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Enterprise Resource Planning (ERP): a review of the literature

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Abstract: This article is a review of work published in various journals on the topics of Enterprise Resource Planning (ERP) between January 2000 and May 2006. A total of 313 articles from 79 journals are reviewed. The article intends to serve three goals. First, it will be useful to researchers who are interested in understanding what kinds of questions have been addressed in the area of ERP. Second, the article will be a useful resource for searching for research topics. Third, it will serve as a comprehensive bibliography of the articles published during the period. The literature is analysed under six major themes and nine sub-themes.

Keywords: Enterprise Resource Planning; ERP; survey; journal articles.

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1 Introduction

The Enterprise Resource Planning (ERP) system is an enterprise information system designed to integrate and optimise the business processes and transactions in a corporation. The ERP is an industry-driven concepts and systems, and is universally accepted by the industry as a practical solution to achieve integrated enterprise information systems. The academic research community has been contributing to the field in various ways. A typical way of contributing to a field is by publishing archival journal papers for public benefits. This article is a review of the literature on ERP published between 2000 and 2006 (31 May).

The article intends to serve three goals. First, it will be useful to researchers who are interested in understanding what kinds of questions have been addressed in the area of ERP. Second, the article will be a useful resource for searching for research topics. Third, it will serve as a comprehensive bibliography of the articles published during the period.

The set of papers published in various journals between 2000 and 2006 (as of 31 May 2006) is vast, comprising 313 articles. As a consequence, it is difficult to provide detail review of all the articles. Instead, an aggregate summary for each theme is described. Direct references are deliberately avoided, but a complete list of references for each theme is provided. The reviewed articles are organised into themes and some collective properties of the articles are described for each theme.

Two review articles have been written on ERP prior to this article. The one by Esteves and Pastor (2001) is an annotated bibliography of the main journal and conference articles in Information Systems (IS) during the period 1997–2000. They include a brief summary sentence for each article along with a complete list of references. The total numbers of articles surveyed are 189. However, the numbers of journal articles among these is only 21, perhaps reflecting the infancy of the field during that period. The other review article on ERP is by Botta-Genoulaz *et al.* (2005). They analysed the ERP literature during the period 2003–2004. Similar to this article, they also developed six categories and classified the articles under each category. The six categories that they adopted are:

1 implementation of ERP

2 optimisation of ERP

3 management through ERP

4 the ERP software

5 ERP for supply chain management

6 case studies.

Summary and analysis are provided with a reference to corresponding articles. A total of 81 articles were surveyed. However, more than 17 of these are non-journal articles such as conference proceeding publications.

In contrast to previous two review articles, this article surveys only the journal articles and covers a longer and more recent period (between January 2000 and May 2006). No restrictions are imposed on the field of the journals, thus representing truly multi-disciplinary views on ERP.

The article is divided into four remaining sections. Section 2 describes the methodology followed in collecting and analysing the articles. Section 3 provides the aggregate properties of these articles for each major theme. Some analyses of statistics on the reviewed articles along with a few obvious trends are provided in Section 4. The paper concludes with Section 5.

2 Methodology

The criteria for choosing articles for the review are as follows. First of all, the article must have been published in a peer-review, archival journal. Second, to avoid never ending revision of the article, 31 May 2006 was selected as the cut-off date. Third, only the articles with ‘ERP’ as a part of their titles were selected. The exceptions are those articles that are explicitly dealing with ‘ERP’ but for some reasons the authors decided not to use ‘ERP’ in the title. The inclusion of such articles is inevitably *ad hoc*.

Consequently, it is possible that there exist more of such articles which are not surveyed in this article. Fourth, no restrictions were imposed on the field of the surveyed journal. This should allow a comprehensive set of viewpoints on ERP by different fields. According to these criteria, an attempt has been made to collect all the available journal articles. The effort to compile has been carried out over two years through exhaustive computer search, database search, internet search, reference checking, *etc.* However, it is always possible that some of the articles are missing from this list. The complete list of the 79 journals along with the number of articles appeared in each journal is found in Table 1.

