



**ECOLEAD**

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Organizations LEADership initiative

## D52.3

# A reference model for Collaborative Networks

*Edited by*  
UNINOVA and UvA

## ECOLEAD WP5 Theoretical Foundation

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## GLOSSARY

CN – Collaborative Network

CNO – Collaborative Networked Organization

VBE – Virtual Organization Breeding Environment

PVC – Professional Virtual Community

VO – Virtual Organization

VE – Virtual Enterprise

VT – Virtual Team

VOM – Virtual Organization Management

# 1. INTRODUCTION AND TARGET CHARACTERIZATION

A reference model is a generic abstract representation for understanding the concepts, entities, actions, and the significant relationships among those elements of some area, and for the derivation of other specific models for particular cases in that area. Preferably a reference model is based on a small number of unifying concepts and may be used for education, explaining, and systems' development.

A reference model for Collaborative Networked Organizations (CNOs) is thus a generic conceptual model that synthesizes and formalizes the base concepts, principles and recommended practices for collaborative networked organizations. It is intended as an authoritative basis (guide) to streamline or facilitate the creation of focused models for the various manifestations of CNOs as well as architectures and implementation models for particular systems development.

On the other hand it is important to have in mind that a reference model is generic and not directly applicable to concrete cases but rather provides the basis for the development (derivation) of other models closer to those cases.

Sub-project 5.2 intends to develop a reference model for CNOs called ARCON (A Reference model for COllaborative Networks), as part of the Theoretical Foundation work package. For this purpose, a number of steps were planned, as illustrated in Fig. 1.1.

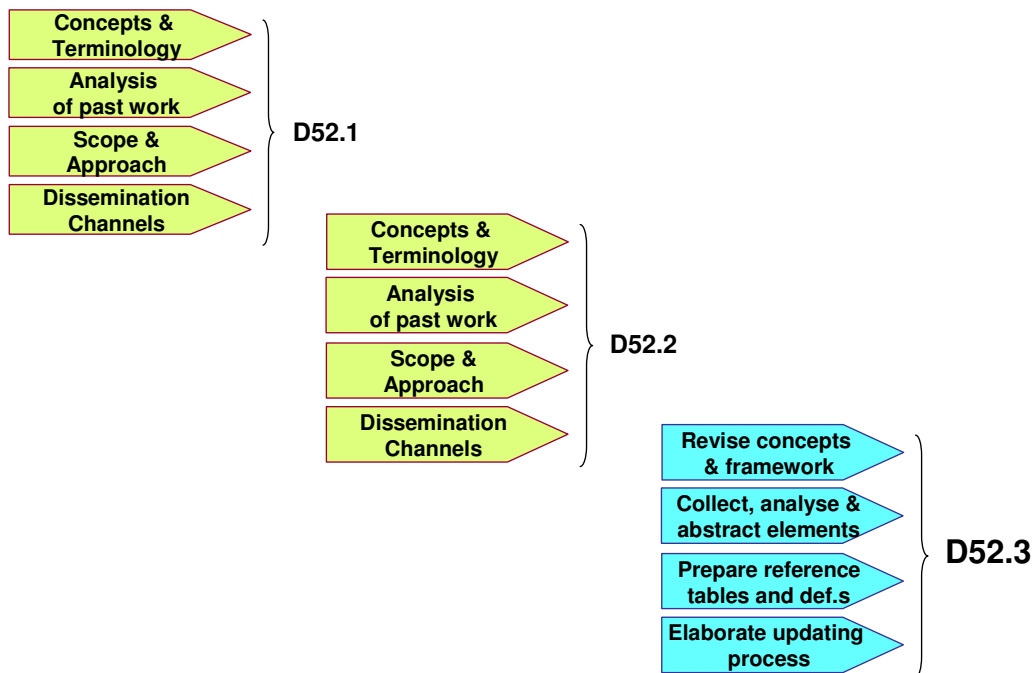


Figure 1.1 – Main phases and results of WP5.2

This report – **D52.3** – is the third report of this sub-project and represents the proposal for a first reference model for Collaborative Networks. A revised version, also taking into account the results of the next activities in WP5, will appear in the planned book containing all developed contributions to the theoretical foundation for CNOs.

In this report, sections 2, 3, and 4 are improved versions of the previous material included in D52.2, taking into account the feedback received from various external experts, namely through interactions in conferences and workshops.

Section 5 includes the main set of elements for the reference model. As inputs for this section, in addition to the previous knowledge and experience of the involved partners, an extensive amount of information was collected from the CNO cases studied in the other WPs of ECOLEAD. This material was complemented with contributions from external experts, with particular relevance to the contributions collected during a focused workshop organized in Valencia, Spain, on 14-15 March 2007.

Section 6 introduces a process for future updating and evolution of the reference model.

### 1.1 Scope and structure

The vision for the ARCON reference model for collaborative networked organizations is to develop a generic abstract representation – intended as an authoritative basis - for understanding the involved entities and significant relationships among these entities. It is also intended as a basis for the derivation of (or specialization into) other specific models for particular cases and various manifestations of CNOs. Considering this complex task, preferably a reference model is based on a small number of **unifying concepts** located at the most generic point of the modeling CNO abstraction hierarchy.

The CNO reference model and its derivations/specializations may be used for education, research, and designing architectures for CNO system development.

### 1.2 Desired characteristics

In an ideal case, the main purposes considered for ARCON reference model for CNOs include:

- **Simplicity** (*to increase its usability by the stakeholders*) – easy to understand, clear, not technical, and logical.
- **Comprehensiveness in capturing the unifying concepts** (*towards holistic description of CNOs*) – as much as possible addressing the CNO in its entirety; so that any element can be mapped against it to understand where they fit within the context of the CNO as a whole.
- **Neutrality** (*applying a base uniform presentation notation*) – at its base it is defined totally independent of the *tools or methodologies* that can further *model* or *implement* different CNO aspects, and therefore any tool or any methodology can be mapped against it to understand/evaluate their implicit trade-offs (what they can or cannot do).

### 1.3 Limitations

In spite of these desired characteristics, it is necessary to consider some limitations:

- Provision of a formal presentation (**formal/theoretical definition**) of the ARCON components, although could be useful for automatic verification of its consistency and correctness, is not a part of the work in ECOLEAD due to the following points:
  - 1) not suitable for supporting the majority of ARCON's stakeholders,
  - 2) not yet appropriate at this stage of CNO reference model definitions, when many of the ARCON's concepts are not yet fully introduced and are being semi-formally defined by ECOLEAD for the first time, so no previous research has addressed their structured modeling before, and
  - 3) the theoretical definition of ARCON's components requires much further elaboration within future research projects.

Therefore, the formal definition of the ARCON elements is considered outside the scope of this work, although where necessary a partial formalization is achieved.

- Choice of a base language (**uniform notation**) to represent detailed subjects of the ARCON, while necessary to improve both its coherent definition and its understandability by the stakeholders, nevertheless creates notation-dependency. On one hand it introduces some limitations that are inherent in every notation, e.g. for

UML, it is the limited number of features of the notation that can be used, and on the other hand it implies/requires complete fluency in the chosen notation by the stakeholders in order for the reference model to become accepted and used. Therefore, considering mainly the need to communicate among the majority of its stakeholders, for the *general representation* of ARCON we have chosen the *textual form in the English language* for representation of the detailed definitions of all its elements.

#### **1.4 Stakeholders**

In the development of ARCON, as mentioned in D52.1, the following main stakeholders are considered:

- *Researchers* – The main target group for ARCON are CNO researchers that may use the reference model as a consolidated basis for further developments.
- *Engineers and other practitioners* – Professionals with a reasonable background and experience on CNOs can also use the reference model as a basis for their practical developments as it is supposed to clarify the main concepts and their inter-relationships. However, ARCON cannot be seen as a text book for people not familiar with the area of CNOs.
- *Decision makers* – The most general components of ARCON, i.e. high level definitions of main concepts, are also useful to provide background knowledge about the area to industrial decision makers and other development policy makers.
- *Educators* – Similarly to researchers, educators can use ARCON models as a basis for introduction of concepts and preparation of focused training material.

## 2. COLLABORATION CONCEPT

"I believe I found the missing link between animal and civilized man. It is *us*"  
Konrad Lorenz

This section addresses the base concepts of 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, 2006a). 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:

**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.

**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 components of collaboration.

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.

**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.

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.

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. 2.1, each of the above concepts constitutes a “building block” for the next definition. Coordination extends networking; cooperation extends coordination; and collaboration extends cooperation.

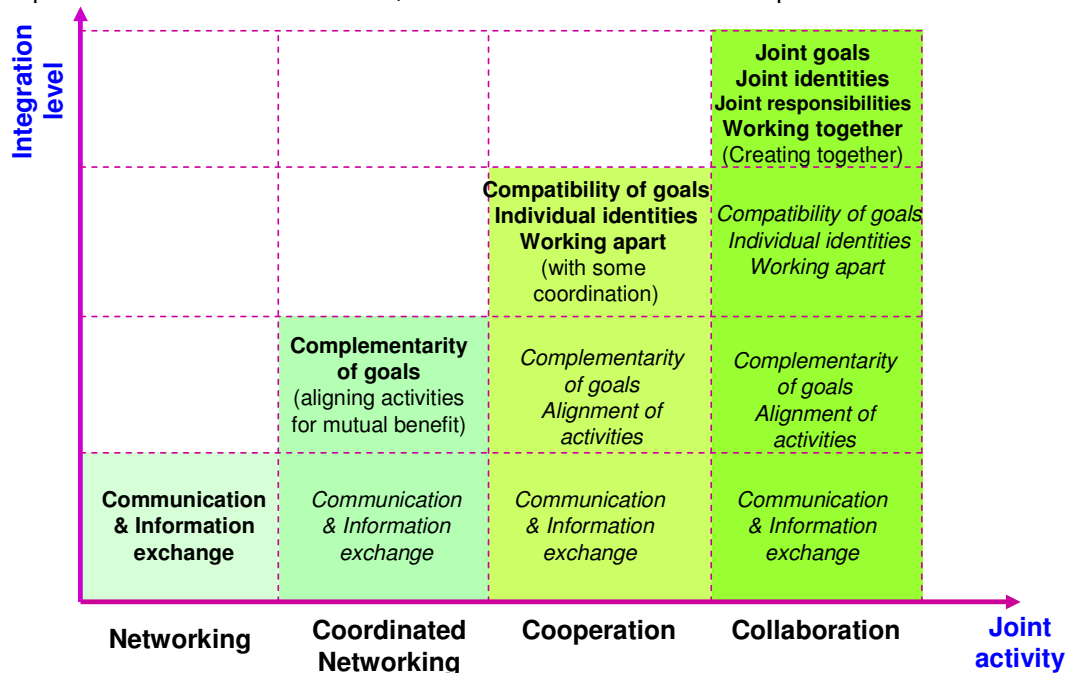


Figure 2.1 – Examples of joint endeavor

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.

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 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.

- 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 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).
- 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 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 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, 1999, 2005, 2006a) as well as providing a minimal definition, though informal of the terms used. Below we provide a set of definitions (referred to as *Definitions 1 to 14*), 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 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.

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, these can be called manifestations of **collaborative networked organizations (CNOs)** (Fig. 3.1). Other more spontaneous forms of collaboration in networks can also be foreseen. For instance, 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.

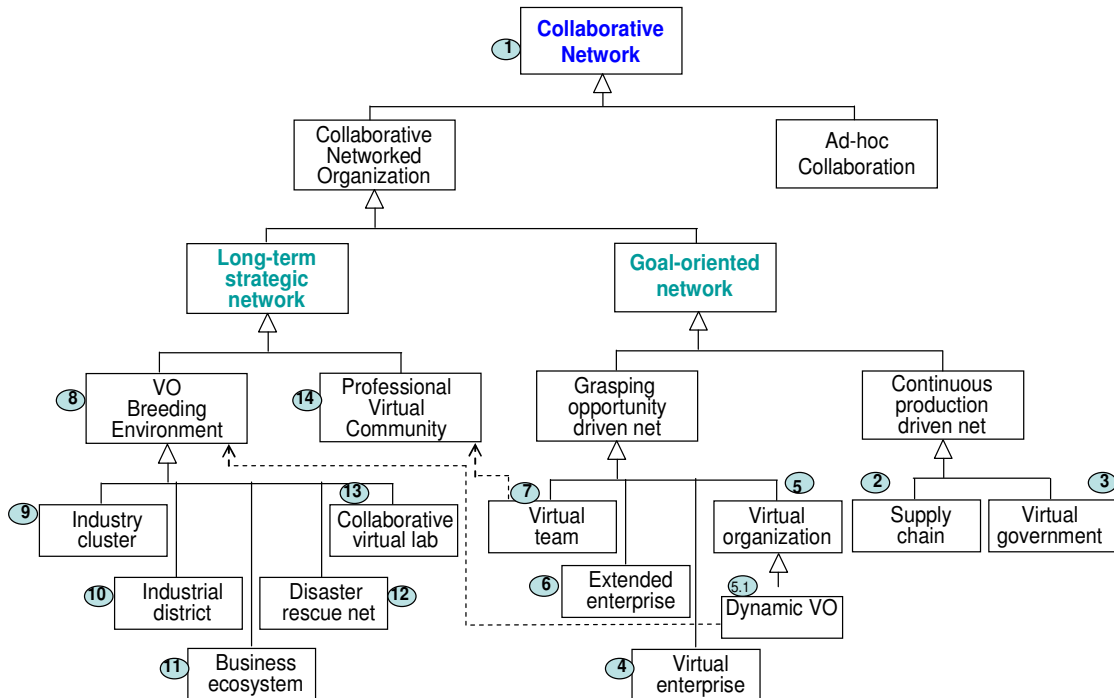


Fig. 3.1. Examples of Collaborative Networks

Among the CNOs, some networks are goal-oriented in which intense **collaboration** (towards a common goal) is practiced among their **partners**, as opposed to longer term strategic alliances described below, where in fact not collaboration but **cooperation** is practiced among their **members**.

**Goal-oriented networks** can themselves be either driven by continuous production / service provision activities, or driven by the aim of grasping a single (collaboration) opportunity, as described below. In Goal-oriented networks, the first case of CNOs labeled as **Continuous-production driven** in Fig. 3.2, 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 2: **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.

*Definition 3: **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.

The second case of CNOs within the Goal-oriented networks are labeled as **Grasping-opportunity driven** CNOs in Fig. 3.2, and are dynamically formed to answer a specific collaboration opportunity and will dissolve once their mission is accomplished. Examples in Fig. 3.2 and Fig. 3.3 include (Camarinha-Matos, Afsarmanesh, 1999, 2005):

*Definition 4: **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.

*Definition 5: **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 for profit enterprises. A virtual enterprise is therefore, a particular case of virtual organization.

*Definition 5.1: **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 6: **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.

*Definition 7: **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.

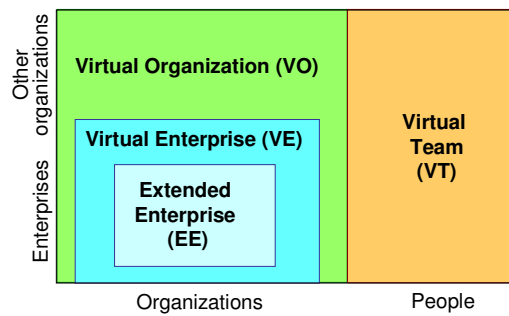


Fig. 3.2. Single-opportunity CN

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.

Besides the Goal-oriented networks, another class of CNOs is the **long-term strategic networks** (see Fig. 3.3) are alliances aimed at offering the conditions and environment to support rapid and fluid configuration of collaboration networks, when opportunities arise. *VO breeding environments* (Camarinha-Matos, Afsarmanesh, 2003, 2005a, 2005b) and *professional virtual communities* exemplify these kinds of networks.

**Definition 8: VO Breeding environment (VBE)** – represents an association of organizations and their 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. Some examples include:

**Definition 9: 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.

**Definition 10: 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.

**Definition 11: Business ecosystems** – is inspired by the mechanisms of the biological ecosystems, these networks try to preserve local specificities, tradition, and culture, and they frequently benefit from (local) government incentives. A business ecosystem, 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. 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 12: 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 13: Virtual Laboratory (VL) 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.

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. Complementary views and coverage of these organizational forms are shown in Fig. 3.4.

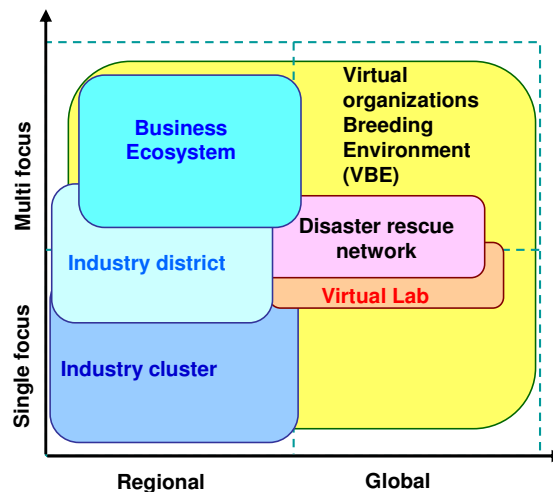


Figure 3.3 – Examples of strategic alliances

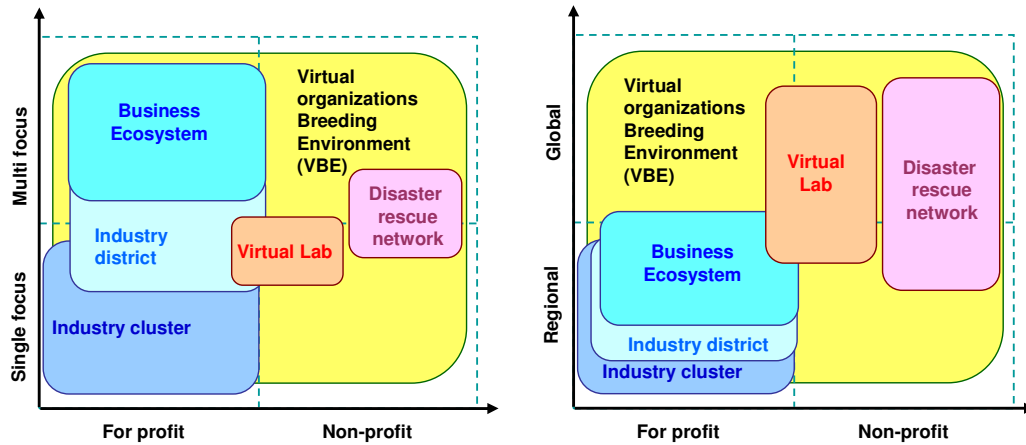


Figure 3.4 – Other views of the strategic alliances

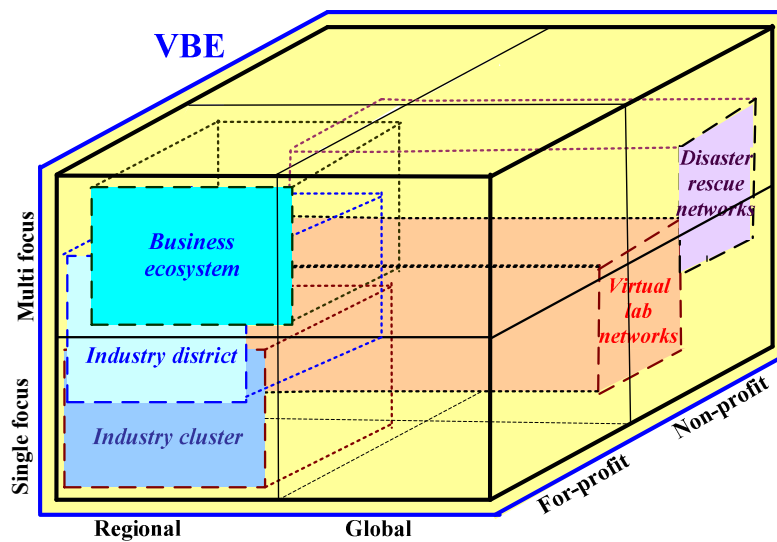


Figure 3.5 – Long-term strategic alliances – putting the views in perspective

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

**Definition 14: Professional virtual community** is 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.

One example could be an association of free-lancer knowledge workers (e.g. engineers, consultants). 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.

