ERP II: a conceptual framework for next-generation enterprise systems?

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Abstract

Purpose – The purpose of this paper is to frame next-generation enterprise systems (ES).

Design/methodology/approach – The model is based on a retrospective analysis of the evolution of enterprise systems, enterprise resource planning (ERP) research and emerging business requirements.

Findings – The paper proposes a conceptual framework for extended enterprise resource planning (ERP II). The aim of this model is to compile present ES concepts into a comprehensive outline of ERP II, thus composing a generic map and taxonomy for corporate-wide enterprise systems.

Research limitations/implications – The paper concludes that the ERP research needs to broaden its perspective in order to accommodate itself to the new issues of next-generation enterprise systems.

Practical implications – The model is seen as a first step towards a tool to analyse and design complex enterprise systems architecture.

Originality/value – This paper is the first attempt to formalize and capture the ERP II concept and the next-generation enterprise systems.

Keywords Operating systems, Manufacturing resource planning, Supply chain management

Paper type Conceptual paper

Introduction

"ERP is dead – long live ERP II" is the title of a path-breaking research note from GartnerGroup (Bond *et al.*, 2000). In this research note GartnerGroup envisions how enterprise resource planning (ERP) vendors will respond to market challenges and how ERP and ERP strategies will have evolved by 2005. GartnerGroup defines ERP II as a transformation of ERP into next-generation enterprise systems. Today the major vendors have adopted this concept into their ERP packages.

Research, however, do not respond to new business practices too hastily. This lag is an issue in Klaus *et al.* (2000), and the inertia of information systems (IS) research delayed the emergence of ERP research until the late 1990s. The ERP research interest was fuelled by the unsuccessful ERP implementation projects and has only recently been consolidated into a strategic and managerial perspective on enterprise systems (ES) management (Shanks *et al.*, 2003).

For quite some time supply chain management (SCM) has been the driving force in challenging the industry to integrate and to collaborate with other businesses, and ES are instrumental in this transformation. New information technology (IT) has had a significant impact on SCM practices, and interest is now growing towards loose-coupled and network oriented perspectives (Christopher, 1998).

ERP II is an important concept to industry and until now the research on this concept has neither been consistent nor conclusive as regards the content and status of this phenomenon.

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In this study the ERP II concept will be approached by evaluating the development of the ERP packages and the emerging business requirements. This will lead to an outline of a conceptual framework for ERP II. This study builds on existing ERP theory, analysis of the vendors' systems and current business practices., The paper suggests that the framework will be useful in the analysis and design of the complex enterprise systems in practice.

The next two chapters will establish an analytical approach to ERP II. The first chapter explains the evolution of enterprise systems concepts and ERP research, and the following chapter discusses the new requirements for enterprise systems.

Then the ERP II concept is decomposed, expanded and the conceptual framework is outlined. Finally the paper discusses the research and business implications of next-generation enterprise systems and sum up further research into enterprise systems.

Enterprise systems in retrospect

The concept of ES has often been explained through the evolution of ERP (Wortmann, 1998; Klaus *et al.*, 2000; Markus and Tanis, 2000; Chen, 2001). The concept of ES has evolved over almost 50 years driven by the changing business requirements, new technologies and software vendors' development capabilities (see Table I).

The fundamental structure of ERP has its origin in the 1950s and 1960s with the introduction of computers into business. The first applications automated manual tasks such as bookkeeping, invoicing and reordering. The early inventory control systems (ICS) and bill of material (BOM) processors gradually turned into standardized material requirements planning (MRP). The legacy of the IBM's early COPICS specifications can be traced in the structure of the systems even today.

The development continued in the 1970s and 1980s with the MRP II and CIM concept. Even though the CIM ideas failed in many aspects, the research, e.g. on IS development (ISD) and enterprise models, provided the background for gradually integrating more areas into the scope and of the information systems (Wortmann *et al.*, 2000). This development peaked in the early 1990s with the advent of the ERP systems – often embodied in SAP R/3 (Bancroft *et al.*, 1997) along with the other major vendors: JD Edwards, Baan Oracle, Peoplesoft, and SAP the so-called JBOPS. Although the ERP systems have other legacies like accounting, planning and control philosophy is rooted in manufacturing.

ERP is a standardized software packaged designed to integrate the internal value chain of an enterprise. An ERP system is based on an integrated database and consists of several modules aimed at specific business functions.