Table 1 Number of articles in each journal (all in alphabetical order)

Journal title	*Number of ERP journal articles*
Australian Accounting Review	1
Business Horizons	1
Business Process Management Journal	30
Communications of the ACM	10
Communications of the AIS	3
Computer Standards and Interfaces	1
Computers in Human Behavior	2
Computers in Industry	12
Construction Management and Economics	1
Data & Knowledge Engineering	1
The Data Base for Advances in Information Systems	6
Decision Sciences	2
Decision Support Systems	3
European Journal of Information Systems	10
European Journal of Operational Research	10
Expert Systems with Applications	2
Government Information Quarterly	1
IEEE Transactions of Engineering Management	1
IEEE Transactions of Software Engineering	1
Industrial Management & Data Systems	25
Industrial Marketing Management	2
Information and Management	9
Information and Organization	2
Information and Software Technology	1
Information Management & Computer Security	5
Information Resources Management Journal	2
Information Systems	2
Information Systems Frontiers	5
Information Systems Management	3

Table 1 Number of articles in each journal (all in alphabetical order) (continued)

Journal title	*Number of ERP journal articles*
Information Technology and People	4
Information Technology and Management	1
Integrated Manufacturing Systems	1
International Journal of Accounting Information Systems	6
International Journal of Agile Management Systems	1
International Journal of Computer Applications in Technology	2
International Journal of Computer Integrated Manufacturing	1
International Journal of Human-Computer Interaction	6
International Journal of Information Management	1
International Journal of Management and Enterprise Development	7
International Journal of Operations and Production Management	4
International Journal of Physical Distribution and Logistics Management	1
International Journal of Production Economics	13
International Journal of Production Research	10
International Journal of Project Management	2
International Journal of Quality and Reliability Management	1
Journal of Computer Information Systems	1
Journal of Database Management	1
Journal of Education for Business	1
Journal of Engineering and Technology Management	2
Journal of Enterprise Information Management	22
Journal of Government Financial Management	1
Journal of Information Science	1
Journal of Information Systems	2
Journal of Information Systems Education	12
Journal of Information Technology	6
Journal of Information Technology Cases and Applications	1
Journal of Management in Medicine	1
Journal of Management Information Systems	3
Journal of Manufacturing Technology Management	3
Journal of Materials Processing Technology	1
Journal of Organizational and End User Computing	1
Journal of Organizational Change Management	1
Journal of Organizational Computing and Electronic Commerce	1
Journal of Software Maintenance and Evolution: Research Practice	5
Journal of Strategic Information Systems	9
Journal of Systems and Software	1
Knowledge and Process Management	1

Table 1 Number of articles in each journal (all in alphabetical order) (continued)

Journal title	*Number of ERP journal articles*
Logistics Information Management	1
Management Accounting Research	1
Management Decisions	1
Managerial Auditing Journal	1
Omega	4
Production and Inventory Management Journal	3
Qualitative Market Research: An International Journal	1
Requirements Engineering	1
Robotics and Computer-Integrated Manufacturing	1
Sloan Management Review	1
Technovation	5
Transportation Research Part E: Logistics and Transportation Review	1
Total	313

Table 2 Major themes and sub-themes within the domain of ERP

Themes
Implementation
Case study
Critical success factors
Change management
Focused stage in the implementation process
Cultural (national) issues
Using ERP
Decision support
Focused function in ERP
Maintenance
Extension
Value
Trends and perspectives
In a particular sector
Education

The major themes defined in this article are (1) implementation, (2) using ERP, (3) extension, (4) value, (5) trends, and (6) education. For (1) implementation, we defined five sub-themes: (a) case study, (b) critical success factors, (c) change management, (d) focused stage, and (e) cultural issues. For (2) using ERP, four sub-themes are defined: (a) change management, (b) decision support, (c) focused function, and (d) maintenance. For (5) trend, we have only one sub-theme: in a particular sector. Table 2 shows these themes and sub-themes used in this article.

