



Revista de Administração da Unimep

E-ISSN: 1679-5350

gzograzian@unimep.br

Universidade Metodista de Piracicaba
Brasil

Vallejos Vargas, Rolando; Kunrath Dilly, Eliete; Gonzatto Peretti, Jucelda de Lourdes; Dorion, Eric
Towards a Meta-Reference Model for the Collaborative Network Area
Revista de Administração da Unimep, vol. 6, núm. 2, mayo-agosto, 2008, pp. 122-136
Universidade Metodista de Piracicaba
São Paulo, Brasil

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Towards a Meta-Reference Model for the Collaborative Network Area

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Revista de Administração da UNIMEP, v. 6, n. 2, Maio / Agosto – 2008

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Revista de Administração da UNIMEP

ISSN – ISSN 1679-5350

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Mestrado Profissional em Administração

ABSTRACT

The collaborative network concept is not new, but its use has been influenced in the political, social and economic global changes. The concept is not only being applied in the industry, but also in the service sector, as well as governmental and non-governmental social organizations. For that reason reference models for different sectors are being proposed, developed and implemented. In the present work are presented and compared four different reference models of collaborative networks considering a functional dimension perspective. The objective of this work is to identify core processes that exist in those four models that could be considered as a basis for the development of a meta-reference model for the Collaborative Network discipline. The paper introduced the idea to develop a meta-reference model in order to facilitate the creation and operation of new collaborative networks.

Key-words: Reference models of collaborative networks.

1. INTRODUCTION

Saint-Simon (1760-1825) is known as the pioneer of the use of the modern concept of network and its conception, because he introduces a flow system as well. The author's concerns were related to the use of the network concept to assure the transformation of the feudal system into the industrial system. This change from "domination" into "association" could only be assured by developing communication networks among members. This concept of network was derived from three fundamental elements: association, communication and participation (D'AVILA NETO, 2003).

The concept of network is not new, but its use nowadays has been influenced by global changes, in politics, society, and economics. Some strong arguments may explain the dissemination of the use of network's concept. In an economical perspective, a network may constitute an answer to challenges for the organizations because of the intense competition caused by a globalized economy (CASTELLS, 1998; LOIOLA and MOURA, 1996). In a political perspective, a network seems to constitute an answer to the fiscal crisis and to the erosion of the contemporaneous Government supremacy (CASTELLS, 1998).

Among the various types of networks, a special relevance is giving to collaborative networks. The concept of Collaborative Network (CN) has become stronger in recent years within the academic and industrial areas. It constitutes an effort to concretize and modernize the traditional concept of cooperation networks among companies. A CN is constituted by

several entities (e.g., organizations and people) that are autonomous, geographically distributed, and heterogeneous in terms of their: operating environment, culture, social capital, and goals. These entities collaborate to achieve common goals, and their interactions are supported by a computer network. 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, 2005).

A large number of research projects in this area are carried out worldwide and a growing number of practical cases on different forms of CNs 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 as the behavioural 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 (CAMARINHA-MATOS, 2005).

In order to contribute for the foundations of the CN area, this paper aims to present and compare four different reference models of CNs, one proposed by Vallejos, Lima and Varvakis, (2006), other developed in the *Cooperation Networks Program* coordinated by the Government of the State of Rio Grande do Sul (Brazil), other proposed by Inojosa (1999) for Social Networks and the last one proposed in the GLOBEMEN Project. The objective of this work is to identify convergent processes that exist in those four reference models that could be considered as a basis for the development of a meta-reference model for the CN area. In the present paper the intention is to realize that comparative analysis considering only a functional dimension perspective.

2. AMBIANCE FRAMEWORK FOR MOULD AND DIE SECTOR

The Virtual Enterprise (VE) paradigm started to provide intuitive approaches to challenges offered by turbulent markets, being supported by recent development in

Information and Communication Technologies (ICTs) and by new approaches in management area (VALLEJOS et al., 2006).

A VE is a temporary alliance of enterprises that join together to share skill or core competencies and resources in order to better respond to business opportunities, where cooperation is supported by computer networks. Two key elements are enhanced in this definition are: network and cooperation (CAMARINHA-MATOS and AFSARMANESH, 1999).