Table I.
Enterprise systems in retrospect

Decade	Concept	Function
50	Inventory control systems (ICS)	Forecast and inventory management
60	Material requirement planning (MRP)	Requirement calculations based on bill-of-material (BoM)
70	Manufacturing resource planning (MRP II)	Closed-loop planning and capacity constraints
80	Computer-integrated manufacturing (CIM)	Automation, enterprise models
90	Enterprise resource planning (ERP)	Integrated processes

According to Nah (2002) the American Production and Inventory Control Society (APICS) defines ERP as:

> [. . .] a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company.

This definition emphasizes the business purpose of the system.

Davenport's sequel on enterprise systems (Davenport, 1998, 2000; Davenport and Brooks, 2004) is an indicator of the changing business perspective on ERP and the ERP hype. In the late 1990s the ERP hype was primarily motivated by companies rushing to prepare for Y2K (Callaway, 2000). Davenport (1998) sums up this first wave of experience from implementing ERP systems in a much cited paper on "putting the enterprise system into the enterprise", and points to the new potential business impact of ERP systems. The discussion evolved over the first enthusiastic expectation on integration, via the growing number of horror stories about failed or out-of-control projects, towards the renewed hype of expectations on e-business and SCM.

Skok and Legge (2002) summarize the early key drivers for adopting ERP systems as:

- legacy systems and Y2K system concerns;
- globalization of business;
- increasing national and international regulatory environment, e.g. the European Monetary Union;
- BPR and the current focus on process standardization, e.g. ISO 9000;
- scaleable and flexible emerging client/server infrastructures; and
- trend towards collaboration among software vendors.

The research on ERP in the last millennium is well analyzed for instance. through the works of Esteves and Pastor (2001). They review the ERP literature through an ERP lifecycle model reflecting the adoption process. Rosemann (2003) reviews several lifecycle models and concludes that the common denominator is the distinction between pre-implementation and post-implementation stages and the lack of an explicit usage stage. He observes that up to 30 per cent of the research deals with implementation issues.

Skok and Legge (2002) further summarize the differentiating factor for the complexity of ERP projects:

- the number and variety of stakeholders in any implementation project;
- the high cost of implementation and consultancy;
- the integration of business functions;
- the subequent configuration of software representing core processes;
- the management of change and political issues associated with BPR projects; and
- the enhanced training and familiarization requirement.

This complexity has triggered two large strands of ERP implementation research and ERP success/failure research (e.g. Nah *et al.*, 2001; Shanks *et al.*, 2003). The concepts of implementation, success and failure are even more complex, and Ross and Vitale (2000)

introduced an "ERP journey" and the idea of understanding ERP implementation as a business transformation enabled by ERP.

Another strand of ERP research that deals with the business transformation is the process-oriented research (e.g. Al-Mashari, 2001; Davenport *et al.*, 2004). This strand emphasizes the ERP technology as an enabler of business process reengineering (BPR); it deals with issues of process orientation and the organizational change – both internally and as a second phase in the supply chain (Davenport and Brooks, 2004; Willis and Willis-Brown, 2002).

Kræmmergaard and Møller (2000) elaborate on these strands and combine them into a multi-dimensional model of the transformation essentially encompassing people, business, technology, and process issues. The combination of implementation and usage is discussed in Kræmmergaard *et al.* (2003) and the next section discusses the required business transformation.

New business requirements

SCM has become one of the most important new business concepts. Global competition and outsourcing have caused the fragmentation of the supply chain, and supply chain excellence is now a prerequisite for competitive advantage (Christopher, 1998). Theoretically SCM emphasizes the management of the entire supply chain as one entity, and the practice of SCM is to extend the internal business processes into the supply chain thus developing an integrated supply chain (Fox, 1999).

The concept of SCM dates back to the late 1950s where research on system dynamics explored the systemic properties of enterprises collaborating in chains. Business dynamics (Forrester, 1958) dealt with delays and information flow and addressed contemporary problems like the "Bullwhip effect" which is still a significant issue (e.g. Lee and Whang, 2001).

There was no business implication of this research due to the immaturity of the available computers, but also the success of the emerging MRP systems postponed interest in this approach for decades. The concepts re-emerged at the beginning of the 1980s initially in operations and logistics research, and by the 1990s many businesses were implementing major structural changes in their supply chain.

SCM took a systems approach to planning and controlling the material and information flow from the raw material to the final customer, and therefore SCM was defined as:

> The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole (Christopher, 1998).

The strategic management discussions dominated the initial research agenda (Scott and Westbrook, 1991), but the software industry responded to the new business requirement by producing a new breed of add-on or "bolt-on" software to ERP called Advanced Planning and Scheduling (APS) systems (Callaway, 2000).

