2.3 Collaboration forms

In order to facilitate a better understanding among professionals involved in collaborative networks, a clarification of the base concepts of networking, coordination, cooperation, and collaboration is made. A taxonomy of the main organizational forms of collaborative networks is introduced and working definitions for those forms are proposed.

1. INTRODUCTION

Collaborative networks appear in a diversity of forms and show a variety of behavioral patterns, what leads to some difficulties both in terms of characterization of the paradigm and communication among experts.

For instance, in terms of structure, three collaborative network topologies seem to appear frequently in literature (Katzy et al., 2005) (Fig. 1): a) chain topology, as in the case of supply chains in manufacturing industries, b) star topology (dominant member), which is typically the case in construction or automotive industries, and c) general network topology, as in creative and knowledge industries. In a chain topology, the partners' interaction pattern mainly follows a value-chain. In a star topology, partners interact with one central hub or strategic center, while partners in general network topology have multiple relationships among all nodes without hierarchy. In the last case we can have not only a peer-to-peer kind of interaction but also a more general form involving several partners, or even all of them.

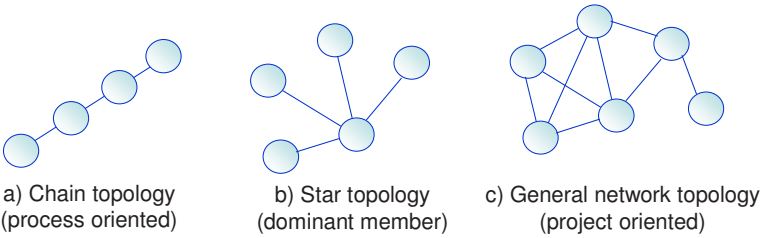

Figure 1 – Examples of topologies of collaborative networks

In terms of duration, we can find short-term networks, typically triggered by a collaboration opportunity, as the case of a virtual enterprise, and long-term networks, as the case of strategic alliances or supply chains. Furthermore, applications in different domains introduce specific terminology for that domain,

what increases the difficulties of mutual understanding in an area that is of a multi-disciplinary nature. In order to cope with such situation, this chapter tries to clarify the basic concepts and introduces a taxonomy of collaborative networks forms.

2. COLLABORATION CONCEPT

This section addresses the base concepts involved in collaboration, and classifies them in a hierarchy to distinguish their differences.

2.1 Ambiguities and working definitions

In order to properly understand and model collaborative networks it is necessary to first focus on the very notion of collaboration (Camarinha-Matos, Afsarmanesh, 2006, 2007a). Although everybody has an intuitive notion of what collaboration is, this concept is often confused with cooperation. For many people the two terms are indistinguishable. Even when a distinction is made, there are many different uses of the term collaboration in the current literature.

The ambiguities reach a higher level when other related terms are considered such as networking, communication, and coordination (Himmelman, 2001), (Pollard, 2005), (Denise, 1999). Although each one of these concepts is an important component of collaboration, they are not of equal value neither one is equivalent to it.

In an attempt to clarify the various concepts, the following working definitions can be proposed:

Definition 2.1: **Networking** – involves communication and information exchange for mutual benefit.

Example: 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.

It shall be noted that this term is used in multiple contexts and often with different meanings. For instance, when people refer to "enterprise network" or "enterprise networking" the intended meaning is probably "collaborative network of enterprises".

Definition 2.2: **Coordinated Networking** – in addition to communication and exchanging information, it involves aligning / altering activities so that more efficient results are achieved. Coordination, that is, the act of working together harmoniously, is one of the main

Example: An example of coordinated networking activities happens when it is beneficial that a number of heterogeneous 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.

components of collaboration.

Definition 2.3:
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.

Example: 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.

Definition 2.4: **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.

Example: A collaboration process happens for instance in concurrent engineering, when a team of experts jointly develop a new product. From this example it can be noticed that although some coordination is needed, collaboration, due to its joint creation facet, involves seeking divergent insights and spontaneity, and not simply a structured harmony.

As presented in the given definitions and depicted in Fig. 2, each of the above concepts constitutes a "building block" for the next definition. In other words, 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 this sense, these various interaction levels can also be seen as a kind of "**collaboration maturity level**". In other words, this organization of "building blocks" can be a basis to define the level of maturity of an organization towards involvement in a collaboration process.

