Enterprise Resource Planning (ERP): A Review Literature Report

R. Addo-Tenkorang and P. Helo

***Abstract* - This report is a review of work published in various journals on the topics of Enterprise Resource Planning (ERP) between 2005 and 28th May, 2010. A total of 154 articles from 49 journals were reviewed. This report intends to serve two goals. First, it will be useful to researchers who are interested in understanding and following the recent trends in the area of ERP. Finally, this report will be useful to both researchers and businesses or industries; because it seeks to highlight the current unanswered but justified research and development (R&D) questions raised in research papers for research and/or development needs. The report is summarized to identify key references in the form of literature reviews; thus, identifying key journals and other key forums such as conferences and societies in the field of ERP. The summary will also identify most cited authors by using a sample statistical report from Harzing's Publish or Perish software. This report will also seek to address the issues and trends, including future trends of the ERP System Life Cycle (SLC) into six major and sub phases.**

***Index Terms* - Enterprise Resource Planning; ERP Trends and Perspective; Journal Articles survey.**

I. INTRODUCTION

An ERP system enables an organization to integrate all the primary business processes in order to enhance efficiency and maintain a competitive position. However, without successful implementation of the system, the projected benefits of improved productivity and competitive advantage would not be forthcoming. In its basic definition, ERP is an enterprise-wide information system that integrates and controls all the business processes in the entire organization. The Enterprise Resource Planning (ERP) system is an enterprise information system designed to integrate and optimize the business processes and transactions in a corporation. The ERP is an industry-driven concept and systems, and is universally accepted by businesses and organizational industries as a practical solution to achieve an integrated enterprise information system solution. ERP systems have become vital strategic tools in today's competitive business environment. The ERP system facilitates the smooth flow of common functional information and practices across the entire organization. In addition, it improves the performance of the supply chain and reduces the cycle times. However, without top management support, having appropriate business plan and vision, re-engineering business process, effective project management, user involvement and education and/or training, organizations cannot embrace the full benefits of such complex system and the risk of failure might be at a high level.

The academic research community has been contributing to the field of ERP in various ways. A typical way of contributing to the field is by publishing archival journal papers for public benefits. This report is a review of the literature on ERP published between 2005 and 28th May, 2010. The report intends to serve two goals. First, it will be useful to researchers who are interested in understanding and following the recent trends in the area of ERP. Finally, the report will be useful to both researchers and businesses or industries; because it seeks to highlight the current unanswered but justified research and development (R&D) questions raised in research papers for research and/or development needs. The report is summarized identifying key references in the form of a literature review; thus, identifying key journals and other key forums such as conferences and societies in the field of ERP. The summary will also identify most cited authors by using a sample statistical report from Harzing's Publish or Perish software. It will serve as a comprehensive bibliography of the articles published during the period as stipulated above. The set of papers published in various journals between 2005 and 28th May, 2010, is simply enormous, comprising 210 articles. As a result, it is hard to provide detail review of all the articles.

Manuscript received February 5th, 2011; revised on May 23rd, 2011.
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Instead, a collective summary for each topic is described, which includes 154 journal articles out of the 210. Direct references are decisively avoided, but a complete list of references for each topic is provided. The reviewed articles are organized into topics and some collective properties of the articles are described for each topic and sub-topics where needed. Four review articles/structured reports have been written on ERP prior to this report. The one by [44] 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 are only 21, perhaps reflecting the early years of the field of ERP during that period. [21] have also reviewed article on ERP. They analyzed the ERP literature during the period 2003–2004. In parallel to this report, [95] has also made a review article on ERP; reviewing a total of 313 articles from 79 journals. He also developed six categories and classified the articles under each category.

The six categories that he adopted include; implementation of ERP, optimization of ERP, management through ERP, the ERP software, ERP for supply chain management and case studies. [46] have also undertaken a critical review of empirical literature on ERP system business values, which investigates the impact of ERP system adoption on various measures of organizational performance; they then critically reviewed in the same journal article the literature concerning the related topic of critical success factors (CSFs) in ERP system implementation, which aimed at identifying and investigating factors that result in more successful ERP system implementation, which generates higher levels of value for organizations. Research focuses on the identification and deeper understanding of 'internal' factors (related to the internal functions of the organization), which can increase the business value generated by MIS, such as the business process redesign, new human skills, innovations, 'soft MIS investment', etc. ([6]; [86]). Finally, in the fourth period (from 2005 until today) researches have started dealing with the effect of 'external' factors, which are related to the external environment of the organization, such as generalized competition, strategy, industry concentration, industry dynamism, etc. on MIS business value ([90]; [86]).