APS was enabled by refining the mathematical programming models and in particular the genetic algorithms applied to solve the network problems of an entire supply chain. The APS systems facilitate the central management of the supply chain activities and processes in real time, essentially by extending the MRP/II planning

concepts to encompass the entire supply chain, and as a result the systems in effect are SCM systems.

Although the SCM concept deals with the entire supply chain, the perspective of the upstream SCM and the downstream SCM differs.

Downstream, SCM deals primarily with demand management, order fulfillment, replenishment and collaborative relations with customers, e.g. collaborative planning, forecast and replenishment (CPFR). Some researchers even proposed demand chain management (DCM) as a new perspective (Hoover *et al.*, 2001). The management of market information became important and the software vendors targeted these new requirements with the customer relationship management (CRM) systems.

Upstream, SCM primarily deals with issues of managing the supplier networks. Issues like supplier relations, partnerships, competence development and technology transfer are barriers for developing the supply chain. Practices based in the just-in-time (JIT) philosophies were implemented in the supply chain and new concepts like vendor managed inventories (VMI) emerged. The traditional purchasing task became strategic sourcing and the new tools required were gathered under the supplier relation management (SRM) hat.

Managing information in an inter-organizational context has become critical and the emergence of the internet and the range of related e-business technologies created new opportunities and threats to supply chain managers.

Lee and Whang (2001) define e-business in a SCM context as:

> The term "e-business" – as distinct from "e-commerce" – can be used to describe this exciting adoption of the Internet to accelerate the goal of supply chain integration.

In this context, e-business specifically refers to "the planning and execution of the front-end and back-end operations in a supply chain using the Internet" (Lee and Whang, 2001). In fact they argue that e-business already has enabled supply chain integration and that focus therefore should be redirected towards managing the demand chain.

European supply chain executives identified five key SCM issues (Akkermans *et al.*, 2003):

(1) further integration of activities between suppliers and customers;

(2) ongoing changes in supply chain needs and required IT flexibility;

(3) more mass customization of products and services leading to increasing assortments while decreasing cycle times and inventories;

(4) the *locus* of the driver's seat of the entire supply chain; and

(5) the supply chain consisting of several independent enterprises.

The same executives saw only a modest role for ERP improvements in future supply chain effectiveness and a clear risk of ERP actually limiting progress in SCM.

A recent study of the perceived benefits from implementing ERP (Davenport *et al.*, 2004) shows that the key factors driving ES benefits are:

- integration of processes;
- optimization of processes; and
- informate, or the transformation of the company based on ES data.

On the other hand, Davenport and Brooks (2004) argue that early ERP was not primarily focused on the supply chain, but the businesses that were able to extend their enterprise systems into the supply chain with "bolt on" SCM systems have experienced substantial benefits.

The key to these benefits goes through the development of infrastructural and strategic capabilities embodied in ERP combined with the SCM systems – the next generation of ERP or ERP II.

The conceptual framework of ERP II

The ERP market experienced a hype as a consequence of the Y2K problem, but after Y2K the ERP market soured. It was doubted that traditional ERP could meet the e-business challenge (Mabert *et al.*, 2001). New vendors of the "bolt-on" systems like, e.g. i2 Technology with SCM and Siebel with CRM appeared on the scene (Callaway, 2000). Application integration (EAI) became a vital issue (Themistocleous *et al.*, 2001) and new delivery and pricing methods like application service provider (ASP) and ERP rentals were conceived (Harrell *et al.*, 2001).

The ERP II was a concept originally conceived by GartnerGroup in 2000. GartnerGroup, who also tagged the ERP concept, defines ERP II as:

> [...] a business strategy and a set of industry-domain-specific applications that build customer and shareholder value by enabling and optimizing enterprise and inter-enterprise, collaborative-operational and financial processes (Bond *et al.*, 2000).

So ERP II builds on ERP (GartnerGroup later resigned on this requirement) thus excluding "bolt-on" vendors like i2, Siebel from the vision (Mello, 2001). AMR Research does not restrict their competing vision on enterprise commerce management (ECM) to the ERP vendors and define ECM as:

> [...] a blueprint that enables clients to plan, manage, and maximize the critical applications, business processes and technologies they need to support employees, customers, and suppliers (www.amrresearch.com/ECM).

ERP II includes six elements that touch on business, application and technology strategy:

(1) the role of ERP II;

(2) its business domain;

(3) the functions addressed within that domain;

(4) the kinds of processes required by those functions;

(5) the system architectures that can support those processes; and

(6) the way in which data are handled within those architectures.

With the exception of architecture, these ERP II elements represent an expansion of traditional ERP (Bond *et al.*, 2000). So in conclusion ERP II is essentially componentized ERP, e-business and collaboration in the supply chain.

