

ASPECTS REGARDING VIRTUAL ENTERPRISES AND OF COMPATIBILITY OF PARTNERS

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Abstract: Massive expansion of the achievements of human activity in virtual enterprises/virtual organizations, a manifestation of Collaborative Networks, brings a consistent experience to scientists, who produced and/or modernize the theoretical support for these new forms of organizations. Making and, soon, implementing at European Union (EU) level of the “eCall” system, part of the general system “112”, is such a successful experience, as an proofing experience of collaborative network.

Keywords: Virtual Enterprise, Collaborative Networks, 112, eCall, VE

1. INTRODUCTION

The name "Virtual Enterprise" has several meanings, designating different fields of knowledge. Thus, in teaching, according to the “California Network Virtual Enterprise, International Website” we have: “**A Virtual Enterprise** is a simulated business that is set up and run by students to prepare them for working in a real business environment. With the guidance of a teacher ("consultant") and real-world business partners, the students determine the nature of their business, its products and services, its management and structure, and engage in the daily operations of running a business”. In real economic activity "A *virtual enterprise* can be described as an already existing opportunistic temporary alliance of several separate companies which meet ad-hoc, pooling skills, expertise and resources to better respond to business opportunities and whose cooperation is based on the use of computer networks [1, 2]. Virtual enterprise paradigm has emerged in response to rapid market development trends, due to economic globalization and the emergence of large economic blocks. It was already been shown that, even if they bring great benefits to partners and consumers, in Europe these networks are hampered by uncertainties in government regulations, While in the U.S. were already over 250,000 such enterprises since 1997. Treating the issues that strangle the agile collaboration potential of the network of firms is of great importance both for the old European Union member states and, also, for new member states, especially as virtual enterprises prospects faster penetration on the common market. Due to very good results obtained by such companies, scientists everywhere - and not only them - have made and make efforts to create theoretical and methodological support to optimize the effects of using virtual enterprises.

2. GENERAL NOTIONS

Traditional methods of organization and management of production, severely limits the expansion and reconfiguration of production capacity due to high costs involved by them. In addition, these methods are becoming less and less adequate to the complexity inherent in existing production systems, which can incorporate thousands of active components (people, machines, technological lines, information, etc.) and between which is established billions of interdependencies.

In theory, centralized, hierarchical methods of production management prevailing today, have indisputable advantages - all information can be gathered in one place and at a given time, an optimal solution can be formulated, to solve an emerging issue, taking into account known factors, which allows direct control of the various stages of solving the problem. In reality, however, that method of organization and management is particularly complex, because it is difficult to change, adapt and to innovate centrally driven processes.

Companies today must cope with a dynamic environment, where changes rapidly increase. Market opportunities appear suddenly and disappear just as fast. Adaptability of traditional companies such changes is reduced. With customer demand for the renewal of new, low cost, high quality, in shorter intervals from conception to market apparition, manufacturers are forced to shorten product development cycles, adaptation and ensure better quality. New organizational forms are required.

What would be the basic requirements that should fulfill a 21st century enterprise, to respond adequately to continuous changes that markets, new technologies and competitors introduce continuously and frequently increasing, in their environment? Shen and Norre (1999) synthesized these basic requirements, that must meet the next generation of production systems to withstand global competition, continuous innovation and rapid changes in market demand. They are:

- **Integrating the enterprise:** to better cope with global competition and rapidly respond to market requirements, an individual or collective enterprise will have to be integrated with all its management systems (e.g. purchasing, sales, production, planning and scheduling, control, transportation, resources, personnel, materials, quality, etc..) and its partners, using the Intranet and Internet networks;
- **The distributed organization:** for effective integration between distributed organizations, it will be necessary to use distributed knowledge systems, which make quick link between customer demand on the market and management of production resources within each component of the organization;
- **Heterogeneous environments:** such knowledge management systems will require heterogeneous software and hardware, distributed both in the manufacturing and information environment;
- **Interoperability:** Heterogeneous information environments may use different programming languages, may be using different languages and data models to represent and operate on different computing platforms. Subsystems and components of these heterogeneous environments should work together in an efficient manner. Translation and other means of communication between these information environments will be needed to ensure interoperability and interaction;
- **Open and dynamic structure:** dynamic integration of new subsystems (software, hardware, or production units) must be possible in the system, or moving existing subsystems without stopping and resetting the working environment;
- **Cooperation:** companies will have to cooperate fully with suppliers, partners and their customers to provide the raw materials, manufacture of certain components, distribution of final products in markets where they are required, the marketing of products and services etc. Such cooperation should be conducted in a rapid and efficient manner;
- **Human-Computer integration:** people and computers have to work together at different stages of product development and even the entire product life cycle,