According to Afsarmanesh and Camarinha-Matos (2005), the formation of any CN depends on the following parameters: (1) partners sharing some common objectives, (2) partners having some level of mutual trust, (3) partners interacting with the use of common technology infra-structures, and (4) partners agreeing about some practices and values of common business.

In order to promote the creation of VEs in the mould and die sector, Vallejos (2005) proposes the creation of a *Virtual Breeding Environment* (VBE), that he calls AmbientCE (Environment for creation of Virtual Enterprises; in Portuguese: *Ambiente de Criação de Empresas Virtuais*), to face difficulties and to overcome problems that may come up while forming or maintaining a VE. The author considers that an AmbientCE provides the creation of necessary conditions so that entrepreneurs and employees adapt their current culture into a new working culture which considers aspects of trust, competence, and the use of ICT.

The framework AmbientCE was developed so that small and medium enterprises (SMEs) in the mould and die sector, already competing among them, consolidated a new collaborative working way through the formation of VEs (VALLEJOS, 2005).

The AmbientCE framework (figure 1) is composed of three steps:

- a) Prepare AmbientCE: identification and preparation of SMEs with potential to form VEs. It is sub-divided in three phases: identify enterprises, align objectives, and develop a new culture;
- b) Structure AmbientCE: the goal of this step is the creation of a more stable and durable inter-companies' relationship environment, which is carried out in three phases: organize AmbientCE, qualify people, and implement AmbientCE;
- c) Act: treats about the Life Cycle of a VE, and it is divided into three other phases: create VE, operate VE, and dissolve VE.

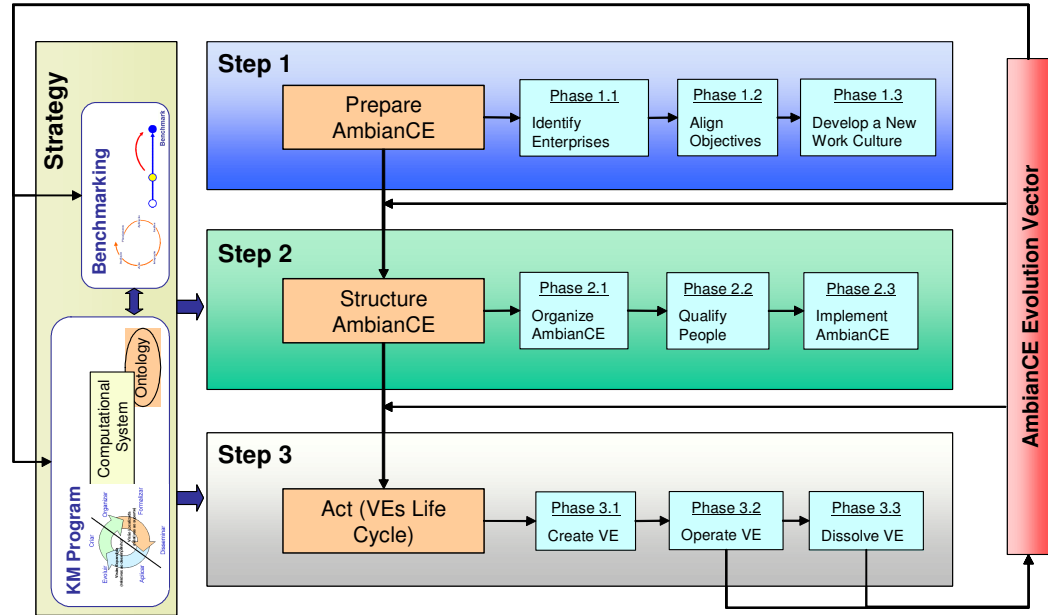


Figure 1: AmbianCE framework and its constitutive elements.

The model uses, still, a strategy to be implemented, which is called *AmbianCE Strategy*, which is based on a *Knowledge Management Program* and a *Benchmarking Methodology*. Such strategy also uses a ‘vertical’ element called *AmbianCE Evolution Vector* connecting steps two and three, creating a cyclical process that allows the constant improvement of the framework.

3. SEDAI COOPERATION NETWORKS PROGRAM MODEL

Networks of companies appeared from the need to face new challenges that the consumers’ market imposes nowadays. More and more competition is not really happening between isolated companies, but among supply chains and/or productive networks. Innovation and cooperation constitute the basis to increasing, also offering the possibility of disposing of technologies and reducing transactional costs related to the process of innovation and distribution. It improves economy and efficiency and, as a consequence, it increases competitiveness (PORTER, 1998; SCHMITZ and NADVI, 1999).