Throughout the ERP industry this new philosophy of ERP and e-business was gradually incorporated into the legacy ERP systems offering; systems architectures were redesigned and modularized, for instance like SAP intends to do with the NetWeaver platform. Therefore the standard systems today incorporate ERP II. The

ERP industry survived the challenge and recent market analysis does not show any signs of market fragmentation. Table II illustrates the top-fvie ERP vendors's 2001 and 2002 market shares (more than 50 percent). It shows a market with one dominant actor, a handful of important vendors and a large number of less significant vendors.

Today all the major vendors have adopted the ERP II concept, either partly or fully. The evolution is driven by the emerging business requirements and new information technology as we have argued in the preceding section was the case of the evolution of ERP. The technologies are not necessarily the inventions of the ERP vendors, rather the technology is sourced from the market as components, e.g. application frameworks (.NET or J2EE), databases (Oracle or MS SQL) or decision support systems (DSS) from third-party vendors, but when incorporated into ES the business benefit increases.

Business intelligence (BI) is an example of an analytical DSS tool. BI was previously associated with add-on systems like data warehouse systems. BI is based on OLAP technology which is now integrated into to core of the standard databases. BI refers to a broad category of analytical applications that help companies make decision based on the data in their ERP systems. Another example is internet standards like XML, originally devised outside the control of the major vendors but gradually adopted into the infrastructure of the ERP systems.

Consequently there is an emerging pattern of generic application architecture. Callaway (2000) and Weston (2003) have attempted to frame the development and aspects have been dealt with in, e.g. Wortmann *et al.* (2000) and Møller (2003). The conceptual framework of ERP II illustrated in Figure 1 consists of four layers to be elaborated on in the following:

(1) the core components: the foundation layer;

(2) the central component: the process layer;

(3) the corporate components: the analytical layer; and

(4) the collaborative components: the e-business layer.

In Table III these layers are decomposed into a set of generic components which are explained in the following.

Core components

The foundation layer is the core component of ERP II and the basic architecture. One core element is the integrated database. The database does not need to be monolithic but may be distributed. Another core element is the application framework.

Vendor	Market share (%) 2002	2001
SAP AG	25.1	24.7
Oracle	7.0	7.9
PeopleSoft	6.5	7.6
SAGE	5.4	4.6
Microsoft Business Solutions	4.9	4.6
Others	51.1	50.3
Total market share	100.0	100.0

Source: Gartner Dataquest (June 2003)

Table II.
Top five world-wide ERP software application new license revenue market share estimates for 2002

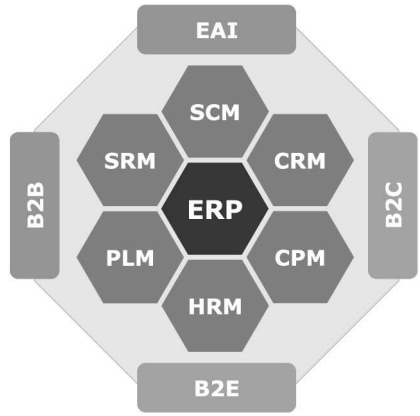

Figure 1.
The conceptual framework for ERP II

Layer	Components	
Foundation	Core	Integrated database (DB) Application framework (AF)
Process	Central	Enterprise resource planning (ERP) Business process management (BPM)
Analytical	Corporate	Supply chain management (SCM) Customer relationship management (CRM) Supplier relationship management (SRM) Product lifecycle management (PLM) Employee lifecycle management (ELM) Corporate performance management (CPM)
Portal	Collaborative	Business-to-consumer (B2C) Business-to-business (B2B) Business-to-employee (B2E) Enterprise application integration (EAI)

Table III.
The four layers in ERP II

Central components

The process layer is the central component which reflects the transaction-based systems. ERP II is web based, open and componentized. This is different from being web enabled, and the ultimate ERP II concept may be implemented as a set of distributed web services.

ERP is the central component in the ERP II conceptual framework. The traditional ERP modules like financials, sales and distribution, logistics, manufacturing, and human resources are still the backbone of ERP along with additional modules like quality management, project management or maintenance.

ERP II systems are based on business process management (BPM). ERP has been based on "Best-practice" process reference models but ERP II systems build on the notion of the process as the central model entity including tools to design (or orchestrate) processes, to execute and evaluate processes (business activity monitoring).

BPM allows for a flexibility of ERP II as regards different business practices, but for specific segments that otherwise would require problematic customization, like apparel and footwear or the public sector, ERP II also has vertical solutions. Vertical solutions are sets of standardized pre-configured systems with "add-ons" to match specific requirements or partial models in CIMOSA terms.