which means quick access to information and knowledge. Heterogeneous information sources must be integrated continuously to support and provide the necessary information and thereby increase system capacity decisions. Bidirectional communication environments are needed to ensure rapid and efficient communication between human and computer interaction and facilitate production processes;

- **Agility:** considerable attention has to be given to reducing production cycle time to respond as rapidly as the consumer wants and needs. Agile production is the ability of a changing production environment to adapt to continuous and unexpected change of market demands and, therefore, constitutes an essential part of production strategy for global competition. To be agile, production facilities (machines, technological lines, production facilities, etc.) must be able to quickly reconfigure and interact with heterogeneous systems and partners;
- **Scalability:** scalability means that additional resources can be incorporated into the organization when necessary. This should be possible to work anywhere in the system at any level in these points. Extended use of resources should be possible without disrupting organizational interdependencies and operating rules previously established;
- **Fault tolerance:** the system of production - distribution - supply should have an acceptable error tolerance both at the whole system and subsystems components, so that significant deviations from the parameters and production schedules can be detected and corrected, minimizing their impact on the working environment and, especially, on the final products.

Of course that these requirements are currently difficult to meet and even to imagine in the conditions and methods for organizing centralized management of production systems.

Agile enterprise, e.g. virtual enterprise, provides the ability to respond quickly to rapid and unpredictable changes.

Production system in an agile company (virtual) is composed of various resources belonging to several companies. Although cooperation between companies and network are not new concepts for industrial companies, using ICT offers new opportunities to improve business. A virtual enterprise can quickly configure the necessary resources and can maximize use of resources, which belong to different companies through better coordination. When well configured, combinations of company processes will lead to economic success [3].

In particular, a virtual enterprise is created to exploit these opportunities because, in a network, business processes can be quickly adapted to the requirements of short-term opportunities. Competition in the information age is less expected to take place between individual companies, but more between industrial actors working together to exploit value business opportunities.

In a virtual enterprise, producers no longer have to create products in isolated facilities. They operate as nodes in a network. The overall objective for companies engaging in such networks is increasing the market share as much as possible. Participation in a virtual enterprise project can help, because it maximizes flexibility and adaptability to environmental changes by developing a reservoir of skills and resources [4].

Even though it was introduced in a primitive form as early as the 1980s, the virtual enterprise is a new concept. The concept has been refined throughout the 1990s, and pilot projects to incarnate the virtual enterprise were implemented by the U.S. government in the mid-1990s.

A **Virtual Enterprise** (VE) can be defined as 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. It is a manifestation of Collaborative Networks and Distributed Collaborative Working.

There are several definitions of virtual enterprises [5]:

- Temporary network of independent institutions, businesses or specialized individuals, who work together in a spontaneous fashion by way of information and communication technology, in order to gain an extant competitive edge. They integrate vertically, unify their core-competencies and function as one organization (or organizational unit).
- Temporary network of independent companies, suppliers, customers - even rivals, linked by information technology to share costs, skills and access one another's markets. It will have neither central office nor organizational chart, no hierarchy, no vertical integration.
- Dynamic alliance between organizations that bring in complementary competencies and resources and that are collectively available to each other, with the objective of delivering a product or service to the market as a collective.

These definitions indicate common characteristics of virtual enterprises. The specific features can be summarized as follows [6]:

- Boundary crossing
- Complementary core competencies
- Geographical dispersion
- Complementary nature of the partners
- Participant equality
- Extensive use of information and communications technology
- Temporary
- No creation of a new legal entity
- Collaboration Virtual Enterprise

Globalization is a source of both opportunities and threats. Global market advantages seem to be exploitable only by large organizations. Small and medium enterprises need to find organizational ways to meet global opportunities without suffering the effects of reduced resources available. The virtual enterprise is a form of cooperation in the network that can be viewed as a suitable alternative to overcome these deficiencies. If SMEs want to be more than marginal players in the economy of the future, they should cooperate in special forms of production networks. Major strategic benefits of leading SMEs to cooperate are sharing the costs, infrastructure, responsibilities and research. By aggregating of complementary competencies, design time and flexibility are increased. In multi-enterprise production, individual companies solve together production tasks, often, more effective than a single company that would work alone [7].

