Chapter 2.31
Interactive Models for Virtual Enterprises

Håvard D.Jørgensen
Computas, Norway

John Krogstie
SINTEF and NTNU, Norway

INTRODUCTION

Business environments are becoming increasingly dynamic and knowledge intensive. Cooperation across traditional organizational boundaries is increasing, as outsourcing and electronic business are enabled by the Internet and other information systems. In VEs, each partner company contributes unique and complimentary competence vital for the success of the joint project. When interorganizational cooperation moves beyond the buying and selling of goods and well-defined services, there is thus a need for flexible infrastructures that support not only information exchange but also knowledge creation, evolution, and sharing.

While computerization automates routine procedures, knowledge-based cooperation remains a challenge. Paradoxically, studies conclude, "simple and adaptable technologies enable more complex virtual collaboration" (Qureshi & Zigurs, 2001). Low-level tools like e-mail are used far more frequently than sophisticated coordination systems. VE process management tools are currently regarded as "obtuse and inaccessible to the vast majority of knowledge workers" (Delphi Group, 2001). This chapter aims to demonstrate that information and communication technology (ICT) infrastructures controlled by enterprise models can offer rich, but at the same time simple, and comprehensible support to VEs.

BACKGROUND

A VE is defined as "a customer solution delivery system created by a temporary and ICT enabled integration of core competencies" (Tølle, Bernus, & Vesterager, 2002, p. 1). Infrastructures developed for VEs face three highly intertwined challenges:

- **Heterogeneity:** Incommensurable perspectives, software infrastructures, working practices etc., among the partner companies.
- **Flexibility:** Due to need for learning, change, and exception handling.
- **Complexity:** The richness and uncertainties of interdependencies among partners, their activities, resources, skills, and products.

Heterogeneity, change, and complexity must be managed at different levels:

- **Knowledge:** The skills needed for problem solving and work performance, the shared language and frames of reference needed for communication, etc.
- **Process:** The planning, coordination, and management of cooperative and interdependent activities and resources.
- **Infrastructure:** The information formats, software tools, and interoperability approaches of the participating companies

The resulting problem space is summarized in Table 1. Each level is elaborated upon. For networks of small and medium-sized enterprises (SMEs), these challenges are amplified, as resources are scarcer and high entry costs are prohibitive.

Process Structure, Diversity, and Evolution

Unstructured creative activities are often most important for the competitiveness of an enterprise. Even in seemingly routine work, exceptions and uncertainties permeate the environment. Workers reflect upon and manage these problems in a sophisticated manner (Wenger, 1998). To some extent, most work can thus be regarded as knowledge intensive. On the other hand, most work processes also have routine parts that can be structured and automated. Many companies have prescribed quality management procedures for administration, audit, approval, etc. Systems must thus integrate support for ad hoc and structured work (Haake & Wang, 1997; Jørgensen & Carlsen, 1999). Users must be supported in selecting a suitable degree of plan specificity for the current state of their process, balancing plan complexity with the need for guidance and control.

Table 1. Problem space for VE integration

	Knowledge	Process	Infrastructure
Heterogeneity	*Communication*, establishing a common language across companies and disciplines	*Process diversity*, negotiating different procedures between the partners	*Interoperability* across companies' software architectures
Complexity	*Integrate capabilities*, form effective teams across local cultures	*Work management*, planning and coordinating complex and uncertain interdependencies among several concurrent activities	*Enterprise architectures*, managing systems portfolios; avoiding *featuritis* (unmanageably complex systems)
Flexibility	*Learning*, partners must be able to improve practice based on common experience from the VE	Supporting both structured and ad hoc work (with evolving plans); handling unforeseen *exceptions*	*Customized* and personalized support; *Rapid formation* of VEs, allowing partners to join along the way