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Sustaining the Momentum: Archival Analysis of Enterprise Resource Planning Systems (2006–2012)

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Abstract:

The domain of Enterprise Resource Planning (ERP) systems is an enduring paradigm for Information Systems (IS) researchers. The Enterprise System paradigm provides a rich environment to test fundamental concepts like system adoption, system use and system success, while acknowledging changes derived through longer system lifecycles and multiple user cohorts. On the other hand, ERP systems are in the centre of new contemporary radical changes in technologies on cloud computing, mobile platforms and big data. Moreover, ERP Systems provide the context for cross disciplinary research such as change management, knowledge management, project management and business process management research. This article provides a critique of 219 papers published on ERP Systems from 2006–2012, making observations of ERP research and make recommendations for future research directions.

Keywords: enterprise resource planning systems, enterprise systems, archival analysis

I. INTRODUCTION

With the advent of Enterprise Resource Planning (ERP) systems, Esteves and Pastor [2001] and Esteves and Bohorquez [2007] provided two bibliographical analyses of prior ERP studies to establish "an annotated bibliography of the ERP publications published in the main Information Systems conferences and journals and to review the state of art in this area" [Esteves and Pastor, 2001]. Their studies were valuable in that they informed the community of the current trends, gaps and some possible future directions in relation to ERP-related research. Moreover, these papers are treasured by the novice researcher as a repository and summary of past related studies.

Periodic observations of literature on important paradigms are important at multiple counts: (1) as a cumulative summary of all research published, (2) to understand the evolution of concepts, (3) to determine theoretical saturation, and (4) to determine future areas of research. Following in the footsteps of Esteves and Pastor and in the spirit of building cumulative knowledge, we build an archival analysis of ERP systems articles from 2006–2012 to observe the current state of ERP systems studies and to direct future research on this important phenomena. In addition to providing a continuing analysis, this period is significant to our observations, marked by dramatic developments in technology such as cloud and mobile computing, big data analytics, and growth in Small and Medium Enterprises (SMEs) [Sedera, Gable, and Chan, 2003]. Notwithstanding the above, contributing to the conjectural discussion of the evolution of ERP systems as a domain, it could be revealing to understand the future of ERP systems research and also to seek to answer why scholars rarely move beyond the established tracks of research (e.g., ERP systems lifecycle on implementation, adoption and use).

The underlying research questions for our archival analysis, therefore, are: *What are the trends and patterns of ERP systems research observed for periods 2006 to 2012?* and *What are the gaps in ERP research that must be addressed to better understand related phenomena?* To address these questions, our approach consists of three prongs: (1) consult an exhaustive list of ERP systems literature to trace the top researched areas, organized through the widely adopted ERP systems performance lifecycle [Esteves and Pastor, 1999], (2) conduct an extended analysis of the nature of research, and (3) identify topics that stagger through a periodic analysis from 1997 to 2012. Hence, our study extends the work of Esteves and Pastor in three ways: (i) This study extends the past work by analysing a different time period (2006–2012), (ii) in a consolidated manner, we examine for a body of literature: the stakeholders perspective sought, the country the research originated in and the mode of analysis utilized, and (iii) we make comparisons across three analysis 2001, 2007 and now 2012.

The remainder of the article is organized as follows. First, we discuss the archival method. Next, we present our annotated bibliography on ERP systems from 2006 to 2012. Our analytical strategy includes across topic, within topic analysis and identifying the stagger across time periods. This article concludes with a discussion on areas for future research.

II. METHOD

This section of the article details the method that was used when analysing the ERP systems literature, and is comprised of the journals that were reviewed, the search string utilised and the classification framework that was used.

Journals Reviewed

Our archival analysis on ERP systems literature includes studies published between 1 January 2006 and 31 December 2012 in the leading Information Systems (IS) journals listed in Table 1.

Table 1: Journals Reviewed	
AMR	*Academy of Management Review*
BPMJ	*Business Process Management Journal*
CACM	*Communications of Association for Computing Machinery*
CAIS	*Communications of the Association for Information Systems*
DS	*Decision Sciences*
DSS	*Decision Support Systems Journal*
EJIS	*European Journal of Information Systems*

Table 1: Journals Reviewed – Continued	
HBR	*Harvard Business Review*
IEEEC	*IEEE Computer*
IM	*Information & Management*
ISF	*Information Systems Frontiers*
ISJ	*Information Systems Journal*
ISM	*Information Systems Management Journal*
ISR	*Information Systems Research*
JAIS	*Journal of the Association of Information Systems*
JGIM	*Journal of Global Information Management*
JIT	*Journal of Information Technology*
JMIS	*Journal of Management Information Systems*
JSIS	*Journal of Strategic Information Systems*
MISQ	*Management Information Systems Quarterly*
OM	*Omega*
OS	*Organization Science*
SMR	*Sloan Management Review*

The journals examined were predominately based on the journals analysed by Esteves and Bohorquez [2007]. The *Journal of the Association of Information Systems* (JAIS) was added to the journal list as it is identified in the top eight AIS Senior Scholars Basket. However, unlike Esteves's studies, our analysis does not include conference papers.

To retrieve the relevant articles from the aforementioned journals in Table 1, we performed a keyword search using the following terms: "ERP", "ES", "Enterprise Resource Planning Systems", "Enterprise systems", "enterprise-wide systems", "packaged software", and the ERP vendors: "SAP", "Oracle", "Baan", "JD Edwards", "Microsoft Dynamics" and "PeopleSoft". Next, each article identified through the search was read in its entirety and the relevance of the articles was determined. The relevant papers then were classified according to an extension of the classification scheme developed by Esteves and Bohorquez [2007]. Second, additional papers were identified through 'snow balling' through papers identified in Step 1.

Classification Framework

Esteves and Bohorquez's [2007] annotated bibliography is the foundation of our study and the platform for constructing a comparative framework across the multiple time periods. Esteves and Bohorquez's [2007] framework is an evolution of Esteves and Pastor's [2001], in which the deficiencies of Esteves and Pastor's [2001] study were identified and either eliminated or minimised. Esteves's papers classified articles based on the lifecycle phases developed by Esteves and Pastor [1999]. Articles which did not fit within the lifecycle were classified as either an educational topic or a general topic. Educational topics focus on the use of ERP systems in tertiary education curricula. Meanwhile, the general topic encapsulates publications pertaining to business process modelling, software development issues and general research issues [Sedera, Gable, and Palmer, 2002].

Esteves and Pastor's [1999] lifecycle consists of six phases: (1) adoption decision, (2) acquisition, (3) implementation, (4) use and maintenance, (5) evolution and (6) retirement. The adoption decision phase consists of the decision of the organization to implement an ERP system as opposed to an in-house development or alternative software package. It includes requirements analysis, the objectives, and evaluation guidelines for the ERP system. The acquisition phase is characterised by instances where an organization has decided to adopt an ERP system and the vendor and ERP system package needs to be selected. Once the package is decided upon, the next phase is the implementation process, which typically consists of the configuration and customisation of the system to meet the organisation's requirements. After the system implementation, the lifecycle focuses on the use and maintenance of the ERP system with the objective of maximizing the benefits obtained. The evolution phase focuses on the integration of new and existing technology to achieve greater benefits and maximize the fit of the ERP system to the requirements of the adopting organisation. The enterprise system lifecycle concludes with the retirement phase, which includes instances where an organization decides to abandon the ERP system [Esteves and Pastor, 1999].

To allow for further granularity Esteves and Bohorquez [2007] segmented the lifecycle phases, the general topic and educational topics into a number of different subsections. The retirement phase is the only phase of the lifecycle that is not comprised of different subsections due to the limited amount of research that has been performed in that area. Table 2 depicts the segmentation of the topics and the definitions of the subsections. One weakness of the lifecycle is that the retirement phase may potentially overlap with other phases of the lifecycle (e.g., adoption decision and acquisition). We refined the classification of articles by documenting: the method of analysis, the stakeholders

involved in the research, organisational size (e.g., SME, large organisations), and geographic region. Parenthetically, the categories used to segment the articles were identical to Esteves and Bohoroquez [2007]. Subsequently, when classifying the articles in accordance with Esteves and Bohorquez's [2007] framework, the authors read the article in its entirety and, using deductive logic, classified the articles according to the framework. This maintains the cumulative tradition of prior research; this classification schema is a tried and tested approach in two annotated bibliographies (refer to Esteves and Bohorquez, 2007; Esteves and Pastor, 2001), which have been cited over 400 times.

Table 2: Classification Framework		
High Level Topics	**Subtopics**	**Description of Subtopics**
General	Research Issues	Literature reviews, annotated bibliographies and archival analyses on ERP systems. This includes lifecycle-wide topics and different research methodologies.
	Business Modelling	Encompasses enhancing the alignment between ERPs and the business processes within an organization. Also provides comparisons of the business processes in use by the organisation as opposed to the business processes defined by the ERP system
	ERP Product Development Issues	The issues, communication techniques and programming languages used to develop an ERP product.
Adoption Decision	Adoption Impact	The impact that the adoption decision has on both internal and external stakeholders.
	Adoption Approach	The approach taken by the organization to make the adoption decision.
	Challengers and Enablers	The internal and external factors that challenge and enable the ERP adoption decision.
Acquisition	Acquisition Approach	The approach used to decide on a specific ERP system package and vendor.
	Acquisition Evaluation	The evaluation strategies used to evaluate ERP vendors to ensure the selection of the ERP package that best aligns with the requirements of the organization.
Implementation	Implementation Approach	The approach that is used to implement the ERP system within the organization, including big bang method, phased method and the form of ERP hosting.
	Success/Failure	The factors that affect the success or failure of the ERP implementation project, with the key focus being on the critical success factors (CSFs).
	Organisational Issues	The organisational factors that influence the organisation's performance, learning and training of the system and how to handle the resistance that occurs in the various types of user groups.
	Knowledge Management Issues	The issues that pertain directly to the transferal of knowledge and the factors that influence such transferal.
	Other Issues	Any other issue that occurs during the implementation procedure that cannot be categorized as approach, success/failure, organizational issues or knowledge management issues.
Usage	Use Benefits and Success	The benefits that are achieved through the use of an ERP system, includes comparison between adopting organisations and non-adopting organisations with industry comparisons.
	Maintenance	The maintenance of an ERP system and the factors that influence the decision of the organization to perform system updates.
Evolution	Emerging Technologies	Includes information about new and emerging ERP technologies and other technologies that are developed to be integrated with an ERP system.
	Integration Issues	Issues that occur with the integration of technologies with the ERP system.
Retirement		The decision to abandon the current ERP systems that are used.
Education	Usage	Focuses on universities introducing ERP systems.
	ERP Courses	The structure and type of courses related to ERP systems that are provided by tertiary education institutions
	IS Curricula	The teaching methods that are used within the IS curricula.

Adapted from Esteves, J., and V. Bohorquez (2007) "An Updated ERP Systems Annotated Bibliography: 2001–2005", *Communications of the Association for Information Systems,* (19), pp. 386–446.

III. RESULTS AND DISCUSSION

Previously, Esteves and Pastor [2001] had reviewed thirty-three articles from 1997 to 2000 and Esteves and Bohorquez [2007] had reviewed 147 articles from 2001 to 2005. In our analysis, we identified a total of 219 publications in the reviewed journals from 2006 to 2012 that are relevant to ERP systems. Table 3 summarizes the number of articles reviewed from 1997 to 2012 and positions our study against prior [Esteves and Bohorquez, 2007; Esteves and Pastor, 2001] categorization and analysis. Cumulatively, the table shows a total of 399 journal articles from 1997 to 2012. The remainder of this section discusses the categorisation and analysis of articles published from 2006 to 2012. We discuss the main topics and subtopics of ERP research in our top information systems journals, their current understanding and potentially interesting fronts for ERP researchers.