A summary is provided with a reference to corresponding articles. One hundred and fifty four (154) articles in total were surveyed. However, more than 8 of these are non-journal articles such as conference proceeding and societies publications. In contrast to previous four review articles, this report surveys only the journal papers and covers a half decade and more recent period (between 2005 and 28th May, 2010). No restrictions are imposed on the field of the journals, thus representing truly multi-disciplinary views on ERP. This report is divided into seven main sections; including the main introduction of report, methodology, ERP trends and perspectives, review of the journal articles, analysis and finally conclusions, contribution and research gaps; findings for future/further research.

II. METHODOLOGY

This section describes the methodology followed through in collating and analyzing the articles and journals used in this report. It is rather hard to confine the report on ERP to specific orders; the relevant material is spread out across various journals. The criteria for choosing journal articles for the review are as follows. First of all, the article must have been published in a peer-review and/or archival journal. Secondly, to avoid never ending revision of the report, 28th May, 2010 was selected as the cut-off date. Finally, only the articles with 'ERP' as a part of their title contents 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 inclusions of such articles are inevitably unplanned. Consequently, it is possible that there exist more of such articles, which are not surveyed in this report. No restrictions were imposed on the field of the surveyed journal. This should allow a comprehensive set of perspectives on ERP by different fields. According to these criteria, a vigorous attempt has been made to collate all the available journal articles. The effort to compile has been carried out through exhaustive computer search, database search,

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

internet search, reference checking, most cited authors using Harzing's Publish or Perish software, *etc.*. *However*, it is always possible that some of the articles are missing from this list. A Harzing's Publish or Perish software statistical results for mostly cited authors in the field of ERP between 2005 and 2010 is found in Tables I, II, and III below in a descending-order.

TABLE I
HARZING'S PUBLISH OR PERISH MOST CITED ERP JOURNAL ARTICLES AND AUTHORS*

Harzing's Publish or Perish - General Citation Search for "Enterprise Resource Planning" -&- "ERP" (2005-2010) Title words only.					
Cites	**Authors**	**Title**	**Year**	**Source**	**Publisher**
62	[41]	Identifying critical issues in enterprise resource planning (ERP) implementation	2005	Computers in Industry	Elsevier
42	[95]	Enterprise resource planning (ERP): a review of the literature	2007	International Journal of Management and Enterprise	Inderscience
37	[124]	Achievement assessment for enterprise resource planning (ERP) system implementations based on critical success factors (CSFs)	2005	International Journal of Production …	Elsevier
25	[108]	Enterprise resource planning (ERP)--A brief history	2007	Journal of Operations Management	Elsevier
25	[84]	Managing user acceptance towards enterprise resource planning (ERP) systems-understanding the dissonance between user expectations and managerial policies	2005	European Journal of Information …	ingentaconnect.com
24	[2]	Enterprise resource planning (ERP) implementation: a useful road map	2006	… of Management and Enterprise	Inderscience
18	[102]	Enterprise resource planning (ERP) operations support system for maintaining process integration	2005	International Journal of Production Research	informaworld.com
17	[88]	A conceptual model for enterprise resource planning (ERP)	2005	Information Management & …	emeraldinsight.com
15	[127]	Identification of critical failure factors in the implementation of enterprise resource planning (ERP) system in Taiwan's industries	2005	… of Management and Enterprise …	Inderscience
9	[61]	Do top-and mid-level managers view Enterprise Resource Planning (ERP) systems success measures differently?	2006	… Journal of Management and Enterprise …	Inderscience

*Harzing's Publish or Perish Most Cited Authors (Accessed on 28/05/2010, Revised on 07/07/2010).
*The Harzing's Publish or Perish software used for general citation search for "Enterprise Resource Planning" in All the words field and "ERP" in Any of the words field and then Title words only box ticked.

TABLE II
HARZING'S PUBLISH OR PERISH MOST CITED ERP JOURNAL ARTICLES AND AUTHORS*

Harzing's Pulish or Perish - General Citation Search for "Enterprise Resource Planning" (2005-2010) Title words only.					
Cites	**Authors**	**Title**	**Year**	**Source**	**Publisher**
69	[35]	Enterprise resource planning systems, management control and the quest for integration	2005	Accounting, Organizations and Society	Elsevier
62	[41]	Identifying critical issues in enterprise resource planning (ERP) implementation	2005	Computers in Industry	Elsevier
42	[95]	Enterprise resource planning (ERP): a review of the literature	2007	International Journal of Management and Enterprise	Inderscience
42	[91]	Enterprise resource planning and organisational innovation: a management perspective	2005	Industrial Management & Data …	emeraldinsight.com
37	[124]	Achievement assessment for enterprise resource planning (ERP) system implementations based on critical success factors (CSFs)	2005	International Journal of Production …	Elsevier
36	[53]	Enterprise resource planning systems and its implications for operations function	2006	Technovation	Elsevier
25	[108]	Enterprise resource planning (ERP)--A brief history	2007	Journal of Operations Managmt	Elsevier
25	[150]	Implementation of enterprise resource planning in China	2006	Technovation	Elsevier
25	[84]	Managing user acceptance towards enterprise resource planning (ERP) systems-understanding the dissonance between user expectations and managerial policies	2005	European Journal of Information …	ingentaconnect.com
24	[8]	Organizational adoption of enterprise resource planning systems: A conceptual framework	2007	The Journal of High Technology …	Elsevier
24	[2]	Enterprise resource planning (ERP) implementation: a useful road map	2006	… of Management and Enterprise …	Inderscience
21	[37]	Strategic success factors in enterprise resource-planning design and implementation: a case-study approach	2005	International Journal of Production Research	informaworld.com
21	[109]	Enterprise resource planning systems, strategic enterprise management systems and management accounting	2006	Management	emeraldinsight.com