3. ENTERPRISE COLLABORATION ARCHITECTURE

In 2004 has been published by the Object Management Group (OMG) the first version of the **Enterprise Collaboration Architecture (ECA)**. The vision of the (ECA) is to simplify the development of component based and services oriented systems by providing a modeling framework aligned with the Model Driven Architecture (MDA) of the Object Management Group (OMG).

The **ECA** thus provides a modeling framework for technology neutral business process design followed by implementation mappings onto the chosen architecture and technologies. It requires bi-directional traceability across the across specification, implementation and operation.

The **ECA** specifies a set of **UML** models used to model different aspects (e.g. static and dynamic aspects) of the system concerns and a set of viewpoints addressing different concerns (e.g. business concerns, engineering concerns, technology concerns).

The **ECA** comprises four **UML** models:

- Component Collaboration Architecture,
- Business Process Model,
- Events Model, and
- Entities Model.

The Component Collaboration Architecture (CCA) provides a recursive decomposition and assembly of logical parts or process roles. These represent abstract role players which are ultimately mapped onto physical system components. **ECA** thus separates process roles from the physical process components realizing these roles.

The business process model defines the business processes across levels of granularity using compound task diagrams. A compound task coordinates lower level activities to perform a higher level activity. Process roles can be defined for activities. **ECA** defines the following three process roles

- Responsible party
- Performer
- Artifact

The **ECA** does not require the formal specification of services contracts for performers, but in most cases this would be encouraged. The **events model** aims to support the specification of loosely coupled, event-driven applications. It defines

- Processes with events in-flow and action out-flow, as well as
- Entities with action in-flow and events out-flow.

The **entities model** defines the structure of and relationships between business entities. The **ECA** views are directly taken from the Reference Model of Open Distributed Processing RM-ODP:

- Enterprise view: The *enterprise view* specifies the CCA, the processes, business entities and their relationships, the events leading to actions in a technology neutral way.
- Computational view: The *computations specification* gets as inputs the enterprise specification and a set of mapping patterns and produces the computational specification.
- Information view: The *information view* gets as inputs the entity specifications, relationships and a set of mapping patterns and generates the information specification.
- Engineering view: The *engineering view* specifies abstract technology decisions like which components are to be network accessible, where messaging is to be used as integration channel and how entities are to be mapped onto persistent storage without specifying the concrete technologies to be used.
- Technology view: The *technology view* specifies the mapping onto technologies like the component hosts (e.g. JavaEE, SOA/JBI, CORBA-CCM, Microsoft.Net), concrete middleware providers, concrete persistence providers.

4. VIRTUAL ENTERPRISES IN THE EUROPEAN UNION (EU)

Pairing with separate legal personality of the partners, as an **interest group**, or **cluster of interest**, was legislated by the European Union as *European Economic Interest Group – EEIG*.

In terms of organization, EEIG is composed of several companies, organizations or associations, their number may reach several hundred, which are divided into three categories:

- *Board members*: which tasks are accepting new members, accept and promote initiatives within the group, determining the optimal solutions for financing initiatives, promoting the group interests at European level, interests confirmed in the constitutive act of the group;
- *Full members*, who can participate in group initiatives, propose new collaborations and initiatives, recommend other members for their integration within the group;
- *Acceding members*, who may take part, as a guest at the group initiatives, without a voting right within the group.

Most of the objectives of integration and / or development in the European Union member countries are made in projects that are committed by a consortium of institutions who designate resources (specialists, technical means, specific methods, media and software products, etc.), for the establishment of work collectives, actually to form a virtual enterprise.

This virtual enterprise (project completion collective) is created to make its own offer for the project, is stabilized at the conclusion of the contract, builds the project under the contract conditions and dissolves after completion of the contract. To create a uniform framework for conducting scientific work in virtual enterprises, EU has initiated a number of projects with objectives in this regard [8, 9].