Table 3: Number of Articles Reviewed																				
	1997	1998	1999	2000	Total	2001	2002	2003	2004	2005	Total	2006	2007	2008	2009	2010	2011	2012	Total	Σ
AMR*	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0	0
BPMJ*	-	-	-	-	0	14	2	1	5	8	30	1	8	8	7	8	5	1	38	68
CACM	-	-	-	8	8	-	3	2	2	1	8	2	1	1	1	4	-	-	9	25
CAIS	-	-	1	1	2	1	2	2	-	1	6	1	3	2	2	-	4	1	13	21
DS*	-	-	-	-	0	-	1	-	-	-	1	1	-	-	-	1	-	-	2	3
DSS	-	-	-	-	0	-	-	-	-	1	1	5	-	4	2	1	1	4	17	18
EJIS	-	1	-	1	2	2	1	2	-	5	10	4	2	1	1	3	1	1	13	25
HBR	-	-	1	-	1	-	-	-	-	-	0	-	-	1	-	-	-	-	1	2
IEEEC*	-	-	-	-	0	-	-	-	-	-	0	-	1	1	2	-	1	1	6	6
IM*	-	-	-	1	1	-	2	3	3	-	8	1	5	8	3	3	1	1	22	31
ISF*	-	-	-	-	0	-	1	-	-	-	1	-	-	1	-	1	2	1	5	6
ISJ	-	-	-	-	0	-	3	1	1	1	6	4	3	4	-	1	1	2	15	21
ISM*	-	-	-	-	0	1	2	3	1	4	11	3	1	1	1	1	3	2	12	23
ISR	-	-	-	-	0	-	-	-	-	-	0	1	-	-	-	2	5	1	9	9
JAIS**	-	-	-	-	0	-	-	-	-	-	0	-	1	1	2	2	-	1	7	7
JGIM	-	-	1	-	1	-	1	-	-	-	1	1	1	-	-	1	-	-	3	5
JIT	-	-	2	6	8	1	1	-	1	-	3	1	1	3	5	3	3	3	19	30
JMIS	-	-	-	-	0	-	3	-	1	-	4	1	2	-	2	2	-	1	8	12
JSIS*	-	-	-	-	0	-	-	-	6	5	11	-	2	-	-	2	2	-	6	17
MISQ	-	-	-	-	0	-	-	1	-	2	3	1	1	1	1	3	1	1	9	12
OM*	-	-	-	-	0	-	1	1	2	-	4	-	-	-	-	-	-	1	1	5
OS*	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0	0
SMR*	-	-	-	-	0	1	1	1	-	-	3	-	-	-	-	1	-	2	4	7
Others	1	3	2	4	10	5	5	24	2	-	36	-	-	-	-	-	-	-	0	46
Total	1	4	7	21	33	25	29	41	24	28	147	27	33	37	29	39	30	15	219	399

Adapted from Esteves, J., and V. Bohorquez (2007) "An Updated ERP Systems Annotated Bibliography: 2001–2005", *Communications of the Association for Information Systems,* (19), pp. 386–446.
* Journals that were not analysed from1996 to 2000
** Journals that were not analysed from 1996 to 2005

Analysis of Articles 2006–2012

The (219) ERP-related articles published between 2006 to 2012 are categorized according to the classification scheme depicted in Table 2. Figure 1 illustrates the number of articles reviewed in each category across the ERP systems lifecycle as well as general topics and educational topics. As seen in Figure 1, preliminary observations suggest implementation is the most studied phase of the ERP systems lifecycle (n = 77) followed by the usage of the system (n = 46). In contrast, the acquisition phase has received little attention with only nine articles pertaining to

how an organisation selects a packaged software solution. The general topics, which encompasses lifecycle-wide topics, product development issues and business modeling has received the same number of publications (n = 46) from 2006 to 2012 as the usage phase (n = 46) of the ERP systems lifecycle. Rather surprisingly, the retirement phase of the ERP systems lifecycle has received virtually no attention, with only one article being classified as pertaining to reasons for systems abandonment. Tertiary education also appears to have had only limited attention (n = 5). The remainder of this section summarizes the categorisations and brief description of all relevant journal articles read.

Figure 1. Classifying Articles by Topics
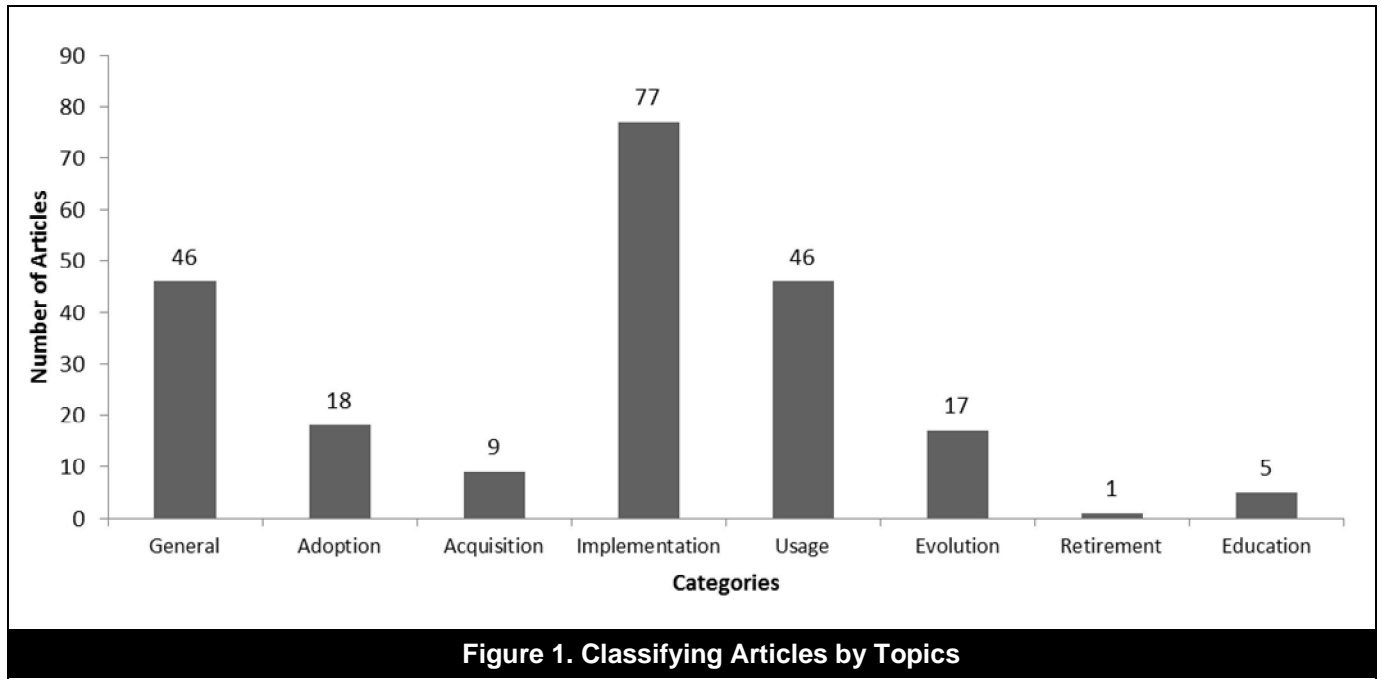
General Articles

The articles that were classified into the general topics are articles that do not fit within a single phase of the ERP system lifecycle and also do not pertain to tertiary education. The general section is comprised of three different topics: (1) research issues, (2) business modeling, and (3) product development issues. Figure 2 depicts the segmentation of articles into these topics. Forty-six articles in total were classified within the general topic. We observe that articles classified as a general research issue account for the majority of these articles (n = 27), followed by product development issues (n = 11), and finally business modelling (n = 8).

Figure 2. Number of General Articles
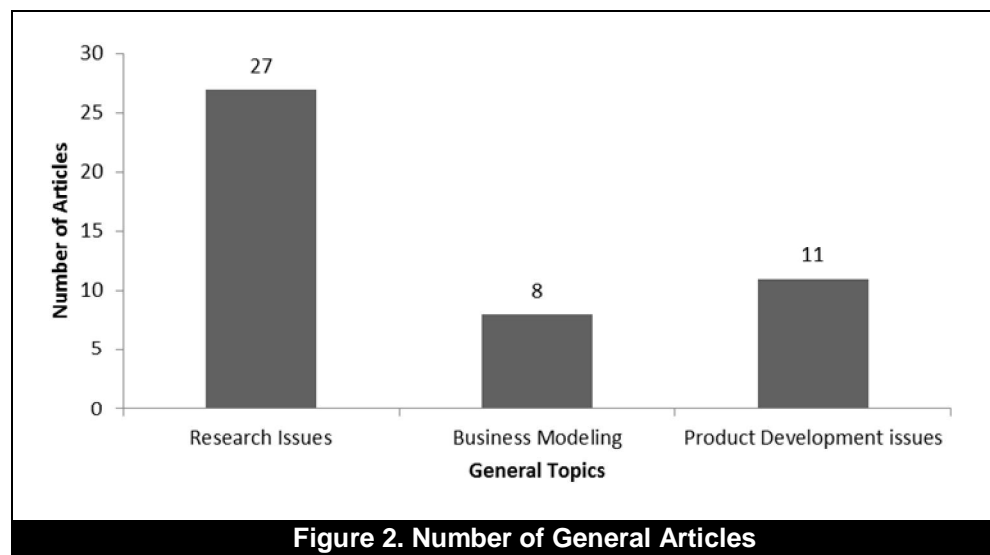
General—Research Issues

General research issues articles seek to investigate the trends of ERP systems, including literature reviews, annotated bibliographies and archival analyses. It also includes comparisons of ERP systems with other Information

Systems (IS), research strategies and methodologies used in the IS realm and articles that pertain to the ERP systems lifecycle as a whole. Table 4 details the common themes that are apparent in the general research issues subtopic, which is followed by a brief description of each article categorised within this subtopic.

Table 4: Common Themes: General Research Issues	
Theme	**References**
Research Methods	Sedmak and Longhurst, 2010; Williams and Pollock, 2012
Impact/Potential Impact	McAfee and Brynjolfsson, 2008; Mueller, Viering, Legner, and Riempp, 2010; Beath, Becerra-Fernandez, Ross, and Short, 2012
Lifecycle-wide	Benders, Batenburg, and van der Blonc, 2006; Rettig, 2007; Chang, Yen, Huang, and Hung, 2008; Mignerat and Rivard, 2009; Themistocleous, Soja, and da Cunha, 2011
Comparisons	Remus, 2007; Naslund, 2008; Westrup and Liu, 2008; Bernroider, Suczina, and Pucihar, 2011
External Parties (community/customers)	Ramasubbu, Mithas, and Krishnan, 2008; Leimeister, Huber, Bretschneider, and Krcmar, 2009; Wang and Ramiller, 2009
Research Gaps	Esteves and Bohorquez, 2007; Vathanophas, 2007; Sidorova and Isik, 2010
Others	Farhoomand, 2007; Deng, Doll, Al-Gahtani, Larsen, et al., 2008; Xue, Liang, and Boulton, 2008; Bidan et al., 2012; Luftman, Zadeh, Derksen, Santana, et al., 2012; Sarker, Sarker, Sahaym, and Bjorn-Anderson, 2012; Trapero, Kourentzes, Fildes, 2012

- Benders et al. [2006] analysed the isomorphic forces that influence multiple phases of the ERP systems lifecycle.

- Esteves and Bohorquez [2007] developed an annotated bibliography of ERP systems research from 2001 to 2005.

- Farhoomand [2007] analysed the transformation of SAP from a proprietary software to open-source, customisable and integratable software package.

- Remus [2007] analysed the critical success factors of enterprise portals and compared them to the critical success factors of ERP implementations.

- Rettig [2007] identified several novel issues associated with ERP systems, such as: companies that have an ERP system typically have a substantial amount of non-integrated software, the complexity of the code makes customisation difficult, the errors present within the data, and the cost associated with the implementation.

- Vathanophas [2007] determined where the gaps in the ERP systems research lies through a focus group conducted in Singapore containing post-graduate students who were previously IT professionals, practitioners or had no prior work experience.

- Chang et al. [2008] developed five reference models that depict the management of an ERP system across its entire lifecycle.

- Deng et al. [2008] tested and compared the results obtained for the end-user computing satisfaction instrument in India, Saudi Arabia, Taiwan, Western European countries and the USA.

- McAfee and Brynjolfsson [2008] analysed how ERP systems and other Information Technology investments affect organisations.

- Naslund [2008] performed a comparison of lean and six sigma to previous improvement methodologies such as CSF in ERP implementation.

- Ramasubbu et al. [2008] surveyed a project team in the United States of America to determine the factors that influence customer satisfaction of Enterprise System Support Services.

- Westrup and Liu [2008] performed a comparison of ICT joint ventures in the UK and China through conducting interviews with workers.

- Xue et al. [2008] determined the governance patterns in IT investments through conducting surveys, interviews and case studies in China.

- Leimeister et al. [2009] reviewed the concept of ideas competition using SAP's SAPIENS ideas competition.

- Mignerat and Rivard [2009] performed a literature review that studied the institutional effects and pressures experienced during all phases of the IS lifecycle.

- Wang and Ramiller [2009] developed a conceptual model for community learning by performing an archival analysis.

- Mueller et al. [2010] developed a framework to determine the economic potential of service-oriented architecture by performing a comprehensive literature review.

- Sedmak and Longhurst [2010] present the differences in research methodologies used in ERP systems research through performing an extensive literature review.

- Sidorova and Isik [2010] performed a literature review to determine the trends occurring in business process research.

- Bernroider et al. [2011] compared the absorption of ERP systems in transition and developed economies.

- Themistocleous et al. [2011] performed a comparison of the ERP systems lifecycle in transitional economies to developed economies through interviewing directors, consultants, managers, end-users.

- Beath et al. [2012] analysed how companies manage and capitalize on the transactional data produced from ERP systems and Customer Relationship Management (CRM) systems due to the substantial growth rate of data collected from organisations.

- Bidan, Rowe, and Truex [2012] found that Enterprise Application Integration (EAI) and ERP are amongst the three most common methods of fulfilling the overarching of interoperability and system integration of SMEs.

- Luftman et al. [2012] surveyed senior IT executives across the globe to determine the top five management concerns and influential technologies. The findings showed the ERP systems were rated as the second most influential technology.

- Sarker et al. [2012] investigated a business to business alliance by performing case studies and interviews with vendor partners and competitors.

- Trapero et al. [2012] analysed planning collaboration for forecasting, which is necessary for Supply Chain Management (SCM) in ERP systems.

- Williams and Pollock [2012] believe that alternatives to single site case studies and new research methods need to be used and developed in IS research.

General—Business Modelling

Business modelling publications provide insights into how organizations enhance the alignment between ERP systems and the organization's existing business processes. Furthermore, it includes details on comparisons of the organisation's business processes to those embedded in the ERP system.

- Dietrich [2006] analysed resource planning, such as material resource planning, labour resource planning, and service resource planning, involved within a business process when delivering a service.

- Ingvaldsen and Gulla [2006] illustrated how event logs can be extracted and used to improve an organisation's business processes.