*Harzing's Publish or Perish Most Cited Authors (Accessed on 28/05/2010, Revised on 07/07/2010).
*The Harzing's Publish or Perish software used for general citation search for "Enterprise Resource Planning" in All of the words field and then Title words only box ticked.

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

TABLE III
HARZING'S PUBLISH OR PERISH MOST CITED ERP JOURNAL ARTICLES AND AUTHORS*

Harzing's Publish or Perish - General Citation Search for "ERP" (2005-2010) Title words only.					
Cites	**Authors**	**Title**	**Year**	**Source**	**Publisher**
127	[137]	An AHP-based approach to ERP system selection	2005	International Journal of Production	Elsevier
120	[48]	What happens after ERP Implementation: Understanding the impact of inter….	2005	MIS Quarterly	csz.csu.edu.tw
96	[21]	A survey on the recent research literature on ERP systems	2005	Computers in Industry	Elsevier
91	[152]	A framework of ERP systems implementation success in China: An empirical study	2005	International Journal of …	Elsevier
67	[57]	ERP plans and decision-support benefits	2005	Decision Support Systems	Elsevier
62	[41]	Identifying critical issues in enterprise resource planning (ERP) implementation	2005	Computers in Industry	Elsevier
62	[74]	The role of ERP tools in supply chain information sharing, cooperation, and cost optimization	2005	International Journal of Production Economics	Elsevier
62	[68]	Exploring knowledge sharing in ERP implementation: an organizational culture framework	2006	Decision Support Systems	Elsevier
61	[76]	Impediments to successful ERP implementation process	2005	Business Process Management …	emeraldinsight.com
61	[143]	ERP implementation failures in China: case studies with implications for ERP vendors	2005	International Journal of …	Elsevier
57	[47]	Success and failure factors of adopting SAP in ERP system implementation	2005	Business Process Management …	emeraldinsight.com
56	[93]	ERP II: a conceptual framework for next-generation enterprise systems?	2005	Management	emeraldinsight.com
55	[31]	A balanced scorecard based framework for assessing the strategic impacts of ERP systems	2005	Computers in …	Elsevier
53	[10]	Sticking to standards; technical and other isomorphic pressures in deploying ERP-systems	2006	Information & Management	Elsevier
49	[9]	What managers should know about ERP/ERP II	2006	Mangemnt Research News	emeraldinsight.co
47	[154]	Measuring user satisfaction and perceived usefulness in the ERP context	2005	Journal of Computer Information …	万方数据资源系..

*Harzing's Publish or Perish Most Cited Authors (Accessed on 28/05/2010, Revised on 07/07/2010).
*The Harzing's Publish or Perish software used for general citation search for "E R P" in All of the words field and then Title words only box ticked.

III. ERP TRENDS AND PERSPECTIVES

Journal articles which belong to this subject mostly provide introductions to ERP definitions and issues of ERP, common ERP misinformation on business and industrial organizational issues, different perspectives of ERP, survey studies on industry experiences, recent trends in ERP and surveys of the ERP literature. The introductory articles provide enlightening guidelines for managers and beginning researchers in the field of ERPs. The emphasis seems to be on the close relation with Business Process Reengineering (BPR) and a wide range of organizational change issues accompanying ERP implementation. Some articles attempt to clarify the basic meanings surrounding ERP to provide reflections on many years' of practices.

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 journal articles supported by the actual data. A number of articles also provide different perspectives on ERP. For example, they are perspectives from managers, users and/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 'What are the significant values of ERP system?' 'What is good about ERP best business practices?', etc. A common observation on the future trends in ERP is its further expansion in scope. New integration technology such as software modularization, Enterprise Application Integration (EAI), Service-Oriented Architecture (SOA) systems applications, (Web 2.0) web services is introduced and their implications discussed. A couple of articles attempt to provide a sense of direction in the ERP research community by analyzing the ERP literature. They identify the gaps between the industry and the academia and also within the academic research, thus pointing out the potential future trends in terms of further expansion (i.e. ERP II). A few articles provide a similar information, but on a fussy segment. Example these fussy segments include the public organizations, the educational organizations, the healthcare organizations, the fashion industry, the manufacturing industry and the service industry. These articles are interesting since common attributes across different segments as well as unique features of a particular organizational segment can be analyzed.