Corporate components

The analytical layer comprise the corporate components that enhance and extend central ERP functions by providing decision support for the management of relations and corporate issues. These components are not necessarily directly synchronized with the integrated database:

- SCM systems support the planning and production of goods. For instance, SCM provides information such as where the product is to be produced, the procurement of parts and delivery schedules.
- CRM systems facilitate the managing of a broad set of functions that primarily include the customer identification process and customer service management.
- SRM is the vendor side analogy to CRM aimed at the effective management of the supplier base. SRM enables the enterprise to manage its supplier relations in their entire life-cycle.
- Product lifecycle management (PLM) including product data management (PDM) enables enterprises to bring innovative and profitable products to market more effectively, especially in the evolving e-business environment. PLM enables extended enterprises to harness their innovation process through the effective management of the full product definition lifecycle.
- Employee lifecycle management (ELM) is the integration of all aspects of information relation to an employee from hiring to retirement from the company. ELM enables enterprises to effectively manage their portfolio of competencies.
- Corporate performance management (CPM) is an umbrella term that describes the methodologies, metrics, processes and systems used to monitor and manage the business performance of an enterprise. Thus CPM provides management with an overall perspective on the business.

Collaborative components

The e-business layer is the portal of ERP II. The collaborative components deal with communication and integration between the ERP II system and external actors:

- Business to consumer (B2C) or e-commerce denotes commercial sales transactions either with businesses or with individual customers over the electronic medium, usually the internet. This does indeed require an extensive infrastructure of which the main features are a catalogue, online ordering facilities and status checking facilities. The ERP system serves as the transaction processing back end for the Internet-based front end.
- Business to business (B2B) or e-procurement improves efficiency by automating and decentralizing the procurement process. The traditional procedures of sending Request for Quotes (RFQ) documents and obtaining invoices etc. are

carried out over the web through purchasing mechanisms such as auctions or other electronic marketplace functions, including catalogues.

- Business to employee (B2E) or an intranet provides the employee with an updated, personalized portal to the enterprise on his desktop. The perspectives of the intranet and knowledge management in combination increase with the ERP II concept.
- EAI or extranet provides the ERP II system with a platform for integration with other systems inside or outside the corporation. EAI provides the support for automating processes across various IT platforms, systems and organizations.

The adoption of next-generation enterprise systems

The conceptual framework for ERP II is a theoretical model based on generalized observations and on an analysis of the past and the present of enterprise systems. The analysis focused on business requirements and the available technology, but the framework does not consider the actual business transformations. Therefore we need to consider the adoption of the technology.

A recent survey on ERP adoption in large Danish enterprises (Møller, 2004) concluded that:

- ERP has become a pervasive technology;
- ERP has become a contemporary technology;
- the ERP market has matured; and
- the dominant ERP strategy is still the single vendor strategy.

The study was based on telephone interviews with ERP managers in 88.4 per cent of the top 500 enterprises in Denmark. 13.6 per cent of the enterprise had more than one ERP system. Table IV provides a summary of the findings distributed on the top-five vendors, in-house developed ERP and other vendors. We assume that the five largest ERP vendors in Denmark accounting for 66.6 per cent of the installations all have incorporated part of the ERP II components in their recent releases.

Based on the average age of the ERP systems and the software versions we conclude that the large (Danish) enterprises already have, or will acquire the foundation for the ERP II in the near future.

It has been argued that people, structure, realignment and change management will prove important to accomplish the ERP II vision (Weston, 2003). Based on a Delphi study (Akkermans *et al.*, 2003) and a similar Danish workshop for logistics managers held in 2002 (Sørensen, 2003), it can be deduce that supply chain integration is progressing slowly and facing barriers based on the enterprise systems.

Consequently, if we acknowledge Davenport *et al.* (2004) observations we can wrap it up to: ERP II nice technology, but no integration – no benefit! This means that the technology may be available in the businesses but not necessarily put into intended usage.

One of the cases of successful SCM is Dell (Margretta, 1998). Dell uses the internet in combination with their ES to create a rapid-responding supply chain consisting of customers, Dell and Dell's suppliers. Thus Dell is able to purpose-build computers by synchronizing supply and demand. Judging from best-practice cases, e.g. the cases collected in the ASCET projects (www.ascet.com), we primarily find excellence in