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 manufacturing systems architectures (Barata, Camarinha-Matos, 2003), (Eberst, Nof, 1993).

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

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Contributed by: Uninova, UvA

## 4. ARCON REFERENCE MODELING FRAMEWORK

Modeling complex systems requires a proper framework to capture their complexity. The Collaborative Networked Organizations (CNOs) inherit their complexity from both aspects related to **collaborations** and aspects related to **networks**, and thus no exception to this rule. Inspired by the modeling frameworks introduced in the literature related to these two areas, and considering the complexity of CNOs and their wide variety of aspects and constituting elements, the ARCON modeling framework is developed to divide this complexity into a number of perspectives, in order to comprehensively and systematically cover all relevant aspects of the CNOs.

### 4.1 The 3 modeling perspectives of CNOs

For the purpose of modeling the CNO components, at the highest level three perspectives are identified and defined in the ARCON framework.

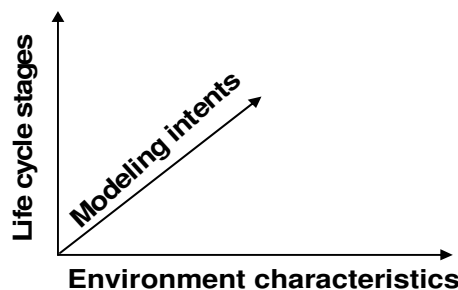


Figure 4.1 – Modeling perspectives in ARCON

First we identify and define a perspective addressing the timing cycle for different CNO stages, to capture the diversity and evolution of CNOs during their entire life cycle (CNO-Life-Cycle – vertical perspective). Then a second identified and defined perspective focuses on capturing the CNO environment characteristics (as a horizontal perspective). This perspective includes two subspaces (points of view) to comprehensively cover, the internal (In-CNO) characteristics as well as the external (About-CNO) characteristics that are related to the logical surrounding of the CNOs. The third perspective identified and defined for ARCON reference modeling (diagonal perspective) is related to different intents for the modeling of CNOs, from the general representation to their specific models (using a specific modeling approach or theory), to the detailed specification of implementation architectures for each CNO element. These three perspectives are further described below.

The main usages considered for ARCON, when planning these three perspectives include:

- Providing a model that can be instantiated to capture the definition of all potential CNOs.
- Supporting the reusability and portability of its defined concepts.
- Facilitating the co-working and co-development among the stakeholders.
- Providing the high level base for design and building of the architectural specifications of modular CNO components.
- Providing insight into the modeling tools/theories that are appropriate for mapping different CNO components (in further research).

#### 4.1.1 Life-Cycle perspective

In a typical (long-term) organization, usually its operation stage constitutes its entire livelihood. In other words most successful organizations spend only a negligible fraction of their life time in their setting up and dissolution. Therefore, earlier research on reference modeling for enterprises did not need to elaborate much on the life cycle perspective. But unlike typical organizations, for a wide variety of classes of CNOs (e.g. the state of the art in emerging manufacturing industry VBEs) their creation stage (as well as their dissolution or metamorphosis) is complex and takes up considerable effort. This is certainly not a negligible fraction of time, and due to the involved complexity, it requires receiving proper attention during the build up of the reference model. Our earlier study of the life cycle stages for CNOs has revealed 4 main stages for the CNO life cycle, which match the typical pattern of the self-organizing systems in chaordic systems thinking. Therefore, the presence of the life cycle as a perspective and life cycle stages as rows in the ARCON's reference tables is justified. In ARCON, this perspective guarantees that the reference model covers all stages of the CNO's life span.

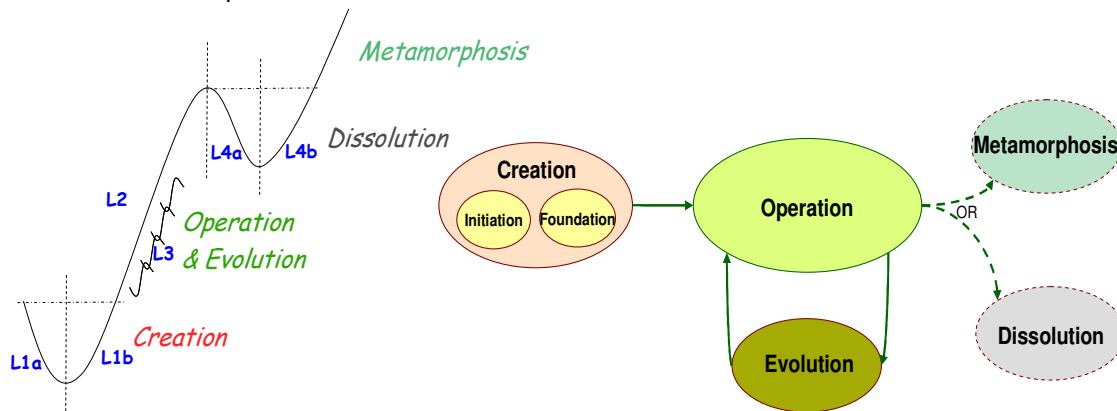


Figure 4.2 – CNO life cycle stages

As illustrated in Fig. 4.2, the **CNO-Life-Cycle** perspective consists of 4 main stages:

- **L1. Creation** – The creation stage can be divided into two phases, namely (i) initiation and recruiting, dealing with the strategic planning and initial incubation of the CNO; (ii) foundation, dealing with the constitution and start up.
- **L2. Operation** – Certainly the most important phase, when the CNO actually operates towards achieving its goals.
- **L3. Evolution** – During the operation of a CNO it might be necessary to make some changes to its membership, structural relationships, and roles of its members. Therefore, the CNO can go through an adjustment or evolution process in parallel with the operation stage.
- **L4. Dissolution or metamorphosis** – A short-term CNO such as a VO will typically dissolves after accomplishing its goal. In the case of a long-term alliance, considering its valuable bag of assets gradually collected during its operation, its dissolution is a very unusual situation. Instead, it is much more probable that this CNO goes through another stage, that we call the *metamorphosis* stage, where it can evolve by changing its form and purpose. Therefore, metamorphosis may be considered as a **huge evolution leap** within the CNO.

These stages of the life cycle are already defined in details in several previous ECOLEAD deliverables, e.g. D21.1 – Report characterizing the key components and features and key operating principles of the VBE.

#### 4.1.2 Environment characteristics perspective

When modeling a CNO, it is important to consider both its internal and external aspects (Fig. 4.3). Namely, how to see and model the network from inside (as in the traditional systems modelling) addressing its *Endogenous elements*, and from outside (i.e. the interactions between the CNO and its surrounding environment) addressing its *Exogenous Interactions* (Camarinha-Matos, Afsarmanesh, 2006a, b). These two subspaces of the CNO's environment characteristics are further addressed below.

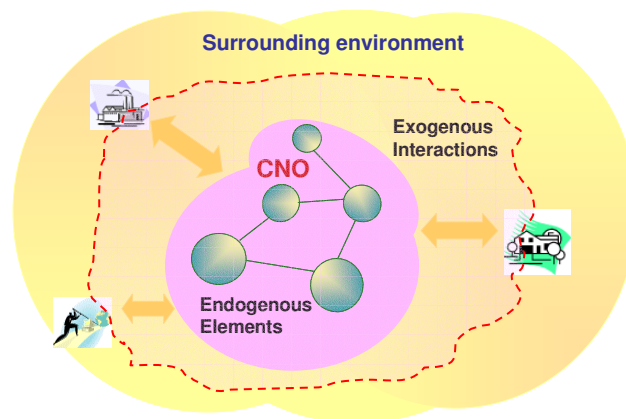


Figure 4.3 – Two modeling perspectives

**Endogenous Elements (Endo-E) subspace.** This perspective aims at providing an abstract representation of the CNO *from inside*, namely the identification of a set of characteristic properties that can together capture the elements constituting CNOs. As discussed earlier, abstraction and classification of CNO's Endo-E is challenging due to the large number of distinct and varied entities, concepts, functionality, rules and regulations, etc. inside the CNOs. In addition to a variety of tangible elements and resources inside the CNO, there are also networks of organizations in which every node plays a specific role and has heterogeneous relationships with other nodes. Furthermore, there are certain rules of behavior that either constitute the norms, or shall be obeyed by the CNO participants, and needless to say that in every CNO there are a set of activities and functionalities that also need to be abstracted. To better characterize these aspect, **four dimensions** are proposed and defined to cover the Endo-E subspace, as follows:

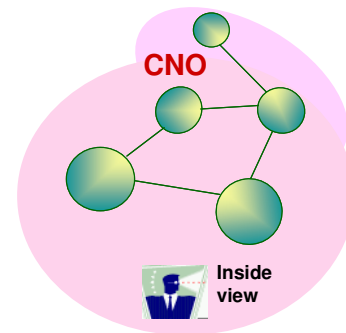


Figure 4.4 – Inside view

- **E1 - Structural dimension.**

This dimension addresses the structure or composition of the CNO's constituting elements (namely its participants and their relationships) as well as the roles performed by those elements and other compositional characteristics of the network nodes such as the location, time, etc. This perspective is used in many disciplines (e.g. systems engineering, software engineering, economy, politics, cognitive sciences, manufacturing), although with different "wording" and diversified tools.

- **E2 - Componential dimension.**

This dimension focuses on the individual tangible/intangible elements in the CNO's network, e.g. the resource composition such as human elements, software and hardware resources, information and knowledge. Not all these elements are "physical" in a strict sense; in fact some are conceptual, e.g. knowledge, but rather together they represent the "things" out of which the network is built. Furthermore, the componential dimension also consists of ontology and the description of the information/knowledge repositories that pertain to the CNO.

- **E3 - Functional dimension.**

This dimension addresses the "base functions / operations" available at the network, and time-sequenced flows of executable operations (processes and procedures) related to the different phases of the CNO life cycle.

- **E4 - Behavioral dimension.**

This dimension addresses the principles, policies, and governance rules that drive or constrain the behavior of the CNO and its members over time. Included here are elements such as principles of collaboration and rules of conduct, principles of trust, contracts, conflict resolution policies, etc.

These specific dimensions are chosen for the reason of their "near-orthogonality" in the sense that they are primarily disjoint in dividing this sub-space, and that if elements in different dimensions are bound to each other, then changes in one dimension can only weakly affect the elements of the other dimensions, across some region of relevance. For example in a CNO, shrinking the "number of workers" in one organization below certain level (a componential element of modeling an organization) may affect the "role" of this organization in the network (a structural element of modeling that organization).

As such, with these four dimensions every CNO can be comprehensively defined (modeled) in relation to its Endo-E, by the collection of its four models, as well as a set of (weak) bindings defined across the constituents of those models. Every such model represents specific (and orthogonal) aspects/perspective/dimension of a CNO.

Two examples for bindings follow: 1- Dependencies and bounds between the componential components (e.g. the personnel) and the structural model counterpart (e.g. the role and skill of the personnel) within a CNO. 2- Connection between an organization's structural component (e.g. rights/duties of the organization in a VO) and the behavioral model counterpart (e.g. the organization's contract components in the VO).

Fig. 4.5 crosses the life-cycle perspective and Endogenous Elements, and exemplifies the elements of each dimension.

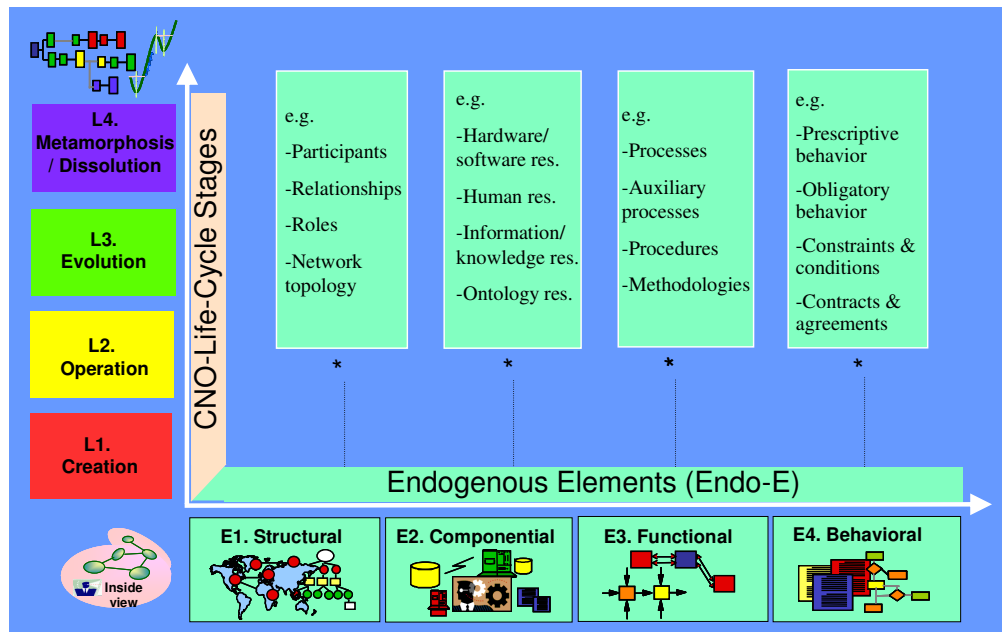


Figure 4.5 – Crossing CNO life cycle and the Endogenous Elements perspective

**Exogenous Interactions (Exo-I) subspace.** This perspective aims at reaching an abstract representation of the CNO as seen from the outside, i.e. which characteristic properties the CNO reveals in its interaction with its “logical” surrounding environment. The purpose here is not to model the surrounding environment but focus on the interactions between the CNO and this environment. A CNO as a whole might interact with, influence, and be influenced by a number of “interlocutors”, e.g. customers, competitors, external institutions, potential new partners. The interactions between the CNO and these external entities are quite different, the same as the way each of these entity groups looks at the CNO.

In order to better characterize these interactions, the following additional modeling dimensions – I1-Market, I2-Support, I3-Society, I4-Constituency - are proposed for the external or Exogenous Interactions perspective:

• **I1 - Market dimension.**

This dimension covers the issues related to both the interactions with “customers” (or potential beneficiaries) and “competitors”. The customers’ facet involves elements such as the transactions and established commitments (contracts), marketing and branding, etc. On the competitors’ side issues such as market positioning, market strategy, policies, etc. can be considered. The purpose / mission of the CNO, its value proposition, joint identity, etc. are also part of this dimension.

• **I2 - Support dimension.**

Under this dimension the issues related to support services provided by third party institutions (outside the CNO) are to be considered. Examples include certification services, auditing, insurance services, training, accounting, external coaching, etc.

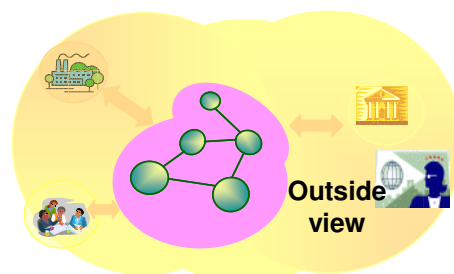


Figure 4.6 – Outside view

### • I3 - Societal dimension.

This dimension captures the issues related to interactions between the CNO and the society in general. Although this perspective can have a very broad scope, the idea is to model the impacts that CNO has or potentially can have on the society (e.g. impact on employment, economic sustainability of a given region, potential for attraction of new investments) as well as the constraints and facilitating elements (e.g. legal issues, public body decisions, education level) the society provides to the CNO development.

### • I4 - Constituency dimension.

This perspective focuses on the interaction with the universe of potential new members of the CNO, i.e. the interactions with those organizations that are not part of the CNO but that the CNO might be interested in attracting. Therefore, general issues like sustainability of the network, attraction factors, what builds / provides a sense of community, or specific aspects such as rules of adhesion and specific “marketing” policies for members, are considered here.

Fig. 4.7 crosses the life-cycle perspective with the Exogenous Interactions.

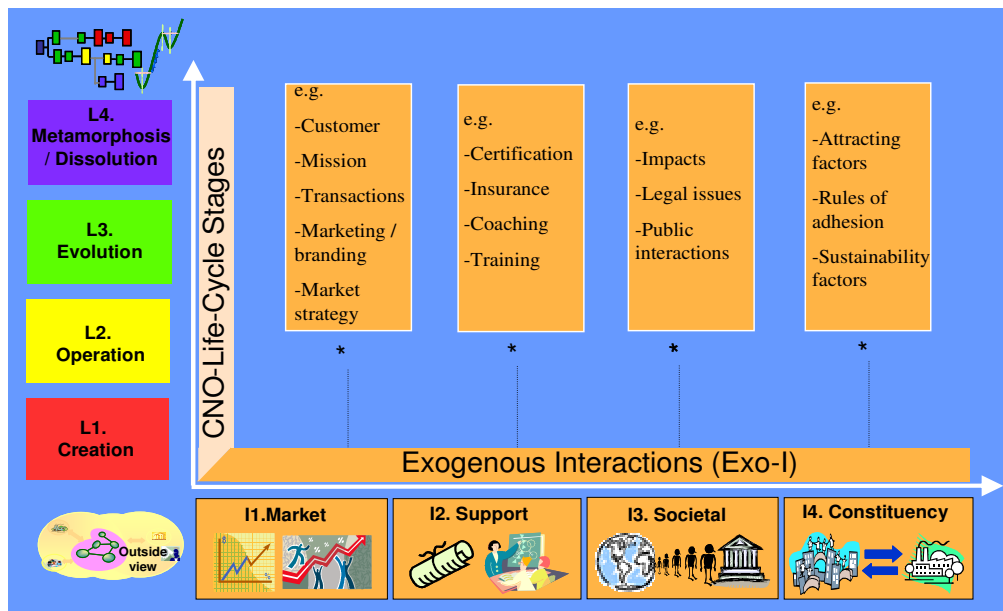


Figure 4.7 – Crossing CNO life cycle and Exogenous Interactions perspective

#### 4.1.3 Model intents perspective

In addition to these perspectives, a CNO reference model can be defined at multiple levels of abstraction. Following the research practices in modeling, the following three layers are considered in ARCON:

- **General Representation layer** – that includes the most general concepts and related relationships, common to all CNOs independently of the application domain (e.g. all kinds of VBEs independent of the area).
- **Specific Modeling layer** – an intermediate level that includes more detailed models focused on different classes of CNOs (the CNO typology).
- **Implementation Modeling layer** – that represents models of concrete CNOs.

Each of these modeling layers crosses with all of the elements in the other two perspectives.

We will further address the role of modeling intents in Section 4.2.

Fig. 4.8 crosses the environment characteristics with the model intents.