A. Future Trends and Perspectives

Organizations are under constant pressure from customers, shareholders, and suppliers to continuously improve and make better products quickly and efficiently. Competing in a dynamic environment and meeting global challenges requires agility. Successful companies must be able to respond quickly and cost-effectively to change. The change could be of any type; shift in customer demands and supply chain partners, modifications to a business model or business process, business expansion and the need for new initiatives like outsourcing, and regulatory pressures imposed by financial markets, industrial groups, and government bodies. Organizations need to convert their industries into responsive, demand-driven, profit-making enterprises by optimizing their operations. Their competitive advantage and ultimate survival depend on the use of extended information system applications and/or technology (e.g. ERP II, SOA, WEB 2.0 or Software as a Service – SaaS, etc.). According to [67] this has led to an increasing interest among vendors to improve future ERP-systems to support the end-customer organization even better. Below is a brief introduction of each of the above listed extended information system applications and/or technology.

B. ERP II

ERP II systems are not just the backbone of the enterprise. They are also the information link for an enterprise in the supply chain. This is because the business of tomorrow is going to play multiple roles in multiple supply chains, from traditional sources to electronic marketplaces. The challenge for ERP II is two-fold. First, it's to aggregate and manage the data surrounding all the transactions of an enterprise as accurately as possible in real time. Then, it is also to open up the system to make that information available to trading partners in the supply chain.

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

C. Service Oriented Architecture (SOA)

One of the main market trends is the technology transformation to; Service Oriented Architecture (SOA) which will have the largest effect on redefining the ERP market. As indicated by analysts, SOA will transform software from an inhibitor to an enabler of business change by 2015 [153]. SOA will shift revenue from packaged software to subscription services and from monolithic suites to composite applications. SOA is an approach to designing, implementing, and deploying information systems such that the system is created from components implementing discrete business functions. These components called 'services' can be distributed across geography, and can be reconfigured into new business processes as needed. The services are 'loosely coupled' allowing for more flexibility than older technologies with respect to re-using and re-combining them to create new business functions both within and across an organization. The business component architecture forms the foundation of its specialized versions: service oriented and event-driven architectures. SOA reduces complexity, eliminates point-to-point integrations and introduces flexibility through process-driven applications. This provides agility to meet the ever-changing needs of the plant, business unit, enterprise and the supply chain. It provides a controlled and secure environment to meet the requirements of regulatory issues. Most vendors today are in the process of transforming their technology architecture into SOA.

D. Web 2.0 / Software as a Service (SaaS)

Software-as-a-service (SaaS) in short; is software delivered as a hosted application from a vendor or distributor whom the end-customer can access via a browser? The SaaS-model enables the end-customer organization to decrease the cost of implementation, maintenance and the overall administration of the application. Furthermore, is independent of existing IT-infrastructure, scalable and flexible [54]. In that sense, the end-customer organization can focus on its core business without worrying about technicalities that will be handled by the distributor. There are examples of successful SaaS-vendors, (e.g. Salesforce.com), but when it comes to ERP-systems delivered as Software-as-a-Service, there is not yet a solution that has had a commercial breakthrough. However, as already stated the SaaS-model is a key strategic area for SAP AG and most likely also for other ERP-system vendors. The SaaS-model is therefore, of much interest when researching in the future of ERP systems; however, there seem to be not much academic research published within this area yet. When looking at the SaaS-model it seems to challenge the distributors' business in the ERP-system value chain, since the vendor can deliver solutions directly to the end-customer and thereby bypass the distributor. Therefore, this future delivery model might change the current ERP-systems value-chain. This might not completely undermine the business for distributors, as the future ERP-system value-chain very well could include hybrid SaaS-solutions, where the distributors offer the customized SaaS-solutions to the end customer. However, if the SaaS-model becomes successful it can very well threaten the distributor's position. It could be seen as a further enhancement of the 'best practice' approach that undermines the competitive advantage of the distributors. In that sense, the SaaS-model can be seen as a solution that favours the 'best practice' approach. Furthermore, it can be discussed if the SaaS-model can have influence on an ERP-system, whether it is perceived as competitive advance or not within the end-customer organizations, since the IT delivered, hardly can be called a scarce resource. This has only been a short introduction to ERP-systems delivered as SaaS, which clearly is an area that could be interesting for research further. It could be interesting to examine how ERP-systems delivering SaaS meet the Business IT needs of organizations, including the small and mid-sized; and what the implications are for the ERP system value-chain if the paradigm switches from perpetual licenses to SaaS offerings. Both the resource based perspective as well as the perspective of core competencies could offer interesting approaches when looking at the future ERP-systems and the value-chain.