In Brazil, several kinds of business alliances appeared in the last decade, such as local productive arrangements, consortia, and networks, among others. The Government of the

State of Rio Grande do Sul, thru its Business Development Department, Center of Development and International Affairs (SEDAI), started in 2000 the *Cooperation Networks Program*, with the objective to “[...] foment cooperation among companies, generate exiting environment for entrepreneurship and provide technical support to form, consolidate and develop networks” (SIMON, 2004).

The *Cooperation Networks Program* was thought for industry, commerce and services entrepreneurs. It guarantees better competitive conditions in relation to the current market demands. After analyzing several kinds of alliances among companies, the program establishes an associative culture as a better way to formalize the relationships among companies that belong to the network (TIMM and SILVA, 2004).

The central idea is to join companies that have common interests in CNs through the constitution of an established juridical entity, with no capital quote, and that maintain legal independence and its individual participation as a company. Again, network crystallization allows common actions, which makes easier solving common problems and making possible new opportunities that would never happen in an isolate perspective and consequently, such alliance will reduce and shared costs and risks, rise new markets, qualify products and services and access new technologies. It demonstrates that the idea that as a whole it creates an added value from each entity. The constituted networks are democratically managed, allowing direct participation of every entity in the strategic decisions and for a symmetric distribution of the benefits.

The program has a state dimension and it is coordinated by SEDAI, though the Cooperation Networks Division. It is regionally executed in an articulated way with Superior Studies Institutes (SSI), which offers their infrastructure, such as meeting rooms, equipment, events’ organization, material, and so on. The supervision of each region is carried out thru a technician identified by the partner SSI, which is responsible for the accomplishment of the actions of consultants and for the objectives established in an agreement with the State.

A partnership between SEDAI and SSI defines and establishes the methodology and the processes including the establishment of objectives and steps of the working plan that determines the activities that will be held (SEDAI, 2004). The model used by the *Cooperation Networks Program* is composed of five steps (figure 2):

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- a) **Sensibilize:** it carries out the basic planning of acting, the companies' prospecting, the preparation for the sensilize meeting;
- b) **Network structuring:** this step aims to clear up some still confusing aspects and to identify coincident aspects among companies and to start up the process to form a Network. It is composed of four phases: the construction of the SWOT matrix, the identification of common aspects to companies, the environment analysis, and, at the end, the verification of the group cohesion;
- c) **Juridical format:** this step determines the network's functional structure. It comprehends the group construction of a Social Statute, of the Internal Regiment and of the association's Ethics Code, as well as it is necessary to constitute the board of Directors and Councils. In the second phase, it is held an integration process among business people and their families and in the third phase, there is a legal register of the association;

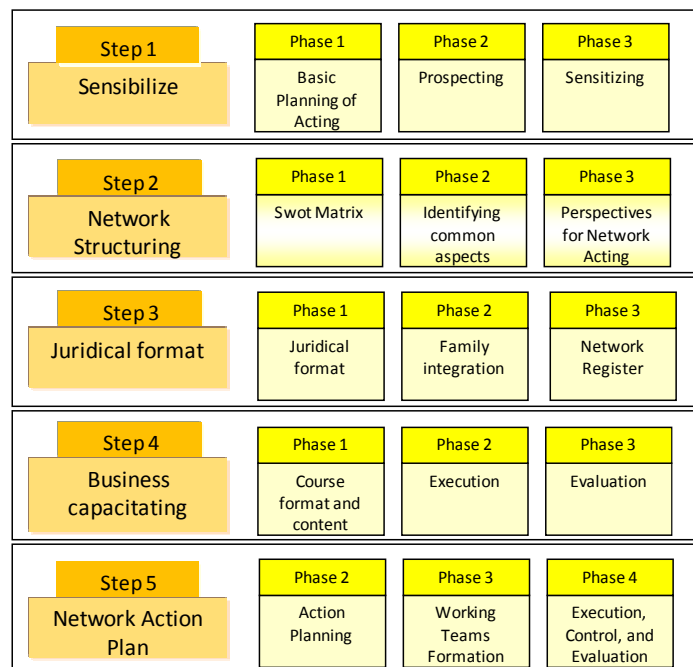


Figure 2: Cooperation Networks Program model.

