strategies to remain competitive. Thus, progress in Collaborative Networks shows a growing number of manifestations including the Virtual Organization (e.g. Davidow and Malone 1992; Katzy and Schuh 1997; Venkatraman and Henderson 1998; Camarinha-Matos and Afsarmanesh 2004), as new ways of fostering innovation and economic growth by combining the best skills or core competencies and resources of two or more organizations in order to provide a competitive advantage to better respond to collaborative (business) opportunities by excelling individual capabilities (Camarinha-Matos and Afsarmanesh 2006a).

Consequently, the area of Collaborative Networks continues its consolidation as a new scientific discipline of its own (Camarinha-Matos and Afsarmanesh 2005), with a stronger theoretical foundation and a growing number of applications cases in industry and services (Camarinha-Matos 2006), showing an appealing utilitarian perspective of collaboration as a driver for value co-creation and a strategy for improving basis for competitiveness, world excellency, and agility in turbulent market conditions. Collaborative Networks bring different benefits to those organizations that get involved in them, such as identify and exploit new business potential, boost innovation, and increase their knowledge through the creation of Virtual Organizations (Camarinha-Matos and Afsarmanesh 2006a).

The benefits of collaboration are clear, but the path to a successful collaboration is not always smooth, as many drivers exist also many barriers tend to appear, therefore several projects around the World have worked or are currently

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working in providing innovative solutions to current and emerging collaboration challenges (e.g. ALIVE, BAP, BIDSAVER, e-COGNOS, E-COLLEG, eLEGAL, e-MMEDIATE, EXTERNAL, GENESIS, GLOBEMEN, GNOSIS-VF, IDEAS, ISTforCE, MASSYVE, OSMOS, PRODCHAIN, PRODNET II, PROMINENCE, TeleCARE, THINKcreative, ECOLEAD, ATHENA, INTEROP, COIN, etc.).

ECOLEAD (European Collaborative networked Organizations LEADership initiative) was one of these projects, "aiming to create strong foundations and mechanisms needed to establish the most advanced collaborative network-based industry society in global landscape". ECOLEAD project addresses the most fundamental and inter-related focus areas, which form the basis for dynamic and sustainable networked organizations: Virtual Organization Breeding Environments, Virtual Organizations and Professional Virtual Communities (Camarinha-Matos et al. 2005a). In this paper, Virtual Organization Breeding Environments and Virtual Organizations are addressed, due to the involvement of organizations in this type of Collaborative Networks.

Virtual Organization Breeding Environments (VBEs) "are strategic associations/coalitions of autonomous, geographically dispersed and heterogeneous organizations adhering to a base long-term cooperation agreement, and adoption of common operating principles and infrastructures, with the main goal of increasing their preparedness towards collaboration. The VBE aims to prepare its member organizations and support institutions, and enhance their readiness for potential involvement in collaboration opportunity-based Virtual Organizations". A Virtual Organization (VO) "is defined as a temporary association/consortium of (legally) independent organizations that come together to share skills or core competencies and resources to achieve a common goal, such as preparing a proposal (or a bid), or jointly performing a value adding task needed to satisfy a market/society opportunity by co-producing products/services for the customer, and whose cooperation is supported by computer networks" (Camarinha-Matos and Afsarmanesh 2006a; Romero et al. 2008a).

This paper presents a detailed description of an Integral Business Process Management (I-BPM) Framework, using Business Process Modeling Notation (BPMN), to describe a set of process models that depict what happens during each VBE and VO management processes, taking the point of view of an external observer, to provide rationale of activities that should be carried out by a set of VBE actors to achieve the expected business process results.

A Business Process Analysis (BPA) was used in order to follow a process-centric approach to first design the functionalities and methodologies supported by different prototypes developed within the ECOLEAD project and then translate them into five pillars integrating the reference framework proposed in this paper (See Fig. 1). The BPA exercise was helpful to understand how the business processes automated by different technological tools worked together to meet the VBE and VO management needs and goals, which resources are compromised in each business process, and the interactions that exist among them in collaborative business transaction workflows. The decision of following a BPM (Business Process Model) centric approach was based-on successful well-documented cases in literature where most of the organizations having a BPM framework in place have reported increases in their operational efficiency, and because a BPM approach can be useful to replicate, deconstruct and redesign the business processes in the future for its instantiation and improvement. Furthermore, the BPM Modeling tool used for this exercise was TIBCO Business Studio 2.0, allowing the business users to properly model, simulate and manage business processes.

2 Integral business process management framework overview

VBE effective management is bound to the objective of preparing VBE members and maintaining this preparedness for collaboration in VOs. As such, preparedness is a strategic item that requires time to be established and must be refreshed and maintained throughout the entire VBE lifecycle (Afsarmanesh and Camarinha-Matos 2005). Implementing an efficient VBE Management Framework helps to shrink VO set-up times in contrast to selecting enterprises from an "open universe" of organizations that never collaborated before; therefore collaboration opportunities can be captured much faster and more reliably when using the VBE mechanisms (Camarinha-Matos and Afsarmanesh 2007; Romero et al. 2008a).

Keeping enterprises prepared for ad-hoc collaboration requires management of different kinds of business processes and information (databases). The I-BPM Framework proposed in this paper was designed to depict all the business processes needed to support the VBE lifecycle and the VO lifecycle according to the reference models developed within ECOLEAD project. The I-BPM Framework has the objective to give a prioritization of all VBE and VO management processes to be supported by human or information systems interactions through the whole VBE and VO lifecycles.

This paper will focus on describing the design and development of the proposed integral reference framework for VBEs and VOs management processes, under the guidelines of ECOLEAD project and its researchers, using a business process perspective. The proposed I-BPM Framework was described in a generic and replicable way,

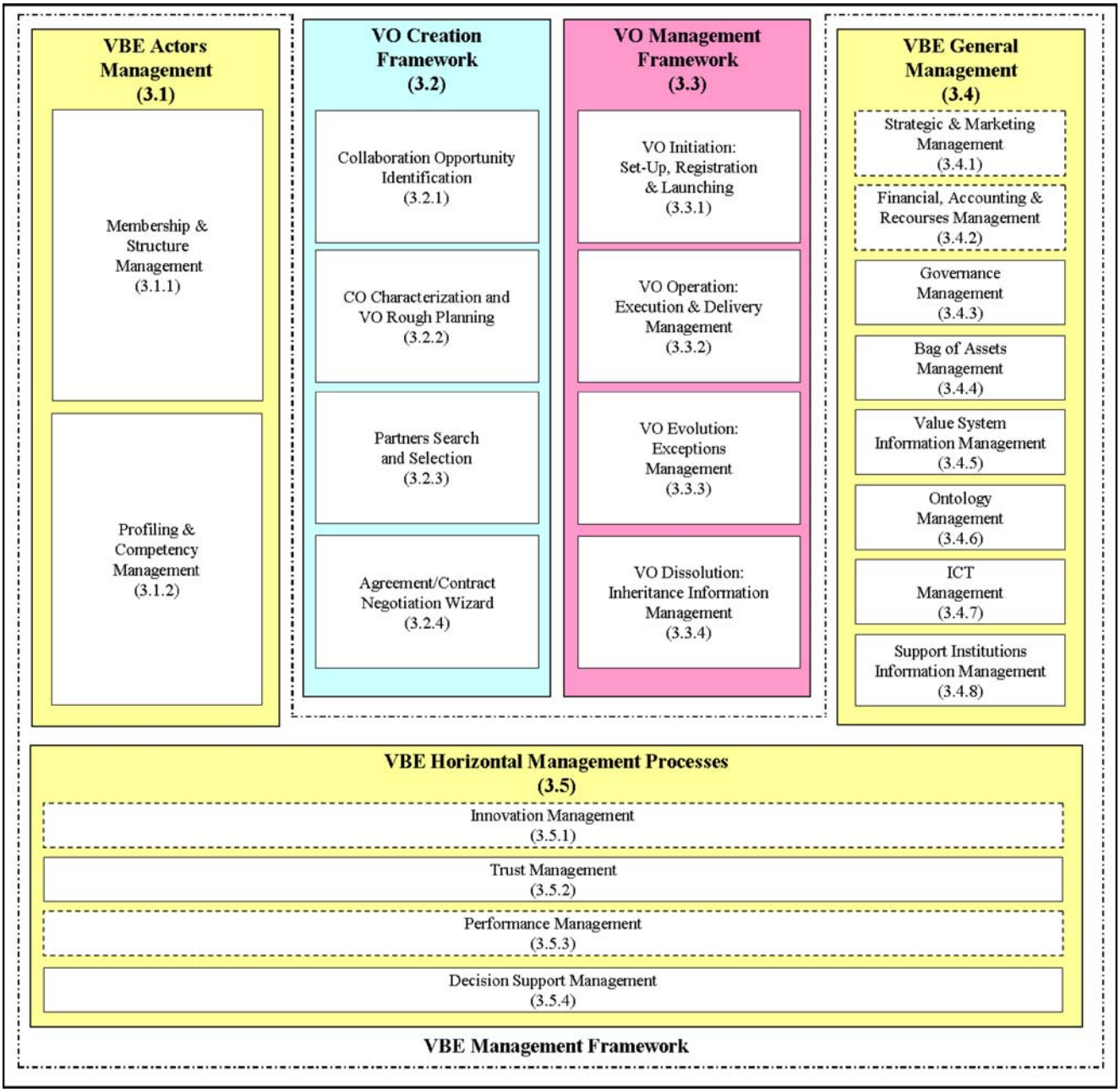

Fig. 1 VBE & VO Integral Business Process Management (I-BPM) framework

in order to be instantiated to different domains in order to tackle the most important needs in VBE and VO administration, and as a result guarantee the smooth management during its entire lifecycle.

Three important sub-frameworks can be identified in the I-BPM Framework: (1) *VBE Management Framework* including the VBE Actors Management, VBE General Management and VBE Horizontal Management Processes Pillars; (2) *VO Creation Framework* referring to the VO Creation Processes; and (3) *VO Management Framework* related to the VO Management Processes–as described in the paragraphs below.

2.1 VBE management framework

A VBE Management Framework can be defined as a set of processes, used by its stakeholders during its lifecycle to ensure that a VBE can fulfill all tasks required to achieve its objectives (Afsarmanesh and Camarinha-Matos 2005; Romero et al. 2008a). According to ECOLEAD project,

VBEs aim at achieving their business objectives of fluid configuration of VOs towards arisen collaboration opportunities, by conducting various activities, where each activity is performed by different VBE actors (stakeholders). To support the VBEs smooth operation, the VBE administration shall support and facilitate the following among others: (1) management of information, resources and knowledge; including repository creation, modification, access, and manipulation, (2) sharing and exchange of information, resources, and knowledge with authorized users, (3) provision of up-to-date information and data for collaboration, (4) administration of activities such as the execution of a set of functions required for controlling, planning, allocating, deploying, coordinating, and monitoring the VBE functionality and its resources, (e.g. profiling management, members registration, etc.), (5) provision of base functionality and information for development of advanced services needed for VO creation, (6) decision-making within the VBE including members' trustworthiness, competency, etc., and (7) provision of information/services to facilitate the VBE marketing to the outside world (Afsarmanesh et al. 2007).

Therefore, according to ECOLEAD project, the VBE management should provide an important catalysis to the achievements and success of activities within the VBE, and the base for successful configuration of VOs. The VBE administration should support and facilitate the activities needed to be performed through the VBE lifecycle stages, from the VBE creation through its operation/evolution, and to its metamorphosis or dissolution (Afsarmanesh and Camarinha-Matos 2005; Romero et al. 2008a).

It is important to note that main VBE business processes defined in ECOLEAD were complemented with some specific processes that support the VBE General Management (as described in Chapter 3). Business processes added to the I-BPM Framework were: Strategic & Marketing Management; Financial, Accounting & Resources Management; Innovation Management; and Performance Management (more details in Sections 3.1, 3.4 and 3.5).

2.2 VO creation framework

A VO Creation Framework involves three main phases as described by Camarinha-Matos et al. (2005b; 2007): (1) *Preparatory Planning,* which includes the collaboration opportunity identification and characterization, plus the VO rough planning to fulfill the collaboration opportunity needs; (2) *Consortia Formation,* which involves potential VO partners search, assessment and selection, plus the negotiation process of agreements and governance principles for the VO structure; and (3) *VO launching,* in where final details for the VO operation are adjusted, contracts between partners are signed and the VO is launched (more details in Section 3.2).

2.3 VO management framework

VO Management (Framework) aims to incorporate all the activities, measures and operations needed to guide the inter-organizational consortium of organizations, and to control the VO operational processes, tasks and their interdependencies in order to achieve the VO objectives (creating the integrated value of required quality, and within the required time and cost frame) and to meet or exceed the needs and expectations of the VO customer without breaking the legal, ethical or VBE-specific rules (Karvonen et al. 2004; 2005; Ollus et al. 2007) (more details in Section 3.3).

3 Integral business process management framework modeling

3.1 VBE actors management

This pillar is represented by two business processes (see Fig. 2): *Membership and Structure Management* as a set of management tasks and supporting tools allowing the integration, accreditation, disintegration, rewarding, and categorization of associated members within a VBE (Sitek et al. 2007; Romero et al. 2008c, d); and *Profiling and Competency Management* as a set of management tasks and supporting tools for creating and maintaining VBE-itself, VOs and VBE member's profiles descriptions as the main characteristics of VBE entities (Ermilova and Afsarmanesh 2006; 2007; 2008).

3.1.1 Membership and structure management

A VBE Management Framework should include some mechanisms and procedures to manage the entities (organizations and support institutions) that want to become VBE members (Sitek et al. 2007; Romero et al. 2008c, d). Primary mechanisms identified by ECOLEAD project include (see Fig. 3):

- The *VBE members' registration* mechanism's objective is to ensure that all information and supporting evidence to build credibility related to a VBE membership applicant should be provided to the VBE manager for decision-making about accreditation process. This information includes general profile-information and competency-related information about the VBE membership applicant that will be used for approving or denying the request for VBE membership. In case that VBE membership is denied, a feedback will be provided to the VBE applicant suggesting improvement areas to become ready to collaborate in the VBE.
- The *VBE members' rewarding* mechanism's objective is to monitor and reward VBE members' proactive

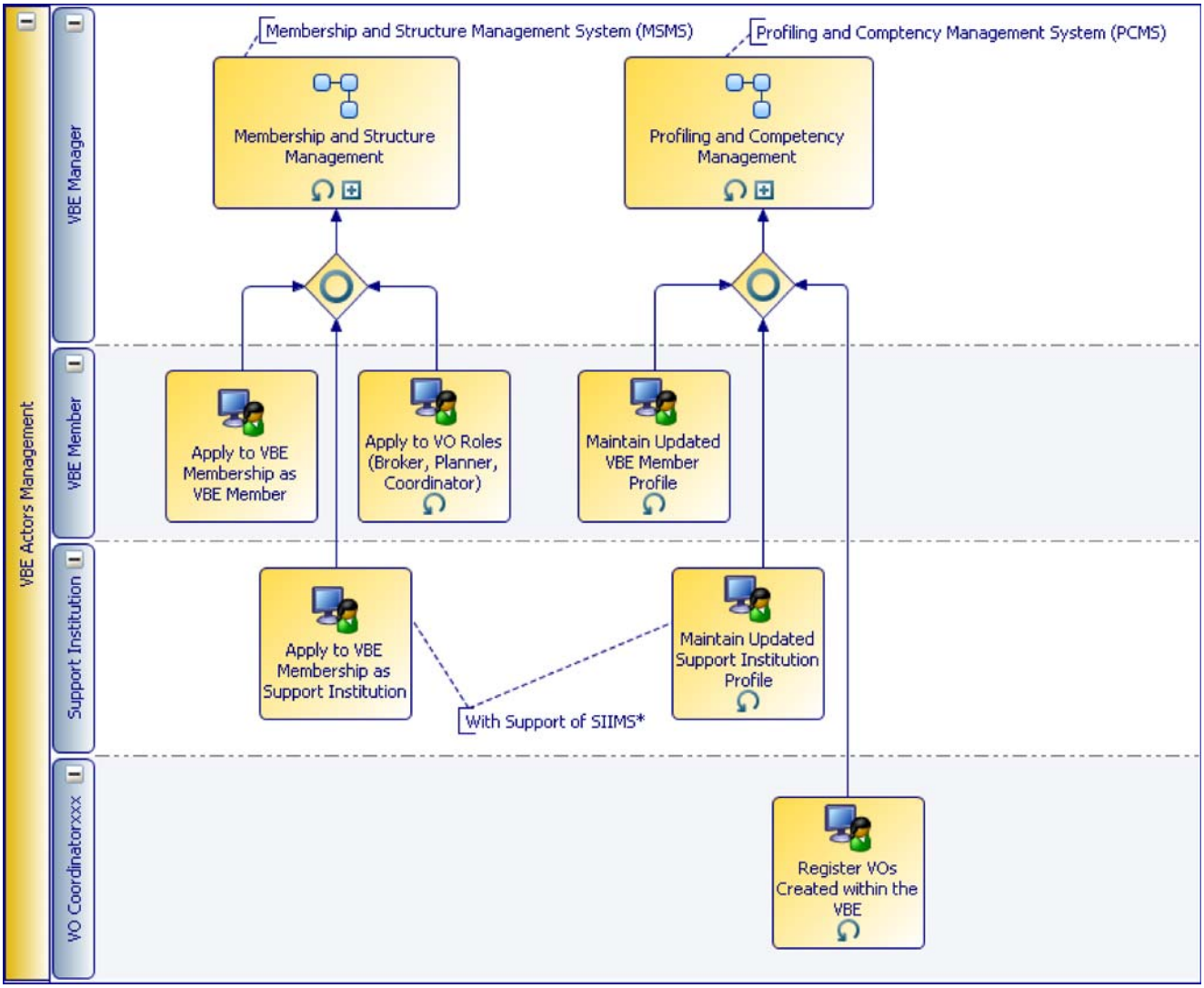

Fig. 2 VBE actors management meta-business processes

behavior. Criteria for rewarding and scoring proactive behavior within a VBE should be decided by each VBE administration. Commonly awarded behaviors in collaborative environments are: contributions to a common bag of asset, risk-taking assuming certain VBE roles (e.g. VO planner, VO coordinator), or providing supporting services to other VBE members (e.g. acting as a VBE service provider: coaching, training, etc.).