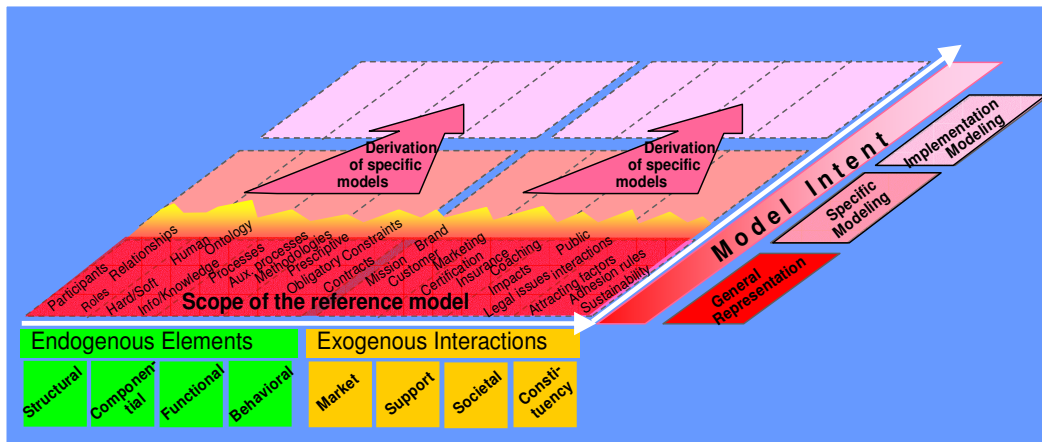


Figure 4.8 – Modeling intents and scope for reference model

## 4.2 The 3D ARCON reference modeling framework for CNOs

A comprehensive framework is thus developed for the reference modeling of the CNOs that captures all of its complexity through the definition of all specific elements needed related to cross section of its three perspectives, as explained below.

Fig. 4.9 crosses the three perspectives addressed above in one 3D diagram.

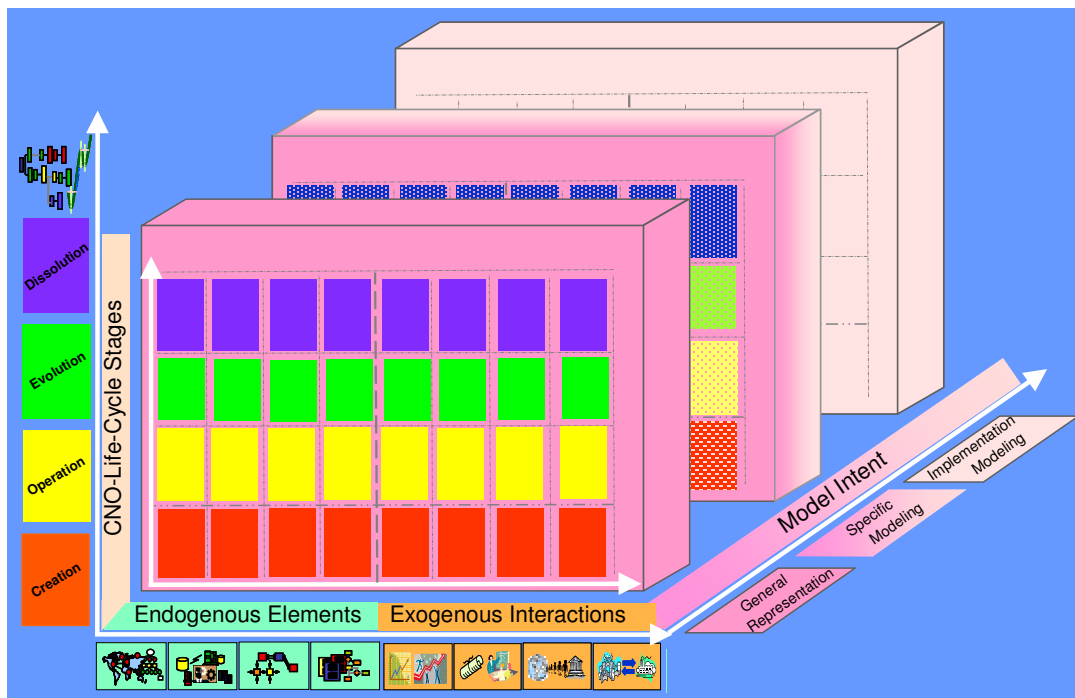


Figure 4.9 – ARCON Reference modeling framework

In this matrix, for the two subspaces of the *Endogenous Elements* and *Exogenous Interactions* within the CNO **Environment characterization perspective**, their respective dimensions (E1 to E4 and I1 to I4, addressed in Section 4.1.2) are depicted as different columns. Similarly, for the CNO **Life-Cycle stages perspective**, each stage of the life cycle (L1 to L4, addressed in Section 4.1.1) is depicted as one row. The **Model Intent perspective** constitutes the third axis of the matrix, with its three respective elements addressed in 4.1.3. Each cell in the ARCON reference table therefore, represents the intersection of a particular life cycle stage with one dimension (either within the *Endogenous Elements* or *Exogenous Interactions*), and for one specific model intent.

What will be recorded in each cell determines the “subjects” (kinds of element) that needs to be addressed and modeled in relation to these three axes. Without the proper perspectives representing each cell, the information recorded in them cannot be properly interpreted. In other words, by elimination of any of the three perspectives introduced for ARCON (from your mind), trying to describe a CNO may lack some of its aspects. Namely, this framework suggests that a CNO can be properly and comprehensively described with these three perspectives.

Each of the environment characterization subspaces (i.e. *Endogenous Elements* and *Exogenous Interactions*) defines a point of view or a level of abstraction for the information contained in its related cells. For example, if we consider all of the cells in the single *Endogenous Elements* sub-space, we will have the abstraction of all the *subjects* that need to be defined and considered from the *Endogenous Elements*’ perspective.

At the same time, the subjects in all the cells within a single row, such as the life cycle stage of “evolution” will provide a complete description of the CNO from that perspective. Similarly, each column in each of the two sub-spaces (e.g. the behavioral dimension of the *Endogenous Elements*’ sub-space) captures the CNO subject for that particular dimension through the entire life cycle stages of the CNO. For any kind of CNO, e.g. **VBE**, **VO**, **PVC**, etc., and with the model intent of **General Representation (GR)**, through the definition/representation of each *individual subject* in this layer of its ARCON reference table, its comprehensive definition, thus its **reference model**, can be achieved. Furthermore, for each individual subject defined in every cell of the GR layer of a CNO’s ARCON matrix, a number of specific models can be formalized and represented at its **Specific Modeling (SM)** layer. And in the same way, if desired, an architectural component can be defined for a *specific model* (defined within a cell in the SM layer of the ARCON matrix) that will be represented in its corresponding cell within the **Implementation Modeling (IM)** layer of the CNO’s ARCON matrix.

Fig. 4.10 depicts the inter-relationships among the three layers of modeling intent, in relation to different models that represent the same subjects.

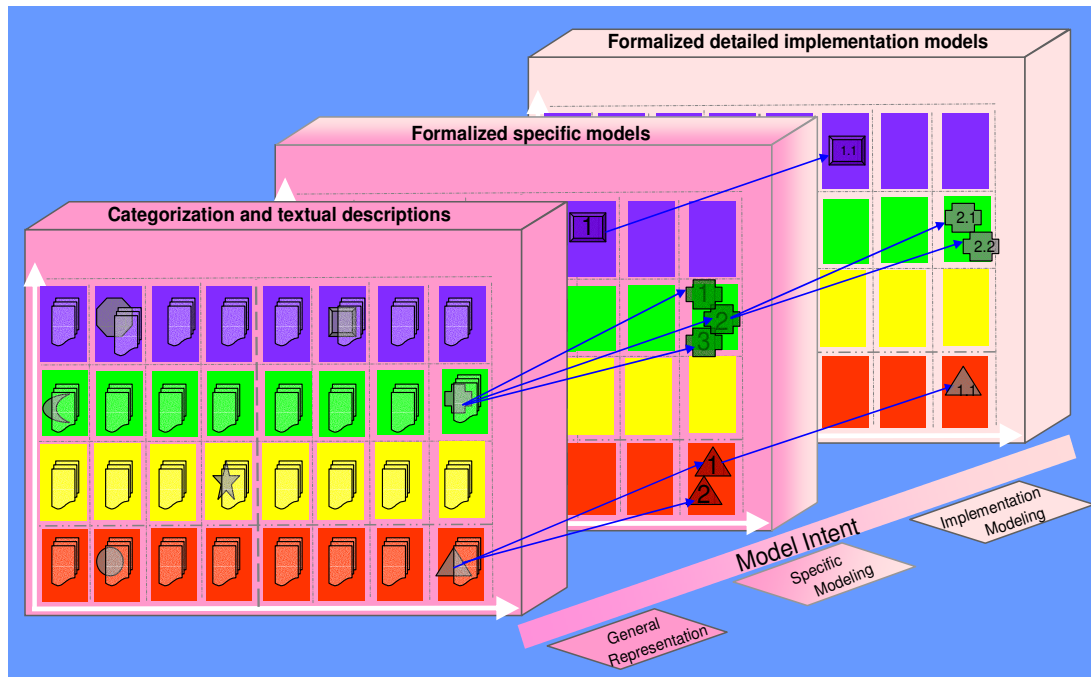


Figure 4.10 – Three Model intent layers and their inter-relationships

Given the base definition of reference models presented earlier, the scope of a CNO's reference model covers mainly the “General Representation” layer and it might represent some elements from the “Specific Modeling” layer. In other words, at the current stage of development of the CNO area, the first priority for a reference model for CNOs is to consolidate its most general aspects that are common to all types of CNOs. With further progress in this area of research, CNOs are better defined gradually. Therefore, it is important to also support the “maintenance of the reference model for CNOs”, such that in time it can progressively and incrementally consolidate more and more specific models, as each major class of CNOs will become well developed. Section 6 of this report addresses this issue further.

In terms of representation, and considering the arguments presented in this and other previous deliverables of WP5, for the definition of the **CNO reference model**, the most **neutral** means of **textual representation** is chosen for ARCON, at its General Representation layer, and thus elements of CNO reference model are textually defined in Section 5.

For the other two levels of the ARCON modeling intent, depending on the specific subject/feature (e.g. within each of the cells) that need to be represented, and depending on its nature and complexity, other suitable modeling tools/ systems/theories shall be chosen for its representation. For example, for the Specific Modeling level, the set theory, graph theory, Petri nets, deontic logic, complexity theories, multi-agent systems, federated systems, etc., can be suitable for the subject/feature, and similarly for the Implementation Modeling level, the UML, Flowcharts, workflows, etc. can be considered.

## 5. A FIRST REFERENCE MODEL

### 5.1 Approach to identify the general CNO modeling concepts

Previous chapter introduced the ARCON modeling framework. It is now necessary to identify and model the elements that should go into each “cell” of this framework for CNOs.

At this stage we would apply a “bottom-up” approach (Fig. 5.1): We first apply (and validate) the framework to various CNO cases, namely the VBE, VO, PVC, VT, and VLC, those studied in the various WPs of ECOLEAD. In this way the knowledge developed in the various technical WPs is re-used, organized and integrated. Furthermore, by extraction of the “common” elements and concepts out of these individually developed models, we will gradually build the elements of the higher level, i.e. the reference model for CNOs.

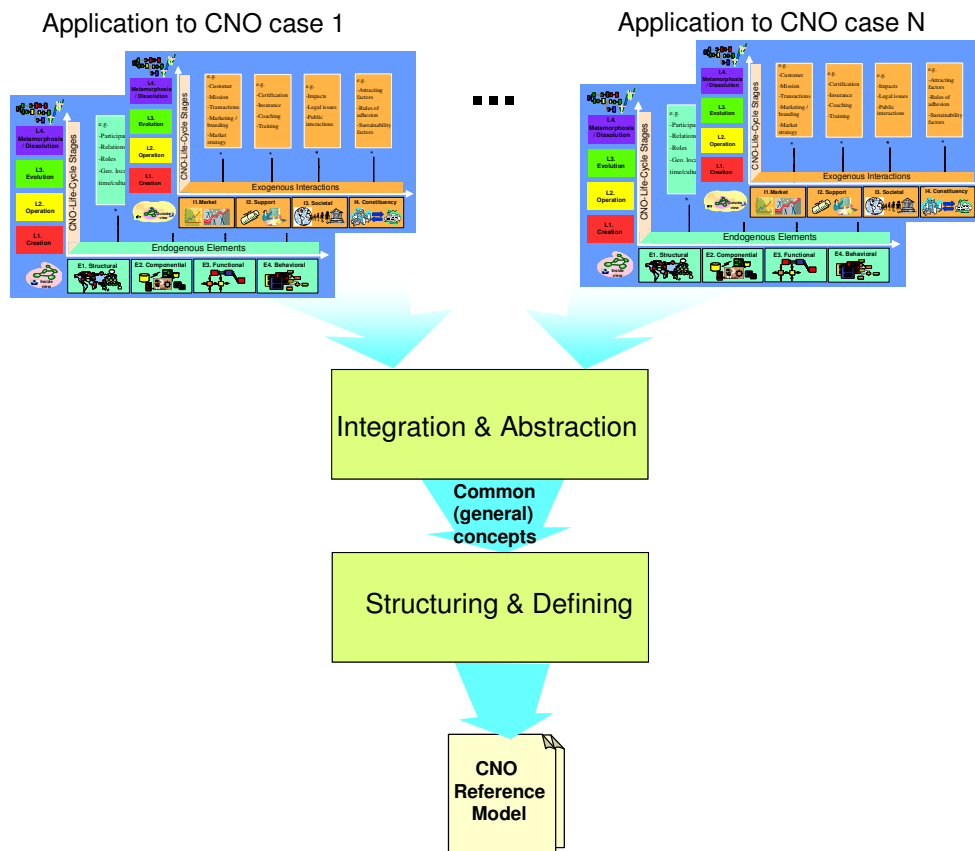


Figure 5.1 – Towards a CNO reference model

Therefore, as a first step of this bottom up approach, some reference tables were developed for the various classes of CNOs studied in **ECOLEAD**. Specifically, the following tables were filled out for the cases of VO Breeding Environment, VO, PVC, and Virtual Team. A general (more abstract) table needs to then be synthesized based on these examples, leading to the

identification of a set of general (common) concepts that will be at the base of the CNO reference model (Fig. 5.2).

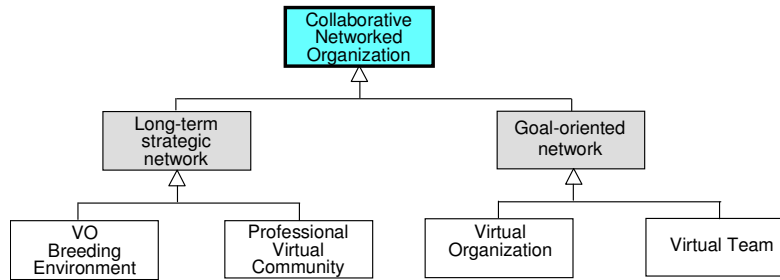


Figure 5.2 – Main classes of collaborative networks considered in this study

With this approach being followed, i.e. resorting to previous work in ECOLEAD and other past projects, we try to reduce the time needed for this ambitious task. Nevertheless one should have in mind that those reference modeling initiatives that gained some success (e.g. CIM-OSA, GERAM, Zachman) took many years to develop, and decades to get known by their target communities.

## 5.2 General concepts

### 5.2.1 Main elements according to the *Endogenous Elements perspective*

This section collects the main elements of the this subspace for the CNO's reference model, through the integration of elements found in VBEs with PVCs (Table 1), and in VOs with VTs (Table 2).

It is assumed that such lists of concepts and entities evolve, namely when more experience is collected from practice. Therefore, this set is to be understood as a starting basis.

For the *Endogenous Elements perspective*, the elements that are defined in each of its dimension (E1 to E4 addressed in section 4.1.2), are classified into the following four categories according to their nature. This serves to better represent their modeling semantics:

- **Active entity** – a tangible object that can behave and/or perform an action in the CNO, e.g. an organization, or an individual, e.g. the CNO member/partner organizations.
- **Passive entity** – a tangible object that cannot behave and/or perform any action in the CNO; rather it is a “object” on top of which actions can occur, e.g. an information resource, or an ICT resource.
- **Action** – a procedure or operation that is executed within the CNO, e.g. the CNO's member registration, competency management, contract negotiation, conflict resolution processes.
- **Concept** – an intangible aspect in the CNO that can be also associated with Active/Passive Entities or Actions, e.g. the role (associated with an organization in the CNO), brokerage principles (associated with the VO creation processes), or conflict resolution policies (associated with the CNO operation management processes).

Table 1. Main Endogenous Elements for long-term strategic alliances (LA)