- d) **Business capacitating:** one of the objectives in this step is to improve business people's acting. The applied methodology stimulates the entrepreneur's behaviour, strengthens business aptitudes, and leverages group knowledge. Another objective is

to give the meaning of profits in a short term because of the participation in the network;

e) **Network's Action Plan:** in this step, the network is ready to start structuring for a medium term. It identifies the possibilities of action and determines work groups, according to the themes defined in the network planning: marketing, negotiation, management and innovation, and expanding. From this step on there is the execution of established plans, besides the control and evaluation of the results.

4. REFERENCE MODEL FOR SOCIAL NETWORKS

The current interest on networks as an alternative to social action has been provoked by the criticism, results of management in public policies, which shows a not well ratio cost/benefit or which is not able to reach wider objectives (INOJOSA, 1999). Thus, Inojosa (1999) proposes a typology of networks named **Social Committed Networks** that, according to the author, is determined by the commitment of people, once they realize there is a problem that risks the balance of the society or the social development perspectives. This pattern brings people together on a common objective to preserve the original identity of each partner.

The study presents a social commitment network concept in a partnership among public institutions, non-governmental organizations and ordinary people with the purpose of contributing to improve teenager's quality life and to reduce drugs' consuming among them in a region of São Paulo (Brazil).

The creation of a Social Committed Network has three steps, as shown in figure 3. The first has the objective of identifying problems that make more difficult or block the social development of a certain region, which is distributed in three phases: *set out social problems*, that is to identify social problems faced by the actors; *analyze the identified social problems*, that is to select the main problem among actors and to deepen the analysis of this problem and its relationships; and *align the objectives* of the actors.

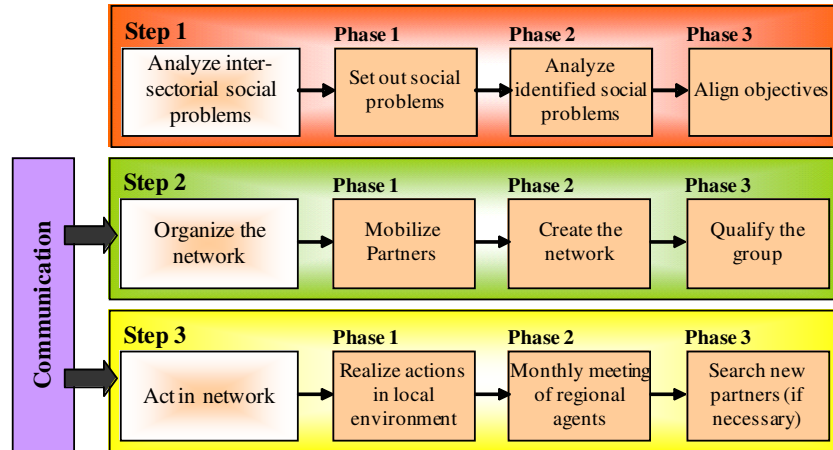


Figure 3: Social Committed Network model.

The second step aims to get together the group of necessary partners to reach the objectives proposed by the initial group. The first phase, *mobilize partners*, is determined by the mobilization of other organizations interested in this work. The second phase, *create the network*, is a consequence of the actors' will to solve problems defined in the strength-idea. The phase of *qualify the group* aims to technically prepare people to think about the specific projects and the local actions necessary to reach the network's objectives.

The third step characterizes by the actions locally held and by monthly regional meetings. Finally the search for other partners may be necessary if it is important to have other contributions to formulate and carry on projects related to the network's public target.

The communication process, which goes through steps 2 and 3, aims to circulate information about the network actors' actions among everybody, as well as to disseminate information of interest to the people involved, such as bulletins, journals, internet sites, among others.

5. VIRTUAL ENTERPRISE METHODOLOGY – VEM

The Virtual Enterprise Methodology (VEM) consists of activity models that must be considered when preparing, creating, and operating a network and a virtual enterprise environment. This methodology was developed as part of the Globemen project (GLOBAL Engineering and Manufacturing in Enterprise Networks), a found formed by research

institutes, universities and enterprises from the European Union, Australia and Japan. The project had the objective of defining and developing the architecture to manage the development, project and manufacturing life cycle of a product globally distributed.

Figure 4 presents the key activities to create and operate a VE network (Tolle and Vesterager, 2003).