In the rest of this chapter we focus on collaborative networks which subsume all other forms.

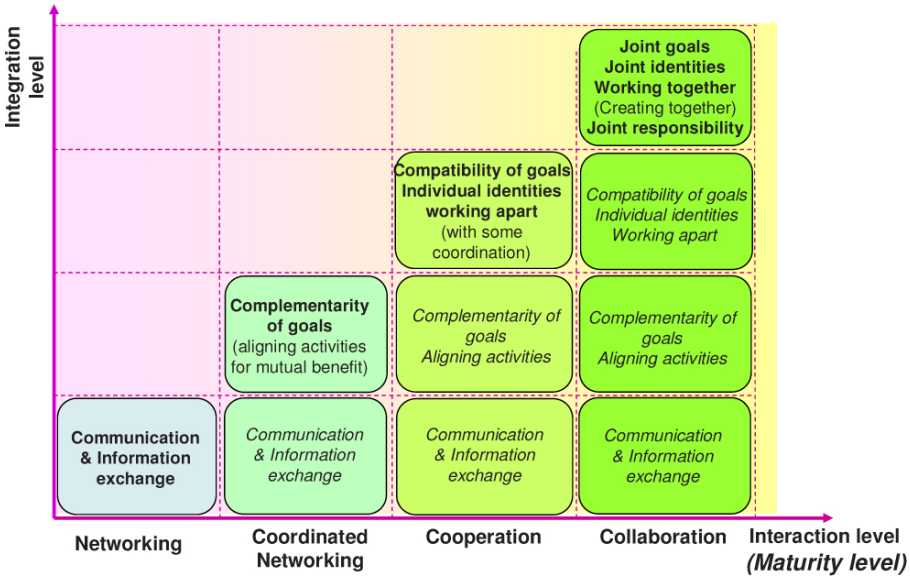

Figure 2 – Examples of joint endeavor (Camarinha-Matos, Afsarmanesh, 2007a)

Even with these definitions, in practice the distinction between collaboration and cooperation is not always very clear. In fact, in a collaborative network, collaboration in its strict sense does not happen all the time. For example, in the manufacturing alliances, very often there are phases of intense collaboration, e.g. design and planning phases of a project, intermixed with periods when the participants work individually and independently on their assigned tasks. Then from time to time they "come together" (physically or virtually) to integrate their results and continue the joint problem solving. Therefore, a collaboration process clearly involves periods of only cooperation. Understanding and supporting collaboration, which is the most demanding joint endeavor, also leads to understanding and supporting the other less demanding forms of interaction.

In collaboration, parties are more closely aligned in the sense of "working together" to reach the desired outcome, rather than that outcome being achieved through "individualistic" participation constrained by contextual factors such as those imposed by client-supplier relationships.

2.2 Requirements for collaboration

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 / compatible 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 (Giesen, 2002), (Brna, 1998):
  - Parties mutually agree to collaborate, which implies accepting to share.
  - Parties know 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 and commitment.
- As a process, collaboration requires setting a number of generic steps (Giesen, 2002):
  - Identify parties and bring them together.
  - Define scope of the collaboration and define desired outcomes.
  - Define the 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", i.e. an environment to enable and facilitate the collaboration process. The characteristics and nature of this "space" depend on the form of collaboration. Collaboration can take place 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*) (Winkler, 2002). Remote collaboration is the most relevant case in collaborative networks, which may involve both synchronous and asynchronous interactions.
- Some major points of difficulty in collaboration include (Wolff, 2005): resources, rewards, commitments, and responsibilities:
  - 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 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 all these issues must be settled by a set of common working and sharing principles.

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.

2.3 Collaboration and competition

To better understand collaboration it is also useful to put it in contrast with competition. Competition has been seen as one of the most successful basic mechanisms in the struggle for survival, namely in case of scarce resources. It is interesting to note that even Economics is defined as the study of "the efficient allocation of scarce resources among competing uses", and Politics is understood as "the relations between special interest groups competing for limited resources" (Kangas, 2005).

In fact, the formation of cooperation and collaboration alliances has emerged to allow more efficient competition against other entities or groups. This is typically what leads SMEs to join efforts in order to survive in turbulent markets. Also in Nature we find natural alliances that compete with others for survival – the species (Kangas, 2005). The stronger the threat is, the higher is the internal cohesion and sense of group identity.