- Van der Aalst [2006] analysed differences between organizational processes and the processes defined by the ERP systems vendors.

- Shang and Seddon [2007] interviewed project managers, key decision makers, users and process owners to analyse the issues and limitations associated with packaged software solutions in regards to process changes.

- Srivardhana and Pawlowski [2007] developed a framework to depict how knowledge sharing within an organisation affects ERP system use.

- Fettke [2009] analysed the conceptual modelling tools and techniques used by practitioners. Although not specifically on ERP systems, the authors specified the importance of conceptual modelling for ERP system customisation.

- Sousa, Mendonca, Lievyns, and Vanderdonckt [2011] developed a model that linked business processes with user interfaces with the goal of an enhancing the alignment between ERP systems and business processes.

- Tallon [2012] surveys IT and business executives in the United States of America, the United Kingdom and Ireland to examine the effects of alignment of a process within a value chain.

General—ERP Product Development Issues

ERP product development publications pertain to the development of ERP systems experienced by vendors and not the implementation of an ERP system into an organization.

- Klein and Herskovitz [2007] debated Quinean holism to Poppers' falsification model for use with prototype validation of packaged software.

- Oshri, Kotlarsky, and Willcocks [2007] investigated collaborative techniques that globally distributed software development teams can use.

- Fink and Markovich [2008] developed verticalization strategies to match the characteristics of ERP system vendors.

- Samaranayake [2009] devised a framework that used enhanced EPC diagrams to improve the blueprint models of ERP systems.

- Subramoniam and Tounsi [2009] illustrated that Visual Prolog object-oriented programming language can be used to transform ERP systems from transaction systems to decision-making systems.

- Chellappa and Saraf [2010] used social network methods to analyse enterprise system software firms' competition.

- Chellappa, Sambamurthy, and Saraf [2010] analysed the market environments that enterprise system software firms operate in.

- Hopkins [2010] interviewed the Chief Sustainability Officer of SAP to determine the benefits and the customer perception of sustainability with the use of SAP.

- Doğan, Mookerjee, and Radhaknishnan [2011] developed a model which consisted of four different upgrading strategies that product suppliers can take based on demand variability and word-of-mouth demand.

- Subramanyam, Ramasubbu, and Krishnan [2011] analysed the flexibility and efficiency when model-driven, component-based software development methodology is used.

- Kiron [2012] interviewed Mark Talon from SAP to discuss SAP's Community Networks and the use of other social media platforms. The interview highlighted that these facilities promotes members to discuss potential product functionalities.

Research Issues in the General Phase

Articles categorised within the general theme are diverse in nature and include lifecycle-wide issues, comparisons between different systems, literature reviews, business process reengineering and product development issues.

Research Areas: General Research Issues

In terms of the general research issues subtopic, several literature reviews have been performed (e.g., Mignerat and Rivard, 2009; Sidorova and Isik, 2010) in an attempt to analyse the state of the literature. However, no comprehensive archival analysis since Esteves and Bohorquez [2007] have categorised, analysed and comprehensively determined said gaps. These comprehensive literature reviews should also be performed on CRM and SCM publications to determine: *What are the gaps present in the CRM and SCM literature?* and *How can the knowledge embedded in the CRM and SCM literature inform ERP systems research?*

Our examination of general issues articles found comprehensive analyses of lifecycle-wide factors such as institutional effects, pressures, isomorphic forces [Mignerat and Rivard, 2009] and management [Chang et al., 2008]. Comparisons were also made between ERP systems lifecycle in different economic climates [Themistocleous et al., 2011]. Due to the advent of SaaS technologies, and on-demand subscription-based ERP systems, we need to uncover: *What is the on-demand subscription-based ERP systems lifecycle?* and *How does this lifecycle differ from on-premise solutions?*

Research Areas: ERP Product Development Issues

This advent of SaaS technologies also links to product development issues in terms of green technologies. An emerging topic is green IT, which investigates system capabilities for measuring its resources and emissions and the sustainability of the organisation that develops the system. More information is necessary in developing models for

determining the sustainability of an organisation and whether a product developer using sustainability techniques influences potential and existing customers. Therefore: *How can the sustainability of an organisation be effectively determined? What factors influence the sustainability (e.g., government policies)?* and *How can the sustainability of an organisation be monitored and improved by ERP systems?* These questions need to be answered as governments are increasingly placing regulations on monitoring carbon dioxide (CO_2) emissions. Furthermore, *Are companies going to opt for a cloud-based solution as they are considered to be green due to server utilisation?* The need for mobile enterprise applications are also growing with ERP system vendors developing e-Marketplaces in which their clients can purchase applications developed either by the vendor themselves or an external party [2012]. Parallel to this changing of business models, product development issues will arise for the vendor, in particular: *How is the vendor going to manage the e-marketplace? Is the ERP system's vendor going to certify that the applications provided by third parties are in working order, and what testing does this require?* and *What mobile applications should be developed to enhance the end-user experience*?

Research Areas: Business Modelling

Finally, in terms of the business modelling segment, several publications have focused on minimising the gap between ERP systems and the business processes within organisations. In doing so, models have been developed that link the business processes performed in an organisation to user interfaces of the system. Other authors examined the differences in the processes taking place within an organisation, in other words, the lack of standardised business processes. Whilst the publications on business modelling topics are quite comprehensive, gaps in the literature are still apparent, and research should be conducted into answering such questions as: *What is the optimal phase of the ERP systems lifecycle for minimising the gap between the ERP system and the organisational processes, or should minimising the gap be treated as an ongoing continual improvement within the organisation?*

Adoption

The adoption phase of the ERP systems lifecycle encompasses the organisation's decision to choose to adopt an ERP system, the impact of that decision, and the facilitating and inhibiting factors that impact the adoption decision. Thus the adoption phase of the lifecycle consists of three distinct phase: (1) adoption impact, (2) adoption approach, and (3) adoption challenges and enablers.

Adoption—Impact

The adoption impact subcategory includes articles pertaining to the impact the adoption decision has on internal and external stakeholders.

- Ranganathan and Brown [2006] analysed how the decision to adopt an ERP system affects the stock market prices in the United States of America.

- Lai, Liu, Lai, and Wang [2010] performed interviews and surveys with top management to investigate the imitative forces that occur and also are impacted on when an organisation is deciding to adopt an ERP system.

Adoption—Approach

The adoption approaches subcategory details the approaches an organization can use when deciding to adopt an ERP system. Our general observation is that this research is typically performed from the perspective of IS management and mid-level management.

- Bunker, Kautz, and Anhtuan [2008] performed a case study and interviewed consultants, managers and users in Australia to analyse the skills focus approach in IS adoption.

- Poba-Nzaou, Raymond, and Fabi [2008] performed a single case study of an SME in France to analyse the adoption process that was used within an organization.

- Benlian and Hess [2011] compared evaluations of proprietary software (ERP) with regards to open source software through the surveying of IS managers and senior management in Germany.

Adoption—Challenges and Enablers

The adoption challenges and enablers subcategory refer to factors that can influence the decision of an organization to adopt an ERP system for both small and medium enterprises (SMEs) and large enterprises. This includes alternatives to ERP systems and predictive models for the success and time taken for the implementation procedure, as this can also influence the decision to adopt the ERP system. Table 5 depicts the common themes that are apparent in the adoption challenges and enablers subtopic, which is then followed by a brief description of the articles categorised in this subtopic.

Table 5: Common Themes: Adoption Challenges and Enablers	
Theme	**References**
ERP Alternatives	Olsen and Saetre, 2007a; Olsen and Saetre, 2007b; Olsen, 2009
Reasons for Adoption	Walden and Browne, 2009; Berg and Stylianou, 2009; Chang, Hung, Yen, and Lee, 2010; Lorca and de Andrés, 2011; Poba-Nzaou, Uwizeyemungu, Raymond, and Paré, 2012
Adoption Considerations	Plaza, 2008; Kosalge and Chatterjee, 2011;
Other	Wang, 2009; Meissonier and Houzé, 2010; Poba-Nzaou and Raymond, 2011

- Olsen and Saetre [2007a] analysed alternatives to ERP system adoption for SMEs.

- Olsen and Saetre [2007b] analysed four case studies of organisations in niche markets that have adopted ERP systems and determined that ERP systems may be inappropriate for niche markets. They also provide alternatives to ERP systems so that the organisation remains competitive and gets the desired functionality out of the IT infrastructure.

- Plaza [2008] developed a mathematical model to predict the time it would take for the implementation of an ERP.

- Berg and Stylianou [2009] analysed the different factors that influence the organisation's decision to adopt a large complex IS.

- Olsen [2009] discussed the need for niche companies to develop and use proprietary software as opposed to ERP systems to gain a competitive advantage in the marketplace.

- Walden and Browne [2009] developed a mathematical model to explain the reason for the adoption of a large complex IS.

- Wang [2009] developed a model of the adoption process that incorporated both internal and external factors of the organisation.

- Chang et al. [2010] surveyed CEOs, top management and owners in Taiwan to explore the factors that influence ERP adoption for SMEs.

- Meissonier and Houzé [2010] conceptualized the IT conflict resistance theory by performing action research during the pre-implementation phases of the ERP system lifecycle.

- Lorca and de Andrés [2011] conducted a questionnaire with managers in Spain to analyse the reasons for the adoption of an ERP system with an emphasis on the organisation's performance and the manager's characteristics.

- Kosalge and Chatterjee [2011] modelled the processes and human behaviour within two organisations to determine whether ERP system adoption is appropriate for the organisation.

- Poba-Nzaou and Raymond [2011] analysed the risk management strategies used in the adoption decision phase of the ERP systems lifecycle.

- Poba-Nzaou et al. [2012] analysed 180 published case studies to determine the underlying reasons of organisations within the health-care industry organisations adopting ERP systems.

Research Issues in the Adoption Decision Phase

This section details the topics that have previously been examined and areas for future research in terms of the adoption impact, adoption approach, and the adoption challenges and enables.

Research Areas: Adoption Impact

The impact the adoption decision has on organisations is still an under-researched paradigm, with most of the research conducted in this area focusing on specific contextual scenarios. For example, whilst how the adoption decision of an organisation affects stock market prices in the USA [Ranganathan and Brown, 2006] is a valuable piece of research and adds to the domain of knowledge, theoretical gaps exist in determining the effect the adoption decision has in varying contexts. From this, we derive a set of questions for future research: *How do different economic climates and cultures of the organisation affect the impact of the adoption decision on the stock market as well as on other external entities?* and *Does this impact change in different industry sectors?* Parenthetically, researchers conducting comparative research may potentially uncover augmented findings such as cross-industry (health-care vs. banking) adoption of ERP systems (for example, across more developed nations and hence more

developed industries). Lastly, comparing the impacts of adoption can potentially be an incentive and/or become a key control variable for researchers investigating other higher topic areas (e.g., acquisition).

Research Areas: Adoption Approach

Of the 219 articles examined in the 2006 to 2012 period, only three pertained directly to the approach taken by an organisation to make the adoption decision. This research was performed in Australia [Bunker et al., 2008], France [Poba-Nzaou et al., 2008], and Germany [Benlian and Hess, 2011], which are all considered to be developed nations. Yet, it is well-known that ERP systems have different impacts in different economic climates and cultures due to the system being based on Western best practices [Soh, Kien, and Tay-Yap, 2000] and being both a technical and organisational system [Xue, Liang, Boulton, and Snyder, 2005]; thus, it is concerning that no publication within this time period examined different cultural climates. Hence, finer research questions include: *What is the adoption decision approach performed by organisations in developing nations?* and *Who is responsible for making this decision?* These questions can be explored by performing multi-site case studies and interviews. Once the adoption process in developing nations is better understood, researchers can perform a comparison to determine: *How does this adoption decision process deviate to the process undertaken by organisations in developed countries?*

Research Areas: Adoption Challenges and Enablers

An emerging trend in this phase of the lifecycle which was not encountered in Esteves and Pastors's [2001] nor Esteves and Bohorquez's [2007] prior work is the adoption decision in Small and Medium Enterprises (SMEs). Due to new technologies such as cloud-based systems and the affordability of such software solutions [Poba-Nzaou and Raymond, 2011], SMEs have become a crucial target market of ERP systems vendors today. SMEs are unique as, unlike large enterprises, they typically do not adopt on-premise solutions, but rather adopt on-demand subscription-based systems [Torbacki, 2008]. The research pertaining to SMEs encompassed alternatives to ERP systems and factors that influence the adoption decision. These factors include top management, organizational attributes, and environmental characteristics [Chang et al., 2010]. However, publications pertaining to this topic have not encapsulated the influence of each of these factors in the contextual scenario of an SME undertaking the adoption decision process. Thus there are crucial gaps in the literature which include: *How is the adoption decision process handled by SMEs? What factors are influential in the stages of the adoption decision process?* and *Are there any factors that are responsible for triggering the subsequent phases in the adoption decision process?* In summary, as SMEs differ in terms of size, complexity, resources, organisational structures, as well as types of systems used (on-premise verse on-demand) to large enterprises, it is expected that their adoption decision process also would vary and thus poses the following questions: *To what extent does the adoption decision process alter between organisations of varying size?* and *Do the adoption decision factors vary between SMEs and large enterprises?*

Acquisition

Articles pertaining to the acquisition phase of the ERP systems lifecycle generally report on when an organisation is attempting to decide and evaluate different ERP systems vendors. We classify them into two related topics: (1) acquisition approach, and (2) acquisition evaluation.