- The *VBE members' rights, roles and responsibilities* mechanism's objective is to manage role assignment for each VBE actor according to the role it is playing in a certain moment and the tasks associated to this role.

3.1.2 Profiling and competency management

A VBE main characteristic is the set of competencies that it can offer to the market and society (Ermilova and Afsarmanesh 2007; 2008). According to Ermilova and Afsarmanesh (2006), VBEs' competencies can be classified as follows: (1) VBE's (self) competencies addressing the VBE abilities to manage a network of organizations towards VO creation; (2) VBE member's competencies constituting the competencies, capabilities and capacities of a VBE member which it can offer to the VBE in order to get involved in a VO; (3) VO's competencies that are the result of clustering VBE members' competencies in a VO.

Ermilova and Afsarmanesh (2006) suggest a Profile and Competency Management System (PCMS) for managing profile-information and competency-related information about VBE members, VOs and the VBE itself: (1) VBE member's profile could be based-on a common profile model (Note: Fig. 3 introduces the VBE member profile representation). (2) VOs' profiles, in addition to common profile elements, should include: list of VO partners, type of partnership, collaboration opportunity description, VO part-

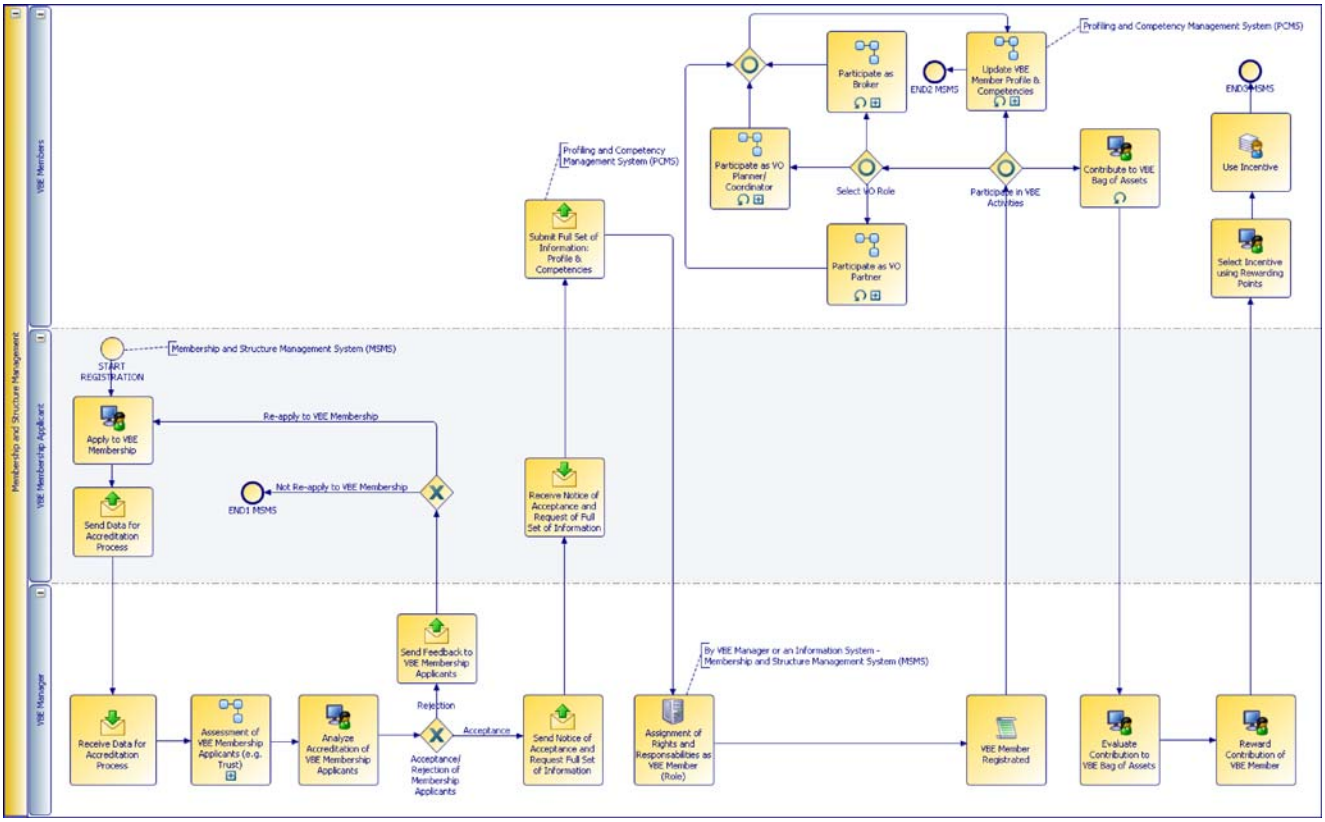

Fig. 3 Membership and Structure Management System (MSMS)

ners' competencies, VO emerging competencies (result of VO partners' collaboration) and other general VO-related information. (3) VBE (self) profile, in addition to the common profile elements, should include: list of VBE members, list of VBE actors, list of VBE roles, list of VBE governance rules and other general VBE-related information.

Two main mechanisms are identified for Profiling and Competency Management (Ermilova and Afsarmanesh 2006; 2007; 2008) (see Fig. 4):

- *Profiling and competency management* mechanism that supports the creation, updating, structuring, search & retrieval, and analysis of VBE members, VOs and VBE itself catalogue of profiles, including their competencies.
- *Discovery/search of new competency* mechanism that analyzes VBE members' catalogue of competencies for new competencies discovery of out of the collective competencies of all associated members to the VBE.

3.2 VO creation & registration management

This pillar refers to the VO Creation Framework (see Fig. 5), which depicts the VO creation and registration processes considered to happen in a VBE context according to the ECOLEAD project. VBEs aim to improve the preparedness of their members to rapidly respond to a collaboration opportunity through a truly dynamic VO creation process (Camarinha-Matos and Afsarmanesh 2006b; 2007). Following Sections will briefly explain the main steps in the VO Creation Framework, from the Collaboration Opportunity Identification to the VO Initiation: Set-Up, Registration & Launching (Camarinha-Matos et al. 2005b; 2007).

3.2.1 Collaboration opportunity identification

VO Creation Framework first step (see Fig. 5) is the identification of a collaboration opportunity (CO). VO creation can be triggered as a result of the identification of a collaboration opportunity by a VBE member (acting as a broker), by computer agent (also, acting as a broker) or by a potential VO customer.

In most cases, a broker search for COs through call for tenders (CfTs) in different places such as newspapers, bulletin boards, marketplaces, etc. and select the most appropriate ones according to certain criteria. Next, the broker with VO planner's help should identify competency requirements to respond to these CfTs and immediately search for available VBE members' competencies (as a set of processes, resources and standards) with the capabilities and capacities required to respond to the VO customer specifications. This manual process could result in processing some COs that certain VBE

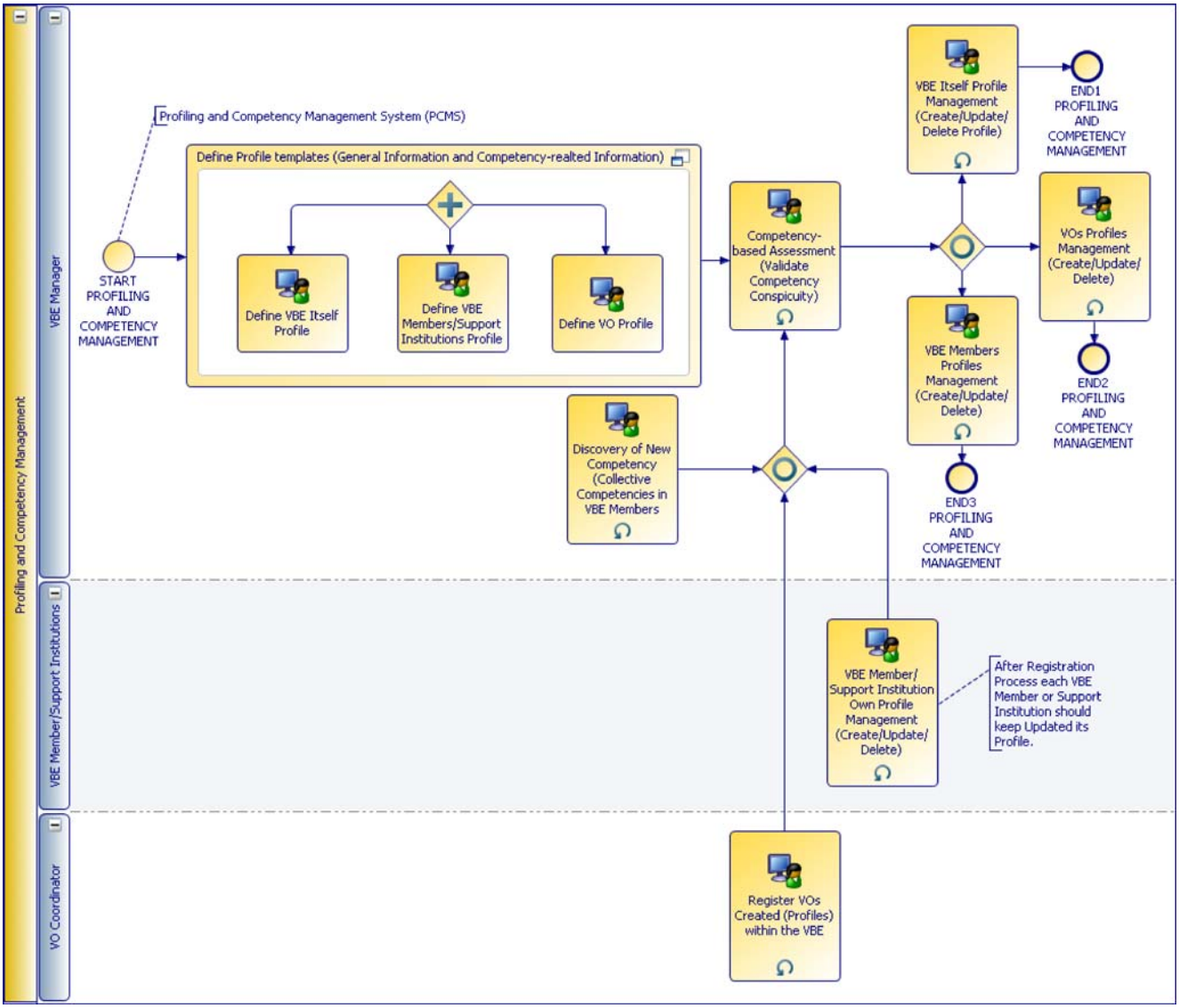

Fig. 4 Profiling and Competency Management (PCMS)

member's collectively can not be capable to tackle, representing cost opportunity time (Demšar et al. 2007).

Some brokerage practices can be supported by a computer agent, including Web crawling techniques, in order to find and monitor potential COs on selected Websites (e.g. e-marketplaces). The same approach could be taken manually by a broker, but it may result in a very demanding and time consuming task, therefore computer assistance appear as a practical approach to facilitate the broker's work (Demšar et al. 2007).

In this scenario, ECOLEAD project proposed a Collaboration Opportunity Identification (CO-Finder) tool to support CO identification through a computer agent searching for CfTs according certain criteria defined by a broker, see Fig. 6 (Demšar et al. 2007). The advantage of computer assistance will be that selection criteria can be supported by the VBE competencies' catalogue represented by the PCMS tool.

As a result, the same process described in paragraph above, will become more effective and efficient by supporting CO identification task with two main tools proposed: the CO-Finder and the PCMS selecting automatically only the CfTs that can be answered by the VBE competency domain and alert the broker of their existence to start the VO planning process together with the VO planner help.

3.2.2 Collaboration opportunity characterization and VO rough planning

VO Creation Framework second step (see Fig. 5) is the characterization of the CO identified and the creation of a rough plan for the potential VO. In this step, the VO planner

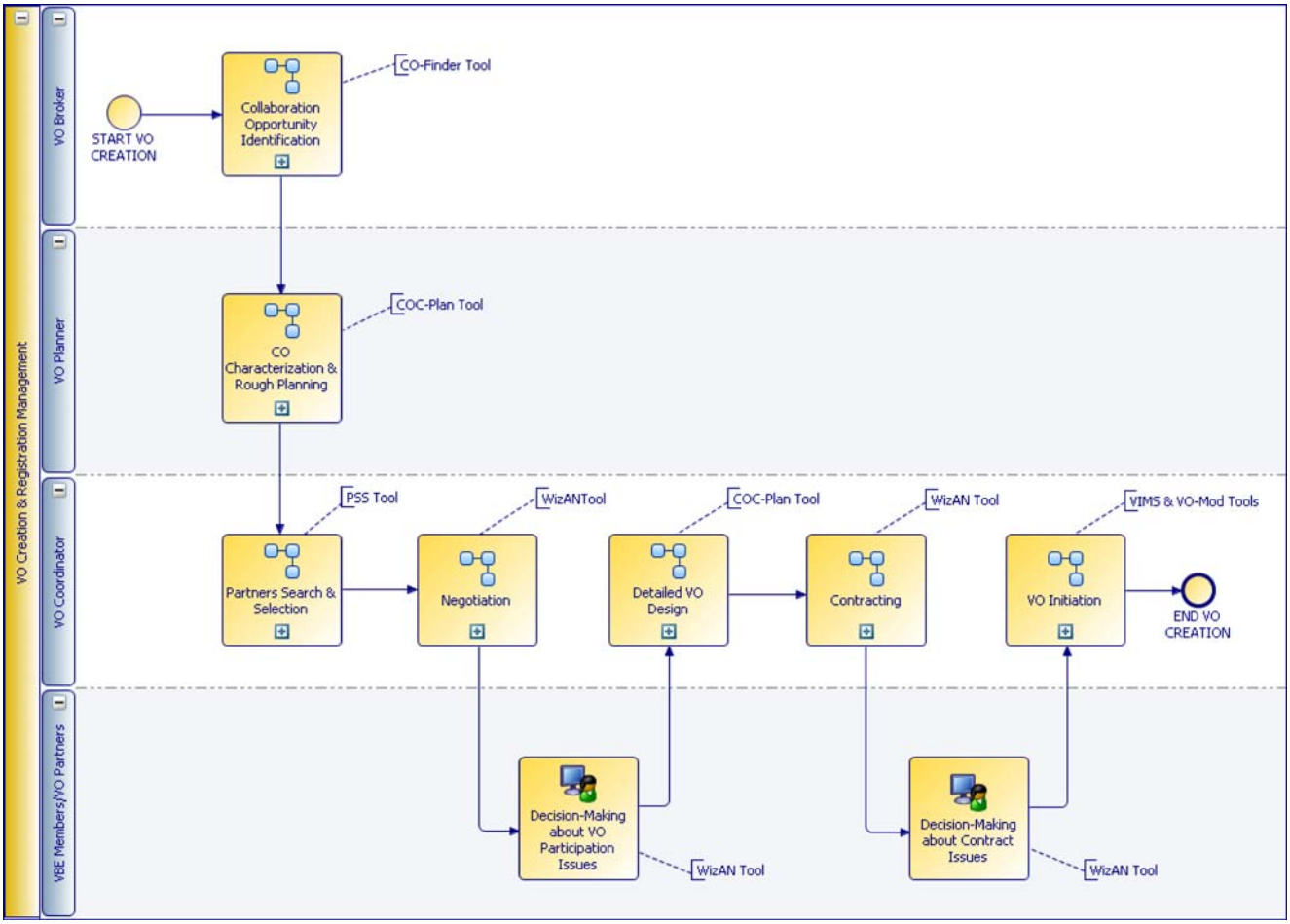

Fig. 5 VO creation & registration management meta-business processes

characterizes and defines a strategy for responding to the CO identified, through the design of a rough plan for the creation and operation of the potential VO (Concha et al. 2008).