IV. REVIEW OF THE JOURNAL ARTICLES

In this section, is a brief aggregate summary of the journal articles used in this report is provided in the following tables below. It is not intended to provide a detail description of each article and references of major topics and sub topics used in this review report. Hence, an attempt to draw a collective summary report is made in this section.

TABLE IV
NUMBER OF ARTICLES IN EACH JOURNAL (ALL IN ALPHABETICAL ORDER)

Journals	Number of ERP Journal Articles
Accounting, Organization and Society	1
AMR Research Inc	1
Business Process Management Journal	10
Computers in Human Behavior	2
Computers in Industry	14
Decision Support Systems	5
Electronic Markets	1
Electronic Government, an International Journal	1
Enterprise Information Management	1
Enterprise Information Systems	1
European Journal of Information Systems	7
Financial Executive	1
Gartner Research	1
IEEE Computer Society	3
IEEE Transactions of Engineering Management	1
IEEE Xplore	6
IFIP AICT	1
Industrial Management & Data Systems	10
Information Technology and People	1
Information and Management	3
Information Management & Computer Security	5
Information Systems Management	2
International Journal of Enterprise Information Systems	2
International Journal of Information Management	1
International Journal of Management and Enterprise Development	11
International Journal of Operations and Production Management	2
International Journal of Production Economics	14
International Journal of Production Research	2
International Journal of Quality and Reliability Management	1
International Journal of Services and Standards	2
Internet and Enterprise Management	1
Journal of Computer Information Systems	2
Journal of Enterprise Information	1
Journal of Enterprise Information Management	14
Journal of High Technology Management Research	2
Journal of Information Systems	1
Journal of Management and Enterprise Development	1
Journal of Management Information Systems	1
Journal of Manufacturing Technology Management	2
Journal of Operations and Management	1
Journal of Strategic Information Systems	4
Journal of Theoretical and Applied Information Technology	1
Managerial Auditing Journal	1
Management Research News	2
Management Science	1
MIS Quarterly	1
MIT Sloan Management Review	1
PICMET Proceedings	1
Technovation	3
Total	**154**

Analysis of Journal articles used in this review report.

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

TABLE V
CONFERENCE AND SOCIETY PROCEEDING ARTICLES

Conferences and Society's Proceeding Articles			
Main Event	**Topic**	**Coordinators**	**Year**
European and Mediterranean Conference on Information Systems	Critical Sucess Factors in ERP Implementation: A Review	[1]	2008
IEEE Computer Society, Panhellenic Conference on Informatics	ERP System Business Value: A Critical Review of Empirical Literature	[46]	2008
AMR Research Inc.	The ERP Market Size Report 2006-2011	[64]	2007
Financial Executives	SaaS sets the stage for Clouding Computing	[54]	2008
PICMET Proceedings	Key factors Driving the Sucess of Technology Adoptation: Case Example of ERP Adoptation	[123]	2009
IEEE Computer Society. The International Conference on Risk Management & Engineering Management	Application of Fuzzy Comprehensive Evaluation Model Based on Variable Fuzzy Set Method in Construction Enterprisees' ERP Project Risk Evaluation	[149]	2008
US Symposium/Itxpo, 23-27, Gartner Research (25C, SPG5) San Diago	ERP II Vision	[153]	2003/5
ASBBS Annual Conference Proceedings, Las Vegas. Vol 17, No.1	ERP and Success Factors	[119]	2010

Conferences and Society's Proceeding Articles Used in this Review Report.

The six Major topics and sub-topics within the domain of ERP in this report are

(1) Implementation
- case study,
- critical success factors,
- change management,
- focused stage,
- Cultural issues.

(2) ERP Exploration,
- change management,
- decision support,
- focused function,
- Maintenance.

(3) Extension,
(4) Value,
(5) Trends,
(6) Education

Tables VI and VII above shows these topics and sub-topics used in this article. A comprehensive table containing these topics and their classified references for each topic is provided in Table VII below. 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 topic. For example, an article may address implementation issues but provide general information or trends on ERP. In such a case, more credence topics are chosen to classify the article according to the reporter's judgment. Listing an article under more than one sub-topic was hereby allowed.