Acquisition—Approach

In this subcategory, articles discuss the approach taken by the adopting organisation to select an ERP system. It includes the influence that stakeholders have during the acquisition process.

- Howcroft and Light [2006] applied the power relations framework to the software acquisition process.

- Damsgaard and Karlsbjerg [2010] conducted interviews with senior directors which resulted in a list of seven principles to help organisations select a packaged software solution that best fulfils their requirements.

- Howcroft and Light [2010] developed a framework to illustrate how stakeholders influence the acquisition process.

- Tsai, Lee, Shen, and Lin [2012] developed a model to depict the selection criteria of an ERP system based on surveys conducted in Taiwan with project managers and the project team.

Acquisition—Evaluation

In this subcategory, articles discuss how organisations evaluate different ERP system vendors and packages.

- Bernroider and Stix [2006] proposed a method to determine which IS best suited the company; the method was tested using a case study of an organisation in the process of selecting the ERP system.

- Keil and Tiwana [2006] determined the factors that IS managers use to evaluate packaged software solutions.

- Wu, Shin, and Heng [2007] developed a methodology to determine the ERP system that best matched the requirements of an organisation.

- Annamalai and Ramayah [2011] evaluated SAP and Oracle with respect to the different software modules that the vendors offered.

- Gürbüz, Alptekin, and Isiklar Alptekin [2012] developed a model which took into account vendor, customer, and software functionality criteria for evaluating ERP system selections.

Research Issues in the Acquisition Phase

The acquisition phase of the lifecycle is an under-researched paradigm. Below is a discussion of future research areas pertaining to the acquisition approach and evaluation strategies.

Research Areas: Acquisition Approach

Several scholars have documented models to capture varying stakeholders' perspectives in the acquisition process, but there is a lack of in-depth studies, which are necessary to better understand how the acquisition process occurs. In addition, ongoing studies should ensure that such processes are subject to deeper theoretical scrutiny. Furthermore the articles within this category neglected to perform comparisons in terms of the effect of culture and economic climate. Consequently, the following gaps in the literature exist: (1) *What is the actual acquisition process that organisations follow?* (2) *Does this process differ in different regions or industry sectors?* and (3) *Which stakeholders influence this process, and which phases are different stakeholder groups responsible for?*

It is important to note that a list of seven principles [Damsgaard and Karlsbjerg, 2010] has been developed through conducting a field study and interviews to help organisations during the acquisition phase. These principles, whilst useful to practice, appear to have not been tested in further organisations; thus the generalizability and effectiveness of these principles are unknown. Thus (1) *Do these seven principles adequately aid the decision-making process in all industry sectors, across cultures and economic climates*? (2) *Are other principles necessary to truly aid the decision making process?* and (3) *How do these principles fit within the overall acquisition process?*

The contextual scenario of small and medium enterprises during the acquisition approach phase of the ERP systems lifecycle is lacking. The acquisition process of SMEs should be modelled using the process theoretical viewpoint in an attempt to answer the questions: *How is the acquisition process performed by SMEs?* and *Who are the key stakeholder groups involved in the SME process?* This knowledge will enable researchers to inform practitioners of the most effective process to follow when selecting their ERP package and who should be involved in the decision-making process.

Research Areas: Acquisition Evaluation

The factors used to evaluate a vendor and their ERP systems for acquisition are well-documented in literature. These evaluation factors include vendor comparisons [Annamalai and Ramayah, 2011], cost, reliability [Keil and Tiwana, 2006] and functionality [Gürbüz et al., 2012; Keil and Tiwana, 2006]. Arguably the most comprehensive empirical study pertaining to acquisition in the time period studied was performed by Kiel and Tiwana [2006] who examined the importance of different evaluation factors for hypothetical ERP purchasing scenarios. However, as the authors examined only hypothetical situations, the actual purchase decision could not be determined. Thus, it could not adequately take into account the effect of real external pressures encountered by organisations. Furthermore, to comprehensively understand evaluation factors performed, we need to consider: (1) *What are the weightings of evaluation factors experienced by organisations?* and (2) *How are these weightings influenced by perceptions held by varying stakeholder groups?*

It is understandable that the vast majority of past publications have been performed on large corporations, due to the traditional on-premise ERP system characteristics. Characteristics such as size, complexity and the sheer cost of configuring such software meant that the software itself was virtually unattainable to SMEs. However, with the advent of the technological innovation of cloud and on-demand software, ERP systems are now a possible software solution for the SME market. Therefore, it is concerning that the SME market has virtually been neglected during the acquisition phase within the studied time periods. With ERP systems vendors shifting their marketing strategy to target SMEs by utilising SaaS technologies, we, as researchers, need to answer the following question: *What are the key evaluation strategies of SMEs when selecting an ERP system?* This will inform vendors on how to effectively market their products to potential SME customers and also demonstrate the key functionality requirements of SMEs, thus minimising the gap between the adopting organisation's requirements and the software package.

Implementation

Implementation of ERP systems is the most researched topic in the lifecycle, with over 35 percent of the relevant articles pertaining to the topic. The topic includes articles covering organisational issues, critical success factors of implementation, the importance of knowledge management and its various techniques, as well as any other issues that occur during the implementation procedure. Furthermore, it encompasses the approaches taken by the organisation to implement the system (e.g., phase, big bang, locally hosted or an Application Service Provider [ASP] hosted). In our analysis, we classify the implementation publications into the related subcategories: (1) implementation approach, (2) implementation success or failure, (3) implementation organisational issues, (4) knowledge management and (5) other issues. Figure 3 depicts the number of articles that were classified in each subtopic of the ERP systems lifecycle. Implementation success and failure was the most widely published phenomenon (n = 28) followed by the organisational issues that arise during ERP system implementation (n = 23). Knowledge management (n = 12) and other implementation issues (n = 11) had a similar amount of articles pertaining to them, with implementation approach being the least studied phenomenon of the implementation procedure (n = 3).

Figure 3. Number of Implementation Articles
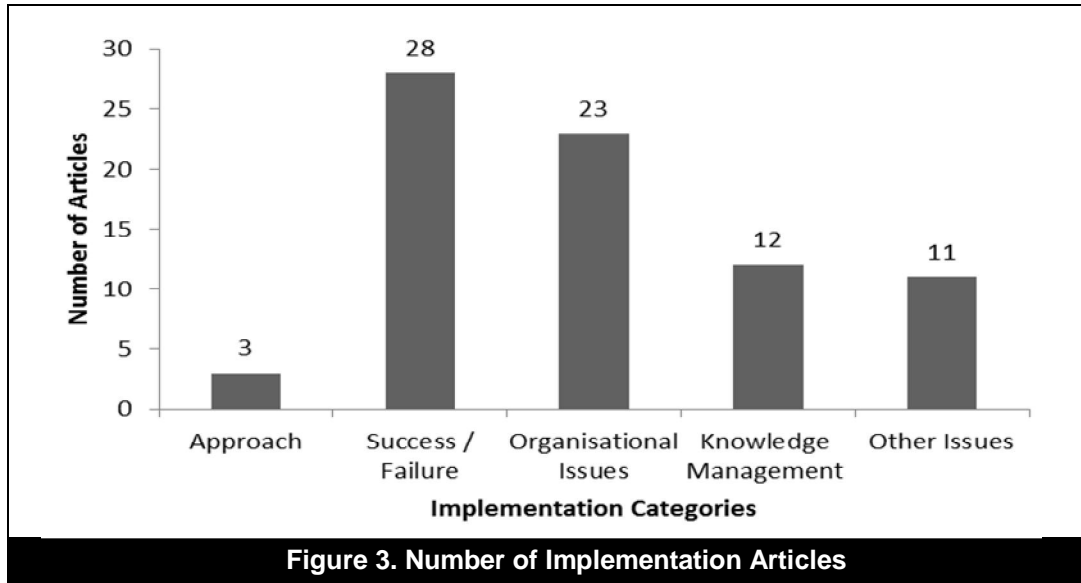
Implementation—Approach

Regarding implementation approaches, publications report the frameworks, techniques and strategies that organisations can use when implementing an ERP system.

- Dreiling, Rosemann, van der Wil, Heuser, et al. [2006] presented configuration patterns through the use of Event-driven Process Chains and petrinets.
- Solis, Putnam, Gemoets, Almonte, et al. [2006] compared the risks and benefits of implementing an application service provided hosted ERP system to a self-hosted ERP system.
- Elbanna [2010] discussed methods of how to handle multiple projects at one time based on an ERP system case study.

Implementation—Success and Failure

In this subcategory, articles report on the factors during the implementation process that influences the success of the ERP implementation, also known as critical success factors (CSFs). Table 6 demonstrates the common themes that are apparent in the implementation success and failure subtopic, which is subsequently followed by a brief description of the articles in this category.

Table 6: Common Themes: Implementation Success/Failure	
Theme	**References**
Critical Success Factors	Finney and Corbett, 2007; Sawah, Tharwat, and Rasmy, 2008; Chuang and Shaw, 2008; Liu and Seddon, 2009; Francoise, Bourgault, and Pellerin, 2009; Lin and Rohm, 2009; Zabjec, Lovacic, and Stemberger, 2009; Dezdar and Ainin, 2011; Doherty, Ashurst, and Peppard, 2012
Business Processes	Al-Mudimigh, 2007; Karimi, Somers, and Bhattacherjee, 2007a; Newman and Zhao, 2008; Subramoniam, Tounsi, and Krishnankutty, 2009; Kumar, Movahedi, Lavassani, and Kumar, 2010
Governance	Wang and Chen, 2006b; Bernroider, 2008
Culture	Wang, Klein, and Jiang, 2006; Ke and Wei, 2008
Top Management	Dong, 2008; Dong, Neufeld, and Higgins, 2009
Failure	Momoh, Roy, and Shehab, 2010; Krotov, Boukhonine, and Ives, 2011
Risk	Aloini, Dulmin, and Mininno, 2007; Dey, Clegg, and Bennett, 2010
Pre-implementation influence	Soja, 2008; Sammon and Adam, 2010
Others	Tsai, Shaw, Fan, Liu, et al., 2011; Finney, 2011

- Wang et al. [2006] developed a model to explain how the consultants and origin of the packaged software affect the perceived misfit of the system.

- Wang and Chen [2006b] proposed a model that illustrated the impact that governance has on ERP system success.

- Al-Mudimigh [2007] determined how business process management affected ERP system implementation success.

- Aloini et al. [2007] investigated the risks apparent in the entire ERP system lifecycle to ensure ERP system implementation success.

- Finney and Corbett [2007] performed a literature review to compile a list of CSFs of ERP system implementation.

- Karimi et al. [2007a] developed a model to depict how business process outcomes were influenced by the implementation support and radicalness.

- Bernroider [2008] adopted the Delone McLean IS success model to assess ERP systems value to determine the effect of IT governance on the delivery of an ERP system.

- Chuang and Shaw [2008] analysed the critical success factors of Enterprise Resource Management (ERM) components. ERP systems are a component of ERM.

- Dong [2008] identified how top management support influenced ERP system success from deterministic, contingent and dynamic perspectives.

- Ke and Wei [2008] derived a list of propositions by conducting a comprehensive literature review to determine how an organisation's culture and leadership team affect the ERP system implementation success.

- Newman and Zhao [2008] analysed the CSFs of ERP systems with a focus on business process reengineering.

- Sawah et al. [2008] performed surveys and interviews with consultants, vendors, project managers, IT managers and system administration in Egypt to determine the importance of the CSFs in an Egyptian context.

- Soja [2008] surveyed adopting organisations and ERP system vendors in Poland to identify how pre-implementation definitions of goals and strategy affect the success of an ERP system implementation project.

- Dong et al. [2009] analysed the types of actions involved for the CSF of top management support.

- Francoise et al. [2009] performed a literature review and a Delphi survey to determine the actions that can be performed in relation to CSFs.

- Liu and Seddon [2009] demonstrated the causal relationship between critical success factors and organisational benefits.

- Lin and Rohm [2009] performed surveys and interviews with end users and managers of ERP systems in China to determine if there was a difference in their views of the importance of the CSFs.

- Subramoniam et al. [2009] analysed the critical success factor: business process reengineering.

- Zabjec et al. [2009] analysed the CSFs of business process management, top management support and change managements and determined how they influenced success.

- Dey et al. [2010] identified the risks that can occur during an ERP system implementation.

- Kumar et al. [2010] performed interviews with top management in Canada and the United States of America to determine whether process orientation influenced ERP implementation success.

- Momoh et al. [2010] analysed the reasons for ERP implementation failure by performing a literature review of articles published between 1997 and 2009.

- Sammon and Adam [2010] performed four case studies with interviews and document analysis to determine if an organisation's preparedness or lack thereof for an ERP implementation project results in problems occurring during the ERP system implementation procedure.

- Dezdar and Ainin [2011] performed a survey with mid-level managers in Iran to analyse the CSFs in a developing nation.

- Finney [2011] analysed how communication is important to both internal and external stakeholders throughout the ERP implementation procedure.

- Krotov et al. [2011] documented the scenario in which a Russian company implementation failed for use within an educational context.

- Tsai et al. [2011] developed a success model that looked at both the internal and external factors that can lead to ERP system success. The authors focused on consultants, providers and project management.

- Doherty et al. [2012] converted a subset of CSFs into explicit organisational benefits for public sector organisations.

Implementation—Organisational Issues

In this subcategory, articles reported issues such as communication and power shifts that occur due to the implementation procedure. Aside from detailing issues, it also includes information on training and system misfits that cause changes to the organisation. Table 7 outlines the common themes that are apparent in the organisational issues subtopic, which is followed by a brief description of the articles classified in this subtopic.

