

Virtual Enterprise Organization

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INTRODUCTION

Competition among enterprises is changing. Initially competition was made between individual production systems. Now we are assisting to development of another kind of competition between production systems organized according to virtual enterprise (VE) concepts. This new focus is motivated by several aspects. The new global markets and the evolution of technologies and communications accomplished by the unpredictable consumer's attitude may be pointed out as the most relevant. Understanding social, economical, and technological changes, and taking advantage of them, is the path that will allow production systems to sustain their competitiveness. In this path, enterprises must make radical modifications, both inside their boundaries and also in their relations with partners and competitors. Coordination of participants in new forms of organization, such as virtual enterprises, global manufacturing, and logistics networks, and other company-to-company alliances, has become functionally and strategically important (Gunasekaran, Williams, McGaughey, 2005). The definition of each participant function in the organization and overall information exchange have become key components in their manufacturing strategies.

BACKGROUND

Opening countries' borders to external competitors, adding new international agreements between countries, and expanding industrialization processes to undeveloped countries are some of the aspects that have definitively contributed to the appearance of a worldwide economy concept (Alvi & Labib, 2001). New business opportunities are rising and become accessible as countries' internal economical protection borders are falling down. This economical globalization has increased competitiveness intensity and market uncertainty. It also has accelerated

the decrease of product lifecycles (Kraemer, Gibbs, & Dedrick, 2002). In this new environment enterprises are allowed to access new technologies and new talents (Atkinson & Coduri, 2002).

Globalization will create new business opportunities, but also introduce worldwide competition. Information and communication technologies (ICTs) are considered one of the most relevant support factors to the latest world changes. In fact, they are an enabler of, and also enabled by, globalization (Kraemer et al., 2002). In a world that desperately claims for innovation, information and communication technologies are nowadays essential to catalyze and speed changes archived in managers' minds (Boyson, Corsi, Dresner, & Harrington, 1999). The ongoing evolutionary process of those technologies will affect enterprises in two different ways. First, considering a more proactive perspective, entrepreneur enterprises may take advantage of information and communication technologies to make an evolutionary jump in new collaborations, new partnership direction, and achieving new business and markets.

Another point of view reveals that enterprises must incorporate information and communication technologies as one of their strategic and operational components (Moodley, 2003).

This technological revolution also has a deep influence on the globalization process, supplying new tools that allow the capture of new global market opportunities. Using these new tools, enterprises became more agile and capable of dealing with changes in a more sensible way. The adoption of ICTs allows enterprises to stimulate a worldwide consumer appetite (Fraser & Oppenheim, 1997). In a global manufacturing environment, ICTs play a dominant role, as they allow the integration of production systems physically worldwide distributed (Gunasekaran, 1999).

One possible way to cope with these new organizational needs is the *virtual enterprise* paradigm (Wu & Su, 2004). A virtual enterprise is a temporary partnership of independent companies and/or individuals—suppliers of

specific goods and services, customers—who are linked through modern telecommunications to exploit and profit from rapidly changing business opportunities. In a virtual enterprise, companies can share costs, skills, knowledge and access to specialized expertise, and access to regional and global markets, with each partner supplying what it can do best—whether a product or a service (VEA, 2002).

The virtual enterprise concept is in its youth and growing. In literature it is not possible to find yet a consensual and rigorous definition for all the concepts that surround it (Camarinha-Matos, Afsarmanesh, Garita, & Lima, 1998). More commonly found was the general term *virtual enterprise* and the concept of *extended enterprise*. At times it is possible to ease any confusion, to some degree, by looking at the utilization of each (Rolstadas, 1997). The virtual enterprise concept has a wider scope than extended enterprise and includes it in its meaning (Jagdev & Browne 1998; Camarinha-Matos & Afsarmanesh 1999). We may also be confronted with opinions that consider extended enterprise as the dominant expression. In a virtual enterprise the integration level is bigger and, comparatively to extended enterprise, the partnership agreements are shorter in time (Jagdev & Browne 1998).

In literature it is also possible to find a complete structure that allows developing virtual companies from virtual networks (Franke & Hickmann 1999). The virtual network concept is seen as the organizational part, with long-term duration and without time limit. This means that the set of enterprises that belong to that net are stable. Based on business opportunities, virtual companies are building up from that set of enterprises where the most adequate partners are selected. Virtual companies are dissolved when they have reached their purpose.

The idea behind the virtual organization concept looks to the virtual as being a dimensional organization and not as a distinguished factor (Steil, Barcia, & Pacheco, 1999). Virtual is used to describe an organizational logic especially relevant when geographical space, time limits, organizational units, and information access are relegated to a second level. This type of organization is based on the substitution of the traditional organizational structure by ICTs, seen as essential conditions of a non-institutionalized structure with time-limited cooperation (Sandhof, 1999). The cooperation time may be reduced to the fulfillment of a unique contract. In this sense, the subcontracting concept is being used to new limits (Golder & Brockie, 2001).

Virtual corporations (Davidow & Malone, 1993; Franke & Hickmann, 1999), variable production networks (Wiendahl & Helms, 1997), multi-site production facilities (Roux, Dauzere-Peres, & Lasserre, 1999; Zhou & Besant, 2001), virtual production networks (Tuma, 1998), logistic networks (Schonsleben, 2000), supply chain manage-

ment, electronic commerce, cross-border enterprises, networks of enterprises (Camarinha-Matos et al., 1998), and virtual manufacturing systems (Davidrajuh & Deng, 2000) are other designations given to the same concept.

Concerning its lifecycle, a traditional enterprise may be seen as a stable organization that searches or creates business opportunities. A virtual enterprise formation is based on a business opportunity that may be seen as the virtual enterprise heart (Van-Schoubroeck, Cousy, Droshout, & Windey, 2001). By definition, a virtual enterprise will exist until the moment that the business opportunity will no longer be profitable. The time from the moment of virtual enterprise first steps formation until its dissolution is known as the virtual enterprise lifecycle (Goranson, 1999). Inside this lifecycle we find several concepts, including formation, reconfiguration or evolution, activity or operation, and dissolution or termination. Depending on the authors, the number of virtual enterprise lifecycle phases may change (Spinosa, Rabelo, & Klen, 1998; Strader, Lin, & Shaw, 1998; Goranson, 1999; Kanet, Faissat, & Mertens, 1999; Rocha & Oliveira, 1999; Biondi, Bonfatti, & Monari, 2000; Davidrajuh & Deng, 2000; Eschenbacher, Knuck, & Weiser, 2001; Katzy & Dissel, 2001; Van-Schoubroeck et al., 2001).

AUTONOMOUS PRODUCTION SYSTEM (APS) CONCEPT

Companies are traditionally organized in a hierarchical structure where the communication is established from top management to bottom levels and from bottom levels to top management through several levels of responsibility. In this type of organization, each department can only communicate with the outside world through the top management channel (Figure 1, top left).

In this work we assume that VEs based on the autonomous production system (APS) concept will increase their agility in coping with market needs (Carvalho, Moreira, & Pires, 2005). Thus, a company, instead of being organized as the traditional hierarchy of departments and sections, should become a network of APS, in a way that the relationships between its APS should be based on a partner-to-partner relationship (see Figure 1). In this way each APS could cooperate equally with an APS of another company for a particular business opportunity, as well as with an APS of the same company. An APS can be considered the smallest part of a company that, if divided, loses its autonomy. We will not concentrate on how APSs are generated. We will assume that they exist and virtual enterprises are APS based (Figure 1, top right). The big difference here is that VEs made from traditional enterprises use all the enterprise structure and APS-based VEs use only the needed APS (see Figure 2).

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