CO-Characterization refers to the task of modeling a CO based-on a competency-approach as a combination of processes, resources and standards required in potential VO partners for further matching them in the selection of VBE members capable of collectively responding to the CO identified. CO modeling includes the decomposition of a product and/or a project to be manufactured or executed from its most complex items (assemblies/activities) to the simplest ones (components/sub-activities), each one of these items with their specific competencies required to produce or perform them (Concha et al. 2008).

After finishing the CO-Characterization process, the VO planner will determine a rough structure for the potential VO. This activity is carried out using some modeling tools defined for specific collaborative modalities such as: collaborative business process modality (e.g. workflow tools, web services orchestration), collaborative project modality (e.g. project management tools), collaborative problem solving modality (e.g. expert systems), and ad-hoc collaboration modality (e.g. ubiquitous and co-work tools). Furthermore, with the already identified competencies requirements and capacities in the CO-Characterization, and the selection of the collaborative modality as a basic approach for VO creation, the VO planner will proceed to draft the rough plan for the potential VO with a specific structural and topological design of its future architecture. This process will be supported by the modeling and simulation (assessment) of different collaborative architectures (e.g. VO topology options) as many different activity sequences can be designed in order to tackle the CO identified by the broker in the shortest time (e.g. project critical path) (Concha et al. 2008).

In this scenario, ECOLEAD project proposed a Collaboration Opportunity Characterization and VO Rough Planning (COC-Plan) tool to support VO planner in the characterization of a CO in terms of competencies required to further matching VO partners in the Partners Search and Selection step, and also in terms of collaboration modalities for defining the VO project Gantt (the VO rough plan)

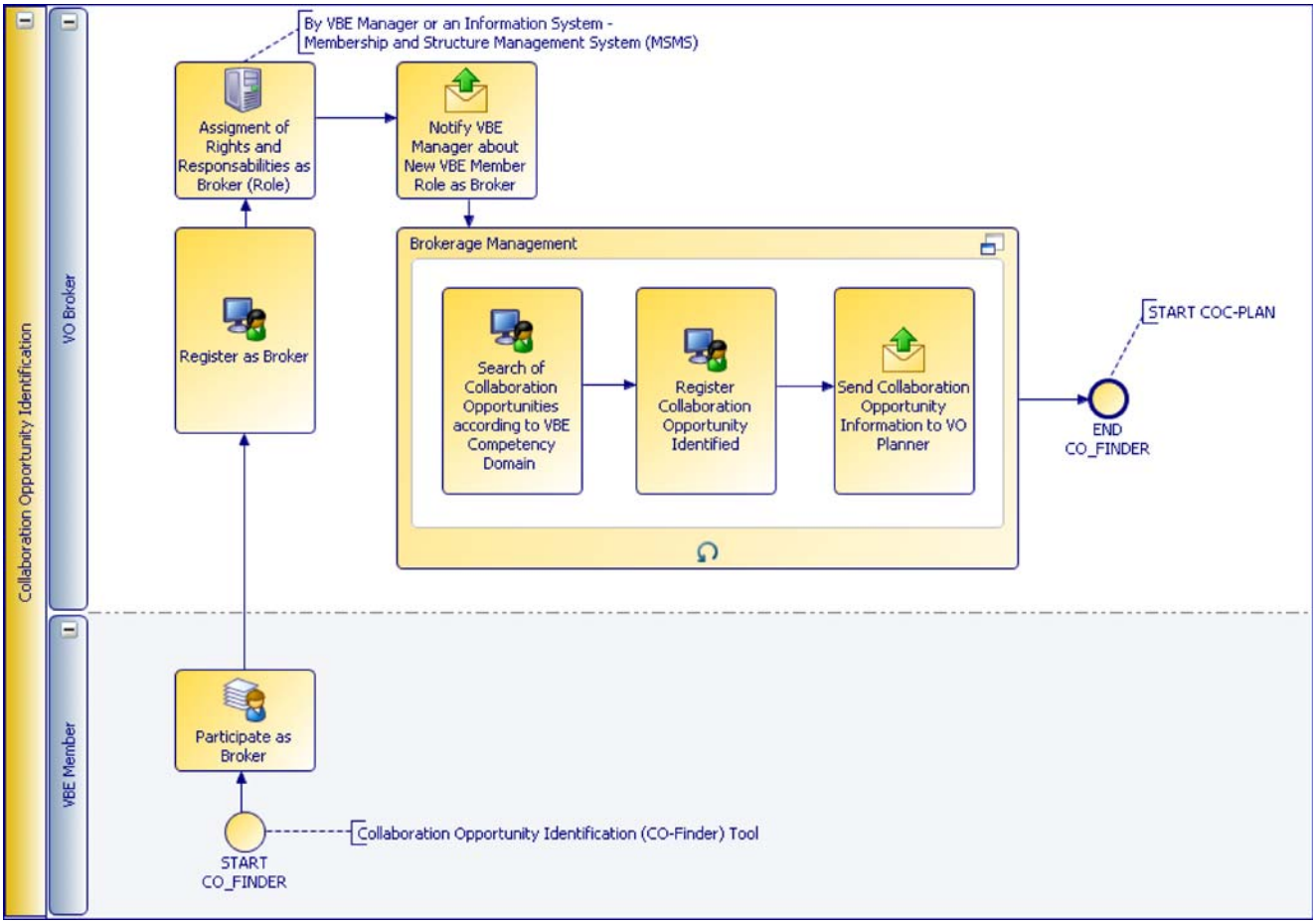

Fig. 6 Collaboration opportunity identification (CO-finder)

needed to finalize the VO creation process (Concha et al. 2008). Note: ECOLEAD project is currently addressing the collaborative project modality and the other three collaborative modalities remain as further research (see Fig. 7).

3.2.3 Partners search and selection

VO Creation Framework third step (see Fig. 5) is the partners search and selection (see Fig. 8). This step is devoted to the potential VO partners' identification, assessment, and selection when a CO is identified. The VO partners search is carried out by the VO planner in a first instance based-on the competency requirements identified in the CO-Characterization process. Additionally, VO partners' assessment and selection is performed based-on a sort criteria like price, delivery date, quality level, etc. and also based-on a past performance record analysis and collaboration preparedness level of the potential VO partners (Baldo et al. 2007; Jarimo et al. 2006).

The Partner Search and Selection (PSS) tool is proposed to assist the VO planner in the search, assessment and selection of the most suitable VO partners regarding to the specific requirements of a given CO in terms of competencies (processes, resources and standards). This selection, performed manually, could be very time consuming in a VBE with huge number of members, and their assessment based on multi-criteria approach appears to be also very complex to be carried out manually, therefore computer assistance approach to facilitate the VO planner's work is proposed (Baldo et al. 2007; Jarimo et al. 2006).

PSS will try to match the CO-characterization results (a list of competencies and other CO specifications) with the VBE members' competencies by matching CO-Characterization data vs. PCMS data with the purpose of obtaining a list of potential VO partners to configure the VO. This list should include an associated risk analysis and the possible configurations expected performance with respect to the VO partners selection criteria. Moreover, these possible VO configurations should be presented to the VO planner for a further decision making about the final VO composition (Baldo et al. 2007; Jarimo et al. 2006).

3.2.4 Agreement/contract negotiation wizard

VO Creation Framework fourth step (see Fig. 5) also considerate an interactive process during the whole VO

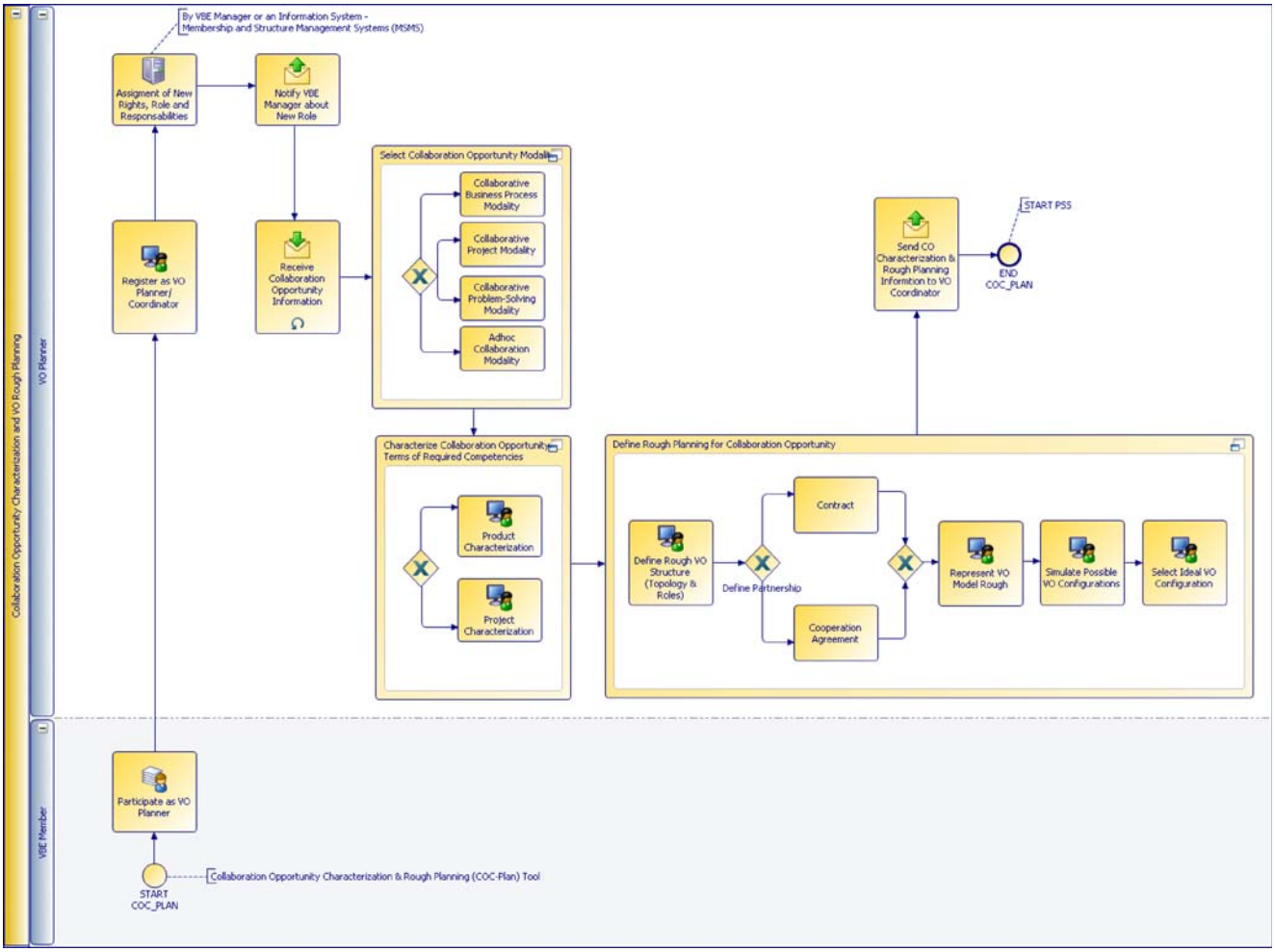

Fig. 7 Collaboration Opportunity Characterization and VO Rough Planning (COC-Plan)

creation process, is the modeling of contract and agreements between VO actors (see Fig. 9). In this context, the Agreement/Contract Negotiation Wizard tool (WizAN) proposed by ECOLEAD project aimed to assist VO planner, VO coordinator and potential VO partners in the possible negotiations between them to get involved in a VO. The main outcome of this negotiation was a contract with certain agreements that will govern the behavior of VO actors involved in the future VO (Camarinha-Matos and Oliveira 2006c; Oliveira et al. 2008).

The WizAN is a tool proposed to offer computer assistance to a process that is mainly conducted by human actors (VO planner, VO coordinator and potential VO partners) in the VBE distributed environment, and can be hardly structured as a flow and length of interactions between actors trying to reach an agreement through a set of decisions about their conditions for collaborative work in a VO. For this reason, ECOLEAD project aimed to support an e-negotiation environment with a set of electronic interactions that attempted to enable fast contracting process through virtual meeting rooms and e-contracts, where actors can discuss and try to reach agreement in the description of the rights and duties of all VO partners, including penalties to apply to those that do not satisfied the agreements taken (Camarinha-Matos and Oliveira 2006c, Oliveira et al. 2008). According ECOLEAD project main functionalities to be provided by a WizAN tool are:

- The *assistance perspective* mechanism objective refers to providing an edition of (legal) contract templates and catalogue of clauses to help VO actors in composing contracts for their organizations in an incrementally collective process where the final contract results from intensive negotiation steps during VO creation process of different agreements that will finally be integrated in a single document known as “contract”; clauses may include some performance indicators to measure VO partners’ performance along the VO operation.
- The *internal agreement* mechanism objective aims to put on the negotiation table a set of agreements between

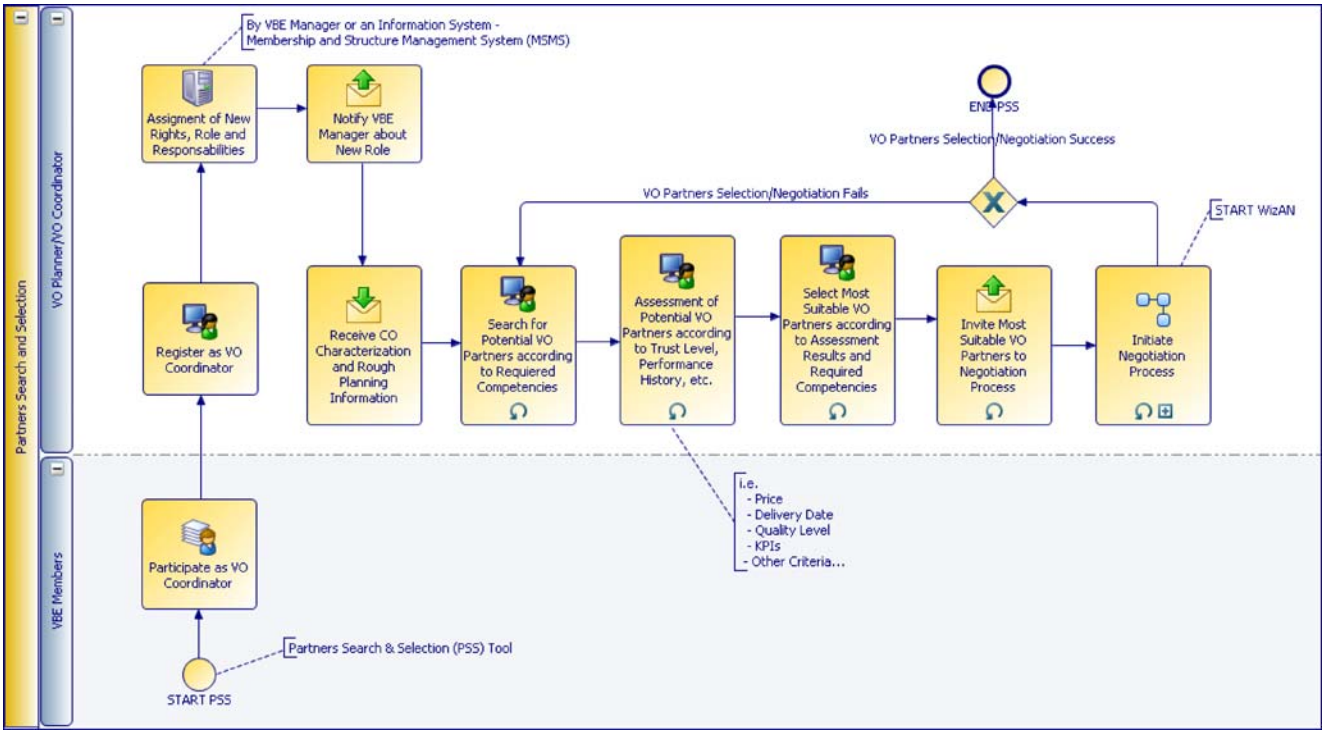

Fig. 8 Partners Search and Selection (PSS)