Table 7: Common Themes: Organisational Issues	
Theme	**References**
Organisational Control and Performance	Law and Ngai, 2007; Ignatiadis and Nandhakumar, 2007; Dhillon, Caldeira, and Wenger, 2011; Yeh and Yang, 2010; Soh, Chua, and Singh, 2011
Learning and Training	Karuppan and Karuppan, 2008; Gravill and Compeau, 2008; Davis and Hikmet, 2008
Analysis of Organisational Issues	Berente, Gal, and Yoo, 2010a; Berente and Yoo, 2011; Lyytinen, Newman, and Al-Muharfi, 2009
Handling Users and Staff	McCubbrey and Fukami, 2009; Shepherd, Clegg, and Stride, 2009; Klaus, Wingreen, and Blanton, 2010; Morris and Venkatesh, 2010; Rose and Schlichter, 2012
Factors Affecting Organisation	Amrani, Rowe, and Geffroy-Maronnat, 2006; Kwahk and Lee, 2008
Others	Huq and Martin, 2006; Osei-Bryson et al., 2008; Velcu, 2010; Strong and Volkoff, 2010; Wagner, Newell, and Kay, 2012

- Amrani et al. [2006] performed a case study, interviews and surveys to develop a model that depicted the factors that affect the organisation during the implementation process.

- Huq and Martin [2006] performed a qualitative analysis into business process reengineering by performing a case study in the United States of America.

- Ignatiadis and Nandhakumar [2007] performed a case study and interviews with office staff and managers to determine the relationship between organisation resilience and control with the aim of uncovering how ERP system implementation affects the resilience of the organisation.

- Law and Ngai [2007] performed interviews and surveys with middle level management, high level management, supervisors and professionals in Hong Kong and developed a model to explain business process improvement and organisation performance affecting the success of ERP systems.

- Davis and Hikmet [2008] performed a case study on the healthcare industry in the United States of America and developed a theoretical model of learning and training.

- Gravill and Compeau [2008] developed a model to explain how self-regulated leaning affects the different types of knowledge.

- Karuppan and Karuppan [2008] developed a model that depicts the progression of super users' mental models.

- Kwahk and Lee [2008] surveyed end users in Korea to develop a model for the organisation's readiness to change by focussing on personnel competence and the organisation's commitment.

- Osei-Bryson et al. [2008] tested a model to determine if ERP system implementation would be successful and focussed on the organisation's climate and values.

- Lyytinen et al. [2009] applied institutional theory to an ERP system implementation project by performing a single case study and interviewing the project team in a Saudi Arabian context.

- McCubbrey and Fukami [2009] analysed the options that an organisation has when responding to concerns and queries raised by staff members.

- Shepherd et al. [2009] determined the factors that influenced user reactions to ERP systems through conducting interviews, focus groups and surveys with end users, project teams, managers and consultants in the United Kingdom.

- Berente et al. [2010a] used Foucault's dressage approach to analyse NASA ERP implementation and observed several organisational issues.

- Klaus et al. [2010] identified the characteristics of different groups of users in an ERP implementation project. Furthermore, they developed strategies for handling different user groups.

- Morris and Venkatesh [2010] developed a model to explain the impact that ERP systems have on job satisfaction by using the job characteristics model from the perspective of clerical staff, administration staff and management.

- Strong and Volkoff [2010] analysed the misfits that occur from the standardised ERP implementation process.

- Velcu [2010] surveyed CEOs, CIOs and CFOs to develop an extended theoretical framework for the relationship between organisational factors and benefits.

- Yeh and Yang [2010] identified the organisational shifts that occur during the implementation of an ERP system by performing a case study in Taiwan.

- Berente and Yoo [2011] analysed the institutional contradictions that occur within NASA to determine the effect these organisational issues have during the ERP system implementation process.

- Dhillon et al. [2011] analysed the interactions between intentionality and organisational power during an ERP implementation.

- Soh et al. [2011] developed a control portfolio that identified control mechanisms when more than one stakeholder was involved as a controllee. A controllee in an ERP implementation scenario includes user representatives and consultants.

- Rose and Schlichter [2012] developed a model to explain how to manage trust in IS implementation.

- Wagner et al. [2012] analysed the ERP system implementation project of a USA company through a liminal lens to observe the transition between the old system and the new system.

Implementation—Knowledge Management Issues

Knowledge management issues in the implementation phase encompass strategies to handle knowledge transfer throughout the organisation during an ERP implementation project. Table 8 depicts the common themes apparent, followed by a description of the articles classified in this subtopic.

Table 8: Common Themes: Knowledge Management	
Theme	**References**
Knowledge Sharing/Management	Topi, Lucas, and Babaian, 2006; Jones, Cline, and Ryan, 2006; Sedera and Gable, 2010; Remus, 2012
Factors Influencing Knowledge Transfer	Ke and Wei, 2006; Xu and Ma, 2008; Hung, Ho, Jou, and Kung, 2012
Knowledge Flow Process	McGinnis and Huang, 2007; Kotlarsky, van Fenema, and Willcocks, 2008;
Others	Park, Suh, and Yang, 2007; Thomas, Sostom, and Gouge, 2007; Janson, Cecez-Kecmanovic, and Zupancic, 2007

- Jones et al. [2006] performed a case study and interviewed the project team as a means of examining the dimensions of culture within an organisation and how they impact knowledge sharing.

- Ke and Wei [2006] developed a framework to depict the organisational factors that influence knowledge acquisition.

- Topi et al. [2006] performed interviews with upper management, middle management and end users to analyse informal knowledge sharing within an organisation.

- Janson et al. [2007] applied Snell and Chak's framework to analyse both the types and levels of learning in a Slovenian case organisation.

- McGinnis and Huang [2007] developed a model to depict how knowledge is transferred throughout the implementation of an ERP system.

- Park et al. [2007] developed a model to explain how the knowledge, understanding and assimilation affect the performance of the ERP system.

- Thomas et al. [2007] describes how virtual teams use Information Communication Technology (ICT) for collaboration breakdowns in implementation projects.

- Kotlarsky et al. [2008] developed a model to explain how mechanisms influence the flow of knowledge within an organisation.

- Xu and Ma [2008] surveyed project managers, directors, consultants and key users in China and developed a model which depicts the factors that influence knowledge transfer in an ERP system implementation project.

- Sedera and Gable [2010] developed and tested a research model for the knowledge management lifecycle's impact on knowledge management competence and how it impacts ERP system success.

- Hung et al. [2012] proposed a model that demonstrated the factors that impact the knowledge transfer climate within an organisation, which in turn affects actual knowledge transfer.

- Remus [2012] analysed the dynamics of knowledge management activities in an ERP system implementation project of a New Zealand manufacturing company.

Implementation—Other Issues

Other issues regarding implementation pertain to issues that occur during the implementation phase of the ERP system lifecycle that are not covered in the adoption approach, success or failure, organisational and knowledge management above.

- Elbanna [2006] used the improvisation approach and actor network theory (ANT) to analyse the implementation process of an ERP system.

- Wang and Chen [2006a] developed a framework to investigate the importance of communication and conflict resolution techniques used by organisations and consultants during ERP system implementation.

- Karimi, Somers, and Bhattacherjee [2007b] developed a model to determine the relationship between resources and capabilities with business process outcomes.

- Taylor [2007] interviewed vendors to determine the factors that influenced the overall success of outsourced IT projects.

- Chen, Sun, Helms, and Jih [2008] performed a case study and interviewed management consultants, project members, IT specialists, clients and vendors in Taiwan with the aim of determining the relationship between different stakeholders within an ERP system implementation project. They also determined the role the management consultant plays.

- Dreiling et al. [2008] developed an integrated meta model of the processes that are undertaken within an organisation which are aimed at increasing the efficiency of the ERP system implementation.

- Elbanna [2008] used actor network theory (ANT) to analyse the drift experienced in ERP system implementation.

- Luo and Liberatore [2009] developed and tested a model to determine the role of coordination between clients and consultants in achieving their objectives.

- Wagner and Antonucci [2009] performed a single case study within the United States of America and interviewed users, consultants, trainers, functional leads and senior managers. The data obtained was then used to analyse the issues, critical success factors, and implementation strategies used throughout the ERP system implementation process in a public sector organisation. Furthermore, they compared the results obtained from the public sector to the experience of private sector organisations.

- Santamaria-Sanchez, Nunez-Nickel, and Gago-Rodriguez [2010] performed a comparison of the time it takes to implement value chain modules to business support modules.

- Teoh, Pan, and Ramchand [2010] performed a case study and interviewed the project team and end users within a single organisation in the health care industry in Singapore. Furthermore they developed a model for resource management in ERP system implementation projects.

Research Issues in the Implementation Phase

This section examines the research areas for implementation approach, success and failure, organisational issues, knowledge management issues and other issues subtopics.

Research Areas: Implementation Approach

Despite substantial research on the implementation phase of the ERP system lifecycle, in-depth research on the approaches taken by the organisation to implement the system appears understudied. In the 2006 to 2012 period only three articles pertained to the implementation approach taken within an organisation. This is quite concerning due to the high failure rates, time and budget overruns that ERP system implementation projects still incur. The three articles identified focused on Application Service Providers (ASP) versus self-hosted ERP systems [Solis et al., 2006], how to handle multiple implementation projects [Elbanna, 2010] and different configuration patterns [Dreiling et al., 2006]. The research on ASPs versus self-hosted and how to handle multiple projects were both single case studies, but presents a useful roadmap for future research to qualify the findings. However, from reports of vendors shifting their focus to the SME market as the market for large organisations has virtually reached its saturation point, new frontiers such as cloud strategies are at the forefront of the ERP systems discipline. Many of these systems are marketed as being subscription-based and easy to configure with no need to hire consultants for the task. In light of the above, emergent questions include: *Who are the stakeholders involved in ERP configuration for SMEs? To what extent are SMEs utilising consultants throughout the implementation project? What are the issues that SMEs encounter when configuring their ERP systems?* With the ease of configuration apparently being dramatically improved: *Do the same critical success factors apply to SMEs as large enterprises?* and *Does the importance of these CSFs vary throughout the configuration phase?*

Whilst most ERP system implementation consists of only a single vendor, multi-vendor implementations still exist. The multi-vendor approach is utilised when a single vendor does not meet all or a vast majority of an organisation's requirements [Subasinghage, Sedera, and Murphy, 2012] and the organisation decides to implement different modules from separate vendors [Beheshti and Beheshti, 2010]. However, as ERP systems are considered to be both a technical and organisational software solution, with organisations needing to change their processes to mirror the best practices of the ERP system, selecting different modules from different vendors will mean that the best practices will not be adequately defined and could potentially result in bottlenecks in the process. Furthermore, many companies opting for this approach are not willing to change their existing processes and are, therefore, treating the implementation as a technical solution without considering the organisational ramifications. Subsequently, treating an ERP project as only a technical solution is a known reason for implementation failure [Teixeira, Brandao, and Rocha, 2012]. Aside from the aforementioned aspects associated with multi-vendor implementations, there are

further complexities in the installation process, as interfaces also need to be developed [Kumar, Nirmalkar, and Meesala, 2013]. A recent case study performed in Pakistan also has attributed a non-standardised multi-vendor implementation of an ERP system as a barrier for business intelligence adoption within organisations [Khan, Amin, and Lambrou, 2010]. Thus, emergent research questions include: *What are the complexities associated with multi-vendor ERP implementations? Can multi-vendor implementations be directly attributable to implementation project failure? Are multi-vendor implementations a significant barrier to future functionality (e.g., Business Intelligence)?* Further work has been performed that suggests that, when following a multi-vendor approach, one of the vendors should be given the role of a prime contractor to minimise the inherent risks; therefore, *What are the risk management strategies that can be put into place to prevent multi-vendor implementation project failure?*

Research Areas: Success and Failure

The emphasis of the large number of publications concerning the implementation of ERP systems is on the Critical Success Factors (CSFs) and organizational issues during implementation. The analysis of the literature from 2006 to 2012 shows that the identification of CSFs have been analysed in depth, with comparisons between developed and developing nations and across different economic climates being performed. Aside from deriving lists of CSFs, several researchers have analysed the importance of individual CSFs, with a focus on the need for top management support, business process management, effective communication and change management.

Following our observations, we agree with Esteves and Bohorquez [2007] that the identification of the critical success factors has reached theoretical saturation. Not only did Esteves and Bohorquez [2007] believe that the saturation point had been reached for defining critical success factors, they also highlighted that a limited amount of attention had been paid to risk factors. We observed that in the 2006 to 2012 period, several scholars have answered this call and explored how risk management ensures implementation success [Aloini et al., 2007; Dey et al., 2010]. Similarly, the operationalization of critical success factors was found to be under-researched in the 2001 to 2005 period. Conversely, in our analysis, several scholars have shown how critical success factors can convert into explicit organisational benefits [Liu and Seddon, 2009; Doherty et al., 2012].

Finally, although research into ERP implementation failure from 1997 to 2009 by Momoh et al. [2010] fulfils a gap in the literature as identified by Esteves and Bohorquez [2007], we believe that more research into the success and failure rates of ERP system implementations over time is still relevant. This is especially so considering the market trending towards SMEs and comparisons between different cultural regions. As the ERP market for large enterprises has virtually reached saturation in terms of the percentage of large organisations which utilise ERP systems, it is critical that we better understand the similar inherent complexities and challenges facing the SME market. This is to better inform practitioners such that the substantial failure rates that plagued large organisations in terms of ERP system configuration/customisation are not repeated.

