AN INSTANTIATION METHODOLOGY FOR VIRTUAL BREEDING ENVIRONMENTS MANAGEMENT

THESIS
PRESENTED AS PARTIAL REQUIREMENT TO OBTAIN THE ACADEMIC DEGREE OF

Master in Administration of Information Technologies

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MONTERREY, N.L.            March 2007
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Dedicatory

To God for giving me the strength and wisdom
to live and achieve my dreams.

To my father for being an image of struggle and overcoming in life,
for teaching me that if I really want it, I can change the stars.

To my mother, my best friend, for being a strong woman and being with me in good
and bad times of my life, for giving me her love and unconditional support.

To my brother for believing in me, for sharing with me the passion for learning
and the happiness of the success after the arduous work.

To my sister, for her silently admiration.

To my intellectual uncle, for his affection, support and leverage
to my ideas and dreams along this continuous path of growth and learning.

To my working partners,
for team working,
for supporting and encouraging me.

To my working friends,
list is big,
but I appreciate every one of you.

To my fun friends,
Tux, Snake, Alien, Rubik,
Hacky Sack Balls, Turtle,
Chicken and Yahoo Widgets.
Acknowledgements

To my assessor, Arturo Molina,
for allowing me to be part of your research group,
for believing in me and my research work
for your support, guidance and time in this thesis research.

To my reviser, Nathalie Galeano,
for your patience and friendship,
for sharing with me your knowledge,
for your advices to this thesis research.

To my reviser, Ricardo Ramirez,
for your comments and suggestions
for your contributions to this thesis research.

To ECOLEAD project and Partners
for their knowledge and wisdom,
for their contributions to this thesis research.
Executive Summary

Virtual Organization Breeding Environments (VBEs) are long-term cluster/associations of autonomous, geographically dispersed and heterogeneous organizations. The VBE aims to prepare its member’s 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 temporally association of (legally) independent organizations that come together to share skills and resources to achieve a common goal, such as preparing a proposal (or a bid), or jointly performing the tasks needed to satisfy a market/society opportunity by co-producing products/services for the customer, and whose cooperation is supported by computer networks.

Effectively managing of a Virtual Breeding Environment (VBE) is bound to the objective of preparing VBE members and maintaining this preparedness for collaboration in a Virtual Organization (VO). As such, preparedness is a strategic item that requires time to be established and must be refreshed and maintained throughout the entire VBE life cycle. Implementing and efficiently managing a VBE helps to shrink VO set-up times in contrast to selecting enterprises from an “open universe” of enterprises that never collaborated before. Collaboration Opportunities (CO) can be captured much faster and more reliably when using means of a VBE.

Keeping enterprises prepared for collaboration requires management of various kinds of information and business processes. The VBE Management Framework proposed in this thesis is designed to depict all the management business processes needed to create, operate/evolve, metamorph and dissolve a VBE according to the models and concepts developed within ECOLEAD project. The VBE Management Framework has the objective to give a prioritization of all VBE management processes to be supported by human or information system interactions through VBE life cycle.

Finally, a VBE Instantiation Methodology, as a set of guidelines and suggested tools, is proposed to instantiate the VBE Management Framework in different Virtual Breeding Environments domains.
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Chapter 1: Introduction

1.1 Scenery Problem

According to Camarinha-Matos (2002), last decade (90’s) was fertile in the emerging of new collaboration mechanism and forms of dynamic virtual organizations, leading to the concept of dynamic business ecosystem, which is supported (or introduce?) by the progress of the ubiquitous/pervasive computing and networking. The new technologies, collaboration business models, and organizational forms supported by networks tools “invade” all traditional business and organizations what requires thinking in term of whole system, i.e. seeing each business part as part of a wider economic system and environment. It is also becoming evident that the agile formation of very dynamic virtual organizations depends on the existence of a proper longer-term “embedding” or “nesting” environment (e.g. industry clusters and industrial districts), in order to guarantee certain basic requirements such as trust building (“trusting your partners is a gradual and long process”); common interoperability, ontology, and distributed collaboration infrastructures; agreed business practices (requiring substantial engineering/re-engineering efforts); a sense of community (“we vs. the others”), and some sense of stability (when is a dynamic state or stationary state useful). The more frequent situation is the case in which this “nesting” environment is formed by organizations located in a common region, although geography is not a major facet when cooperation is supported by computer networks (Camarinha-Matos, 2002).

According to Camarinha-Matos, Afsarmanesh & Ortiz, (2005), progress in collaboration networks continues showing a growing number of manifestations including virtual organizations, virtual enterprises, dynamic supply chains, professional virtual communities, collaborative virtual laboratories, etc. with a wide spectrum of application domains. The realization that all these collaboration forms represent variations of general paradigm has lead to their consolidation into Collaborative Networks (CN) as a new scientific paradigm (Camarinha-Matos, Afsarmanesh & Ortiz, 2005).

According to Camarinha-Matos & Afsarmanesh (2003b), collaborative networked organizations (CNOs), either as a collaborative among organizations such as virtual enterprise/virtual organization represents a very dynamic research and development area. CNOs provide basis for cooperation, competitiveness, world-excellence, and agility in turbulent market
and environment conditions. In the case of the companies, CNO can support them to identify and exploit new business potential, boost innovation, and increase their knowledge (Camarinha-Matos & Afsarmanesh, 2003b).

According to Bacquet, (2004), in the creation and support of CNOs, information and communication technologies (ICTs) are playing an important role to foster innovative products and business processes. Full benefits for organizations of all sizes will come from their participation in the evolution of clusters from informal alliances of business partners into CNOs, characterized by on-demand co-operation and requiring high inter-linked ICT infrastructures (Bacquet, 2004).

According to Camarinha-Matos (2003), the combination of two factors – the possibilities offered by the fast progress on computer networks and communication technologies, and the markets turbulence and globalization – are inducing new forms of collaboration. In addition to the traditional concept of supply chain and the fist models of virtual enterprise/virtual organization, new organizational forms are emerging. Furthermore the pace of change or evolution in such collaborative organizations is very high, directing the focus of attention to the dynamic/evolutionary aspects of networks. Examples of this trend include: rapid formation or teams for emergency situations/rescue teams (characterized by a scenario with multiple leaders, lack of information and urgency in making decisions). Collaborative entertainment networks (an emerging culture with teenagers), collaborative remote diagnosis, collaborative problem solving (e.g. collaborative data mining), virtual institutes (education), elderly care virtual communities, etc. Understanding the structure and associated behavior of these collaborative forms as well as the required infrastructure, support tools, regulations and operating principles, economic models, and support institutions, are major research challenges (Camarinha-Matos, 2003).

According to Camarinha-Matos & Afsarmanesh (2004d), a large variety of organizational forms of collaboration have emerged during the last years as a result of the many socio-economic challenges faced by society and enabled by new information and communication technology (ICT) developments. Advanced and highly integrated supply chains, virtual enterprises, virtual organizations, professional virtual communities, value constellations, virtual institutes, and collaborative virtual laboratories, represent only the tip of a major trend in which enterprises and professional seek complementarities and joint activities to allow the participate in competitive
business opportunities, in new markets and/or reaching scientific excellence for innovation developments (Camarinha-Matos & Afsarmanesh, 2004d).

As result, according to Camarinha-Matos & Afsarmanesh (2004a), several new industrial paradigms have emerged in recent years as an answer to the fast changing socio-economic challenges, such as the virtual manufacturing, lean enterprise, agile manufacturing, Fractal Company, and holonic manufacturing. Introduction of these concepts in enterprises has made them face successive “was of restructuring” during the last decades. Emergence of the virtual enterprise/virtual organization paradigm falls in the natural sequence of these restructuring processes, enable by the “explosive” developments in the information and communication technologies. The need for remain competitive in the open market forces companies seek “world class” status and therefore, to concentrate on their core competencies while searching for alliance when additional skills/resources are need to fulfill business opportunities (Camarinha-Matos and Afsarmanesh, 2004a).

Furthermore, according to Camarinha-Matos & Afsarmanesh (2004c), a large number of research projects are carried out worldwide and a growing number of practical cases on different forms of collaborative networks are being reported. This trend has so far led to an extensive amount of empirical base knowledge that now needs to be leveraged. In addition to the identification of many required components, tools and the base infrastructure functionalities, awareness is being built and partially studied, even in the traditional collaborative organizations, regarding the fundamental configuration and operational rules, as well the behavioral patterns that emerge. It is now urgent to consolidate and synthesize the existing knowledge, setting a sound foundation for the future research and development in this area. The establishment of the scientific discipline for collaborative networks is a strong instrument to achieve this purpose (Camarinha-Matos and Afsarmanesh, 2004c).

According to Camarinha-Matos & Afsarmanesh (2004d), the emerging paradigm of collaborative networked organizations (CNOs), or simply collaborative networks, is fundamentally changing the way that commercial, industrial, cultural, and social activities are organized. In addition the rapid evolution of traditional supply chain and outsourcing practices, a growing trend nowadays consists of task performed by autonomous teams of a small number of people or small and medium enterprises (SMEs), set up as independent contractors or small firms and linked by a network. These teams usually come together, some times in temporary
arrangements, to tackle various projects, and may dissolve once the work is done. Consider for instance, the wide variety of recent radical outsourcing in design for manufacturing, in software development, or the firm industry: in almost every case, in one way or another “Smart Organizations”, “Virtual Organizations” or “Networked Organizations” represent the collaboration configuration. This trend is also observed in many sectors (Camarinha-Matos and Afsarmanesh, 2004d).

According to Camarinha-Matos & Afsarmanesh (2004d), it is frequently stated that collaborative networks provide basis for competitiveness, world-excellence, and agility in turbulent market conditions. These networks can support SMEs to identify and exploit new business potentials, to boost innovation, and to increase their knowledge. The networking of SMEs with large-scale enterprises also contributes to the success of both kinds of companies in the global market (Camarinha-Matos and Afsarmanesh, 2004d).

According to Saabell et al (2002), in the past years a large amount of collaborative network concepts and approaches have been developed. The motive is based on the changing business situation of companies and customers needs. Main drivers for the rise of organizational networks are mass-customization, extension of products, globalization, and agility (Saabell et al, 2002).

1.2 Problem Statement

According to Afsarmanesh & Camarinha-Matos (2005), early works have assumed that partners for a new VO could be easily identified and selected from the wide open universe of available enterprises/organizations, and merged into a collaborative network. The assumption however overlooks a number of important obstacles in this processes among which following can be mentioned: How to know about the mere existence of potential partners in the open universe and deal with incompatibles sources of information? How to acquire basic profile information about organizations, when there is no common template or standard format? How to quickly establish and inter-operable collaboration infrastructure, given the heterogeneity of organizations at multi-levels, and the diversity of their interaction system? How to build trust among organizations, which is the base for any collaboration? How to develop and agree on the common principles of sharing and working together? How to quickly define the agreements on the roles and responsibilities of each partner, to reflect tasks, the rights on the produced results, etc.? (Afsarmanesh & Camarinha-Matos, 2005).
Also, according to Alexakis et al (2004), the inhibitors and challenges identified during an empirical study for SMEs to participate in collaborative networks are: (1) Clear Organization, (2) Adequate Workforce, (3) Finance, (4) Communication, (5) Loss of Competence, (6) Development of Partnerships, (7) Low Acceptance, and (8) Intellectual Property.

Facing these obstacles, inhibitors and challenges require a proper breeding environment to increase organizations preparedness to support the effective creation and operation of dynamic virtual organizations (Afsarmanesh & Camarinha-Matos, 2005).

As a basic rule, according to Afsarmanesh & Camarinha-Matos (2005), in order to support rapid formation of those collaborative networks, it is necessary that potential partners are ready and prepared to participate in such collaboration. This readiness includes common interoperable infrastructure, common operating rules, and common cooperation agreement, among others. Any collaboration also requires a base level of trust among the organizations. Therefore, the concept of breeding environment has emerged as the necessary context for the effective creation of dynamic virtual organizations (Afsarmanesh & Camarinha-Matos, 2005). We define the Virtual Breeding Environment (VBE) as: “an association of organizations and their supporting institutions adhering to a base long term cooperation agreement, and adoption of common operating principles and infrastructures, with the main goal of incrementing their changes and their preparedness towards collaboration in potential virtual organizations (VOs)” (Camarinha-Matos & Afsarmanesh, 2003a).

According to Camarinha-Matos (2003), the key areas requiring urgent attention regarding to VBE management include: coordination, administration and management of highly distributed activities, risk management and assessment tools, development of value added-services, dynamic evolution of revenues, rights and liabilities, in combination with the understanding of new value system, soft-modeling and reasoning, e-contract management, advanced simulation tools for collaborative networks and new user interfaces seeking an entertainment facet as a way to overcome cultural barriers (Camarinha-Matos, 2003).

According to Camarinha-Matos, Afsarmanesh & Ollus (2005), VBE management it’s the heart of the VBE research and development. Due the fact that are so far no defined “reference models” for the VBEs, to address their different aspects including their behavior, structure, topology, cultural/legal framework, etc., the are no clear definitions of what exact activities are
associated with the VBEs, that need to be supported by their management system. Defining a comprehensive and generic “reference model” for VBEs is very challenging. Nevertheless, with the basis on the initial empiric knowledge that can be gathered from existing cases, it is realistic to gradually define a “reference framework for VBEs”, addressing some of the aspects of the reference model for VBEs, such as its behavior, topology, and structure (Camarinha-Matos, Afsarmanesh and Ollus, 2005).

1.3 Objectives

The objectives of this thesis are:

- To define a generic and replicable VBE Reference Framework for the Management of Virtual Breeding Environments during its entire life cycle.
- To define a VBE Instantiation Methodology as a set of guidelines and suggested tools for instantiated in different VBE domains the key management processes that will support the entire VBE life cycle.

1.4 Scope of the Research

The thesis research was developed within the emerging area of Collaborative Networked Organizations (CNOs). The concept of Virtual Breeding Environment (VBE) will be understood as a fundamental entity to enable the formation of dynamic Virtual Organizations. The research covers the definition of a VBE Reference Framework for the Management of Virtual Breeding Environments (VBEs) and its Instantiation Methodology in different VBE domains. The Instantiation Methodology allows the definition of the key management processes in a VBE and it is based on the stages of the VBE life cycle. A case of study is developed to demonstrate how to use the VBE Instantiation Methodology.

1.5 Structure of Thesis

The concept of Virtual Breeding Environment will be defined in Chapter 2. This chapter will explain first the main requirements for collaboration, and the basic concepts on Collaborative Networked Organizations including their strategic business trends, key drivers for collaboration and business perspectives. Second, it will explain the background and related areas for Virtual Breeding Environments including their source, current manifestations, emerging cases and future trends to finally present their constituting elements, aims, features, actors and their roles, and life cycle.
Regarding to VBE management, Chapter 3 will present a VBE Reference Framework for Management of Virtual Breeding Environments based on three management building blocks: VBE Actors Management, VO Creation and Registration Management, and VBE general Management.

Chapter 4 will propose a methodology to be used in the instantiation of the VBE Management Framework in different VBE domains. This methodology will identify and guide the necessary steps to create, operate/evolve, metamorphes, and dissolve a Virtual Breeding Environment.

An Industrial Case in Monterrey, Nuevo Leon, Mexico will be explained in Chapter 5 using the VBE Instantiation Methodology to create a VBE for the aerospace sector.

Finally, Chapter 6 will mention the main result, key learning points and conclusions drawn after the research done in this thesis.

1.6 About ECOLEAD Project

ECOLEAD is an “Integrated Project” co-funded by the European Commission within 6th Framework Programme (2002-2008). Commencing in April 2004, ECOLEAD is a 6-year project involving 27 partners from 15 countries across Europe.

Vision: “In ten years, in response to fast changing market conditions, most enterprises and specially the SMEs will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations”.

www.ecolead.org
**Objective:** European Collaborative networked Organizations LEADership initiative, ECOLEAD, aims to create strong foundations and mechanisms needed to establish the most advanced collaborative and network-based industry society in Europe: “In ten years most enterprises will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations in response to fast changing market conditions”.

The fundamental assumption in ECOLEAD is that a substantial impact in materializing networked collaborative business ecosystems requires holistic approach. Area's complexity and the multiple inter-dependencies among the involved business entities, social actors, and technologies, substantial breakthroughs cannot be achieved with incremental innovation in isolated areas. On the other hand, project plans must remain manageable. Thus ECOLEAD addresses the most fundamental and inter-related focus areas, which form the basis for dynamic and sustainable networked organizations: the VO Breeding Environments, Dynamic Virtual Organizations and Professional Virtual Communities. In addition to these three vertical focus areas, the holistic approach is reinforced and sustained on two horizontal areas: the theoretical foundation for collaborative networks and the horizontal ICT infrastructure. The horizontal activities support and affect all three vertical focus areas. The theoretical foundation shall provide the basis for technology-independent understanding of the area and its phenomena. The existence of an invisible, low-cost ICT infrastructure is a pre-condition for the establishment of truly dynamic collaborative networks. ECOLEAD is expected to impact industrial competitiveness and societal mechanisms, by providing means to effectively exploit opportunities deriving from the deployment of VOs, and by designing and enabling new professional work paradigms, capable of enacting the knowledge-based society throughout Europe.
Chapter 2: Literature Review

2.1 Notion of Collaboration

2.1.1 Collaboration Definition

In order to properly understand the term collaborative network (CN), or more specifically collaborative networked organization (CNO) it is necessary to first focus on the very notion of “collaboration”. According to Camarinha-Matos & Afsarmanesh (2006b), although everyone has an intuitive notion of what collaboration is about; this concept is often confused with cooperation. The ambiguities reach a higher level when other related terms are considered such as networking, communication, and coordination (Intriligator, 1992; Denise, 1999; Himmelman, 2002; Pollard, 2005). Although each one of these concepts is an important component of collaboration, they are not equal value and neither ones is equivalent to another. In an attempt to clarify various concepts, Camarinha-Matos & Afsarmanesh (2006b) have proposed the following working descriptions based on Himmelman Continuum of Collaboration (2002):

- **Networking** – “involves communication and information exchange for mutual benefit. A simple example of networking is the case in which a group of entities share information about their experience with the use of a specific tool. They can all benefit from the information made available/shared, but there is not necessarily any common goal or structure influencing the form and timing of individual contributions, and therefore there is no common generation of value”.

- **Coordination** – “in addition to exchanging information, it involves aligning/altering activities so that more efficient results are achieved. Coordination, that is, the act of working harmoniously in a concerted way, is one of the main components of collaboration. An example of coordinated activities happens when it is beneficial that a number of autonomous entities share some information and adjust the timing of for example their lobbying activities for a new subject, in order to maximize their impact. Nevertheless each entity might have a different goal and use its own resources and methods of impact creation; values are mostly created at individual level”.

- **Cooperation** – “involves not only information exchange and adjustments of activities, but also sharing resources for achieving compatible goals. Cooperation is achieved by division of some labor (not extensive) among participants. In this case the aggregated value is the result of the addition of individual “components” of value generated by the various participants in a quasi independent manner. A traditional supply chain based on
client-supplier relationships and pre-defined roles in the value chain, is an example of a cooperative process among its constituents. Each participant performs its part of the job, in a quasi-independent manner (although coordinated with others). There exists however, a common plan, which in most cases is not defined jointly but rather designed by a single entity, and that requires some low-level of co-working, at least at the points when one partner’s results are delivered to the next partner. And yet their goals are compatible in the sense that their results can be added or composed in a value chain leading to the end-product or service”.

- **Collaboration** – “a process in which entities share information, resources and responsibilities to jointly plan, implement, and evaluate a program of activities to achieve a common goal. This concept is derived from the Latin *collaborare* meaning “to work together” and can be seen as a process of shared creation; thus a process through which a group of entities enhance the capabilities of each other. It implies sharing risks, resources, responsibilities, and rewards, which if desired by the group can also give to an outside observer the image of a joint identity. Collaboration involves mutual engagement of participants to solve a problem together, which implies mutual trust and thus takes time, effort, and dedication. The individual contributions to the value creation are much more difficult to determine here”.

![Figure 1 – Examples of Joint Endeavor](Camarinha-Matos & Afsarmanesh, 2006b)
As presented in the given definition and depicted in Figure 1 by Camarinha-Matos & Afsarmanesh (2006b), each of the above concepts constitutes a “building block” for the next definition. Coordination extends networking; cooperation extends coordination; and collaboration extends cooperation. As we move along the continuum from networking to collaboration, we increase the amounts of common goal-oriented risk taking, commitment, and resources that participants must invest into the joint endeavor. In the rest of this report we focus on collaborative networks which subsume all other forms (Camarinha-Matos & Afsarmanesh, 2006b).

2.1.2 Requirements for Collaboration

According to ECOLEAD research (D52.2), collaboration is a difficult process and thus the chances for its success depend on a number of requirements:

- Collaboration must have a purpose – usually translated to a joint goal or problem to be solved. It is not enough that parties have their own individual goals.

- Basic requirements or pre-conditions for collaboration include according to Brna (1998) & Giesen (2002):
  - Parties mutually agree to collaborate, which implies accepting to share.
  - Parties keep a model of each other’s capabilities.
  - Parties share a goal and keep some common vision during the collaboration process towards the achievement of the common goal.
  - Parties maintain a shared understanding of the problem at hands, which implies discussing the state of their progress (state awareness of each other).

- Sharing involves shared responsibility for both participation and decision making, shared resources, and shared accountability for the outcomes, both in terms of rewards and liabilities, as well as mutual trust. However we shall notice that sharing does not imply equality. Different parties might have different “amounts” of involvement according to their roles.

- As a process, collaboration requires setting a number of generic steps according to Giesen (2002):
  - Identify parties and bring them together.
  - Define scope of the collaboration and define desired outcomes.
  - Define structure of the collaboration in terms of leadership, roles, responsibilities, ownership, communication means and process, decision-making, access to resources, scheduling and milestones.
Define policies, e.g. handling disagreements/conflicts, accountability, rewards and recognition, ownership of generated assets.

Define evaluation/assessment measures, mechanisms and process.

Identify risks and plan contingency measures.

Establish commitment to collaborate.

- Collaboration requires a “collaboration space” according to Winkler (2002), i.e. an environment to enable and facilitate the collaboration process. The characteristics and nature of this “space” depend on the form of collaboration. Furthermore, collaboration can take place according to Winkler (2002) at the same time (synchronous collaboration) or at different times (asynchronous collaboration). It may also occur in the same place (collocated collaboration) or in different places (remote or virtual collaboration).

- Some major points of difficulty in collaboration include according to Wolff (2005):
  - **Resources** – Ownership and sharing of resources is a typical difficulty, whether it relates to resources brought in by members or resources acquired by the coalition for the purpose of performing the task.
  - **Rewards** – Finding a fair way of determining the individual contributions to a joint intellectual property creation is a rather challenging issue. Intellectual property creation is not linearly related to the proportion of resources invested by each party. At the very base of this issue is the need to reach a common perception of the exchanged values, which requires the definition of a benefits model and a system of incentives, based on a common value system.
  - **Commitments** – Whenever there is an attack or any other obstacle to the collaboration do parties respond as a whole, facing the consequences together, or do each one try to “save its neck”?
  - **Responsibilities** – A typical phenomenon in collective endeavors is the dilution of responsibility. A successful collaboration depends on sharing the responsibilities, both during the process of achieving the goal, and also the liabilities after the end of the collaboration.

Therefore, ECOLEAD research (D52.2), all these issues must be settled by a set of common working and sharing principles towards collaboration between organizations. In spite of the difficulties of this process the motivating factor is the expectation of being able to reach results that could not be reached by parties working alone.
2.2 Basic Concepts on Collaborative Networked Organizations

2.2.1 Collaborative Networked Organizations

A collaborative network (CN) is “an alliance constituted by a variety of entities (e.g. organizations or individuals) that are largely autonomous, geographically distributed, and heterogeneous in term of their operating environment, culture, social capital and goals; nerveless to better achieve common or compatible goals, their interaction is supported by computer networks”. Unlike other networks, in CN collaboration is an intentional property that derives from the shared belief that together the network members can achieve goals that would not be possible or would have a higher cost if attempted by them individually (Camarinha-Matos, Afsarmanesh and Ollus, 2005).

In today’s society, collaborative networks manifest in a large variety of forms, including virtual enterprises, virtual organizations, extended enterprises, virtual teams, etc. Most of the collaborative networks imply some kind of organization over the activities of their constituents, identifying roles for the participants and some governance rules. Therefore, these can be called manifestations of “Collaborative Networked Organizations” (Camarinha-Matos, Afsarmanesh & Ortiz, 2005).

The term Collaborative Networked Organization (CNO), as opposed to the more general case of collaborative networks that may also include unorganized collaborations, is defined as “a set of entities (profit/non–profit organizations and individuals) sharing common aims” (Camarinha-Matos & Afsarmanesh, 2003a).

2.2.1.1 Short-term Collaborative Networked Organizations

According to Camarinha-Matos & Afsarmanesh (2004a), considering the opportunity driven of collaborative networked organizations formed to answer a specific collaboration opportunity and dissolved once their mission is accomplished, the following different forms of CNOs are identified:

- **Virtual Enterprise (VE)** – “is a temporary alliance of enterprises that come together to share skills or core competencies and resources in order to better respond to business opportunities, and whose cooperation is supported by computer networks”.

- **Extended Enterprise (EE)** – “the concept of extended enterprise is typically applied to an organization in which a dominant enterprise “extends” its boundaries to all or some of
its suppliers. In comparison, the virtual enterprise can be seen as a more general concept including other types of organizations, namely a more democratic structure in which the cooperation is peer to peer. In this sense, an extended enterprise can be seen as a particular case of virtual enterprise”.