A comprehensive table containing these themes and their classified references for each theme is provided in Table 3. There is no particular sequence among the references listed in the table. It is unavoidable to have an article that is relevant to more than one theme. For example, an article may address implementation issues but provide general information or trends on ERP. In such a case, more weighted theme is chosen to classify the article according to the author's judgment. Listing an article under more than one sub-theme was allowed.

Table 3 Themes and references

Themes	*References*
Implementation	
General	Siriginidi, 2000; Lee and Lee, 2000; Ross and Vitale, 2000; Teltumbde, 2000; Scott and Vessey, 2000; Parr and Shanks, 2000; Markus *et al.*, 2000c; Willcocks and Sykes, 2000; Adam and O'Doherty, 2000; Stensrud, 2001; Clemmons and Simon, 2001; Light, 2001; Weston, 2001; Huang and Palvia, 2001; Besson and Rowe, 2001; Dong, 2001; Al-Mudimigh *et al.*, 2001; Xu *et al.*, 2002; Rajagopal, 2002; Robey *et al.*, 2002; Gulla and Brasethvik, 2002; Motwani *et al.*, 2002; Siau and Messersmith, 2003; Voordijk *et al.*, 2003; Mabert *et al.*, 2003a; Soffer *et al.*, 2003; Bradford and Florin, 2003; Mabert *et al.*, 2003b; Haines and Goodhue, 2003; Kumar *et al.*, 2003; Mandal and Gunasekaran, 2003; Soh *et al.*, 2003; Scott and Wagner, 2003; Abdinnour-Helm *et al.*, 2003; Yen and Sheu, 2004; Thomas and Jajodia, 2004; Ho *et al.*, 2004a; Siau, 2004; Amoako-Gyampah, 2004; Huin, 2004; Jones and Price, 2004; Okrent and Vokurka, 2004; Fleisch *et al.*, 2004; Ho *et al.*, 2004b; Ioannou and Papadoyiannis, 2004; Gefen, 2004; Lee and Myers, 2004; Soffer *et al.*, 2005; Trimi *et al.*, 2005; Zafiropoulos *et al.*, 2005; Buonanno *et al.*, 2005; Metaxiotis *et al.*, 2005; Light, 2005; Kim *et al.*, 2005; Worley *et al.*, 2005; Gosain *et al.*, 2005; Wei *et al.*, 2005b; Nandhakumar *et al.*, 2005; Ward *et al.*, 2005; Cadili and Whitley, 2005; Al-Mashari *et al.*, 2006; Bubak *et al.*, 2006
Case study	Bhattacherjee, 2000; Koh *et al.*, 2000; Al-Mashari and Zairi, 2000b; Brown and Vessey, 2001; Akkermans and van Helden, 2002; Kawalek and Wood-Harper, 2002; Barker and Frolick, 2003; Al-Mashari and Al-Mudimigh, 2003; Sarkis and Sundarraj, 2003; Cowan and Dder, 2003; Sarker and Lee, 2003; Yusuf *et al.*, 2004; Gupta *et al.*, 2004; Alshawi *et al.*, 2004; Gulledge and Simon, 2005; Berchet and Habchi, 2005; Tchokogue *et al.*, 2005
Critical success factors	Sumner, 2000; Nah *et al.*, 2001b; Hong and Kim, 2002; Akkermans and van Helden, 2002; Trimmer *et al.*, 2002; Umble *et al.*, 2003; Nah *et al.*, 2003; Huang *et al.*, 2004b; Loh and Koh, 2004; Somers and Nelson, 2004; Sun *et al.*, 2005; Motwani *et al.*, 2005; Ehie and Madsen, 2005; Dowlatshahi, 2005; Gargeya and Brady, 2005
Change management	Al-Mashari and Zairi, 2000a; Aladwani, 2001; Sia *et al.*, 2002; Al-Mashari, 2003a; Amoako-Gyampah, 2004; Soh and Sia, 2004; McAdam and Galloway, 2005; Ettlie *et al.*, 2005; Loarne, 2005; Boersma and Kingma, 2005b; Benders *et al.*, 2006

Table 3 Themes and references (continued)

