

Market of Resources for Virtual Enterprise Integration

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INTRODUCTION

Most definitions of virtual enterprise (VE) incorporate the idea of extended and collaborative outsourcing to suppliers and subcontractors in order to achieve a competitive response to market demands (Webster, Sugden, & Tayles, 2004). As suggested by several authors (Browne & Zhang, 1999; Byrne, 1993; Camarinha-Matos & Afsarmanesh, 1999; Cunha, Putnik, & Ávila, 2000; Davidow & Malone, 1992; Preiss, Goldman, & Nagel, 1996), a VE consists of a network of independent enterprises (resources providers) with reconfiguration capability in useful time, permanently aligned with the market requirements, created to take profit from a specific market opportunity, and where each participant contributes with its best practices and core competencies to the success and competitiveness of the structure as a whole. Even during the operation phase of the VE, the configuration can change, to assure business alignment with the market demands, traduced by the identification of reconfiguration opportunities and continuous readjustment or reconfiguration of the VE network, to meet unexpected situations or to keep permanent competitiveness and maximum performance (Cunha & Putnik, 2002, 2005a, 2005b).

The implementation of the VE model presents several requirements in order to keep the partnership aligned with the market, that is, with business (Cunha & Putnik, 2005a). Such requirements include (1) the reduction of reconfiguration costs and effort, and (2) the capability to preserve the firms' private knowledge on products or processes (Cunha & Putnik, 2006c). These must be assured by a specific environment, or, in other words, by organizational infrastructures as meta-organizational structures for VE design (or integration) and operation such as the market of resources, an environment developed

and validated by the authors to cope with the highlighted requirements (Cunha & Putnik, 2005c, 2006b; Cunha, Putnik, Gunasekaran, & Ávila, 2005).

BACKGROUND

Networking and reconfiguration dynamics are the main characteristics of the VE model. However, there can be identified two factors against or disabling this emerging organizational model: transaction cost and leakage of private information. The BM_virtual enterprise reference model proposes three enabling tools for the VE model (Putnik, 2001; Putnik, Cunha, Sousa, & Ávila, 2005).

Networking and Reconfiguration Dynamics

Reconfigurability, that is, the ability of fast change to face the unpredictable changes in the environment (market), is a requirement of the VE to keep the partnership aligned with business requirements and is a consequence of product life cycle dynamics, or business and market dynamics. This requirement implies the ability of:

1. Flexible and almost instantaneous access to the optimal *resources* to integrate in the enterprise.
2. Design, negotiation, business management, and manufacturing management functions independently from the physical barrier of space.
3. Minimization of the reconfiguration or integration time.

Reconfiguration, meaning the substitution of resources providers, generating a new instance of the

network, can happen mainly from four reasons (Cunha & Putnik, 2006c):

1. Reconfiguration during the network company life cycle as a consequence of the product redesign in the product life cycle, to keep the network aligned with the market requirements, that is, to deliver the right product.
2. Reconfiguration as a consequence of the nature of the particular product life cycle phase (the evolutionary phases of the product).
3. Reconfiguration can happen also as a consequence of the evaluation of the resources performance during one instantiation of the network, or a consequence of voluntary contract rescission by a participating resources provider, willing to disentail from the network.
4. Reconfiguration can also be a consequence of fluctuation in the demand side, or even a consequence of the so-called bull-whip effect phenomenon in the supply chain, where a little fluctuation in end customer demand can be dramatically amplified at the upstream company, requiring a fast adaptation for a short period of time. Supply chain dynamics is a strong cause of reconfiguration needs originating a new instantiation of the VE, substituting or reinforcing the provision of any resources.

Networking and Dynamics Disablers

The implementation of the VE model should assure the required reconfiguration dynamics, which is dependent of (1) the reduction of reconfiguration costs and effort, that is, requires a balancing between reconfiguration dynamics and reconfiguration time and costs and (2) the capability to preserve the firms' private knowledge on products or processes. This way, the two critical factors to overcome towards the VE model are:

1. The *transaction costs*, that is, the firm reconfiguration cost, associated with partners search, selection, negotiation, and integration as well as permanent monitoring and the evaluation of the partnership performance. Resource allocation in the market is normally guided through prices, but within the firm, the work/job is done through decisions and commands of management (Coase, 1937). Activities are collected in a firm when transaction costs incurred in using the price mechanism exceed the

cost of organizing those activities through direct managerial controls (i.e., in-house).

2. *Preservation of firm's knowledge* on organizational and management processes, as it is the firm's competitive factor. The firm incurs the risk of leakage of private information when opting to perform an activity by an independent market firm.

For the efficient implementation of the VE model, it is necessary to conceive tools to overcome the networking and dynamics disabling factors.

Tools for Managing, Controlling, and Enabling Networking and Dynamics According to the BM_VEARM Approach

The main tools conceived by the BM_virtual enterprise reference model (BM_VEARM) (Putnik, 2000), for managing, controlling, and enabling networking and dynamics, overcoming the two critical factors, are:

- The *market of resources* as the environment for enabling and management of efficient configuration and assuring virtuality at low transaction costs and reduced risk of knowledge leakage.
- The *broker* or organization configuration manager is the main agent of agility and virtuality, acting either between two operations of the VE (off-line reconfigurability, providing agility only) or online with the operation (online reconfigurability, providing virtuality, and a higher level of agility).
- *Virtuality* makes possible the transition from one physical structure (instance) to another in a way that the enterprise or process owner is not affected by the system reconfiguration or aware of the reconfiguration—the underlying service structure and reconfiguration process are hidden.

Additionally, VE must satisfy the highest level of integration and (geographic) distribution of the networked partners.

MARKET OF RESOURCES: CHARACTERIZATION AND FUNCTIONALITIES

The market of resources is an institutionalized organizational framework and service assuring the accom-

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