- **Virtual Organization (VO)** – “this is a concept similar to a VE, comprising a set of (legally) independent organizations that share resources and skills to achieve mission/goal, but not only limited to an alliance for profit enterprises. Similar to the case of VE, these organizations provide to outside world a set of services and functionality, as if they together represent a single organization. Furthermore, VOs represents a temporary alliance of diverse organizations that form a collaboration network, sharing knowledge, skills, and resources towards the provision of value added products and services and that resort to a computer network and associated tools to support their cooperation. Virtual enterprises and extended enterprises are particular cases of the virtual organizations”.

- **Dynamic Virtual Organization** – “this kind of virtual organizations touches the issue of duration of VOs life cycle. A dynamic virtual organization typically refers to a virtual organization that is established in a short time to respond to a competitive market or society worthwhile opportunity, and has a short life cycle, dissolving when the short term purpose of the virtual organization is accomplished”.

- **Virtual Communities (VC)** – “represent a network of individuals focused around common subject(s) of interest and whose interaction is supported by computer networks”.

### 2.2.1.2 Long-term Collaborative Networked Organizations

According to Camarinha-Matos & Afsarmanesh (2004a), another kind of networks is the longer-term strategic establishment, aimed at offering the conditions and environment for rapid and fluid configuration of collaboration networks, when opportunities arise are:

- **Virtual Organization Breeding Environment (VBE)** – “it represents an association or pool of organizations and their related supporting institutions that have both the potential and the will to cooperate with each other through the establishment of a “base” long-term cooperation agreement. When a business opportunity is identified by one member (acting as a broker), a subset of these organizations can be selected and thus forming a VE/VO. A breeding environment, being a long-term networked structure, presents adequate base environment for the establishment of cooperation agreements, common infrastructure, common ontologies and mutual trust, which are the necessary facilitating elements when building a new VE/VO. In other words, VBE represents a group of organizational entities
that have developed preparedness for cooperation, in case a specific opportunity arises. Therefore such form or organization, also known as source network, is considered by many authors as a pre-condition for the effective establishment of dynamic virtual organizations. Industry clusters or industry districts are examples of such breeding environments. The more frequent situation is the case in which a cluster is formed by organizations located in a common region, although geography is not a major facet when cooperation is supported by the computer networks”.

- **Professional Virtual Community (PVC)** – “it represents the combination of concept of virtual community and professional community. Virtual communities are defined as social systems of networks of individuals, who use computer technologies to mediate their relationships. Professional communities provide environments for professionals to share body of knowledge of their professions such as similar working cultures, problem perceptions, problem–solving techniques, professional values and behavior. When professional communities adopt computer networks and most of the practices and tools of virtual communities, they become professional virtual communities. Similar to facilitation of VO configuration in VBEs, PVCs facilitate the configuration of opportunity-based Virtual Teams (VTs)”.

### 2.3 Collaborative Networked Organizations as Strategic Business Trends

According to Österle et al (1999), collaborative networked organizations (CNOs) are becoming one of the most powerful strategic business trends. Major challenges in the economy are taking place, involving a move vertically integrated companies towards flexible network organizations, and the ability to quickly and efficiently set-up, maintain, develop and dissolve partnerships with business partners - networkability - is a critical success factor. In fact, according to Soares, de Sousa & Barbedo (2003), enterprises of all sizes are collaborating more than ever to meet demand of their customers. Collaboration spanning customers, suppliers and business partners is crucial for developing the right products, for the right markets, at the right time.

Furthermore, according to Soares, de Sousa & Barbedo (2003), the need to go beyond traditional internal business process, and tackle larger and more complex cross-enterprise processes, has emerged as a natural way to increase flexibility and efficiency. In this view business strategy, that can broadly be called “collaborative business”, where business partners in a whole value network collaborate, sharing information and processes, to provide a higher value products/services, with increased profitability. Naturally, according to Amit & Zoot (2001),
collaborative business leverages the potential for value creation by enhancing opportunities for efficiency gains, exploitation of complementarities, customer and partner lock-in, and the introduction of novel products, services, processes and new business and revenue models.

As result, Camarinha-Matos, Afsarmanesh & Ollus (2005) mentioned that it is frequently stated that CNOs can provide basis for competitiveness, world-excellence, and agility in turbulent market conditions. They have potential to support enterprises of all sizes, but mainly small and medium enterprises (SMEs), in identifying and exploiting new business potential, boosting innovation, and increasing their knowledge. Networking of SMEs with large-scale enterprises also contributes to the successful of the big companies in the global market. Reinforcing the effectiveness of collaborative networks, mostly based on SMEs, and creating the necessary conditions for making them an endogenous reality in the world landscape, are key survival factors.

Furthermore, according to Alexakis et al (2004a), the potential drivers for SMEs to participate in collaborative networks as part of a collaborative business strategy are:

- **Increased flexibility** – “The combination of several enterprises with different core competencies leads to synergistic effects that can boost new market development: virtual organizations (VOs) can react faster and more flexibility to changes in the market. The speed of changes in the market and changes in the customer’s behavior lose importance as virtual organization can offer a broader range of products/services with higher flexibility. As customers expect complete product/service portfolios, the joining of a VO offers SMEs a great chance to satisfy those customer’s needs. Virtual organizations can change their market focus much quicker than their traditional competitors as they have knowledge in different core areas spread over the business partners. So a fast reaction to changing market requirements can be realized. Changing dynamics do not have to be seen as a disadvantage any longer, as they can be a competitive edge against lumbering competitors”.

- **Cost reduction** – “The positive effect on a company’s costs is very obvious, as the cost for the development of new products/services can be shared among partners. In many cases, it will not be necessary to begin the development from the scratch as for one or a few of the network partners the required basis skills will be available which would have to be gained expensively otherwise. Especially when it is about large and expensive
projects, this is an important advantage against “traditional” competitors. In this way, even a network of SMEs gains the ability to compete large, worldwide-acting enterprise.

- **International presence of SMEs** – “Nowadays, international presence is crucial for the majority of SMEs. Joining a virtual organization, opens the gate to the markets of the collaborating companies - possibly located in different countries or even worldwide. Each network partner of a virtual organization gains access to a far larger market than he could develop on his own. This allows companies to enter new markets by using the contacts of their network partners. The typical barriers companies have to overcome in order to access new markets become much lower. This offers new sales potentials - for the virtual enterprise as a unit, as well as for each network partner. In addition, the adoption of the VO concept helps SMEs to rise from small, minor competitors to a network, which can be seen as a global player on a global market”.

- **Realization of the time advantages (Time-to-Market)** – “A network of different companies with the different core competencies offers a broad variety of material and personnel resources. This leads to a faster development process of new products or services and allows the competitors to react faster on changes on the market (compare to increased flexibility). Adequate staff will be available any time, material and knowledge resources will exist in at least one of the partners companies. The virtual enterprise has the possibility to react to an order from a new business field, or even to new market demands without the need to employ new specialized personnel, which is indeed a time and resource consuming process. This allows for a quicker reaction to market changes.

- **Access to external knowledge** – “Depending on the type of VO, collaboration in virtual networks offers companies the chance to access the knowledge pool of their partners. Of course - this can only happen under the condition that partners in a network are not direct competitors outside, e.g. they need to have access to different markets or offer different core competencies. Even in a virtual organization, the interest of the individual company stands in the foreground. But in case network partners are able to share their knowledge - sometimes even confidential information - this will have positive effects on trust building as well as on the effectiveness of work”.

- **Coping with changing dynamics** - “A striking challenge today’s business world is the changing dynamics within the complex relationships of the organization, its workforce, customers, and suppliers. The most dramatic change that shows up on the news is a massive lay off for the purpose of downsizing. Less visible to the general public is business process re-engineering. Many companies are re-orienting themselves in order to

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cope with changing dynamics. With support of Internet-based communications and information transfer technology in order to maximize corporate resources and satisfy a common pool of customers, the concept of the virtual organization is a good possibility to respond to the changing environment. The virtual organization uses technology in order to create new, possibly temporary, arrangements among employees, suppliers, customers, or other important partners, and for fast exploitation of new opportunities with greater efficiency and lower cost”.

- Effective knowledge management – “Knowledge (whether it is inside the mind of an employee or a customer) is increasingly important to today’s highly competitive organization. Any methods for more effective use of information and knowledge can enhance competitiveness in a world market that has no mercy for weak slow competitors. A common knowledge management system, which integrates the information of all network partners on a common platform, can help to achieve this goal. As a benefit, decreased research times, higher effectiveness, and increasing common culture of trust (we share confidential information) will be created with positive effects on the value creation”.

Moreover, according to Camarinha-Matos, Afsarmanesh & Ollus (2005), a key question is how to guarantee the basic requirements to enable such drivers as part of a collaborative business strategy. Among others, the formation of any collaborative coalition depends on some base commonality among its members, including: sharing common or compatible goals, possessing some level of mutual trust, having established common or interoperable infrastructures, and having agreed on some common policies, codes for practice and value system, e.g. common business practices in industry-based collaborative networks. Achieving these challenge base conditions, according to Camarinha-Matos & Afsarmanesh (2003a), is a pre-requisite for agility in collaborative networks and the reason of existence of Virtual Breeding Environments (VBEs) as supporting environments enabling collaboration in short-term networked organizations, i.e. virtual organizations.

2.3.1 Key Drivers for Collaborative Networked Organizations Evolution

According to Camarinha-Matos (2003) findings, some key drivers affecting the evolution of collaborative organizational forms have been already identified by a group of experts in the subject are:
• **Regional clustering and globalization** – “Although regional clusters, by reinforcing long-term relationships and leveraging local culture, local specificities, and proximity to customers, might have in the short term some effects against the threats of globalization, the trends in the medium and long term are unclear”.

• **Customer orientation** – “(1) Trends in product/service, especially in medium and long term, point to mass customization. (2) Guaranteeing customer loyalty is clearly a determining competitive advantage. (3) The responsibility of customer satisfaction is likely to become more diluted among network members and no son much and exclusive responsibility of the customer interface node”.

• **Internal complexity** – “(1) Systems (e.g. manufacturing, service providers) will become increasingly complex, a trend that will become in the medium and long term. (2) There is a moderate tendency for products to become increasingly complex, namely in terms of their internal structure”.

• **External complexity** – “Business process tend to be supported on highly dynamic and increasingly complex networks of collaboration entities, a trend particularly expected in the medium and long term, but not a so clearly reality in the short term”.

• **Turbulent environment** – “(1) The speed of change in business environments is likely to increase, even in the short term, and a definitive expectation for the long term. (2) The amount if change in business environment is likely to continue growing, as a moderate expectation for the short term and a clear trend in the long term”.

• **Focus on core competence** – “In order to remain lean and highly efficient in competing markets, organizations progressively trend to focus on their core competencies”.

• **Changing role of government** – “Governments will not be an active in the business environment, but will progressively play only a regulatory role”.

• **Power of corporations/markets** – “Corporations and markets will increase power, reducing the power of governments and smaller organizations”.

• **Integration vs. disintegration of corporations** – “The structure of large organizations is likely to evolve, in the medium and long term, namely in the form of organized disintegration (forming complex networks of interacting units)”.

• **Reliance on technology** – “(1) Modern economy and society in general will increasingly rely on technology. (2) In the medium and long term there will be a progressive emerge of a post-technology era with emphasis put on the human skills”.

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• **Accountability**  – “(1) There will be a growing accountability on ethical, environment, financial, and social issues. (2) Although already a trend, this scenario will become clearer in the medium and long term”.

• **Information and knowledge**  – “(1) The clear expectation that organizations will more and more struggle with information and knowledge overload. (2) At the same time, decision-making process will be more based on a sound of information and knowledge basis”.

• **Demographic shift**  – “(1) It is likely that aging of population will accelerate the emergence of new organizational forms in the medium and long term. (2) But the aging of population will be progressively compensated by increased migration flows, which in turn might lead to an increase of socio-cultural clashes”.

• **Life-long learning**  – “(1) Life–long learning will become widely recognized and supported by organizations. (2) In the medium and long term, as a reaction to the market demand, universities will change their teaching models in order to offer life–long learning programs. (3) At the same time new curricula have to be defined by universities and training institutions, including new competencies that are fundamental to assure new organizational forms and ways of doing business”.

• **Growing individualism**  – “(1) There is an expectation in the medium term and especially in the long term collaborative behavior, and strong human networks (professional and social), will grow as a creation to a competitive fast changing society. (2) In parallel, also in the medium and long term, it is expectable that new social systems will emerge to provide for new contractual relationships between individuals and organizations. (3) In the short, under increasing competition and social turbulence, the social trends are unclear”.

• **New ways of work**  – “(1) In the short and medium term, new ways of work (e.g. telework, e-freelancing, entrepreneurship) will stay confined to specific sectors. (2) In the long term there is a moderate expectation that new ways of work will become more significant”.

• **Dynamic relationships**  – “(1) In the medium and long term we might observe a growth in dynamic short-term collaborative relationships, especially within limited contexts (e.g. regional clusters). (2) In the short terms it remains unclear whether the collaborative relationships will be established mainly on a long-term basis or on a short-term dynamic basis”.

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• **Innovation** – “(1) Innovation on products, services, and processes will clearly become a dominant success factor. (2) Innovation will be pursued mainly in collaborative networks, especially in the medium and long term”.

• **Social/moral/ethical implications of virtual collaborative environments** – “It is not expectable that society will react against virtual collaborative environments (i.e. a push-back in technological development is not foreseen). On the contrary the society will progressively learn to make the best use of virtual collaborative environments and technology”.

• **Crisis management** – “(1) There is a moderate expectation that, in the medium and long term, crisis management will become a standard “capability” in organizations. (2) At the same time, crisis management might become a specialized activity (market niche) for some specific entities”.

• **Support infrastructures** – “(1) In the short current technologies could provide adequate support for agile/dynamic cooperative organizations but the lack of common infrastructures and business supports functions is regarded as an obstacle. (2) In the medium and long term the trends are unclear, which might be related to the uncertainly regarding requirements posed by new organizational forms”.

• **Interoperability crisis** – “(1) In the short term and medium terms, the lack of interoperability of software/hardware systems represents a crucial obstacle in developing new forms of cooperation; this obstacle is however attended by engineering efforts. (2) In the long term, the interoperability scenario is unclear”.

### 2.3.2 Business Perspective of Collaborative Networked Organizations

According to Belak et al (2002) & Bititci et al (2004), business perspective in collaborative networks is often neglected. Research on business aspect of collaborative networks is scarce, and the few research studies available tackle very specific issues, such as value transactions in collaborative environments or accounting models of economic relationships in virtual enterprises.

According to Chituc & Azevedo (2005) collaborative networks analysis from a business perspective compromises business relationships within the network of partner, as well as several attributes such as:

• **Competences** – “refer to the expertise (skills, knowledge, etc.) one organization offers in a certain area/domain, its capacity to disseminate and better advertise its capabilities, and also to its ways to make other entities discover its skills and knowledge”.
• **Availability** – “this is concerned with its attainability in terms of negotiation, business operation, etc.”

• **Cost** – “that concerns the stared production (development) cost, and also the costs to the join in the collaborative network”.

• **Value** – “which according to Martinez (2003) has two components: internal value (i.e. shareholder perspective, where value is synonym to wealth), and external value (i.e. customer perspective, where value refer to client’s satisfaction)”.

• **Functions and roles allocation and fulfillment** – “this refers to organizations’ functions and roles allocated within the CN, their performance, and functions and roles fulfillment during the CN life-time and after their dissolution (i.e. support and maintenance services, exploitation strategies, etc.)”.

• **IPR (Intellectual Property Rights)** – “concerns, among, others, issues related to the ownership of the information assets in a CN”.

• **Trust** – “that refers to the confidence among CN partners”.

• **Security** – “(i.e. security of information shared and exchanged)”.

• **Business agreements** – “that concerns a (formal or informal) contract among CN partners setting out the terms of the collaboration”.

• **Quality of service/quality of delivery** – “refers mainly to service level agreement (SLA) that represents a contract between a service provider and an end-user, which stipulates and commits the service provider to a required level service”.

• **Past performance** – “is related to the reliability of the partners considering their past accomplishments”.

• **Legal issues** – “concern aspects such as risk management, tax payment, etc.”

• **Coordination and management** – “CN coordination assumes a critical role, since a CN comprises heterogeneous entities, with different goals and cultures, but symbiotic interest”.

• **Development of new partnerships** – “that could determine the creation of a new CN based on past fruitful collaborations”.

• **Business alignment** – “concerns one enterprise’s business activity performance, within the CN, that should be in line with the activities developed by the rest of the partners”.
2.4 Virtual Breeding Environments

2.4.1 Background and Related Areas

According to Afsarmanesh & Camarinha-Matos (2005), collaboration among autonomous and geographically disperse entities is a process that is increasingly facilitated by advances in computer networks, support services, and related technologies. A growing number of collaboration networks, including the “classical” virtual enterprises, virtual organizations, professional virtual teams and communities, as well as a wide range of new organizational forms are emerging.

According to Camarinha-Matos, Afsarmanesh & Ollus (2005), dynamic collaborative networks, able to rapidly establish and adapt to changing conditions, provide good intuitive approaches to face the challenges of turbulent markets. A key question is however, how to guarantee the basic requirements to enable such dynamism collaboration. Among others, the formation of any collaborative coalition depends on some base commonality among its members, including: sharing common or compatible goals, possessing some level of mutual trust, having established common or interoperable infrastructures, and having agreed on some common policies, codes for practice and value system, e.g. common business practices in industry-based collaborative networks. Achieving these challenge base conditions is a pre-requisite for agility in collaborative networks.

Related to the need for agility, another discussion point is whether collaborative organizations shall be temporally or long-term establishments. Afsarmanesh & Camarinha-Matos (2005) commented that while temporary organizations seem to better fit the dynamic of the market and the variable duration of business opportunities (typically short duration); long-term organizations better cope with the trust building process and the investment in common infrastructures and code of practices. Some existing interesting and successful experiments have combined both types of organizations, hybrid network, namely a long-term (growing and permanent) club o cluster of organizations that are willing and somewhat prepared to cooperate, and shorter-term coalitions involving subsets of these organizations that are dynamically assembled in order to responded to business opportunities. In this context, most enterprises and specially the SMEs will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations and emerge of the
industry clusters and industrial districts (Bremer et al 1999; Molina & Flores, 2002; Camarinha-Matos & Afsarmanesh, 2003a; Plüss & Hurber, 2005; Afsarmanesh & Camarinha-Matos, 2005).

2.4.2 Source of Breeding Environments

The term “breeding environment” was introduced by Camarinha-Matos & Afsarmanesh (2003a) for a long-term network that emphasize the importance of preparation actions (e.g. development of procedures, standards, common processes and ICT to support the customer deliveries) for a short-term collaborative networked organizations. According to Kürümlüoglu et al (2005), this preparation is necessary to be able to react quickly to potential business opportunities; that is, to set up a virtual organization/virtual enterprise to fulfill a customer task.

In addition of configuring and creation virtual organizations, Kürümlüoglu et al (2005) commented that preparation is needed for the smooth operation and lean management of the virtual organization (VO). Preparation and previous experience contribute to the building of trust between the VO partners. Trust - again - enables fast operation in the inter-enterprise relationships.

Furthermore, according to Kürümlüoglu et al (2005), networks or breeding environments are partly created around a specific product/ product family/brand and a leading enterprise. Another type of networks is the case in which a network is formed by organizations located in a common region, although geography is not a major facet when co-operation is supported by computer networks. Nerveless, the geographical closeness has some advantages for co-operation, as it may facilitate better adaptation to local (culture) needs and an easier creation of a “sense of community”. Culture ties, even particular human relationships are motivating factor form such networks which represent in fact the VO Breeding Environments (VBE) for the dynamic formations of VOs. For each business opportunity found by one of the VBE members, acting as a broker, a subset of the VBE enterprises may be chosen to form a VO for that specific business opportunity (Kürümlüoglu et al, 2005).

2.4.3 Current Manifestations, Emerging Cases and Future Trends

Some current manifestations of Virtual Breeding Environments (VBEs) are mostly focused on a regional basis:
2.4.3.1 Industry Clusters

Industry targeting, that is the identification of specific industries or types of enterprises for emphasis in economic development activities, has become an important element in regional development strategies because it enables the developer to focus resources on a specific goal in order to increase efficiency and leverage efforts (Andersen, 1994).

According to Andersen (1994), the use of “clusters” captures the economic relationship among specific industry sectors, providing far richer source of information about regional dynamics than is available in typology in specific sectors inherent to the standard industrial classification system. At the same time, the use of clusters provides a powerful set of tools for analysis, policy formulation, and regional organization and implementation to increase effectiveness of economic development strategies.

Industry clusters (Porter, 1990) are one of the earliest forms of virtual organizational breeding environments, representing a geographical concentration of competitive firms in related industries and associated institutions that do business with each other and share needs for common talent, technology and infrastructure (Porter, 1998).

Industry clusters are phenomenon’s linked to geographic concentrations of national industries which origin from vertical or horizontal relationships between companies. Firms in a cluster are often located in a single town or region within a nation (Porter, 1990). Other authors have also argued that regionality or locality is a major characteristic of a cluster (Arboníes & Moso 2002; Scheel, 2002 & Tallman et al, 2004).

According to Porter (1990) the power of a cluster lies in fierce competition within it, which obliges the firms to elevate their standards of performance. Aggressive rivalry is induced by the bargaining power of customers who may be in contact with several firms within the cluster. These connections also encourage the flow of information and diffusion of innovations (Porter, 1990). These phenomena can also be termed spillovers.

In addition to rivalry, Arboníes & Moso (2002) claim that clusters prosper on the basis of their interaction. According to Porter (1990) developing clusters attract resources away from isolated firms and industries. This is because clusters can exploit these resources more efficiently. Physical proximity of world–class rivals of the same industry acts as the driving force (Porter
The concept of industry is central in the cluster model. It is often taken as a self-evident fact that a cluster is a part or a representative of an industry (Dayasindhu, 2002 & Tallman et al. 2004).

Finally, industry clusters are usually created to prove guidance to industry attraction programs with limited resources programs with limited resources, and in surfacing areas for improvement in infrastructure and other resources needed by dominant industry clusters in a specific region. At the same time, the creation of industry clusters, allows them to obtain to tailor their products more readily to the specific needs of the region (Anderson, 1994).

2.4.3.2 Industrial Districts

The terms “industry cluster” and “industrial district” are often used interchangeably. However, these terms cover two distinct concepts (McDonald & Vertova, 2001).

The concept of industrial districts stems from the work of Marshall (1890), where the author argued that the dynamic of geographical concentration of firms leads to growth and organizational developments that enable firms to reap external economies of scale.

The Marshallian industrial district model emphasizes the benefits of economic and business links. Industrial districts are, therefore, a cluster of firms in a particular industry that have constructed local networks with firms in supporting industries and also with the local community (McDonald & Vertova, 2001).

The main difference between clusters and industrial districts is the presence of networks, which are mechanisms to reduce costs involved in the creation and diffusion of information. These networks involve all firms in the industrial district and their relation with other firms (McDonald & Vertova, 2001).

According to Brusco (1990), industrial districts are composed of three different kinds of firms. “Final-firms” that produce for the final market, “stage-firms” that are involved in only one stage of production, and “others” that work in a different industry from that which defines the district but, nevertheless, belong to the same vertically integrated sector as the final-firms.
Following this categorization, three kinds of business networks can be identified:

- **Horizontal networks** – “Close inter-firm relations among different final-firms and among final-firms and stage-firms, in order to support each other by the common provision of technical, business, financial and other services”.

- **Vertical networks** – “The supply chain of final–firms and others and stage-firms and others linked by backward and forward vertical integration”.

- **Other networks** – “Links between firms and institutions for the support of production needs, for example, relationships with universities, R&D agencies and governmental agencies”.

In brief, industrial districts are a term mostly used in Italy that represents a concept quite similar to an industry cluster and can be defined as a spatial agglomeration of a number enterprises specialized in one or more phases of a specific value chain dynamical and temporarily working together to respond to a specific market opportunity (Powell, 1996).

### 2.4.3.3 Business Ecosystems

Inspired by the mechanisms of the biological ecosystems a business ecosystem is defined as “an economic community supported by a foundation of interacting organizations and individuals – the organism of the business world”. This economic community produces goods and services of value to customers, who are themselves members of the ecosystems (Moore, 1996). A business ecosystem includes customers, lead producers, competitors and other stakeholders. The key to a business ecosystem are leadership companies, “the keystone species”, who have a strong influence over the co-evolutionary process (Moore, 1996).

Members of a business ecosystem “work co-operatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations”. Thus, business ecosystems base their success on both competition and cooperation (Moore, 1993).

Furthermore, a business ecosystems can be defined as “extended system of mutually supportive organizations; communities of customers, suppliers, lead produces and other stakeholders, financing, trade associations, standard bodies, labor unions, governmental and quasigovernmental institutions and other interested parties. These communities come together in a partially intentional, high self-organizing and eve somewhat accidental manner” (Moore, 1998).
First definition highlights the interaction with a business ecosystem (Moore, 1996), while the second one emphasis decentralized decision making and self-organization (Moore, 1998).

Business ecosystems are based on core capabilities, which are exploited in order to produce the core product. In addition to the core product, a customer receives “a total experience” which includes a variety of complementary offers (Moore, 1996). The life cycle of a business ecosystem can be divided into four stages. In the birth stage it is essential to do more than just satisfy customers. In the expansion stage the scale-up potential of the business concept is tested. In the leadership stage the business ecosystem reaches stability and high profitability. The final stage, self-renewal or death, is caused by the threat of rising new ecosystems (Moore, 1993).