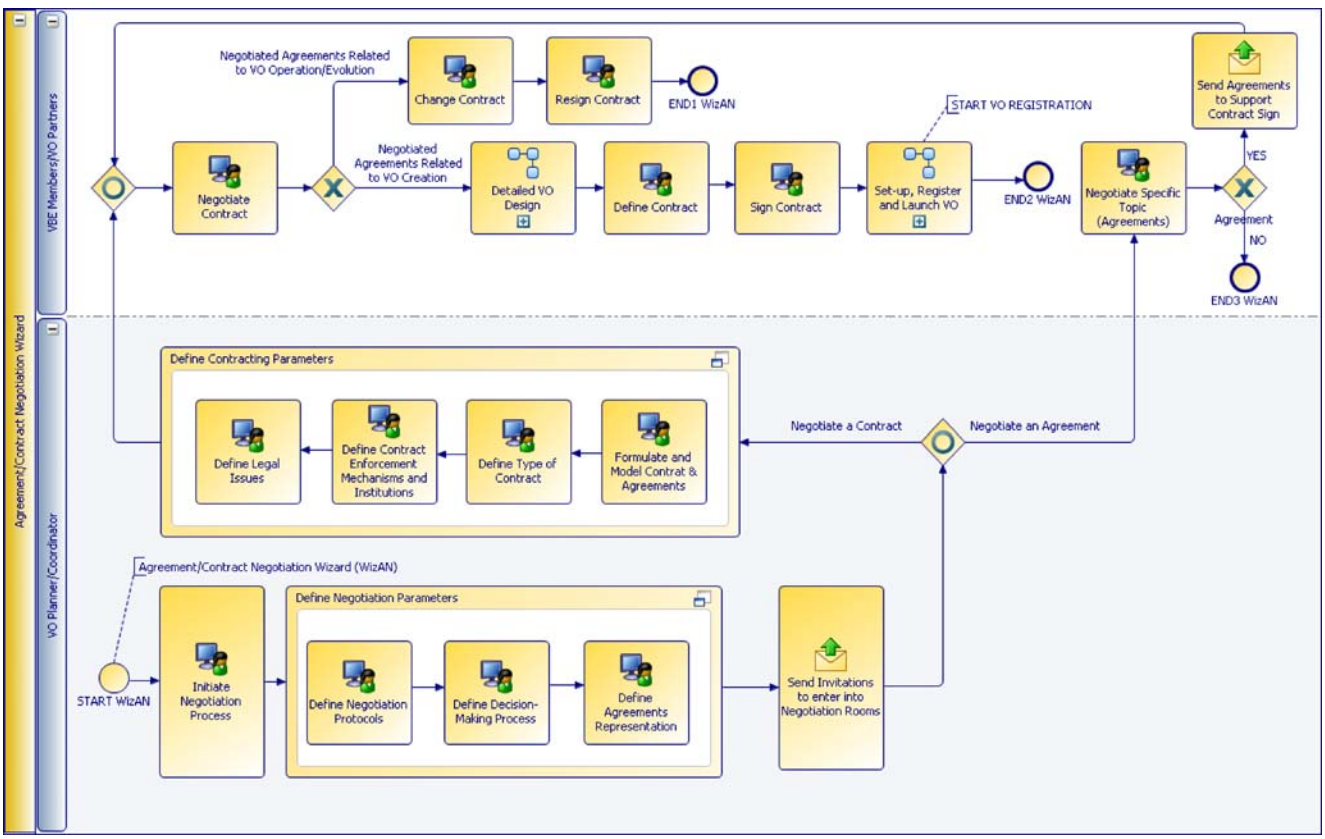

Fig. 9 Agreement/contract negotiation wizard (WizAN)

VO actors, rather than on the contract with the VO customer, to establish all the agreements among VO partners that will regulate their collaboration. Furthermore, it is important to mention that the negotiation is a multi-step interactive process that can support other VBE and VO processes and tools if it is necessary.

- The *negotiation focus* mechanism's objective is to ensure that negotiation between VO actors happens and agreements are reached by providing the necessary negotiation instruments towards the selection of members to compose the VO.

3.3 VO operation management

This pillar refers to the VO Operation Management emphasizing the VO initiation, operation, evolution and dissolution phases in the VO lifecycle (see Fig. 10). It is important to note that VO Management is about the business processes management going over and across the VO partners; it is not about the VO partners themselves managing. Therefore, the VO management concern is to look with a magnifying glass to the performance of the VO partners' business processes responsible for a specific part of the complete VO distributed business process (Karvonen et al. 2004; 2005; Ollus et al. 2007).

3.3.1 VO initiation: Registration, set-up & launching

Once that VO creation process ends with a VO contract signed detailing the VO operation structure, detail rough plan (schedule, milestones and checkpoints) and VO partners' responsibilities, profit and risk sharing , three final tasks should be performed before VO is launched according to ECOLEAD research (see Fig. 11).

First task is the new VOs' registration at the VO Information Management System (VIMS) to carry out a control of the newly number of VOs created within the VBE and what kind of VO partnerships are being created to engage the different types COs identified. Moreover, *VO registration process* refers to the VO profile creation that should include general information about the VO itself and partners (e.g. list of VO partners, roles and rules), plus competency-related information as the VO partners' competencies involved for tackling the CO identified. Second task refers to the VO infrastructure and collaborative tools set-up. Third task refers to the definition of a set of key performance indicators to be used to monitor the VO performance during its operation.

Furthermore, ECOLEAD project suggested the use of a Supported Indicator Definition (SID) tool designed to support the VO coordinator in the selection, configuration and activation of VO performance indicators with the assistance of a catalogue of pre-defined indicators, an indicator management, an impact analyzer, and a measurement schedule generator (Karvonen et al. 2004; 2005; Ollus et al. 2007).

3.3.2 VO operation: Execution & delivery management

Once the VO is launched, the operation of its regular (distributed) processes and activities according to its detailed plan start. At the same time the VO performance measurement starts monitoring the VO performance as a whole, but also the single VO partners' activities based-on a set of VO performance indicators defined with the SID tool help (Karvonen et al. 2004; 2005; Ollus et al. 2007). VO performance measurement focuses on providing visualization, monitoring and alerting functionalities to the VO coordinator by managing different sources of data and information coming from the VO partners' processes (Graser et al. 2005; Ollus et al. 2007; Westphal et al. 2007) (see Fig. 12).

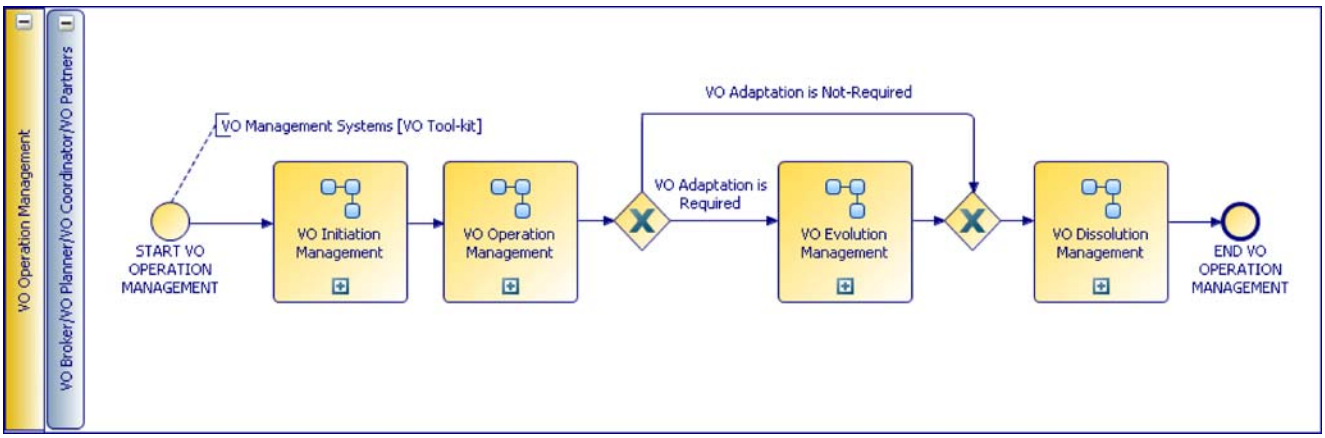

Fig. 10 VO operation management meta-business processes

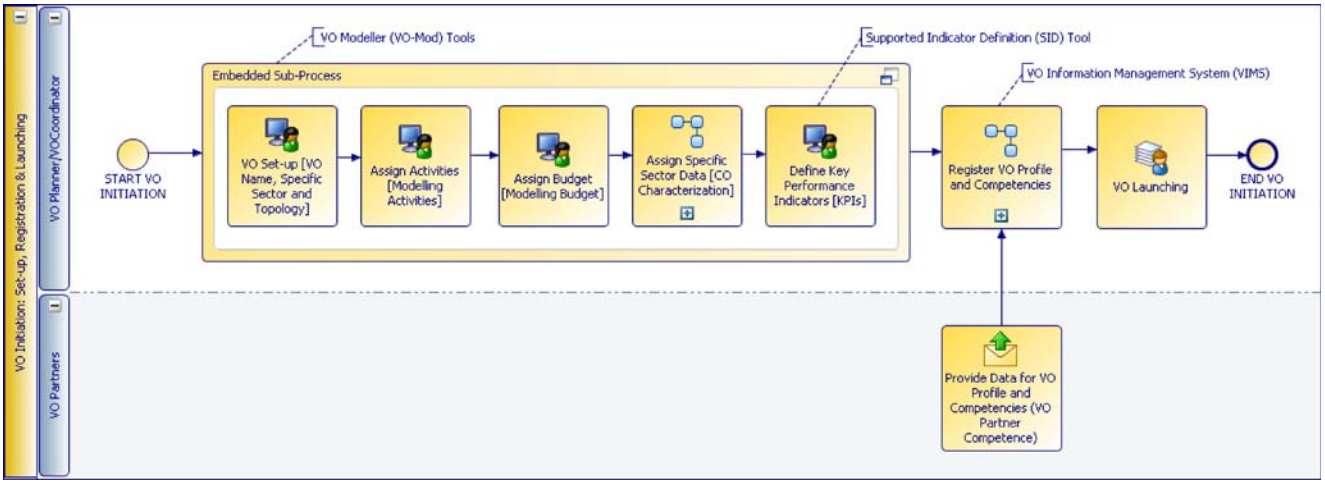

Fig. 11 VO initiation: set-up, registration & launching

- The *VO visualization* functionality aims to support the observation and monitoring of the VO state and its progress with real-time view of ongoing VO activities.
- The *VO monitoring* functionality focuses on detecting exception conditions that may require the evolution of the VO to achieve its goal (see Section 3.3.3).
- The *VO alerting* functionality notifies the VO coordinator about the current VO status and its progress during its entire VO lifecycle.

ECOLEAD project suggested the use of a Distributed Indicator Information Integrator (D3I) tool to collect the performance measurements of the distributed VO partners, which were transformed into aggregated measurements by the Support Indicator Definition (SID) tool. Furthermore, the VO coordinator can monitor all VO indicators defined through a Monitor and Finance Component (MAF) tool represented by a dashboard capable of providing an appropriate visualization of the actual VO status based-on the alert rules defined for monitoring the VO performance. In case of possible inconsistencies or lack of performance the MAF will alert the VO coordinator to prevent exceptions, or in case that an exception occurs move to an VO evolution process (see Section 3.3.3) as a contingency plan to guarantee VO success (Karvonen et al. 2004; 2005; Ollus et al. 2007).

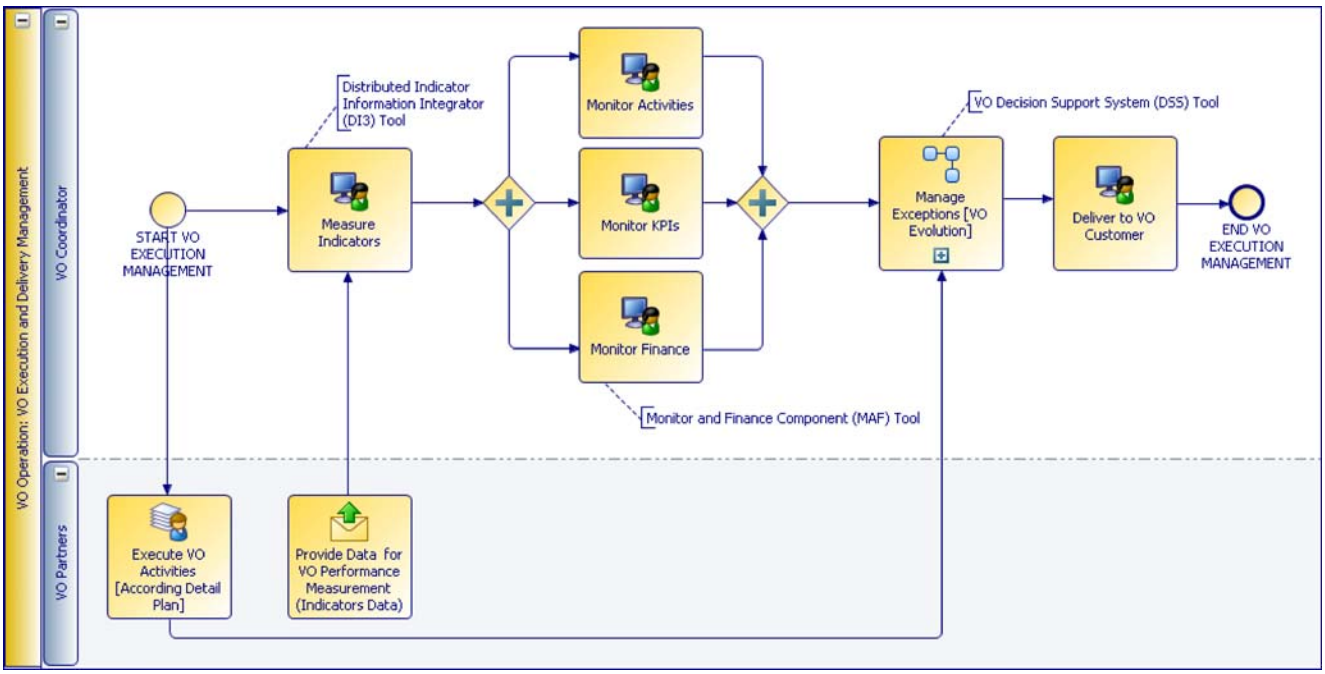

Fig. 12 VO operation: execution & delivery management

3.3.3 VO evolution: Exceptions management

Different exception conditions can modify the VO detail plan during the VO operation, such as: task rescheduling, partner substitution, activities reallocation, resources reallocation, risk management and budget management; these conditions trigger the VO evolution process. The purpose of the monitoring and alerting functionalities described before, aim to detect these exception conditions in a proactive way to prevent the VO failure in case of identification of delays or other problems like no availability of the required resources, quality problems, etc. In this way, on-time correction actions can be taken to guarantee the VO success (Karvonen et al. 2004; 2005; Ollus et al. 2007) (see Fig. 13).

For this purpose, ECOLEAD project suggested a VO Decision Support System (DSS) with simulation capabilities that generated "what-if" scenarios starting from a given VO status (snapshot) to support the decision-making activities of the VO coordinator (Karvonen et al. 2004; 2005; Ollus et al. 2007).

3.3.4 VO Dissolution: Inheritance information management

As part of the VO dissolution process, the VBE management will get involved in the VO management to pull as an inheritance procedure all valuable immaterial assets created during the VO creation and operation (see Fig. 14).

VOs create various kinds of assets during its lifecycle, and these assets could be valuable for the VBE, for this reason, proper management of them could be a benefit for VBE administration and other VBE actors. VO inheritance management has the objective of retrieving priceless information from the VOs created as possible best practices and lessons learned from these VOs (e.g. collaborative best practices and procedures), to store them in the VBE bag of assets (see Section 3.4.4) as useful knowledge for future VO creation processes. This knowledge could help in the near future the VBE administration or more accurate the VO planners and VO coordinators in the process of creating and running new VOs (Loss et al. 2006a, b; Karvonen et al. 2007).

According to ECOLEAD research, a consideration to be taken into account when in comes to inheritance management or in other words, a kind of knowledge management, is to respect the confidentiality of the information retrieved from VOs and their members. This information should be classified into confidential, restrictive and public to respect certain agreements in VBE/VO governance (e.g. contracts). Furthermore, other important aspects to consider are the intellectual and property rights (IPR) issues (Loss et al. 2006a, b; Karvonen et al. 2007).

In summary, VO inheritance management refers to a set of processes (e.g. process-based methods and documentation-based methods, see Schindler and Eppler 2003) for gathering all the achievements (information, knowledge and experience) of the VOs created and being dissolved, and its storage in the VBE bag of assets to ensure the sustainability and success of VO creation and operation processes in the near future (Loss et al. 2006a, b; Karvonen et al. 2007).

3.4 VBE general management

This pillar concentrates on the VBE General Management business processes (see Fig. 15) needed to run some basic but relevant management processes in charge of supporting the effective VBE management during its lifecycle. Following sections will detail each one.