Themes	*References*
Focused stage	Bernroider and Koch, 2001; Stefanou, 2001; Verville, 2002a; Gefen, 2002; Verville, 2002b; Alvarez and Urla, 2002; Bryson and Sullivan, 2003; Arinze and Anandarajan, 2003; Verville, 2003a; 2003b; Wei and Wang, 2004; Bendoly and Jacobs, 2004; Luo and Strong, 2004; Wei *et al.*, 2005a; Baki and Cakar, 2005; Verville *et al.*, 2005
Cultural issues	Soh *et al.*, 2000; Krumbholz *et al.*, 2000; Adam and O'Doherty, 2000; Krumbholz and Maiden, 2001; Kumar, 2002; Kumar *et al.*, 2002; Sheu *et al.*, 2004; Baki *et al.*, 2004; Boersma and Kingma, 2005a; Xue *et al.*, 2005; Wang *et al.*, 2005; Zhang *et al.*, 2005; Tsai *et al.*, 2005; Baki and Cakar, 2005; Bendoly *et al.*, 2006; Jones *et al.*, 2006; Yusuf *et al.*, 2006
Using ERP	
General	Kremers and van Dissel, 2000; Koch, 2001b; Boykin, 2001; Vosburg and Kumar, 2001; Koh and Saad, 2002; Stratman and Roth, 2002; O'Leary, 2002; Stirling *et al.*, 2002; Somers and Nelson, 2003; Nah *et al.*, 2004; Calisir and Calisir, 2004; Martin and Cheung, 2005; Yu, 2005; Koh and Simpson, 2005; Botta-Genoulaz and Millet, 2005a; Park and Kusiak, 2005; Voordijk *et al.*, 2005; Brown and Nasuti, 2005; Brazel, 2005; El Sayed, 2006; Koh and Saad, 2006
Decision support	Holsapple and Sena, 2003; Bendoly, 2003; Chen *et al.*, 2003; Holsapple and Sena, 2005
Focused function	Rolland and Prakash, 2000; Palaniswamy and Tyler, 2000; Mandal and Gunasekaran, 2002; Gardiner *et al.*, 2002; Granlund and Malmi, 2002; Metaxiotis *et al.*, 2003; Mensching and Corbitt, 2004; Hsu and Chen, 2004; O'Leary, 2004; Gupta and Kohli, 2006; Rom and Rohde, 2006
Maintenance	Nah *et al.*, 2001a; Ng, 2001; Hirt and Swanson, 2001; Gable *et al.*, 2001; Light *et al.*, 2001; Kwon and Lee, 2001; Ng *et al.*, 2002; Nikolopoulos *et al.*, 2003
Extension	Scott and Kaindl, 2000; Zheng *et al.*, 2000; Tarn *et al.*, 2002; Willis and Willis-Brown, 2002; Choi and Kim, 2002; Sumi and Tsuruoka, 2002; Yen *et al.*, 2002; Lee *et al.*, 2003; Weston, 2003; Akkermans *et al.*, 2003; Rutner *et al.*, 2003; Newell *et al.*, 2003; Symeonidis *et al.*, 2003; Kovács and Paganelli, 2003; Ash and Burn, 2003; Ng and Ip, 2003; Gulledge *et al.*, 2004a; 2004b; Frank, 2004; Bendoly and Kaefer, 2004; Davenport and Brooks, 2004; Koh and Saad, 2004; Barthorpe *et al.*, 2004; Ndede-Amadi, 2004; Cardoso *et al.*, 2004; Chou *et al.*, 2005; Burn and Ash, 2005; Moon and Phatak, 2005; Moller, 2005; Bendoly and Schoenherr, 2005; Lea *et al.*, 2005; Jaiswal and Kaushik, 2005; Kelle and Akbulut, 2005; Biehl, 2005; Burca *et al.*, 2005; Sammon and Adam, 2005; Sharma *et al.*, 2006

Table 3 Themes and references (continued)