The following European Union projects are focused on virtual enterprises:

- Business Integrator Dynamic Support Agents for Virtual Enterprise (BIDSAVER)
- Working group on Advanced Legal Issues in Virtual Enterprise (ALIVE)
- Legal issues for the advancement of Information Society Technologies (LEGAL-IST)
- European Collaborative networked Organizations Leadership initiative (ECOLEAD)

5. ECALL SYSTEM COMPLETING THE CURRENT 112 SYSTEM

In order to make the reporting of an accident more simple and to give the emergency call operator more information about the accident the European Union launched a communication telling in UE Member State to implement the single European emergency call number "112", which has been followed by all UE Member States.

eCall provide reliable full-duplex data communication between "In Vehicle System *IVS and Public Safety Answering Point (PSAP) in addition to emergency voice call (E112) via the cellular network, and can be initiated either automatically or manually. eCall allows reliable transmission of Minimum Set of Data (MSD) alternating with a speech conversation through the existing voice communication paths in cellular mobile phone systems [10, 11].

eCall system is under implementation in five states of the European Union which collaborate in a virtual enterprise established within a specific project objective of implementing.

Collaboration implies networking between enterprises in the communications field (technology producers, service providers, etc.), transport sector (transport manufacturers, transportation providers, etc.) and related local government (provision of coordinated intervention unit, maintenance of system functionality, etc.), but also of state governments and the European Union by government representatives (ministries, agencies, etc.), of special services, etc.

Outside the framework provided by provision of virtual enterprises, such collaboration would be practically impossible, because of restrictions imposed by the very status of collaboration being of many components, would be inappropriate in duration and working conditions required of collaboration itself.

6. CONCLUSIONS

As with all types of enterprises, virtual enterprises present both benefits and challenges. Organizations can benefit from virtual enterprises through more economical connections with suppliers, greater opportunities to create revenue, more efficient operations, and a reduction in administrative costs. The challenges facing virtual enterprises are: inexperienced users, security, expense control, and the level of incorporation required to create a successful virtual enterprise (Sun Microsystems, Inc., 2004). A large community of the Virtual Enterprises area gathers annually around the PRO-VE conference.

Such discipline is strongly multidisciplinary and thus PRO-VE Working Conference is designed to offer a major opportunity to mix contributions from Engineering, Economics, Managerial or Socio-Human communities.

Over the last couple of decades, we have seen a major shift from an industrial economy to that of an information economy. This has led to an enormous increase in competitiveness among companies, and new technology is needed to help capitalize on the information economy. Virtual Enterprises (VE) are a new and major trend in the cooperative business, or B2B scenario. Virtual Enterprises allow businesses to specialize and be flexible within their environments.

In the past, this business model has been applied to outsourcing and supply chains, as well as temporary consortia. Because the formation of Virtual Enterprises is an intricate process, a new form of technological support has been developed. The most ambitious of the support systems actually intends to automate part of the creation process, as well as the operation of these enterprises.

Virtual Organizations defy the conventional rule for operating an organization. They do so by accomplishing tasks traditionally meant for an organization much bigger, better resourced, and financially stable. A company having the technical capability, one with the right human skill set, the other with the solution, may come together to create a VO.

The CNO-life cycle stages consist of the following stages:

- **Creation (Initiation and Foundation):** During the initiation a strategic plan is made for the operational stage and the foundation of the CNO is executed by the constitution and actual start up.
- **Operation:** Execution of operations within the defined scope of the strategic plan.
- **Evolution:** The context of virtual organizations is rapidly changing and therefore in continuous evolution of its operation within the current strategic plan, this means, minor alterations.
- **Metamorphosis or Dissolution:** Because a CNOs did gained much experience during it relatively short life they either keep the knowledge by metamorphosing into a new organization with a new purpose or dissolute.

Collaborative Networks emerged a decade ago, as a key issue for Economic growth and a very active area of scientific production. Dynamic collaborative organizations are an essential answer to the increasing need of strong adaptability to a constantly changing economic context. Several collaborative forms such as Virtual Organizations, Virtual Enterprises and other forms of Enterprise Networks, Professional Virtual Communities, or industry clusters and business ecosystems are now supported by large research and business practice communities. These new organizational forms put forth the development

of a new theoretical background. In the recent years, many international projects have contributed to these scientific advances. The accumulated body of empiric knowledge and the size of the involved research community provide the basis for the foundation of a new scientific discipline on "Collaborative Networks".

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