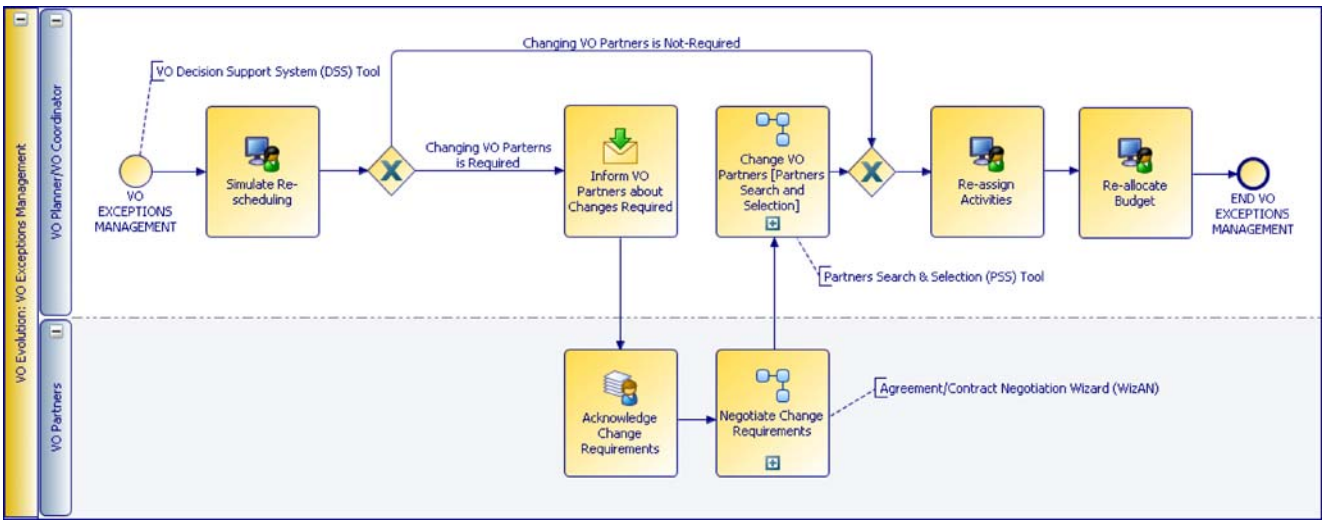

Fig. 13 VO evolution: exceptions management

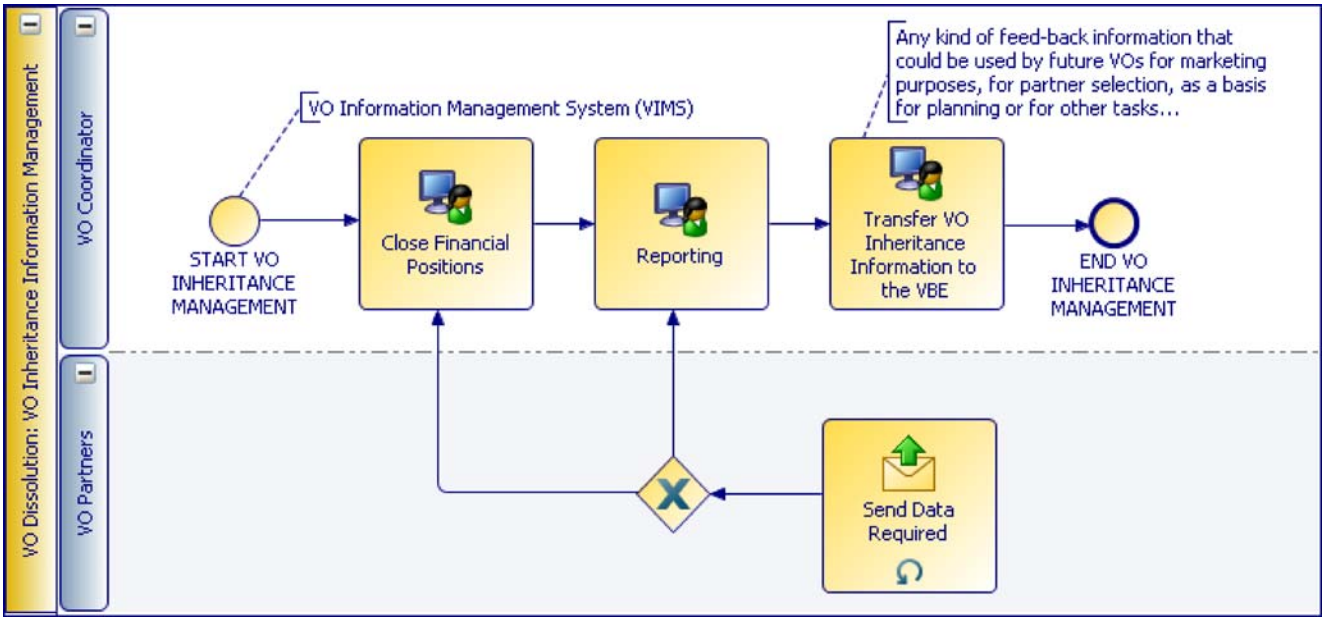

Fig. 14 VO dissolution: VO inheritance information management

3.4.1 Strategic & marketing management

Since a VBE represents a collaborative network, traditional strategic management and marketing/branding concepts based-on single organizations might not work in a network context.

However, considering strategic management as a "bundle of activities enabling the conscious alignment of organization's ambitions with the internal resources and the external settings it is facing", it may be possible to extend this concept to cover a new "network" strategic management approach where strategic thinking focuses on activities related to the alignment of different organizations ambitions that have the potential and willingness to cooperate with each other (Sturm et al. 2004). In this sense, strategic management in network structures such as a VBE hopes that based on common assumptions about benefits of collaboration such as: survivability in turbulent market conditions and better achievement of common goals by excelling individual capabilities (focus on core-competencies), VBE members will favor the confrontation of ideas and practices for strategy formulation and deliberated about strategy making in order to combine their skills, resources and technologies to collaboratively plan a strategy for the VBE. This strategy should benefit all VBE actors and promote the VBE members competencies for VO creation as a way of reaching business opportunities that would not be possible on their own (Camarinha-Matos and Afsarmanesh 2006a).

Furthermore, the challenge for network strategic management would be to manage a collaborative strategy making process where related activities such as: goal setting, strategic analysis, strategy formulation, strategy implementation and strategic control, will be surrounded by

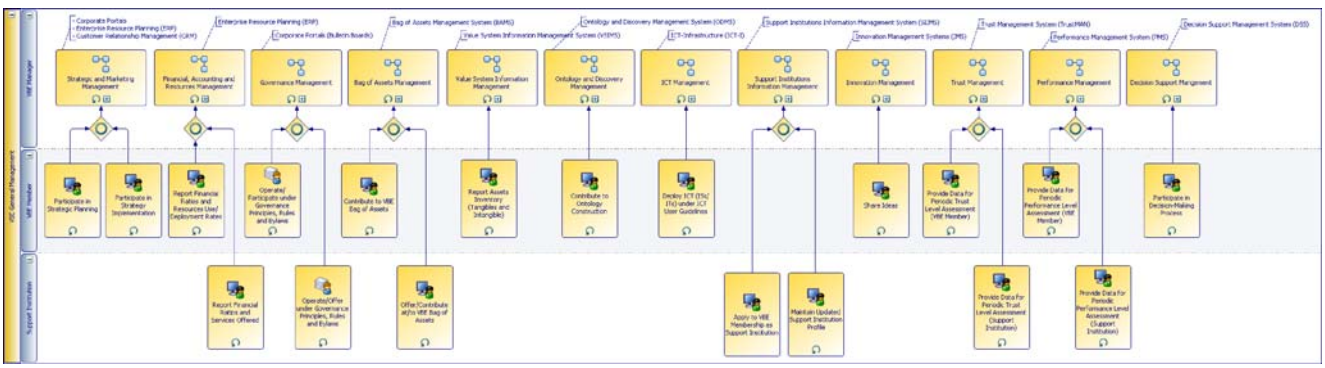

Fig. 15 VBE general management meta-business processes

some frictions, dilemmas and tensions in the process (Sturm et al. 2004).

Some benefits of collaborative strategy formulation could be the availability of more information about the market and potential customers by combining the different business intelligence knowledge bases of VBE members to support strategic decision making for VBE strategy.

On the other hand, when it comes to marketing and branding in network context, two concepts can be applied to the VBEs: (1) co-branding and (2) relationship marketing.

Relationship marketing involves the creation and distribution of value through mutual co-operation and interdependence (Sheth 1994), and co-branding involves the long- or short-term association or combination of two or more individual brands, products, services, or other distinctive proprietary assets to form a separate and unique product, represented by a unique brand (Park et al. 1996).

Relationship marketing aims to develop strong relationships with a range of stakeholders, in which emphasis is placed on building longer term relationships with stakeholders, especially customers, rather than on individual transactions. It involves understanding the customers' needs as they go through their lifecycles. It emphasizes providing a range of products or services to existing customers as they need them (Sheth 1994).

Applying the concept of co-branding and relationship marketing to the VBE context a co-branding strategy for VBE members could be the combination of their brands, organizational prestige's and reputations in a unique VBE/VO trademark with high market penetration and positioning in customers minds. This unique and powerful trademark will be marketed using the network structure of the VBE, through a relationship marketing strategy whose objective it is to reach all possible stakeholders and customers in the global market.

To summarize, strategic management comprise the process of strategy formulation, defining a set of activities that enable the conscious alignment of VBE actors' interests with their competencies and the external business environment that the VBE and its member's faces. Furthermore, the process of marketing and branding will support the breeding environment mechanisms for promoting VBE competencies with potential VO customers (see Fig. 16).

3.4.2 Financial, accounting and resources management

As any kind of single organization, a collaborative network such as a VBE has to carry out three fundamental management tasks (see Fig. 17):

- *Financial management* address VBE administration procedures to rise, allocate, and use monetary resources over VBE lifecycle, taking into the account the risk entailed in its investments (e.g. projects). The activity of financial management is the application of a set of techniques that VBE administration use to manage VBE financial affairs, particularly the difference between incomes and expenditures, tax considerations and the risk of investments.
- *Accounting management* is the practical application of management techniques to control and report on the financial status of the VBE to its stakeholders. This involves the analysis, planning, implementation, and control of programs designed to provide financial data reporting for managerial decision making. This includes the maintenance of bank accounts, developing financial statements, cash flow and financial performance analysis.
- *Resource management* is the efficient and effective deployment of VBEs resources when they are needed. Such resources may include financial resources, inven-

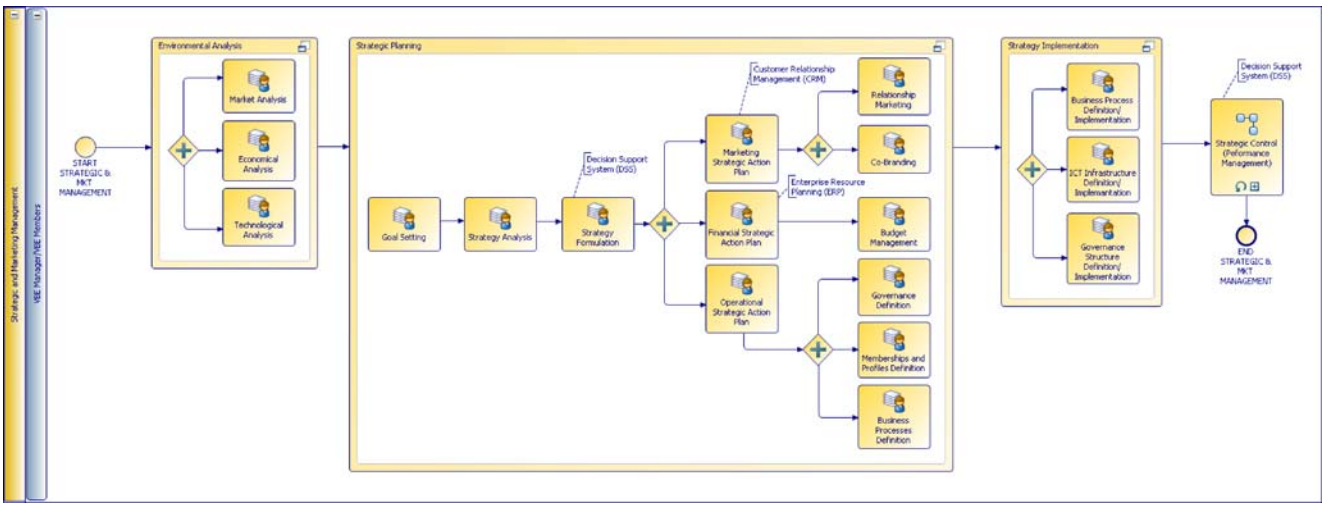

Fig. 16 Strategic and marketing management

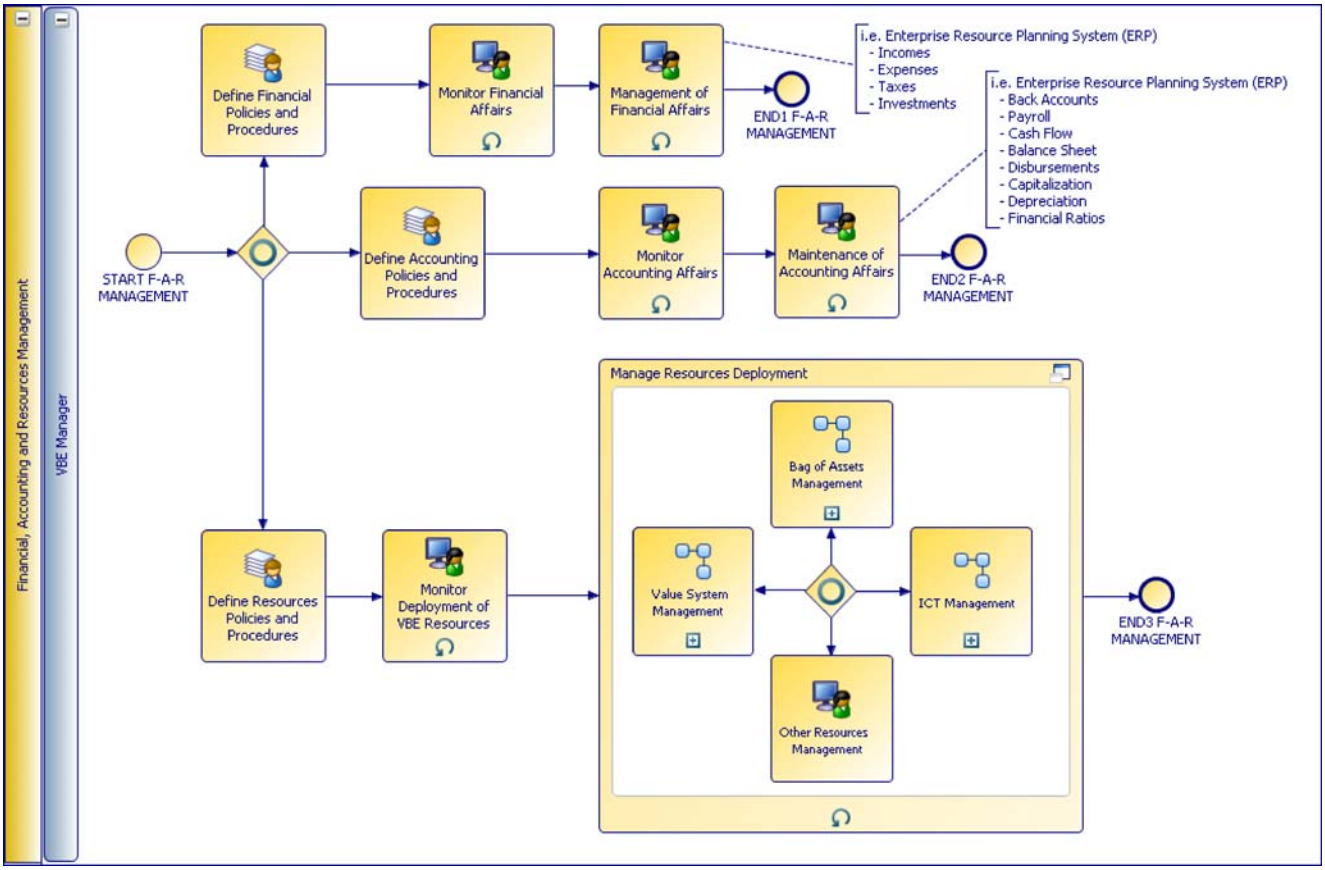

Fig. 17 Financial, accounting and resources management

tory, human/organizational skills, production resources, or information technology. This activity is supported by the following VBE management processes: financial and accounting management, bag of assets management, ICT management, and value system information management.