Themes	*References*
Value	Kennerley and Neely, 2001; Mabert *et al.*, 2001; Poston and Grabski, 2001; Hayes *et al.*, 2001; Robinson and Wilson, 2001; Hitt *et al.*, 2002; Hunton *et al.*, 2002; Gattiker and Goodhue, 2002; Beretta, 2002; Hunton *et al.*, 2003; Somers *et al.*, 2003; Spathis and Constantinides, 2003; Stensrud and Myrtveit, 2003; Spathis and Constantinides, 2004; Hedman and Borell, 2004; Nicolaou, 2004; Gattiker and Goodhue, 2004; Huang *et al.*, 2004a; Spathis and Ananiadis, 2005; Chand *et al.*, 2005; Tsai *et al.*, 2006; Wieder *et al.*, 2006; Wu and Wang, 2006; Spathis, 2006
Trends and perspectives	
General	Markus *et al.*, 2000a; Sprott, 2000; Mabert *et al.*, 2000; Rao, 2000; Van Everdingen *et al.*, 2000; Chung and Snyder, 2000; Davenport, 2000; Gupta, 2000; Markus *et al.*, 2000b; Scheer and Habermann, 2000; Rosemann, 2000; Klaus *et al.*, 2000; Koch, 2001a; Hanseth *et al.*, 2001; Esteves and Pastor, 2001; Themistocleous *et al.*, 2001; Van Stijn and Wensley, 2001; Chen, 2001; Al-Mashari, 2001; Wood and Caldas, 2001; Ghoshal and Gratton, 2002; Al-Mashari, 2003b; Ohlager and Selldin, 2003; Kalling, 2003; Al-Mashari *et al.*, 2003; Stevens, 2003; Jacobs and Bendoly, 2003; Watanabe and Hobo, 2004; Kallinikos, 2004; Puschmann and Alt, 2004; Davenport *et al.*, 2004; Lengnick-Hall *et al.*, 2004; Wagner and Newell, 2004; Liang and Xue, 2004; Beard and Sumner, 2004; Marnewick and Labuschagne, 2005; Gulledge *et al.*, 2005; Botta-Genoulaz *et al.*, 2005; Newman and Westrup, 2005; Sharif *et al.*, 2005; Hwang, 2005; Lim *et al.*, 2005; Allen, 2005; Volkoff *et al.*, 2005; Lee *et al.*, 2006; Yeh *et al.*, 2006; Gulledge, 2006; Wang and Chen, 2006
In a particular sector	Gulledge and Sommer, 2003; Pollock and Cornford, 2004; Bertolini *et al.*, 2004; Bergstrom and Stehn, 2005; Stefanou and Revanoglou, 2006; Botta-Genoulaz and Millet, 2006; Yang *et al.*, 2006
Education	Becerra-Fernandez *et al.*, 2000; Shtub, 2001; Stewart and Rosemann, 2001; Hawking *et al.*, 2001; Joseph and George, 2002; Volkoff, 2003; LeRouge and Webb, 2004; Draijer and Schenk, 2004; Cannon *et al.*, 2004; Johnson *et al.*, 2004; Noguera and Watson, 2004; Davis and Comeau, 2004; Antonucci *et al.*, 2004; Hajnal and Riordan, 2004; Strong *et al.*, 2004; Boykin and Martz, 2004; Hawking *et al.*, 2004; Fedorowicz *et al.*, 2004; Grenci and Hull, 2004; Peslak, 2005

3 Overview of the articles

In this section, a brief aggregate summary of the articles for each theme is provided. It is not intended to provide detail description of each article. Rather, an attempt to draw a collective summary is made in this section. For the articles reviewed for each theme, refer to Table 3 above.

3.1 Implementation

Implementing an ERP system is a major project requiring a significant level of resources, commitment and changes throughout the organisation. Often the ERP implementation project is the single biggest project that an organisation has ever launched. As a result, the issues surrounding the implementation process have been one of the major concerns in industry. And it further worsens because of numerous failed cases including a few fatal disasters which lead to the demise of some companies.