Finally, the idea of business ecosystem is the same as of natural ecosystem. It is a system that can sustain itself without outside interventions. As time goes by it adapts to and evolves with the changes in its environment. Selection plays a major role. Business ecosystems are complex systems which exhibits complex behavior (Moore, 1996).

2.4.3.4 Virtual Industry Cluster

With the fast progress on computer networks and communication technologies, geography is not a major facet; inducing new forms of emerging cases of VBEs focused on geographically disperse basis such as: Virtual Industry Clusters (VIC) defined as aggregations of small and medium enterprises, whose main goals are: provide information about technological capabilities of its enterprises members in order to create Virtual Enterprises (VE); improve its capability to learn and innovate through the experience, information and best practice exchange; increase their strategic management capabilities by complementing individual functions with collective functions; complement its specialization areas and productive capabilities; develop core competences; establish strategic alliances; and, increase its bargaining power (Molina et al, 1998).

VICs will be created by the aggregation of enterprises around the world with complementary competences, supported by information technology infrastructures. The creation of new VICs will be focused on the necessity to satisfy market needs and new trends (Molina et al, 1998),
According to Molina et al (1998) the objectives of Virtual Industry Clusters are:

- Improve member’s capacity to learn and innovate by exchanging experiences and information, enhancing their contact through the VIC, and complementing their areas of specialization and productive capabilities.

- Increase their strategic management capabilities by complementing individual functions with collective functions to search for competitive intelligence information, share information resources and best practices, establish strategic alliances within the VIC and develop their core competences.

- Increase their negotiation power and economies of scale by developing supplier programs, exploit collective acquisitions, use common services and share financial risks in project funding and business endeavors.

In short, VICs are virtual concentrations of interconnected companies and institutions in any field. The main characteristics to qualify in these clusters are complementary core competences of entities. Finally, the VIC is supported by information technology infrastructures that overcome the restriction of geographic proximity (Molina et al, 1998; Eversheim, 1998).

2.4.4 VBE Constituting Elements

According to Camarinha-Matos, Afsarmanesh & Ollus (2005), traditionally, clusters/association of organizations are established in a geographic region (Bremer et al, 1999), within the advantage of having common business culture, and sense of community, and typically focused on one of the specialty sectors of the region. What is challenging today is to tackle this restriction, and the best replace it by a new “support environment” called breeding environment, that applies effective information/communication infrastructures to provide common grounds for interaction/collaboration, facilities the configuration and establishment of VOs, introduces new approaches and mechanisms to build trust, define collaboration business culture, and the common value systems and working/sharing principles among independent organizations, even from different geographical regions. Culture ties and particular human relationships are important motivating factors to start up and form such association representing the VBE, as the support environment for dynamic formation of VOs (Camarinha-Matos, Afsarmanesh & Ollus, 2005).

According to Afsarmanesh & Camarinha-Matos (2005), VBE is regulated open, but controlled-border association of its members. It aims at improving the preparedness of its member organizations for joining the potential future VOs, hence providing a cradle for dynamic and agile
establishment of opportunity-driven collaborative networks. As represented in Figure 2, it is far
costly and much more effective to quickly build a VO in a breeding environment context (branch
1b) that through a generalized partners’ search (branch 2). In other words, VBEs substantially
contribute to the increase of the level of preparedness of their members for participation in
potential collaborative processes (Afsarmanesh & Camarinha-Matos, 2005).

According to Afsarmanesh & Camarinha-Matos (2005), a VBE must have a controlled
border, but does not need to be closed boarder, namely at any time new members can join the
VBE association by complying with its general operating principles. Therefore, there may be
different levels of membership defined and supported by the VBE administrator, each
corresponding to different rights and responsibilities. In principle, different levels of membership
may constitute a range, with loose-membership on one end and tight-member on the other end of
the spectrum. For instance, a loosely associated member of the VBE may need to adhere to
nothing more that a minimum level of organization “preparedness” that is necessary for getting
involve in a VO, and to making some minimum information available to the VBE administration,
e.g. about their activities related to the VO. At the same time, typically a fully active member of
the VBE contributes to its promotion, growth, and the enrichment of its bag of assets, and can

Figure 2 – Two Approaches to the Formation of Virtual Organizations
(Afsarmanesh & Camarinha-Matos, 2005)
take an active role from brokerage and planning of VOs in a niche market, to being involved in
the expansion of the VBE into new sectors, and initiating VOs towards innovation (Afsarmanesh
and Camarinha-Matos, 2005).

2.4.5 VBE Aims

According to Afsarmanesh & Camarinha-Matos (2005), the main aim of the VBE is focused
on the transition from point-to-point connections among organizations to a network structure, in
order to increase the chances of its member organization’s involvement in opportunities for
collaboration.

Traditionally, breeding environments are established within one geographic region, in the
tradition of industry districts, with the advantage of having common business culture and sense of
community, as well as on one specialty sector of the region. But, this restriction can today in most
cases be overcome by VBEs (Afsarmanesh & Camarinha-Matos, 2005).

According to Afsarmanesh & Camarinha-Matos (2005), VBEs primarily constitute two
regions categories regional and global. While regional VBEs mainly involve organizations (of
different sizes) from one geographical region, global VBE incorporates the involvement of
demographically distributed organizations Furthermore, both regional and global VBEs can be
either single-sector, i.e. specializing in a single focus area, or multi-sector, i.e. covering a number
of focus areas (Afsarmanesh & Camarinha-Matos, 2005).

According to Afsarmanesh & Camarinha-Matos (2005), efficient creation of VOs is the main
purpose for the existence of the VBEs. Therefore, the motivation for creation of VBEs primarily
depends on identification/creation of opportunities for organization collaboration in certain
sector(s). There are two kinds of opportunities pursued by a VBE, namely those that can be
identified in the market/society, and those that can be created by the VBE for the purpose of
innovation. The main actors in the creation/identification of opportunity are either VBE members
who broker the VOs, or the VBE administrator who promotes the initiation of some VOs that
seem to be beneficial for the market/society (Afsarmanesh & Camarinha-Matos, 2005).
Some of the main aims of the VBE according to Camarinha-Matos, Afsarmanesh & Ollus (2005) can be formulated as follows:

- Establishment the base trust for organizations to collaborate in VOs, by gathering/preparing the credibility records of organizations, as well as the definition of proper credit-assignment principles.
- Reduce the cost/time to find suitable partners for the configuration of the VOs.
- Assist with the creation, reaching agreements, and contract negotiation for the establishment of VOs.
- Assist with the dynamic re-configuration of the VOs, thus reducing the risk of big losses due to some organizations failures.
- Provide some commonality for interaction and “accepted business culture”, by offering:
  - Base ICT infrastructure (for collaboration), thus reducing the set up times during the VO formation.
  - Cooperative business rules (measured by the developed common metrics to evaluate member’s credibility & performance).
  - Template contracts for involvement in VOs (samples are provided for VOs).
  - Base technology for the sector (to be incrementally developed within the VBE).

2.4.6 VBE Features

Establishment of VBEs provides the ten advantages listed and exemplified below by Afsarmanesh & Camarinha-Matos (2005):

1. Agility in opportunity-based VO creation.
   - Supporting reduction of needed efforts and complexity, flexibility for VO re-configurability, and cost effective.
2. Provision of base effective ICT technology infrastructures for VBE members.
   - The common grounds for interoperability/inheritability/collaboration.
3. The VBE bag of assets, providing properties of interest for its members.
   - General sharable information/knowledge (e.g. standardized product definitions and processes), software tolls, lesson learned.
4. Provision of mechanism, guidelines, and assisting services to both motivate and facilitate configuration and establishment of VOs.
   - Creating system of incentives, mechanism to create positive reputation, and services for partners search, contract negotiation, etc.
5. Proactive management of competences and resources available in the VBE.
   - Assuring coverage of the needed competency/resources within the VBE.

6. Provision of related consulting/life maintenance support for VBE members through its support institutions.
   - Supporting insurance, branding, training, etc.

7. Introduction of approaches/mechanisms to build trust among VBE members.
   - By recording the performance history, and definition of criteria for the organizations’ trustworthiness.

   - Constituting rules of conduct, working and sharing principles, value systems, collaboration ethics and culture, IPR protection, etc.

9. Increasing the chances of VO involvement for VBE members, even from remote geographic regions.
   - Through provision of members’ profile in the VBE catalogue, including their competences, resources, products, services, etc.

10. Improving the potential/capacity of risk taking by the VO initiators.
    - Due to the reduction of the VO setup efforts/time, availability of both wide variety of competency/resources as well as indicators of the level of trustworthiness and past performance of the VBE members.

2.4.7 VBE Actors and their Roles

According to Camarinha-Matos, Afsarmanesh & Ollus (2005) organizations or actors in a VBE can include:

- **Business entities** – “providing products and services to the market that get involved in the VO to gain quantitative profit”.

- **Non-profit institutions** – “that get involved in the VO to gain qualitative profit”.

- **VO support institutions** – “for example; legal and contractual service providers, companies supporting life maintenance to individuals (e.g. insurance and training companies), ministries, sector associations, chamber of commerce, environmental organizations, etc”.

Furthermore, participants in the VBE can play several roles according to Camarinha-Matos, Afsarmanesh & Ollus (2005). The following main roles are considered:

- **VBE member** – “this is the basic role played by those organizations that are registered at the VBE and are ready to participate in the VBE activities”.

- **VBE administrator** – “performed by the organization responsible for the VBE operation and evolution, promotion of cooperation among VBE members, filling the skill/competency gaps in the VBE by searching and recruiting/inviting new organizations into the VBE, daily management of the VBE general processes, e.g. assignment/reassignment of rights and common VBE policies, among others”.

- **Opportunity broker** or simply **Broker** – “performed by the VBE actor (a VBE member organization or an individual representing a VBE member) that identifies and acquires new collaboration opportunities (business opportunities or others), by marketing VBE competences and assets and negotiating with (potential) customers. There is the also the possibility of this brokerage function being played by an outside entity as a service to the VBE”.

- **VO planner** or business integrator – “performed by a VBE actor that, in face of a new collaboration opportunity (designed by an opportunity), identifies the necessary competences and capacities, selects an appropriate set of partners (VBE members and even outsiders in case there is not enough competences and/or capabilities inside the VBE, and the structures the new VO”.

- **VO coordinator** – “performed by a VBE actor that will coordinate a VO during its life cycle in order to fulfill the goals ser for the collaboration opportunity that triggered the VO”.

![Figure 3 – Main VBE Actors](Camarinha-Matos, Afsarmanesh & Ollus, 2005)
Additional roles that might be useful considering in a VBE are: VBE advisor (or an advisory board), VBE service provider, VBE ontology provider, etc. In general it is possible that several roles are performed by the same actor (Camarinha-Matos, Afsarmanesh & Ollus, 2005).

2.4.8 VBE Life Cycle

According to Eijnatten, 2003 adapted by Camarinha-Matos, Afsarmanesh & Ollus, (2005), the life cycle of the VBE represent all the stages that a VBE may go through, form its creation stage, to its operation, and possible dissolution. In fact VBE, being a long-term alliance, and considering its valuable bag of assets gradually collected in the VBE, its dissolution is a very unusual situation. Instead, it is mucho more probable that the VBE goes trough another stage, as so called metamorphosis stage, where it can evolve and change its form and purpose. On the other hand, it is the case that only during the operation stage of the VBE, the VO can be created. VBEs by nature are self organizing and can be modeled and represented following the principles of the Chaordic System thinking. Figure 4 represents the five stages of the VBE life cycle in a chaordic diagram.

![Figure 4 – Chaordic Graph Representation of VBE Life Cycle Stages (Eijnatten, 2003 adapted by Camarinha-Matos, Afsarmanesh & Ollus, 2005)](image)

Figure 4 – Chaordic Graph Representation of VBE Life Cycle Stages (Eijnatten, 2003 adapted by Camarinha-Matos, Afsarmanesh & Ollus, 2005)

Considering the typically VBEs serve specific sectors/domain and have specific aims, there will be many different sector/domain-dependent VBEs need to be established in the future in order to support the creation of different forthcoming VOs (Camarinha-Matos, Afsarmanesh & Ollus, 2005).
The VBE life cycle stages, as seen in Figure 5, include: the VBE creation – composed of the VBE initiation/recruiting and the VBE foundation, the VBE operation/evolution, the VBE metamorphosis, and the VBE dissolution.

1. **VBE Creation**, includes **VBE initiation and Recruiting** – Planning and incubation and **VBE Foundation** – constitution and start up.

2. **VBE Operation and Evolution** – the normal phase of the VBE existence, also comprising the small changes in membership and daily operating principles.

3. **VBE Metamorphosis** – major changes in objectives, principles, membership, and/or mergers, leading to a new form of organization.

4. **VBE Dissolution** – When the collaborative entity ceases to exist; being a long term entity, this stage of the VBE is typically replaced by the metamorphosis, preserving the gained knowledge.

Figure 5 – VBE Life Cycle Stages

(Afsarmanesh & Camarinha-Matos, 2005)
Chapter 3: VBE Management Framework

This chapter will focus on the design and development of a general and replicable Reference Framework for the management of Virtual Breeding Environments (VBEs), under the guidelines of ECOLEAD project research. The VBE Management Framework proposed can be applied to different VBE domains in order to tackle the most important needs in breeding environments administration, and as a result guarantee the smooth management of the VBE during its entire life cycle.

The author proposes the following Reference Framework for VBE management. This framework will be explained in the following sections.

Figure 6 – VBE Management Framework

Since the VBE Management Framework will be described in a generic and replicable way, therefore it can fit diverse VBEs from all sectors. Namely, the VBE Management Framework can
be applied to any industrial sector or other domain, and its generic model can be customized and adjusted to specific management needs according to the type of VBE. This processes also called an instantiation, support that general model proposed can be extended and converted into a specific model using a methodology presented in Chapter 4. The VBE Instantiation Methodology will provide the necessary steps to adapt general VBE management tasks into specific tasks according to explicit VBE administration requirements.

3.1 VBE Management Overview

A VBE Management Framework can be defined as a set of processes and procedures, used by its stakeholders during its lifecycle to ensure that the VBE can fulfill all tasks required to achieve its objectives (Afsarmanesh & Camarinha-Matos, 2005).

According to ECOLEAD research (D22.1), VBEs aim at achieving their business objectives of fluid configuration of VOs towards risen opportunities, by conducting various activities, where each activity is performed by different VBE actors and stakeholders. To support the smooth operation of VBEs, the VBE management shall support and facilitate the following among others:

- Management of information, resources and knowledge; including repository creation, modification, access, and manipulation.
- Sharing and exchange of information, resources, and knowledge with authorized users.
- Provision of up-to-date information and data for collaboration.
- Administration activities such as the execution of the set of functions required for controlling, planning, allocating, deploying, coordinating, and monitoring the functionality and resources of the VBE, e.g. management of the profile, registration of members, etc.
- Provision of base functionality and information for development of advanced services needed for VO configuration.
- Decision making within the VBE environment including trustworthiness of members, competence of members in the VBE, etc.
- Provision of information/service to facilitate marketing of the VBE to the outside world.

Therefore, according to ECOLEAD research (D22.1), 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 management should support and facilitate the
activities needed to be performed through the VBE life cycle stages, from VBE creation through its operation and evolution, and to its metamorphosis or dissolution.

3.2 VBE Management Functionalities

3.2.1 VBE Actors’ Management

According to ECOLEAD research (D22.1) about “VBE Management Requirements and Framework Architecture Design” a set of important management tasks related to membership regulation and competency management should be included in a reference framework for VBE management. Following sections will detail each one.

3.2.1.1 Membership and Structure Management

Since a Virtual Breeding Environment (VBE) is a regulated open, but controlled-border association of organizations and their support institutions, namely at any time new members can join the VBE. Therefore, different levels of membership, each corresponding to different set of rights and responsibilities, should be defined to support VBE administration (Afsarmanesh & Camarinha-Matos, 2005).

In this sense, the VBE management framework should include some processes and procedures to manage those entities that want to become VBE members. According ECOLEAD project research (D22.1, D22.2a), the management of the structure of the VBE and the company-related information of its members is a crucial cornerstone for supporting management of all the VBE related activities.

Primary functions identified by ECOLEAD research (D22.1 & D22.2a) for VBE membership management include: 1) Registration of new VBE members, 2) Rewarding proactive behavior within the VBE, and 3) Management of members rights and roles.

The function of *member registration* is to ensure that all information and supporting evidence for build credibility related to VBE membership applicants (a company that is interested in becoming a VBE member) is provided to the VBE administration for decision-making about accreditation. This information, including general information and competency-related information about the VBE applicant, will be used by the VBE administration to approval or denial the request for membership.
The function of rewarding is to monitor and award members proactive behavior. Rewarding members is a valuable strategic task for VBE administration to incentive and motivate pro-activeness in all VBE members. Criteria for rewarding and scoring proactive behavior will be decided by each VBE administration. Some common awarded behaviors in collaborative environments are: contributions to a common bag of asset (e.g. VBE bag of assets), risk-taking assuming certain roles (e.g. VO planner, VO coordinator), or providing supporting services to other members (e.g. acting as a service provider - training).

The function of member’s rights, roles and responsibilities consider that each VBE member is related to one or more specific roles during the VBE life cycle, so VBE administration should be able to define and manage specific rights and responsibilities for each VBE actor according to the role it is playing in certain moment and the tasks associated to this role.

In short, the membership and structure management will provide services for allowing the integration, accreditation, rewarding and categorization of members within the VBE.

### 3.2.1.2 Profiling and Competency Management

A main characteristic of a Virtual Breeding Environment (VBE) is the set of competencies that it can offer to the market and society. The competencies in a VBE need to be defined through the competencies of its main components, including VBE member, VO and the VBE as a whole. Therefore, according to Ermilova & Afsarmanesh (2006), competencies in VBEs can be classified as follows:

- **VBEs (self) competencies** addressing the abilities of the breeding environment to manage network of organizations towards VO creation.
- **VBE member’s competencies** constituting the capabilities and capacities of a VBE member which it can offer to the breeding environment in order to form a VO.
- **VOs competencies** that are the result of clustering VBE members’ competencies in a VO.

For managerial purposes, the competencies of VBE members, VOs and the VBE can be arranged into a VBE competency catalogue, which should be part of an organizational profile. Therefore, in order to provide complete structured information about organizations involved in a VBE (including the VBE itself) to the VBE administration, Ermilova & Afsarmanesh (2006) suggest a Profile and Competency Management System (PCMS) that should
include general information and competency-related information about VBE members, VOs and the VBE itself. VBE member’s profile could be based on a common profile model. VOs profiles, in addition to common profile elements, should include: list of VO partners, type of partnership, collaborative opportunity description, VO partner’s competencies, VO emerging competencies (result of VO partner’s collaboration) and other general information. VBE (self) profile, in addition to the common profile elements, should include: list of members, list of actors, list of roles, list of rules and other general VBE related information.

Main functionalities identified by ECOLEAD research (D21.2a, D22.1, & D22.2a) and supported in Ermilova & Afsarmanesh (2006) research for profile and competency management include: 1) Profiling and competency management and 2) Discovery/Search of new competency.

The function of profiling and competency management is to support the creation, updating, structuring, and search & retrieval of VBE members, VOs and VBE itself catalogue of profiles (including their competencies).

The function of discovery/search of new competency is to analysis VBE members’ catalogue of competencies for discovery of new competencies out of the collective of all VBE members in the VBE.

In summary, the profile and competency management will provide services for creating and maintaining VBE members, VOs and VBE itself profiles, as well as for the competency based assessment of new VBE members and discovery of new competencies in the VBE.

3.2.2 VO Creation and Registration Management

In ECOLEAD project (D22.1, D22.2a, D23.1, D23.2, & D23.4), VO creation is considered to happen in the context of a Virtual Breeding Environment. VBEs aim to improve the preparedness of their members to rapidly respond to collaboration opportunities through the creation of Virtual Organizations (Afsarmanesh & Camarinha-Matos, 2005). Therefore, according ECOLEAD research (D22.1, D22.2a, D23.1, D23.2, & D23.4) a VBE management framework should include a set of management tasks and supporting tools to carry out VO creation and registration process. Following sections will briefly explain the main steps in VO creation process, from collaborative opportunity identification to VO registration.
3.2.2.1 Collaboration Opportunity Identification

The first step in VO creation process is the identification of a collaborative opportunity. VO creation can be triggered as a result of the identification of a collaborative opportunity by a VBE member (acting as a broker) or by computer agent (also, acting as a broker). In both cases, the purpose of this task is to discover new collaboration opportunities (e.g. brokering) to exploit business potential deriving from sharing skills or core competencies and resources in order to better respond to market opportunities through the deployment of Virtual Organizations. Moreover, and other trigger for VO creation that could be mention is the case when a client approaches the VBE with a specific proposal for a collaborative opportunity.

Some brokerage practices can be supported by a computer agent, including web crawling techniques, in order to find and monitor collaboration opportunities on selected web sites and portals (e.g. e-marketplaces). Same approach could be taken manually by an broker, but it may result in a very demanding and time consuming task, therefore computer assistance appear as a practical approach to facilitate the work of broker.

In most cases, a broker search for collaboration opportunities through call for tenders (CfTs) in different places such as newspapers, bulletin boards, marketplaces, etc. and select the most appropriate ones according certain criteria. Next, the broker with the help of VO planner should identify competency requirements to respond to these CfTs and immediately search for processes, resources and practices in different organizations with the capabilities and capacities to perform them according customer specifications. This manual process could result in processing some collaboration opportunities that certain association of organizations is not capable to tackle, representing cost opportunity time.

In this scenario, ECOLEAD project (D23.1, D23.2, & D23.4) proposes a coFinder tool to support collaboration opportunity identification through a computer agent searching for CfTs according certain criteria defined by a broker. The advantage of computer assistance will be that selection criteria could be supported by the catalogue of competencies available in the VBE and represented by the PCMS. As result, same process described in paragraph above, will become more effective and efficient by supporting collaboration opportunity identification task with two main tools: coFinder tool and PCMS tool, that will select automatically only the CfTs that can be answered by the VBE according competencies available in its members and alert the broker of
their existence to start VO planning process with VO planner help. coFinder tool will make easier broker’s job of searching collaboration opportunities for VBE members.

To conclude, collaboration opportunity identification process with the help of coFinder tool will support the detection and filter of collaboration opportunities through CfTs in different e-sources (e.g. e-marketplaces) and select the most appropriate ones according to the VBE domain of competencies.

3.2.2.2 Collaboration Opportunity Characterization and Rough Planning

The next step in VO creation process is the characterization and rough planning of the collaboration opportunity identified by the broker (perhaps with the support of coFinder tool). In step, the VO planner characterizes and defines a strategy for responding to the collaboration opportunity identified, through the design of a rough plan for the creation and operation of potential Virtual Organization.

Collaboration opportunity characterization refers to the task of modeling a collaboration opportunity in terms of competencies as a combination of processes, resources and practices required in partners for further matching in the selection of VO partners capable of collectively respond to a collaboration opportunity according to customer requirements. Modeling a collaboration opportunity include the decomposition of a product in terms of assemblies and components, and/or the decomposition of a service in terms of activities and sub-activities, each one with their specific competencies required to produce or perform them.

After CO characterization, the next step in VO creation process and consequently for the VO planner will be the determination of a rough structure for the potential Virtual Organization. This activity is suggested by ECOLEAD research (D23.1, D23.2, & D23.4) to be guided using some 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 requirements of competencies and capacities in CO characterization, and the selection of the collaborative modality as a basic approach for VO creation, the VO planner will proceed to draft a rough plan for the potential Virtual Organization 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. topology options) as many different activity sequences can be designed in order to tackle the collaboration opportunity identified by the broker in the shortest time (e.g. critical path in project Gantt).

In this scenario, ECOLEAD project (D23.1, D23.2, & D23.4) proposes a COC-Plan tool to support VO planner in the characterization of a collaboration opportunity in terms of competencies required to further matching partners in the Partners Search and Suggestion step, and also in terms of collaboration modalities for defining the plan of activities (rough plan) needed for the finalization of VO creation process.

In few words, CO characterization and rough planning (COC-Plan) as a process and a tool will describe and model the collaborative opportunity identified by the opportunity broker in a more structured way in order to support VO planner in collaboration opportunity definition and characterization, and then assist in the definition of detailed working structure of the main processes that will have to be carried out by certain number of VO partners (according to their competencies) in the potential Virtual Organization.

3.2.2.3 Partners Search and Suggestion

The next step in VO creation process is partners search and suggestion. This step is devoted to the identification of potential partners, and their assessment and selection to become part of a VO when a collaborative opportunity is identified. The search of potential VO partners is carried out by the VO planner in first instance based on competencies requirements identified in CO characterization. Additionally, assessment and selection of potential VO partners is performed also by the VO planner in a sort criteria based on traditional elements like price, delivery date and quality level, and the analysis of past performance record and level of preparedness for collaboration in VBE members available in the breeding environment to guarantee the selection of the most suitable members to get involved in the VO that will respond to the collaborative opportunity identified.

In this scenario, ECOLEAD project (D23.1, D23.2, & D23.4) proposes a PSS tool to assist the VO Planner in the search, assessment and selection of the most suitable VO members regarding to the requirements of a given collaboration opportunity in terms of competencies (processes, resources and practices). 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 appear as a practical approach to facilitate the work of VO planner.

In this sense, PSS will try to match the results of CO characterization (list of competencies and other collaboration opportunity specifications) with the VBE member’s competencies available in the breeding environment by matching CO characterization data vs. PCMS data with the purpose of obtaining a list of potential VO partners to configure the Virtual Organization. This list should include an associated risk analysis and the configurations’ expected performance with respect to selection criteria. Moreover, these possible configurations of VO should be presented to the VBE administration for a further decision making and final Virtual Organization composition.