TABLE VI
TOPICS AND REFERENCES

Topic	References
Implementation	
▪ General	[117]; [126]; [151]; [26]; [92]; [83]; [76]; [141]; [50]; [97]; [136]; [29]; [2]; [25]; [5]; [8]; [9]; [10]; [11]; [12]; [15]; [21]; [28]; [30]; [31]; [33]; [35]; [39]; [46]; [48]; [52]; [56]; [64]; [66]; [67]; [85]; [95]; [98]; [101]; [106]; [108]; [112]; [123]; [129]; [138]; [148]; [152];
▪ Case study	[51]; [7]; [23]; [13]; [125]; [55]; [58]; [63]; [82]; [87]; [122]; [139]; [143]; [145]; [150]; [152];
▪ Critical success factors	[124]; [96]; [41]; [37]; [47]; [1]; [3]; [80]; [34]; [36]; [45]; [61]; [96]; [70]; [71]; [99]; [100]; [103]; [110]; [130]; [119];
▪ Change management	[91]; [85]; [18]; [10]; [65]; [74]; [75]; [84]; [127];[144];
▪ Focused stage	[138]; [7]; [130]; [59]; [60]; [41]; [69]; [72]; [37];
▪ Cultural issues	[17]; [144]; [135]; [152]; [127]; [7]; [12]; [150]; [68]; [73]; [133];
ERP Exploration/Uses	
▪ General	[89]; [148]; [78]; [19]; [102]; [132]; [24]; [22]; [43]; [77]; [20]; [32]; [40]; [49]; [66]; [77]; [80]; [83]; [94]; [115]; [116]; [141];
▪ Decision support systems	[57]; [54]; [81]; [104]; [142]; [149];
▪ Focused function	[53]; [109]; [105]; [120]; [121]; [134]; [135]; [136]; [146]; [151];
▪ Maintenance	[42]; [55]; [62]; [102];
Extension	[33]; [28]; [94]; [93]; [11]; [81]; [63]; [74]; [15]; [27]; [111]; [114]; [79]; [113]; [118];
Value	[153]; [121]; [31]; [128]; [139]; [142]; [120]; [4]; [154];
Trends and Perspectives	
▪ General	[88]; [51]; [21]; [98]; [113]; [60]; [84]; [4]; [131]; [82]; [146]; [52]; [134]; [9]; [16]; [27]; [132];
▪ In a particular sector	[14]; [122]; [20]; [145]; [43];
▪ Education	[9]; [140]; [1]; [38];

Analysis of references: major and sub-topics used in this review report.

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

E. Implementation

Implementing ERP systems can potentially allow a company to manage its business better with potential benefits of improved process flow, better data analysis, higher quality data for decision making, reduced inventories, improved coordination throughout the supply chain, and better customer service [48]. ERP system is a major project requiring a significant level of resources, commitment and changes throughout the organization. Often the ERP implementation project is the single biggest project that an organization 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 topic. It comprises more than 54% 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. Furthermore, various models of implementation stages and different implementation methodologies are presented. Other topics handled under this subject 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 not forgetting evaluation and validation issues among others. A group of articles are classified under a sub-topic of 'Case Study'**;** these articles typically investigate the ERP implementation experiences at one or several companies and provides real data and observations. Unlike other articles which also use case studies, here extraction of general knowledge is more emphasized. Also, the articles belonging to this sub-topic tend to focus on individual cases. Some generalizations are occasionally provided in these articles. One of the popular topics in the ERP implementation is to identify or develop 'Critical Success Factors – (CSF)'; According [5], product life cycle have become very short and technology is changing more rapidly hence new success factors may be arising. Likewise, while the CSF for implementation of ERP systems has been discussed and analysed, there have been many inconsistent and inconclusive findings on this topic [80].

It is argued that, there are many differences between CSFs researchers have defined [34]. 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 organization and often accompanies with a major business process reengineering efforts. Therefore, change management becomes a critical topic in the ERP implementation. Some set of articles address the change management by explaining why it is important in the ERP implementation, how to do it effectively. The lessons discovered, and the change management strategies. The ERP implementation has a life cycle beginning with a company's decision to go for it to finally go live stage and then subsequently selecting an ERP package. The articles belonging to a sub-topic of 'Focused Stage' address a particular stage of the ERP implementation life cycle. They are the ERP system selection process, the customization of the ERP system, the configuration of the ERP system, the determination of a hosting service, *etc*.*:* Finally, a group of articles are interested in any differences between cultural and/or national views in implementing ERP systems. Comparative studies are conducted and analyses are provided in terms of differences and similarities. Explanations for such findings have been also endeavoured.

F. ERP Exploration/Uses

Upon an organization's successfully implementation the ERP system, 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 utilization 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 as the process of moving from functional applications to an ERP system is difficult as well as challenging [147]. Moreover, the decision to use an ERP system is expensive, and it requires development of new procedures, actions, training and education in conveying or converting data [152]. Thus, this greatly depends on, greater cooperation with senior level management, clearer and more defined business plan and/or vision, effective project management priorities, teamwork, appropriate ERP software system selection, user involvement and efficient education/training. The articles under this topic tackle various topics of using the ERP system during the post-implementation era, ranging from end user acceptance, to end user satisfaction, from a business process reengineering after ERP implementation to uncertainty management and to particular functions such as designing return material process and handling Sarbanes-Oxley requirements in finance and accounting. Additional issues addressed by the articles include version upgrade/migration, managing dirty data, ERP usage by consulting firms, and political role of ERP system. Thus; forming about 20.5% of the total number of journal articles reviewed in this report. Most organizations focus on the operational capability of the ERP system. Some other articles particularly address the decision support functions of the ERP system (i.e. employing intelligent agents) and these are classified under a sub-topic – 'Decision Support Systems' mainly instrumental in forecasting and planning of organizational and industrial operations. The articles accentuating the efficient exploration of ERP systems in a particular function are grouped under a sub-topic – 'Specific Function'. Example, these specific functions are; manufacturing, marketing, accounting, production, strategic/project management, operations, and data archiving.