But even inside a friendly group we often find the interplay between collaboration and competition. Internal competition happens as the means to gain more power, status, or material resources. On the other hand, if we consider the creative facet of collaboration – creating together – we can also find the interplay among the two concepts (Denise, 1999). In fact innovation very often results from healthy confrontation of different ideas and perspectives. A fruitful collaboration space shall allow for some degree of divergence. Often enough creativity is resulted from challenges to the current directions, norms, or assumptions. It is however fundamental that such divergences do not undermine the basic foundations of the group cohesiveness, such as trust, fairness, and sharing.

Finding the right balance between collaboration and competition in order to not only efficiently react to external threats or opportunities but also to excel individual capabilities and breed innovation is a major challenge for the definition of the governance policies, working/sharing principles, and supporting tools and infrastructures for collaborative networks.

3. BASE COLLABORATIVE ORGANIZATIONAL FORMS

Given the large diversity of manifestations of collaborative networks in different

application domains, often using different terminologies, it is important to define a taxonomy of the various organizational forms (Camarinha-Matos, Afsarmanesh, 2005, 2006a, 2007a, b) as well as providing a working definition, though informal of the terms used. Below we provide a set of definitions (referred to as *Definitions 3.1 to 3.22*), addressing different kinds of collaborative networks, as also indicated in Figure 3.1. The remaining elements of this Figure are also defined within the text of this section.

Definition 3.1: A **collaborative network** (CN) is a network consisting of a variety of entities (e.g. organizations and people) that are largely autonomous, geographically distributed, and heterogeneous in terms of their operating environment, culture, social capital and goals, but that collaborate to better achieve common or compatible goals, and whose interactions are supported by computer network.

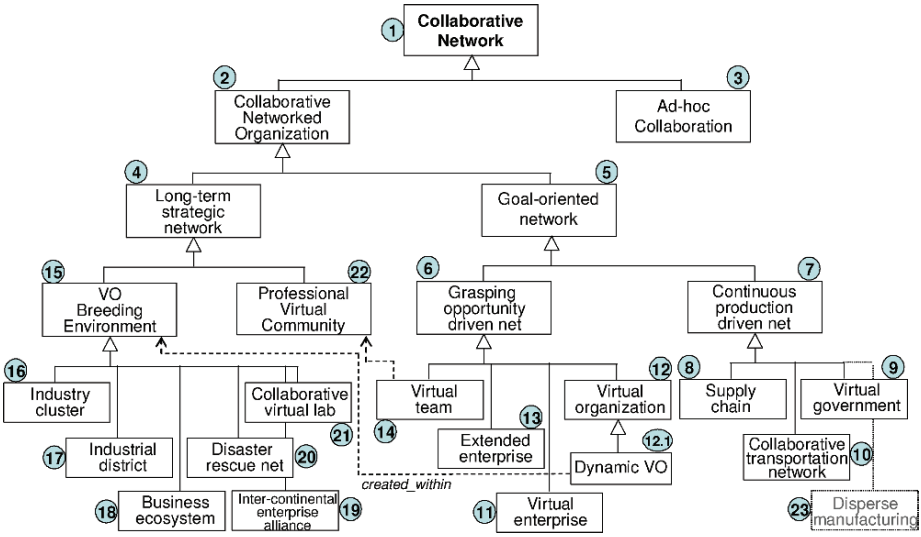

Figure 3 - Examples of Collaborative Networks

Although not all, most forms of collaborative networks imply some kind of *organization* over the activities of their constituents, identifying roles for the participants, and some governance rules. Therefore, we can consider:

Definition 3.2: **Collaborative networked organization** (CNO) – a collaborative network possessing some form of organization in terms of structure of membership, activities, definition of roles of the participants, and following a set of governance principles and rules.

Definition 3.3: **Ad-hoc collaborative** – a "spontaneous" form of collaboration

*Example: various **ad-hoc collaboration processes** can take place in virtual communities, namely those that are not business oriented – e.g. individual citizens contributions in case of a natural disaster, or simple gathering of individuals for a social cause. These are cases where people or organizations may volunteer to collaborate hoping to improve a general aim, with no pre-plan and/or structure on participants' roles and how their activities should proceed.*

without a precise structure or pre-defined organization.