In short, financial, accounting and resources management provide quality service and leadership through a system of accountability that ensures the effective, efficient, and equitable use of VBE resources in accordance with policies and legal mandate of VBE governance structure.

3.4.3 Governance management

Governance refers to the act of affecting government and monitoring (through policy) the long-term strategy and direction of an organization, in this case the VBE as a collaborative network. According to ECOLEAD research and supported in Romero et al. (2006; 2007b) research, main elements involved in VBE governance include internal operational rules and bylaws. Some of these elements include: membership, incentive and sanction policies, ethical code, VBE culture and administrative functions in order to identify priorities, roles and responsibilities, and bases for decision making in managing sphere during VBE lifecycle.

Governance management (see Fig. 18) will provide the structure of actors, positions, authorities, rights, roles, responsibilities and relationships, and principles, bylaws and rules involved in managing the VBE. The governance structure will define who can make what decisions, who is accountable for which effects, and how each of the VBE actors must work to operate the VBE management process effectively. The VBE governance structure includes actors in defined positions/roles that are for example involved in the creation and managing of the VBE bag of assets, developing and supporting ICT infrastructure, marketing VBE competencies, and most of all achieving the VBE mission (Romero et al. 2006; 2007b).

In few words, VBE governance refers to the broadly rules, processes, or laws by which the VBE is operated, regulated, and controlled.

3.4.4 Bag of assets management

VBEs should promote the sharing of knowledge, skills and resources to facilitate VO creation process. To make this

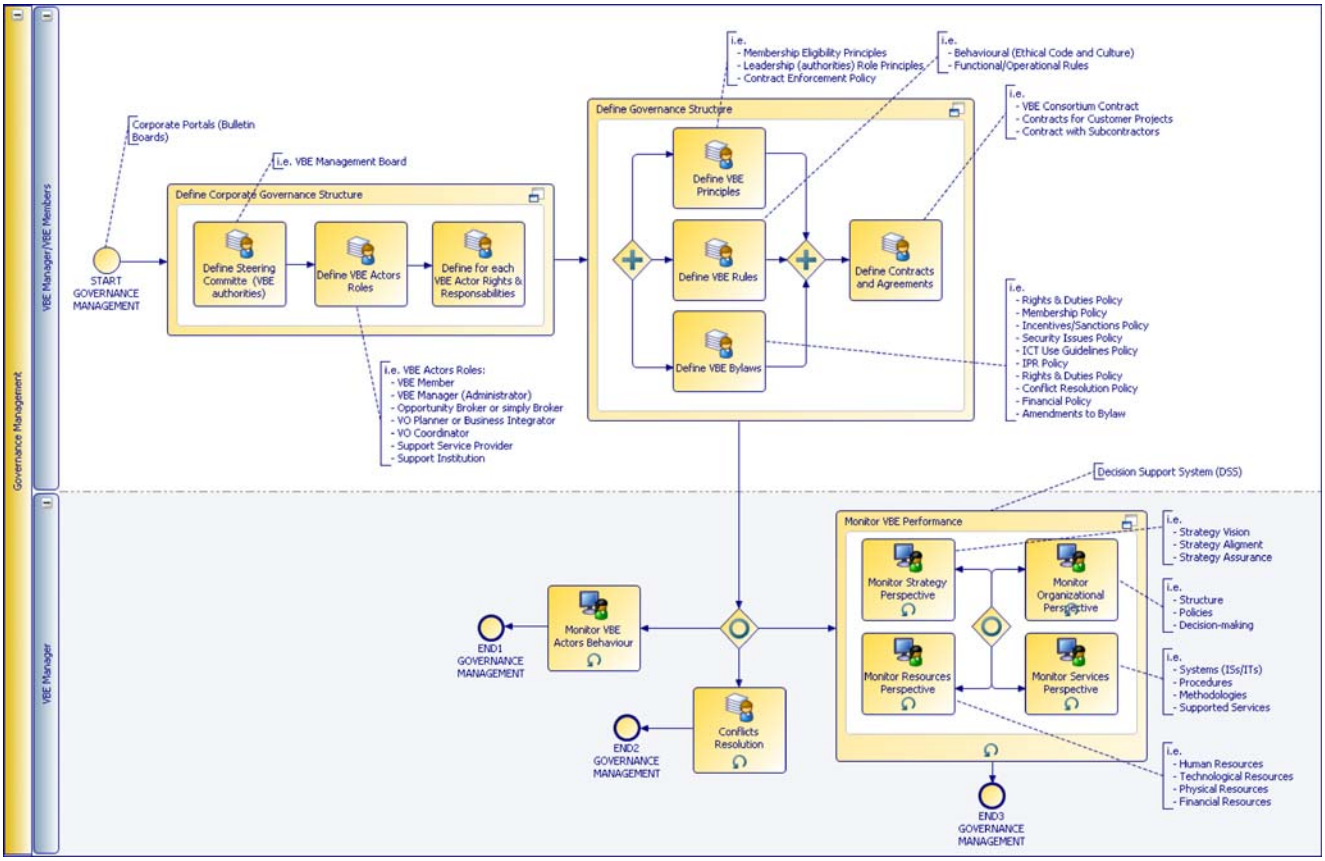

Fig. 18 Governance management

process easier, VBE members should have access to several assets (e.g. sharable information/knowledge, standardized processes, software tools, lessons learned, etc.). These assets are called VBE assets and are kept in the so-called VBE bag of assets.

An asset is anything owned which can produce future valuable benefits: current assets, fixed assets, intangible assets, long-term investments, etc. All these types of assets can be found inside a single VBE actor. Some of them can also be a property of the VBE administration. The main purpose of the VBE bag of assets is to provide those valuable assets property of different VBE actors that are interesting and useful to be shared with other VBE actors (see Fig. 19). Moreover, VBE related assets aim to speed up and improve the process of a VO creation (which is the main task of a VBE).

In a VBE, according ECOLEAD research, the following potential assets have been identified: (a) general policies in the form of documents, books, leaflets to help (new and old) VBE members to easily follow the VBE guidelines; (b) sample contracts to speed up the contracting phase; (c) general legal issues related to the VBE sector; (d) information of interest, specific to the VBE sector; (e) links to other sources of information; (f) lessons learned; (g) FAQs (Frequent Asked Questions). Therefore the main components of a VBE bag of assets should include: documents, software, tools and the VBE ontology.

In this scenario, ECOLEAD project proposed a VBE bag of assets tool as a Content Management System (CMS) and/or Knowledge Management Systems (KMS) that will allow publishing and managing the VBE relevant information. Furthermore, VBE bag of assets can be used by different VBE actors as a bulletin board to provide relevant supporting information to other VBE actors, or by the VBE administration as a dash board to monitor sharing behavior in VBE actors and reward this pro-active and collaborative behavior.

Briefly, this process will provide the features necessary for handling the VBE bag of assets, and support information/knowledge transfer between VBE actors, as well as serve as a rewarding mechanism.

3.4.5 Value system information management

A VBE represents a value system where different activities are carried out by a number of VBE actors forming a value-creation system (e.g. a VO) that uses tangible and intangible assets for creating value for VBE stakeholders and VO customers. Furthermore, VBE actors participate in the value-creation system by converting their skills or core-

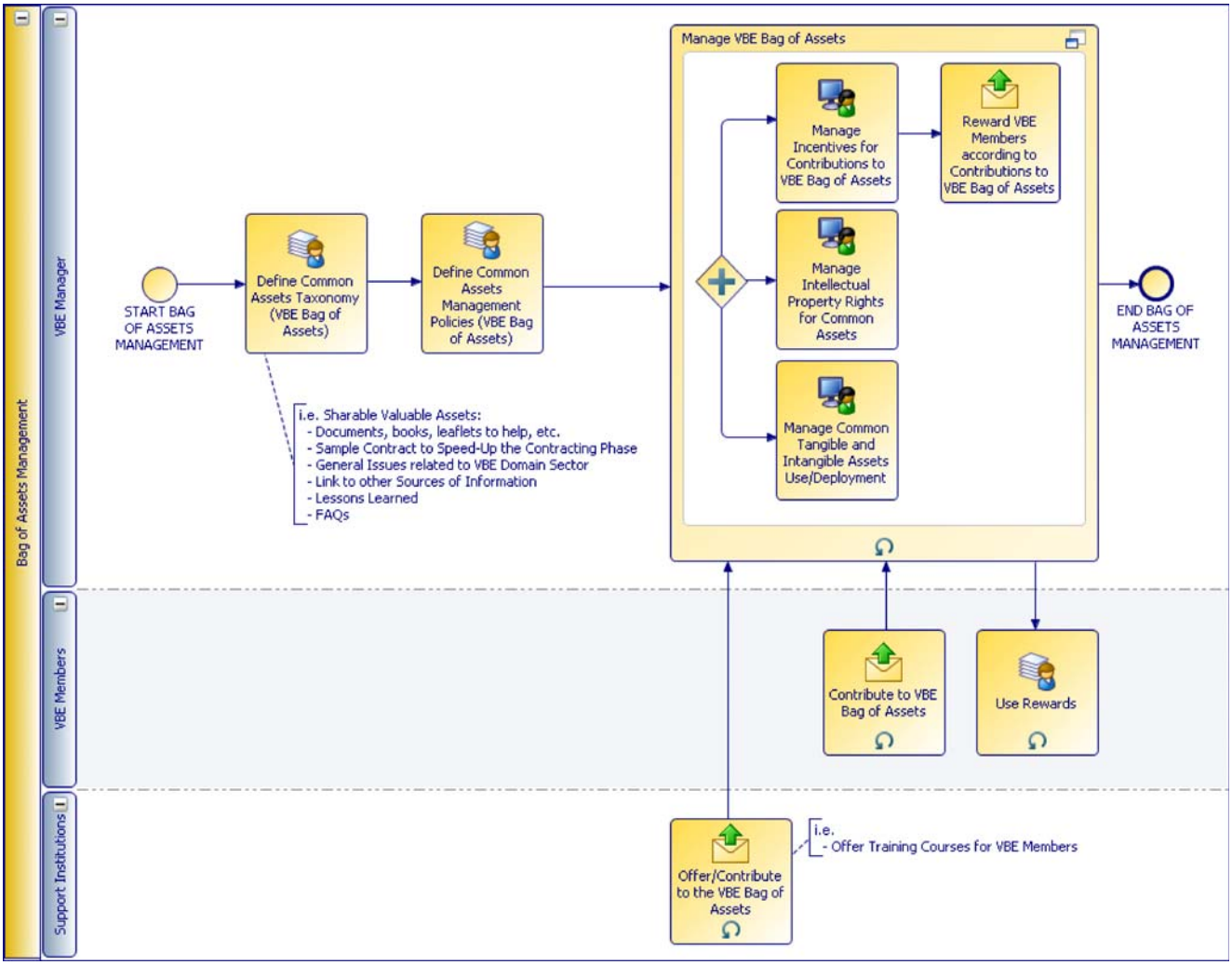

Fig. 19 Bag of Assets Management (BAMS)

competencies and resources (including knowledge) into tangible and intangibles deliverables that should have value for other VBE actors. In a successful VBE every actor should contribute and receive value in ways that sustain their own success (wealth) and the success of the VBE as a whole (Romero et al. 2007a; 2008b).

Therefore, value system information management (see Fig. 20) refers to the identification, structure and measurement of a set of values that a VBE actor holds, exchanges and creates for specific purposes (Romero et al. 2007a; 2008b). However, since these values (assets) may fall into different categories given that the concept of value is multifaceted, based-on the ECOLEAD research and supported in Romero et al. (2007a; 2008b), a type of management structure is proposed as an inventory called "VBE capital system" to better handle these assets. This inventory aims to identify main value generation assets in VBE actors and their possible benefits (productivity related, strategic, social, etc.), and also classified them in a taxonomy according to its nature (financial, intellectual or social capitals) and its owners (VBE actors or VBE itself). Moreover, financial capitals will be related to all physical assets that generate tangible values/assets (e.g. money, products, technologies); meanwhile intellectual and social capitals will be related to all the knowledge and relational based assets that generate intangible and tangible values (e.g. intellectual property, business/commercial relationships).

Additionally to provide an inventory of the value generation assets inside the VBE, value system management will guarantee their effective use to create wealth (value) by carrying out performance measurement based on performance management process to monitor how different VBE actors, activities and resources work together to co-produce value, and will support a set of functional rules that guarantee the ethical viability of the VBE business operation supported in governance management process.

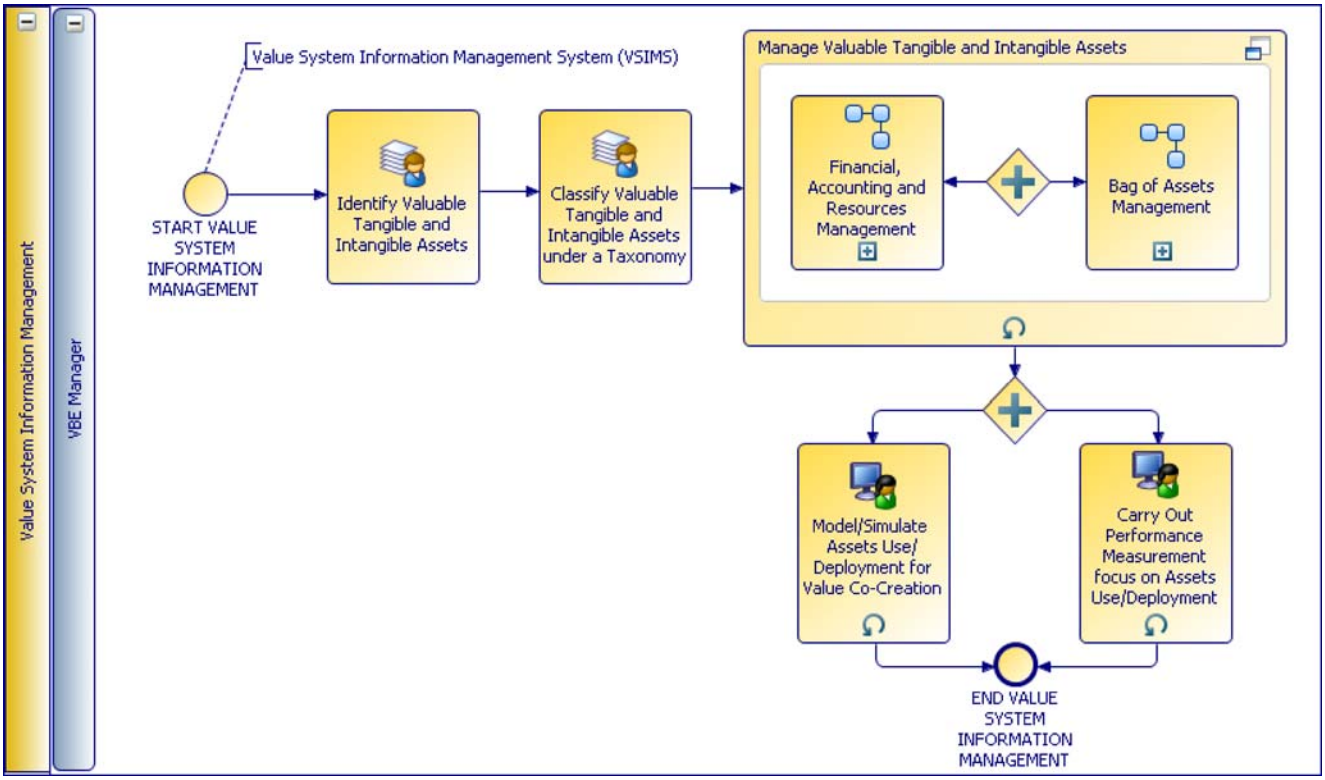

Fig. 20 Value System Information Management (VSIMS)

3.4.6 Ontology management

As mentioned before the VBE ontology is part of the VBE bag of assets but requires a different management approach in relation to other VBE assets. According ECOLEAD research, the VBE ontology refers to a form of dictionary for supporting a common understanding of VBE related concepts among all VBE actors. It represents a formal classification of knowledge and support the interoperability of knowledge among different VBE actors and VBEs (Afsarmanesh and Ermilova 2007; Plisson et al. 2007).

The VBE ontology management process (see Fig. 21) and tool proposed by ECOLEAD project include the following functionalities:

- The *adaptation of common VBE ontology* functionality refers to its adaptation for a specific VBE domain.
- The *discovery and management of VBE ontology* functionality aims to provide evolution of the ontology during the VBE lifecycle and features of viewing/ searching for concepts in it as a form of dictionary.

Furthermore, the Ontology Discovery and Management System (ODMS) proposed by ECOLEAD project used some semi-automatic methods for learning the ontology concepts from on-line text-corpora, since only manual methods will not be effective in a dynamic environment such as the VBE, where new members, competencies, VOs, etc. may occur spontaneously, and processing a huge amount of data may be required, specially in a large VBEs (Afsarmanesh and Ermilova 2007; Plisson et al. 2007). In a phrase, the ontology management will support common understanding between VBE actors and VBEs by providing a common meaning of different VBE related concepts.