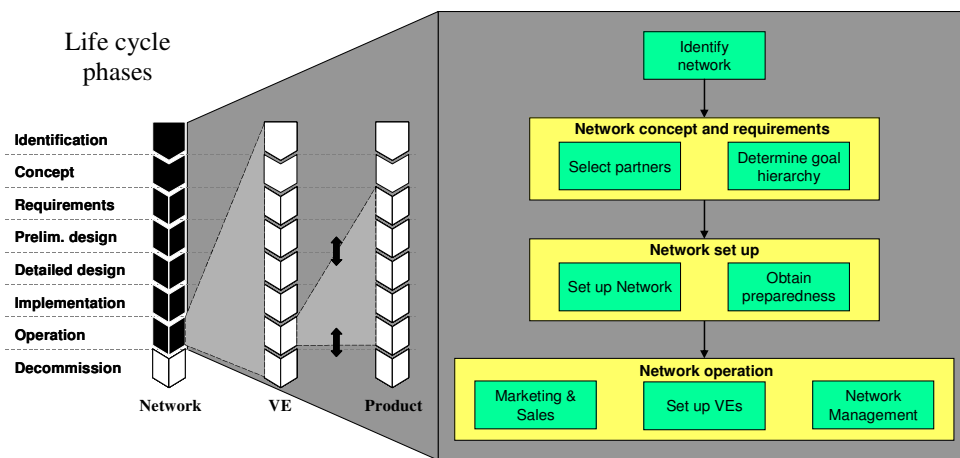


Figure 4: Set up and managing an enterprise network (VEM).

The first activity aims to *identify the network's objective*. As a main result it is possible to determine its key direction, the enterprises network's motivation and to clarify the general purpose. The second activity, *selecting partners*, is a central element to prepare the network's creation. It consists in identifying and selecting partners that will be able to come up with the vision of the enterprises' group. To be part of a VE, enterprises must have basically two kinds of competences: functional and of alliance, meaning that the partners must have the ability not only for the necessary tasks but to implement, manage and be part of alliances as well.

The third activity consists of *defining the hierarchy of objectives*. It avoids potential conflicts among the network's subjects. Efforts such as the definition of mission, vision, strategy, and objectives must be done to assure that the selected partners have common goals. A key challenge to competitiveness of a VEs network is to be able to start its activities in a short term.

Then, *set up the network* as the forth activity, has as key element to *prepare network's partners* (fifth activity). A great diversity of elements may be prepared and the kind and level of preparation depends on the kind and frequency of the tasks the network expects to carry on.

The next three phases belong to the network operation step. The Marketing and Sales activities must be held, as well as the identification of the customers' needs. The network management includes every kind and level of management tasks that are known in traditional management of conventional enterprises.

After this initial formation, Tolle and Vesterager (2003) state that is necessary to define the **engineering and operation of the VE** (figure 5). The first step consists of the *concept and requirements of the VE*. It is composed by three phases: analyse the customers' requirements, assuring the network may attend all the exposed needs; select partners to be part of the specific VE; and the creation of a Work Breakdown Structure that will decompose the product of the VE according to the deliveries and will follow the selection of partners.

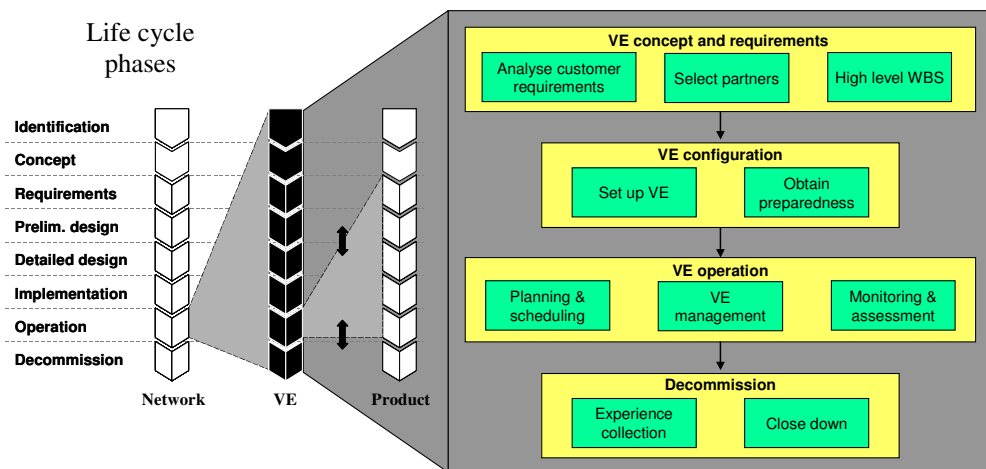


Figure 5: Key activities related to VEs (VEM).