E1. Structural	E2. Componential	E3. Functional	E4. Behavioral
<u>Active entity</u> <ul style="list-style-type: none"> <li>▪ <b>Actor</b> <ul style="list-style-type: none"> <li>▪ Primary-entity</li> <li>▪ Support-entity</li> </ul> </li> </ul> <u>Passive entity</u> ---	<u>Active entity</u> ---	<u>Active entity</u> ---	<u>Active entity</u> ---
<u>Passive entity</u> ---	<u>Passive entity</u> <ul style="list-style-type: none"> <li>▪ <b>Domain specific device</b> <ul style="list-style-type: none"> <li>▪ Manufacturing machinery</li> </ul> </li> </ul>	<u>Passive entity</u> ---	<u>Passive entity</u> ---
<u>Action</u> ---	<ul style="list-style-type: none"> <li>▪ <b>ICT resource</b> <ul style="list-style-type: none"> <li>▪ Hardware</li> <li>▪ Internet</li> <li>▪ Software <ul style="list-style-type: none"> <li>- LA Management System</li> </ul> </li> </ul> </li> </ul>	<u>Action</u> <ul style="list-style-type: none"> <li>▪ <b>Fundamental process</b> <ul style="list-style-type: none"> <li>▪ LA management process <ul style="list-style-type: none"> <li>- Membership management</li> <li>- Profile and competency management</li> <li>- Trust management</li> <li>- Sub-network Inherit/performance managem.</li> <li>- Value System info. management</li> <li>- Support institution info. management</li> <li>- Bag of Assets management</li> </ul> </li> <li>▪ Participants operational processes <ul style="list-style-type: none"> <li>- Member enrolment</li> <li>- Roles/responsibility update req.</li> <li>- Participants trust assessment</li> <li>- Sub-network creation</li> <li>- Sub-network registration</li> </ul> </li> </ul> </li> </ul>	<u>Action</u> ---
<u>Concept</u> <ul style="list-style-type: none"> <li>▪ <b>Role</b> <ul style="list-style-type: none"> <li>▪ LA member <ul style="list-style-type: none"> <li>- Administrator</li> <li>- Adviser</li> <li>- Support provider</li> <li>- VO/VT broker</li> <li>- VO/VT planner</li> <li>- Sub-network's actor</li> </ul> </li> <li>▪ Spot member</li> </ul> </li> <li>▪ <b>Relationship</b> <ul style="list-style-type: none"> <li>▪ Trusting</li> <li>▪ Cooperation</li> <li>▪ Communication / information flow</li> <li>▪ Exchange / sharing</li> <li>▪ Socializing</li> <li>▪ Control/supervision</li> </ul> </li> <li>▪ <b>Network</b> <ul style="list-style-type: none"> <li>▪ LA-self network</li> <li>▪ Sub-network</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Human resource</b> <ul style="list-style-type: none"> <li>▪ Contact person for Network</li> <li>▪ Contact person for an Actor</li> </ul> </li> <li>▪ <b>Info / knowledge / asset resource</b> <ul style="list-style-type: none"> <li>▪ Profile/ competency data <ul style="list-style-type: none"> <li>- Actor's profiles data</li> <li>- Network's profiles data</li> </ul> </li> <li>▪ Inheritance information <ul style="list-style-type: none"> <li>- LA inheritance</li> <li>- Sub-network inheritance</li> </ul> </li> <li>▪ Ontologies <ul style="list-style-type: none"> <li>- LA's common ontologies</li> <li>- Domain ontologies</li> </ul> </li> <li>▪ Bag of assets <ul style="list-style-type: none"> <li>- LA Governance info.</li> <li>- Value System Info.</li> <li>- Sharable SW tools</li> <li>- LA doc. repository</li> <li>- Templates</li> </ul> </li> </ul> </li> <li>▪ <b>Network result</b> <ul style="list-style-type: none"> <li>▪ VO characterization</li> <li>▪ VT characterization</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Background process</b> <ul style="list-style-type: none"> <li>▪ LA management process <ul style="list-style-type: none"> <li>- Creation of repositories</li> <li>- Setup LA management system</li> <li>- Bulk registration of founding participants</li> <li>- LA inheritance management</li> <li>- Decision support management</li> <li>- Members' rewarding</li> <li>- Ontology adapt/evolu. manage.</li> <li>- Performance measurement</li> <li>- IP Management</li> </ul> </li> </ul> </li> </ul>	<u>Concept</u> <ul style="list-style-type: none"> <li>▪ <b>Prescriptive behavior</b> <ul style="list-style-type: none"> <li>▪ Cultural principles <ul style="list-style-type: none"> <li>- Regional traditions</li> <li>- Business culture</li> <li>- NGO culture</li> </ul> </li> <li>▪ Governance principles <ul style="list-style-type: none"> <li>- LA general principles</li> <li>- Domain specific principles</li> </ul> </li> <li>▪ Incentive policies and rewarding</li> </ul> </li> <li>▪ <b>Obligatory behavior</b> <ul style="list-style-type: none"> <li>▪ LA bylaws <ul style="list-style-type: none"> <li>- Conflict Resolution Policy</li> <li>- Security issues policy</li> <li>- Bylaw amendments policy</li> <li>- Membership policy</li> <li>- Financial policies</li> <li>- Contract enforcement policy</li> </ul> </li> <li>▪ Internal regulations <ul style="list-style-type: none"> <li>- ICT Use Guideline</li> <li>- Sanctions Principles</li> </ul> </li> <li>▪ General law</li> </ul> </li> <li>▪ <b>Contract &amp; agreement</b> <ul style="list-style-type: none"> <li>▪ LA adhesion agreement</li> <li>▪ Agreement amendments</li> </ul> </li> <li>▪ <b>Constraint &amp; condition</b> <ul style="list-style-type: none"> <li>▪ Confidentiality constraints</li> <li>▪ Legal constraints</li> <li>▪ Standards constraints</li> <li>▪ Internal normative constraints</li> <li>▪ Physical constraints</li> </ul> </li> </ul>
	<u>Action</u> ---	<u>Concept</u> <ul style="list-style-type: none"> <li>▪ <b>Methodology &amp; Approach</b> <ul style="list-style-type: none"> <li>▪ Network setup handling <ul style="list-style-type: none"> <li>- Governance rules / value system definition</li> <li>- LA network set up</li> <li>- Sub-network set up</li> </ul> </li> <li>▪ Network operation handling <ul style="list-style-type: none"> <li>- Participant's registration</li> <li>- Participant's recruiting</li> <li>- Members' information quality assurance</li> <li>- LA's info. / policy transparency</li> <li>- Interactions w/ support institutions</li> <li>- Sub-network coordination selection</li> <li>- Social processes</li> <li>- Governance rules updating</li> <li>- Role/right assignment</li> <li>- Risk management</li> <li>- Conflict resolution</li> <li>- IP management</li> <li>- Technology adoption</li> <li>- Ontology management and updates</li> <li>- Sub-network's inheritance handling</li> </ul> </li> <li>▪ LA evolution/metamorphosis handling <ul style="list-style-type: none"> <li>- Revision of gathered knowledge</li> </ul> </li> </ul> </li> </ul>	

		<ul style="list-style-type: none"> <li>- Transition to new organizational structure</li> <li>▪ LA dissolution / inheritance handling <ul style="list-style-type: none"> <li>- Transfer of knowledge and assets</li> <li>- Re-defining of roles</li> </ul> </li> </ul>	
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Table 2. Main endogenous elements for goal-oriented networks

E1. Structural	E2. Componential	E3. Functional	E4. Behavioral
<u>Active entity</u> <ul style="list-style-type: none"> <li>▪ <b>Actor</b> <ul style="list-style-type: none"> <li>▪ Primary-entity</li> <li>▪ Support-entity</li> </ul> </li> </ul> <u>Passive entity</u> --- <u>Action</u> --- <u>Concept</u> <ul style="list-style-type: none"> <li>▪ <b>Role</b> <ul style="list-style-type: none"> <li>▪ Partner <ul style="list-style-type: none"> <li>- Coordinator</li> <li>- Support provider</li> <li>- Broker</li> <li>- Planner</li> </ul> </li> <li>▪ Spot member</li> </ul> </li> <li>▪ <b>Relationship</b> <ul style="list-style-type: none"> <li>▪ Peer-peer</li> <li>▪ Client-supplier</li> <li>▪ Trusting</li> <li>▪ Collaboration</li> <li>▪ Communication / information flow</li> <li>▪ Exchange &amp; sharing</li> <li>▪ Socializing</li> <li>▪ Control/supervision</li> <li>▪ Product/services flow</li> <li>▪ Monetary flow</li> </ul> </li> <li>▪ <b>Network</b></li> </ul>	<u>Active entity</u> --- <u>Passive entity</u> <ul style="list-style-type: none"> <li>▪ <b>Appli./Dom. specific device</b> <ul style="list-style-type: none"> <li>▪ Manufacturing machinery</li> </ul> </li> <li>▪ <b>ICT resource</b> <ul style="list-style-type: none"> <li>▪ Hardware</li> <li>▪ Internet</li> <li>▪ Software <ul style="list-style-type: none"> <li>- VO/VT Management System</li> </ul> </li> </ul> </li> <li>▪ <b>Human resource</b> <ul style="list-style-type: none"> <li>▪ Of Network</li> <li>▪ Of Actor</li> </ul> </li> <li>▪ <b>Info / knowledge / asset resource</b> <ul style="list-style-type: none"> <li>▪ Profile/ competency data <ul style="list-style-type: none"> <li>- Actor's profiles (history) data</li> </ul> </li> <li>▪ Inheritance information</li> <li>▪ Ontologies <ul style="list-style-type: none"> <li>- Network ontology</li> <li>- Actor's ontology</li> <li>- Domain's ontology</li> </ul> </li> <li>▪ Data/knowledge repositories</li> <li>▪ Templates</li> </ul> </li> <li>▪ <b>Network result</b> <ul style="list-style-type: none"> <li>▪ Tangible product</li> <li>▪ Service</li> </ul> </li> </ul> <u>Action</u> --- <u>Concept</u> ---	<u>Active entity</u> --- <u>Passive entity</u> --- <u>Action</u> --- <ul style="list-style-type: none"> <li>▪ <b>Fundamental process</b> <ul style="list-style-type: none"> <li>▪ Network management process <ul style="list-style-type: none"> <li>- Purpose characterization process</li> <li>- Tasks plan. &amp; schedul. process</li> <li>- Roles/responsibility assignment</li> <li>- Trust management</li> <li>- Evolution process</li> <li>- Dissolution process</li> <li>- Data/Knowledge management</li> </ul> </li> <li>▪ Participants operational processes <ul style="list-style-type: none"> <li>- Mediation/agreement process</li> <li>- Negotiation process</li> <li>- Roles/responsibility update req.</li> <li>- Business process</li> </ul> </li> </ul> </li> <li>▪ <b>Background process</b> <ul style="list-style-type: none"> <li>▪ Network management process <ul style="list-style-type: none"> <li>- Creation of repositories</li> <li>- Setup of management system</li> <li>- Network inheritance handling</li> <li>- Decision support management</li> <li>- Ontology management</li> <li>- Ontology evolution management</li> <li>- Performance measurement</li> <li>- IP Management</li> </ul> </li> </ul> </li> </ul> <u>Concept</u> <ul style="list-style-type: none"> <li>▪ <b>Methodology &amp; Approach</b> <ul style="list-style-type: none"> <li>▪ Network setup handling <ul style="list-style-type: none"> <li>- Governance rules / value system def.</li> </ul> </li> <li>▪ Network operation handling <ul style="list-style-type: none"> <li>- Members' information quality assurance</li> <li>- Network's info. / policy transparency</li> <li>- Social processes</li> <li>- Governance rules updating</li> <li>- Risk management</li> <li>- Conflict resolution</li> <li>- IP management</li> <li>- Technology adoption</li> <li>- Ontology managem. &amp; updates</li> </ul> </li> <li>▪ Network evolution handling <ul style="list-style-type: none"> <li>- Revision of gathered knowledge</li> <li>- Transition to new organizational structure</li> </ul> </li> <li>▪ Network dissolution / inheritance handling <ul style="list-style-type: none"> <li>- Transfer of knowledge and assets</li> <li>- Re-defining of roles</li> </ul> </li> </ul> </li> </ul>	<u>Active entity</u> --- <u>Passive entity</u> --- <u>Action</u> --- <ul style="list-style-type: none"> <li>▪ <b>Concept</b> <ul style="list-style-type: none"> <li>▪ <b>Prescriptive behavior</b> <ul style="list-style-type: none"> <li>▪ Cultural principles <ul style="list-style-type: none"> <li>- Regional traditions</li> <li>- Business culture</li> <li>- NGO culture</li> </ul> </li> <li>▪ Governance principles <ul style="list-style-type: none"> <li>- Network general principles</li> <li>- Domain specific principles</li> </ul> </li> <li>▪ Incentive policies and rewarding</li> </ul> </li> <li>▪ <b>Obligatory behavior</b> <ul style="list-style-type: none"> <li>▪ Network bylaws <ul style="list-style-type: none"> <li>- Conflict Resolution policy</li> <li>- Security Issues policy</li> <li>- Amendments to Bylaw policy</li> <li>- Financial Policies</li> <li>- Contract enforcement policy</li> </ul> </li> <li>▪ Internal regulations <ul style="list-style-type: none"> <li>- ICT Use Guideline</li> <li>- Sanctions Principles</li> </ul> </li> <li>▪ General law</li> </ul> </li> <li>▪ <b>Contract &amp; agreement</b> <ul style="list-style-type: none"> <li>▪ Coalition agreement</li> <li>▪ Agreement amendments</li> <li>▪ Individual partner agreements</li> </ul> </li> <li>▪ <b>Constraint &amp; condition</b> <ul style="list-style-type: none"> <li>▪ Confidentiality constraints</li> <li>▪ Legal constraints</li> <li>▪ Standards constraints</li> <li>▪ Internal normative constraints</li> <li>▪ Physical constraints</li> </ul> </li> </ul> </li> </ul>

By comparing the two tables, a large commonality can be extracted at this level of abstraction. Therefore a set of common endogenous elements are identified for each dimension (Table 3).

Table 3. Common endogenous elements for CNO's reference model

E1. Structural	E2. Componential	E3. Functional	E4. Behavioral
<u>Active entity</u> ■ <b>Actor</b> <ul style="list-style-type: none"> <li>Primary-entity</li> <li>Support-entity</li> </ul> <u>Passive entity</u> ---	<u>Active entity</u> ---	<u>Active entity</u> ---	<u>Active entity</u> ---
<u>Passive entity</u> ---	<u>Passive entity</u> ■ <b>Domain specific device</b> <ul style="list-style-type: none"> <li>Manufacturing machinery</li> </ul>	<u>Passive entity</u> ---	<u>Passive entity</u> ---
<u>Action</u> ---	■ <b>ICT resource</b> <ul style="list-style-type: none"> <li>Hardware</li> <li>Internet</li> <li>Software               <ul style="list-style-type: none"> <li>CNO Management System</li> </ul> </li> </ul>	<u>Action</u> ■ <b>Fundamental process</b> <ul style="list-style-type: none"> <li>Main network management process               <ul style="list-style-type: none"> <li>Roles/responsibility management</li> <li>Trust management</li> <li>Data/Know. management</li> </ul> </li> <li>Participants operational processes               <ul style="list-style-type: none"> <li>Roles/responsibility update request</li> </ul> </li> </ul>	<u>Action</u> ---
<u>Concept</u> ■ <b>Role</b> <ul style="list-style-type: none"> <li>Participant               <ul style="list-style-type: none"> <li>Administrator</li> <li>Support provider</li> <li>Broker</li> <li>Planner</li> </ul> </li> <li>Spot member</li> </ul>	■ <b>Human resource</b> <ul style="list-style-type: none"> <li>HR of Network</li> <li>HR of Actor</li> </ul>	■ <b>Background process</b> <ul style="list-style-type: none"> <li>Network manag. process               <ul style="list-style-type: none"> <li>Creation of repositories</li> <li>Setup of manag. system</li> <li>Bulk registration of founding participants</li> <li>Network inheritance management</li> <li>Decision support management</li> <li>Members' rewarding</li> <li>Ontology management</li> <li>Ontology evolution management</li> <li>Performance measurement</li> <li>IP Management</li> </ul> </li> </ul>	<u>Concept</u> ■ <b>Prescriptive behavior</b> <ul style="list-style-type: none"> <li>Cultural principles               <ul style="list-style-type: none"> <li>Regional traditions</li> <li>Business culture</li> <li>NGO culture</li> </ul> </li> <li>Governance principles               <ul style="list-style-type: none"> <li>Network general principles</li> <li>Domain specific principles</li> </ul> </li> <li>Incentive and rewarding policies</li> </ul>
■ <b>Relationship</b> <ul style="list-style-type: none"> <li>Cooperation / Collaboration</li> <li>Trusting</li> <li>Communication / information flow</li> <li>Exchange &amp; sharing</li> <li>Socializing</li> <li>Control/supervision</li> </ul>	■ <b>Info / knowledge / asset resource</b> <ul style="list-style-type: none"> <li>Profile/ competency data               <ul style="list-style-type: none"> <li>Actor's profiles data</li> </ul> </li> <li>Inheritance information</li> <li>Ontologies               <ul style="list-style-type: none"> <li>Network ontology</li> <li>Domain's ontology</li> </ul> </li> <li>Data / knowledge Repositories</li> <li>Templates</li> </ul>	■ <b>Methodology &amp; Approach</b> <ul style="list-style-type: none"> <li>Network setup handling               <ul style="list-style-type: none"> <li>Governance rules / value system definition</li> </ul> </li> <li>Network operation handling               <ul style="list-style-type: none"> <li>Members' information quality assurance</li> <li>Network's info. / policy transparency</li> <li>Social processes</li> <li>Governance rules updating</li> <li>Risk management</li> <li>Conflict resolution</li> <li>IP management</li> <li>Technology adoption</li> <li>Ontology manag. &amp; updates</li> </ul> </li> <li>Network evolution handling               <ul style="list-style-type: none"> <li>Revision of gathered knowledge</li> <li>Transition to new organizational structure</li> </ul> </li> <li>Network dissolution / inheritance handling</li> </ul>	■ <b>Obligatory behavior</b> <ul style="list-style-type: none"> <li>Network bylaws               <ul style="list-style-type: none"> <li>Conflict Resolution Policy</li> <li>Security Issues policy</li> <li>Bylaw amendments policy</li> <li>Financial Policies</li> <li>Contract enforcement policy</li> </ul> </li> <li>Internal regulations               <ul style="list-style-type: none"> <li>ICT Use Guideline</li> <li>Sanctions Principles</li> </ul> </li> <li>General law</li> </ul>
■ <b>Network</b>	■ <b>Network outcome</b>		■ <b>Contract &amp; agreement</b> <ul style="list-style-type: none"> <li>Network adhesion / coalition agreement</li> <li>Agreement amendments</li> </ul>
	<u>Action</u> ---		■ <b>Constraint &amp; condition</b> <ul style="list-style-type: none"> <li>Confidentiality constraints</li> <li>Legal constraints</li> <li>Standards constraints</li> <li>Internal normative constraints</li> <li>Physical constraints</li> </ul>
	<u>Concept</u> ---		

		- Knowledge & assets transfer - Re-defining roles	
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### 5.2.2 Endogenous Elements definition for CNO's reference model

This section includes textual definitions of common elements in the endogenous perspective of the CNO's reference model. Later, in Section 5.3 these elements are crossed against the life cycle stages of the CNO's reference model.

#### E1. Structural dimension

##### Active entity

- **Actor** Entity identifying all the participating actors (nodes) in the network. The actors can be enterprises, other types of organizations, or people.  
An actor can have the role and relationship properties.  
Two (or more) actors can be linked through a number of different types of relationships.
- **Primary-entity** An actor that can have a direct participation in the main business processes leading to the products or services that can be produced in the scope of the network's domain.
- **Support-entity** An actor not directly involved in the "production" processes but that performs supporting services to facilitate / enable the normal operation of the CNO.

##### Concept

- **Role** Concept describing and characterizing the roles that can be performed by the actors in the network. A role defines an expected behavior for an actor in a given context.
- **Participant** The basic role played by any actor that is registered as member of the CNO and is willing to participate in the CNO's activities. Since at different times and actor may assume different roles, and as each of these roles requires assigning different proper rights/responsibilities, e.g. for access to information and services provided, it is necessary to distinguish among these more specific roles.
- **Administrator** The role of the CNO actor responsible for the network's operation and evolution as well as for promoting cooperation / collaboration among its actors. Also responsible for filling in the skill/competency gaps by searching and recruiting/inviting new organizations into the network. It is also responsible for daily management of the general processes of the CNO, conflict resolution, etc. In the case of a goal-oriented network this role is often designated as *coordinator*.
- **Support provider** A role typically performed by support-entities, although it can also be played by primary entities, and that represents the responsibility of providing support services and support tools and mechanisms for the operation of the CNO.
- **Broker** Role played by an actor when engaged in identifying and acquiring collaboration opportunities (business opportunities or others), by marketing CNO competencies and assets and

negotiating with (potential) customers. Also responsible for interacting with (potential) customers, on behalf of the CNO, during the early phases of response to these opportunities. In some cases there is also the possibility of this opportunity brokerage role being played by an outside entity, as a service to the CNO.

- Planner Also known as business integrator, it covers the design, planning, and launching of a new goal-oriented network (typically in response to a collaboration opportunity identified by the broker). It involves the identification of the necessary competencies and capacities, selection of an appropriate set of partners, and structuring the new network. In many cases the roles of broker and planner are performed by the same actor.
- Spot member Refers to a temporary participant that was invited into the CNO for a specific participation. This member usually has limited rights and will not stay as member during the full life cycle of the network.
- Relationship Any kind of logical or physical connection or association, usually referring to some form of interaction, between / among two or more actors. In the case of CNOs several relationships can be defined between participants. For each type of relationship and the involved participants a specific network topology (graph) can be represented.
- Cooperation / collaboration Used to reflect that two actors have a joint cooperation or collaboration activity. In the case of a long-term alliance we find typically cooperation relationships. In goal-oriented networks we might have collaboration or cooperation relationships depending on the way the network and the work are organized.
- Trusting To represent levels of trustworthiness between actors.
- Communication / information flow An association between two or more actors for the purpose of information exchange. In CNOs this case can be used to represent the flows of information in the network.
- Exchange & sharing Association to represent the exchange or sharing of some resource or goods among actors.
- Socializing Represents any connection of a social nature. Useful, for instance, to represent situations in which actors are engaged in joint social, cultural, or sport events.
- Control/supervision When an actor controls or supervises another actor. Useful to represent the power structures in the network.
- Network Concept representing the CNO as a whole, through its main properties, e.g. *identity*, *size*, *location*, *participants*, *topology*.