To sum up, the partners search and suggestion (PSS) process and tool will use a sort of criteria for searching and filtering inadequate partners for a VO with accurate competencies and performance indicators, and select the ones that better fit the desired requirements for VO configuration.

3.2.2.4 Agreement/Contract Negotiation Wizard

The final step in VO creation process, but also considerate a set of interactive steps during the whole VO creation process (from rough planning to detailed plan), is the modeling of contract and agreements between VO actors. In this context, the agreement/contract negotiation wizard tool (WizAN) proposed by ECOLEAD project (D23.1, D23.2, D23.3, & D23.4) aims to assist VO planner, VO coordinator and potential VO members in the possible negotiations between them to get involved in a Virtual Organization. The main outcome of this negotiation will be a contract with certain agreements that will govern the behavior of VO actors involved in the future Virtual Organization.

F2F negotiation between actors in VO creation process is an expensive process considering that potential VO members could be geographically distributed according to VBE definition, so it will represent a big effort for these actors in terms of cost, time and staff energy to travel and make possible these face to face (F2F) meetings. Therefore, these reunions according to ECOLEAD research (D23.1, D23.2, D23.3, & D23.4) should be reduced with the help of computer assisted negotiation and e-contracting tools such as the WizAN tool, providing a faster and cheaper solution than standard F2F negotiation and manual contracting.
In this scenario, the WizAN is a tool proposed by ECOLEAD project (D23.1, D23.2, D23.3, & D23.4) to offer computer assistance to a process that is mainly conducted by human actors (VO planner, VO coordinator and potential VO members) 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 (D23.1, D23.2, D23.3, & D23.4) aims 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.

According ECOLEAD research (D23.1, D23.2, D23.3, & D23.4) main functionalities to be provided by a WizAN tool are: 1) Assistance Perspective, 2) Internal Agreement, and 3) Negotiations Focus.

The function of assistance perspective 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 members’ performance along the VO operation.

The function of internal agreement aims to put on the negotiation table a set of agreements between 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 negotiation is a multi-step interactive process that can support other VBE/VO creation processes and tools if it is necessary.

The function of negotiation focus 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 Virtual Organization.

To come to a final point, WizAN process and tool will provide computer-assisted support to the process of negotiation and reaching agreements during VO creation process and will initiate
with a contract type specification and general definitions, follow by a contract under negotiation, and finally a signed contract by all VO actors: VO members, VO planner and VO coordinator.

3.2.2.5 VO Information Management

VO information management refers to two set of management tasks, one after a VO is launched to initiate operation, known as VO registration, and another one when the VO is dissolved, known as VO inheritance information.

3.2.2.5.1 VO Registration Management

After VO creation process comes to an end, and the Virtual Organization is launched to initiate operation, one final task should be done in relation to VBE management. This task is the registration of the new VO in the VBE profile and competencies management system (PCMS) to carry out a control of the newly number of VOs created within the breeding environment and what kind of partnerships are being created to engage the different types collaborative opportunities identified.

According ECOLEAD research (D23.1, D23.2, & D23.4), VO registration process refers to the creation of VO profile that should include general information about the VO itself and its members (e.g. list of members, roles and rules), plus competency-related information as the VO partners’ competencies involved for tackling the collaboration opportunity identified.

In short, the VO registration process support the managing of the information related to the VO registered within the VBE, with the help of the PCMS tools.

3.2.2.5.2 VO Inheritance Information

As part of VO dissolution process, VBE management will get involved in VO management to pull as inheritance procedure all valuable immaterial assets created during the creation and operation of a Virtual Organization.

VOs create various kinds of assets during its life cycle, and these assets could be valuable for the Virtual Breeding Environment, so proper management of them could be a benefit for VBE administration and other VBE/VO actors. VO inheritance management has the objective to retrieve priceless information from the VOs created as possible best practices and lessons learned from these VOs (e.g. collaborative practices and procedures), to store them in the VBE bag of assets as useful knowledge for future VO creation processes. This knowledge could help in the
near future to the VBE administration or more accurate the VO planners and VO coordinators in the process of creating and running new Virtual Organizations.

According ECOLEAD research (D23.1, D23.2, & D23.4), some consideration to taken into account when it 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 as for example in confidential, restrictive and public to respect certain agreements in VBE/VO governance (e.g. contracts). Furthermore, other important aspect to consider will be the possible intellectual and property right (IPR) issues when it comes to inheritance some immaterial assets.

In summary, VO inheritance management refers to a set of processes to gather all achievements (information, knowledge and experience) of the VOs created and being dissolute, 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.

### 3.2.3 VBE General Management

According to ECOLEAD research (D21.2a, D21.3, D21.4a, D21.4b, D22.1, & D22.2a), a VBE management framework won’t be complete if general management activities were not consider to run some basic but relevant management processes in charge of supporting the effective management of a Virtual Breeding Environment during its life cycle. Following sections will detail each one.

#### 3.2.3.1 Strategic and Marketing Management

Since a Virtual Breeding Environment (VBE) represent a form of Collaborative Networked Organization (CNO), 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 focus in 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 the VBE,
hope 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 deliberate about strategy making in order to combine
their skills, resources and technologies to collaborative plan a strategy for the Virtual Breeding
Environment. This strategy should benefit all VBE actors and promote the VBE members
competencies for the creation of Virtual Organizations as a way of reaching business
opportunities that by their own won’t be possible (Camarinha-Matos & Afsarmanesh, 2006).

Furthermore, the challenge for network strategic management will 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 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 Virtual Breeding Environments: 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 life cycles. 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 VBE/VO customers.

3.2.3.2 Financial, Accounting and Resources Management

As any kind of single organization, a Collaborative Networked Organization (CNO) such as the Virtual Breeding Environment (VBE) has to carry out three fundamental management tasks: 1) Financial Management, 2) Accounting Management and 3) Resources (Assets) Management.

Financial management address VBE administration procedures to rise, allocate, and use monetary resources over VBE life cycle, 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 health 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, inventory, 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 (section 3.2.3.5), ICT management (section 3.2.3.7) and value system information
management (section 3.2.3.8).

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 (section 3.3.3).

3.2.3.3 Governance Management

Governance refers to the act of affecting government and monitoring (through policy) the
long-term strategy and direction of an organization (Graham et al, 2003), in this case the Virtual
Breeding Environment (VBE) as a form of Collaborative Networked Organization (CNO).

According ECOLEAD research (D21.4a & D22.1) and supported in Romero et al (2006,
2007) 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 life cycle.

Governance management 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 include actors in defined positions/roles that
are for example involved in creation and managing of the VBE bag of assets, developing and
supporting ICT infrastructure, marketing VBE competencies, and most of all achieving the

In few words, VBE governance refers to the broadly rules, processes, or laws by which the
Virtual Breeding Environment is operated, regulated, and controlled.
3.2.3.4 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 Virtual Breeding Environment, and also serve as 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 manage when it comes to increase the chances of VBE members to get involved in Virtual Organizations with little know or even unknown of their potential VO partners. Moreover, in order to enhance VBE members’ preparedness to collaborate with 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 (D21.4b, D22.1, & D22.2a) and supported in Msanjila & Afsarmanesh (2006) research, the main purpose of trust management is to support the establishment and promotion of trust relationships between VBE actors. Main functions identified by ECOLEAD research (D21.4b, D22.1, D22.2a) for trust management process are: 1) Assessment of trust level of VBE member applicants, 2) Assessment and management of the base trust level of VBE members, and 3) Assessment of trust level of potential VO partners.

The function of assessment the trust level in VBE member applicants refers to the processes of verifying according certain membership requirements the basic trust level required for the application acceptance of a new VBE members.

The function of assessment and management of trust level in VBE members aims to periodically assessment the base trust level of VBE members, updating their trust background information (e.g. historic performance record) according 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 collaborative opportunities arisen, and also to support VBE administration in the assignment of rights, roles and responsibilities to VBE actors.

The function of assessment the trust level of potential VO partners refers to the processes of verifying according certain requirements the basic trust level required for participation in future VO.
Furthermore, in order to facilitate trust management process, ECOLEAD project (D21.4b, D22.1, & D22.2a) and Msanjila & Afsarmanesh (2006) propose a Trust Management System (TrustMAN) as a tool for helping VBE administration and VO planner/VO coordinator in the handle of two main tasks: base trust management, and 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).

To conclude, trust is an intangible enabler of collaboration required to make sustainable a Collaborative Networked Organization (CNO) such as the VBE and allow smooth VO creation process inside it.

3.2.3.5 Performance Management 1

Performance Management is a process that will provide the VBE administration with the possibility of improving Virtual Breeding Environment effectiveness in the accomplishment of its mission and goals. Therefore, performance management represents a systematic procedure of planning work and setting expectations and continually monitoring performance of the VBE as whole and its members by evolving/developing the capacity to perform periodically rating of performance in a summary fashion and rewarding for any good performance VBE actors (adapted from U.S.OPM).

In an effective Virtual Breeding Environment, administrative work and especially work that involve collaboration of different VBE actors should be planned out in advance. Planning process means setting performance expectations and goals for VBE actors to channel their efforts towards achieving VBE objectives. Getting all VBE actors involved in the planning process will help them understand the goals of the VBE, what needs to be done, why it need to be done, and how well it should be done. The regulatory requirements for planning VBE actors’ performance should include the establishment of the performance standards for appraisal plans. Performance standards should be measurable, understandable, verifiable, equitable, and achievable. Through critical standards, VBE actors are held accountable as organizations for work assignment or

1 This section was supported in an adaptation of U.S. Office of Personal Management (U.S.OPM), “Overview about Performance Management”, URL: http://www.opm.gov/perform/overview.asp#6
responsibilities. VBE actors’ performance plans should be flexible so that they can be adjusted for changing program objectives and work requirements. When used effectively, these plans can be beneficial working documents that are discussed often and not merely paperwork that is filed in a drawer and seen only when rating of record are required (adapted from U.S.OPM).

In an effective Virtual Breeding Environment, assignments are monitored continually. Monitoring process means consistently measuring performance and providing ongoing feedback to VBE actors on their progress towards reaching their common goals that should be part of VBE goals. Regulatory requirements for monitoring VBE actors’ and VBE performance include conducting progress reviews with VBE actors where their performance is compared against the VBE standards. Ongoing monitoring provides the opportunity to check how well VBE members are meeting predetermined standards and to make changes to unrealistic or problematic standards. And by monitoring continually, unacceptable performance can be identified at any time during the appraisal period and assistance provided to address such performance rather than wait until the end of the period when summary rating levels are assigned (adapted from U.S.OPM).

In an effective Virtual Breeding Environment, VBE actors’ developmental is needed to be evaluated and addressed. Developing process in this instance means increasing the capacity to perform through training, giving assignments that introduce new skills or higher levels of responsibility, improving work processes, or other methods. Providing VBE actors with training and developmental opportunities encourages good performance, strengthens task-related skills and competencies, and helps VBE actors keep up with changes in the VBE, such as the introduction of new technology. Carrying out the processes of performance management provides an excellent opportunity to identify developmental needs. During planning and monitoring of work, deficiencies in performance become evident and can be addressed. Areas for improving good performance also stand out, and action can be taken to help successful VBE actors improve even further (adapted from U.S.OPM).

From time to time, VBE administration should summarize VBE performance. This can be helpful for looking at and comparing performance over time or among various VBE actors to know who their best performers are. Within the VBE context of formal performance appraisal requirements, rating means evaluating VBE actors performance against the standards in a VBE performance plan and assigning a summary rating of record. The rating of record
performance is assigned according to procedures included in the VBE appraisal program. It is based on work performed during an entire appraisal period (adapted from U.S. OPM).

In an effective Virtual Breeding Environment, rewards should be well used. Rewarding process means recognizing VBE actors, individually and as members of VOs, for their performance and acknowledging their contributions to the VBE mission. A basic principle of effective management is that all behavior is controlled by its consequences. Those consequences can and should be both formal and informal and both positive and negative. Good performance is recognized without waiting for nominations for formal awards to be solicited. Recognition is an ongoing, natural part of day-to-day experience. Nonetheless, awards regulations provide a broad range of forms that more formal rewards can take, such as cash, time off, and many non-monetary items. The regulations also cover a variety of contributions that can be rewarded, from suggestions to group accomplishments (adapted from U.S. OPM).

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 and whether activities are performed efficiently, and to identify problems that may require additional efforts or attention of the VBE administration.

According ECOLEAD research (D21.4a D22.1), three important factors to be considered when measuring performance are: 1) VBE actors’ capacities, 2) VBE actor’s processes performed, and 3) Final or progressive outcomes achieved by VBE actors.

In short, performance management is the process of continually measure performances of VBE actors’ activities with some quantifiable performance indicators or key indicators based on a standard on which a judgment or decision can be based.

3.2.3.6 Bag of Assets Management

Virtual Breeding Environments (VBEs) as long-term alliances of organizations promote the sharing of knowledge, skills and resources to facilitate VO creation process in order to respond to a specific collaboration opportunity. To make easier this process within a VBE, its 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. According to the U.S. Generally Accepted Accounting Principles (GAAP), assets can be classified as follows:

- **Current assets:** cash and other assets expected to be converted to cash.
- **Long-term investments:** these are to be held for many years and are not intended to be disposed in the near future.
- **Fixed assets:** purchased for continued and long-term use in earning profit in a business. This group includes land, buildings, machinery, furniture, tools, wasting resources (assets which decline in value over time, e.g. gas, oil etc.).
- **Intangible assets:** these lack physical substance and usually are hard to evaluate. They include patents, copyrights, franchises, goodwill, trademarks, trade names, etc.
- **Other assets:** this type includes a high variety of assets, most commonly long-term prepaid expenses, long-term receivables, property held for sale 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 share with other VBE actors. 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 Virtual Breeding Environment, according ECOLEAD research (D22.1 & D22.2a), the following potential assets have been identified:

- General policies in the form of documents, books, leaflets to help (new and old) members to easily follow the guidelines of a VBE.
- Sample contracts to speed up the contracting phase.
- General legal issues related to the sector.
- Information of interest, specific to the VBE sector.
- Links to other sources of information.
- Lessons learned.
- FAQs (Frequent Asked Questions).

Therefore, according ECOLEAD research (D22.1 & D22.2a), the main components of a VBE bag of assets should include: documents, software, tools and the *VBE ontology* (to be explained forward in section 3.2.3.9).
In this scenario, ECOLEAD project (D22.1 & D22.2a) proposes a VBE bag of assets tool as a Content Management System (CMS) or Knowledge Management Systems (KMS) that will allow publishing and managing of 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 dashboard 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.

3.2.3.7 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. Moreover, support institutions always try to keep up with new trends and technologies in their field of expertise and thus tend to propose a solution that is up to date and optimized for their clients. 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 Virtual Breeding Environment and by assuming certain rights and duties can be also considered VBE members (Romero et al, 2006).

In this sense, the management of support institutions, according ECOLEAD research (D22.1 & D22.2a), should provide functionalities for identifying and acquiring support institutions for the VBE and a tool for managing its information. Those main functionalities are: 1) Registering Support Institutions, and 2) Support Institutions Search.

The functionality of registering support institutions will be carried out by using a simplified member registration process (section 3.2.1.1), where support institutions will register their general information and competency-related information.

The functionality of support institutions search will support all VBE actors in the competence-based search at the PCMS to find the right support institution for helping them in a specific problem.
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.

3.2.3.8 ICT Management

According to ECOLEAD research (D22.1, D61.1a, & D61.1b) and Ricardo et al (2006), the implementation and management of a Virtual Breeding Environment 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, need to be designed and implemented enabling VBE actors to agile define and set-up relations with each other (e.g. VO creation). Roughly, this mean the need for building and managing an ICT infrastructure that allows well establish group of organizations in the VBE to collaborate between each other as well as to manage this collaboration.

In a Virtual Breeding Environment, the ICT infrastructure will play the intermediary role as enabler of interoperation among VBE actors and the support services provided and involved in the VBE. The ICT infrastructure is the base enabler for safe and coordinated interactions among VBE/VO members (Camarinha-Matos & Afsarmanesh, 2004b; Rabelo et al, 2006).

To sum up, the ICT management process 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 & Afsarmanesh, 2004b; Rabelo et al, 2006).

3.2.3.9 Value System Information Management

A Virtual Breeding Environment represents a value system where different activities are carried out by a number of VBE actors forming a value-creation system (e.g. VO) that use tangible and intangible assets for creating value for VBE/VO customers (adapted from Parolini, 1999). Furthermore, VBE actors participate in the value-creation system by converting their skills or core-competencies and resources (including knowledge) into tangible and intangibles deliverables that should have value for other VBE actors. In a successful Virtual Breeding Environment every VBE 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, 2007).
Therefore, value system information management 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, 2007). However, since these values (assets) may fall into different categories given that the concept of value is multifaceted, ECOLEAD research (D21.4a, D22.1, & D22.2a) and supported in Romero et al (2007) research propose a type of management structure as an inventory called “VBE capital system” to better handle these assets. This inventory aims 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 (section 3.2.3.5) 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 (section 3.2.3.3).

To cut the long story, the value system management process will support and handle the material and immaterial values/assets within the VBE for the purpose of modeling and assessing their use towards co-producing value for VBE/VO customers.

3.2.3.10 Ontology Management

As mentioned before the VBE ontology is part of the VBE bag of assets (section 3.2.3.6) but requires a different management approach in relation to other VBE assets. According ECOLEAD research (D21.3, D22.1, D22.2a), the VBE ontology refers to a form of dictionary for supporting common understanding of VBE related concepts among all VBE actors. It represents a formal classification of knowledge and support the interoperability of knowledge among VBE actors and among different VBEs.
The VBE ontology management process and tool proposed by ECOLEAD project (D21.3, D22.1, & D22.2a) include the following functionalities: 1) Adaptation of common VBE ontology and 2) Discovery and Management of VBE ontology.

The functionality of adaptation of common VBE ontology refers to its adaptation for a specific VBE domain.

The functionality of discovery and management of VBE ontology aims to provide evolution of the ontology during the VBE life cycle 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 (D21.3, D22.1, & D22.2a) will use some semi-automatic methods for learning the ontology concepts from on-line text-corpora, since only manual methods are will be not effective in a dynamic environments 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.

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.

3.2.3.11 Decision Support Management

Decision support management in 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 (D22.1 & D22.2a) proposes a decision support system (DSS) as a tool to help VBE administration and perhaps VBE members to keep high level of competitiveness and performance by taking the right decisions.

The management decision support functionalities that according ECOLEAD project (D22.1 & D22.2a) should be provided to the VBE administration for assisting administrators in their decision and management process are:

- Data analysis by processing the data stored in VBE databases for providing administrator with easy to understand results (e.g. reports).
• Pro-active notification by automatically perform selected data analysis regularly and notify administrator by email when the results of analysis require his attention.

Furthermore, the decision support functionalities cover the following areas: 1) VBE competency gap analysis, 2) Lack of performance warning, and 3) Low trust level warning.

The functionality of *VBE competency gap analysis* is used to discover weak points and missing competencies by comparing current state of the VBE with the planned future strategy (section 3.2.3.1). In addition, the system also assist 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.

The functionality of *lack of performance warning* is a security precaution for ensuring the wealth of the VBE actors. Based on the performance indicators handle by the performance management process (section 3.2.3.4) some calculation will be carried out periodically to monitor that VBE actors’ performance standards are being achieved and send e-mail notification to appropriate VBE actors (e.g. VBE administration) when some actors’ performance level falls below the specified threshold.

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 (section 3.2.3.4).

To conclude, the VBE decision support management process and tool will provide monitoring of certain indicators in the VBE and issuance of notifications and warnings.
3.2.4 VBE Management Supporting Tools

Acronyms:

- CMS: Content Management System
- coFinder: Collaboration Opportunity Identification
- COC-Plan: Collaboration Opportunity Characterization and Rough Planning Tool
- CRM: Customer Relationship Management
- DSS: Decision Support System
- FAS: Financial Accounting System
- ICT-I: Information and Communication Technology Infrastructure
- KMS: Knowledge Management System
- ODMS: Ontology Discovery and Management System
- PCMS: Profiling and Competency Management System
- PMS: Performance Management System
- Portal: (e.g. Web page)
- PSS: Partners Search and Suggestion Tool
- TrustMAN: Trust Management System
- WizAN: Agreement/Contract Negotiation Wizard Tool

*Not included as ECOLEAD developed system/tool.
Chapter 4: VBE Instantiation Methodology

The VBE Instantiation Methodology proposed in this thesis was conceived and built by means of an inheritance and adaptive process of the most significant modeling dimensions (structural, componential, functional and behavioral) of the modeling framework for CNOs proposed by Camarinha-Matos and Afsarmanesh (2006a) called “ARCON - A Reference Model for COllaborative Networks”. Furthermore, these dimensions were adapted by the author to the Virtual Breeding Environment case as a long-term Collaborative Networked Organization (CNO). Additionally an exercise was carried out by developing a VBE Management Framework (Chapter 3) according to ECOLEAD project research to understand better each VBE management process (functional dimension) towards defining some guidelines for their instantiation in different VBE domains.

Following tables in section 4.3 will present the VBE Instantiation Methodology as a set of guidelines and suggested tools for instantiated the VBE management processes during the entire VBE life cycle and for different VBE domains.

4.1 Instantiation Process Definition

In order to explain what an instantiation process is, we may explain first the definition of “instantiation”, as the process of generating a partial model from a general model, and a particular model from the partial model. A general model is a representation that is valid to describe all the entities of some type or many of them. A partial model represents only part of the universe covered by the general model. Finally a particular model represents a particular case of the partial model.

The instantiation concept enables the definition of a generic and replicable management reference framework that can be applied to any kind of VBE. Partial frameworks can describe part of the VBE management or a kind of VBE management that can be developed from the generic one proposed in Chapter 3. And the same instantiation approach can be used to obtain the management framework for the case of a particular VBE using the methodology presented in section 4.3.

4.2 Instantiation Approach

To approach the instantiation process of a VBE Management Framework, the author considers the most general modeling dimensions of a Virtual Breeding Environment (VBE) as a
long-term Collaborative Networked Organization (CNO). The CNO general model proposed by Camarinha-Matos & Afsarmanesh (2006a) can describe any kind of CNO. Then from this CNO model, the author customized it for modeling the specific case of a VBE as a long-term type of CNO, so it is valid just for this type of the CNO universe. Finally the author proposes an instantiation methodology to support the generation of a particular model that describes a specific type of VBE.

In order to instantiate the VBE Management Framework it is necessary to identify and model the main elements of this type of CNO. A wide variety of actors and management activities co-exist in a typical VBE environment. VBEs should include heterogeneous organizations of different sizes and support institutions. The VOs are from time to time created and will interact with the VBE. Furthermore, the VBE administration will control the base running environment enforced by a number of policies and regulations, as well as providing a set of common tools, facilities and information that constitute the bag of assets for the VBE. Therefore, a large variety of information and knowledge must be properly modeled, organized, and applied to manage the VBE (Afsarmanesh and Camarinha-Matos, 2005).
4.2.1 From General to Partial Model

According to Camarinha-Matos and Afsarmanesh (2006a) in the context of a complex system like a CNO, modeling is fundamental for understanding, managing, simulating/predicting the behavior of CNOs (in this case the VBE), and certainly also for software development.

As a first attempt to reach a comprehensive modeling framework for CNO modeling, Camarinha-Matos and Afsarmanesh (2006a) have proposed the following four dimensions to provide an abstract representation of a CNO from inside, namely the identification of a set of characteristic properties that can together capture the elements constituting CNOs:

- **Structural dimension** – “addressing the structure of the CNO in terms of constituent elements (participants and their relationships) as well as the roles performed by those elements and other characteristics of the network nodes such as the location, time, etc.”
- **Componential dimension** – “focuses on the individual tangibles/intangible elements in the CNO network like resources composition such as human elements, software and hardware resources, information and knowledge, and ontologies”.
- **Functional dimension** – “addresses the base operation available at the network and the execution of time-sequenced flows of operations (processes, procedures and methodologies) related to the operational stage of the CNOs life cycle”.
- **Behavioral dimension** – “addresses the principles, policies, and governance rules that drive or constrain the behavior of the CNO and its members over time, like principles of collaboration, rules of conduct, contracts, and conflict resolutions policies”.

Figure 8 – Crossing CNO Life Cycle and In-CNO Abstractions
(Camarinha-Matos & Afsarmanesh, 2006a)
Furthermore, Camarinha-Matos and Afsarmanesh (2006a) also proposed the following four dimensions to provide an abstract representation of a CNO as seen from outside:

- **Market dimension** – “covers both the issues related to the interactions with customers and competitors”.
- **Support dimension** – “addresses the support services provided by third party institutions”.
- **Societal dimension** – “captures the issues related to the interactions between the CNO and the society in general”.
- **Constituency dimensions** – “focuses on the interaction with the universe of potential new members of the CNO”.

Finally, Camarinha-Matos and Afsarmanesh (2006a) propose three levels of abstraction in a model intent perspective, including the entire CNO life cycle perspective constituted by four main stages: creation, operation, evolution, and metamorphosis/dissolution:

- **General concepts** – “that includes the most general concepts and related relationships, common to all CNOs independently of the application domain”.
- **Specific modeling level** – “an intermediate level that includes more detailed models focused on different classes of CNOs”.
- **Implementation modeling level** – “that represents models of concrete CNOs”.

