A Practical Management Model
for Supporting Virtual Organizations Creation
within Their Breeding Environments

Angelita Moutin Segoria Gasparotto and Fábio Müller Guerrini

São Carlos Engineering School (USP) – Production Engineering Department,
Trabalhador São-Carlense Avenue, 400 Zip Code 13566-590 São Carlos, Brazil
angelita@usp.br, guerrini@sc.usp.br

Abstract. Among the various manifestations of collaborative networks in the literature, the Virtual Breeding Environment (VBE) has highlighted in the economic scenario since its implementation can provide the creation of Virtual Organizations (VO). The objective of this paper is to propose a practical model for supporting virtual organizations within their breeding environments, under the analytical approach of networks. The research method used is the study of multiple cases, involving eight VBEs of the manufacturing sector. The methodology that will support the creation of the proposed model is called Enterprise Knowledge Development (EKD), comprised of models of goals, concepts, business rules, actors and resources, processes and requirements and technical components. It is hoped that this model can enable the generation of concrete possibilities of facilitating the operation of the network as a whole. Additional topics will be presented in further work.

Keywords: Model, VBE, VO, EKD Methodology.

1   Introduction

The occurrence of multiple forms of relationships among companies is a topic that has been discussed in the literature recursively. Thus, there is a growing convergence of views of different schools for a better competitive performance that should focus not only on individual company alone, but primarily on investigating the relationships among companies and with other institutions [1]. In this context, collaborative networks arise, which with the advance of Information and Communication Technologies (ICT) allow regionally distributed and heterogeneous entities can share resources, skills and risks, in order to reach common goals. Aiming at a better promotion of the conditions for the establishment of virtual organizations, there are environments for creating virtual organizations (Virtual Breeding Environment - VBE), which correspond to a set of organizations and institutions that have great potential for collaboration. [2], [3].

The possibility of creating a virtual organization triggered during the operation phase of a network VBE has been one of the main mechanisms of corporation survival, since it allows different entities to offer products and services in a global

market [4], [5]. In this context, the basic assumption is that the entities that are part of a VBE are prepared to collaborate [6], [7]. This preparation should include common infrastructure, documented agreements, mutual trust and work patterns. [8].

Regarding the determination of models that describe briefly the operational phase of a network VBE, it is observed as the current stage, a lack of published works on this topic. The literature presents some proposed models for collaborative networks as [9], [10]. The proposition of Camarinha-Matos and Afsarmanesh [11] lists the necessary elements of a collaborative network in a reference model - ARCON (A Reference model for COllaborative Networks). From this model, Romero and Molina [12] propose a reference model for the creation of virtual organizations, placed in the context of a VBE. This model has the following steps to create virtual organizations: a) identification and characterization of opportunities, b) project planning, c) research and selection of partners and competence, d) negotiation, e) detailed planning, f) assignment and g) launching.

However, these models do not predict a systematic overview of how the concepts are related to the processes for supporting virtual organizations creation within their breeding environments. Since the primary purpose of a VBE is to establish necessary conditions for the creation of a virtual organization, the purpose of this paper therefore is to systematize the concepts and processes involved in the steps of creating virtual organizations, within the operational phase of the VBE. From the literature review and the support of the EKD methodology, the model of concepts will then be developed. Through of the multiple cases studies, the processes model is developed.

2   Literature Review

2.1   Organizational Modeling

In the context of modeling, a model can be understood as an abstract representation of a system, which will be used as a guide for development. A model may also be important to manage the operation of a system during its life cycle [13]. Thus, some effort has been undertaken for the development of models, such as: ARCON [14], FEA [15], SCOR [16] and VERAM [17].