Research Areas: Organisational Issues

Aside from a very detailed account of the critical success factors, we find a substantial amount of literature on organisational issues during the implementation phase. This includes identifying the user groups present in an implementation project, organisational resilience, the organisation's readiness to change, learning and training and the causal relationship between organisational factors and benefits. Comprehensive case studies (e.g., Amrani et al., 2006; Ignatiadis and Nandhakumar, 2007; Davis and Hikmet, 2008; Lyytinen et al., 2009) of organisational issues that are present during an implementation project were performed. With ERP systems now being applicable to both large and small organisations, it would be interesting to uncover: *What are the organisational issues that are experienced by SMEs?* and *How do the organisational issues differ between the small and medium organisations?* In terms of large organisations, the issues experienced by the middle-level management team and how this team communicates with the operational level staff members need to be explored.

*Research Areas: Knowledge Management*

Knowledge management also was a key factor in the implementation project, with the models being developed and tested to determine the factors that influence the transferral of knowledge throughout the organisation and throughout the implementation project [Park et al., 2007; McGinnis and Huang, 2007; Kotlarsky et al., 2008; Sedera and Gable, 2010]. This research has examined the transferral of knowledge between the three key players of the implementation process: the client, the vendor, and the consultants. Throughout an implementation project an organisation traditionally hired only one consultant firm and acquired its knowledge from that firm. However, organisations have commenced hiring consultants in a best-of-breed process, and, therefore, multiple consultant firms can be involved in the one implementation project. Therefore, the following research questions are necessary for contemporary ERP implementation projects: *How can knowledge be transferred to the client from multiple consultant parties in a consistent manner?* and *How can consultant organisations share knowledge with one another throughout an implementation project without jeopardising intellectual property?*

Research Areas: Other Issues

Another novel concept recently established is ERP systems application stores. ERP system application stores are e-commerce marketplaces [Weiblen, Giessmann, Bonakdar, and Eisert, 2012] whereby service providers supply and sell their services, typically in the form of disaggregated software add-ons [Wenzel, Faisst, Burkard, and Buxman, 2012], to help bridge the gap between customer requirements and the cloud-based ERP system. These enterprise application stores are hosted by the ERP system vendor and include applications developed by either the ERP system vendor or external suppliers. Salesforce AppExchange, the SAP store, and SugarCRM's SugarExchange are all examples of existing ERP systems app-store models [Wenzel, Novelli, and Burkard, 2013]. As not all of the software provided in these application stores are developed by the ERP vendor, the configuration support is provided by the explicit application developer; therefore, novel research questions are: *What issues do organisations encounter when installing these applications? What stakeholders are involved in configuring these applications into the existing cloud-based ERP system, and are external consultants necessary during this process?* It is important that we understand: *How is the ERP system market trending?* and *What is the future role of consultants in the customisation/configuration process?*

Usage

The usage phase of the ERP systems lifecycle describes how the system is used to achieve the expected benefits and the overall success of the ERP systems project. It includes the maintenance and upgrading that packaged software solutions require. Thus, publications pertaining to the usage phase of the ERP are classified according to: (1) use benefits and success, and (2) maintenance. Figure 4 depicts the segmentation of the articles into the varying usage categories. It can be observed that use benefits and success is the most researched topic of the usage phase of the ERP system lifecycle with thirty-seven articles being categorised, as opposed to the maintenance component which is comprised of only nine articles.

Figure 4. Number of Usage Articles
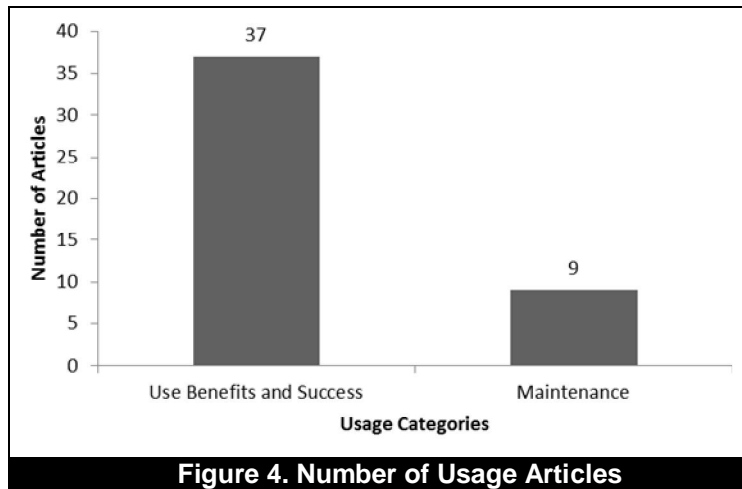
Usage—Use Benefits and Success

Use benefits and success focuses on the benefits that organisations achieve through the use of the system. Furthermore, it includes articles that pertain to the factors that affect the actual use of the system and the individual user's performance. We found articles that extend the Technology Acceptance Model (TAM) in an ERP system context. Comparisons have been made between the profitability and productivity of ERP systems adopting organisations to non-adopting organisations. Table 9 depicts the common themes that are apparent in this subtopic, which is followed by a brief description of the relevant articles.

Table 9: Use Benefits and Success	
Theme	**References**
Factors Affecting Use/TAM	Po-An Hsieh and Wang, 2007; Liang, Saraf, Hu, and Xue, 2007; Scott, 2008; Sun, Bhattacherjee, and Ma, 2009; Scott and Walczak, 2009; Klaus and Blanton, 2010; Saeed, Abdinnour, Lengnick-Hall, and Lengnick-Hall, 2010; Liu, Feng, Hu, Huang, 2011; Xue, Liang, and Wu, 2011; Adya and Mascha, 2011; Saraf, Liang, Xue, and Hu, 2012
Benefits/Impacts	Cottleleer and Bendoly, 2006; Chang, 2006; Devadoss and Pan, 2007; Gable, Sedera, and Chan, 2008; Schubert and Williams, 2011

Table 9: Use Benefits and Success – Continued	
Factors Leading to Benefits	Boontaree, Ngwenyama, and Osei-Bryson, 2006; Wagner and Newell, 2007; Jones, Zmud, and Clark, 2008; Chou and Chang, 2008; Ifinedo, 2008; Seddon, Calvert, and Yang, 2010; Staehr, 2010; Sasidharan, Santhanam, Brass, and Sambamurthy, 2011; Scherrer-Rathje and Boyle, 2012; Staehr, Shanks, and Seddon, 2012
Evaluations/User evaluations	Allen, 2008; Hakkinen and Hilmola, 2008; Uwizeyemungu and Raymond, 2009, 2010; Chang, Yen, Ng, Chang, et al., 2011
Comparisons of Organisations	Goeke and Faley, 2009; Romero et al., 2010
Others	Fuβ, Gmeiner, Schiereck, and Strahringer, 2007; Berente, Ivanov, and Vanderbosch, 2010b; Wagner, Newell, and Piccoli, 2010; Trinh, Molla, and Peszynski, 2012

- Boontaree et al. [2006] surveyed users, supervisors, mid-level managers and top level managers in the United States of America to develop a model that shows the factors that influence individual performance.

- Chang [2006] performed a comparison to show how IT and organisational respondents view IS functions, success criteria and overall benefits.

- Cottleleer and Bendoly [2006] demonstrated the influence that ERP systems have on operational performance.

- Devadoss and Pan [2007] analysed the impact on the organisation that ERP system use has through the application of Giddens' Structuration Theory.

- Po-An Hsieh and Wang [2007] analysed the Technology Acceptance Model (TAM) and the Information System Continuance (ISC) model in an ERP system environment.

- Fuβ et al. [2007] surveyed the head of IT and finance in organisations within the banking industry to analyse the anticipated benefits and potential disadvantages of implementing ERP systems.

- Liang et al. [2007] applied institutional theory to develop a model that analyses top management support at the assimilation phase of the ERP system lifecycle.

- Wagner and Newell [2007] analysed if user participation in the early stage of the IS lifecycle is crucial for the overall success of the IS.

- Allen [2008] analysed whether the ERP systems that were evaluated as successful immediately after implementation remained successful over time.

- Gable, Sedera, and Chan [2008] developed a list of IS impact measures gathered from performed surveys with key IS users.

- Hakkinen and Hilmola [2008] performed a single case study and interviews with ERP system users and analysed the user evaluations of the system.

- Chou and Chang [2008] developed a model that shows how the implementation factors influence the benefits obtained by the ERP system post implementation.

- Ifinedo [2008] analysed the factors that directly link to the overall success and benefits obtained from using an ERP system.

- Jones et al. [2008] developed a model through the interviewing of users and managers to explain the factors that lead to the benefits of a system and actual usage of the system being achieved.

- Scott [2008] extended the Technology Acceptance Model (TAM) to depict the perceived usability of documentation by the surveying of ERP system users in the United States of America.

- Goeke and Faley [2009] compared companies' productivity and profitability of organisations who adopted SAP to those who did not in the United States of America.

- Scott and Walczak [2009] analysed whether a person's judgment on their ability to use a system impacts the acceptance of technology.

- Sun et al. [2009] surveyed end users in China and developed a model that depicts the factors that influence the use of IT and the performance of individuals.

- Uwizeyemungu and Raymond [2009] developed a method for the evaluation of ERP systems post-implementation.

- Berente et al. [2010b] developed a model to depict how process gatekeepers can ensure compliance.

- Klaus and Blanton [2010] performed focus groups and interviews in the United States of America to develop a framework which explained user resistance.

- Romero, Menon, Banker, and Anderson [2010] analysed the profits of ERP adopters and non-adopters in the oil and gas industry.

- Saeed et al. [2010] developed a model to depict how pre-implementation intentions of users impacted the users' post-implementation.

- Seddon et al. [2010] developed a model that demonstrates the factors that affect organisational benefits from ERP system use.

- Staehr [2010] identified the direct and indirect factors that affect the benefit of use in the Australian manufacturing industry.

- Uwizeyemungu and Raymond [2010] performed a case study and interviews with top management, middle management, super users and consultants in the manufacturing industry in Canada. The data was used to develop a method for evaluating an ERP system after implementation.

- Wagner et al. [2010] depicted an approach that can be used to transform an unsuccessful ERP system project into a successful one.

- Adya and Mascha [2011] analysed the impact that early exposure of an ERP system has on the acceptance of the system.

- Chang et al. [2011] developed a model to evaluate the performance of an ERP system.

- Liu et al. [2011] performed a case study and interviewed top management, middle management and ERP system users in China to develop a model that depicts the factors that influence the assimilation of an ERP system.

- Saraf et al. [2012] surveyed managers in China to uncover how absorptive capacity affects the assimilation of ERP systems.

- Sasidharan et al. [2011] performed surveys of employees within a university in the United States of America immediately after, six months after, and twelve months after the ERP system implementation to determine how network structures affect the overall success of an ERP system.

- Schubert and Williams [2011] developed a framework that identified the benefits of ERP implementation and categorised the benefits into where they occur.

- Xue et al. [2011] extended the Technology Acceptance Model (TAM) to show how consequences of actions and perceived justice affects the end user to be fully compliant when using an enterprise system.

- Scherrer-Rathje and Boyle [2012] performed interviews with CEOs, users, managers and supervisors in a European country to determine which factors of ERP systems should be flexible to ensure success.

- Staehr et al. [2012] performed multiple case studies of manufacturing firms using SAP R/3 software to develop a framework in an attempt to determine both how and why organisations do or do not achieve benefits from using the ERP system.

- Trinh, Molla, and Peszynski [2012] developed a conceptual framework to depict how ERP systems facilitate organisational agility. The authors strongly state that this relationship is not directly attributed to the ERP system, but the ERP system has to be transformed in such a way to have 'agility-enabling' capabilities.

Usage—Maintenance

In this subcategory, articles are centred on performing upgrades, maintenance and auditing. It not only focuses on the actual updates that need to be performed but also includes the factors that influence an organisation into actually performing the upgrade. It also includes reasons for individuals being reluctant to perform the upgrade.

- Beatty and Williams [2006] derived a list of items that minimises the implementation issues that occur during system upgrades.

- Mahato et al. [2006] performed a single case study to define a road map for the enterprise system consolidation phase.

- Khoo and Robey [2007] developed a model to depict the forces that influence an organisation's decision to upgrade its packaged software.

- Huang, Yen, Hung, Zhou, et al. [2009] analysed the auditing procedures that need to occur in IS.

- Maheshwari, Kumar, and Kumar [2010] analysed the stability of the system during the post-implementation phase of the ERP system lifecycle.

- Ng and Gable [2010] performed a single case study and interviewed the top-level managers in an Australian organisation to observe the maintenance process of an ERP system.

- Khoo, Chua, and Robey [2011a] determined techniques that can be used to encourage users to perform packaged software updates.

- Khoo, Robey, and Rao [2011b] analysed the impact that packaged software updates have on stakeholders within an organisation.

- Majdalawieh, Sahraoui, and Barkhi [2012] developed a model that integrated continuous auditing with continuous monitoring in an enterprise system environment.

Research Issues in the Usage Phase

This section highlights areas for future research pertaining to the use, benefits, and success; and maintenance subcategory.