Reflecting such a level of importance, the largest number of articles belongs to this theme. It comprises more than 40% of the entire articles. Many of these articles share implementation experiences from various companies. Some articles attempt to explain why the ERP implementation is difficult and what needs to be done to achieve desirable results. Also, various models of implementation stages and different implementation methodologies are presented. Other topics handled under this theme include comparison between a single system approach and a best of breed system approach, comparison of the implementation practices between developing countries and developed countries, issues of hosted ERP systems, data quality issues, and project management issues.

A group of articles are classified under a sub-theme of 'Case Study'. These articles typically investigate the ERP implementation experiences at one or several companies and provide real data and observations. Unlike other articles which also use case studies, here extraction of general knowledge is more emphasised. Also, the articles belong to this sub-theme tend to focus on individual cases. Some generalisations are occasionally provided in these articles.

One of the popular topics in the ERP implementation is to identify or develop 'Critical Success Factors'. The idea is that some important factors determining the success or failure of an ERP implementation can be learned from prior implementation experiences. Some articles focus on generating the list of the critical success factors and others conduct data analysis regarding those factors.

Implementing an ERP system inevitably involves a large portion of the organisation and often accompanies with major business process reengineering efforts. Therefore, change management becomes a critical topic in the ERP implementation. A set of articles address the change management by explaining why it is important in the ERP implementation, how to do it effectively, the lessons learned, and the change management strategies.

The ERP implementation has a life cycle beginning with a company's decision to go for it to final go live stage. The articles belonging to a sub-theme of 'Focused Stage' address a particular stage of the ERP implementation life cycle. They are the ERP system selection process, the customisation of the ERP system, the configuration of the ERP system, the determination of a hosting service, *etc.*

Finally, a group of articles is interested in any differences between cultures and nations in implementing ERP systems. Comparative studies are conducted and analyses are provided in terms of differences and similarities. Explanations for such findings are also attempted.

3.2 Using ERP

Once the company successfully implements the ERP, the attention moves forward to the most efficient use of the system. Especially since considerable resources have been invested in the ERP implementation, the best possible utilisation of the system is anticipated. Indeed, the value of an ERP system draws from its effective and efficient usage and not so much from the system itself. The articles under this theme address various topics of using the ERP system during the post-implementation era, ranging from end user acceptance, to end user satisfaction, to business process reengineering after ERP implementation, to uncertainty management, to particular functions such as designing return material process and handling Sarbanes-Oxley requirements. Additional issues addressed by the articles include version upgrade/migration, managing dirty data, ERP usage by consulting firms, and political role of ERP system.

Majority companies focus on the transactional capability of the ERP system. Four articles particularly address the decision support functions of the ERP system, and these are classified under a sub-theme – 'Decision Support'. The articles emphasising the efficient usage of ERP systems in a particular function are grouped under a sub-theme – 'Focused Function'. The example functions are manufacturing, marketing, accounting, production, strategic management, operations, and data archiving. Eight articles address the 'Maintenance' issues in ERP systems.

3.3 Extension

The companies which have implemented ERP systems and are relatively satisfied with their operations are now considering the extension of the functionalities provided by the original ERP systems. Some companies implement ERP systems even though their ultimate objectives lie in further extended systems. Others implement ERP systems with some plans to extend later. The articles belong to this theme deal with the issues of extending ERP systems toward e-business, supply chain management, customer relationship management, supplier relationship management, business intelligence, manufacturing execution systems, *etc.*

Some articles attempt to understand the direction of the industry regarding the extensions. A few explain enabling technologies of further extensions and integrations. Some report research on how to expand the existing functionalities of the ERP system. As most of ERP vendors now developed a broader definition of Enterprise Integration, these articles may well provide a good picture on the trends.

3.4 Value

Since the investment and collective efforts required to implement and run ERP systems are significant to any organisation, the fundamental question of the ERP system's value has been a key issue. The articles under this theme mainly address these fundamental questions: Is an ERP system of any value to an organisation? What values an ERP system brings to an organisation? How do we measure the value of an ERP system? These articles tend to investigate these issues in a more systematic and rigorous fashion backed with some statistical evidence, beyond simple enumerating commonly believed benefits.