3.4.7 ICT management

According to ECOLEAD research and Rabelo et al. (2006), the implementation and management of a VBE depends on the existence of an ICT infrastructure/middleware that allows different distributed/heterogeneous applications/ actors to communicate with each other transparently and seamlessly. Therefore, in order to leverage the potential benefits of networking, more flexible and generic infrastructures are needed to be designed and implemented enabling VBE actors to agilely define and set-up relations with each other (e.g. VO creation). Roughly, this means the need for building and managing an ICT infrastructure that allows a well established group of organizations in the VBE to collaborate between each other as well as to manage this collaboration.

In a VBE, the ICT infrastructure will play the intermediary role as an enabler of interoperation among VBE actors and the support services provided and involved in the

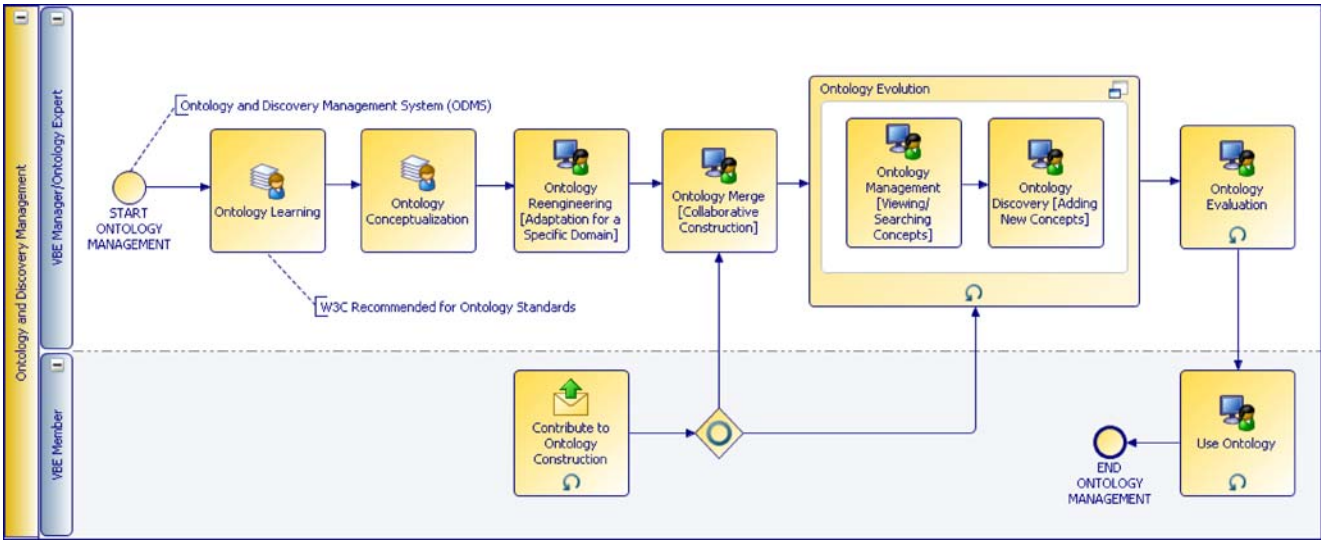

Fig. 21 Ontology Management (ODMS)

VBE. The ICT infrastructure is the base enabler for safe and coordinated interactions among VBE members (Camarinha-Matos and Afsarmanesh 2004; Rabelo et al. 2006; Rabelo and Gusmeroli 2008).

In summary, the ICT management process (see Fig. 22) will enable the interoperation among VBE actors through the design, development and management of a transparent, easy to use, and affordable "plug-and-play" ICT infrastructure (Camarinha-Matos and Afsarmanesh 2004; Rabelo et al. 2006; Rabelo and Gusmeroli 2008).

3.4.8 Support institutions information management

A support institution is defined as any organization that may provide a broad range of services to the VBE and its members. Support institutions can be used in VBE for different purposes of assisting the VBE members and/or the VBE administration. Support institutions constitute part of the VBE and by assuming certain rights and duties can be also considered VBE members (Romero et al. 2006).

In this sense, the support institutions management (see Fig. 23), according ECOLEAD research, should provide functionalities for identifying and acquiring support institutions for the VBE and a tool for managing its information. Those main functionalities are:

- The *support institutions registration* will be carried out by using a simplified version of the *VBE members' registration* mechanism (see Section 3.1.1) where the support institutions will register their general information and competency-related information.
- The *support institutions search* mechanism's objective is to support all VBE actors in the competence-based search at the PCMS tool to find the right support institution for helping them in a specific problem.

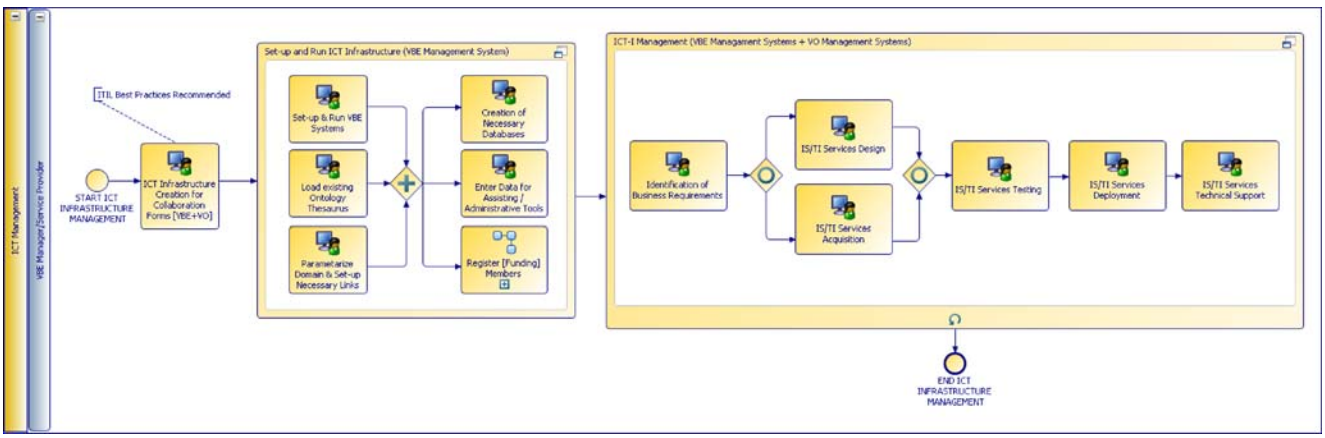

Fig. 22 ICT management

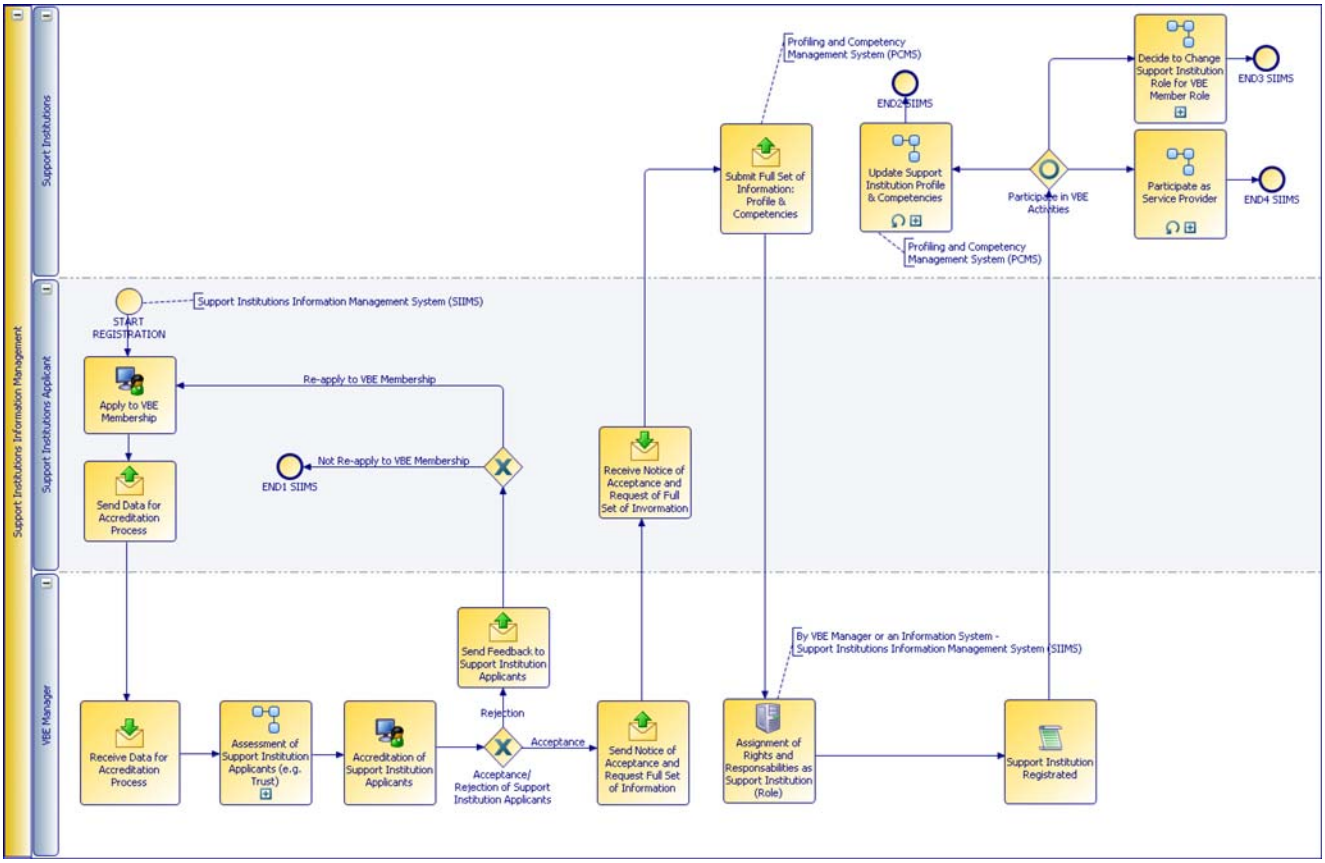

Fig. 23 Support Institutions Information Management (SIIMS)

In summary, support institutions information management will provide support in identifying, and integrating support institutions into the VBE and filter them based on competence-based search for identifying a specific solution provider for specific circumstances.

3.5 Horizontal VBE business process

The horizontal pillar is constituted by four business processes that support the four vertical pillars already described. The VBE Horizontal Management Processes aim to maintain, leverage and optimize daily business processes operations based-on the creation of trustable working environments, with clear performance measurements to support good decision-making processes, towards continuous improvement through a set of innovation processes.

3.5.1 Innovation management

Innovation management refers to managing ideas (innovation) by promoting their generation and leading them into new products, processes or services. Innovation leads ideas through their development into prototypes and marketing tests, and if the internal innovation process succeeded; ideas will reach customers in the form of new products and services (Serrano and Fischer 2007).

In the VBE context, collaboration induces innovation, and thus the creation of new value in the form of new products, processes or services by confrontation of ideas and practices, combination of resources and technologies, and creation of synergies between VBE members (Camarinha-Matos and Afsarmanesh 2006a).

Figure 24 presents the process proposed for generating new ideas that should lead to the development of new products and services that increase the market opportunities of the VBE members.

3.5.2 Trust management

Trust building is one of the most important tasks in VBE management. Trust will be the glue that holds and links all VBE actors together inside the VBE, and also serves as an enabler for cooperation and complexity reduction in negotiations between VBE members to collaborative work in potential VOs. Therefore, trust is a key issue to be managed when it comes to increase the chances of VBE members to get involved in VOs with little known or even unknown of their potential VO partners. Moreover, in order to enhance VBE members' preparedness to collaborate with

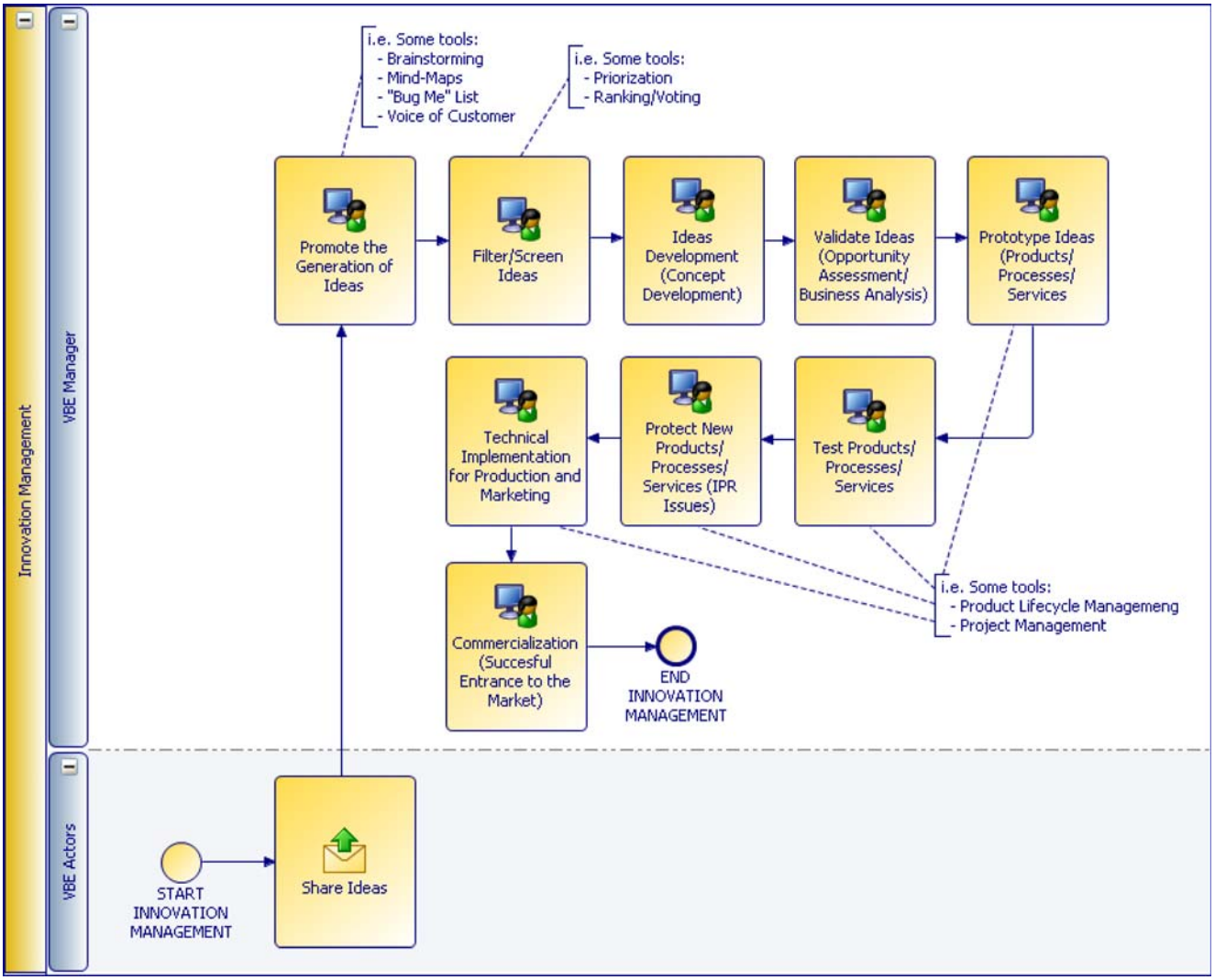

Fig. 24 Innovation management

each other in the achievement of common goals some trustworthiness should be established before VO creation process or any other collaborative process is triggered by a collaboration opportunity.

According ECOLEAD research and supported in Msanjila and Afsarmanesh (2006; 2007b) research, the main purpose of trust management (see Fig. 25) is to support the establishment and promotion of trust relationships between VBE actors. Main functions identified by ECOLEAD research or trust management process are:

- The *VBE membership applicants trust level assessment* mechanism's objective is to verify according to a certain set of membership requirements the basic trust level required for the membership application acceptance of a new VBE members.
- The *VBE members trust level assessment and management* mechanism's objective aims to periodically evaluate the VBE members base trust level, updating their trust background information (e.g. historic performance record) according to a base trust criteria (e.g. social, organizational, managerial, technological or economical) to promote confidence between VBE actors about their collaborative behavior (e.g. fair play) when a collaboration opportunity rise, and also to support VBE administration in the assignment of rights, roles and responsibilities to VBE actors.
- The *VO partners trust level assessment* mechanism's objective is to verify according to certain requirements the basic trust level required for participation in potential VOs.

