Business Modelling to Support the Development of Integrated Process Support Systems in the Extended Enterprise

Dr. Gerard J. Lyons
Enda Dunican, M.Sc.

Information Technology Centre
National University of Ireland, Galway

Abstract

Recent years have witnessed rapid advances in the areas of Business Process Reengineering(BPR) and Software Engineering. In order for BPR to work, successful deployment of Information Technology is imperative, with the lack of adequate IT support being cited as the single largest impediment in BPR projects. Furthermore, new business concepts such as extended enterprises and agile enterprises which build upon basic BPR call for even more complex software support in an ever-changing global business environment. This paper addresses these problems and proposes a framework which supports the design and development of information systems which support business processes in the extended enterprise.

1. Introduction

Despite its many critics, Business Process Reengineering (BPR) has promoted a radically different view on the way businesses meet customer objectives via work organisation, structures, measures and information systems. Building on the successful deployment of total systems and cycle-time reduction techniques, BPR provides an organisation-wide understanding of the end-to-end chain of linked activities which are needed to deliver customer value, in terms of products or services.

In its original incarnation, BPR was concerned with the re-modelling of core operational processes within the control and limited geographic (and structural) dispersal of individual business organisations. Almost from the outset of BPR practice, however, Venkatraman [14,15] had recognised the potential for applying a similar process logic to extended product and service supply chains, which embrace a constellation of far flung collaborating organisations in today's business enterprises. The extended enterprise, then, refers to inter-enterprise integration along the business process dimension, and involves the co-ordination of organisationally dispersed activities along the value supply chain, supporting the operation of common customer-focused business processes.

2. Background

While a rich crop of enabling information technologies is available to support process re-design, the development and implementation of process-based information systems has been the single greatest impediment to process realisation in BPR practice to-date [3]. The difficulties encountered in the design and deployment of enterprise-wide process support systems are significantly greater than those for organisation specific BPR, given the diversity of IT platforms, systems requirements and business objectives of the organisations participating in the extended supply chain. Enterprise-wide processes create a demand for the seamless inter-linking of systems involved in automating the various components of end-to-end supply chains. This challenge reaches far beyond the exchange of structured data via EDI linkages and has been recently described as "extreme integration" [5].
The development of integrated, enterprise-wide process support systems remains aspirational, at this stage. Indeed, a recent CSC Index survey [4] confirms the continuing preoccupation of systems professionals with the development of functionally bound (as distinct from process based) solutions. Of the 500 or more senior IT executives surveyed, only 20% of US and 9% of European respondents described their current development projects as "enterprise wide" implementations. This is hardly surprising given the way in which individual IT projects are funded and structured. A key shortcoming is the common methodology for software development, which reinforces

a functional orientation through its insistence on the stepwise decomposition of high level business functions.

This paper identifies the limitations of current systems development methodologies and proposes a framework for the design of inter-organisational systems (IOS) which support extended business processes.

3. Developing integrated enterprise process-based systems

Conventional systems development and IT planning methodologies [8,18,19] are based on top-down decomposition of functional transactions and information needs and, inadvertently, serve to institutionalise existing functional organisational structures, work practices, and information flows. Furthermore, the deployment of data and process modelling techniques used in these methodologies reinforces functional and organisational boundaries. Many of the current methodologies set-out to craft extensive, corporate IT architectures, and require large investments in time and resources, rendering their accessibility and implementation beyond the scope of smaller business units. Such top-down corporate architectures are even more difficult to implement when systems are required to support many organisations in a "value -chain constellation"[9].

Despite these shortcomings, the specific mapping, modelling and analytical techniques available in conventional methodologies are both robust and reliable. The challenge, then, is to integrate these techniques into a development framework which promotes an extended enterprise process orientation.

Such a framework should support the:
* development of inter-organisational, process based systems;
* design of individual process based systems, rather than of total IT architectures;
* customisation of designs to meet the changing systems needs of different business delivery models, new enterprise participants and organisational configurations;
* use of available modelling techniques and tools, rather than inventing further mapping approaches.