The values that ERP systems may generate are multifaceted: operational benefits, financial benefits, benefits for investors, user satisfaction, *etc.* Sometimes, the value may be measured by observing market reactions to the mere announcement of the ERP project.

The value assessment methods can be numerous and complex. For example, the benefits may be measured by cost savings, return on investment, asset turnover, return on assets, perceptions by the market, *etc.* Some articles address relationships between different measurements while others focus on longitudinal study of the ERP system on company's performance.

As more companies have implemented ERP systems and more is known about the implementation processes and the questions on the value of ERP systems seem to be investigated more often and rigorously. This is an indication that the practices and understanding of the field have matured enough to warrant some serious reflections on its fundamental questions.

3.5 Trends and perspectives

The articles that belong to this theme provide introductions to ERP, definitions and issues of ERP, common misinformation on ERP, different viewpoints of ERP, survey studies on industry experiences, recent trends in ERP and surveys of the ERP literature. The introductory articles provide informative guides for managers and beginning researchers in ERP. The emphases seem to be on the intimate relation with Business Process Reengineering (BPR) and a wide range of organisational changes accompanying with the ERP implementation. Some articles attempt to clarify the basic meanings surrounding ERP to provide reflections on many years' of practices. Also, a number of survey studies are reported from the findings of current industry's experience with ERP. These survey studies can complement the general introductory articles supported by the real data. A number of articles provide different perspectives on ERP. For example, they are perspectives from managers, users, or vendors.

Several articles present various types of models for ERP. They range from a conceptual model that explains the ERP system, to the taxonomy of success factors of ERP implementation, to a model of ERP governance, and to a user acceptance model. And others try to challenge commonly held views or misconception on ERP by asking questions such as 'Is the ERP system valuable?' 'Are best business practices are good?', *etc.*

A common observation on the future trends in ERP is its further expansion in scope. New integration technology such as software componentisation, Enterprise Application Integration (EAI), service-oriented architecture, web services is introduced and their implications are discussed. A couple of articles attempt to provide a sense of direction in the ERP research community by analysing the ERP literature. They identify the gaps between industry and academia and within the academic research, thus point out the potential future trends in terms of further expansion.

A few articles provide a similar information, but on a particular sector. The example sectors include the public organisations, the educational organisations, the healthcare organisations, the fashion industry, the manufacturing industry, the service industry. These articles are interesting since common attributes across different sectors as well as unique features of a particular sector can be analysed.

3.6 Education

With the industry-wide acceptance of ERP, the subject became important and popular in many universities. A number of articles report what has been done in a course, a set of courses or a curriculum. Most of them provide justifications for inclusion of ERP contents in their curricula since the subject is not one of the traditional subjects. Furthermore, the ERP education demands multi-disciplinary approach involving various units or colleges in a university. The articles emphasise the natural role of the ERP systems in term of changing functionally oriented curricula to holistic curricula. Some share experiences with using industry-scale ERP systems, which was supported by leading ERP vendors. One article describes the experience of adopting an educational version of ERP system. A few of them also provide practical tips, guidelines and obstacles for those who want to begin the similar course of actions.

A few articles attempt to go further by applying theories in changing such a curriculum or by conducting experiments on the validity of using hands-on experiences. Despite of a significant level of activities going on in the universities (notably, the vendor-supported university alliance programmes), the number of journal articles on education seems to be relatively few. Only 18 articles (5%) out of 313 surveyed were written primarily for education. Perhaps this is an area which the university community needs to pay attention to in order to archive more relevant knowledge.

4 Analysis

The field of ERP has matured in a relatively short period of time. As Table 4 shows, the number of journal articles published from 2000 has steadily increased, but there is a sign of stabilising in recent years. Considering the fact that most of journal articles started appearing in late 1990s, this field certainly gained significant research interests from many researchers in a short period of time.