G. 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 (i.e. ERP II). Forming about 18% of the total number or journal articles surveyed, this shows that businesses and organizations have now started to look for something beyond what ERP can offer. 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 belonging to this topic deal with the issues of extending ERP systems (ERP II) toward e-business, supply chain management (SCM), customer relationship management, supplier relationship management, business intelligence, manufacturing execution systems, *etc*., with some sort of extended software systems such as ERP II mentioned above, System-oriented architecture (SOA), Software as a Service (SaaS) or Web 2.0 system application. Some articles attempt to understand the direction of the industries regarding these ERP extensions. A few explain enabling technologies of further ERP extensions and integrations. These technologies are as close to virtual enterprise as businesses and industries today have ever seen. 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.

H. Value

There is no doubt about how valuable information systems implementation and operation are to both the private and public businesses and industries. In this age of globalization, the more sophisticated the supply chain management system, the higher the need for system tools for businesses and industries to efficiently and effectively manage their activities and to enable them to strategies their operations to survive in this global village. According to [56] information system is considered a fundamental tool for a competitive organization and/or industry. One of the sort after and/or mentioned information systems in research, businesses and in industries is the Enterprise Resource Planning (ERP) system. It was estimated that in the past decade about $500 billion was invested in the ERP systems worldwide [49]. In view of the investment and collective efforts required to implement and run ERP systems, which are very significant to any organization, the fundamental question of the ERP system's value has been a key issue. The high investment that is required and the decision to purchase and implement an ERP system, is one of the most important decision businesses and industrial leaders have to make [9]. The articles under this topic mainly address these fundamental questions: Is an ERP system of any value to an organization? What are the values an ERP system will bring to an organization? How do we assess 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 detailing commonly believed benefits.

The values that ERP systems may create are enormous and versatile: operational benefits, financial benefits, benefits for investors, user satisfaction, *etc*. Sometimes, the value may be evaluated by observing market reactions to the mere pronouncement of the ERP project. The value assessment methods can be numerous and sophisticated. For example, the benefits may be evaluated by cost savings, return on investment, asset turnover, return on assets, perceptions by the market forecasts or trends, *etc*. Some articles address relationships between different dimensions while others focus on the 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.

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

This is an indication that the practices and understanding of the field have matured enough to warrant some serious reflections on its essential issues. Thus, reflecting about 3.33% of the total number or journal articles surveyed turns out to be an area with potentials for more future researches.

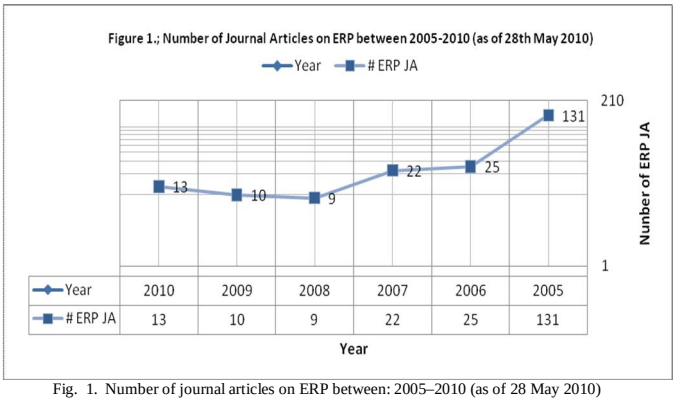
I. Education/Training

Educating and training users to use ERP is important because ERP is not easy to use even with good IT skills [140]. [9] Cited lack of availability of adequate skills as one reason for failure. According to [1] user involvement in terms of education and training is one of the most cited critical success factors in ERP implementation projects. It is quite obvious from above that training and educating users of the ERP system, is very essential because it improves perceived control through participating in the entire project plan. Due to the importance of user involvement in the initial stages of ERP system definition in the implementation stages of ERP systems, training and education of the system users cannot be over emphasized at any stage. However, surprisingly this topic forms only about 2.4% of the total number of journal articles surveyed, thus making this topic another key potential area for future research.