	Share based on installations (%)	Average revenue m DDK	Share based on revenue (%)	Average staff	Share based on staff (%)	Average ERP users	Share based on ERP users (%)	Average ERP age	Average return (%)
Microsoft	34.2	1,408.16	15.0	792.53	10.1	136.60	12.8	2.4	4.17
SAP	19.9	6,975.15	43.2	8,195.73	61.2	779.00	41.0	2.4	3.64
EDB Gruppen	5.1	2,421.50	3.8	1,529.00	3.0	401.40	5.6	3.2	2.25
Intentia	4.1	1,267.69	1.6	1,164.81	1.8	266.56	3.0	2.8	3.00
Oracle	3.3	5,855.31	6.0	3,355.23	4.2	371.92	3.4	0.7	−3.82
Other vendors	17.3	2,579.87	13.9	1,488.68	9.4	265.25	12.5	3.6	5.46
In-house	9.4	4,233.32	12.4	2,324.34	7.9	884.63	21.7	4.8	1.24
No ERP	6.6	1,897.62	3.9	1,083.33	2.5				−19.83
Total	100.0	3,211.71	100.0	2,708.25	100.0	396.81	100.0	2.8	2.29

Table IV. Summary of the ERP system of Danish top 500 enterprises

supply chains with a dominating enterprise – a supply captain – guiding the supply chain. Present SCM practices and systems are focused on tight-coupled supply chains.

The concept of the extended enterprise (EE) is often utilized to capture twenty-first century agile networking organizations. The EE has been used to characterize the global supply chain of a single product in an environment of dynamic networks of agile companies engaged in various complex relationships. The inter-organizational network may be defined as a virtual enterprise of all the relevant functions of a company, its suppliers and its customers, who together are termed the EE (Patterson *et al.*, 1997). The EE introduces the idea of the loosely coupled supply chain, sometimes referred to as an adaptive supply network. Jagdev and Thoben (2001) typify the networks and emphasizes the role of IT in those enterprise networks, but until now IS research has not dealt with enterprise systems explicitly in loose-coupled supply chains. The ERP II conceptual framework needs to be extended in order to incorporate the EE perspective.

Another observation from the Dell case is their ERP strategy. Dell abandoned a SAP project and implemented their "G2 strategy" based on an open flexible architecture and EAI middleware. EAI middleware is increasingly being used as a tool to integrate the supply chain in adaptive networks (Evgeniou, 2002; Themistocleous *et al.*, 2001). Consequently a new ES integration strategy called "Best of Breed" (BoB) has become feasible (Light *et al.*, 2001). The ERP II conceptual framework encapsulates the BoB and EAI strategy by the componentizing the concept. Therefore ERP II is able capture the application architecture independently of vendors or systems.

The BoB strategy is competing head to head with a single ERP vendor strategy. Markus *et al.* (2000) discuss two possible views on the future of ERP: a continuity view extending on the existing ERP systems and a discontinuity view where exchanges drive the supply chain integration and the monolithic ERP is replaced by fragmented systems and that ERP only is needed in the intermediating marketplace hub. At least in the short term there are no signs that the enterprise is giving up on their corporate ERP strategy but the network perspective of the ERP transformation is important. Consequently the ERP II conceptual framework need to be enhanced and thus combine the corporate and the network perspective on supply chain integration.

As a conclusion to this discussion ERP II is an important extension of ERP with regard to three key aspects:

(1) the combination of the corporate and the network perspectives on supply chain integration;

(2) the loosely coupled supply chain perspective; and

(3) the view on application architecture independent from specific vendors and systems.

Conclusions

Based on a retrospective analysis of the ERP concept, ERP research and the emerging business requirements this paper has established a conceptual framework for ERP II.

The paper proposed a conceptual framework for ERP II. The model compiled sets the ES concept into a comprehensive outline of ERP II and thus composes a generic map and taxonomy for contemporary corporate enterprise systems. The model is offered as a first step towards a tool to analyze the completeness of the ERP II vision in an enterprise or to analyze the products from an ERP vendor.

The next-generation ES is already out there, is concluded from the findings in a Danish survey. But we need an instrument to measure the usage of the ERP II vision. We need to enhance the conceptual framework to be able to measure which processes are used and how they are executed. For instance we would need to decompose the SCM component further into processes like demand management, Available-to-Promise, and supply chain planning, etc, in order to capture the implementation of the systems. We have argued that inter-organizational integration is crucial to reaping the benefits of ERP II. ERP II is a new vision that has only recently been embraced by ERP vendors, and it will take a while before we are able to actually evaluate the impact of ERP II on industry.

The paper has categorized ERP II as a non-disruptive technology based on the ERP theory and the retrospective analysis. We have argued that the ERP II encompasses the vision of the integrated supply chain but the perspectives of the ERP research must be extended into the supply chain.