## E2. Componential dimension

### Passive entity

- Domain specific device Entities characterizing the production equipment needed for the specific application domain of the CNO. In the case of industry networks it can include the layout of the shared facilities as well as the logistics networks.
- Manufacturing machinery In the manufacturing domain this refers to the equipment that is used to manufacture products.
- ICT resource Entities characterizing the ICT equipment, software, and infrastructures used / shared in the network. It can include the

	architecture of the computer network supporting the collaboration.
▪ <u>Hardware</u>	Refers to the computer hardware infrastructure available to the network.
▪ <u>Internet</u>	Represents the specific Internet-based networking infrastructure and corresponding tools available to the CNO.
▪ <u>Software</u>	Refers to the common software tools available to the network.
▪ <u>CNO management system</u>	A specific software resource aimed at supporting and facilitating the management of the activities of the network and its members along all phases of its life cycle. In addition to management services, it often includes collaboration support functionalities.
▪ <u>Human resource</u>	A characterization of the human resources available in the network, namely in terms of their competencies, profile, potential roles they can perform, etc.
▪ <u>HR of network</u>	Refers to the individuals that perform general functions at the CNO level (e.g. brokerage, management). These resources can be specifically hired for the network (namely in the case of long-term alliances) or being part of a specific member organization but assigned a network-level responsibility.
▪ <u>HR of actor</u>	Refers to the individuals within an organization member of the CNO.
▪ <u>Information / knowledge / asset resource</u>	Entities including the repositories of information and knowledge that are shared by the network members or that support the collaboration processes and the networked organization.
▪ <u>Profile / competency data</u>	A set of structured information describing the CNO and its participants, including its competencies. An actor's competency is the actor's capability to perform (business) processes (in collaboration with partners), having the necessary resources (human, technological, physical) available, and applying certain practices, with the final aim to offer certain products and/or services to the customers.
▪ <u>Actor's profile data</u>	A set of structured information describing the CNO participant. This profile can be sub-divided into public profile and private profile (available CNO participants or administrator only).
▪ <u>Inheritance information</u>	Represents a set of documents/information and assets which are inherited from past collaboration cases. It can represent, for instance, a record of past performance, a set of learned lessons, etc. For instance, when a VO is dissolved, part of this information is inherited by the underlying VBE. The same for a VT dissolution and the PVC.
▪ <u>Ontologies</u>	Entities representing the main (common) ontologies used in the network and that facilitate the mutual understanding among the network members. One example can be the ontology of competencies available in the network.
▪ <u>Network ontology</u>	The high level ontology representing the concepts common to all members of the network.
▪ <u>Domain's ontology</u>	Specific ontology related to the domain of Network's activities..
▪ <u>Data / knowledge repositories</u>	Refers to concrete repositories of data and knowledge such as databases, knowledge bases, available to the members of the CNO or to actors playing some specific roles for the CNO (e.g. administrator, broker, or planner).
▪ <u>Templates</u>	In general it is a form, mold, or pattern used as a guide to making something. Often it is a model or reference document which includes an intended format but leaves empty slots or variables to be filled in when the template is instantiated into a concrete document for a specific use case. A CNO can build and use as an

- **Network outcome**

asset a repository of templates of contracts, main processes, VO/VT structures, etc. The use of such templates is aimed at reducing the effort of generating concrete documents / structures.

Refers to the results of the CNO operation, such as Products or Services in the case of goal-oriented networks, and VOs or VTs in the case of long-term alliances.

### **E3. Functional dimension**

#### **Action**

- **Fundamental process**

Concerned with the processes involved in the main line of activities of the collaboration. Processes represent the main structured part of the operational activities of the network. An example is the distributed business processes in a business oriented CNO.

- **Main network management process**

Concerned with the main activities related to the management of the CNO along its life cycle, towards the achievement of the network's mission. This process may resort to a number of auxiliary processes.

- **Roles / responsibility management**

Responsible for keeping track and assigning roles and responsibilities to the CNO participants.

- **Trust management**

Devoted to promote the establishment of trust relationships among CNO participants, including the assessment of the trust level among members and between members and the CNO as a whole. It also includes the definition of the trust assessment criteria.

- **Data / knowledge management**

Responsible for the management of the data and knowledge repositories hold by the CNO.

- **Participants' operational processes**

Refers to a set of processes to be carried out by participants during the operational phase of the CNO. These processes are quite varied according to the type of network. In the case of long-term alliances there might be processes for member's enrolment, trust assessment, creation of sub-networks, etc. In the goal-oriented networks there might be business processes (related to the achievement of the network's goal), negotiation processes, mediation / agreement reaching processes, etc. In both classes of networks there might be a process for requesting change / update of roles and responsibilities.

- **Roles / responsibility update request**

A sub-type of the participant's operational processes aimed at requesting, from the network administration, the change/update of the roles and responsibility of the participant.

- **Background process**

Including those processes that are designed to assist the CNO in terms of its maintenance and improvement of operations.

- **Network management process**

Covering the preparatory and administrative activities necessary for the proper operation of the network.

- **Creation of repositories**

Responsible for the creation and initial population of the various repositories needed for the operation of the CNO – databases, knowledge bases, templates, etc.

- **Setup of management system**

Configuration and parameterization of the various components of the CNO management system in order to tune it according to the chosen policies.

- **Bulk registration of**

Responsible for the registration in the corresponding repositories,

- founding participants

of the initial / founding members of the CNO, including the introduction of their profiles and competencies.
- Network inheritance management

Responsible for handling the various activities involved in processing the inheritance elements. For instance, when a VO dissolves, this process will handle the inherited information and assets from the VO and “registers” them in the corresponding VBE repositories.
- Decision support management

Collection of sub-processes supporting various decision making actions. Examples of such sub-processes include: determination of warning levels (e.g. low trustworthiness level), assistance in determining competencies gap, assistance in evaluating members’ readiness to participate in a collaboration opportunity, etc.
- Member’s rewarding

Process implementing the determination and assignment of rewards to CNO members according to the adopted incentives and rewarding policies. For instance, this process can involve processing various items recorded in the CNO repositories that are relevant to determine the merit of each partner.
- Ontology management

Responsible for the definition, maintenance and access to common ontologies. It may involve semi-automatic ontology extraction (e.g. from corpora text) or simply support manual definition of the ontologies.
- Ontology evolution management

Organizes and orchestrates the activities involved in the evolution of common ontologies, including consistency checking.
- Performance measurement

Responsible for performance measurement at the network level, through the determination of a set of performance indicators. This process also involves the distributed data acquisition for the computation of these indicators.
- Intellectual Property management

Set of activities responsible for the various aspects of intellectual property management, including methods for determination of property ownership, supporting value assignment to the members, protection mechanisms, etc.

### Concept

- Methodology and approach

Typically less formalized and conveying less detailed information than processes, represent the body of practices, procedures, and rules used mainly by human actors in a CNO. They are frequently represented as a semi-structured set of steps (informal enumeration of activities) combined with some structured representation of input / output information. Although giving a sequence of steps, they are not very strict in terms of schedule, indication of involved resources, etc. as it can be expected in a process definition. An example can be the methodology to be followed by a broker to announce a business opportunity to the CNO members.
- Network setup handling

Set of procedures and practices involved in the set up phase of the network’s life cycle (the last stage of the network’s creation), including the final setting up of the governance rules, value systems, configuration of infrastructures, etc.
- Governance rules / value system definition

Refers to the methodology involved in the definition and agreement on the governance rules to be applied to the network as well as its value system.
- Network operation handling

Set of methods, the underlying rationale, recommended practices and supporting tools to deal with the network’s operation. A large

- number of methodologies and approaches can be included under this item in order to cover for the large set of activities and events that happen during the operational phase of the CNO.
- Member's information quality assurance  
Approaches and methods used to check for the quality of information provided by network members. For instance, it is important to assess the accuracy of the profile and competencies information provided by participants in order to reduce the subjectivity.
  - Network's information / policy transparency  
Approaches, supporting methods and mechanisms to deal with the information visibility levels and transparency in the CNO. Transparency is a fundamental concept in order to guarantee the sustainability of a collaborative network.
  - Social processes  
Refers to a number of practices and guidelines related to social activities organized by and for the network participants, namely with the purpose of reinforcing the team spirit.
  - Governance rules updating  
Methodology to be followed when there is an intention to change or update the governance rules of the CNO. It shall define the protocols to be followed as well as the participants that shall be involved in each phase.
  - Risk management  
Approaches and methods to deal with risks in the CNO, including risk analysis and estimation, methods for fair distribution of risk consequences, risk avoidance measures, etc.
  - Conflict resolution  
Methodology and recommended practices to be adopted in case of conflicts in the network at the various levels of the CNO coordination structure.
  - IP management  
Methods, decision making guidelines, and identification of external supporting entities to be used in the management of the intellectual property in the CNO.
  - Technology adoption  
Recommended practices to be followed in the case of introduction of new technologies that affect the whole CNO or several of its members.
  - Ontology management & updates  
Methodological guidelines, protocols and supporting tools to be adopted in the management and updating of the common ontologies, namely changing/extending the classification of entities/concepts in use in the network.
  - Network evolution handling  
Methodology and approaches to be used when it is necessary to make significant changes in the network in terms of membership, organizational and coordination structure, roles, and responsibilities.
  - Revision of gathered knowledge  
An auxiliary methodology to be used during the network's evolution stage to deal with the re-organization and consolidation of the knowledge acquired during the previous operational phase, in order to start with a cleaned up version in the next stage of the CNO.
  - Transition to new organizational structure  
Guidelines and recommended practices to be adopted when a CNO goes through a metamorphosis, i.e. a major change, turning into a new kind of organization. Not only the re-design / planning of the new organizational structure, but also the temporary aspects and liabilities coming from the past organization need to be properly handled.
  - Network dissolution / inheritance handling  
Approaches and support methods to use when the network dissolves and how to handle its inheritance. It shall include a clear identification of the inheritance elements (assets, liabilities), the corresponding owners / responsible participants, who will inherit them, under which conditions the transfer will be made, etc.

- Knowledge & assets transfer Refers to a particular aspect of the network's inheritance, dealing with the transference of acquired / gathered knowledge and other valuable assets when the CNO dissolves.
- Re-defining roles Guidelines and recommended practices for the re-definition of roles of participants when the CNO dissolves or evolves to a substantially different structure.

#### **E4. Behavioral dimension**

##### **Concept**

- Prescriptive behavior A set of concepts capturing the elements that lies down or prescribes normative guidelines or rules for the proper behavior of the CNO such as (general) principles, strategies, and protocols. An example is a recommendation for CNO members to give preference to network peers when searching for partners for a business opportunity. Another example could be the recommended protocol when negotiating a contract.
- Cultural principles Those guidelines and principles generally accepted and promoted by a given group or society, and that are in general practiced by the accepted members of that group or society. Being the CNO immersed in a given "society", such general principles shall be followed in order to guarantee a good acceptance by the surrounding environment.
  - Regional traditions Includes the cultural specificities of a particular geographical region. For instance, in a given region it might be considered as appropriate social behavior that organizations operating in that region sponsor (or facilitate the participation of employees in) the local festivities.
  - Business culture Captures the set of practices followed by the business sector in which the CNO operates, i.e. "the way actors in this business sector do business".
  - NGO culture Captures the set of practices and guidelines usually followed by (philanthropic) non-governmental organizations, whose value systems are substantially different from business-oriented entities. A CNO devoted to disaster rescue management will naturally follow this particular culture.
- Governance principles Refers to set of norms to be followed in order to effectively manage and monitor (through policy) the operation according to the strategy and goals of the CNO. These principles shall also reflect the value system and ethical code of the network.
- Network general principles Set of elements defined as the result of a vision, ethical code, values and principles the CNO wants to follow and that may include cases such as:
  - Honesty and integrity
  - Trust and accountability
  - Openness
  - Well performance
  - Professionalism
  - Mutual respect
  - Commitment to Network
  - Code of ethics
  - IPR Policy.
- Domain specific principles Set of principles that are adjusted to the common practices in the specific domain of operation of the CNO. These principles may include:

- Leadership role principles
  - Interoperability principles
  - Decision-making principles
  - Etc.
- Incentive & rewarding policies Set of principles and mechanisms to create incentives for proactive engagement of participants in the fulfillment of the CNO's objectives, including a list of rewards and their granting rules.
  - Obligatory behavior A set of concepts describing those rules and principles that are mandatory to be followed inside the network. This includes policies, governance values and associated rules, and enforcement steps. An example can be the internal rules used for distribution of benefits or for sharing the operational costs of the network.
  - Network bylaws Formalizes the regulations that CNO adopts that set forth duties, limit authority and establish orderly procedures for conducting business (internal affairs).
  - Conflict resolution policy The policy to workout emerging problems among participants during CNO activities, in charge of a CNO board headed by network manager. Examples of relevant cases that could introduce conflicts to the CNO are: Breach to a contract, disclose of confidential information, use the CNO means for approaching particular interests external to the network, Intellectual Property Rights misuse (in case of patents), among others.
  - Security issues & policy Regulations regarding the safeguard the confidentiality of exchanged information and obtained knowledge that must be defined prior to operations of the CNO.
  - Bylaw's amendments policy Specify the policy to be followed in the revisions/modifications to bylaws. For instance, notice of proposed changes in the rules should be circulated to all CNO participants with a considerable time in advance of the decision making point.
  - Financial policies The set of policies for payments and an accounting in order to guarantee a potential growth of the network at economic level and the satisfaction of its members in compliance with the law.
  - Contract enforcement policy The set of policies to enforce the fulfillment of contracts and agreements, either internal or between the network and its customers, including the monitoring mechanisms and sanctions.
  - Internal regulations Formalize a set of operational regulations, in complement of the bylaws, defining responsibilities (rights and duties) of all CNO participants, communication mechanisms, reporting protocols, as well as prioritization of actions and some related functions.
  - ICT use guideline Regulate the use of technology as a mean to disclose and share the information, respecting the policies and rules, according to the ethical and behavioral code.
  - Sanctions principles Sanctions are negative/punitive actions referred to members and taken under a performance assessment, which is given through definition and measurement of indicators.
  - General law Refers to the applicable law of the country or region in which the CNO operates. When a CNO spans over different countries, its members typically agree on using the law of one specific country or region.
  - Contract & agreement A set of concepts covering both the contracts between the CNO and external customers and the internal contracts and cooperation agreements among the network members. These models may include both representations understandable to humans and to software systems.

▪ <u>Network adhesion / coalition agreement</u>	A formal document defining the conditions and relations that shall prevail between the CNO and a new participant joining the network. It typically specifies the rights and duties of both parties and identifies the background knowledge and assets brought in by the new member.
▪ <u>Agreement amendments</u>	Formal changes to agreements that need to be defined according to the established amendment policy or procedures.
▪ <b><u>Constraint &amp; condition</u></b>	A set of concepts representing those “environmental features” that limit the context of operation of the CNO and its members. An example is a set of restrictions on the use of intellectual property of one member by other members of the network.
▪ <u>Confidentiality constraints</u>	Constraints regarding the (non-)disclosure of information imposed either by the customer or by CNO participants.
▪ <u>Legal constraints</u>	Refers to the constraints imposed by law.
▪ <u>Standards constraints</u>	Refers to constraints derived from existing national or international standards in the domain of the CNO.
▪ <u>Internal normative constraints</u>	Constraints that derive from the internal agreements and regulations.
▪ <u>Physical constraints</u>	Refers to physical or geographical constraints imposed by the specific nature of the domain of the CNO. For instance, a CNO in the civil construction domain will require that most participants have some performance in the same physical place i.e. the construction site.

### 5.2.3 Main elements according to the Exogenous Interactions perspective

This section collects the main elements of the this subspace for the CNO's reference model, through the integration of elements found in VBEs with PVCs (Table 4), and VO's with VTs (Table 5). Similar to the Endogenous tables, it is assumed that such lists of concepts and entities evolve, namely when more experience is collected from practice. Therefore, this set is to be understood as a starting basis.

The Exogenous Interactions perspective captures the aspects related to the interactions between the CNO, as a whole, and its surrounding environment. Therefore three main groups of elements are considered for each dimension:

- **Network identity**, defining the general *positioning* of the CNO in the environment or how it presents itself to the environment;
- **Interaction parties**, identifying the relevant entities the CNO interacts with;
- **Interactions**, listing the various transaction types between the CNO and its interlocutors.

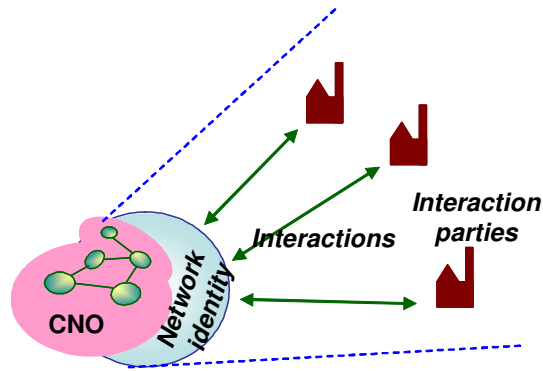


Figure 5.3 - Exogenous interactions

Table 4. Main exogenous interactions for long-term strategic networks

I1. Market	I2. Support	I3. Societal	I4. Constituency
<b><u>Network identity</u></b> <ul style="list-style-type: none"> <li>▪ Mission statement <ul style="list-style-type: none"> <li>- (General) Strategy</li> <li>- (Long term) Goals</li> </ul> </li> <li>▪ References / testimonials</li> <li>▪ Network profile <ul style="list-style-type: none"> <li>- Who we are</li> <li>- How to contact us</li> </ul> </li> <li>▪ Market strategy <ul style="list-style-type: none"> <li>- Marketing strategy</li> <li>- Branding strategy</li> </ul> </li> </ul>	<b><u>Network identity</u></b> <ul style="list-style-type: none"> <li>▪ Network's social nature <ul style="list-style-type: none"> <li>- Profit</li> <li>- Not for profit</li> <li>- Governmental</li> <li>- NGO</li> </ul> </li> </ul>	<b><u>Network identity</u></b> <ul style="list-style-type: none"> <li>▪ Legal status <ul style="list-style-type: none"> <li>- Legal entity</li> <li>- Informal entity</li> </ul> </li> <li>▪ Values &amp; principles</li> </ul>	<b><u>Network identity</u></b> <ul style="list-style-type: none"> <li>▪ Attracting &amp; recruiting strategy</li> </ul>
<b><u>Interaction parties</u></b> <ul style="list-style-type: none"> <li>▪ Customers <ul style="list-style-type: none"> <li>- Strategic customers</li> <li>- Potential customers</li> </ul> </li> <li>• Competitors <ul style="list-style-type: none"> <li>- Direct competitors</li> <li>- "Indirect" competitors</li> </ul> </li> <li>▪ (Potential) Suppliers</li> </ul>	<b><u>Interaction parties</u></b> <ul style="list-style-type: none"> <li>▪ Certification entities <ul style="list-style-type: none"> <li>- National institutions</li> <li>- International institutions</li> </ul> </li> <li>▪ Insurance entities <ul style="list-style-type: none"> <li>- Private institutions</li> <li>- Public institutions</li> </ul> </li> <li>• Logistics entities</li> <li>• "Standard" registries <ul style="list-style-type: none"> <li>- Clearing centers</li> <li>- Master data providers</li> </ul> </li> <li>▪ Financial entities <ul style="list-style-type: none"> <li>- Banks</li> <li>- Investors</li> <li>- Sponsors</li> </ul> </li> <li>▪ Coaching entities <ul style="list-style-type: none"> <li>- Advisers</li> <li>- Individual external experts</li> </ul> </li> <li>▪ Training entities <ul style="list-style-type: none"> <li>- Advisers</li> <li>- Professional association</li> <li>- Individual external experts</li> </ul> </li> <li>▪ Research entities <ul style="list-style-type: none"> <li>- Universities</li> <li>- Research institutes</li> </ul> </li> </ul>	<b><u>Interaction parties</u></b> <ul style="list-style-type: none"> <li>▪ Governmental organizations <ul style="list-style-type: none"> <li>- Social security</li> <li>- City hall</li> <li>- Civil defense</li> </ul> </li> <li>▪ Associations</li> <li>▪ Interest groups <ul style="list-style-type: none"> <li>- Supporters</li> <li>- Opponents</li> </ul> </li> <li>▪ Regulatory bodies</li> <li>▪ Other entities</li> </ul>	<b><u>Interaction parties</u></b> <ul style="list-style-type: none"> <li>▪ Business organizations <ul style="list-style-type: none"> <li>- Private institutions</li> <li>- Individual experts</li> </ul> </li> <li>▪ Public institutions</li> </ul>
<b><u>Interactions</u></b> <ul style="list-style-type: none"> <li>▪ Advertising <ul style="list-style-type: none"> <li>- Broadcast</li> <li>- Direct</li> </ul> </li> <li>▪ Bidding</li> <li>▪ Handling inquiries</li> </ul>	<b><u>Interactions</u></b> <ul style="list-style-type: none"> <li>▪ Service acquisition <ul style="list-style-type: none"> <li>- Financial relation</li> <li>- Technological service</li> <li>- Training action</li> <li>- Coaching action</li> <li>- Guarantee action</li> </ul> </li> </ul>	<b><u>Interactions</u></b> <ul style="list-style-type: none"> <li>▪ Political relations</li> <li>▪ Seeking support</li> <li>▪ Information transfer <ul style="list-style-type: none"> <li>▪ Broadcast</li> <li>▪ Direct</li> </ul> </li> </ul>	<b><u>Interactions</u></b> <ul style="list-style-type: none"> <li>▪ Member searching <ul style="list-style-type: none"> <li>▪ Invitation</li> <li>▪ Solicitation</li> </ul> </li> <li>▪ Receiving applications</li> </ul>