Among the CNOs, we can distinguish between long-term strategic alliances and goal-oriented networks:

Definition 3.4: **Long-term strategic network** or **breeding environments** – a strategic alliance established with the purpose of being prepared for participation in collaboration opportunities, and where in fact not collaboration but **cooperation** is practiced among their **members**. In other words, they are alliances aimed at offering the conditions and environment to support rapid and fluid configuration of collaboration networks, when opportunities arise.

Definition 3.5: **Goal-oriented network** – a CN in which intense **collaboration** (towards a common goal or a set of compatible goals) is practiced among their **partners.**

Goal-oriented networks can themselves be sub-divided into:

Definition 3.6: **Grasping opportunity driven network** – a CN driven by the aim of grasping a single (collaboration) opportunity and that dissolves after the goal is accomplished.

Definition 3.7: **Continuous *production* driven network** – a CN driven by or oriented to continuous production / service provision activities.

In goal-oriented networks, the case of ***Continuous-production driven*** includes those networks that have a long-term duration and remain relatively stable during that duration, with a clear definition of members' roles along the value chain. Typical examples include:

Definition 3.8: ***Supply chains*** – a stable long-term network of enterprises each having clear roles in the manufacturing value chain, covering all steps from initial product design and the procurement of raw materials, through production, shipping, distribution, and warehousing until a finished product is delivered to a customer.

Example: This is the most classical example of networks of enterprises that work in a cooperative way. Examples can be found in all industrial sectors.

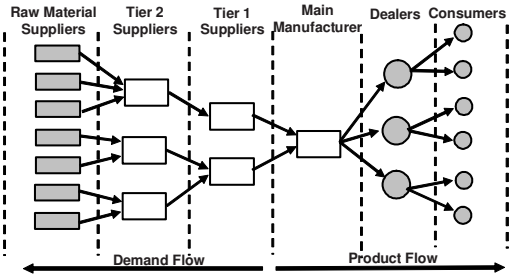

Figure 4 – Example of supply chain

Classical supply chains are long-term, coordinated, and quasi-static structures.

Definition 3.9: ***Virtual government*** – an alliance of governmental organizations (e.g. city hall, tax office, cadastre office, and civil infrastructures office) that combine their services through the use of computer networks to provide

integrated services to the citizen through a common front-end.

More recently the principles of collaboration are being applied in other domains leading to new collaboration forms, such as:

Example: Most of the so-called e-government initiatives do not correspond to this concept as they basically provide access to government services through the web but do not integrate services involving various governmental organizations. A real collaborative network in e-government should "hide" from the "customer" (i.e. the citizen) the actual organizational structure of the various governmental entities and provide a unique "front-end" to the citizen.

Definition 3.10:
Collaborative transportation networks – a long-term CN involving a diversity of actors such as road management entities, logistic operators, parking management entities, gas stations, banks, etc. in order to provide integrated transportation services.

Example: The "Via Verde" organization in Portugal is an example of such innovative network (Osorio, Camarinha-Matos, 2006).

The other case of CNOs within the Goal-oriented networks is labeled as ***Grasping-opportunity driven*** CNOs, which are dynamically formed to answer a specific collaboration opportunity and will dissolve once their mission is accomplished. Examples include (Camarinha-Matos, Afsarmanesh, 1999, 2005):

Definition 3.11: ***Virtual enterprise*** (VE) – represents 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.

Example: A temporary consortium of independent companies involved in a major construction (e.g. new bridge) and that use a computer network and ICT tools to support their collaboration and dissolve after the delivery of the construction product.

It shall be noted that the term "virtual enterprise" has been often used in the literature with slightly different meanings. For instance, some authors also include in the definition the long-term strategic alliances.

Definition 3.12: ***Virtual Organization*** (VO) – represents a concept similar to a virtual enterprise, comprising a set of (legally) independent organizations that share resources and skills to achieve its mission / goal, but that is not limited to an alliance of profit enterprises. A virtual enterprise is therefore, a particular case of virtual organization.

Definition 3.12.1: ***Dynamic Virtual Organization*** – typically refers to a VO that is established in a short time to respond to a competitive market opportunity, and has a short life cycle, dissolving when the short-term purpose of the VO is accomplished.