Research Areas: Use Benefits and Success

One of the predominant themes apparent in the usage phase is the specification of factors that influence the actual use of the ERP system. These factors include intrinsic motivation, job specification [Liu et al., 2011], absorptive capacity [Saraf et al., 2012], compatibility of the IT system to the organizational work [Sun et al., 2009], and whether prolonged exposure in the pre-implementation phases of the ERP systems lifecycle impacted the degree to which users actually used the system. The Technology Acceptance Model (TAM) and the Information Systems Continuance Model was analysed by a number of authors, and extensions to TAM were made to depict the usability of documentation [Scott 2008] and the perceived justice and the consequence to an action [Xue et al., 2011]. These studies on the factors affecting the assimilation of the ERP system were performed in a variety of different organisations within different industries and countries. For example, several of these studies were performed in China, in which culture plays a unique role. Furthermore, other publications determined the factors that influence the overall success of an ERP system, as well as the anticipated benefits and possible disadvantages that ERP systems have on an organisation. Since ERP systems represent a significant investment for adopting firms, the benefits experienced need to be not only specified, but details of their operationalization need to be made [Sedera, Eden, and McLean, 2013]. Therefore, an interesting research question is: *How are the factors that influence usage and benefits operationalized, with respect to different user groups?*

In several other phases of the ERP system's lifecycle comparisons between different industry sectors have not been made, which presented gaps in the literature. Alternatively, in the usage phase, comparisons have been made between the productivity and profitability of adopting organisations versus non-adopting organisations [Goeke and Faley, 2009] and between firms in different industry sectors (e.g., Romero et al., 2010). This research was performed in the USA [Goeke and Faley, 2009], and a separate study was performed in the oil and gas industry [Romero et al., 2010]. More cross-industry and cross-country analysis should be performed, as this is a clear way to document the benefits of ERP systems and can lead to organisations determining if any financial or productivity benefits can be realised through the use of an ERP hence, it links to adoption decision and acquisition process. Parenthetically, this research would be more valuable if it linked to other phases of the lifecycles, for instance, *How does the implementation approach affect the profitability?* and *How long after implementing an ERP system would an organisation expect to obtain benefits and improve over their non-ERP system counterparts?*

In some cases, we find that scholars who specified SMEs as a context do not account for their characteristics nor compare them to large enterprises. As mentioned earlier, SMEs are increasingly turning to alternative cloud-based solutions with the potential for using ERP systems to fulfil their functionality requirements. A potential issue that arises is whether SMEs are effectively using the best practice processes as defined by the ERP systems vendor, when using these applications. Therefore, *What are the benefits experienced by SMEs using the ERP system? How do these benefits compare to large enterprises?* and *Are these benefits being amplified or diminished through the use of the Enterprise Applications?*

Research Areas: Maintenance

We observed a substantial amount of research on organisations performing software updates. Typical findings include how to encourage users to perform updates [Khoo et al., 2011a], the impact the updates have on an organisation [Khoo et al., 2001b] and the forces that influence a user's decision to upgrade software [Khoo and Robey, 2007]. Also included were the issues that can occur during system upgrades. Once again, these issues may be extended to an SME context. Since the applications on the enterprise marketplace typically are not developed by the ERP systems vendor, *What issues are experienced with the configured applications when an update takes place? If the application is no longer supported after the update, what becomes of the information pertained?* and *What risk management strategies can be utilised when updating the ERP system?* These are critical questions to ask, as they will determine if the enterprise marketplaces are really a viable option for SMEs.

On one hand, a substantial amount of research into system updates has been performed, but, on the other hand, very little research has been performed on the maintenance process of such systems. In fact in the 2006 to 2012 period, only one article detailed the maintenance process, and that was within Australian organisations only [Ng and Gable, 2010]. Hence, we deduce a set of interrelated research questions which includes: (1) *How do organisations undertake maintenance of ERP systems?* (2) *When does the maintenance work occur? Is it required daily or at set time intervals?* (3) *How does the maintenance process compare in different industry sectors and across different cultures?* (4) *What are the issues that arise within the maintenance process? How can these issues be overcome?* (5) *What are the factors and inhibitors in the maintenance process?* (6) *Which stakeholders are involved in the maintenance process?* and (7) *What are the risk management strategies that can be used when performing system maintenance?*

Evolution

In this subcategory, articles introduce new technologies that can be integrated with ERP systems to improve their overall functionality. This integration allows for the gap between the organisational requirements and system functionality to be minimised. It also includes the issues that occur during ERP system integration. Hence, the publications cover: (1) emerging technologies and (2) the integration issues.

Evolution—Emerging Technologies

Emerging technologies are technologies that are developed to integrate with ERP systems in an effort to minimise the gap between the organisation's requirements and system functionality.

- Nordheim and Paivarinta [2006] analysed the issues present in an Enterprise Content Management system by performing a single case study in Norway.

- Kaiser [2007] detailed the benefits and issues associated with both traditional module-based ERP systems and enterprise Service Oriented Architecture (SOA). The Enterprise Physics Approach as an emerging technology, however, was the focal point of this research, and it detailed the benefits and technical challengers that it possessed.

- Salo [2007] demonstrated how the delivery process can be automated through the use of an ERP system and Internet. It also showed the benefits that mobile technologies can provide an organisation.

- Bose, Pal, and Ye [2008] performed a single case study in China to depict the benefits and challenges involved with the integration of supply chain management with an ERP system.

- Susarla, Barua, and Whinston [2009] developed a model that shows that, when an organisation is using an authorised service provider, contracts need to be developed.

- Demirkan, Cheng, and Bandyopadhyay [2010] developed a mathematical model to depict the coordination strategies of software-as-a-service [Monsaas].

- Downing [2010] performed a comparison of companies that had no supply chain integration, non-Web-based supply chain integration and Web-based supply chain integration.

- Kourouthanassis, Giaglis, and Karaiskos [2010] proposed a framework to delineate the pervasiveness in IS.

- Ilk, Zhao, Goes, and Hofmann [2011] developed and tested the Semantic Enrichment Process Model in a SAP environment with the goal of bridging the gap between the source code and the service-oriented architecture.

- Koh, Gunasekaran, and Goodman [2011] analysed the drivers and barriers, critical success factors of ERP II systems and the future of Enterprise Systems by conducting interviews with vendors, consultants, users and suppliers of ERP systems.

- Thiagarajan, Sarangan, Suriyanarayanan, Sethuraman, et al. [2011] developed an IT framework, which was based on the extraction of data related to carbon emissions from ERP systems and other systems with the goal of managing and reducing the carbon emissions of an organisation's building.

- Erbes, Motahari-Nezhad, and Graupner [2012] discussed the necessity of cloud services for the future of Enterprise IT, with ERP and CRM systems shifting to the public cloud.

- Liu, Liu, and Xu [2012] analysed the value added by CRM using Tobins Q based on the number of modules implemented, ERP system integration and market environments.

- Madaan, Kumar, and Chan [2012] analysed how to improve the performance of Reverse Enterprise Systems (RES).

Evolution—Integration Issues

In this subcategory, publications cover issues that occur when trying to integrate another software component with the ERP system.

- Ward and Zhou [2006] developed a model to depict how lean and Just-in-Time can reduce customer lead time when used with Enterprise Systems.

- Bahli and Ji [2007] developed frameworks to express the facilitators and inhibitors of enterprise application integration (EAI) technology.

- Mendoza, Medaglia, and Velasco [2009] analyses integrating vehicle routing tools with ERP systems.

Research Issues in the Evolution Phase

This section discusses areas for future research in evolution phase pertaining to emerging technologies and integration issues.

Research Areas: Emerging Technologies

We observed a broad range of solutions introduced in publications classified under this phase of the ERP systems lifecycle. Some articles performed comparisons of companies which use differing forms of Supply Chain Management (SCM) integration [Downing, 2010], whilst other publications have examined the value of integrating Customer Relationship Management (CRM) systems [Liu et al., 2012], yet further research could be performed on the sensing and responding capabilities of client organisations [Attapattu, 2013]. However, a key IT solution that has received virtually no attention in the specific context of ERP evolution and integration is Business Intelligence (BI) systems. Business Intelligence modules are increasingly being incorporated into ERP systems [Chou, Tripuramallu, and Chou, 2005]. With sophisticated in-memory processing (e.g., SAP HANA) being available due to recent technology improvements, companies can use the vast array of data that is captured in the ERP system and then perform real-time analytics to make strategic decisions and achieve a competitive advantage [Sahay and Ranjan, 2008]. Therefore, it will be worthwhile uncovering: *What is involved in integrating a BI system with an ERP system*? and *Are organisations yielding a greater amount of benefits when utilising ERP systems and BI systems simultaneously as opposed to ERP systems on their own?*

ERP II systems are an emergent research domain. Topics to date include critical success factors as well as the benefits and technical challenges associated with the Enterprise Physics Approach, Enterprise Application Integration Technology and mobile technologies [Kaiser, 2007]. However, parenthetically speaking, very little research has been performed into ERP II, which is necessary for the future success of ERP systems. Therefore, *What is the future of ERP technologies?*

As new technologies develop, research into Software-as-a-Service technologies in ERP systems can potentially inform practitioners in small and medium organisations. This is a combination of the saturated large ERP market and new IT solutions (e.g., cloud computing). Due to this shift in trends it is important that SaaS technologies are completely comprehended in terms of ERP system capabilities. Mobile technologies are another key trend in which staff members can complete certain tasks with their ERP system with applications readily available in smart phone application stores. Due to the growing interest in mobile technologies, it would be useful to uncover: *Why are organisations pairing their ERP system with Mobile Applications?* and *How do organisations select the mobile application for the task they require?*

Research Areas: Integration Issues

Whilst the evolution phase of the lifecycle is receiving increasing attention with promising research being published, the broad research questions of this category are still relevant: (1) *How do organisations determine whether they*

need to integrate new and emerging technology into their ERP system? (2) *What factors inhibit integration?* (3) *Who are the stakeholders who are involved in the integration process?* and (4) *What issues are experienced when integrating evolving technologies into the ERP system?* Understanding the evolution of ERP systems, as well as how to overcome integration issues and reluctance from key stakeholders will ensure that ERP systems do not become a stagnant technology artefact.

Retirement

The retirement phase of the lifecycle is when the organisation decides to abandon the ERP system. Only one article was classified as retirement and is detailed below:

- Furneaux and Wade [2011] developed a model to explain the factors that cause IS discontinuance, which included system shortcomings and reduced support availability.

Research Issues in the Retirement Phase

With only one article found in the 2006 to 2012 period, there are grounds for further research on the retirement phase of the ERP system lifecycle. Furneaux and Wade [2011] publication developed a model in which current system shortcomings and reduced system support significantly increased the discontinuance intentions, and systems with high levels of integration statistically decreased the discontinuance intentions. However, this research was performed by analysing with any type of IS, and not in the specific context of ERP systems. Furthermore, the research examined only medium- to large-sized organisations. More research needs to determine: (1) *Why do organisations decide to abandon their ERP systems?* (2) *What are the internal and external pressures that impact the retirement decision?* (3) *Which members of the organisations arrive at the decision to discontinue use of the ERP?* (4) *To what extent do organisations retire their system (e.g., replace an ERP with another ERP system, or do they completely abandon the concept of ERP)?* and (5) *What are the positive and negative impacts on the organization due to the retirement of the ERP system?* This research should be extended across cultural barriers, in different industries, and both SMEs and large enterprises as if a new technology innovation takes over the market the same way that ERP systems did in the 1990s. Findings could potentially impact practitioners, informing them of what organisations need to be effectively prepared to make the change.

The shifting of ERP solutions from an on-premise to an on-demand subscription-based model will have an impact on organizational decisions. For instance, some SMEs that currently have adopted on-premise solutions may wish to shift to cloud-based solutions to take advantage of ongoing support from vendors. In light of this, emergent research questions include: *To what extent are organisations reitiring their on-premise ERP system to a cloud-based ERP system?* Furthermore, on-demand solutions are characterized by subscription-based use and the absence of lock-in periods, which brings about another research question: *How easy is it to discontinue the use of a cloud-based system?*

Education

As explained earlier, the education category is not part of the ERP systems lifecycle; instead, it includes articles pertaining to how tertiary institutions use the ERP system, including courses and IS curricula. The education category of articles is broken down into three components: (1) education usage, (2) ERP courses, and (3) IS curricula.

Education—Usage

The usage of a system within the education component focuses on how universities utilise the ERP system in a training environment. In the sample of articles studied, no articles pertained to this category.

Education—ERP Courses

ERP courses focus on the courses provided by tertiary education facilities.

- Wilson and Tulu [2010] focused on courses that utilized both information systems and health at tertiary education.
- Alshare and Lane [2011] analysed the factors that influence a student's outcome and satisfaction within an ERP system course.

Education—IS Curricula

IS curricula focus on the expertise required by faculty members to provide ERP system courses.

- Strong, Fedorowicz, Sager, Stewart, et al. [2006] analysed and provided advice on teaching strategies that are used for enterprise system units within the Information System curriculum at a tertiary education level.

- Hardaway, Mathieu, and Will [2008] argued that the IS discipline needs to have a more hands-on practical approach with IT technologies such as ERP systems as opposed to a mere theoretical teaching view.

- Finkelstein [2009] discussed the importance and benefits of universities encouraging their students to be interns for organisations and discussed management techniques companies can use with interns.

Research Issues in Education

This section details future research areas in terms of ERP usage by tertiary organisations in a training environment, ERP courses and IS curricula.