	<ul style="list-style-type: none"> <li>- Knowledge transfer</li> <li>- Consulting service</li> </ul>	<ul style="list-style-type: none"> <li>▪ Social relations <ul style="list-style-type: none"> <li>- Cultural</li> <li>- Patronage</li> </ul> </li> </ul>	
	<ul style="list-style-type: none"> <li>▪ Agreement establishment</li> </ul>		

Table 5. Main exogenous interactions for goal-oriented networks

I1. Market	I2. Support	I3. Societal	I4. Constituency
<u><b>Network identity</b></u> <ul style="list-style-type: none"> <li>▪ Goal</li> <li>▪ References / testimonials (of core partners)</li> <li>▪ Network profile <ul style="list-style-type: none"> <li>- Who we are</li> <li>- How to contact us</li> </ul> </li> <li>▪ Market strategy (product/service) <ul style="list-style-type: none"> <li>- Marketing</li> <li>- Branding</li> </ul> </li> </ul>	<u><b>Network identity</b></u> <ul style="list-style-type: none"> <li>▪ Network's social nature <ul style="list-style-type: none"> <li>- Profit</li> <li>- Not for profit</li> <li>- Governmental</li> <li>- NGO</li> </ul> </li> </ul>	<u><b>Network identity</b></u> <ul style="list-style-type: none"> <li>▪ Legal status <ul style="list-style-type: none"> <li>- Legal entity</li> <li>- Informal entity</li> </ul> </li> <li>▪ Values &amp; principles</li> </ul>	<u><b>Network identity</b></u> <ul style="list-style-type: none"> <li>▪ Strategy for inclusion of external members</li> </ul>
<u><b>Interaction parties</b></u> <ul style="list-style-type: none"> <li>▪ Customers <ul style="list-style-type: none"> <li>- Known</li> <li>- Un-known</li> </ul> </li> <li>▪ Competitors</li> <li>▪ Suppliers</li> </ul>	<u><b>Interaction parties</b></u> <ul style="list-style-type: none"> <li>▪ Certification entities <ul style="list-style-type: none"> <li>- National institutions</li> <li>- International institutions</li> </ul> </li> <li>• Logistics entities</li> <li>• "Standard" registries <ul style="list-style-type: none"> <li>- Clearing centers</li> <li>- Master data providers</li> </ul> </li> <li>▪ Insurance entities <ul style="list-style-type: none"> <li>- Private institutions</li> <li>- Public institutions</li> </ul> </li> <li>▪ Financial entities <ul style="list-style-type: none"> <li>- Banks</li> <li>- Investors</li> <li>- Sponsors</li> </ul> </li> <li>▪ Coaching entities <ul style="list-style-type: none"> <li>- Advisers</li> <li>- Individual external experts</li> </ul> </li> <li>▪ Training entities <ul style="list-style-type: none"> <li>- Advisers</li> <li>- Professional association</li> <li>- Individual external experts</li> </ul> </li> <li>▪ Research entities <ul style="list-style-type: none"> <li>- Universities</li> <li>- Research institutes</li> </ul> </li> </ul>	<u><b>Interaction parties</b></u> <ul style="list-style-type: none"> <li>▪ Governmental organizations <ul style="list-style-type: none"> <li>- Social security</li> <li>- City hall</li> <li>- Civil defense</li> </ul> </li> <li>▪ Associations</li> <li>▪ Interest groups <ul style="list-style-type: none"> <li>- Supporters</li> <li>- Opponents</li> </ul> </li> <li>▪ Regulatory bodies</li> <li>▪ Other entities</li> </ul>	<u><b>Interaction parties</b></u> <ul style="list-style-type: none"> <li>▪ Business organizations <ul style="list-style-type: none"> <li>- Private institutions</li> <li>- Individual experts</li> </ul> </li> <li>▪ Public institutions</li> </ul>
<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Advertising <ul style="list-style-type: none"> <li>- Broadcast</li> <li>- Direct</li> </ul> </li> <li>▪ Customer-oriented transactions</li> <li>▪ External suppliers-oriented transactions</li> </ul>	<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Service acquisition <ul style="list-style-type: none"> <li>- Financial relation</li> <li>- Technological service</li> <li>- Training action</li> <li>- Coaching action</li> <li>- Guarantee action</li> <li>- Knowledge transfer</li> <li>- Consulting services</li> </ul> </li> <li>▪ Agreement establishment</li> </ul>	<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Political relations</li> <li>▪ Seeking support</li> <li>▪ Information transfer <ul style="list-style-type: none"> <li>▪ Broadcast</li> <li>▪ Direct</li> </ul> </li> <li>▪ Social relations <ul style="list-style-type: none"> <li>- Cultural</li> <li>- Patronage</li> </ul> </li> </ul>	<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ External members search <ul style="list-style-type: none"> <li>▪ Invitation</li> <li>▪ Solicitation</li> </ul> </li> <li>• Receiving applications?</li> </ul>

Comparing the two tables, a quasi-total similarity can be found. In fact, at this level of abstraction the differences are mainly at the level of importance of the various concepts and entities. For instance "attracting and recruiting" new members may be a key aspect in a long-term alliance, while the inclusion of external members in a goal-oriented network typically

only happens when the current members in the underlying breeding environment cannot adequately satisfy the requirements.

Other differences may though exist, even when the same terms are used. For instance, external suppliers are a quite normal party that a goal-oriented network needs to interact with. For the long term alliances, this concept is not so relevant, as these networks are not involved in any real production activity. Therefore, for long term alliances we can talk of potential suppliers, instead of actual suppliers. Another example of difference is the concept of “goal”, which is a fundamental characterizing element of the goal-oriented networks. For a long-term alliance it is more reasonable to think in terms of “mission statement”, which includes “generic” long-term goals and strategies.

Finally there are some concepts / entities that are important for one class of networks while they are not so important for the other class. As an example, “competitors” are important in the Market dimension for long-term alliances; for goal-oriented networks they may be negligible, especially in those cases the networked is driven by a firm contract with the customer. In the cases that a goal-oriented networked is created to develop a product/service to put in the market (i.e. not ordered by a concrete customer), then it also makes sense considering competitors.

Nevertheless, although being a bit excessive in some cases, it is reasonable to consider a common table of exogenous elements for the CNO’s reference model, at the general concepts modeling level.

Table 6. Common exogenous elements for CNO’s reference model

<b>I1. Market</b>	<b>I2. Support</b>	<b>I3. Societal</b>	<b>I4. Constituency</b>
<p><b><u>Network identity</u></b></p> <ul style="list-style-type: none"> <li>▪ Mission               <ul style="list-style-type: none"> <li>- Strategy</li> <li>- Goals</li> </ul> </li> <li>▪ References / testimonials</li> <li>▪ Network profile               <ul style="list-style-type: none"> <li>- Who we are</li> <li>- How to contact us</li> </ul> </li> <li>▪ Market strategy               <ul style="list-style-type: none"> <li>- Marketing strategy</li> <li>- Branding strategy</li> </ul> </li> </ul>	<p><b><u>Network identity</u></b></p> <ul style="list-style-type: none"> <li>▪ Network’s social nature               <ul style="list-style-type: none"> <li>- Profit</li> <li>- Not for profit</li> <li>- Governmental</li> <li>- NGO</li> </ul> </li> </ul>	<p><b><u>Network identity</u></b></p> <ul style="list-style-type: none"> <li>▪ Legal status               <ul style="list-style-type: none"> <li>- Legal entity</li> <li>- Informal entity</li> </ul> </li> <li>▪ Values &amp; principles</li> </ul>	<p><b><u>Network identity</u></b></p> <ul style="list-style-type: none"> <li>▪ Members’ attracting &amp; recruiting strategy</li> </ul>
<p><b><u>Interaction parties</u></b></p> <ul style="list-style-type: none"> <li>▪ Customers               <ul style="list-style-type: none"> <li>- Strategic customers</li> <li>- Potential customers</li> </ul> </li> <li>• Competitors               <ul style="list-style-type: none"> <li>- Direct competitors</li> <li>- “Indirect” competitors</li> </ul> </li> <li>▪ Suppliers</li> </ul>	<p><b><u>Interaction parties</u></b></p> <ul style="list-style-type: none"> <li>▪ Certification entities               <ul style="list-style-type: none"> <li>- National institutions</li> <li>- International institutions</li> </ul> </li> <li>▪ Insurance entities               <ul style="list-style-type: none"> <li>- Private institutions</li> <li>- Public institutions</li> </ul> </li> <li>• Logistics entities</li> <li>• “Standard” registries               <ul style="list-style-type: none"> <li>- Clearing centers</li> <li>- Master data providers</li> </ul> </li> <li>▪ Financial entities               <ul style="list-style-type: none"> <li>- Banks</li> <li>- Investors</li> <li>- Sponsors</li> </ul> </li> <li>▪ Coaching entities               <ul style="list-style-type: none"> <li>- Advisers</li> <li>- Individual external experts</li> </ul> </li> <li>▪ Training entities               <ul style="list-style-type: none"> <li>- Advisers</li> <li>- Professional association</li> <li>- Individual external experts</li> </ul> </li> </ul>	<p><b><u>Interaction parties</u></b></p> <ul style="list-style-type: none"> <li>▪ Governmental organizations               <ul style="list-style-type: none"> <li>- Social security</li> <li>- City hall</li> <li>- Civil defense</li> </ul> </li> <li>▪ Associations</li> <li>▪ Interest groups               <ul style="list-style-type: none"> <li>- Supporters</li> <li>- Opponents</li> </ul> </li> <li>▪ Regulatory bodies</li> <li>▪ Other entities</li> </ul>	<p><b><u>Interaction parties</u></b></p> <ul style="list-style-type: none"> <li>▪ Business entities               <ul style="list-style-type: none"> <li>- Private institutions</li> <li>- Individual experts</li> </ul> </li> <li>▪ Public institutions</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Research entities <ul style="list-style-type: none"> <li>- Universities</li> <li>- Research institutes</li> </ul> </li> </ul>		
<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Advertising <ul style="list-style-type: none"> <li>- Broadcast</li> <li>- Direct</li> </ul> </li> <li>▪ Customer/supplier-oriented transactions <ul style="list-style-type: none"> <li>- Bidding</li> <li>- Reporting</li> <li>- Asking quotation</li> </ul> </li> <li>▪ Handling inquiries</li> </ul>	<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Service acquisition <ul style="list-style-type: none"> <li>- Financial relation</li> <li>- Technological service</li> <li>- Training action</li> <li>- Coaching action</li> <li>- Guarantee action</li> <li>- Knowledge transfer</li> <li>- Consulting service</li> </ul> </li> <li>▪ Agreement establishment</li> </ul>	<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Political relations</li> <li>▪ Seeking support</li> <li>▪ Information transfer <ul style="list-style-type: none"> <li>▪ Broadcast</li> <li>▪ Direct</li> </ul> </li> <li>▪ Social relations <ul style="list-style-type: none"> <li>- Cultural</li> <li>- Patronage</li> </ul> </li> </ul>	<u><b>Interactions</b></u> <ul style="list-style-type: none"> <li>▪ Member searching <ul style="list-style-type: none"> <li>▪ Invitation</li> <li>▪ Solicitation</li> </ul> </li> <li>▪ Receiving applications</li> </ul>

This set of concepts is certainly not complete and will evolve with the emergence of new collaborative forms and the evolution of the markets and society. Nevertheless they give a good indication of relevant aspects to consider relative to the interactions between the CNO and its surrounding environment.

#### 5.2.4 Exogenous Interactions definition for CNO's reference model

This section includes textual definitions of common elements in the exogenous perspective of the CNO's reference model. Later, in Section 5.3 these elements are crossed against the life cycle stages of the CNO's reference model.

### 11. Market dimension

#### Network identity

- Mission Typically includes the mission statement of the CNO, representing its purpose for existence. Of relevance to the market it shall include the target market, range of products / services, geographic domain, and expectations. It can be divided into "strategy" and "goals". In the case of goal-oriented networks it might be reduced to the definition of the specific goal that triggered the creation of the coalition.
- References / testimonials List of relevant past successful collaboration stories and / or short testimonials from customers, attesting the level of competence / professionalism of the CNO.
- Network profile Brief information about the members of the CNO ("who we are") and contact information.
- Market strategy Defines how the CNO plans to engage customers, prospects and competitors in the market arena for the success of its mission. It involves elements such as:
  - Marketing strategy – defining how the CNO concentrates its resources on the most relevant opportunities for achieving its goals and a sustainable competitive advantage.
  - Branding strategy – in order to create a unique identity for the CNO that will differentiate it from the competition and allow (potential) customers to easily associate it with the network. It also defines how the identities of the individual members are related to the common identity of the CNO.

### ***Interaction parties***

- Customers Identifies those entities that can order / receive the products or services produced by focused alliances of network members. In the case of long-term alliances this term refers to the potential customers through which CNO brokers can find collaboration opportunities. For goal-oriented networks it represents those entities that have put the order that triggered the formation of the VO/VT or the entities that will be targeted as potential clients for the product / service being developed by the consortium.
- Competitors Represents the networks or single organizations that compete with the CNO in the same market arena.
- Suppliers Refers to the external entities, not members of the CNO, that might provide raw materials, components, or base services on top of which the CNO builds its own products / services. In the case of long-term alliances this means the set of potential suppliers while in the case of goal-oriented networks it refers to actual suppliers.

### ***Interactions***

- Advertising Refers to the actions devoted to deliver information about the competencies and (potential) products / services to the market in order to attract customers. Various mechanisms can be applied including broadcasting to the target market actors or direct contacts with specific potential customers.
- Customer/supplier-oriented transactions Includes the set of interactions with potential or actual customers and/or external suppliers. Examples of such interactions are:
  - Bidding – when the CNO (or a subset of its members) sends a bid in response to a call for tenders or auction issued by an actor in the market.
  - Reporting – in case of an already acquired contract with a customer, several reporting actions take place according to the agreements established with this customer.
  - Asking for quotation from external suppliers.
- Handling enquiries Refers to the reception of inquiries from (potential) customers about the potential interest of the CNO in a specific business opportunity or about the competencies of the network. It also includes the provision of answers to those inquiries.

## ***12. Support dimension***

### ***Network identity***

- Network's social nature Represents the “identity” of the CNO in terms of its social and economic objectives. Various options can be considered:
  - A profit-oriented organization, the typical case in business scenarios.
  - A not-for-profit organization.
  - A governmental organization (which is typically a not-for-profit organization).
  - A non-governmental organization (which is also typically a not-for-profit organization).

The interactions with a number of support entities will depend on the nature of the CNO (e.g. there might be special incentives such as tax reductions when dealing with not-for-profit organizations).

### ***Interaction parties***

- Certification entities Those entities that are entitled to issue certificates of compliance with establish regulations or norms. For instance, certifications of quality, such as compliance with ISO 9000. These entities can operate at national or international level.
- Insurance entities Including insurance companies or associations of insurance companies that can provide specific insurance policies for the CNO and its members. A special case would be new forms of social security, namely for the case of professional virtual communities.
- Logistics entities The entities that manage and control the flow of goods, energy, information and other resources (materials, products, etc.) along a value chain. These operators, if not part of the CNO, are important support entities for the operation of a geographically distributed network.
- «Standard» registries Entities that keep centralized formal records of information such as brand names, official registration numbers, domain entities (Internet), copyrights, etc. Examples of such entities include:
  - Clearing centers – locations for clearing permissions.
  - Master data providers – offering reference data for specific business branches.
- Financial entities Those entities that can give financial support to the CNO, either in business terms or as a sponsoring action. This group includes banks, investors, and sponsors (either private or governmental).
- Coaching entities Refers to entities, either people or organizations, which can help the network members in operating as a collaborative organization. Not to be mistaken with network management, they focus on non-directive questioning, provoking and helping network members to analyze and solve their own challenges.
- Training entities Organizations or people that can support the CNO by providing (on demand) training on specific technical subjects of their operating domain (e.g. new processes, new technologies) and therefore contributing to enrich the set of competencies of the network.
- Research entities Institutes (public or private) and universities that can offer targeted research activities in support of the CNO, although they are not part of the network.

### ***Interactions***

- Service acquisition Involving a large set of interactions between the CNO and the support institutions for acquisition of specific services. According to the various supporting parties, there could be acquisitions of:
  - Certification services
  - Financial support
  - Technological services
  - Training actions
  - Coaching actions
  - Guarantee services
  - Knowledge transfer
  - Consulting services
  - etc.
- Agreement establishment Refers to the protocols and actions involved in the established of agreements between the CNO and support institutions. Unlike a

specific service acquisition, these agreements typically refer to a longer-term cooperation arrangement.

### **13. Societal dimension**

#### **Network identity**

- **Legal status** Gives indication of the particular place of the CNO in the society, relative to the law, which determines the laws that affect or regulate the existence and operation of the network. This status depends on the particular legal provisions existing in each country or geographical region where the network operates. Some CNOs may constitute a legal entity, in one of the available forms (e.g. association, joint venture, etc.), or be an informal association.
- **Values & principles** This element states the value system and the ethical, moral, and social principles that guide the behavior of the CNO. This gives the society an indication of what can be expected from the network. Such values & principles are closely related to the mission statement and represent a complementary perspective of the CNO's identity.