Definition 3.13: ***Extended Enterprise*** (EE) – represents a concept typically applied to an organization in which a dominant enterprise "extends" its boundaries to all or some of its suppliers. An extended enterprise can be seen as a particular case of a virtual enterprise (in case of a temporary and goal-oriented extended enterprise) or of a supply chain (in the case of a long-term structure).

Example: A typical example of extended enterprise can be found in the automotive industry. The car maker, which is mainly responsible for the final assembly, has a dominant role over its network of suppliers. This dominance is reflected in the imposition of tough contractual conditions, namely in terms of quality, delivery times, etc, but also in terms of tools and methods to be used.

Definition 3.14: ***Virtual team*** (VT) – is similar to a VE but formed by humans, not organizations, a virtual team is a temporary group of professionals that work together towards a common goal such as realizing a consultancy job, a joint project, etc, and that use computer networks as their main interaction environment.

Example: A group of free-lancing engineers based in different geographical locations can be organized as a virtual team in order to jointly perform a consultancy project.

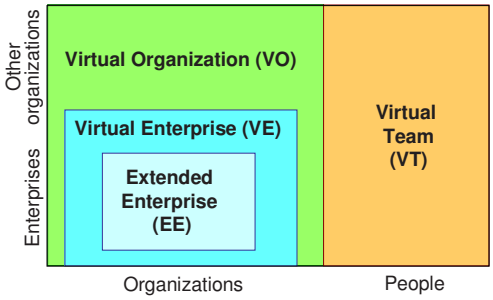

Figure 5 - Grasping-opportunity CNs

The term "virtual" in the above organizations comes from the fact that these networks act or appear to act as a single entity, thanks to their organized communication and coordination mechanisms enabled by computer networks, although they are (usually) not a single legal entity, they may not have a physical headquarter, and are typically geographically distributed.

Examples of ***long-term strategic networks*** include *VO breeding environments* (Camarinha-Matos, Afsarmanesh, 2003, 2005a, 2005b), (Afsarmanesh, Camarinha-Matos, 2005) and *professional virtual communities*.

Definition 3.15: ***VO Breeding environment*** (VBE) – represents an association of organizations and a number of related supporting institutions, adhering to a base long term cooperation agreement, and adoption of common operating principles and infrastructures, with the main goal of increasing their preparedness towards rapid configuration of temporary alliances for collaboration in potential Virtual Organizations. Namely, when a business opportunity is identified by one

member (acting as a broker), a subset of VBE organizations can be selected to form a VE/VO.

Earlier cases of VBEs were mostly focused on a regional basis, e.g. industry clusters, industry districts, and business ecosystem. Besides the production / services focus, a large number of more recent VBEs focus in new areas, e.g. science and virtual laboratories, crises management (Afsarmanesh, Camarinha-Matos, 2007). Some examples include:

Example: A well known example of VBE is Virtuelle Fabrik which is a network of about 70 small and medium enterprises in the metal-mechanics sector, located in Switzerland. A basic ICT infrastructure is used as a communications platform and some level of commonality of business practices and agreed cooperation rules. When a business opportunity if found by any member, acting as a broker, a virtual enterprise is formed with a selected subset of enterprises.
Another interesting example is the Swiss Microtech that involves a sub-network of SMEs in Europe and a complementary sub-network of organizations in China.
Other relevant examples include IECOS (Mexico), ISOIN (Spain), CeBeNetwork (Germany), Supply Network Shannon (Ireland), etc.

Definition 3.16: ***Industry cluster*** – is one of the earliest forms of VO breeding environments, consisting of a group of companies, typically located in the same geographic region and operating in a common business sector, that keep some "binds" with each other in order to increase their general competitiveness in the larger area. These binds may include sharing some buyer-supplier relationships, common technologies and tools, common buyers, distribution channels or common labor pools, all contributing to some form of cooperation or collaboration when business opportunities arise. Earlier forms of clusters did not require a strong ICT infrastructure but more and more collaboration resorts to such support.

Example: The cluster of mould makers in Portugal. Being located in the same geographical region (Marinha Grande), these companies show some similarity in terms of practices, methods of work, used tools, etc. Often they collaborate in joint projects (workload sharing), but they are not yet organized as a full VBE.

Definition 3.17: ***Industrial district*** – is a term mostly used in Italy that represents a concept quite similar to an industry cluster. It can be focused on one single sector or cover a number of sectors in a given region.