4. Proposed framework

The proposed framework implements many of the techniques found in conventional IS development methodologies e.g. matrix mapping techniques, data and process modelling[8,17,18,19]. However it differs from these in its deployment of conventional techniques and its focus on business processes to drive systems development in an integrated value-chain constellation. The framework consists of five levels:

1. Enterprise business design level
2. Process level
3. Process-based data level
4. System specification level
5. Implementation level

Level one incorporates the development of high level enterprise business models to support business network re-design[2,3]. The following models are developed:
1. High level function/enterprise mapping
2. Functional block diagram indicating current business functions.
3. Function/Enterprise matrix (current and new).

The high level function/enterprise mapping (fig 1a) identifies the current functions conducted in an integrated value chain and how they are dispersed amongst the various enterprises. As depicted in fig 1a this identifies the location of the functions conducted by enterprise participants. This may often reveal duplication of functions and activities at various locations. The next model, the function block diagram (fig 1b) takes each function identified in the previous model and implements high level overlays of time, material accumulation and cross-enterprise communication(which may take the form of information or material flow). On completion of this model a business analyst can identify areas for improvement and ultimately result in the elimination of unnecessary time and material delays. Conventionally this may be described as high-level business process re-engineering, however since we are dealing with the re-arrangement of functions amongst various parties in an integrated supply chain with the aim of developing extended business processes, we refer to this activity as business network re-design.

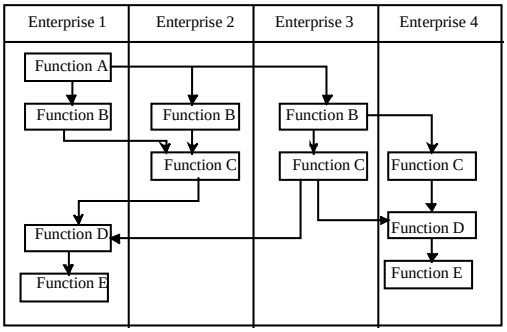

Fig 1(a) Function/Enterprise Mapping

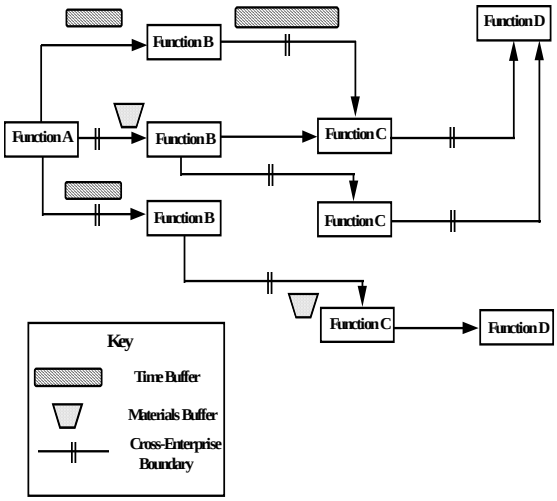

Fig 1(b) Function Block Diagram Mapping

The output of the previous level consists of a set of business models with each representing newly-identified/re-engineered extended business processes. Level two incorporates the modelling of these processes highlighting the arrangement of their triggering events and associated activities incorporating conventional process decomposition techniques. The processes modelled at this point will assume that none of the traditional functional and organisational boundaries exist. The focus at this stage is the development of minimum cycle-time processes, which are tangible, measurable and whose end-products are observable. An important point concerning process modelling at this level is acknowledgement of the fact that a process, and, as a consequence, it's model may be structured differently as the value constellation changes and therefore may require frequent re-configutaion. Traditional IT architectures assume stability of business processes and data models. However in order to support dynamic reconfiguration of business network designs, supporting process and data models must also be capable of re-design allowing IS re-development to reflect the changing business designs (modelled in level one). The output of level two is a set of process models unconstrained by conventional functional and organisational boundaries.

Level three focuses on identification of data entities which support business processes identified and modelled at previous levels. Matrix mapping techniques are used to develop:
1. Process/entity matrix
2. Organisation /entity matrix.