#### **Interaction parties**

- Governmental organizations Are the set of governmental institutions and departments that the CNO might need to interact with. It includes central, regional, and local government related entities such as ministries, city hall, regional development agencies, social security, civil defense entities, etc.
- Associations Includes industry and commerce associations, professional associations, chambers of commerce, etc. The CNO might interact with them in terms of getting support, access to information dissemination channels, etc.
- Interest groups Are relevant, formal or informal, groups in society that are organized to defend specific economic, cultural, or social interests and that might play a role of supporters or opponents of the CNO.
- Regulatory bodies Public or private entities that issue regulations and standards on how businesses and some professions can be practiced. Examples include the standardization organizations, some professional associations, national strategic infrastructures regulators (e.g. tele-communications, energy).
- Other entities Any other relevant entity that plays a significant role in the local society where the CNO operates and that might affect or influence the network.

#### **Interactions**

- Political relations Relates to the interactions with the power groups, often as a lobbying activity, in order to influence political decision making in the domains that affect the CNO.
- Seeking support Actions in order to get direct or indirect support for the CNO from the relevant actors in society.
- Information transfer Includes all exchanges of information between the CNO and the social actors. Some of these interactions have the objective of raising awareness for the activities of the CNO and their importance to the (local) society and, as such, constitute also a

- Social relations

 mechanism to indirectly seek support.
   
 Relate to the contributions of the CNO to activities of benefit to the society in general. Examples include sponsoring cultural activities, being the patron of events, scholarships, regional publications, sport activities, etc.

#### **14. Constituency dimension**

##### ***Network identity***

- Members' attracting & recruiting strategy

 An important element of the "identity" of the CNO, defining rules for membership, attraction mechanisms for engaging new members, as well as the recruiting mechanisms. In the case of long-term alliances it means the policies to get new entities adhering to the principles of the established breeding environment or professional virtual community. In the case of goal-oriented networks it defines general principles for resorting to external members when there are no appropriate candidates in the breeding environment.

##### ***Interaction parties***

- Business entities

 Refers to the recruitment universe for business-oriented CNOs. This universe includes business organizations (e.g. enterprises), and/or individual professionals.
- Public institutions

 Refers to the universe of public institutions that might be interesting to attract to the CNO. In case of collaborative e-government, these institutions are the natural members. In the case of business oriented CNOS, public institutions can typically participate as supporting members.

##### ***Interactions***

- Member searching

 Interactions with the constituency actors in order to identify and select potential new members for the CNO. This can involve a number of mechanisms such as direct invitation, open solicitation / calls, etc.
- Receiving applications

 Actions related to the reception of applications for membership and sending the corresponding response after a decision is made.

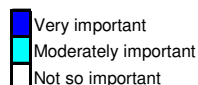
## 5.3 Representation schemas

### 5.3.1 Concepts along the life-cycle

The following two tables show how the identified elements appear / are used along the life-cycle of the CNO.

Table 7. Endogenous elements along the CNO life-cycle




E1. Structural	c	o	e	m	d	E2. Componential	c	o	e	m	d	E3. Functional	c	o	e	m	d	E4. Behavioral	c	o	e	m	d
<u>Active entity</u>						<u>Active entity</u>						<u>Active entity</u>						<u>Active entity</u>					
<b>Actor</b>						---						---						---					
Primary-entity						<u>Passive entity</u>						<u>Passive entity</u>						<u>Passive entity</u>					
Support-entity						<b>Domain specif. dev</b>						---						---					
<u>Passive entity</u>						Manufacturing machin						<u>Action</u>						<u>Action</u>					
---												<b>Fundam. Process</b>						---					
<u>Action</u>						<b>ICT resource</b>						Main CNO manag proc						<u>Concept</u>					
---						Hardware						- Roles/respons. Mng.						<b>Prescript. behavior</b>					
<u>Concept</u>						Internet						- Trust management						Cultural principles					
<b>Role</b>						Software						- Data/Know. Manag.						- Regional traditions					
Participant						- CNO Manag. System						Particip. operat. proc.						- Business culture					
- Administrator												- Roles/resp. Update rq.						- NGO culture					
- Support provider						<b>Human resource</b>												Governance principles					
- Broker						HR of Network						<b>Backgr. Process</b>						- Net. gen. principles					
- Planner						HR of Actor						Network manag. proc.						- Domain specif. princ.					
Spot member												- Creation reposit.s						Incent.&reward. policy					
						<b>Info/knowl./asset r.</b>						- Manag. Sys. Setup											
<b>Relationship</b>						Profile/compet. data						- Bulk regist. particip.s						<b>Obligatory behavior</b>					
Cooperation/Collaborat.						- Actor's profiles data						- Net. Inherit. mang.						Network bylaws					
Trusting						Inheritance information						- Decis. support man.						- Conflict resol. policy					
Communication /info flow						Ontologies						- Members' rewarding						- Secur. issues policy					
Exchanging & sharing						- Network ontology						- Ontology manag.						- Bylaw amend.s pol.					
Socializing						- Domain's ontology						- Ontol. Evolution man.						- Financial policies					
Control/supervision						Data/knowl. Reposit.s						- Performance man.						- Contract enfor. pol.					
						Templates						- IP Management						Internal regulations					
<b>Network</b>																		- ICT Use Guideline					
						<b>Network outcome</b>						<u>Concept</u>						- Sanctions principles					
												<b>Methodo.&amp;Approach</b>						General law					
						<u>Action</u>						Net. setup handling											
						---						- Govern/valu sys def						<b>Contract&amp;agreeme.</b>					
						<u>Concept</u>						Net. operation handling						Net adhesion/coal. agr.					
						---						- Members' info quality						Agreement amendm.s					
												- Net's info./policy tr.											
												- Social processes						<b>Constraint&amp;condit.</b>					
												- Govern. rules updat.						Confidentiality constr.s					
												- Risk management						Legal constraints					
												- Conflict resolution						Standards constraints					
												- IP management						Internal norm. constr.s					
												- Technology adoption						Physical constraints					
												- Ontol. manag.&updates											
												Net. evolution handling											
												- Rev. gathered knowl.											
												- Trans. to new o. str.											
												Net. Dissolut./inherit.											
												- knowl.&assets transfer											
												- Re-defining roles											



c- creation o- operation e- evolution m- metamorphosis d- dissolution

Table 8. Exogenous interactions along the CNO life-cycle

I1. Market	c	o	e	m	d	I2. Support	c	o	e	m	d	I3. Societal	c	o	e	m	d	I4. Constituency	c	o	e	m	d
<b><u>Network identity</u></b>						<b><u>Network identity</u></b>						<b><u>Network identity</u></b>						<b><u>Network identity</u></b>					
Mission						CNO's social nature						Legal status						Attract.&recruit. Strat.					
References/testimonials												Values & principles											
Network profile																							
Market strategy																							
<b><u>Interaction parties</u></b>						<b><u>Interaction parties</u></b>						<b><u>Interaction parties</u></b>						<b><u>Interaction parties</u></b>					
Customers						Certification entities						Governmental organ.s						Business entities					
Competitors						Insurance entities						Associations						Public institutions					
Suppliers						Logistics entities						Interest groups											
						Standard registries						Regulatory bodies											
						Financial entities						Other entities											
						Coaching entities																	
						Training entities																	
						Research entities																	
<b><u>Interactions</u></b>						<b><u>Interactions</u></b>						<b><u>Interactions</u></b>						<b><u>Interactions</u></b>					
Advertising						Service acquisition						Political relations						Member searching					
Customer/supplier-oriented transactions						Agreement establishment						Seeking support						Receiving applications					
Handling inquiries												Information transfer											
												Social relations											

 Very important  
 Moderately important  
 Not so important

c- creation o- operation e- evolution m- metamorphosis d- dissolution

Contributed by: Uninova, UvA

### 5.3.2 A comprehensive *semantic-indexing schema* for ARCON

The ARCON reference modeling of the CNO is developed as an **evolving system**, constituting two parts:

- 1) **ARCON modeling framework**,
- 2) **ARCON reference model**,

that are both represented in details and partially formalized. Namely, at the current stage of the ARCON reference model development for CNOs: 1) every **meta-element** of the ARCON modeling framework is well described and exemplified, and 2) a textual description accompanies every **element** of the ARCON reference model of CNOs, that in fact represents the full *General Representation layer* of the developed CNO reference model. Clearly, the ARCON modeling framework can be used to develop reference models for any kind of CNOs, and at any level as represented in the taxonomy of Fig.3.1, e.g. for Virtual government, VBE, Goal-oriented network, etc.

ARCON is an evolving system, and ARCON reference modeling of CNOs has just completed its first stage of development. We foresee that while the ARCON modeling framework has reached a near-maturity stage (if not already fully mature), in the coming years the ARCON reference model of different kinds of CNOs will be developed and undergo a number of improvement/extension releases. Consequently, ARCON is being equipped with an **evolution environment** to facilitate its incremental improvement and maintenance of its reference models (as well as the framework if needed) until reaching its final stage and turning into standards. The evolution environment of ARCON is addressed in Section 6.

Nevertheless, for the evolving system of ARCON, it is necessary to define **unique identifiers for each element** of the reference models that may **belong to any cell in the ARCON 3D matrix**, as well as each **meta-element** of its modeling framework. Instead of choosing an ad-hoc indexing system for these purposes, we introduce a **semantic-indexing schema** that uniformly generates unique identifiers. To put it simply, the semantic-index for ARCON elements/meta-elements is a notation based on the concatenation of all their *elemental characteristics*. This indexing approach is applied to generating unique identifiers for the elements of both the ARCON modeling framework and the ARCON reference models.

The ARCON index is **color-coded**, namely every index-parameter is always represented in one specific color, e.g. *Life-cycle-stages* (Y-axis of the ARCON matrix) are represented in “red”, model intents (z-axis of the ARCON matrix) are represented in “violet”, all environment characteristics-related information (X-axis of the ARCON matrix) are represented in “blue”, the *mnemonic-labels for element* are represented in “light-green”, etc., which in turn makes it easier to locate them.

*Elemental characteristics of the ARCON-meta-element-index (Fig. 5.4):*

Depending on the axis being modeled, the elemental characteristics for the indices of all meta-elements in the ARCON **modeling framework** (the modeling framework can also be called the **ARCON-intension**) follows:

- For the Model Intent perspective: **Model-Intent (M)**, and a mnemonic-Label for the **meta-element (Lb)**
- For the Environment Characterization perspective: **Sub-space (S)**, **Dimension (D)**, **Nature-of-element (N)**, and a mnemonic-Label for the **meta-element (Lb)**
- For the Life Cycle perspective: **Life-cycle-stage (L)** and a mnemonic-Label for the **meta-element (Lb)**

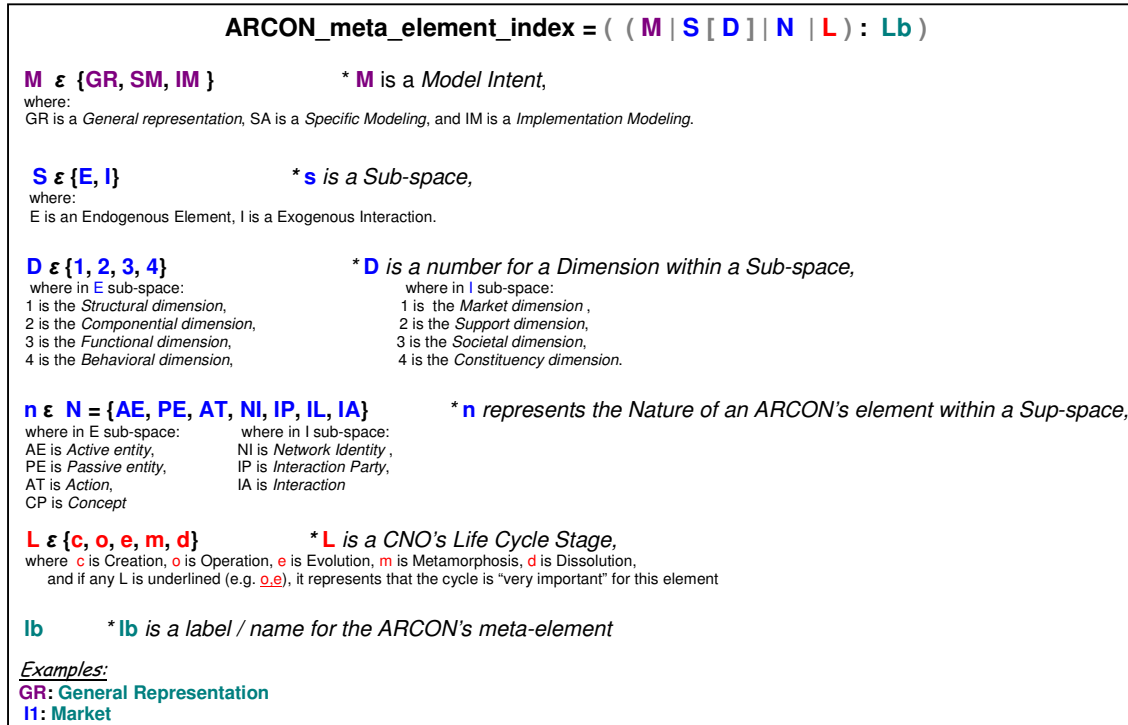


Figure 5.4 – Semantic-indexing for meta-elements in the ARCON reference modeling framework

*Elemental characteristics of the ARCON-element-index (Fig. 5.5):*

An ARCON reference model for a specific CNO, is an instantiation of the ARCON modeling framework that provides the **content** within this framework (the content - the reference model can also be called the **ARCON-extension**), to comprehensively capture all aspects of that CNO. The elemental characteristics for the indices of all elements in the ARCON reference model follows:

- **CNO-type (C)**, **Model-Intent (M)**, **Sub-space-dimension (SD)**, **Nature-of-element (N)**, **relative-order-number (E)**, **life-cycle-stages (Ls)**, and a **mnemonic-Label for the element (Lb)**

Please notice that, as you can also see in Fig. 5.7, with our inclusion of all life cycle stages related to an ARCON element (e.g. "Trusting relationship") at once as a part of its semantic-index (e.g. with the "(coemd)" in its index), we are in fact folding the appearances of this element in all the cells within a column (e.g. the structural dimension of the Endogenous sub-space), in every Model-Intent layer in which it may appear (e.g. the GR Model-Intent layer for the reference model of the CNOs).

About the nature-of-element, in both endogenous and exogenous sub-space, this elemental characteristic exhibits the kind (nature) of the modeled element and can be used for example to decide on the type of "modeling-tool" to be used for the element, in relation to its Specific Modeling layer representation. For example the nature of the "Role" element specified in the Structural dimension of the CNOs's reference model is "concept", namely it is an intangible aspect.

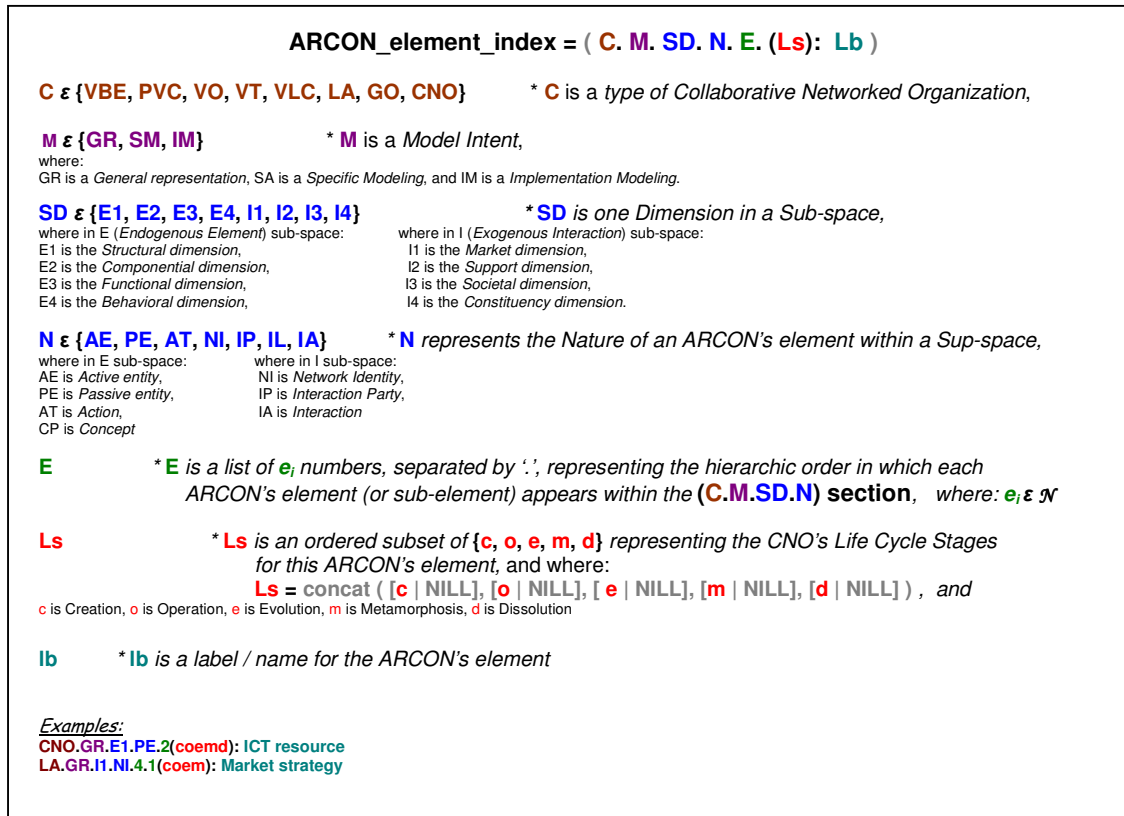


Figure 5.5 - Semantic-indexing for elements in the ARCON reference models

Therefore, the complete model definition of each element in the ARCON reference model also includes (Fig. 5.6):

- Relationship (Rs), Model-representation-extension (X)