Figure 9 – Crossing CNO Life Cycle and About-CNO Abstractions
(Camarinha-Matos & Afsarmanesh, 2006a)
Following the tree levels of abstraction proposed by Camarinha-Matos and Afsarmanesh (2006a), the author instantiate the general dimensions of the In-CNO abstractions in the ARCON Reference Model into a partial model called VBE Management Framework described in Chapter 3, that considers the main management processes require to support the managing of those dimensions identified for a VBE during its entire life cycle, as a long-term type of CNO. Table 1 presents the relationship between the ARCON References Model based on its dimensions for In-CNO abstractions and the VBE Management Framework processes to support them. The dimensions proposed for About-CNO abstractions are also considered and presented in the Table 1 as possible outputs of certain VBE management process, but will not be considered in the for its instantiation because their nature is not related to a process, moreover to an output of them.

Table 1 – Instantiating ARCON Modeling Dimensions to VBE Management Framework Processes

<table>
<thead>
<tr>
<th>CNO Abstractions</th>
<th>CNO Dimensions</th>
<th>VBE Management Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-CNO Abstractions</td>
<td>Structural dimension</td>
<td>• Membership &amp; Structure Management (section 3.2.1.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Profiling and Competency Management (section 3.2.1.2)</td>
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<td></td>
<td></td>
<td>• Governance Management (section 3.2.3.4)</td>
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<tr>
<td></td>
<td>Componential dimension</td>
<td>• Financial, Accounting and Resources Management (section 3.2.3.2)</td>
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<td></td>
<td></td>
<td>• Bag of Assets Management (section 3.2.3.7)</td>
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<tr>
<td></td>
<td></td>
<td>• ICT Management (section 3.2.3.8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Value System Management (section 3.2.3.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ontology Management (section 3.2.3.10)</td>
</tr>
<tr>
<td></td>
<td>Functional dimension</td>
<td>• Strategic &amp; Marketing Management (section 3.2.3.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Financial, Accounting and Resources Management (section 3.2.3.2)</td>
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<tr>
<td></td>
<td></td>
<td>• Value System Management (section 3.2.3.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Collaboration Opportunity Identification (section 3.2.2.1)</td>
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<tr>
<td></td>
<td></td>
<td>• CO Characterization and Rough Planning (section 3.2.2.2)</td>
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<tr>
<td></td>
<td></td>
<td>• Partner Search and Suggestion (section 3.2.2.3)</td>
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<tr>
<td></td>
<td></td>
<td>• Agreement/Contract Negotiation Wizard (section 3.2.2.4)</td>
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<tr>
<td></td>
<td></td>
<td>• VO Information Management (section 3.2.2.5)</td>
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<tr>
<td></td>
<td></td>
<td>• Performance Management (section 3.2.3.16)</td>
</tr>
</tbody>
</table>
Behavioral dimension

- Agreement/Contract Negotiation Wizard (section 3.2.2.4)
- Governance Management (section 3.2.3.4)
- Trust Management (section 3.2.3.5)
- Performance Management (section 3.2.3.16)

About-CNO Abstractions

- Market dimension
  - Strategic & Marketing Management (section 3.2.1.1)
  - Agreement/Contract Negotiation Wizard (section 3.2.2.4)

- Support dimension
  - Membership & Structure Management
  - Profiling and Competency Management (section 3.2.1.2)
  - Support Institutions Management (section 3.2.3.8)

- Societal dimension
  - Governance Management (section 3.2.3.4)
  - Value System Management (section 3.2.3.9)

- Constituency dimension
  - Membership & Structure Management (section 3.2.1.1)
  - Profiling and Competency Management (section 3.2.1.2)
  - Support Institutions Management (section 3.2.3.8)

4.2.2 From Partial to Specific Model

Following the instantiation approach depicted in Figure 7, the author first has instantiated the ARCON Reference Model based on its dimensions for In-CNO abstractions as a generic model for CNOs, into a VBE Management Framework as a partial model for this type of long-term CNO. Next, the author also considering the CNO modeling dimensions for In-CNO abstractions and the VBE management processes in the entire life cycle of a Virtual Breeding Environment, proposes a VBE Instantiation Methodology presented in section 4.3 to move from a VBE management partial model into a specific management model according to the domain and administrative requirements of a specific type of VBE and its administration. Figure 11 presents how the dimensions for In-CNO abstractions of the ARCON Reference Model are considered in the VBE Instantiation Methodology proposed, and of course the VBE management processes are included as processes to be instantiated during the entire VBE life cycle.
4.3 Instantiation Methodology

According to ECOLEAD project (D22.1), the management of a VBE during its life cycle is a fundamental aspect of the VBE existence. The efficiency and success of VBE activities are influenced by the efficiency and completeness of the support from the VBE administration. This shows the importance of identification and implementing the necessary functionalities for all stages of VBE, to support its actors and stakeholders.

In the following tables, it will be addressed the identification and development of required functionalities during the stages of the VBE life cycle: creation, operation/evolution, metamorphosis and dissolution.
4.3.1 VBE Creation Stage - Initiation & Recruiting, and Foundation

This stage includes two main steps:
1. VBE Initiation and Recruiting,
2. VBE Foundation.

VBE Initiation and Recruiting refer to the processes of planning the creation of a new VBE, following a number of preparation steps to facilitate the execution of operational activities.
VBE Foundation refers to the processes of set-up and running the ICT infrastructure to support VBE operation, establishing the VBE governance structure, and populating the VBE by registering founding members and their support institutions to allow the VBE administration to initiate operations.

<table>
<thead>
<tr>
<th>Stage 1: VBE Creation: Foundation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT-I Set-up &amp; Run and Governance Structure Establishment</td>
<td></td>
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<tr>
<td>VBE ICT Infrastructure Setup &amp; Run</td>
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<tr>
<td>VBE Governance Structure Establishment</td>
<td></td>
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<tr>
<td>VBE Constitution (Membership Population)</td>
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<tr>
<td>Receive Membership Application</td>
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<tr>
<td>Invite Potential VBE Members</td>
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<tr>
<td>Assessment and Acceptance of Membership Applicants</td>
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<tr>
<td>Acceptance/Rejection of Membership Applicants</td>
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<tr>
<td>VBE Members Organizational Profiling and Competency Definition</td>
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<tr>
<td>Support Institutions Selection</td>
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<tr>
<td>Support Institutions Registration</td>
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<tr>
<td>VBE Launching</td>
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<tr>
<td>VBE Launching</td>
<td></td>
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<tr>
<td>Next: VBE Operation and Evolution</td>
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</tr>
</tbody>
</table>
### 4.3.1.1 Initiation and Recruiting: Marketing, Economical and Technological Analysis

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage A: Creation - Initiation &amp; Recruiting</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
</tr>
</thead>
</table>

**OBJECTIVE**

Identification of business drivers for VBE creation.

**SCOPE**

The activity applies when there is an entity (organization) that wants to create a VBE. Identification and classification of business attractors (reasons) for organizations join the VBE.

The activity introduces a market, economical and technological analysis.

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Market, Economical and Technological Analysis</td>
<td>Identify main objectives and benefits: what is the main reason for the VBE existence? Identify, classify and analyze needs to be fulfill by the VBE: - Economical needs - Social needs - Technological needs Identify the potential industry sectors and organizations (not limited to geography proximity) that could be involved in the VBE. Identify needs of ICT interoperability and support services to be provided to enable effectiveness in doing business and collaborating. Identify organization core-competencies (e.g. skills and resources) that will contribute to VBE creation in its initial stage.</td>
<td>VBE Initiator VBE Manager VBE Advisor Support Institutions</td>
<td>Perform market analysis:  - Identify market trends.  - Identify Strengths, Weakness, Opportunities and Threats for the VBE.  - Assess the competitive scenario for the VBE business model.  - Classify potential VBE/VO products/services according its complexity and uncertainty (e.g. commodities, durables, fashion or capital goods).  - Identify sustainable competitive advantages for VBE value proposition (products/services):  o Distinct value offer.  - Identify critical market success factors for the VBE value proposition (products/services):  o Market share.</td>
<td>Procedures/Methodologies:  - Market research  - Five Forces Model  - SWOT Analysis  - Critical Success Factors  - Sustainable Competitive Advantages Information Systems/Repositories:  - Business Intelligence Knowledge Bases and Systems</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Perform economical analysis:  - Identify economical trends.  - Identify critical economical success factors for the VBE:  o Key industry sectors  o Industry participation in Gross Domestic Product (GDP)  o Importations and Exportations  o Tax rates</td>
<td></td>
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<tr>
<td>OUTPUTS:</td>
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<td>-----------------------------------------------------------------------</td>
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<tr>
<td>• List of potential customer(s)/market(s) needs to be fulfilled.</td>
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<tr>
<td>• Industrial sector(s) to be covered.</td>
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<tr>
<td>• List of potential organizations (members) that could belong to the VBE.</td>
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<tr>
<td>• Needs/Requirements for transparent, easy to use, and affordable “plug-and-play” ICT infrastructure/middleware.</td>
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</table>

<table>
<thead>
<tr>
<th>RESOURCES:</th>
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</thead>
<tbody>
<tr>
<td>• Human Resources: Individual(s) or team(s) with knowledge and competency in market research, strategic planning and ICT infrastructure developments.</td>
</tr>
<tr>
<td>• Financial Resources: Funding mechanism that could be used.</td>
</tr>
<tr>
<td>• Physical/ICT Resources: Business Intelligence Knowledge Bases and Systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• VBE Initiator refers to any organization(s) involved in the VBE creation process.</td>
</tr>
</tbody>
</table>
### 4.3.1.2 Initiation and Recruiting: Strategic Planning

**VBE Life Cycle Stage:** Stage A: Creation - Initiation & Recruiting  
**Date Issued:** Month day, Year  
**Process ID:** A2

**OBJECTIVE**  
VBE goal setting, strategy analysis and strategy formulation. The activity introduces the first steps towards the definition of VBE business model.

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
<th>PROCEDURES/METHODOLOGIES</th>
</tr>
</thead>
</table>
| 2.1 | Goal setting and Strategy Analysis | Definition of goals:  
- Mission  
- Vision  
- Objectives | VBE Initiator  
VBE Manager  
VBE Advisor  
Support Institutions | Respond to the following questions:  
- What is the reason for VBE creation (Mission)?  
- What wants to achieve the VBE (Vision)?  
- What are the VBE specific objectives?  
- What would be the strategy for VBE creation and operation? | Procedures/Methodologies:  
- Strategic Management Tools (see Process C3, Activity 3.1)  
- Business Model Definition Tools  
- Business Plan Formulation Tools  
Information Systems/Repositories:  
- Business Intelligence Knowledge Bases and Systems |

| 2.2 | Strategy Formulation | Formulation of the business plan, including marketing/branding, financial and operational strategic plans for VBE creation and operation. | VBE Initiator  
VBE Manager  
VBE Advisor  
Support Institutions | Creation of marketing/branding strategic action plan:  
- Target Customers  
- Market demographics/demands  
- Product/Service Mix  
- Advertising and Promotion  
- Pricing and Budgeting  
- Branding  
- Public relationships  
- Value offer differentiation  
- Other marketing/branding issues… | Procedures/Methodologies:  
- 4P’s Marketing Mix Strategy (Product, Price, Place, and Promotion) Tools (see Process C3, Activity 3.1):  
  - Relationship Marketing  
  - Co-branding Strategy  
  - Pricing Strategy  
Information Systems/Repositories:  
- Business Intelligence Knowledge Bases and Systems |

Creation financial strategic action plan:  
- Start-up and operation budgets  
- General Accountability  
- Memberships (fees)  
- Other financial issues…  

Creation operational strategic action plan:  
- Governance definition:  
  - Contracts and Agreements  
  - Organizational structure  
  - Principles, bylaws (policies) and rules  
  - Roles, rights and responsibilities  
  - Memberships and profiles definition.  
- Business process definition:  
  - VBE support services offer for VBE members  
  - VBE support services offer for VO creation and registration | Procedures/Methodologies:  
- Project Management Tools (e.g. Gantt)  
- Contract Templates  
- Clauses Catalogue  
- Commerce Laws  
Information Systems/Repositories:  
- Agreement/Contract Negotiation Wizard Systems |
<table>
<thead>
<tr>
<th>OUTPUTS:</th>
<th>RESOURCES:</th>
</tr>
</thead>
</table>
| • VBE strategy ready for its implementation (Business Model and Business Plan). | • Human Resources: Individual(s) or team(s) with knowledge and competency in marketing/branding, financial and operational strategic planning.  
• Financial Resources: Funding mechanism to be used.  
• Physical/ICT Resources: ICT Resources: Strategic Management, Project Management and Agreement/Contract Negotiation Tools/Systems (e.g. software). |

<table>
<thead>
<tr>
<th>COMMENTS:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• The VBE Strategy will guide and control the implementation of marketing/branding, financial and operational strategic plans during the VBE creation and operation.</td>
<td></td>
</tr>
</tbody>
</table>
### 4.3.1.3 Initiation and Recluting: Strategy Implementation

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage A: Creation - Initiation &amp; Recluting</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
</tr>
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<tbody>
<tr>
<td>Process:</td>
<td>3. Strategy Implementation</td>
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<tr>
<td>Process ID:</td>
<td>A3</td>
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</table>

**OBJECTIVE**

VBE strategy implementation at business processes, ICT infrastructure and governance levels.

**SCOPE**

The activity introduces the final steps towards the definition of VBE business model.

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>VBE Business Processes Definition</td>
<td>Characterization of business processes for VBE management.</td>
<td>VBE Initiator</td>
<td>Definition of business process functionalities, within VBE, for enable successful management:</td>
<td>Procedures/Methodologies:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VBE Manager</td>
<td>• Business processes have to be classified in a manner to perform specific actions on VBE actors.</td>
<td>• Frameworks, Architectures and Reference Models:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VBE Advisor</td>
<td>• VBE business process taxonomy should based on VBE Management Framework:</td>
<td>o Enterprise Architectures:</td>
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<td></td>
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<td></td>
<td>Support Institutions</td>
<td>o VBE Actors Management:</td>
<td>• PERA (Perdue Enterprise Reference Architecture)</td>
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<td></td>
<td>• Membership and Structure Management</td>
<td>• CIMOSA (CIM Open System Architecture)</td>
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<td>• Profiling and Competency Management</td>
<td>• Zachman (IBM Architecture)</td>
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<td>• VO Creation and Registration Management:</td>
<td>• GERAM (Generalized Enterprise Referent Architecture &amp; Methodology)</td>
</tr>
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<td></td>
<td></td>
<td>• Collaboration Opportunity Identification</td>
<td>• FEA (Federal Enterprise Architecture Framework)</td>
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<td>• Characterization and Rough Planning</td>
<td>o Business Architectures</td>
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<td>• Partners Search and Suggestion</td>
<td>o Information Systems Architectures</td>
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<td>• Contract Negotiation Wizard</td>
<td>o Application Architectures</td>
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<td>• VO Information Management</td>
<td>o Technical Architectures</td>
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<td>• VBE General Management:</td>
<td>o Product Architectures</td>
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<td>• Strategic and Marketing Management</td>
<td>• Business Process Management</td>
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<td>• Governance Management</td>
<td>• Other business process taxonomies:</td>
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<td>• Trust Management</td>
<td>o ENAPS (European Network for Advanced Performance Systems)</td>
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<td>• Performance Management</td>
<td>o ISO (International Organization for Standardization)</td>
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<td></td>
<td>• Bag of Assets Management</td>
<td>• Diagrams:</td>
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<td>• Support Institutions Information Management</td>
<td>o Audit diagram</td>
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<td>• ICT Management</td>
<td>o Cause &amp; Effect diagram</td>
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<td>• Value System Management</td>
<td>o Cross functional diagram</td>
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<td>• Ontology Management</td>
<td>o Dataflow diagram</td>
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<td>• Decision Support Management</td>
<td>o EPC diagram</td>
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<td>o Fault tree diagram</td>
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<td>o TQM diagram</td>
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<td>o Workflow diagrams</td>
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| 3.2 | ICT Infrastructure Definition | Characterization of ICT infrastructure/middleware to be used as intermediary interface among VBE actors’ information systems and as a support services provider. | VBE Initiator VBE Manager VBE Advisor Support Institutions Support Service Providers | Definition of supporting information systems and repositories for VBE business processes. | Information Systems/Repositories:  
- Membership Management Systems  
  - Member registration features  
  - Member rewarding features  
  - Member roles, rights and responsibility management features  
- Profiling and Competency Management Systems  
  - Discovery/search of new competencies features  
- Collaboration Opportunity Identification Systems  
- Collaboration Opportunity Characterization and Rough Planning Systems  
- Partner Search and Suggestion Systems  
- Contract Negotiation Wizard Systems  
- VO Information Management Systems  
  - VO registration features  
  - VO inheritance information features  
- Trust Management Systems  
- Performance Management Systems  
- Bag of Assets Management Systems  
- Support Institutions Information Management Systems  
  - Support Institutions registration features  
- Value System Management Systems  
- Ontology Management Systems  
- Decision Support Management Systems  
  - Competency gap analysis features  
  - Lack of performance warning features  
  - Low trust level features |
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<tr>
<td>3.3</td>
<td>Governance Structure Definition</td>
<td>Characterization of governance structure (see Process C3, Activity 3.3)</td>
<td>VBE Initiator</td>
<td>Definition of corporate governance structure:</td>
<td>Procedures/Methodologies:</td>
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<td>VBE Manager</td>
<td>• Steering committee definition</td>
<td>• Guiding steps for VBE governance principles, rules, bylaws, roles, rights and responsibilities definition.</td>
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<td>VBE Advisor</td>
<td>• VBE actors roles definition:</td>
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<td>Support Institutions</td>
<td>o VBE Member</td>
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<td>o VBE Manager (Administrator)</td>
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<td>o Opportunity Broker or simply Broker</td>
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<td>o VO Planner or Business Integrator</td>
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<td>o VO Coordinator</td>
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<td>o VBE Advisor</td>
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<td>o Support Services/Ontology Provider</td>
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<td>o Support Institutions</td>
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<td>o Membership eligibility principles</td>
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<td>o Leadership (authorities) role principles</td>
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<td>o Contract enforcement policy</td>
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<td>• Rules definition:</td>
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<td>o Behavior (ethical code and culture)</td>
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<td>o Functional/Operational rules</td>
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<td>• Bylaws definition:</td>
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<td>o Rights and Duties policy</td>
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<td>o Amendments to bylaw</td>
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<td>• Contracts and agreements definition:</td>
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<td>o VBE Consortium contract</td>
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<td>o Contracts for customer projects</td>
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<td>o Contracts with subcontractors</td>
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<td>• Definition of rights and responsibilities according VBE actors roles.</td>
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</tbody>
</table>

**OUTPUTS:**
- Business process definition.
- ICT infrastructure ready to be set-up and run.
- Governance structure definition.

**RESOURCES:**
- Human Resources: Individual(s) or team(s) with knowledge and competency in business process management, ICT developments and governance/legal issues.
- Financial Resources: Funding mechanism to be used.
- Physical/ICT Resources: ICT Infrastructure - Hardware & Software.

**COMMENTS:**
- Definition of management structure, positions/roles, principles, rules, bylaws, contracts, agreements, rights and responsibilities should remain documented.
### 4.3.1.4 Foundation: ICT-I Set-up & Run and Governance Structure Establishment

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage B: Creation – Foundation</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process:</td>
<td>1. ICT Infrastructure Set-up &amp; Run and Governance Structure Establishment</td>
<td></td>
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<tr>
<td>Process ID:</td>
<td>B1</td>
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</tbody>
</table>

#### OBJECTIVE

**Creation of the VBE.**

The activity focuses on implementing ICT infrastructure and governance structure for the VBE.

#### SCOPE

**The activity focuses on implementing ICT infrastructure and governance structure for the VBE.**

<table>
<thead>
<tr>
<th>NO</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>ICT Infrastructure Set-up &amp; Run</td>
<td>Set-up and run VBE systems and ICT infrastructure.</td>
<td>VBE Initiator, VBE Manager, VBE Advisor</td>
<td>All required middleware for interoperation among all VBE actors’ information systems should be provided.</td>
<td>Procedures/Methodologies: • Mechanisms for setting-up and running the VBE systems and the ICT infrastructure. • Mechanisms for parameterizing and set-up links among nodes in the VBE. • Mechanisms for collecting and loading ontologies and thesaurus. • Mechanisms for transferring inheritance from previous VBEs to the new VBE.</td>
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<tr>
<td></td>
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<td>Load existing ontology and thesaurus.</td>
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<td>Parameterize domain and set-up nodes.</td>
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<td>Create information repositories.</td>
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<td>Enter administrative and assisting data.</td>
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<td>Register founding members.</td>
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<tr>
<td>1.2</td>
<td>Governance Structure Establishment</td>
<td>Creation of steering committee (structure of authority).</td>
<td>VBE Initiator, VBE Manager, VBE Advisor</td>
<td>All related issues about VBE governance structure should be documented and published for acknowledge of all VBE actors.</td>
<td>Procedures/Methodologies: • Guiding steps for VBE governance principles, rules, bylaws, roles, rights and responsibilities definition. Information Systems/Repositories: • Corporate Portals (e.g. bulletin boards)</td>
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<tr>
<td></td>
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<td>Publication of principles, rules, bylaws that will govern the VBE.</td>
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</tbody>
</table>

#### OUTPUTS:

- ICT infrastructure and information systems running.
- Governance structure established.

#### RESOURCES:

- Human Resources: Individual(s) or team(s) with knowledge and competency in ICT developments and governance/legal issues.
- Financial Resources: Funding mechanism to be used.
- Physical/ICT Resources: ICT Infrastructure - Hardware & Software.

#### COMMENTS:

- Future members should read and agree with principles, rules, and bylaws governing the VBE before start membership application registration process.
- Definition of management structure, positions/roles, principles, rules, bylaws, contracts, agreements, rights and responsibilities should remain documented and published.
### OBJECTIVE
Populate the VBE (Members Registration Process).

### SCOPE
The activity focuses in members’ recruiting, membership accreditation, and members’ registration.

<table>
<thead>
<tr>
<th>N°</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
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</thead>
</table>
| 2.1 | Receive Membership Applications or Invite Potential VBE Members | Membership applicants registration: - Organizations apply for VBE membership. - VBE sends invitations (applications) for pre-selected organizations according to competency requirements. | VBE Initiator | Receive or request relevant data for membership accreditation process. | Procedures/Methodologies: - Guiding steps for VBE members registration:  
  o Collection of provided information  
  Information Systems/Repositories:  
  o Member registration features |
|     |          |             | VBE Manager |  |  |
|     |          |             | VBE Advisor |  |  |
|     |          |             | VBE Applicants |  |  |

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<th>N°</th>
<th>ACTIVITY</th>
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<th>GUIDELINES</th>
<th>TOOLS</th>
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</table>
| 2.2 | Assessment and Accreditation of Membership Applicants | Assessment of membership applicants. Accreditation of information provided. | VBE Initiator | Assessment of performance level. Assessment of readiness for collaboration. Accreditation documents to be reviewed:  
  - Accreditations  
  - Certificates  
  - Financial rating  
  - Recommendation letters  
  - Licenses  
  - Patents  
  - Articles (Newspapers and Magazines)  
  - Awards | Procedures/Methodologies: - Guiding steps for VBE members registration:  
  o Validation of provided information  
  o Base trust assessment  
  Information Systems/Repositories:  
  o Member registration features |

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<th>N°</th>
<th>ACTIVITY</th>
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<th>GUIDELINES</th>
<th>TOOLS</th>
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</table>
| 2.3 | Acceptance/Rejection of Membership Applicants | Acceptance/rejection of membership applicants. | VBE Initiator | Basic criteria for acceptance/rejection of applicants:  
  - Basic information validation  
  - Base Trust Level  
  - Validity of evidence information  
  - Compliance of Competency  
  If an Applicant is accepted, it becomes a VBE member that will receive initial responsibilities and rights according its role. If is rejected, it receive feedback for self-improvement and possibility for reapplication. Different roles can be assumed by a VBE member organization, even at the same time, so roles and therefore their associated rights and responsibilities cannot be static. | Procedures/Methodologies: - Guiding steps for VBE members’ assignment of roles, rights and responsibilities.  
  Information Systems/Repositories:  
  o Member registration features  
  o Member roles, rights and responsibility management features |
<p>|     |          |             | VBE Manager |  |  |
|     |          |             | VBE Advisor |  |  |
|     |          |             | VBE Applicants |  |  |</p>
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<tr>
<th>Nº</th>
<th>ACTIVITY</th>
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<th>TOOLS</th>
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<tbody>
<tr>
<td>2.4</td>
<td>VBE Members Organizational Profiling &amp; Competency Registration</td>
<td>Define members profiles and competencies including:</td>
<td>VBE Initiator</td>
<td>Capture profile and competency data for VBE members:</td>
<td>Procedures/Methodologies:</td>
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<tr>
<td></td>
<td></td>
<td>- General/Contact information</td>
<td>VBE Manager</td>
<td>• General information:</td>
<td>• Mechanisms for verification of validity of information provided by members during registration of new members and updating profiles.</td>
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<tr>
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<td>- Competency-related information</td>
<td>VBE Advisor</td>
<td>o Organization’s name</td>
<td>• Mechanisms for management of membership levels.</td>
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<td>- Financial information</td>
<td>VBE Applicants</td>
<td>o General description,</td>
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<td>- Evidence of information validity (conspicuity)</td>
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<td>o Contact information</td>
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<td>o Industry sector</td>
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<td>• Human resource(s)</td>
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<td>• ICT resource(s)</td>
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**OUTPUTS:**
- List of actual VBE members with their complete profile and competency description.