TABLE VII
NUMBER OF PUBLISHED ARTICLES FOR EACH TOPIC

Topics	No. of Articles
Implementation	**115**
▪ General	46
▪ Case study	16
▪ Critical success factors	21
▪ Change management	11
▪ Focused stage in the implementation process	9
▪ Cultural (national) issues	12
ERP Exploration/Uses	**43**
▪ General	22
▪ Decision support	7
▪ Specific function in ERP	10
▪ Maintenance	4
Extension	**16**
Value	**7**
Trends and perspectives	**22**
▪ General	17
▪ In a particular sector	5
Education/Training	5

A table of Number of Published Articles for each of the Six ERP major topic and sub-topics



Year	# ERP JA
2005	131
2006	25
2007	22
2008	9
2009	10
2010	13
Total JA	**210**

Fig. 1. Number of journal articles on ERP between: 2005–2010 (as of 28 May 2010)
(Harzing's Publish or Perish sofware search results[runned on 28/0502010] statistical Fig. & Table

V. ANALYSIS

The field of ERP has matured in a relatively short period of time. As Fig. 1. and its side data table below shows, the number of journal articles published from 2005 has steadily increased, but there is a sign of stabilizing and significant declining in recent years as again clearly shown in the chart 1 below. Considering the fact that most of the earlier journal articles in the topic area started appearing in late 1990s, this field certainly has gained significant research interests from many researchers in a short period of time. Confirming the analysis above on the various topics; ERP Implementation journal articles surveyed formed more than 54%, journal articles surveyed on ERP Exploration/Uses formed 20.5%, ERP Extension and future trends journal articles surveyed formed more than 18%, journal articles surveyed on ERP Values formed about 3.33% and finally Education/ Training journal articles on ERP surveyed formed about 2.4%.

From the data in Table VI above from which the statistical data in Table VII is deduced; a conclusive analysis could be drawn on the fact that the number of journal articles published on the topics such as ERP Trends and perspective's – (In a particular sector) like; ERP in SMEs and ERP in developing countries (Africa and parts of Asia) are areas, which are lacking in ERP research and development. Furthermore, ERP Education and Training are another area lacking much research as this can be seen in the number of journal articles published in these areas between the periods stipulated in this report's frame. Research on ERP Values also comes up as another ERP area lacking adequate research and development as can be seen in Tables VI and VII above. From the data deduced as well as the findings above, and also from the report's analysis in Tables VI and VII above: Percentage analysis on ERP Trends and perspective – in a particular sector constitutes 2.3% as well as ERP Education and Training, which are also 2.3%, and then ERP Values, which also constitutes about 2.4%. These are the three lowly researched and developed areas according to the findings in this review report, which requires further research and development.

VI. CONCLUSION

The concept of ERP seems to be growing and even more so, expanding. It will be useful to investigate topics such as how the companies using the ERP system perceive these trends of extension, how they will cope with the changes and challenges that pose ahead, what tools are needed, such as the infrastructures available to them and the kind of skills and expertise required. Methodologies required and the kind of models useful in the expansion efforts or approaches, *etc*. More literature review articles are expected as the field becomes more mature in the extension phase. Even though this article reports all the articles on ERP without any screening procedure, more selection criteria can be applied to reduce or increase the number of articles for a different kind of review report or research depending on the nature or the research in question. For example, the number of citations or the experts' recommendation could be used in detail to either reduce or increase the number of articles to be reviewed. The ERP research area is diverse and very broad. 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 diverse points of view. This report provides a summary status of the field from 2005 to a cut-off date of 28th May, 2010. The field of ERP will certainly continue to mature and even more in the extension period. 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 both the researchers, businesses and industrial organizations as they are potential areas for future research. Furthermore, the mature and extension status of the field is evident in the rigor and thoroughness of the articles in recent years. 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 scholars or academia to reflect on their experiences and begin publishing for common good.

ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

VII. RESEARCH GAPS; FINDINGS AND CONTRIBUTIONS FOR FUTURE/FURTHER RESEARCH

In this global village, businesses and industrial organizations must be very competitive in order to survive. EPR system implementation on this note seems to be the popular method of using technology as a competitive advantage tool by businesses and industrial organizations. Thus, Future researches on these ERP topics seem very promising. Some of the areas include the education of ERP; ERP implementation on the large scale among SMEs; ERP implementation in developing countries taking into accounts the fact that these countries are not as rich as the Western countries and hence the ERP systems should be administered more in the form of Software as a Service (SaaS); all of these areas listed according to the findings in this review report are eminent research gaps for business and industrial organizations as well the academia. The Software as a Service (SaaS) methodology of ERP administering is more adoptable to implement in small and medium scale enterprise organizations, and they are also cost effective. On that not, ERP security seems to be another area, which is very promising for research as well as ERP values, which also seem to be another area lacking much research as per the data analysis above under Table VII. As already mentioned above; another interesting area is to assess the current status of ERP with international collaboration (i.e. extending ERP to SMEs and also developing countries such as African countries as Asia have already been initiated the use of ERP in some of their industrial organizations). Most articles that attempted to capture differences between diverse cultures or nations are limited to one or two of those. A large scale, simultaneous survey studies might generate useful insights on these topics.

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ISBN: 978-988-19251-7-6
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)