Chapter III
Dynamic Enterprise Modeling for Knowledge Worker Industries

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ABSTRACT

This chapter presents a case study of the empirical development and implementation of a commercially successful enterprise modeling framework and associated constructs. We discuss the objectives from a practical business and management viewpoint and provide a guide for implementation of the empirical framework in real enterprises. An integrated approach was found to be essential quite early in the empirical development for successful outcomes to be obtained. What is offered as novel is the successful integration of standard theoretical frameworks with empirical business and management models, including areas that previously have not been covered in an integrated fashion, such as strategic management capability, the ability to integrate the framework with various management paradigms and partial automation of model data capture.

INTRODUCTION

A large body of knowledge covering Enterprise Integration Architectures, Modeling and Methodologies (EIAM&M) has been developed covering various types of enterprises.

Starting in 1983, the European Commission ESPRIT initiative launched and funded a series of technology projects to advance Europe’s position and competitiveness against Japan and the United States (U.S.) (Hagedoorn, 1995; Mytelka & Delapiere, 1987).

The need for interoperability and efficient Computer Integrated Manufacturing (CIM) design and implementation drove the formation of the AMICE consortium under ESPRIT projects 688, 2422 and 5288. This became CIMOSA.

In the U.S., Purdue University’s Laboratory for Applied Industrial Control (PLAIC) had been working on the solution of industrial control issues and plant design, piloting the framework and methodology with Fluor Daniel (Williams, 1992). This concept of life-cycle based design in
enterprise or systems engineering became PERA (Williams, Rathwell, & Li, 2001).

Similar developments were occurring in another cycle-based framework for design of CIM plant, GRAI-GIM, with the University of Bordeaux and specific industry partners (Williams, Rathwell, & Li, 2001).

Parallel developments led to recognition of a need to include similar initiatives into a best-of-breed, new composite discipline, which led to the formation of the IFIP-IFAC Taskforce in 1990. The Taskforce then devoted itself to developing this Generalized Enterprise Reference Architecture and Methodology (GERAM) (Bernus, 1998). The GERAM development path has continued as International Organization for Standardization (ISO) draft standard 15704, with its acceptance as a generalization of CIMOSA in the European Standards Organization and ISO as prEN/ISO 19439.

Detailed development of consistent ontologies by a number of workers occurred in parallel from 1994 (Gruninger, Atefi, & Fox, 2000).

Most viewpoints in this development have been either static or cycle based, with the major drivers being design and implementation of CIM plant and major engineering projects, including virtual enterprises (Bernus & Nemes, 1996; Whitman & Huff, 1997; Williams, Rathwell, & Li, 2001).

While a focus on interoperability and an agreed ontology is essential to the success of EIAML&M in these types of industries, there was a lack of uptake in many other enterprises, particularly service or knowledge worker-based industries (Whitman, 1999; Whitman & Huff, 2001).

Historically, since the advent of double-entry bookkeeping in 1494 by Paciolo until the development of systems engineering by AT&T in the 1950s (Hall, 1962), economics, risk management and efficiency have been the primary business-driven metrics for enterprises.

Cycle-based systems that ‘wipe the slate clean’ are also not generally appropriate for the required gentle evolutionary changes that minimize attrition of the core assets of existing service and knowledge enterprises, their staff.

Additionally, the experience of Business Process Re-engineering (BPR) has shown that changes imposed from outside an enterprise often fail. This has been shown to be due to not working within appropriate, particularly strategic, frameworks and constraints, or failure to incorporate personnel, informal networks and social issues and constraints (Murphy, 1994; Caron, Jarvenpaa, & Stoddard, 1994).

As early as 1991, Huff, Howell and Liles (1991a, 1991b) proposed the use of integrated IDEF and Petri nets for modeling living or evolving enterprises. Whitman's PhD dissertation (1999), supervised by Huff, showed that models were not often used or kept current in many enterprises. Whitman and Huff (2001) have also investigated the waste involved in ‘one-off’ or throw-away models for BPR.

It was now generally evident that some specialization for different industry types is necessary towards creating a dynamic, evolutionary or living model, with cycle-based models comprising a subset of these EIAML&Ms. This is borne out by Whitman, Ramachandran and Ketkar (2001) in a proposed taxonomy system for EIAML&Ms, plus selection criteria for specific areas of enterprise. Practical observation in developing the empirical framework presented in this chapter has also shown that the major requirements of service and knowledge-based industries are financial and economic efficiency and business risk mitigation, rather than interoperability.

Practical issues and perceptions that have been found to prevent uptake of EIAML&Ms in service and knowledge industries may be summarized as:

- Cost vs. perceived benefits.
- Complexity for users.
- Maintenance and update time delays; lack of model currency.
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