Example: The textile district of Lecco, Italy, which brings together companies specialized in the production of furnishing fabrics, especially jacquard and velvets, that aim at keeping high quality standards, propensity for innovation, strong interaction between firms and take advantage of the significant territorial centralization.

Another organizational structure that shares some characteristics with the above examples is the case of **incubators**. An incubator (of new companies) represents a pool of small companies in their early phase, co-located in

the same geographical space, possibly covering different sectors, and that share some basic infrastructures (communications and other generic services) as well as consultancy support in order to evolve towards mature organizations. However, traditional incubators are not yet real VBEs as they usually do not collaborate much in joint business opportunities. Nevertheless it would be reasonable to imagine a next generation of incubators "absorbing" the goals, principles and mechanisms of a VBE.

Definition 3.18: ***Business ecosystems –*** also sometimes called digital ecosystem, is similar to a cluster or industry district, although it is not limited to one sector but rather tends to cover the key sectors within the geographical region. A business ecosystem is inspired by the mechanisms of the biological ecosystems, try to preserve local specificities, tradition, and culture, and frequently benefit from (local) government incentives. In most aspects business ecosystems simply represents a renaming of the industrial district concept. Namely, differences are subtle and can perhaps be found only in a clearer emphasis on the involvement of a diversity of their actors – the *living forces* of a region – in addition to companies, and a more intense use of advanced ICT tools to support collaboration.

Definition 3.19: ***Inter-continental enterprise alliance –*** a special case of VBE involving sub-networks of enterprises in different continents.

Example: The association of the Swiss Microtech network with a Chinese network (DecoChina) is an example of intercontinental VBE.

Definition 3.20: ***Disaster rescue networks*** – a strategic alliance of governmental / non-governmental organizations specialized in rescue operations in case of disasters is another recent form of VBE aimed at facilitating a rapid and well-coordinated response in case of a disaster. This VBE could have a local / regional coverage or a global geographic span.

Definition 3.21: ***Virtual Laboratory (VL) / e-science networks –*** represent the alliance of autonomous research organizations, each having their own resources (equipments, tools, data and information related to their past experiments, etc.), enabling their researchers, located in different geographically-spread centers to be recognized and considered for taking part in potential opportunity based problem-solving collaborations (forming a kind of VO for each problem solving). During a problem-solving collaboration process, it is typical that some expensive lab equipments owned by one or more organizations is made available for (remote) use by the other collaboration partners.

Example: The VL-e project is an example of a large Dutch initiative to develop support models and tools and establish virtual labs for e-science.

VBE is thus the more recent term that was coined to cover these cases and clearly extends their scope to both regional / global coverage, single / multi-specialty sector, and for-profit / non-profit organizations.

A graphical illustration of the coverage of these organizational forms is shown in

Fig. 6 and Fig. 7 (improved from Camarinha-Matos, Afsarmanesh, 2007b).