**RESOURCES:**
- Human Resources: Individual(s) or team(s) with knowledge and competency in profiling and competency identification.
- Financial Resources: Funding mechanism to be used.

**COMMENTS:**
- VBE applicant refers to potential VBE members in membership accreditation process.
- Membership applications could be received from organizations with interest to become part of the VBE or could be sent to organizations that VBE manager is interest in recruiting.
- Future members should read and agree with principles, rules, and bylaws governing the VBE before start membership applicant registration process.
### 4.3.1.6 Foundation: Support Institutions Selection

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage B: Creation - Foundation</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
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</thead>
</table>

#### OBJECTIVE
Selection of supporting institutions for assisting VBE actors in different purposes.

#### SCOPE
The activity focuses in support institutions’ recruiting, membership accreditation, and members’ registration.

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
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</thead>
</table>
| 3.1 | Support Institutions Registration | Support Institutions registration will be done using a simplified member registration process (see Process B2). Support Institutions can become VBE members. | VBE Initiator VBE Manager VBE Advisor Support Institutions | Selection of supporting institutions that could provide the VBE with services to keep up with new trends and technologies. If a support institution became a VBE member, it will change its role and receive new rights and duties (see Process B2). | Procedures/Methodologies:  
- Mechanisms for verification of validity of information provided by members during registration of new members and updating profiles.  
- Mechanisms for management of membership levels.  
Information Systems/Repositories:  
- Membership Management Systems  
  o Member registration features  
- Profiling and Competency Management Systems (see Process C1, Activity 1.1 and 1.2).  
- Support Institutions Information Management Systems  
  o Support Institutions registration features |

#### OUTPUTS:
- List of actual Support Institutions with their complete profile and competency description.

#### RESOURCES:
- Human Resources: Individual(s) or team(s) with knowledge and competency in profiling and competency identification.  
- Financial Resources: Funding mechanism to be used.  
- Physical/ICT Resources: Membership Management System & Profiling and Competency Management System.

#### COMMENTS:
- Support institutions should read and agree with principles, rules, and bylaws governing the VBE before start any relationship with it.
### 4.3.1.7 Foundation: VBE Launching

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<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage B: Creation – Foundation</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
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<tbody>
<tr>
<td>Process:</td>
<td>4. VBE Launching</td>
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<td>Process ID:</td>
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#### OBJECTIVE
Launch the VBE (Initiation of Operations).

#### SCOPE
The activity focuses on begin VBE business operation.

#### N° ACTIVITY DESCRIPTION RESPONSIBLES GUIDELINES TOOLS

| 4.1 | VBE Launching | Form and launch the VBE. | VBE Initiator, VBE Manager, VBE Advisor, VBE Members, Support Institutions, Support Service Providers | Announce start of VBE operations in different media (Internet, T.V., Newspaper, Radio, etc.) Execute relationship marketing/co-branding strategic plan (see Process A1, Activity 1.1). | Procedures/Methodologies: 4P’s Marketing Strategy (Product, Price, Place, and Promotion) Tools - (see Process A1, Activity 1.1 and Process C3, Activity 3.1):  - Relationship Marketing  - Co-branding Strategy  - Pricing Strategy |

#### OUTPUTS:
- VBE in operation stage.

#### RESOURCES:
- Human Resources: All VBE actors.
- Financial Resources: Funding mechanism to be used.
- Physical/ICT Resources: ICT Infrastructure - Hardware & Software.

#### COMMENTS:
- VBE manager should announce the start of VBE operations.
- Strong emphasis should be put in marketing activities.
4.3.2 VBE Operation and Evolution Stage

- VBE Operation refers to daily VBE actor’s management, VO creation and registration management and VBE general management.
- VBE Evolution refers to feedback processes through performance management to develop proposals for improvements that could include: 1) design, operation and control of new management approaches, 2) recruitment, assessment, and selection of new VBE members and support institutions, 3) re-definition and assessment of VBE actors’ roles...

VBE Operation/Evolution refers to the processes of running, executing and adapting various management activities to support VBE reaching its objectives.

During VBE operation two main events could happen as result of market changes and new trends appearances, VBE could go into a metamorphosis stage to respond to these environmental factors and survive (VBE can adapt its structure to these new competitive factors), or could go into a dissolution stage (because adaptation is not possible and a complete VBE restructure is necessary).
### 4.3.2.1 VBE Actors Management

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<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage C: Operation and Evolution</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
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</thead>
<tbody>
<tr>
<td>Process:</td>
<td>1. VBE Actors Management</td>
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<td>Process ID:</td>
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**OBJECTIVE**

Create a full profile of VBE actors for support competency management towards VO creation.

**SCOPE**

The activity focuses on VBE actors’ management.

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<th>№</th>
<th>ACTIVITY</th>
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<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
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<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
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<tbody>
<tr>
<td>1.2</td>
<td>Profiling and Competency Management</td>
<td>Creation and maintenance of VBE members, VOs and VBE itself profiles. This activity is divide into three mechanisms: - Management of profiles - Competency-based assessment - Discovery of new competencies</td>
<td>VBE Manager</td>
<td>Management of profiles: - Create/Update/Delete VBE members, VOs and VBE itself profiles. Competency-based assessment: - Validate VBE actors’ competence conspicuity according processes capabilities and resources capacities. Discovery of new competencies: - Collective competencies in VBE members.</td>
<td>Profiling and Competency Management</td>
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<td>OUTPUTS:</td>
<td>RESOURCES:</td>
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<tr>
<td>List of actual VBE members with their complete profile and competency description.</td>
<td>Human Resources: All VBE actors.</td>
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<td>Financial Resources: Funding mechanism to be used.</td>
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<th>COMMENTS:</th>
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## 4.3.2.2 VO Creation and Registration Management

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<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage C: Operation and Evolution</th>
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<tr>
<td>Process:</td>
<td>2. VO Creation and Registration Management</td>
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<td>Process ID:</td>
<td>C2</td>
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### OBJECTIVE
Support VO creation and registration activities towards rapid configuration of dynamic VOs in response to collaborative opportunities identified.

### SCOPE
The activity focuses on VO creation and registration.

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<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
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</table>
| 2.1 | Collaboration Opportunity Identification (CO-Finder) | Detection of collaboration opportunities. | Broker VO Customer Support Service Providers | Identification and categorization of collaboration opportunities (COs):
- Detect collaboration opportunities (e.g. call for tenders in newspapers, bulletin boards, web pages, marketplaces, etc.).
- Find required skills to respond to COs.
- Filter COs according to VBE domain of competencies.

Output: General information about COs.
- Contact
- Title
- Description
- Deadline
- URL (Web address)
- Other relevant data… | Procedures/Methodologies:
- Guiding steps for VO governance principles, rules, bylaws, roles, rights and responsibilities definition.
- Interoperability principles |

Information Systems/Repositories:
- Collaboration Opportunity Identification Systems |

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<th>Nº</th>
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<th>DESCRIPTION</th>
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<th>GUIDELINES</th>
<th>TOOLS</th>
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</table>
| 2.2 | Collaboration Opportunity Characterization and Rough Planning (COC-Plan) | Characterization of collaboration opportunities and definition of rough plans for future VOs. | Broker VO Planner Support Service Providers | Selection of type of collaboration opportunities (COs):
- COs modality selection:
  - Collaborative business process → distributed cross-organizational business processes and sub-processes.
  - Collaborative project → occur at project level, where activities are only made by humans.
  - Collaborative problem-solving → from as-is situation to a to-be (gap analysis).
  - Ad-hoc collaboration → quick response for emerging situations.
- COs characterization in terms of competencies:
  - Identification of needed competencies and capacities.
    - Product characterization
    - Service characterization | Procedures/Methodologies:
- Guiding steps for VO governance principles, rules, bylaws, roles, rights and responsibilities definition.
- Interoperability principles |

Information Systems/Repositories:
- Collaboration Opportunity Characterization and Rough Planning Systems |
• COs rough planning:
  o Definition of a rough VO structure, topology, organizational form, levels and associated roles, governance rules.
  o Definition of partnership form: contracts and cooperation agreements.
  o Representation of rough VO model, top-down (planning) vs. bottom-up (emerging)
  o Simulation to assess different configurations.

Output: Ideal VO configuration.

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<th>№</th>
<th>ACTIVITY</th>
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<th>GUIDELINES</th>
<th>TOOLS</th>
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</thead>
<tbody>
<tr>
<td>2.3</td>
<td>2.3 Partners Search and Suggestion (PSS)</td>
<td>Identification of potential partners, and their assessment and selection to become VO members: - Partners’ search. - Partners’ assessment (specification of preferences). - Partners’ selection.</td>
<td>Broker, VO Planner, VBE Members, Support Service Providers</td>
<td>Selection of most sustainable members for a VO regarding the requirements of a given collaboration opportunity. Partners could be assessed/selected based on a sort of criteria: • Price • Delivery date • Quality level • Performance indicators • Other criteria…</td>
<td>Output: List of potential VO partners with maximum compatibility with required competencies for a task(s) that should be performed to fulfill a CO.</td>
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<tr>
<td>2.4</td>
<td>2.4 Agreement/Contract Negotiation Wizard (WizAN)</td>
<td>Computer-assisted support or negotiation and reaching agreements during VO creation: - CO-Finder and COC-Plan: Contract type specification ad general definitions according VO requirements like: structure, topology, etc. - PSS: Contract under negotiation agreed and in process negotiation objects. - VO Registration: Signed agreements/assembled contract.</td>
<td>Broker, VO Planner, VO Coordinator, VBE Members, Support Service Providers</td>
<td>Negotiation: • Definition of negotiation protocols. • Decision making process and corresponding parameters. • Representation of agreements. Contracting: • Formulation and modeling of contracts and agreements. • Identification of type of contract. • Definition of contract enforcement mechanisms and institutions. • Definition of legal issues. Types of Contracts: • VBE contracts (with VBE actors) • VO contracts (with VO members and VO customer)</td>
<td>Procedures/Methodologies: • Guiding steps for VO members’ assignment of roles, rights and responsibilities. o Rights and duties policy • Guiding steps for VO governance principles, rules, bylaws, roles, rights and responsibilities definition. o Membership policy o Membership eligibility principles o Leadership role principles Information Systems/Repositories: • Partners Search and Suggestion Systems</td>
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<td>Nº</td>
<td>ACTIVITY</td>
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<td>RESPONSIBLES</td>
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| 2.5| VO Information Management      | VO information management focus in two process:  
- VO Registration: focuses on VO profile creation.  
- VO Inheritance Information: focuses on retrieval immaterial assets, facilitating VO creation and operation, back to the VBE when VO dissolution occurs. | VBE Manager  
VO Coordinator  
VO members  
Support Service Providers  
Support Service Providers | VO Registration:  
• Once a VO is set-up and ready to run (operate), it should manifest its creation in the VBE by creating its profile.  
• Notification of VO creation should be performed to all members involved. | Procedures/Methodologies:  
- Guiding steps for VO registration:  
  - Collection of provided information  
  - Validation of provided information  
Information Systems/Repositories:  
- Profiling and Competency Management Systems  
- VO Information Management Systems  
  - VO registration features |

### VO Inheritance Management:

Once a VO is dissolved, a lot of knowledge (e.g. lessons learned) valuable for ensuring sustainability of future VOs is out of the VBE and should be transferred back into the VBE when VO dissolution occurs.

Some challenges for VO Inheritance Management will be:
- Select relevant information and lessons learned (successful and unsuccessful) for huge amount of information it can be produced.
- Interpret, analyze, filter, model, store, organize, contextualize, systematize, and show information for decision-making.

<table>
<thead>
<tr>
<th>OUTPUTS:</th>
<th>RESOURCES:</th>
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</thead>
</table>
| • COs identification (brokerage).  
• COs characterization and rough planning.  
• Partners search and suggestions for COs (towards VO creation).  
• Contract templates (for agility in contract negotiation and agreement reach).  
• Registration of created VOs within the VBE.  
• Inheritance of VOs dissolved. | • Human Resources: Broker, VO planner, VO coordinator, VBE manager, VO members and Support Service Providers.  
• Financial Resources: Funding mechanism to be used.  
• Physical/ICT Resources: VO Creation and Registration Systems (tools): coFinder tools, COC-Plan tools, PSS tools, WizAN tools, Inheritance tools, etc. |

### COMMENTS:
- VO members are also called VO partners, and could be actual VBE members or external organizations.
### 4.3.2.3 VBE General Management

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage C: Operation and Evolution</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
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</thead>
<tbody>
<tr>
<td>Process:</td>
<td>3. VBE General Management</td>
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<td>Process ID:</td>
<td>C3</td>
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#### OBJECTIVE
Support the VBE itself management during its operation and evolution stage.

#### SCOPE
The activity focuses on VBE itself management.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Responsible</th>
<th>Guidelines</th>
<th>Tools</th>
</tr>
</thead>
</table>
| 3.1      | Strategic & Marketing Management | Running strategic management process in collaborative environment, in order words: “network strategic management”. | VBE Manager, VBE Advisor, VBE Members, Support Service Providers | Strategic management process:  
- Goal setting  
- Strategy formulation  
- Strategy implementation  
- Strategy control  
Issues in collaborative strategy formulation:  
- Frictions  
- Dilemmas  
- Tensions  
Challenges in collaborative strategy formulation:  
- Negotiation process  
- Reaching common agreements  
- Setting common goals (win-win relationships) | Procedures/Methodologies (for Strategy):  
- Design school (strategy formulation as a process of conception): SWOT analysis, Ashridge mission model, etc.  
- Planning school (strategy formulation as a formal process): Theory of Mechanistic and Organic System, Parenting Styles, Levers of Control, Scenario Planning, etc.  
- Positioning school (strategy formulation as an analytical process): Competitive Advantage, Five Forces, Value Chain, BCG Matrix, Game Theory, The Art of War (Sun Tzu), etc.  
- Entrepreneurial school (strategy formulation as a visionary process): Entrepreneurial Government, Seven Surprises for New CEO’s, Leadership styles, etc.  
- Cognitive school (strategy formulation as a mental process): Whole Brain Model, Johari Window, Groupthink, etc.  
- Learning school (strategy formulation as an emergent process): Organizational Learning, Forget Borrow Learn Framework, Knowledge Management, SECI Model, etc.  
- Power school (strategy formulation as a process of negotiation): Bases of Social Power, Power Distance, Stakeholder Value Perspective, Core Group Theory, Forced Filed Analysis, etc.  
- Cultural school (strategy formulation as a collective process): Appreciative Inquiry, Cultural Dimensions, Cultural Intelligence, Ashridge Mission Model, etc.  
- Environmental school (strategy formulation as a reactive process): Contingency Theory, etc. |
Running relationship marketing strategy and VBE co-branding & identity development strategy.

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<th>Nº</th>
<th>ACTIVITY</th>
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<th>GUIDELINES</th>
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</table>
| 3.3 | Governance Management | Monitor VBE actors behavior (rights, roles and responsibilities) and VBE performance through policy supported in fours perspectives:  
- Strategy perspective:  
  - Strategy vision  
  - Strategy alignment  
  - Strategy assurance  
- Resources perspective (proper use):  
  - Human resources  
  - Technology resources  
  - Physical resources  
  - Financial resources  
- CNO (organizational) perspective:  
- Structure  
- Policies  
- Decision-making  
- Services perspective:  
  - Systems  
  - Procedures  
  - Methodologies  
  - Supported Services | VBE Manager  
VBE Advisor  
VBE Members  
Support Service Providers | VBE principles:  
- Honesty, Trust and Integrity  
- Openness  
- Performance Orientation  
- Responsibility and Accountability  
- Mutual Respect and Commitment to the VBE  
- Membership Eligibility Principles  
- Leadership Role Principles  
- Contract Enforcement Policy  
- Brokering Principles  
- Decision-Making Principles  
- Rewarding and Sanctioning Principles  
- Interoperability Principles  
- Network Governance Principles  
VBE Bylaws:  
- Membership Policy  
- Security Issue  
- Sanctions & Incentives Principles  
- Financial Policies  
- ICT Use Guideline  
- Intellectual Property Rights Policy  
- Rights and Duties Policy  
- Conflict Resolution Policy  
- Amendments to Bylaw | Procedures/Methodologies:  
- Guiding steps for VBE governance principles, rules, bylaws, roles, rights and responsibilities definition.  
Information Systems/Repositories:  
- Corporate Portals (e.g. bulletin boards) |
| 3.4 | Trust Management | Define trust actors (equal to VBE actors).  
Define trust criteria.  
Define and manage trust relationships:  
- Trust among VBE members (or VBE actors).  
- Trust of a VBE members to the VBE administration.  
- Trust of a customer to the VBE or VOs.  
Perform quantitative trustworthiness assessment for support other VBE management processes. | VBE Manager  
VBE Advisor  
VBE Members  
Support Service Providers | Base Trust Perspectives and Criteria:  
- Organizational  
  - Competencies  
  - Expertise/Experience  
- Social  
  - Community Sense  
- Financial/Economical  
  - Financial Ratios  
- Technological  
  - Broadband  
  - Interoperability  
  - Availability  
  - Standards:  
    - Security:  
    - Protocols and Security standards  
    - Software & Hardware standards  
  - Managerial/Behavioral  
  - Managerial Structure  
  - Collaborative Behaviors (e.g. alliances) | Procedures/Methodologies:  
- Methodology for the management of base trust.  
Information Systems/Repositories:  
- Trust Management Systems |
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<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
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<tbody>
<tr>
<td>3.5</td>
<td>Performance Management</td>
<td>Execute Performance Management Cycle:</td>
<td>VBE Manager</td>
<td>Follow Performance Management Cycle:</td>
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<td></td>
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<td>- Planning</td>
<td>VBE Advisor</td>
<td>Planning</td>
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<td></td>
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<td>o Setting goals</td>
<td>VBE Members</td>
<td>Performance Measurement &amp; Monitoring</td>
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<td>o Establishment and communicate elements and standards</td>
<td>Support Service Providers</td>
<td>Evolving</td>
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<td>- Performance Measurement &amp; Monitoring</td>
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<td>o Measure performance</td>
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<td>o Maintain good performance</td>
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<td>o Provide feedback</td>
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<td>- Evolving</td>
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<td>o Provide progress view</td>
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<td>o Address poor performance</td>
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<td>- Rating</td>
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<td>o Maintain good performance</td>
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<td>- Rewarding</td>
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<td>- Rating</td>
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<td>o Summarize performance</td>
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<td>o Assign the rating of records</td>
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<td>o Recognize and reward good performance</td>
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<td>- Rewarding</td>
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<td>3.6</td>
<td>Bag of Assets Management</td>
<td>Share valuable assets property of different VBE actors that could be interesting and useful to share with other VBE actors.</td>
<td>VBE Manager</td>
<td>Common assets of a VBE bag of assets:</td>
<td></td>
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<td></td>
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<td></td>
<td>VBE Advisor</td>
<td>- Documents, books, leaflets to help, etc.</td>
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<td>VBE Members</td>
<td>- Sample contracts to speed up the contracting phase.</td>
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<td>Support Service Providers</td>
<td>- General legal issues related to the sector.</td>
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<td>- Information of interest, specific to the VBE sector.</td>
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<td>- Links to other sources of information.</td>
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<td>- Lessons learned.</td>
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<td>- FAQs (Frequent Asked Questions).</td>
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<tr>
<td>3.7</td>
<td>Support Institutions</td>
<td>Support Institutions registration will be done using a simplified member registration process (see Process B2).</td>
<td>VBE Initiator</td>
<td>Selection of supporting institutions that could provide the VBE with services to keep up with new trends and technologies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information Management</td>
<td>Support Institutions can become VBE members.</td>
<td>VBE Manager</td>
<td>If a support institution became a VBE member, it will change its role and receive new rights and duties (see Process B2).</td>
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<td></td>
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<td></td>
<td>VBE Advisor</td>
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<td>Support Institutions</td>
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<td>Nº</td>
<td>ACTIVITY</td>
<td>DESCRIPTION</td>
<td>RESPONSIBLES</td>
<td>GUIDELINES</td>
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<tr>
<td>3.8</td>
<td>ICT Management</td>
<td>Management of ICT infrastructure based upon ITIL® best practice guidance:</td>
<td>VBE Manager</td>
<td>ITIL® (IT Infrastructure Library) guidelines for planning,</td>
<td>Procedures/Methodologies:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Identification of business requirements</td>
<td>VBE Advisor</td>
<td>delivery and management of quality IT services</td>
<td>• Information Systems Architectures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Planning, Deployment, Design, Testing,</td>
<td>VBE Members</td>
<td>ICT Management Services:</td>
<td>• Application Architectures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Operations, and Technical support and management of ICT services and components.</td>
<td>Support Service Providers</td>
<td>• Network service management,</td>
<td>Information Systems/Repositories:</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>• Operations management</td>
<td>• Security</td>
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<td>• Local processors management</td>
<td>• Networks</td>
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<td>• Computer installation</td>
<td>• Applications</td>
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<td></td>
<td></td>
<td></td>
<td>• Acceptance and systems management.</td>
<td>• Data Bases</td>
</tr>
<tr>
<td>3.9</td>
<td>Value System</td>
<td>Management of material and immaterial values/assets within the VBE for the</td>
<td>VBE Manager</td>
<td>Use taxonomies for handling and classifying assets (e.g. capital systems):</td>
<td>Procedures/Methodologies:</td>
</tr>
<tr>
<td></td>
<td>Information Management</td>
<td>purpose of modeling and assessing their use towards co-producing value for VBE/VO customers.</td>
<td>VBE Advisor</td>
<td>• Financial capitals (tangibles assets)</td>
<td>• Tangible and Intangible Valuation Methods and Models</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VBE Members</td>
<td>• Intellectual capitals (intangibles assets)</td>
<td>• Methods:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Support Service Providers</td>
<td>• Social capitals (intangibles assets)</td>
<td>• Calculated Intangible Value</td>
</tr>
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<td>• Value Added Intellectual Coefficient</td>
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<td>• Intellectual Capital Measurement</td>
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<td>• Q of Tobin</td>
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<td>• Models:</td>
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<td>• Business Navigator (Skandia Navigator)</td>
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<td>• Intellectual Assets Monitor</td>
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<td>• Intellectual Capital Index</td>
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<td>• Technology Broker</td>
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<td>• Balanced Scorecard</td>
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<td>• EFQM Excellence Model</td>
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<td>Information Systems/Repositories:</td>
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<td>• Value System (Systems)</td>
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<td>• Content Management Systems</td>
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<td></td>
<td>• Knowledge Management Systems</td>
</tr>
<tr>
<td>3.10</td>
<td>Ontology Management</td>
<td>Management of Ontology levels:</td>
<td>VBE Manager</td>
<td>Steps to build an ontology:</td>
<td>Procedures/Methodologies:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Top level and Core level</td>
<td>VBE Advisor</td>
<td>• Ontology Learning</td>
<td>• Ontology Design Patterns</td>
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<tr>
<td></td>
<td></td>
<td>- Domain level and Application level</td>
<td>VBE Members</td>
<td>• Ontology Conceptualization</td>
<td>Information Systems/Repositories:</td>
</tr>
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<td></td>
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<td>Support Service Providers</td>
<td>• Ontology Reengineering</td>
<td>• Ontology Discovery and Management Systems</td>
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<tr>
<td></td>
<td></td>
<td>Management of Ontology relationships:</td>
<td></td>
<td>• Ontology Merge (Collaborative Construction)</td>
<td>• XML</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- subclassOf or superclassOf</td>
<td></td>
<td>• Ontology Evolution</td>
<td>• RDF</td>
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<td>- partOf</td>
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<td>• Ontology Evaluation</td>
<td>• OIL</td>
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<td>- hasPart</td>
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<td>• DAML+OIL</td>
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<td>- siblingOf</td>
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<td>• OWL Lite, DL and Full</td>
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<td></td>
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<td>- equivalentTo</td>
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<td>• Dictionary, Glossaries, etc.</td>
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<td>Nº</td>
<td>ACTIVITY</td>
<td>DESCRIPTION</td>
<td>RESPONSIBLES</td>
<td>GUIDELINES</td>
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<td>3.11</td>
<td>Decision Support Management</td>
<td>Decision making as a process leading to the selection of a course of action among alternatives.</td>
<td>VBE Manager</td>
<td>Some guidelines for decision-making:</td>
<td>Procedures/Methodologies:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VBE Advisor</td>
<td>• Recognizing that a decision needs to be made.</td>
<td>• What-If Analysis</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>VBE Members</td>
<td>• Determining who needs to be involved in the decision.</td>
<td>• Goal-Seek Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Support Service Providers</td>
<td>• Identifying options available to the decision maker.</td>
<td>• Pareto Analysis</td>
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<td></td>
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<td>• Identifying the factors that will influence the decisions.</td>
<td>• Paired Comparison Analysis</td>
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<td>• Gathering information about the factors that influence stakeholders.</td>
<td>• Grid Analysis</td>
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<td>• Reaching agreed-upon decisions based on the information.</td>
<td>• Decision Tress</td>
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<td>• Communicating and implementing decisions.</td>
<td>• PMI</td>
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<td>• Force Field Analysis</td>
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<td>• Six Thinking Hats</td>
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<td>• Cost/Benefit Analysis</td>
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<td>• Monte Carlo Simulation</td>
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<td>Information Systems/Repositories:</td>
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<td>• Decision Support Management Systems</td>
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<td>o Competency gap analysis features</td>
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<td>o Lack of performance warning features</td>
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<td>o Low trust level features</td>
</tr>
</tbody>
</table>

**OUTPUTS:**
- Issuance of notifications, warnings and reports about VBE management performance.

**RESOURCES:**
- Human Resources: All VBE actors.
- Financial Resources: Funding mechanism to be used.
- Physical/ICT Resources: All VBE Management Systems.