The second step, *VE configuration*, consists in the VE set up that highly depends on the type and level of work preparation (figure 4). The third step, *VE operation*, starts with planning and scheduling activities. The plan consists of details of actions of each partner and the synchronization allows decisions on sub-contracting and provision. The VE management, the second phase, consists in directly and indirectly monitoring activities. Monitoring and assessment refers to guarantee the project is held in time thru a defined budget.

The last step is the *VE dissolution*, composed in two phases: the experience collection, when it is analyzed the experience learned got from the project, and the closing, which consists of ending the activities of the VE.

6. CONSIDERATIONS

While carrying on an analysis in a functional dimension perspective of these four reference models, it is possible to observe that all of them have similar characteristics, in terms of processes, which indicates that there are common and necessary steps and phases for the constitution of CNs. From this point of view, it is possible to propose the development of a meta-reference model for CNs based in those core processes, established in logical and sequential steps.

One initial step that is present in the four models studied treats about the **structuring of the CN**, where two processes must to be happen, which are: *CN partners' selection* and *aligning objectives*. It will be possible to identify the presence of some previous processes before the selection of partners, like partners' identification, sensibilize and/or set up problems, but may be specifically for each context.

The CN partners' selection constitutes an essential activity since its role and definition are a *sine qua non* condition to convoke wills to act for a common purpose. Nowadays, organizations get better results only when there is a commitment of everyone to the challenges proposed in the objectives. Goals guide the decision making process, is the base for performance evaluation and guide the investment plan and the strategies conception, besides to create a common vision among the CN partners.

The second step is dedicated to **organize** or **set up the network**. This organization may be formal and juridical, as in the Cooperation Networks Program; formal and none necessarily juridical, as in the case of VEs (AmbianCE and VEM), or informal and implicit, as in the case of the Social Committed Network. In this step one core process is the *partners' qualification*, that depends on the objectives established by the network and on the current level of knowledge of the partners, on the which level each partner intend to participate in the workgroup, and finally on the models the partner is intends to work with.

As a last step is proposed the **network operation**, whose governance mechanisms will depend on the degree of formalization of the network. In one way, the relationships are based only on social mechanisms and, on the other way; the property of actors is shared and formally established. For the different processes involved in the operational step of the network is fundamental to implement an information system in order to permit the communication among the partners. The core processes in this step are: *establishing metrics* and *control and evaluation*. Without the establishment of metrics and its control and evaluation is difficult to manage whatever network.

An efficient information management system in CNs permits to have actions such as: real diagnosis of the situation, evaluate partners' performance, change propositions, entrance of new partners, etc... Those systems provide, in detail, each action of each partner, with a view on the interconnections among actors, and others. Considering information management systems, it is important to point out that, although there was no possible to identify common functionalities in the studied models, the use of ICTs by the CNs is a fact that may improve their performance.

7. CONCLUSIONS

A growing number of CNs forms are emerging as a result of the use of ITCs, the market and societal needs, and the application of a large number of academic projects. As result of those experiences are being proposed different models of CNs. This paper introduced the idea to develop a meta-reference model for the CN discipline in order to facilitate the creation and operation of new CNs.

In the present paper, four CNs models were analyzed considering a functional dimension perspective, in which ones; five core processes, in three logical and sequential steps were identified. The steps are: *structure the CN*, *set up the network* and *network operation*. And the core processes are: *CN partners' selection*, *align objectives*, *partners' qualification*, *establish metrics* and *control and evaluation*.

The present work does not intend to provide the ultimate and definitive steps and core processes for the formation and operation of a CN; rather it intends to claim to join efforts in order to construct a meta-reference model for the CN discipline.

Acknowledgements. This work has been supported by the University of Caxias do Sul (UCS). It has been developed in the scope of the Brazilian IFM project (www.ifm.org.br).

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Artigo recebido em: 20/02/2008

Artigo aprovado em: 30/04/2008