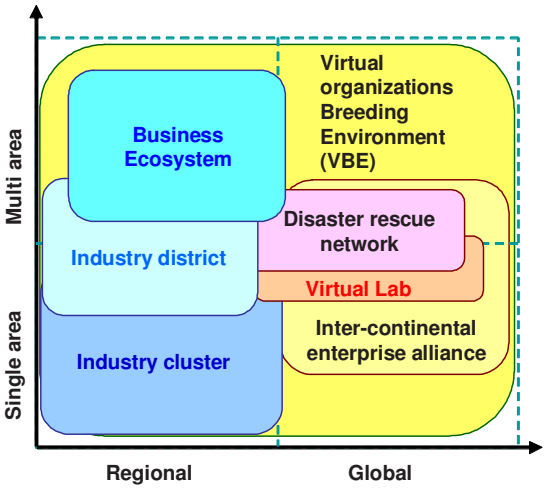

Figure 6 – Examples of long-term strategic alliances

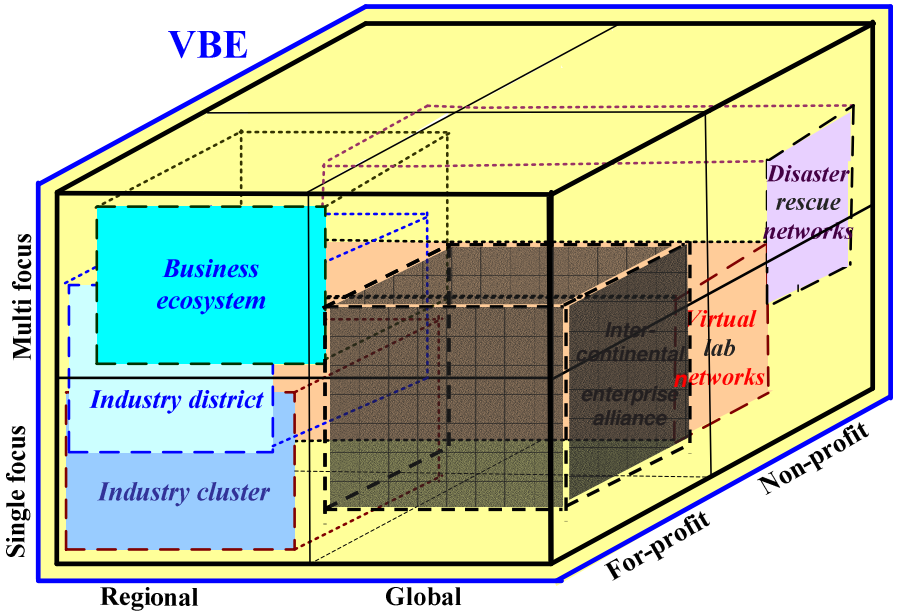

Figure 7 – Long-term strategic alliances – various views

A similar long-term organization is the Professional virtual community, as defined below.

Definition 3.22: ***Professional virtual community -*** an alliance of professional individuals, and provide an environment to facilitate the agile and fluid formation of Virtual Teams (VTs), similar to what VBE aims to provide for the VOs.

When a business opportunity happens (e.g. a design project or consultation activity), similarly to the VO creation, a temporary coalition of experts – a Virtual Team (VT) – can be rapidly formed according to the specific needs of that business opportunity.

Example: Associations of free-lancer knowledge workers (e.g. engineers, consultants).
One such case is the PROJEKTWERK, founded in 1999, that includes about 4500 freelancers and small enterprises. This organization offers functionalities to: Publish profiles, Submit bid invitations, Search for cooperation, and Partners search.

Simultaneously at the shop-floor level a convergent phenomenon is observed. More and more manufacturing systems are composed of autonomous (progressively more intelligent) components / resources, interconnected by computer networks (a truly ubiquitous computing and sensing environment) forming "coalitions" that need to be easily re-configured as driven by the needs of flexibility and agility. The traditional paradigm of control systems is giving pace to other mechanisms (e.g. coordination, negotiation, fuzzy reasoning, contracting) that are characteristic of collaborative networks, as seen in the most innovative recent proposals for advanced **evolvable manufacturing systems** architectures (Onori et al, 2006), (Frei et al, 2007).

Example: The COBASA architecture applies the collaborative networks paradigm to re-configurability of manufacturing shop-floors (Barata, Camarinha-Matos, 2003).

Several other forms of collaborative networks are emerging as a result of both the progress on the information and communication technologies and the progress on the understanding and definition of collaboration mechanisms and supporting frameworks. New manifestations of CN might require revision of the taxonomy. For instance, the term **disperse manufacturing network** is being used to represent networks of manufacturing entities that can be seen as partly supply chain and partly VBE, depending on the particular instantiation.

Therefore, the paradigm of **Collaborative Networks** and the corresponding new discipline (Camarinha-Matos, Afsarmanesh, 2005) provides a uniform paradigm to address such complex and highly dynamic systems.

4. CONCLUSIONS

With the fast developments in collaborative networks, it is becoming very relevant to make an effort to systematize and structure the existing knowledge, first in order to facilitate mutual understanding among the members of this community; second as

a step towards the elaboration of a sound theoretical foundation to boost the developments of collaborative networks and better support their management and operation. Such effort includes both a clarification of the base concepts and the elaboration of a taxonomy of collaborative forms. A number of European projects such as THINKcreative, VOSTER, ECOLEAD and others have been contributing towards this aim. The definitions and taxonomy presented in this article are a partial result of these efforts. Nevertheless, they should be considered as "working definitions" since new developments and further progress in the theoretical foundation will certainly lead to more refined propositions.

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