**COMMENTS:**
- VBE management process and their corresponding procedures, methodologies and information systems/repositories should be adapted to each VBE management structure and policies.
4.3.3 VBE Metamorphosis Stage

**UML Diagram: VBE Metamorphosis Stage**

- VBE Metamorphosis refers to an adaptation of VBE nature by changing its strategy, business processes and structure to tactically respond to new market changes and trends, allowing VBE administration to remain competitive in the global and dynamic market arena.
4.3.4 VBE Dissolution Stage

- VBE Dissolution refers to a closure stage where total activities in the VBE will cease. Dissolution happens when a VBE cannot achieve anymore its objectives, and even its metamorphosis cannot help the VBE to keep going with the new market changes and trends to remain competitive. This stage focuses mainly in planning the transfer of collected knowledge during the entire VBE life cycle to other VBEs.
### 4.3.4.1 Shared Assets Dissolution

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage D: Dissolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process:</td>
<td>1. Shared Assets Dissolution</td>
</tr>
<tr>
<td>Process ID:</td>
<td>D1</td>
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</tbody>
</table>

**Objective**

Return belongings on the VBE bag of assets to their owners.

**SCOPE**

The activity focuses on the dissolution of VBE bag of assets.

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
</tr>
</thead>
</table>
| 1.1| Shared Assets Dissolution | Executive VBE bag of assets dissolution by returning belongings to the VBE members. | VBE Manager  
VBE Advisor  
VBE Members | Identify ownership of VBE members’ belongings that were shared to create the VBE bag of assets. | Procedures/Methodologies:  
• Methodology for appointing or selecting members to be responsible for taking care of inheritance in post-VBE existence.  
• Methodology for defining new rights and roles in post-VBE existence.  
Information Systems/Repositories:  
• Bag of Assets Management Systems  
• Content Management Systems |

**OUTPUTS:**

- None.

**RESOURCES:**

- Human Resources: VBE manager, VBE advisor, VBE members.
- Financial Resources: Funding mechanism to be used.
- Physical/ICT Resources: Bag of Assets Management System.

**COMMENTS:**

- In shared assets dissolution all VBE actors are involved, although the main responsible of this process is the VBE manager.
### 4.3.4.2 VBE Inheritance (Knowledge Transfer)

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage:</th>
<th>Stage D: Dissolution</th>
<th>Date Issued:</th>
<th>Month day, Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process:</td>
<td>2. VBE Inheritance (Knowledge Transfer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process ID:</td>
<td>D2</td>
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</tbody>
</table>

#### OBJECTIVE

- Capture and transfer knowledge collected during the VBE life cycle.
- Transfer trademarks and other brands assets managed during the VBE life cycle.

#### SCOPE

- The activity focuses on the creation of VBE knowledge base legacy.
- The activity focuses on the transfer of trademarks and other brand assets.

<table>
<thead>
<tr>
<th>Nº</th>
<th>ACTIVITY</th>
<th>DESCRIPTION</th>
<th>RESPONSIBLES</th>
<th>GUIDELINES</th>
<th>TOOLS</th>
</tr>
</thead>
</table>
| 2.1 | VBE inheritance (Knowledge Transfer) | Perform knowledge elicitation to all VBE actors to build a knowledge base of the experiences (best practices) collected during VBE life cycle. Inheritance of trademarks and other brands assets. | VBE Manager, VBE Advisor, VBE Members | Identify proper knowledge elicitation and transfer techniques for be used with each VBE actor. Identify proper mechanism for transfer intellectual property rights of trademarks and other brand assets. | Procedures/Methodologies:  
- Methodology for appointing or selecting members to be responsible for taking care of inheritance in post-VBE existence.  
- Methodology for defining new rights and roles in post-VBE existence.  
- Knowledge elicitation techniques: Interviews, Protocol Analysis, Concept sorting, Goal Decomposition Techniques, Limited Information Tasks, Machine Learning, Usage of KE Techniques, Applicability of KE Techniques, etc.  
- Knowledge transfer techniques: Patrons method, Storytelling, ORDIT-XP, etc.  

Information Systems/Repositories:  
- Knowledge Management Systems  
- Content Management Systems |

#### OUTPUTS:

- VBE knowledge base legacy.
- Trademarks and other brand assets legacy.

#### RESOURCES:

- Human Resources: VBE manager, VBE advisor, VBE members.
- Financial Resources: Funding mechanism to be used.

#### COMMENTS:

- In knowledge transfer process all VBE actors are involved, although the main responsible of this process is the VBE manager.
- Knowledge transfer process support future documentation of VBE closing.
## 4.3.4.3 VBE Closing

<table>
<thead>
<tr>
<th>VBE Life Cycle Stage</th>
<th>Date Issued</th>
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</thead>
<tbody>
<tr>
<td>Stage D. Dissolution</td>
<td>Month day, Year</td>
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</tbody>
</table>

**Process ID:** D3

### OBJECTIVE

Ending affairs and contracts with all VBE actors (including customers).

Shutdown VBE information systems and repositories.

Announce the VBE closing.

### SCOPE

The activity focuses on finalizing contracts with all VBE actors (including customers).

The activity focuses on shutting down the VBE information systems and repositories.

The activity focuses on communicating all VBE actors the closing of the VBE.

### N° ACTIVITY | DESCRIPTION | RESPONSIBLES | GUIDELINES | TOOLS |
|---------------|-------------|--------------|-------------|-------|
| 3.1 | Plan and Documentation of VBE Closing | VBE Manager, VBE Advisor, VBE Members | Plan end of contracts with customers, support institutions, support services providers, VBE advisor, brokers and VBE members. Backup data in VBE information systems and repositories or perform VBE inheritance information (see Process D2). | Procedures/Methodologies:  
Methodology for appointing or selecting members to be responsible for taking care of inheritance in post-VBE existence.  
Methodology for defining new rights and roles in post-VBE existence.  
Backup Strategies:  
- Complete System Backup  
- Incremental Backup  
Information Systems/Repositories:  
- Data Backup Systems |
| 3.2 | Communicate VBE Closing | VBE Manager, VBE Advisor, VBE Members | Announce and manage VBE closing leaving a good name behind. | Procedures/Methodologies:  
Ending Contracts  
Announce VBE Closing  
Information Systems/Repositories:  
Media such as: Internet, Television, Newspapers, Radio, etc. |
| 3.3 | Shutdown VBE | VBE Manager, Support Service Providers | Final check to Backup of VBE information systems and repositories (see Process D3, Activity 3.1). Shutdown VBE information systems and repositories. | Procedures/Methodologies:  
Methodology for appointing or selecting members to be responsible for taking care of inheritance in post-VBE existence. |

### OUTPUTS:

- Public announce of VBE business operation.

### RESOURCES:

- Human Resources: VBE manager, VBE advisor, VBE members.
- Financial Resources: Funding mechanism to be used.
- Physical/ICT Resources: Inheritance, Knowledge and Content Management Systems.

### COMMENTS:

- In all VBE actors are involved, although the main responsible of this process is the VBE manager.
Chapter 5: Industrial Case - VBE Aerospace for Mexican SMEs

5.1 Study Case Overview

The main objective of this chapter is to describe how the VBE Instantiation Methodology can be applied to create a Virtual Breeding Environment (VBE) for the aerospace sector. The given name to the new VBE will be “Aerospace CAP”. In this chapter all the activities performed for the creation of VBE-Aerospace CAP will be explained.

VBE-Aerospace CAP members will be searched in the city of Monterrey, Nuevo Leon, Mexico. The result of VBE-Aerospace CAP focuses on developing the city of Monterrey in the aerospace sector. The VBE members will be Small and Medium Enterprises (SMEs) and Large-scale Enterprises with high interest in collaborative networking to contribute to the success of the big aerospace companies in the global market.

5.2 Main Activities to Create the New VBE-Aerospace

To create the new VBE for the aerospace sector, seven processes of the VBE instantiation methodology are recommended to be followed. These processes are related to the VBE creation stage and have been further developed and divided into two sub-stages: VBE initiation and recruiting with three processes, and VBE foundation with four processes. Furthermore, each process suggested has been divided into a set of specific activities to be followed (see Table 2). These activities will be described in the following sections of this chapter.

<table>
<thead>
<tr>
<th>VBE Creation Sub-Stage</th>
<th>Processes</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation &amp; Recruiting</td>
<td>Environmental Analysis</td>
<td>• Market, Economical &amp; Technological Analysis</td>
</tr>
</tbody>
</table>
| | Strategic Planning | • Goal Setting and Strategy Analysis  
| | | • Strategy Formulation |
| | Strategy Implementation | • VBE Business Processes Definition  
| | | • VBE ICT Infrastructure Definition  
| | | • VBE Governance Structure Definition |
| Foundation | ICT-I Set-up & un and Governance Structure Establishment | • VBE ICT Infrastructure Set-up & Run  
| | | • Governance Structure Establishment |
| | VBE Constitution (Members Population) | • Receive Membership Applications/Invite Potential VBE Members  
| | | • Assessment and Accreditation of Membership Applicants  
| | | • Acceptance/Rejection of Membership Applicants  
| | | • VBE Members Organizational Profiling and Competency |
| Support Institutions Selection | | • Support Institutions Registration |
| VBE Launching | | • VBE Launching |
5.2.1 VBE Creation Stage: Initiation and Recruiting

5.2.1.1 Environmental Analysis: Market, Economical and Technological Analysis in Mexican Global & Regional Context

Before the creation of a new VBE is important to identify, classify and analyze the market needs, including the economical, social and technological aspects that should be satisfied by this new VBE. In order to identify the market needs, this section explores the potential of industry sectors in the Mexican global context and proposes the aerospace industry sector for the creation of a Virtual Breeding Environment for the city of Monterrey, Nuevo Leon, Mexico.

5.2.1.1.1 Aerospace Industry Overview

The aerospace industry is one of the largest high-technology employers in advanced countries. The four major civil aircraft prime contractors are Airbus and Boeing (for planes over 100 seats) and Bombardier and Embraer for regional jets. To reduce costs, aerospace OEMs have increased their outsourcing to suppliers of subassemblies (such as engines, structures, landing gears and avionics) and concentrating on their core competencies of design, assembling and marketing aircraft. At the same time, they have made efforts to reduce, reorganize and rationalize their supply base (Niosi & Zhego, 2005).

According to Niosi & Zhego (2005), the Aerospace production is scattered throughout Western Europe and North America, suggesting major international and inter-regional knowledge flows. Table 3 gives an indication of the size of the top 12 aerospace clusters in North America. California dominates with two major clusters which, together with Washington State, represent close to 50 per cent of US aerospace employment.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Metropolitan Area</th>
<th>Aerospace Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Los Angeles, CA</td>
<td>107,500</td>
</tr>
<tr>
<td>2</td>
<td>Seattle, WA</td>
<td>95,500</td>
</tr>
<tr>
<td>3</td>
<td>Washington, DC</td>
<td>45,000</td>
</tr>
<tr>
<td>4</td>
<td>Wichita, KS</td>
<td>40,000</td>
</tr>
<tr>
<td>5</td>
<td>New York, NY</td>
<td>33,500</td>
</tr>
<tr>
<td>6</td>
<td>Montreal, Quebec</td>
<td>26,000</td>
</tr>
<tr>
<td>7</td>
<td>Dallas, TX</td>
<td>24,500</td>
</tr>
<tr>
<td>8</td>
<td>Boston, MA</td>
<td>20,500</td>
</tr>
<tr>
<td>9</td>
<td>Philadelphia, PA</td>
<td>19,500</td>
</tr>
<tr>
<td>10</td>
<td>San Francisco, CA</td>
<td>19,500</td>
</tr>
<tr>
<td>11</td>
<td>Atlanta, GA</td>
<td>11,500</td>
</tr>
<tr>
<td>12</td>
<td>Toronto, ON</td>
<td>8,000</td>
</tr>
</tbody>
</table>
On the other hand, there is a much larger dispersion in European industry, where all 15 countries have some aerospace activity, due to historical reasons (see Table 4). The UK, France and Germany, represent over 50 per cent of the 429,000 European aerospace employees. Toulouse is by far the most important cluster in Europe, with 25,000 aerospace employees (Niosi & Zhegu, 2005).

<table>
<thead>
<tr>
<th>Country</th>
<th>Aerospace Jobs</th>
<th>Clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>150,000</td>
<td>Bristol, Lancashire, Farnborough</td>
</tr>
<tr>
<td>France</td>
<td>101,000</td>
<td>Toulouse, Bordeaux, Ile-de-France</td>
</tr>
<tr>
<td>Germany</td>
<td>70,000</td>
<td>Bavaria, Hamburg/Bremen</td>
</tr>
<tr>
<td>Italy</td>
<td>39,000</td>
<td>Turin, Milan, Naples</td>
</tr>
<tr>
<td>Spain</td>
<td>18,000</td>
<td>Madrid, Bilbao</td>
</tr>
<tr>
<td>Sweden</td>
<td>13,000</td>
<td>Linkoping, Goteborg</td>
</tr>
<tr>
<td>Holland</td>
<td>11,000</td>
<td>Amsterdam</td>
</tr>
<tr>
<td>Belgium</td>
<td>7,000</td>
<td>Sonaca</td>
</tr>
<tr>
<td>Ireland</td>
<td>4,000</td>
<td>Dublin</td>
</tr>
<tr>
<td>Portugal</td>
<td>4,000</td>
<td>Lisbon</td>
</tr>
<tr>
<td>Austria</td>
<td>4,000</td>
<td>Vienna</td>
</tr>
<tr>
<td>Greece</td>
<td>4,000</td>
<td>Athens</td>
</tr>
</tbody>
</table>

Furthermore, according to Niosi & Zhegu (2005), economic concentration in this industry is very high. For each sector (large civilian aircraft, regional aircraft, business jets, helicopters, etc.) there are only a few competitors. Barriers to entry are very high due to capital commitments required to design and produce aircraft. The industry is hierarchically organized into “tiers” (see Figure 12). At the top of the pyramid one finds the airframe assemblers (prime contractors or OEMs) such as Airbus, Bell Helicopter Textron, Boeing, Bombardier, Embraer and Eurocopter. These companies design planes and helicopters, prospect markets and order subassemblies from the second tier. At this second level, we find manufacturers of propulsion systems such as General Electric, Pratt & Whitney or Rolls-Royce. Producers of on-board avionics, such as Honeywell in the USA and Sextant Avionique in France, also belong to this category. Tier 2 also includes manufacturers of airframe structures and subassemblies such as landing gear, nacelles and hydraulic systems. Messier-Dowty (France) and Héroux-Devtek (Canada), both producers of landing gear, belong to this category. Tier 3, producers of electronic subassemblies, hydraulic systems and fuselage parts, is also a very concentrated group of producers at the global level with a handful of firms dominating each segment (Niosi & Zhegu, 2005).
One other group of firms is usually added to the pyramid. Aerospace clusters always include hundreds of small and medium manufacturers offering parts and components assembled by tier 2, 3 and sometimes by tier 1 firms. Even if these firms often get most of their revenues from the aerospace industry, they are also offering their products and services to a large range of other industries (Niosi & Zhegu, 2005).

Most large aerospace clusters thus consist of one or several OEMs surrounded by hundreds of small and medium-sized tier 4 suppliers of components and parts. In aerospace clusters, supply chain management is the vehicle of knowledge spillovers in this industry. This chain is basically international. Supply chain management includes such dimensions as technical specifications, concurrent engineering, strategic engineering alliances, quality control, product co-development, certification of suppliers, delivery time, risk-sharing, cost-sharing, production volumes and prices (Bozdogan et al, 1998; Gostic, 1998; Niosi & Zhegu, 2005).

5.2.1.2 World Economy Insight

According to FAA Aerospace Forecast for 2007-2020, worldwide economic activity is predicted by Global Insight to expand by 3.3 and 3.5 percent in 2007 and 2008, respectively, and average 3.1 percent over the forecast period. Furthermore, Latin America and the Asia/Pacific region will continue with the world’s highest economic growth rates. These regions are expected to expand their economic activity at annual rates of 3.9 and 3.8 percent, respectively over the
period. In Asia, China, with a population of 1.3 billion, is forecast to expand by 7.1 percent a year, while India, with a population of 1.1 billion, is projected to grow 6.2 percent a year over the period 2006 through 2020. Canadian and European GDP growth is anticipated to rise at more moderate rates of 2.4 and 2.5 percent a year, respectively, over the forecast period.

5.2.1.1.3 U.S. Economy Insight

The United States is one of the principal producers of aerospace technology in the world, as well as also the most important market for the industry of the aviation. It is important to analyze the behavior of the American economy and to consider the form in which this one can accelerate or decelerate the growth of the aerospace industry worldwide, principally in Mexico.

According to the U.S. Office of Management and Budget (OMB) forecast, U.S. economy will continue its growth in the following years. On a quarter-by-quarter basis for the next years, OMB projects U.S. economic growth at 2.8 to 3.1 percent through fiscal year 2008. This consistent and solid economic expansion should allow the U.S. commercial aviation industry to continue its growth. Over the forecast period 2006 through 2020, growth is expected to remain strong with rates declining slightly from 3.3 percent in 2006 to 2.8 percent in 2007 and remaining near 3.0 percent for the remainder of the period. According to Global Insight, Inc. the long-term stability of the U.S. economic growth is dependent on continued growth in the workforce, the capital stock, and improved productivity. A major risk to continued U.S. economic growth is the upward pressure on commodity prices, including the price of oil worldwide. These inflationary pressures, if unchecked, could force up inflation and bond yields and reduce domestic demand.

5.2.1.1.4 Mexican Economy Insight

Inside the industry worldwide, the aerospace sector occupies a predominant place due to the high technological and economical advances that it implies. The development of this industry requires the support and joint strategies on the part of three fundamental sectors: academy, government and industry. Nowadays, the support of the Federal Government to the aerospace industry in Mexico is growing; Federal and State authorities have recognized that aerospace industry is a strategic sector to attract more investments and to strengthen the technological advances in the country.

Furthermore, Bombardier’s aerospace division announced officially in its Web site on October 26th 2006, the installation of a factory of aeronautical components in the city of
Queretaro, located at the center of Mexican territory. This is a very prominent event considering that Bombardier also has announced that equipment and raw materials will be bought from the 60 aerospace companies already established in Mexico, consolidating the emerging aerospace cluster in Queretaro. Another indicator of the increasing development of the Mexican aerospace industry is the fact that Honeywell Aerospace glides to move all its operations of outsourcing to Mexico, detonating even more the aerospace cluster already established by companies of the sector.

5.2.1.1.5 Mexican Aerospace Industry Current Situation

According to the Federal Government, in agreement with the Secretary of Economy, the forecast for Mexican aerospace industry is optimistic: in five years Mexico will be in conditions to develop commercial planes in the State of Queretaro. And, in a space from two to three years, Mexico also might turn into a manufacturer of light aircrafts for the markets of exportation.

Along with the last years, Mexican authorities have seek to leave the simple manufacturing based on cheap manpower, to climb in the value chain and to attract much more developed industries that represent a major amount of investments for the country. From this point, for the current Government, strategic sectors like automotive have become the self-propelling ones - where there have been caught important projects from American, German and Japanese companies - and most recently the software development and, particularly, the aerospace industry sectors.

According to the Federal Government, there are three stages for the development of the aerospace sector in Mexico, of which the country is in the second one of them:

- To consolidate the current capacities of manufacturing and engineering.
- To initiate the manufacture of parts and components more complex and structures.
- Ensemble completely a plane in Mexico in the following 4 to 6 years.

The Secretary of Economy has made clear that nowadays there exist 85 manufacturing, maintenance and engineering aerospace companies seated in the country, which generate 10 thousand 500 employments and 400 million dollars a year in exports. As part of this, companies like General Motors, Daimler-Chrysler, General Electric, Delphi and Intel have established Centers of Research and Development. The powerful Group SAFRAN, of French
origin, is also developing in Ciudad Juarez, Chihuahua, harnesses for the combat airplane F16 and, soon, for the two biggest aircrafts of the world: the Boeing 787 and the Airbus 380.

In one of the most important projects for the country, the Canadian Bombardier has installed a Center of Production of Aeronautical Components in the State of Queretaro, and before the ending of the year 2006, the company was already making structures like fuselages, tails and other plane parts, which originally were contemplated for the year 2007 and 2008.

As for light aircrafts the country is more advanced. The company Avipro it is already making diverse components in the State of Puebla and some projects are planned to be developed in its entirety in the States of San Luis Potosi and Morelos.

But not only investments have been looked on the part of the big companies of the aeronautical sector, but also of the suppliers of the same companies, which belong in great majority to the metal-mechanic sector.

The great majority of projects have settled themselves in the north of the country. The state of Baja California has 32 of the companies of the sector, Sonora count with 12 and Nuevo Leon has 11 more. This represents 55 of the whole of 85.

In this industry, Mexico is facing the competition of nations like Brazil, which have leaded their development around the Embraer Company, fourth manufacturer of planes of the world. Because of it, Mexico was fundamental for Bombardier, direct competitor of Embraer.

Finally, Mexico is appearing to the world as a country where not only it is attractive to manufacture, but where to climb in the value chain and where to develop design turns out to be an attractive business.

5.2.1.1.6 Nuevo Leon Aerospace Industry Current Situation

Nuevo Leon along with the States of Baja California, Chihuahua and Sonora, is one of the States in where aerospace industry has obtained a high dynamism. Most of the 20 aerospace companies in the country are located in the State of Nuevo Leon, and are dedicated to the manufacturing of parts and components. Nevertheless already two centers of specialized
engineering and design exist in this important sector that is taking advantage of the high educative level of the working force of the State. Moreover, the success of new investments in the aerospace industry in Nuevo Leon is guaranteed because the state counts on a solid supply base of electrical-electronic equipment, metallic machinery, and engineering of materials, as proves of the high degree of performance that at the moment has the automotive sector in the region.

The State Council of the Aerospace Industry, by instructions of the Governor, and according to the guidelines of the Regional Program of Competitiveness and Innovation, has created five Citizen Councils for the promotion of strategic sectors of the state economy. At the moment the State Council of the Aerospace Industry works in the strategies to consolidate its takeoff. Among them they are:

- To support the installed capacity of the State.
- To obtain an updated overview of the aerospace industry at national and international level.
- To identify the investment opportunities for the manufacturing of parts, components, and more complex structures.
- To develop the capacities for engineering and design.
- In the medium term, to assemble aerospace ships.

Furthermore, MD Helicopters is company established in Rocks Arizona with already investments in State through the Metal Systems Company, specialized in smelting and metal molding. MD Helicopters has chosen Nuevo Leon for its investments because of its strategic location, its distribution networks, the high educative level of its people, and the excellent attitude and disposition of its workers. Since MD Helicopters is a final assembling company, its establishment in Nuevo Leon can detonate the aerospace sector in the State. In its first stage, MD Helicopters will assemble the fuselage for helicopters, with a view to develop suppliers of parts in the State. Its plan to medium term is to produce helicopters of 5 to 8 seats, for the entire American continent. The initial investment is about 15 million dollars, with the creation of 150 technical and professional employments.
**5.2.1.1.7 Mexico/Nuevo Leon Aerospace Industry SWOT**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geographical Location</strong></td>
<td><strong>Geographical Location</strong></td>
</tr>
<tr>
<td>• Mexico has 12 agreements of free trade with more than 40 countries.</td>
<td>• Remote access to European market (UK, France and Germany).</td>
</tr>
<tr>
<td>• More and better possibilities of access to the American industry (BASA).</td>
<td>• Lack of binational agreements with the United States for manufacturing and certification of parts done in Mexico for the aerospace industry.</td>
</tr>
<tr>
<td>• Reduction of times and costs (North America).</td>
<td></td>
</tr>
<tr>
<td><strong>Support Programs</strong></td>
<td><strong>Support Programs</strong></td>
</tr>
<tr>
<td>• Support programs from Federal and State governments.</td>
<td>• Inadequate industrial policies and insufficient fiscal incentives.</td>
</tr>
<tr>
<td>• Agreements with universities and businessmen to support the aerospace industry.</td>
<td>• Lack of state strategies for the attraction of foreign investment.</td>
</tr>
<tr>
<td><strong>Technology and Infrastructure</strong></td>
<td><strong>Technology and Infrastructure</strong></td>
</tr>
<tr>
<td>• In the aerospace industry: 84 companies dedicated to manufacturing, 13 to maintenance and 12 to design and engineering.</td>
<td>• Universities, except few ones, have not implemented study programs dedicated to the aerospace industry.</td>
</tr>
<tr>
<td>• Bombardier, Honeywell, GE and other companies have important projects in Mexico.</td>
<td></td>
</tr>
<tr>
<td>• Experience in the automotive and electronic sectors.</td>
<td><strong>Others</strong></td>
</tr>
<tr>
<td>• Manufacturing processes in: manufacturing of parts and components for turbines, electronic components, cables and harnesses, plastic injection, precision machinery, among others.</td>
<td>• To reinforce the approach of competitiveness.</td>
</tr>
<tr>
<td><strong>Quality in Processes and Services</strong></td>
<td>• To rely on major Benchmarking information.</td>
</tr>
<tr>
<td>• Companies with AS9100 registry.</td>
<td></td>
</tr>
<tr>
<td>• 16 companies accredited by NADCAP.</td>
<td></td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
<td><strong>Threats</strong></td>
</tr>
<tr>
<td>• Airplanes maintenance is an opportunity area and an interesting market niche.</td>
<td>• Instability of the aerospace industry market.</td>
</tr>
<tr>
<td>• Development of non-destructive tests.</td>
<td>• Without a well developed and structure platform and a lack of communication, globalization can turn the aerospace industry into a risk for the region (Mexico).</td>
</tr>
<tr>
<td>• Development of centers of aerospace processes.</td>
<td>• Lack of reforms in the strategic sectors of the country.</td>
</tr>
<tr>
<td>• Joint-ventures of companies of the aerospace sector with first level Mexican businessmen.</td>
<td>• High levels of investment for the technological aerospace development in rival countries.</td>
</tr>
<tr>
<td>• Develop of local supply in special processes, machinery and certificated metrology.</td>
<td>• Loss of competitiveness and of highly qualified manpower.</td>
</tr>
</tbody>
</table>

**5.2.1.1.8 Author’s Recommendations**

According to the activity of market, economical and technological analysis in the VBE Instantiation Methodology, the first step will be to perform a complete environmental research in order to discover market needs or trends for introducing new products and/or services to the market, so the VBE creation be oriented to satisfy those specific needs in a certain industry sector. Furthermore, in order to create a VBE, its initiation staff needs to monitor key macro-environmental forces to determine the needs of the potential customer and/or the emerging market in order to develop the new VBE.