The implications for future research would be that more work on generic ERP concepts is needed. We have not yet managed to fully comprehend the complexity of internal process change. We have only just begun the quest for inter-enterprise integration. When business integrates processes across the supply chain it will face tremendous challenges and a new field, inter-organizational business process integration, will emerge – the next challenge of ERP research.

One last observation would be that if every vendor's package complies with the ERP II vision then the concept appears to be exhausted. ERP II has been instrumental in the vendors' endeavor towards e-business and has not changed the fundamentals of ERP as a standardized software package and ERP research. This paper is by no means intended as the ERP II obituary but it is tempting to paraphrase the opening remark as a conclusion: ERP II is dead – long live ERP!

References

Akkermans, H.A.B., Yücesan, P., van Wassenhove, E. and Luk, N. (2003), "The impact of ERP on supply chain management: exploratory findings from a European Delphi study", *European Journal of Operational Research*, Vol. 146 No. 2, pp. 284-301.

Al-Mashari, M. (2001), "Process orientation through enterprise resource planning (ERP): a review of critical issues", *Knowledge and Process Management*, Vol. 8 No. 3, pp. 175-85.

Bancroft, N.H., Seip, H. and Sprengel, A. (1997), *Implementing SAPR/3: How to Introduce a Large System into a Large Organization*, Manning, Greenwich.

Bond, B., Genovese, Y., Miklovic, D., Wood, N., Zrinsek, B. and Rayner, N. (2000), *ERP Is Dead – Long Live ERP II*, GartnerGroup, New York, NY.

Callaway, E. (2000), *ERP – The Next Generation: ERP Is Web Enabled for E-business*, Computer Technology Research Corporation, Charleston, SC.

Chen, I.J. (2001), "Planning for ERP systems: analysis and future trend", *Business Process Management Journal*, Vol. 7 No. 5, pp. 374-86.

Christopher, M. (1998), *Logistics and Supply Chain Management – Strategies for Reducing Costs and Improving Services*, 2nd ed., Pitman Publishing, London.

Davenport, T.H. (1998), "Putting the enterprise into the enterprise system", *Harvard Business Review*, July/August, pp. 121-31.

Davenport, T.H. (2000), "The future of enterprise system-enabled organizations", *Information Systems Frontiers*, Vol. 2 No. 2, pp. 163-80.

Davenport, T.H. and Brooks, J.D. (2004), "Enterprise systems and the supply chain", *Journal of Enterprise Information Management*, Vol. 17 No. 1, pp. 8-19.

Davenport, T.H., Harris, J.G. and Cantrell, S. (2004), "Enterprise systems and ongoing process change", *Business Process Management Journal*, Vol. 10 No. 1, pp. 16-26.

Esteves, J. and Pastor, J. (2001), "Enterprise resource-planning systems research: an annotated bibliography", *Communications of the AIS*, Vol. 7 No. 8, pp. 1-52.

Evgeniou, T. (2002), "Information integration and information strategies for adaptive enterprises", *European Management Journal*, Vol. 20 No. 5, pp. 486-94.

Forrester, J. (1958), "Industrial dynamics: a major breakthrough for decision makers", *Harvard Business Review*, Vol. 36, July-August, pp. 37-66.

Fox, M.L. (Ed.) (1999), *Charting the Course to Successful Supply Chain Management. Achieving Supply Chain Excellence through Technology*, Vol. 1, Montgomery Research, San Francisco, CA.

Harrell, H.W., Higgins, L. and Ludwig, S.E. (2001), "Expanding ERP application software: buy, lease, outsource, or write your own?", *Journal of Corporate Accounting & Finance*, Vol. 12 No. 5, pp. 37-43.

Hoover, W.E., Eloranta, E., Holström, J. and Huttunen, K. (2001), *Managing the Demand Chain*, John Wiley & Sons, New York, NY.

Jagdev, H.S. and Thoben, K.-D. (2001), "Anatomy of enterprise collaboration", *Production Planning & Control*, Vol. 12 No. 5, pp. 437-51.

Klaus, H., Rosemann, M. and Gable, G.G. (2000), "What is ERP?", *Information Systems Frontiers*, Vol. 2 No. 2, pp. 141-62.

Kræmmergaard, P. and Møller, C. (2000), "A research framework for studying the implementation of enterprise resource-planning systems", in Svenson, L., Snis, U., Sørensen, C., Fägerlind, H., Lindroth, T., Magnusson, M. and Östlund, C. (Eds), *Proceedings of the 23rd Information Systems Research Seminar in Scandinavia: "Doing IT together", Lingatan, 12-15 August*.

Kræmmergaard, P., Møller, C. and Boer, H. (2003), "ERP implementation: an integrated process of radical change and continuous learning", *Production Planning & Control*, Vol. 14 No. 4, pp. 338-48.