Table 4 Number of journal articles on ERP during 2000–2006 (as of 31 May 2006)

Year	*Number of ERP journal articles*
2000	34
2001	39
2002	35
2003	50
2004	67
2005	66
2006	22
Total	313

Table 5 shows the number of articles for each theme and each sub-theme. As mentioned earlier, the number of articles categorised as ‘Implementation’ is the most, over 40% of the total. However, the number of articles for each sub-theme under ‘Implementation’ seems to be well balanced. In ‘Using ERP’, the number of articles belonging to ‘Decision

Support' is the least. It is not surprising that the current ERP is not a major decision support tool. Another notable thing is that the number of articles for 'Education' is merely 18. And this may be an area where researchers want to investigate further.

Table 5 Number of published articles for each theme

Themes	*Number of articles*
Implementation	135
General	61
Case study	17
Critical success factors	15
Change management	11
Focused stage in the implementation process	16
Cultural (national) issues	17
Using ERP	44
General	21
Decision support	4
Focused function in ERP	11
Maintenance	8
Extension	37
Value	24
Trends and perspectives	55
General	48
In a particular sector	7
Education	18

Note: The total number of journal papers over sub-themes may be greater than the number for a corresponding theme due to the fact that certain articles may be designated for more than one sub-theme.

Top 13 journals in terms of the number of articles in ERP are listed in Table 6. These 13 journals have published a total of 179 articles or 57% of the total. In addition to their inherent interests in ERP, special issues may have contributed the increased number of publications. Five journals had one special issue dedicated to ERP. Two special issues were generated by one journal. It is notable that the other journals in this list have consistently published the articles in ERP even without special issues.

In early years, more articles were written to share the experiences of implementing ERP systems or based on opinion survey studies. As more experiences have been gained with the implementation process, different topics such as the importance of using ERP and the assessment of ERP values seem to be becoming of interests to the researchers. Also, the mature status of the field is evident in the rigor and thoroughness of the articles in recent years.

Table 6 Number of articles in each journal in each year (for journals with more than seven articles)

Journal title	*Total number of articles*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Business Process Management Journal	30	1	*14*	2	2	4	7	0
Industrial Management & Data Systems	25	2	1	3	4	8	6	1
Journal of Enterprise Information Management	22	0	0	0	0	*9*	*7*	6
International Journal of Production Economics	13	0	0	2	0	2	7	2
Journal of Information Systems Education	12	0	0	1	1	*9*	1	0
Computers in Industry	12	0	1	0	1	0	*10*	0
Communications of the ACM	10	8	0	0	2	0	0	0
European Journal of Information Systems	10	0	2	1	0	0	*7*	0
European Journal of Operational Research	10	0	0	0	*10*	0	0	0
International Journal of Production Research	10	1	1	3	0	2	3	0
Information and Management	9	1	0	2	2	3	0	1
Journal of Strategic Information Systems	9	0	0	0	0	5	4	0
International Journal of Management and Enterprise Development	7	0	0	0	0	0	2	5
Total	179	13	19	14	22	42	54	15

Note: The italic numbers represent special issues.

5 Conclusion

Several areas for future research seem promising. One area is the education of ERP. After several years of active ERP education due to some vendor sponsored university programmes, a significant amount of experience must have been accumulated. It might be a time for teacher-scholar to reflect on their experiences and begin publishing for common good. Another interesting area is to assess the current status of ERP with international collaboration. Most articles that attempted to capture differences between different cultures or nations are limited to one or two of those. A large scale, simultaneous survey studies might generate useful insights on this subject. The concept of ERP seems to be growing and expanding. It will be useful to investigate topics such as how the companies using the ERP system perceive this trends, how they will cope with the changes, what tools, methodologies, models are useful in their expansion efforts, *etc.*

More literature review articles are expected as the field becomes more mature. Even though this article reports all the articles on ERP without any screening process, more selection criteria can be applied to reduce the number of articles for a different kind of review. For example, the number of citations or the experts' recommendation could be used to reduce the number of articles to be reviewed.

The ERP research community is diverse and comprehensive. The field is truly multi-disciplinary and inter-disciplinary. In a relatively short period of time, the researchers have contributed so much to the field that newer topics are now covered from various points of view. This article provides a snap shot status of the field as of 31 May 2006, which will certainly continue to mature.

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