The methodology EKD (Enterprise Knowledge Development) provides the basis for understanding and support for organizational changes, as well as help in developing information systems that support the organization. Models that are part of the EKD methodology are [18] - a) models of objectives: concentrate on the description of the ideas of the organization, what they want to achieve or avoid; b) models of concepts: represent the entities, attributes and relationships among them; c) models of rules: used to set and maintain the rules formulated and consistent with the model of objectives; d) models of actors and resources: used to describe how different actors and resources are related and how they relate to other models; e) models of processes: used to define the process of the organization, and the way in which they interact with and deal with information and materials; f) models of components and technical requirements: used when the proposition of EKD methodology is to help define the requirements for the development of an information system. From the justifications, the EKD methodology

will be used to build the proposed model, since it fosters systematic analysis, understanding, development, documentation and organization of morphological components for the creating virtual organizations by VBE.

2.2   Environments for the Creation of Virtual Organizations

A Virtual Breeding Environment (VBE) is a set of organizations and their supporting institutions, endowed with human conditions, financial, social, structural and organizational potential for the creation of virtual organizations. A virtual organization is a temporary network of companies or combination of capabilities that share resources and purposes aiming at a common goal within a given period, in response to the opportunities eventually presented to them. At every opportunity, the mission, responsibilities, competences are established and risks are shared. [19].

Since one of the main functions of VBE is to promote the creation of virtual organizations, the ARCON model was instantiated culminating in a set of steps for this purpose. [20]: a) identification and characterization of the opportunity, b) project planning of virtual organization, c) search and selection of partners, d) negotiation, e) detailed planning, f) assignment and g) launching. The model of concepts was developed to represent the phase of operation of the collaborative VBE network for creating virtual organizations (Fig. 1):
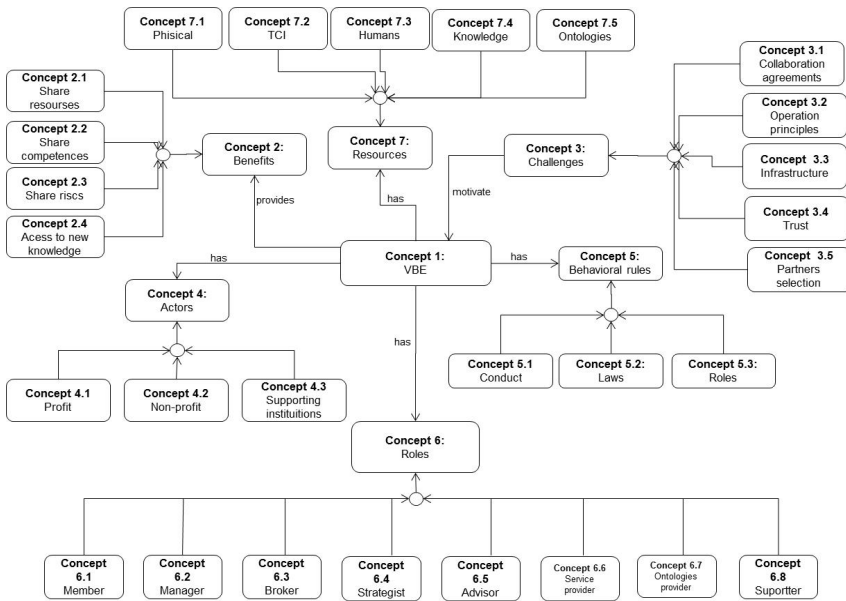

Fig. 1. Model of concepts

As shown in Figure 1, one VBE (Concept 1) provides a number of benefits (Concept 2), among which stand out: the sharing of resources (Concept 2.1), sharing skills (Concept 2.2), risk sharing (Concept 2.3), access to new knowledge, among others. Among the challenges (Concept 3) that motivate the creation of virtual