Furthermore, in order to facilitate a trust management process, ECOLEAD project and Msanjila and Afsarmanesh (2007a) proposed a Trust Management System (TrustMAN) as a tool for helping the VBE administration and the VO planner/VO coordinator to handle three main tasks: base

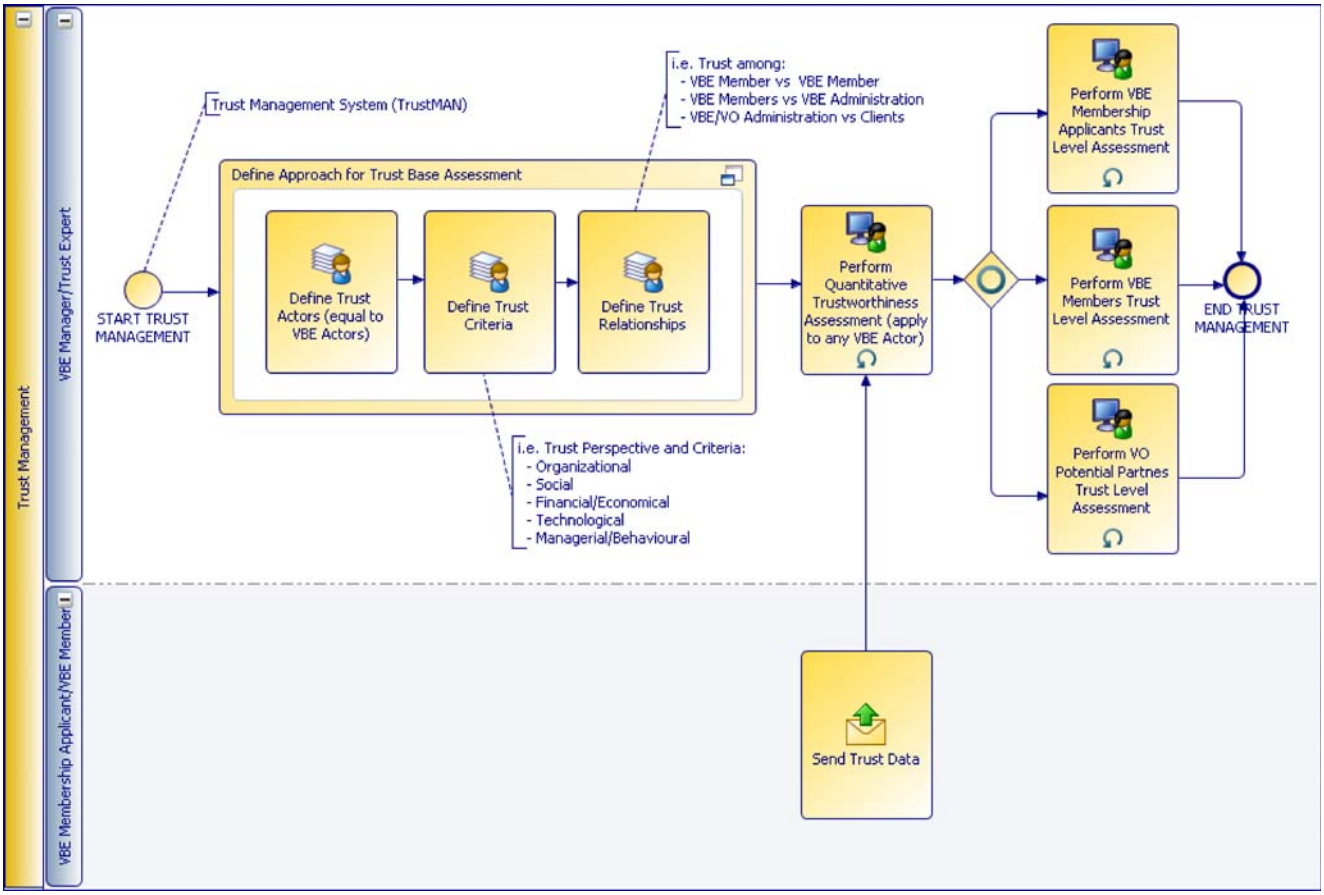

Fig. 25 Trust Management (TrustMAN)

trust management, dynamic trust appraisal and trustworthiness foreseeing. The TrustMAN tool will manage trust background information of VBE member applicants and VBE actors in order to perform trust assessment according criteria defined for supporting decision-making in the different contexts (e.g. selecting VBE members as VO partners).

3.5.3 Performance management

In short, performance management is the process of continually measuring the VBE actors' activities performance with some quantifiable indicators based on a standard on which a judgment or decision can be based. Performance management represents a systematic procedure of planning work and setting expectations and continuously monitoring the VBE performance as a whole and its members by evolving/developing the capacity to execute periodically rating of performance in a summary fashion and reward good performance of VBE actors (adapted from U.S.OPM) (see Fig. 26).

In an effective VBE, administrative work, and especially the work that involves collaboration of different VBE actors should be planned out in advance. This means setting performance expectations and goals so that VBE actors can channel their efforts towards achieving the VBE objectives (Camarinha-Matos and Abreu 2005). Getting all VBE actors involved in the planning process will help them understand the goals of the VBE. The regulatory requirements for planning VBE actors' performance should include the establishment of measurable, understandable, verifiable, equitable, and achievable performance standards.

According to ECOLEAD research, three important factors should be considered when measuring performance: (1) VBE actors' capacities, (2) VBE actor's processes performed, and (3) Final or progressive outcomes achieved by VBE actors.

VBE administration should summarize VBE performance and make a good use of the reward process. On the one hand, this can be helpful for looking at and comparing performance over time or among various VBE actors to know who their best performers are. On the other hand, the rewarding process will recognize the VBE actors, individually and as members of VOs, regarding their performance and will acknowledge their contributions to the VBE mission. Furthermore, applying performance management process to VBE actors' will serve to assess whether progress is being made by the VBE administration and VBE actors towards the desired goals.

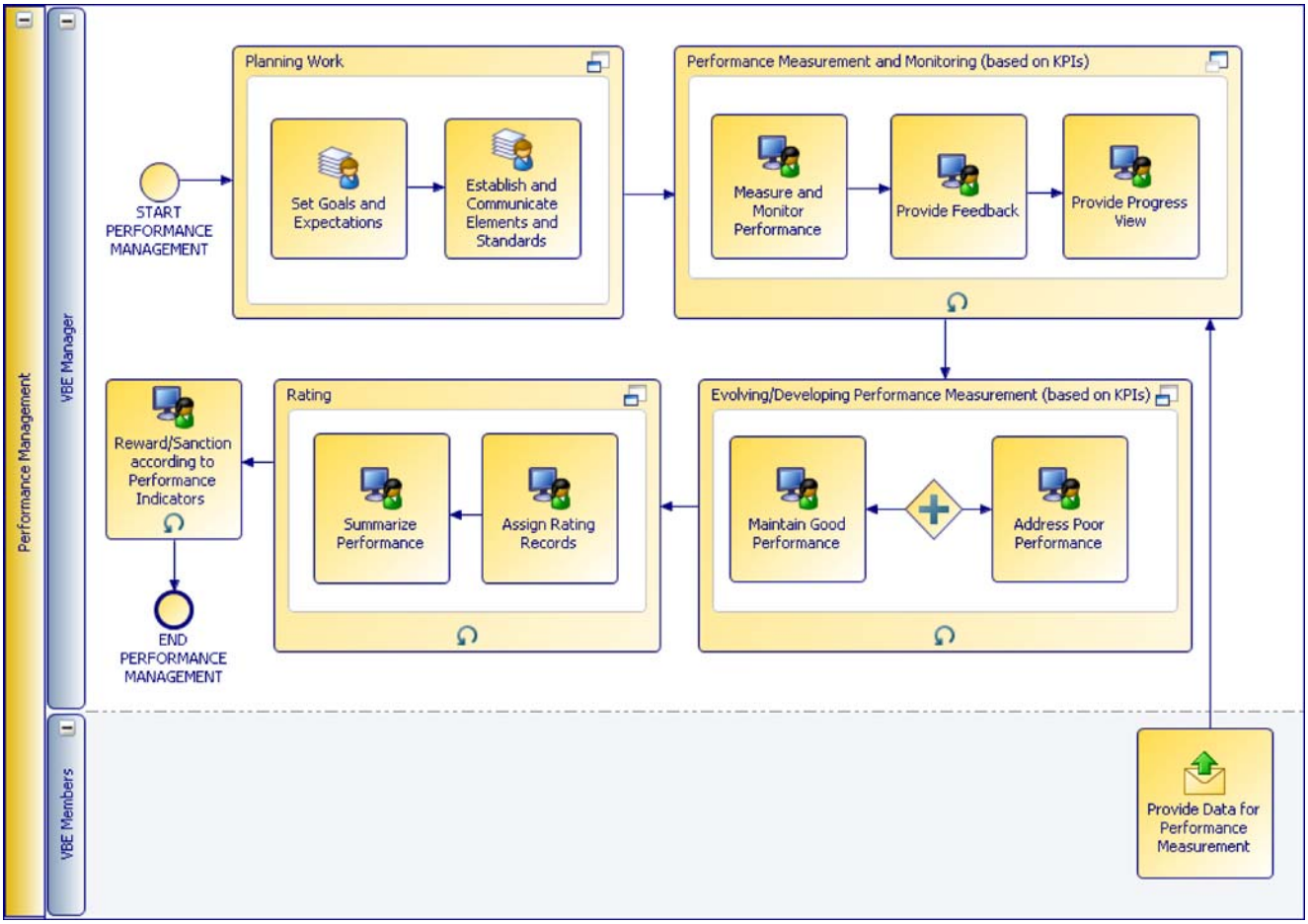

Fig. 26 Performance management

3.5.4 Decision support management

Decision support management (see Fig. 27) in the VBE context refers to the different administrative resolutions to be taken in order to properly manage the multiple activities and roles within the VBE. Therefore, ECOLEAD project proposed a Decision Support System (DSS) as a tool to help the VBE administration and perhaps the VBE members to keep high levels of competitiveness and performance by taking the right decisions. The management decision support functionalities that according to ECOLEAD project should be provided to the VBE administration are: (1) Data analysis by processing the data stored in the VBE databases for providing the administration with easy to understand results (e.g. reports). (2) Pro-active notification by automatically performing, selected data analysis, regularly and notifying the VBE administration by email when the results of these analysis require their attention. Furthermore, the decision support functionalities cover the following areas:

- The functionality of *VBE competency gap analysis* is used to discover weak points and missing competencies by comparing current the state of the VBE with the future strategy. In addition, the system also assists the VBE administration in defining future strategy by determining the missing competencies (competency gap) discovered when evaluating collaboration opportunities or when VO creation failed due to lack of competencies availability.
- The functionality of *lack of performance warning* is a security precaution for ensuring the wealth of the VBE actors. Based on the performance indicators some calculation will be carried out periodically to monitor that VBE actors' performance standards are being achieved. When some VBE actors' performance level falls below the specified threshold an e-mail notification will be sent to the appropriate VBE actors (e.g. the VBE administration).
- The functionality *low trust level warning* is an extension of the lack of performance warning functionality by adding monitoring and notification features to trust management process.

4 Conclusions and further research/work

The I-BPM Framework proposed in this paper was integrated and structured based-on the ECOLEAD project

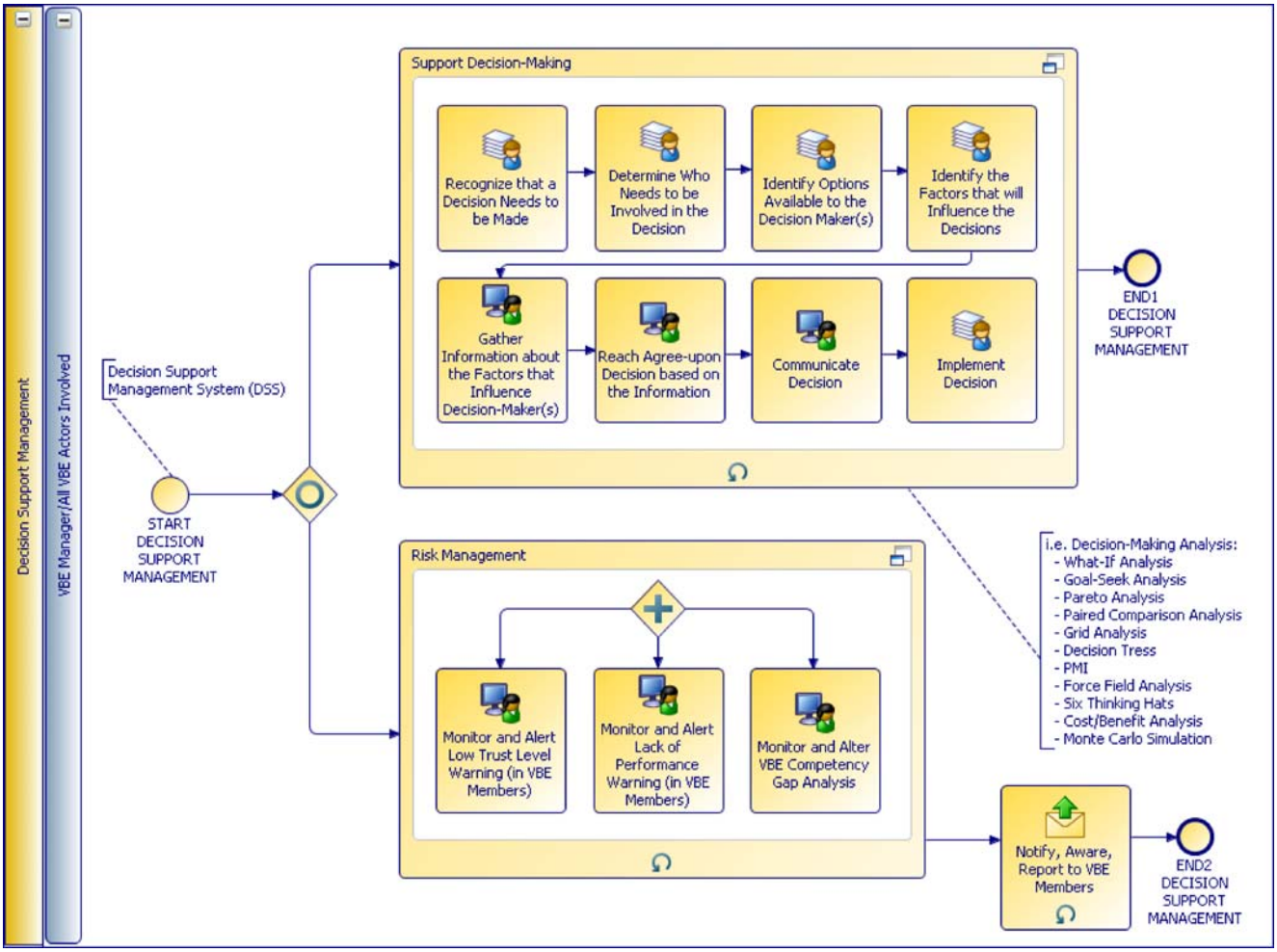

Fig. 27 Decision Support Management (DSS)

key research findings. A complete description for each VBE and VO management processes was provided with a set of process models to explain the rationale of activities that should be carried out by each VBE actor to achieve the expected business process results. The I-BPM Framework aims to serve as a reference model to guarantee the identification and definition of the main VBE and VO management processes for supporting the overall VBE and VO administration during their entire lifecycles.

The BPM centric approach was useful to define a set of general and replicable business processes models for its future instantiation into specific VBEs and VOs. Nevertheless it is important to remark that all business processes will require to be customized according to the VBEs and VOs domains and application environments (see Romero et al. 2008a; Romero and Molina 2009).

Further research will include the simulation of the I-BPM Framework business processes towards its automatic execution in an ICT infrastructure. TIBCO Business Studio 2.0 as the selected tool for the Business Process Analysis (BPA) and BPM modeling exercise presented in this paper will be used again for a simulation exercise. The goal pursued with this outgoing work is to achieve in the near future a business process automation in an ICT infrastructure by translating the business processes models into a XML Process Definition Language (XPDL) and then into a Business Process Execution Language (BPEL) for loading the process models in a Business Process Engine (e.g. JBoss' jBPM) for its automatic execution based-on a set of a set of business process procedural rules to be developed.

Final remarks, the I-BPM Framework can be seen as a fundamental step and a great effort towards defining an integral business process based framework for two of the most promising virtual collaborative forms, the VO Breeding Environments (VBEs) and the Virtual Organizations (VOs).

The I-BPM Framework development was a challenging process, since no "related" integral business process based management frameworks for VBEs and VOs were found in literature, therefore the I-BPM Framework was developed from scratch in order to provide guidance to the VBE managers and VO coordinators responsible for the VBEs and VOs management processes respectively. Authors hope

that this work serve as a staring point to construct in the near future a well-recognized integral business process based management framework for VBEs and VOs.

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