After classifying the entire information gathered from environmental research, the next step will be to structure it to support strategic planning. A first approach could be supported by using Porter’s Five Forces model (see Figure 13) to not only consider direct competition of the
new VBE, but also analyze the consumers, substitute products, suppliers and the threat of new entrants to select the value proposition for the creation of a new VBE. Furthermore, the value proposition (products/services) should be classified according its complexity and uncertainty in relation to its potential market (e.g. commodities, durables, fashion or capital goods).

After analyzing the industry environment, the next step is to identify which are the Strengths, Weakness, market Opportunities and Threats (SWOT) of the analyzed industry sector regarding the value proposition of the future VBE. The strengths and weaknesses are related to the success or failure of the VBE value proposition in the market, this means creating a good relationship marketing and co-branding strategic plan to increase the strengths of the value proposition (products and/or services). On the other hand, the opportunities and threats are related to external factors of the market that can leverage or not the VBE value proposition, and over these last two the VBE will not have control, but may learn to strategically take advantage of the market opportunities to increase profitability and to react tactically to threats to take defensive market actions.

<table>
<thead>
<tr>
<th>Internal Attributes of the Organizations</th>
<th>Helpful to achieve objectives</th>
<th>Harmful to achieve objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths</td>
<td></td>
<td>Weaknesses</td>
</tr>
<tr>
<td>Opportunities</td>
<td></td>
<td>Threats</td>
</tr>
</tbody>
</table>

Figure 14 – SWOT Analysis
Once the Five Forces Model and SWOT analysis be performed, the next step will be to identify Critical Success Factors (CSFs) for the VBE value proposition that potential stakeholders and customers will expect from the products and/or services before, during and after acquiring them. CSFs help to identify those things which must go right for the VBE achieve its goals (mission, vision, objectives). In conjunction with strategic planning, CSFs will keep the VBE administration focused in the priorities that will improve the odds for long-term success of the Virtual Breeding Environment.

<table>
<thead>
<tr>
<th>Critical Success Factor</th>
<th>Source of CSF</th>
<th>Primary Measures &amp; Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 15 – Critical Success Factors Template

After defining an industry sector/niche to create a VBE and its value proposition for its potential stakeholders and customers, and also identified the CSF factors for value creation process, the last step will be to identify Sustainable Competitive Advantages (SCAs) that will make the VBE competitive in the market it serves. SCAs will give the VBE a competitive advantage for its survival against competition over a long period of time (see Figure 16).

Figure 16 – Sustainable Competitive Advantages Elements

Finally, Table 5 presents a check list of what it has been done on environmental research towards the creation of the VBE Aerospace CAP tile now vs. what the VBE Instantiation Methodology suggests:

Table 5 – VBE Market, Economical, and Technological Analysis Check List

<table>
<thead>
<tr>
<th>VBE Instantiation Methodology</th>
<th>VBE Aerospace CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Analysis</td>
<td>YES</td>
</tr>
<tr>
<td>Five Forces Model</td>
<td>NO</td>
</tr>
<tr>
<td>SWOT Analysis</td>
<td>YES</td>
</tr>
<tr>
<td>Critical Success Factors</td>
<td>NO</td>
</tr>
<tr>
<td>Sustainable Competitive Advantages</td>
<td>NO</td>
</tr>
</tbody>
</table>
5.2.1.2 VBE Aerospace Goal Setting, Strategy Analysis and Strategy Formulation

After analyzing the actual Mexican global & regional context and the tendency of fast growth and development of the aerospace industry in the region and the world, the aerospace sector was selected to create the new Virtual Breeding Environment. The new VBE with members in the aerospace sector in the city of Monterrey, Nuevo Leon, Mexico will be called “Aerospace CAP”.

5.2.1.2.1 Aerospace CAP Overview

The Center of Articulated Production - CAP AEROSPACE will have the function to support and leverage the Small and Medium Enterprises (SMEs) of the State of Nuevo Leon, acting as suppliers, by contributing to its openness to the aerospace market, where its involvement will help them to achieve the development and growth to positioning them not only into a competitive national level, but also internationally. The Aerospace CAP will offer forefront technological services and relies on qualified personnel to offer to the aerospace sector SMEs the best services to satisfy each of their needs. This, by means of infrastructure for Not-Destructive Tests (NDT), which will allow the SMEs to lead to end the most high quality tests and under low costs. Moreover, the Aerospace CAP will offer training services in aerospace certifications through specialized personnel.

Other of the functions of the Aerospace CAP will be to be a link for the creation of employments, since the SMEs contribute to the productive chain by providing suitable personnel in order to rely on the manpower and knowledge required.

The Promotion to the foreign investment to leverage the SMEs will be also one of the main functions of the Aerospace CAP since it will be this investment what allows them to have a major push and entry to international markets.

5.2.1.2.2 Goal Setting

Mission
“Leverage the development of the Aeronautical Industry in the State of Nuevo Leon by means of organized and coordinated actions by the Aerospace CAP”.

Vision:
“To leverage the aerospace sector for: the creation of employments, promotion of foreign investment and impulse of the technological innovation”. 
Objectives:

“The strategic aim of the Aerospace CAP is to leverage the aeronautical sector as a driver for economic development in the State of Nuevo Leon and the region North-East of Mexico”.

In the long term, it is waited the development of Centers of Aerospace Design that allow the design, assembly and production of airplanes, converting the VBE Aerospace CAP into a regional leader of the industry and a strong rival worldwide.

In the medium term, it is waited that VBE Aerospace CAP will be in conditions to make aerospace sophisticated components and to complete the assembly of airplanes. For such motive, it is vital to rely on Small and Medium Enterprises (SMEs) certified and accredited in the development of projects of such magnitude.

In the short term, it is necessary to consolidate the aerospace industry in the region and country by identifying those areas of opportunity that allow to exploit the strengths of the different regions and developing projects that allow to maximize the business, technological and innovative opportunities. Inside the principal requirements and needs that will fix the directives for the strategy of development and implementation of the VBE Aerospace CAP in Monterrey, Nuevo Leon, Mexico are:

- To develop new business opportunities at regional and global level for SMEs.
- To facilitate the technological innovation and the competitiveness of SMEs at regional and global level.
- To provide services of regulation in technical standards and accreditations to SMEs.

To consolidate the previous aims it is necessary the creation of a technological platform (virtual space in the network) that stimulates and favors the integration of the aerospace industry by means of:

- Information about news, events and exhibitions of the aerospace industry.
- Center of information and statistics of the aerospace industry.
- Window to the foreign trade.
- Catalogue of competences at regional level.
- Facilities to link clients and suppliers.
• Advising and consulting for certifications and accreditations.
• Opportunities for the incorporation and integration of new enterprises to the aerospace sector.

5.2.1.2.3 Strategy Analysis

Aerospace CAP Impact:
• Offering of Not-Destructive Tests (NDT) laboratories in order allow SMEs to perform quality tests at low costs.
• Training services to accredited SMEs in aerospace certifications.
• Headhunting in collaboration with associated enterprises to recruit specialized personal according to aerospace industry needs.
• Involving of aerospace companies for its installation in the region.

Aerospace CAP Benefits:
• Growth and development of the enterprises of region by joining the aerospace sector since the CAP will offer the infrastructure, technology and personnel to take to end the necessary tests that lead to having better products and in this way to leverage their promotion and connectivity with national and international markets.
• Integration of productive chains and value-added networks of enterprises for the aeronautical sector of the State of Nuevo Leon, by means of an e-HUB of services.
• Integration of SMEs technological competencies in order to better respond to business opportunities on the aeronautical market.
• Collaborative work with local suppliers in the different segments of the productive and technological chain.
• Coordination and cooperation between SMEs to share their knowledge and technological resources in order to better respond to business opportunities.
• Development of SMEs technological and managerial culture to increase their competitiveness.
• Access to advanced engineering technological tools and testing services, and characterization in the areas of metrology, metallurgy and experimentation for the aeronautical industry with preferential costs.
• Increase of the confidence of foreign investors who will perceive the investments that are being done at State level for the development of an aerospace industry.
5.2.1.2.4 Strategy Formulation

Aerospace CAP Services:

The services that will be offer by the Aerospace CAP are related to infrastructure for laboratories of Not-Destructive Tests (NDT). The NDTs are fundamental and essential tools for quality control of engineering materials, manufacturing processes and reliability of products in service and maintenance of systems, which premature fault can be costly or disastrous. The services that the Aerospace CAP will give in the topic of special NDT tests will be:

- Detection and characterization of discontinuities.
- Measurement of thicknesses, extension and corrosion index.
- Determination of physical characteristics like: grain size, elastic constants and metallurgical structure.
- Characterization of links between two materials.

The tests will be carried out in the following equipment: Inspection Systems for RX Mod. Eresco 32, Inspection equipment by phase arrangement Mod Phasor XSB, Videoscope for Visual Inspection Mod XLG3000, Faults Detector Instrument Mod Announcer 2s, and Inspection Portable unit for PM Mod DA-1500.

The application areas are: Metal-mechanic, Aerospace industry, Petrochemical industry, Construction Industry, Sugar industry, Energy Generation, Nourishing industry, Paper Industry, Research Institutes, Mining and Extraction industry, Automotive industry.

Aerospace CAP Funding:

The CAP AEROESPACIAL funding will be supported by the Nuevo Leon State Government, the Secretariat of Economy and ITESM University, which are interested leverage the aerospace sector for benefit of the economic development of Mexico.

5.2.1.2.5 Author’s Recommendations

For the activity of goal setting in the VBE Instantiation Methodology, recommendations include the use of strategic management tools such as Critical Success Factors (CSFs) during market, economical and technological analysis to translate those critical factors in to targets for the Aerospace CAP administration. These targets should be reflected on VBE mission and vision statements, and objectives. The major outcome of the strategy planning process, after gathering all necessary information in environmental research, is the setting of goals for the VBE based on
its vision and mission statements. Objectives must be consistent with mission and vision, specific, measurable, related to time, focused on results and attainable.

For activity of *strategy analysis*, recommendations include the definition of a “business model” determining the value proposition, target stakeholders/customers, distributions channels, relationships, core-capabilities, configuration of activities, partners, revenue streams and cost structure for the VBE business model (Osterwalder, 2004; adapted by Romero et al, 2006).

Table 6 – VBE Business Model Pillars and Building Blocks
(Osterwalder, 2004; adapted by Romero et al, 2006)

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Building Block</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Multi-value Proposition</td>
<td>Value offered to the stakeholder/customer (What).</td>
</tr>
<tr>
<td>Multi-Stakeholder Interface</td>
<td>Target Stakeholders</td>
<td>Target stakeholder/customer and target market (Who).</td>
</tr>
<tr>
<td></td>
<td>Distribution Channel</td>
<td>Channels to reach the market and the customer/stakeholder.</td>
</tr>
<tr>
<td></td>
<td>Stakeholders Relationship</td>
<td>Links and strategies to maintain customer/stakeholder relationship.</td>
</tr>
<tr>
<td>VBE Infrastructure Management</td>
<td>Multi-Value Configuration</td>
<td>Activities and resources arrangement necessary to create value for the customer (Value Configuration - How).</td>
</tr>
<tr>
<td></td>
<td>VBE Capabilities</td>
<td>Capabilities will be integrated to underpin the VBE value proposition.</td>
</tr>
<tr>
<td></td>
<td>Partnership</td>
<td>Strategic alliances, joint-ventures and long-term partnerships.</td>
</tr>
<tr>
<td>Financial Aspects</td>
<td>Cost Structure</td>
<td>Costs incurred in the creation, marketing and delivering of value.</td>
</tr>
<tr>
<td></td>
<td>Revenue Model</td>
<td>Definition of the business model economic sustainability.</td>
</tr>
</tbody>
</table>

For activity of *strategy formulation*, recommendations include the formulation of a “business plan” detailing: 1) business concept, 2) mission and vision statements, 3) market analysis, 4) competitive analysis, 5) overall strategy, 6) products/services, 7) marketing action plans, 6) financial action plans, and 7) operational action plans.

Finally, Table 6 presents a check list of what it has been done on strategy planning and implementation towards the creation of the VBE Aerospace CAP tile now vs. what the VBE Instantiation Methodology suggests:

Table 7 – VBE Strategic Making Process Check List

<table>
<thead>
<tr>
<th>VBE Instantiation Methodology</th>
<th>VBE Aerospace CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Setting</td>
<td>YES</td>
</tr>
<tr>
<td>Strategy Analysis as Business Model</td>
<td>NO</td>
</tr>
<tr>
<td>Strategy Formulation as Business Plan</td>
<td>NO</td>
</tr>
</tbody>
</table>
5.2.1.3 VBE Aerospace Business Process Definition, ICT Infrastructure Definition and Governance Structure Definition

In order to find potential VBE members and support institutions to create a Virtual Breeding Environment, first the VBE strategy should be implemented by defining the main business processes, ICT infrastructure and governance structure that will support the VBE operation.

5.2.1.3.1 Business Process Definition

So far the VBE Aerospace CAP has just identified a few business processes to support its operation:

- VBE Aerospace CAP members’ management through a catalogue of its contact information and competencies.
- VBE Aerospace CAP brokerage to bring into the VBE new business opportunities.
- VBE Aerospace CAP marketing through viral marketing strategy.
- VBE Aerospace CAP ICT management through the selection of an ICT infrastructure provider.

5.2.1.3.2 ICT Infrastructure Definition

VBE Aerospace CAP has selected PyME Creativa as ICT infrastructure provider. PyME Creativa is an e-HUB (integrated e-services center for virtual business) allowing Small and Medium Enterprises (SMEs) to have access to a wide range of value-added services for the creation of value-added industrial networks that will allow the integration of SMEs technological competencies to access new collaborative business opportunities in the global aerospace markets.

Furthermore, the e-services that will be offer to the VBE Aerospace CAP by PyME Creativa are:

- e-Marketing service will offer an intelligent portal that will allow the promotion of products and services facilitating management and maintenance activities for the SMEs.
- e-Brokerage service will offer a mediation process between customers and suppliers. It is formed by various types of processes supporting the matchmaking between consumer needs against suppliers’ capabilities and skills. It is a communication channel for negotiation and bidding.
• e-Planning service will intent to help customers and providers to define the work plan prior to the execution project.

• e-Engineering service will provide, through the use of a collaborative e-engineering environments, the possibility for configuration of specific processes in different enterprises (customization), allowing companies to focus on their core competencies, instead of taking care of technological issues.

• e-Supply service will integrate technologies for the optimization of logistics systems and supply chain integration, and enable import/export services for products and material and supply chain management.

• e-Productivity service will incorporate technologies for diagnosis, planning, and monitoring of SEM development according productivity and benchmarking indicators.

5.2.1.3.3 Governance Structure Definition

The chart below illustrates the governance structure of the VBE Aerospace CAP:

![Governance Structure Diagram]

Figure 17 – VBE Aerospace CAP Governance Structure

5.2.1.3.4 Author’s Recommendations

For the activity of business process definition in the VBE Instantiation Methodology, recommendations include the definition of different VBE management processes as a set of coordinated tasks and activities conducted by both people and/or information systems, to accomplish a specific goal. Business Process Management (BPM) is the approach suggested to define, describe and classify VBE business processes. Some diagrams and taxonomies are
suggested for this task (e.g. cross functional diagrams, workflow diagrams). Furthermore, different frameworks, architectures and reference models can be used to manage them.

For the activity of *ICT infrastructure management*, recommendations include a set of information systems and repositories with different functionalities to support the different requirements of the VBE business processes defined. VBE administration should assess the strength and weaknesses of the capabilities of software and hardware to guarantee the selection of the proper ICT infrastructure to support VBE operation.

For the activity of *governance structure definition*, recommendations include the definition of a structure of authority with a clear definition of rights, roles and responsibilities for VBE actors, and a set of principles, bylaws, and functional and behavioral rules to provide VBE administration with a framework for decision-making, negotiations and accommodations between parties involved and take actions to optimize functionalities, relationships and performance. In general all outcomes related to the spheres of responsibility inside the Virtual Breeding Environment.

Finally, Table 8 presents a check list of what it has been done on business processes, ICT infrastructure and governance structure definition towards the creation of the VBE Aerospace CAP tile now vs. what the VBE Instantiation Methodology suggests:

<table>
<thead>
<tr>
<th>VBE Instantiation Methodology</th>
<th>VBE Aerospace CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Processes Definition</td>
<td>YES</td>
</tr>
<tr>
<td>ICT Infrastructure Definition</td>
<td>YES</td>
</tr>
<tr>
<td>Governance Structure Definition</td>
<td>YES</td>
</tr>
</tbody>
</table>

### 5.2.2 VBE Creation Stage: Founding

#### 5.2.2.1 VBE Aerospace ICT Set-up & Run, and Governance Structure Establishment

Since the VBE Aerospace CAP creation process has not reached the foundation state, ICT Set-up & Run has not been initiated, but as mention before, already an ICT platform has been selected to support VBE operation.

On the other hand, related to VBE Governance Structure Establishment, first steps have been done by making public the already defined structure of authority for the VBE Aerospace CAP.
5.2.2.1 Author’s Recommendations

For the activity of *ICT Set-up & Run* in the VBE Instantiation Methodology, recommendations include six main activities: Set-up and run VBE system and ICT infrastructure, load existing ontology & thesaurus, parameterize domain & set-up nodes, create information repositories, enter administrative & assisting data, and register founding members.

For the activity of *Governance Structure Establishment*, recommendation include documentation and publication of VBE governance principles, rules, bylaws, roles, rights and responsibilities for acknowledge of all VBE actors.

Finally, Table 9 presents a check list of what it has been done on ICT Set-Up & Run and Governance Structure Establishment towards the creation of the VBE Aerospace CAP tile now vs. what the VBE Instantiation Methodology suggests:

Table 9 – VBE ICT Set-up & Run, and Governance Structure Establishment Check List

<table>
<thead>
<tr>
<th>VBE Instantiation Methodology</th>
<th>VBE Aerospace CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBE ICT Set-up &amp; Run</td>
<td>NO</td>
</tr>
<tr>
<td>Governance Structure Establishment</td>
<td>YES</td>
</tr>
</tbody>
</table>

5.2.2.2 VBE Members and Support Institutions Registration Processes

Searching for potential VBE members and support institutions to deliver products, services, processes and technologies for the VBE Aerospace CAP will require three main actions:

- Invite as potential VBE members Small and Medium Enterprises (SMEs) with the interest to collaborative support and develop the aerospace industry.
- Invite as potential support institutions: academic, research and government entities to promote and leverage the VBE Aerospace CAP and therefore the aerospace industry.
- Invite service providers like PyME Creativa to outsource not-strategic business processes.

Nowadays, the VBE Aerospace CAP is trying to contact potential VBE members and support institutions by phone calls and visits to their facilities to explain the SMEs about the advantages and benefits of being part of a Virtual Breeding Environment. Tile now 119 enterprises have been identified as potential VBE members: 90 manufacturing enterprises, 15 maintenance enterprises and 14 engineering and design enterprises. Related to support institutions one university is already involved and also two government entities.
5.2.2.2.1 Author’s Recommendations

For the activity of VBE members and Support Institution Registration Process in the VBE Instantiation Methodology, recommendations include a membership process based on four steps: 1) Receive membership applicants or invite potential VBE members/Support Institutions, 2) Assessment and Accreditation of membership applicants, 3) Acceptance/Rejection of membership applicants, and 4) VBE members organizational profiling and competency definition. In case of rejection the applicant should receive a feedback for self-improvement and open the possibility to reapply later.

Finally, Table 10 presents a check list of what it has been done on business processes, ICT infrastructure and governance structure definition towards the creation of the VBE Aerospace CAP tile now vs. what the VBE Instantiation Methodology suggests:

Table 10 – VBE Members and Support Institutions Registration Check List

<table>
<thead>
<tr>
<th>VBE Instantiation Methodology</th>
<th>VBE Aerospace CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members Initiation (recruiting)</td>
<td>YES</td>
</tr>
<tr>
<td>Support Institutions Initiation (recruiting)</td>
<td>YES</td>
</tr>
<tr>
<td>Assessment and Accreditation</td>
<td>NO</td>
</tr>
<tr>
<td>Profiling and Competency Definition</td>
<td>NO</td>
</tr>
</tbody>
</table>

5.2.2.3 VBE Launching

This is the final activity in the VBE creation process. VBE Aerospace CAP is planned to be officially launched in the final months of 2007.

5.2.2.3.1 Author’s Recommendations

For the activity of VBE launching in the VBE Instantiation Methodology, recommendations focus on announce start of VBE operations in different medias and make strong emphasis in marketing and brokerage strategies to promote VBE competencies.

Finally, Table 11 presents a check list of what it has been done VBE launching towards the creation of the VBE Aerospace CAP tile now vs. what the VBE Instantiation Methodology suggests:

Table 11 – VBE Launching Check List

<table>
<thead>
<tr>
<th>VBE Instantiation Methodology</th>
<th>VBE Aerospace CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBE Launching</td>
<td>NO</td>
</tr>
</tbody>
</table>
Chapter 6: Results, Conclusions and Further Research

6.1 Industrial Case Results

A case of study was prepared to validate the VBE creation stage of the proposed VBE Instantiation Methodology. VBE creation stage is divided into two sub-stages: VBE Initiation and Recruiting, and VBE Foundation. First one focuses in planning the creation of a new VBE by means of strategic making process including environmental research, goal setting, strategy analysis, strategy formulation and strategy implementation including business process, ICT infrastructure and governance structure definition. And second one focuses on putting in execution the strategic action plans to prepare the VBE to be launched and initiate operations, for this final activity in VBE creation, the ICT infrastructure and governance structure that will support and lead the VBE to success should be set-up & run, and established, respectively.

The aerospace industry was the sector selected to validate the first stage of the VBE Instantiation Methodology and therefore to create a Virtual Breeding Environment, its short name: “Aerospace CAP”. The creation of a VBE in the aerospace industry, according to environmental research, appears as a key sector for the economical and technological development of the region and the country. The development of the VBE Aerospace CAP will have positively diverse aspects, from the economic point of view to the advances in technological matter. The goal will be to leverage the aerospace industry in the State of Nuevo Leon by building the infrastructure to offer products, services and technology to the sector. The VBE Aerospace CAP strategy will be supported by the integration of SMEs competencies to satisfy specific needs in the aerospace market and for reaching new business opportunities in the sector through brokerage strategies to bring them into the VBE. Furthermore, the VBE Aerospace CAP strategy will include providing to the SMEs with facilities to leverage their manufacturing processes and ICT infrastructure to enhance their collaborative processes, both with the aim of creating value-added industrial networks (e.g. Virtual Organizations) capable to join the productive aerospace value chain and reaching new business opportunities and competitive levels in the aerospace global market. Finally, a governance structure is already established leading the VBE Aerospace CAP creation process to success through two main actions tile this point towards the VBE launching: 1) VBE members recluting focusing in: SMEs with manufacturing, maintenance, engineering and design competencies, and 2) support institutions recluting, including Government entities as funding mechanism; and Academy and other certification
providers with programs for certifying and accrediting SMEs competencies according the regulations in technical standards in the aerospace sector.

### 6.2 VBE Management Framework Conclusions

As described in Chapter 1, one of the two objectives of this research was to create a VBE Reference Framework for the Management of Virtual Breeding Environments during its entire life cycle. The VBE Management Framework proposed in Chapter 3 was structured based on key research findings of ECOLEAD project and validated through a modeling exercise considering the In-CNO abstractions and dimensions of the ARCON Reference Model to guarantee the identification and definition of the main management process for supporting the overall administration of a breeding environment during its creation, operation/evolution, metamorphosis and dissolution. A complete explanation for each management process was done. The result of this thesis: “a general and replicable management framework for VBEs”.

### 6.3 VBE Instantiation Methodology Conclusions

Second and final objective of this research was to propose a VBE Instantiation Methodology for the VBE Management Framework. Key management processes identified where model using also the In-CNO abstractions and dimensions of the ARCON Reference Model and carried out through entire VBE life cycle to guarantee that the methodology proposed covers all the activities required for customizing the management process identified in the VBE life cycle. The result of this thesis: “as a set of guidelines and suggested tools for instantiated the VBE Management Framework in different VBE domains”.

### 6.4 Further Research

Even though the proposed VBE Instantiation Methodology can be considered as good method for the creation of new Virtual Breeding Environments, this research has to be extended to validate the methodology proposed for the entire VBE life cycle. Furthermore, the VBE Instantiation Methodology serves as a modeling exercise for In-CNO abstractions and dimensions of the ARCON Reference Model, but About-CNOs abstractions and dimensions still require a clear methodology for their modeling and representation.
References


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