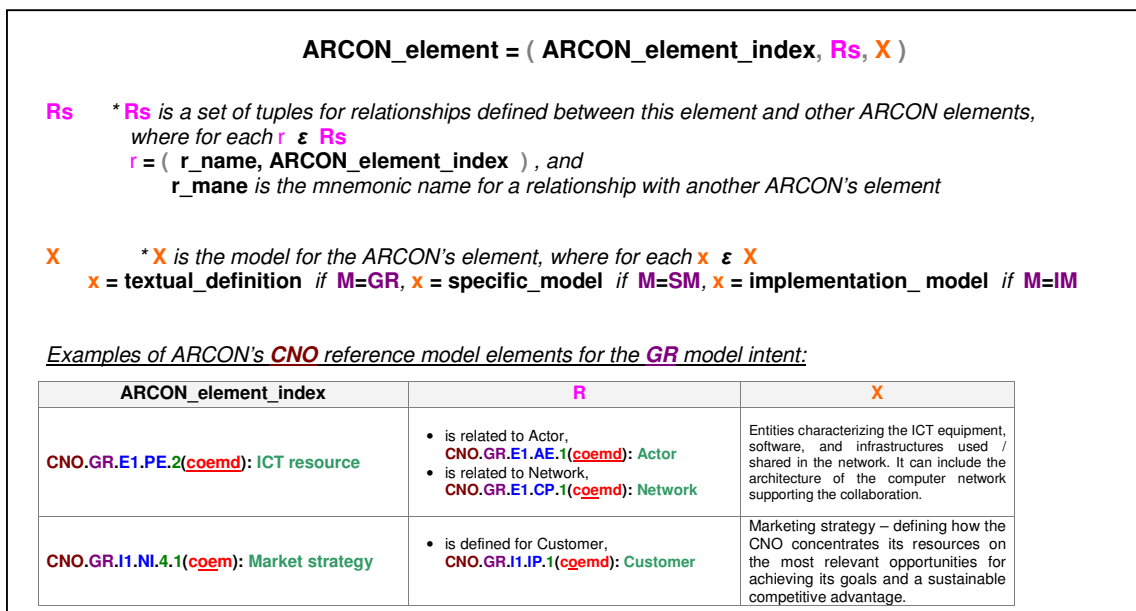
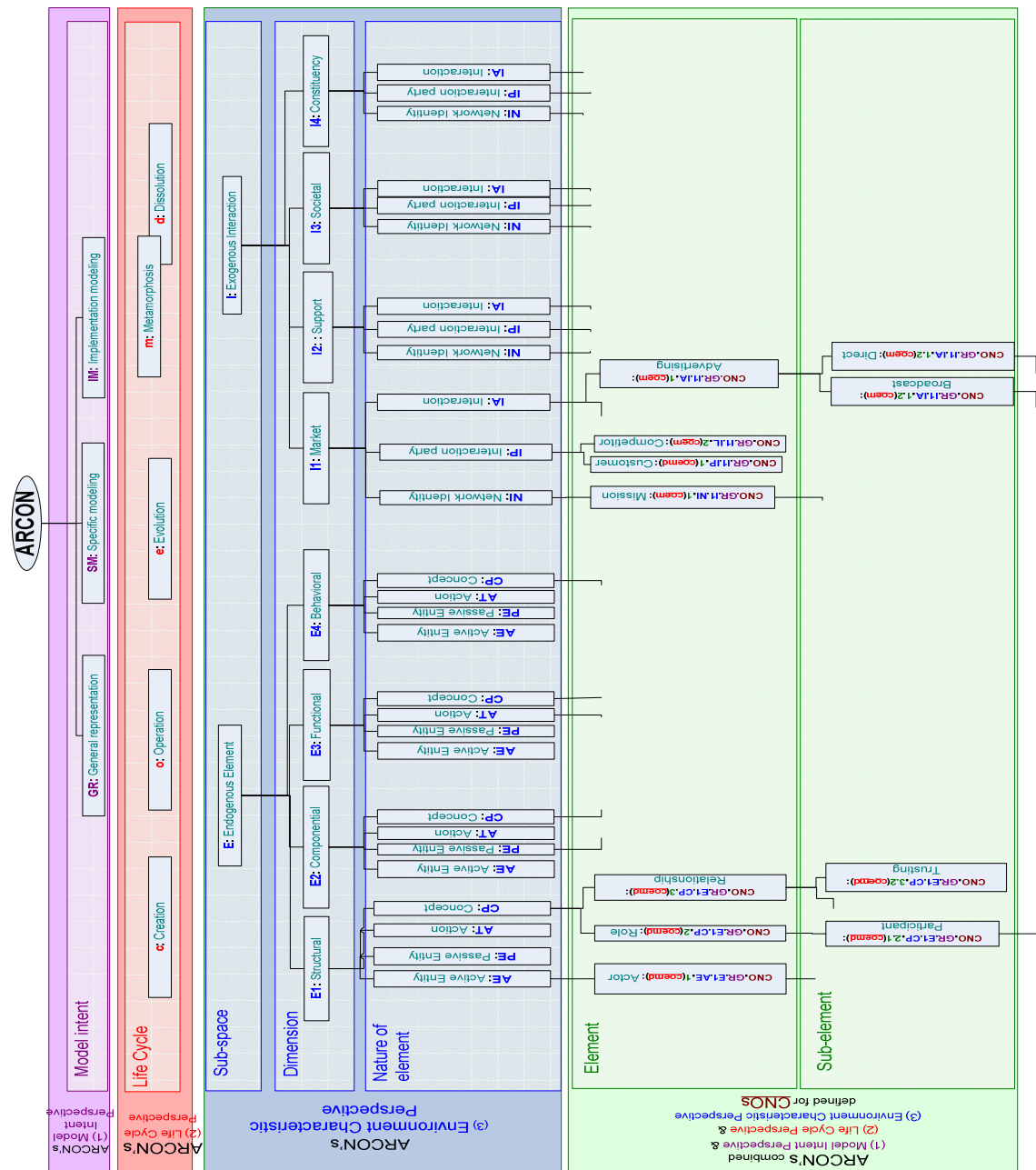


Fig. 5.6. ARCON element representation

Figure 5.7 partially illustrates the visual 2D representation of ARCON, related to the **General Representation (GR) model-intent layer of the CNO reference model**, as defined in the report. Besides exemplifying the ARCON elements (related to this layer) for CNO reference models (with their indices), this diagram also illustrates the ARCON meta-elements (with their indices). The **Index-inheritance** is explicitly represented among the ARCON elements, and implicit from the ARCON meta-elements to the ARCON elements.



**N1:** Please note that every element/sub-element (in the green area - the lowest 2 horizontal sections of this diagram) has many links to different stages of the Life Cycle, as well as Model Intent perspectives. However since this is a 2D representation, the need for the visualization of all these links to the Life Cycle and Model Intent are replaced by their representation within the indices.

**N2:** Please note that at the "General Representation model of CNOs all elements/sub-elements in the green area - the lowest 2 horizontal sections of this diagram should have their textual description in order to become complete. Please see the ARCON's table of definitions in the report.

Figure 5.7 – Indexed meta-elements, and example elements related to the GR model-intent layer of the CNO reference model, and the Index-Inheritance hierarchy

Figure 5.8 represents two example tabular representations related to the ARCHON reference model of CNOs, illustrating partially the content of Tables 3 and 6 in Section 4.

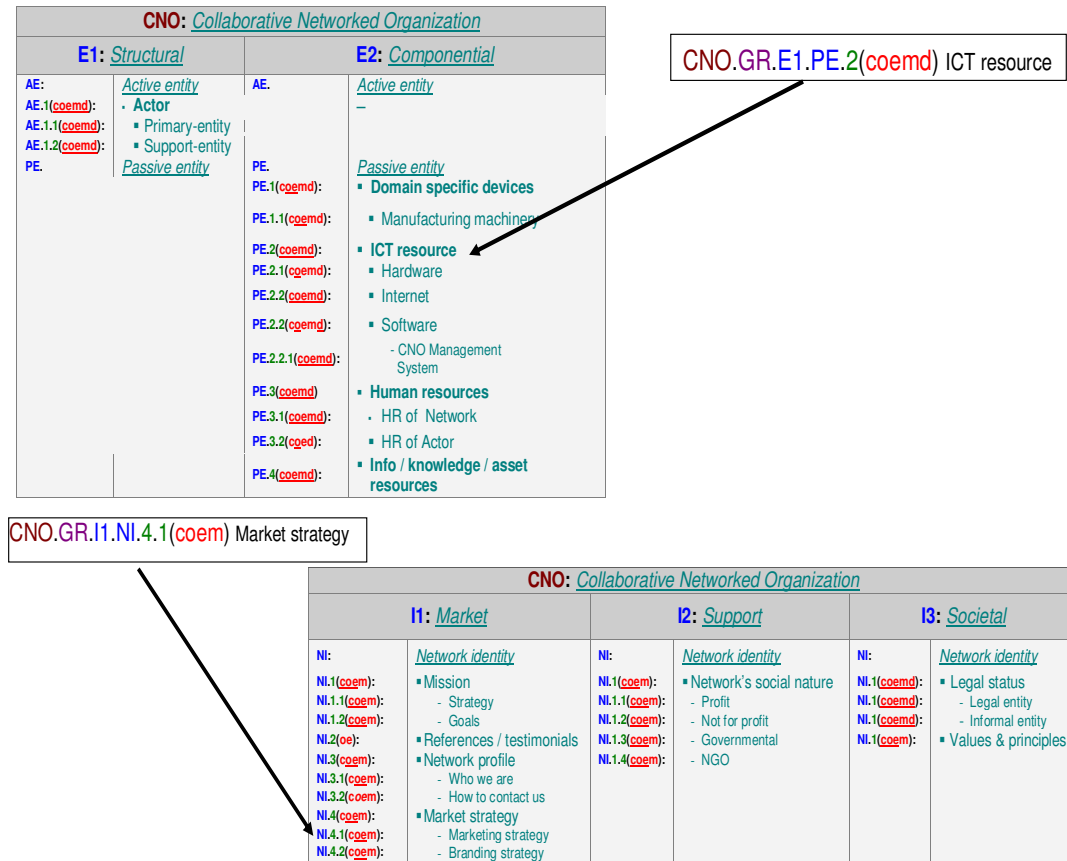


Figure 5.8 – ARCON example tables for reference model of CNOs

As explained in section 5.1, a bottom up approach is usually applied for the development of reference models for CNOs at the higher level of the taxonomy (Figure 3.1) from the lower level CNOs. In this approach usually the “common” elements are located and extracted at the CNOs of the lower level individually developed reference models, and used to gradually build up the elements of the higher level CNO reference model. Figure 5.9 represents a **general derivation rule** that can be applied to the indexed ARCON elements at the lower level CNOs in order to derive the common elements for the higher level CNO. This Figure also represents an example of how this general derivation rule can be applied for the CNO reference model presented in Chapter 4 out of the two reference models of *Long-term strategic network*, and *Goal-oriented network*.

ARCON_element = ( ARCON_element_index, <b>Rs</b> , <b>X</b> )		
<p><b>Rs</b>    *<b>Rs</b> is a set of tuples for relationships defined between this element and other ARCON elements, where for each <math>r \in Rs</math></p> <p><math>r = ( r\_name, ARCON\_element\_index )</math>, and</p> <p><math>r\_name</math> is the mnemonic name for a relationship with another ARCON's element</p> <p><b>X</b>        *<b>X</b> is the model for the ARCON's element, where for each <math>x \in X</math></p> <p><math>x = textual\_definition</math> if <b>M=GR</b>, <math>x = specific\_model</math> if <b>M=SM</b>, <math>x = implementation\_model</math> if <b>M=IM</b></p> <p><i>Examples of ARCON's <b>CNO</b> reference model elements for the <b>GR</b> model intent:</i></p>		
ARCON_element_index	<b>R</b>	<b>X</b>
<b>CNO.GR.E1.PE.2(coemd)</b> : ICT resource	<ul style="list-style-type: none"> <li>is related to Actor, <b>CNO.GR.E1.AE.1(coemd)</b>: Actor</li> <li>is related to Network, <b>CNO.GR.E1.CP.1(coemd)</b>: Network</li> </ul>	Entities characterizing the ICT equipment, software, and infrastructures used / shared in the network. It can include the architecture of the computer network supporting the collaboration.
<b>CNO.GR.I1.NI.4.1(coem)</b> : Market strategy	<ul style="list-style-type: none"> <li>is defined for Customer, <b>CNO.GR.I1.IP.1(coemd)</b>: Customer</li> </ul>	Marketing strategy – defining how the CNO concentrates its resources on the most relevant opportunities for achieving its goals and a sustainable competitive advantage.

Figure 5.9 – Common elements derivation rule (based on their indices) for CNO reference modeling

With the generalization rules defined in Fig. 5.9, we can in fact reason about derivation of common elements for building the CNO reference models.

## 6. ARCON MODEL EVOLUTION GUIDELINES

The purpose of this section is to recommend a process for maintaining and evolving the ARCON reference model. Collaborative Networks is a young field and new organizational forms and collaboration practices are emerging at a fast pace. Therefore, although a base reference model is fundamental to give the area a basis to support a more coherent development, it is clear that a complete model cannot be developed at this stage in time. Some perspectives have been more intensively addressed in the past than others. For instance, the endogenous perspective has received much more attention than the exogenous one in most of the past projects. Similarly, in the scope of the endogenous perspective, most modeling efforts have focused on the structural and functional dimensions, while the behavioral dimension has received very little attention. Therefore, the level of maturity of the elements currently included in ARCON reference model is quite diverse and the reference model shall be seen as an evolving construct that shall be incrementally improved in time

The following actors are considered to play a major role in this process:

- **CN community** – all professionals, researchers, educators, and practitioners, involved in the development and implementation of collaborative networks.
  - **Submitter** – referring to a member of this community that suggests revisions & modifications to specific aspects of the reference model.
- **AMC** – ARCON Maintenance Committee – a group of experts in CN who take the responsibility for maintenance and evolution of this model.
  - At this stage this role is performed by the WP5 of ECOLEAD.
  - After ECOLEAD this mission is planned to be transferred to a dedicated group of experts, in the context of the SOCOLNET (Society of Collaborative Networks).
  - The AMC may appoint some temporary **Revision Teams** to deal with specific revision proposals.

The following high-level phases are also considered for the maintenance process:

- **Submission** – Submitters suggest revisions / modifications to the reference model. The AMC itself shall encourage the CN community to periodically discuss the model and elaborate well-structured proposals for modification.
- **Evaluation** – The AMC evaluates the proposals in terms of global consistency and compliance with ARCON as well as the trends in the field in order to decide if it is worthwhile to consider the suggested revision.
- **Revision** – The AMC selects a team to proceed with the revision and to collect feedback from the stakeholders (e.g. through surveys, workshops, meetings).
- **Approval** – The AMC reviews the final version of the reference model and either approves it or returns it to the revision team for further refinement.
- **Rollout** – Upon final acceptance of a revision / modification, a publication and dissemination plan is defined, and the new version of the CNO reference model is released.

In order to reach the widest acceptance of the reference model, the AMC might establish alliances with the most relevant initiatives (e.g. research projects, other international initiatives and special interest groups and societies) on Collaborative Networks active in each moment.

The following diagram (inspired from the FEA process (FEA, 2005b)) illustrates the main steps of the suggested evolution process.

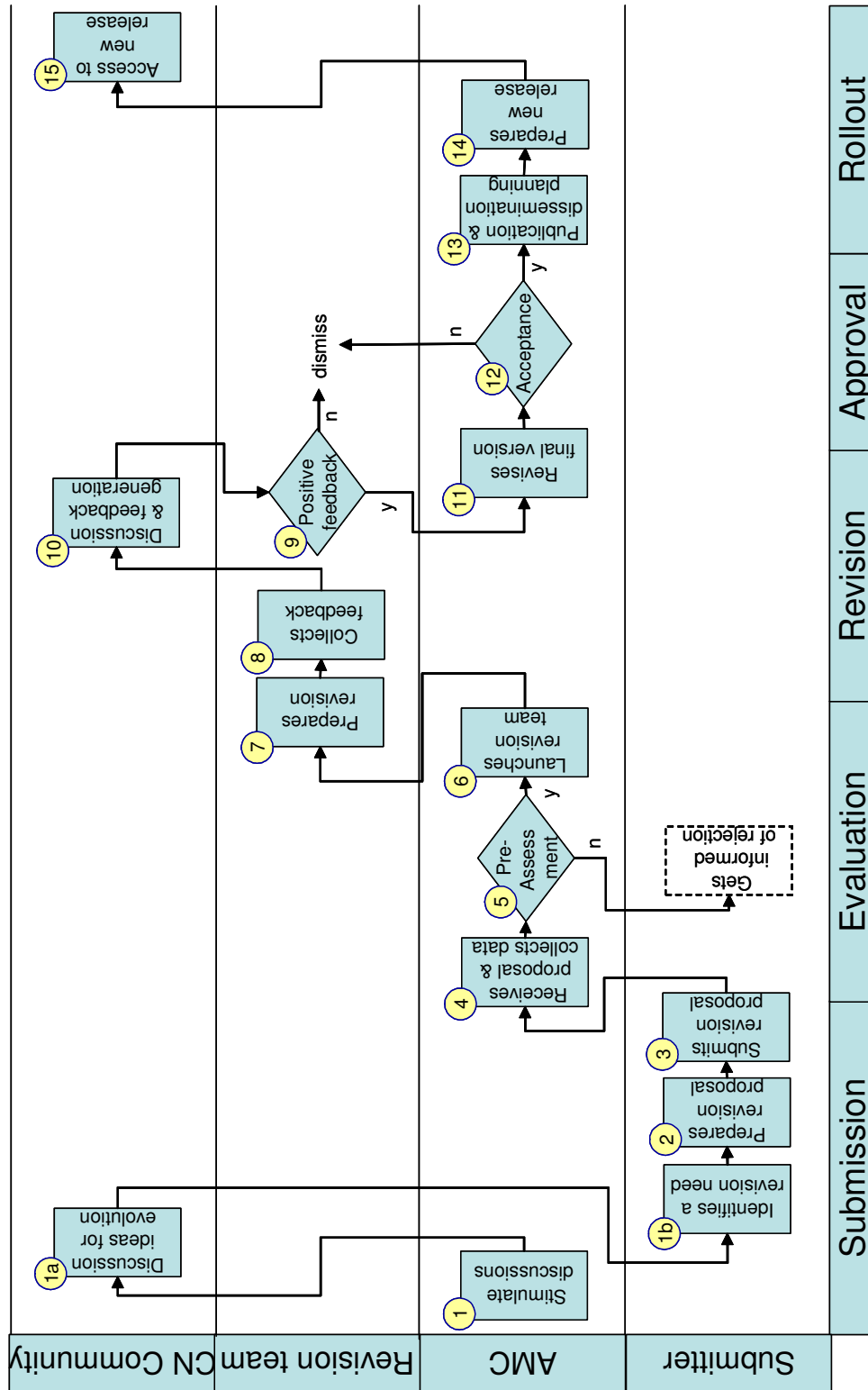


Figure 6.1 – A simplified view of the ARCON updating process

In the long term, after partial maturity is achieved, besides seeking acceptance within the research community, two other following directions shall be pursued for making ARCON recognized and accepted as the reference model for CNOs.

- Seeking **Fitness Evaluation** for ARCON by real case applications, targeting & knowledge dissemination among existing and emerging CNOs.
- Attempt towards wide recognition of ARCON and its endorsement by authorized bodies, e.g. IFIP and others.

## 7. CONCLUSIONS AND NEXT STEPS

Following the plan devised in previous deliverables (D52.1 and D52.2), this report includes a revised version of the ARCON modeling framework and a first contribution to a reference model for Collaborative Networks.

As a baseline for this work we took into account both the state of the art, namely previous relevant works on reference modeling as discussed, the progress made in the ECOLEAD's technical WPs, and inputs from external experts.

Developing a reference model for a complex and rapidly evolving domain such as Collaborative Networks cannot be a “one shot” initiative. Therefore, the adopted approach was to produce a first categorization of concepts, through the selected modeling perspectives and dimensions, and the introduction of a set of definitions. At the considered level of abstraction, the “General Representation” model intent layer, the textual definition of the elements are provided. When more specific models are developed for particular classes of networks, for the “Specific Modeling” layer, different more formal modeling methods shall be used.

As this is just an initial step, which needs to be followed by future revisions and improvements, a maintenance and evolution process for the reference model was also introduced.

Nevertheless we expect that this work can help those entering the field of CNOs, to more rapidly acquire a comprehensive understanding of the paradigm.

It shall be noted that a model does not become a reference just because it is a comprehensive and technically sound model. It is also necessary that it becomes known and accepted by the members of the target community. Therefore, in addition to the technical developments whose results are reported here, it is fundamental to continue the dissemination strategy, which is being done through conferences, journal publications, and the book on the theoretical foundation for CNOs, being prepared.

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