The process/entity matrix identifies which data entities are associated with each process and the nature of association between them, i.e. create, read, update, delete(CRUD). On completion of this, the organisation/entity matrix is developed to identify the required location of data entities. This level introduces the notion of "ownership" of business processes and associated data. Many issues such as representation formats, non ambiguity, neutralisation [16] will have to be addressed as a result of the ownership problem.

Level four entails developing data and process models required for the design of business process-based information systems. The process models differ from those developed in conventional methodologies in that the processes represented in the data flow diagrams are not constrained by traditional functional boundaries. Furthermore the scope of the models are extended so that the boundaries created by conventional "external entities" do not exist and therefore communication amongst various external participants are modelled as part of IOS design.

Level five is concerned with the implementation of the integrated process support systems designed at the previous levels. Decisions on implementation architectures and integration platform [16] are made at this level. Enabling technologies such as the client server model may be decided upon as to allow interaction and process co-ordination amongst co-operative agents in a multi-agent value chain.

5. Summary

This paper has introduced the notion of the extended enterprise. The major limitations of current IS development methodologies in supporting integrated process based systems are highlighted. The proposed framework addresses these limitations by focusing on business process models in an extended valu-chain to drive IS development. It advocates a simplistic approach to IOS development by re-deploying existing techniques making it accessible and usable in non-corporate enterprises.

References

[1] Bloch, M., Pigneur, Y. (1989) The Extended Enterprise : A Descriptive Framework, Some Enabling Technologies. Prentice Hall.

[2] Christopher, Martin. (1992). Logistics and Supply Chain Management. Pitman Publishing.

[3] CSC Index. (1994). State of Reengineering Report. Pub. CSC Index.

[4] CSC Index. (1996). Critical Issues of Information Systems Management. Pub. CSC Index.

[5] Darling, C.B. and Semich, J.W. (1996). Extreme integration. Datamation, November, 1996. Pp. 48-58.

[6] Konsynski, B.R. (1993). Strategic Control in the Extended Enterprise. IBM Systems Journal Vol. 32, No. 1. 1993.

[7] Lyons G. (1995). Application of information technology in the redesign and implementation of business processes. In: Browne & O'Sullivan (eds.). Re-engineering the Enterprise. IFIP and Chapman & Hall, London.

[8] Martin, James. (1990) Information Engineering (3 Volumes). Prentice Hall.

[9] Normann, R. & Ramirez, R. (1993) From Value Chain to Value Constellation: Designing Interactive Strategy. Harvard Business Review July 1993.

[10] Petrie, Charles. (1992). Enterprise Integration Modelling. Proceedings of First International Conference. MIT Press, Boston, Mass.

[11] Rajput, Wasim E. & Von Halle, B. (1994). From the ground up. Database Programming & Design Vol. 7. No. 9. Sept 1994.

[12] Spewak, Steven H. (1993). Enterprise Architecture Planning. QED Publishing.

[13] Venkatraman, N.(1994). IT-Enabled Business Transformation : From Automation to Business Scope Re-Definition. Sloan Management Review, Winter 1994.

[14] Venkatraman, N. (1991). IT-induced business reconfiguration. In: M. Scott-Morton (ed.). The Corporation of the 1990's. Oxford Uni. Press. New York.

[15] Venkatraman, N. & Short, J. (1992). Beyond Business Process Redesign. Redefining Baxters Business Network. Sloan Management Review Fall 1992.

[16] Vernadat, Francois. (1996). Enterprise Modelling and Integration: Principles and Applications. Chapman & Hall, London.

[17] Yourdon, Edward. (1989) Modern Structured Analysis. Prentice Hall.

[18] Zachman, John. (1987). A Framework for Information Systems Architecture. IBM Systems Journal Vol. 26. No. 3.

[19] Zachman, J. & Sowa J. (1992). Extending and Formalising the Framework for Information Systems Architecture. IBM Systems Journal Vol. 31 No. 3.