organizations by VBE can be included: development of collaboration agreements (Concept 3.1), generation of operating principles (Concept 3.2), establishment of infrastructure (Concept 3.3), setting trust (Concept 3.4), partners selection (Concept 3.5), among others. Aiming the creation of virtual organizations, one VBE has behavioral rules (Concept 5) such as behavior (Concept 5.1), laws (Concept 5.2), roles (Concept 5.3), among others. A VBE also features actors (Concept 4), which are organizations registered in the VBE, which can form virtual organizations, like for-profit organizations (Concept 4.1), nonprofit organizations (Concept 4.2), supporting institutions (Concept 4.3), among others. A VBE also plays a number of roles (Concept 6), such as a member (Concept 6.1), manager (Concept 6.2), broker (Concept 6.3), strategist (Concept 6.4), advisor (Concept 6.5), service provider (Concept 6.6), provider of ontologies (Concept 6.7), support (Concept 6.8), among others. A VBE has resources (Concept 7) to provide the necessary conditions for the creation of virtual organizations, such as physical (Concept 7.1), infrastructure, information and communication technology (Concept 7.2), human (Concept 7.3), knowledge (Concept 7.4) ontologies (Concept 7.5), among others.

3   Research Methodology

This research was conducted in three stages. The first, a survey was conducted in bibliographic databases to find articles in journals related to the objects of this study.

The databases used were the Web of Science, Science Direct, Emerald, Compendex and Elsevier. The keywords considered to start the search were collaborative networks, virtual breeding environments and virtual organizations. The papers were selected based on the analysis of the impact factor of the journals that is published in the Journal Citation Report (JCR) indexed by the Institute for Science Information (ISI) and the abstracts to identify the main articles that could contribute to this research. In the second stage, multiple case studies were carried out with eight VBEs. Initially the VBEs administrators were contacted by email and phone. Among the nine VBEs contacted, seven advisors e one administrator (Mexico, Switzerland, Brazil, United Kingdom, Ireland, Italy, Germany and Spain) returned the emails confirming the possibility and interest to participate in the research, and indicated respondents that knew more deeply the working of VBEs surveyed. The purpose of the questionnaire was to understand the process of operationalization of VBE with respect to the creation of virtual organizations [21]. The last stage was the development of an organizational modeling based on the EKD methodology. Considering the purpose of this study, a process model was developed to represent the stages of creation of virtual organizations, by VBEs surveyed.

4   Multiple Case Studies

Data were analyzed, organized and systematized by EKD modeling methodology. To do this, first, the questionnaires and conversations with respondents of VBEs were printed. This information was important for making the current status model. The next model was the future status model. This model was the result of analysis and comparison with literature and the current status model. The process model of the

current status demonstrates how the VBEs in the phase of operationalization perform in order to create virtual organizations (Fig. 2). The analysis of the current status allows us to understand the processes of the organization, identify the actors and resources involved, the dependencies among the actors and business objectives.

Fig. 2. How the VBEs perform to create virtual organizations within their breeding environments

According to survey respondents, an opportunity (Process 1) can arise through external market or among entities that are already part of VBE. Who usually performs the step of identifying opportunities is the broker. Then the broker performs the step of search and selection of partners (Process 2), in order to meet the identified opportunity. From opportunities and partners selected, the VBE manager prepares a Work Breakdown Structure project (Process 3) for the new virtual organization. Definitions of governance (Process 4) contained in the contract establish the rights and duties among members of the virtual organization. The planning stage (Process 5) involves the preparation of a schedule of operation of the virtual organization, from the integration of activities, deadlines and the people responsible of this. Finally, the stage of launching (Process 6) involves putting a virtual organization in operation, by activating the services and notification of members. From the literature review and multiple cases studies (which presented the current status of how VBEs perform the steps of creating VO) it was possible to build a framework (Table 1) containing the changing needs. In other words, it could be identified what are the elements that both the literature and the VBEs recommend for the creation of virtual organizations.