Research Areas: ERP Usage

The usage of ERP systems in a training environment at tertiary institutions has been neglected. In the 2006 to 2012 era no articles pertained to this topic. This is concerning, as leading ERP vendors have commenced partnering with tertiary institutions. Thus, tertiary institutions are empowered to deliver separate certification courses to both students and practitioners. Further research needs to be performed to understanding the relationships between the vendor and the university in terms of: *How do universities manage the relationship/arrangement with the ERP vendor? Do students benefit from performing these certification courses in comparison to those who perform just standard ERP subjects? What are the benefits (tangible and intangible) experienced by universities in delivering the courses?* and *How can universities engage with practitioners to deliver training courses?*

Research Areas: ERP Courses

In the 2006 to 2012 period, ERP education has been understudied with only five articles pertaining to the topic. As the proliferation of ERP systems continues to increase across industry sectors, ERP curricula and skillsets becomes relevant in other disciplines. Consequently, Wilson and Tulu [2010] examined how ERP systems can be blended with the health discipline. This research adds to the body of knowledge, but other related research agendas are also relevant: (1) *Is there a need for ERP system courses to be taught in non-IS disciplines?* and (2) *What methods can be used to transfer this knowledge to students without an IS background?*

With the innovation of SaaS and on-demand ERP systems, ERP system vendors are gradually shifting their focus to SMEs [Haddara and Zach, 2011; Liang and Xue, 2004]. Much of the prior literature on education has been in the context of large companies. Therefore, scholars and educators alike have to consider (1) *How can existing ERP systems subjects incorporate information on SMEs?* and (2) *What topics need to be taught that are specific to ERP systems for SMEs?*

Research Areas: IS Curricula

The adoption of a more hands-on practical approach in curricula, as opposed to providing students with a mere theoretical understanding of ERP systems, is a much-discussed topic within the publications. On this issue, one study we found analyses the factors that can influence a student's outcome or satisfaction, but this research was performed only in two American universities. We believe that the same research can be extended in different geographic regions to determine the generalizability of their results. Hence, the following research questions should be explored: *What are the factors across different cultural climates that impact a student's outcome and learning objectives? And what factors moderate this relationship?* The key research area that was lacking was how tertiary education environments provided training. With the advent of professional academic bodies like SAP's uAcademy, certified training courses can now be conducted by the university to professionals and also students. Therefore, the overarching researching questions are: (1) *To what extent are universities forming training relationships with industry professionals?* and (2) *How is this training being conducted?*

Discussion: Sustaining the Momentum

Our archival analysis provides an update on ERP systems-related research. The classification framework used by Esteves and company underpins our analysis. We use the same headings and definitions when classifying the articles. We refine their approach by extending to the modes of analysis, user perspectives and countries of research. Adopting the same classification headings and classification definitions allows for a cross comparison against prior findings to better understand the trend of ERP systems research. The comparison of the findings from this study and the annotated bibliographies of Esteves and Pastor [2001] and Esteves and Bohorquez [2007] is summarized in Figure 5. This analysis, the authors believe, provides a roadmap for directing future ERP systems-related research.
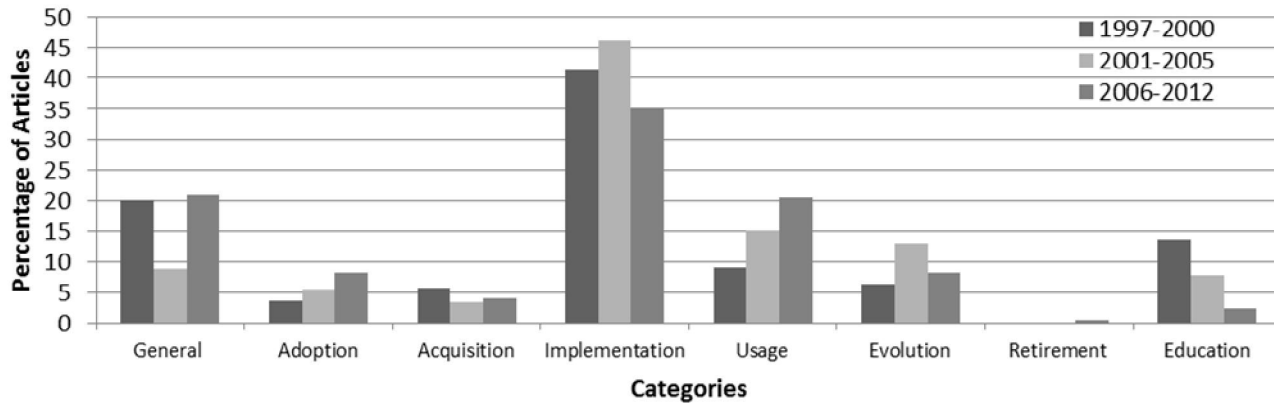
Figure 5. Summarizing Trends by Research Topics

As observed, ERP implementation is the most previously studied phase of the ERP lifecycle, with the retirement phase receiving little attention. As stated by Esteves and Bohorquez [2007], "critical success factors are quite well studied, however their operationalization is not." Yet further studies have continued to try to define the critical success factors and state the importance of top management support, consultants, change management and risk management. Several articles have since attempted to explain how the critical success factors can be put into practice to fulfill the gap in the literature.

The retirement phase is a critical aspect of the ERP lifecycle; it marks the abandonment of particular software. The reasons for the abandonment need to be studied further as if the reasons are known improvements and evolutionary technologies can be integrated within the system to provide further functionality. Therefore, research needs to be performed into the following: (1) determining why organizations are abandoning ERP systems, (2) which members of the team arrive at the decision to discontinue use of the ERP and (3) determining if there are any positive or negative internal or external impacts on the organization due to the retirement of the ERP system. This research needs to be performed from all stakeholders' perspectives and in developed and developing nations and different economic climates, as it has been shown that different cultures have different expected benefits and it may be the lack of these benefits that cause the abandonment of the system [Dezdar and Ainin, 2011]. Notwithstanding the above, the retirement phase of the ERP system lifecycle could potentially overlay the adoption and acquisition phase of the ERP systems lifecycle. For instance, the failure of a pre-existing ERP system also may be a challenger when deciding to adopt an ERP system; furthermore, if lack of vendor support was the reason for the abandonment of the system, it may also influence the organisation's decision when trying to evaluate the ERP systems on offer. Furneaux and Wade [2011] also noted that the oversight of the latter stages in the Information Systems lifecycle should be researched futher, as the abandonment of a system can impact user effectiveness and organisational performance.Thus, more research also needs to be performed into how the factors of abandonment influence the other phases of the ERP systems lifecycle. However, the amount of research performed into the adoption and acquisition phase has remained virtually static over time with only a slight increase in adoption research and a slight decrease in acquisition occuring. These two phases of the ERP systems lifecycle have been the least studied phases, apart from retirement and thus more research needs to be performed in understanding the impacts and the approaches used in those phases.

Interestingly the education of ERP systems in the research has been decreasing. However, we find that many universities have made ERP systems a focal point in their teaching units. This is amidst university retention measures to counter attrition rates and the emergence of software vendor-assisted academic alliances. For this, universities face a massive task of balancing investments into programs with the need to meet industry demand, which can potentially be offset through appropriate pedagogy. Whilst academics are forging new methods of enriching ERP system education through simulation games [Leger, 2006] and seeking vendor assistance [Corbitt and Mensching, 2000; Rosemann and Maurizio, 2005] to keep up to date and explore the way forward in this landscape, scholars must be accountable for publishing methods of engaging students in an ERP systems course. This creates the challenges [Markus, 2005] and forces that have an effect on how educators can be or cannot be more innovative in their method to engage and attract students. Cameron [2008] and Borquez, Connolly, Corbitt, Mensching, et al. [2005] are examples of recent publications that inform scholars on how to incorporate ERP systems into existing IS curriculum to meet industry deficit for skilled ERP system graduates.

Whilst emerging paradigms such as cloud computing are starting to receive attention in the ERP system discipline, the extent of the publications is still lacking. Furthermore, to the best of our knowledge, there were no articles

published pertaining to social media in the context of ERP. Thus, further research needs to be performed in the context of cloud computing and social media within the specific context of ERP to allow for a comprehensive understanding of the future of the ERP systems discipline.

The established and emergernt themes in the ERP system domain, were identified by aligning the most studied topics with the areas for future research section of the reviewed publications. Subsequently we observed the global trends of ERP practices and innovation by utilising the Gartner Group database. Gartner Group identified the "top 10 strategic technology trends for 2013" [2012], many of which have been idetified in this publication as being a gap in the literature and include mobile applications: enterprise application stores (e-marketplaces), cloud computing, analytics (BI) and in-memory computing (e.g., SAP Hana). Table 10 summarises the established and emergent themes which have been discussed in the respective research issues section.

Table 10: Summary of Established and Emergent Themes in ERP Research		
Research Perspective	**Established Themes**	**Emergent Themes**
General	- ERP systems lifecycle - Research methods	- Phase determining - Green IT and sustainability - Mobile application development - Enterprise application stores
Adoption	- SME adoption - Internal and external influences	- Impact of adoption - Comparisons between adoption phases - New economies, e.g., China, India, Gulf
Acquisition	- Selection criteria - Stakeholder influence	- Comparing evaluation criterias - Ranking influencing factors
Implementation	- Defining critical success factors - Operationalising CSFs - Defining user groups - Knowledge transfer	- Implementation approaches - Application Service Provider hosting - Implementatation failure - Multi-vendor implementations
Usage	- Influencing factors - Extending the Technology Acceptance Model - ERP system updates	- System maintenance - Comparing benefits across industry sectors - Use changes with expertise - Performing updates with enterprise apps
Evolution	ERP systems with SCM integrated	- Software-as-a-service - Business process changes - Engagement with mobile cloud platforms - In-memory computing - Analytics
Retirement		- Reasons for system abandonment - Impacts of abandonment - Cloud ERP continuance and discontiuance
Education	Practical teaching approaches	- Quantifiable research of influencing factors - Blending of disciplines

IV. CONCLUSION

In conclusion, this study was conducted to better understand the state of ERP research and to identify key gaps and concepts that have reached theoretical saturation. The current study also helps to establish emerging trends and future directions in the ERP research.

In relation to the current state, we observed not simply a surge of articles in this paradigm across scientific journals, but the broad range of related research topics covered in the past two decades. Correspondingly, in the Senior Scholar Basket of eight IS journals, the number of articles that treat ERP as the core construct has risen sharply. It is noteworthy that across most journals, the aggregate number of articles in 2006 to 2012 has over-doubled when compared to the previous period (2001–2005) (i.e., MISQ: 3 to 9, ISR: 0 to 9, I&M: 8 to 22, ISJ: 6 to 15, JIT: 3 to 19, CAIS: 6 to 13).

In relation to our research question on trends, we see that the traditional lifecycle management-related topics continue to be popular amongst ERP researchers. For example, over 35 percent of studies published between 2006 and 2012 focus on ERP implementations. The focus on implementation, though now less compared to the two

earlier periods, still dominates ERP research. We still value the use of the lifecycle phase approach to study ERP systems. Yet, as scholars have pointed out [Burton-Jones and Gallivan, 2007], each lifecycle phase must be carefully studied for changing user and organizational behaviours. For example, system use will change substantially from its early stage to later phases, where the users increase their expertise, knowledge and capabilities. In addition, ERP researchers should focus on emerging new technologies and how they have been implemented together with traditional ERP systems. As another example, we are concerned with the recent drop in pedagogical studies in ERP. Anecdotal evidence and industry reports suggest that there is a substantial uptake in ERP-related courses in tertiary educational institutes. As such, much needs to be done by educationalists to promote student engagement methods, curricula development and teaching approaches.

In relation to future research, we identified substantial research directions summarized in Table 10 under twenty-seven headings. Some topic areas like 'multi-vendor' ERP implementations are common in the industry now. Yet, we do not find any research on this important topic during the study periods. Similarly, we see the value of focusing on ERP research in emerging economies like the BRIC (Brazil, Russia, India and China). This research should not be restricted to the cultural issues and impact of national cultures, but should encompass the broader maturity of ERP systems and diffusion models. Another interesting topic is Green IT. Companies, especially large organizations, are looking at ERP systems as a mechanism to manage their Green IT initiatives. With many countries and regions developing and implementing Emission Trading Schemes and Carbon Taxes, ERP systems will play a central role in legislative requirements and compliance. The advancement of in-memory technologies and data analytics will add to the changing face of ERP research. Global companies are investing heavily on such initiatives for true real-time data and efficiency gains. The longer-term business value, issues in implementations and the impact on organizational capabilities provided by the ongoing developments would be relevant to researchers and companies alike.

There are several limitations in the current study. One obvious criticism is directed towards the transferability, dependability and generalizability of the analysis. Not all ERP systems papers are accounted for and made it through our sieve, although we argue that examining 219 articles is useful as they provide the first instance for rigor to the archival method. Secondly, to claim that a certain nature of ERP systems research is rapidly emerging or one type is preferred over another is premature and not the authors' intent. Our study opens up various opportunities for establishing cumulative knowledge to the discipline. Future research can be directed towards replication across more studies and across different periods and/or phases of ERP system development, a longitudinal design and further statistical validation, to establish a consolidated view of the direction of the field. The implication of extended analysis for the novice ERP system researcher is that it provides a summary of published research areas and identifies gaps to identify and develop their study focus. For established researchers, the archival analysis captures insights on areas of research that have reached theoretical saturation and subsequently identify emergent topics. This will allow researchers to shift away from studying concepts that have reached theoretical saturation to those topics that have been neglected; this will provide a comprehensive understanding of ERP systems across their entire implementation lifecycle, which will ultimately benefit practitioners.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:
1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
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