Lee, H.L. and Whang, S. (2001), *E-business and Supply Chain Integration*, Stanford Global Supply Chain, New York, NY.

Light, B., Holland, C.P. and Wills, K. (2001), "ERP and best of breed: a comparative analysis", *Business Process Management Journal*, Vol. 7 No. 3, pp. 216-24.

Mabert, V.A., Soni, A. and Venkataramanan, M.A. (2001), "Enterprise resource planning: common myths versus evolving reality", *Business Horizons*, Vol. 44 No. 3, pp. 69-76.

Margretta, J. (1998), "The power of virtual integration: an interview with Dell Computers' Michael Dell", *Harvard Business Review*, March-April, pp. 73-84.

Markus, M.L. and Tanis, C. (2000), "The enterprise systems experience from adoption to success", in Zmud, R.W. (Ed.), *Framing the Domains of IT Research: Glimpsing the Future through the Past*, Pinnaflex Educational Resources, Cincinnati, OH, pp. 173-207.

Markus, M.L., Petrie, D. and Axline, S. (2000), "Bucking the trends: what the future may hold for ERP packages", *Information Systems Frontier*, Vol. 2 No. 2, special issue of on The Future of Enterprise Resource Planning Systems, pp. 181-93.

Mello, A. (2001), "Battle of the labels: ERP II vs ECM", *ZD TECH Update*, October 2.

Møller, C. (2003), "ERP II extended enterprise resource planning", paper presented at the 7th World Multi-Conference on Systemics, Cybernetics and Informatics, Orlando, FL, July/August.

Møller, C. (2004), "ERP in large Danish enterprises: implications for SCM", *Proceedings of the Americas Conference on Information Systems, New York, NY, August*.

Nah, F.F.-H. (Ed.) (2002), *Enterprise Resource Planning Solutions and Management*, IRM Press, Hershey, PA.

Nah, F.F.-H., Lau, J.L.-S. and Kuang, J. (2001), "Critical factors for successful implementation of enterprise systems", *Business Process Management Journal*, Vol. 7 No. 3, pp. 285-96.

Patterson, R., Hardt, D. and Neal, R. (1997), *Next-generation Manufacturing – A Framework for Action*, The Agility Forum, Bethlehem, PA.

Rosemann, M. (2003), "Enterprise system management with reference process models", in Shanks, G., Seddon, P.B. and Willcocks, L.P. (Eds), *Second-wave Enterprise Resource-Planning Systems: Implementing for Effectiveness*, Cambridge University Press, Cambridge.

Ross, J.W. and Vitale, M.R. (2000), "The ERP revolution: surviving vs thriving", *Information Systems Frontier*, Vol. 2 No. 2, pp. 233-41.

Scott, C. and Westbrook, R. (1991), "New strategic tools for supply chain management", *International Distribution and Logistics Management*, Vol. 21 No. 1, pp. 23-33.

Shanks, G., Seddon, P.B. and Willcocks, L.P. (Eds) (2003), *Second-wave Enterprise Resource Planning Systems: Implementing for Effectiveness*, Cambridge University Press, Cambridge.

Skok, W. and Legge, M. (2002), "Evaluating enterprise resource-planning (ERP) systems using an interpretative approach", *Knowledge and Process Management*, Vol. 9 No. 2, pp. 72-82.

Sørensen, M. (2003), *Trends og tendenser for fremtidens forsyningskæder*, Center for Industrial Production, Aalborg (in Danish).

Themistocleous, M., Irani, Z. and Keefe, R.M.O. (2001), "ERP and application integration", *Business Process Management Journal*, Vol. 7 No. 3, pp. 195-204.

Weston, E.C.T. (2003), "ERP II: the extended enterprise system", *Business Horizons*, Vol. 46, November/December, pp. 49-55.

Willis, T.H. and Willis-Brown, A.H. (2002), "Extending the value of ERP", *Industrial Management & Data Systems*, Vol. 102 Nos 1/2, pp. 35-8.

Wortmann, J.C. (1998), "Evolution of ERP systems", in Bititchi, U.S. and Carrie, A.S. (Eds), *Strategic Management of the Manufacturing Value Chain*, Kluwer Academic Publishers, Amsterdam.

Wortmann, J.C., Hegges, H.M.H. and Rolfes, S. (2000), "Embedding enterprise software in extended enterprise models", *Computers in Industry*, Vol. 42, pp. 231-43.

Further reading

Warner, J. *et al.* (Eds) (1999), *Information and Technology in the Supply Chain: Making Technology Pay*, Euromoney Publications, London.