Table 1. Recommendations for creating virtual organizations (Overview of Literature x VBEs)

Literature Recommendations	VBEs - Multiple Case Studies							
	1	2	3	4	5	6	7	8
Identification and characterization of the opportunity	■	■	■	■	■	■	■	■
Project planning of virtual organization	■	■	■	■	■	■	■	■
Search and selection of partners	■	■	■	■	■	■	■	■
Negotiation	■		■			■		
Detailed planning	■	■	■	■	■	■	■	■
Assignment	■	■	■	■	■	■	■	■
Launching	■		■			■		

The comparison between the recommendations of the literature and the findings from multiple cases studies led to the process model proposed for this paper (Fig. 3).
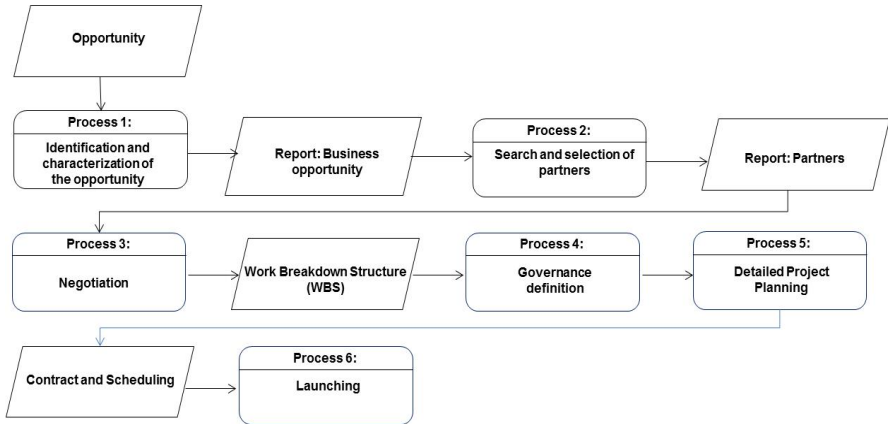

Fig. 3. Process model proposed for creating virtual organizations by VBEs

The proposed process model has six processes: an opportunity (Process 1) can arise through external market or among entities that are already part of VBE. Who usually performs the role of identifying and characterizing opportunities is the broker. In order to automate the process of identifying opportunities in a VBE, Demsar, Mozetic and Lavrac [22] developed a tool called CoFinder (Collaboration Opportunity Finder). The tool compares the potential opportunities for collaboration with the essential skills stored in a database provided by the VBE. Then, the broker executes the search and selection of partners (Process 2), in order to meet the identified opportunity. Ermilova and Afsarmanesh [23] proposed a tool called PCMS (Profile and Competency Management System) whose purpose is to organize and manage a repository of expertise of the organizations that are part of the VBE, as well as the resources and capabilities demanded. From opportunities and partners selected, critical activities related to the creation of virtual organizations are established, among them: who is responsible for virtual organization, how risk sharing among the partners occur, how the sharing of information and treatment of privacy issues should be (Process 3). Definitions of governance (Process 4) establish the rights and duties among members of the virtual organization. Detailed planning (Process 5) involves the preparation of a contract and schedule of operation of the virtual organization. The launching (Process 6) involves placing a virtual organization in operation by configuring the infrastructure of information technology and communication, resource allocation, activation and notification services of the members involved.

5   Conclusions

Over the past years, various entities (such as research centers, companies, universities and government agencies), motivated in part by the process of internationalization of the economy and partly by the highly competitive global markets, have seen

collaborative networking as great opportunity for sharing knowledge, uncertainties, risks and opportunities. In this context, a VBE is strategic for the creation of virtual organizations, especially because the phase of operation can enable the creation of virtual organizations. But note that there are difficulties for the creation of virtual organizations, such as agility, trust, negotiation and finding partners. Studies have shown that there are few studies that establish a systematic framework for the creation of virtual organizations, from the operational phase of the VBE. With the aid of the EKD methodology, a model of concepts was developed to understand the concepts, roles, benefits and challenges of VBEs for creating virtual organizations. From the comparison between the recommendations of the literature and the current situation of the creation of virtual organizations by VBEs, a process model was proposed. The determination of the model that includes the operation phase of VBE should help in the systematization of knowledge, generating the possibility to visualize the steps of creating virtual organizations as a whole, as well as allowing the researcher to find gaps that may be more explored in future research.

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