

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/271257527>

Barriers of ERP while implementing ERP: a Literature Review

Article in *IOSR Journal of Mechanical and Civil Engineering* · January 2012

DOI: 10.9790/1684-0364991

CITATIONS

20

READS

9,501

1 author:



Vijay Khaparde

Somaiya Vidyavihar

4 PUBLICATIONS 20 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Investigation and minimization of barriers for effective implementation of ERP System in Indian Industries [View project](#)

Barriers of ERP while implementing ERP: a Literature Review

Vijay M. Khaparde

Mechanical Engineering Dept., K.J. Somaiya College of Engineering, Mumbai University of Mumbai, India.

Abstract: Purpose - The main purpose of the paper is to do literature survey of ERP Papers (from refereed and International Journals like Elsevier, InderScience, ASME, Springer and ACM(Digital Library) to find out the barriers of ERP when implementing it. Thus, the objective of the paper is to study the literature review papers and find out the barriers of ERP.

Research findings of the paper: While implementing this ERP in an enterprise(s), it is found that there are obviously some barriers which need to be addressed. Out of 200 or so literature papers on ERP, 51 papers were reviewed for barriers and studied in depth. These barriers are mentioned in the form of Table in the literature survey. While implementing ERP, the barriers which are commonly observed are- huge capital incurred for software, poor planning or poor management, lack of perfection, lack of training and predetermined corporate goals, lack of good vendors, lack of risk assessment, lack of approach, lack of data models (support), lack of ERP Systems' benefits, lack of system performance, lack of hierarchical attribute structure and lack of management support etc.

Outline of the paper:

The tool or methodology applied to overcome these barriers is AHP. It analyses the barriers (of ERP) and can help to solve the issues of ERP for its implementation. The results after overcoming the barriers and implementing it are excellent, found to be more productive for the enterprises.

Keywords: ERP (Enterprise Resources Planning), Barriers, Software, System(s), Risk Assessment, AHP (Analytical Hierarchy Process).

I. Introduction

An enterprise resource planning (ERP) is an enterprise-wide application software package that integrates all necessary business functions into a single system with a common database. Enterprise resource planning (ERP) systems integrate and streamline the business processes of an organization across departmental and geographical borders.

In its basic definition, ERP is an enterprise-wide information system that integrates and controls all the business processes in the entire organization. According to Nah and Lau (2001) ERP is "a packaged business software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance, etc.) by providing a total, integrated solution for the organization's information-processing needs". This software facilitates, if well-implemented, the integration of all the functional information flows across the organization into a single package with a common database. Therefore, it allows easy and immediate access to information regarding inventory, product or customer data, and prior history information (Shehab *et al.*, 2004).

Today, many public and private organizations worldwide are implementing ERP systems in place of the functional legacy systems that are not anymore well-compatible with modern business environment. However, according to Kroenke (2008), the process of moving from functional applications to an ERP system is difficult and challenging. Additionally, the switch to ERP system is expensive and it requires development of new procedures, training and converting data (Zhang *et al.*, 2005). Enterprise resource planning systems, also called enterprise systems (ES) are among the most important business information technologies that emerged during the last decade. While no two industries' ERP systems are the same, the basic concept of ERP systems is focused on standardization and synchronization of information, and as a result, improved efficiency. The benefits of ERP systems include coordinating processes and information, reducing carrying costs, decreasing cycle time, and improving responsiveness to customer needs (Davenport 2000; Elarbi 2001).

The business environment is dramatically changing. Companies today face the challenge of increasing competition, expanding markets, and rising customer expectations. This increases the pressure on companies to lower total costs in the entire supply chain, shorten throughput times, drastically reduce inventories, expand product choice, provide more reliable delivery dates and better customer service, improve quality, and efficiently coordinate global demand, supply, and production [1]. As the business world moves ever closer to a completely collaborative model and competitors upgrade their capabilities, to remain competitive, organizations must improve their own business practices and procedures. Companies must also increasingly share with their suppliers, distributors, and customers the critical in-house information they once aggressively protected [2]. And functions within the company must upgrade their capability to generate and communicate timely and accurate

information. To accomplish these objectives, companies are increasingly turning to enterprise resource planning (ERP) systems. ERP provides two major benefits that do not exist in non-integrated departmental systems: (1) a unified enterprise view of the business that encompasses all functions and departments; and (2) an enterprise database where all business transactions are entered, recorded, processed, monitored, and reported. This unified view increases the requirement for, and the extent of, interdepartmental cooperation and coordination. But it enables companies to achieve their objectives of increased communication and responsiveness to all stakeholders [3].

From another aspect, ERP enables the integrated flow of information to be the core system that provides the data needed for all corporate components. In this way, how to take advantage of that information for the use of gaining competitive edge is the key to success.

II. The promise and pitfalls of ERP and Significance of exploring ERP implementation issues

Enterprise systems appear to be a dream come true. The commercially available software packages promise seamless integration of all information flows in the company --financial and accounting information, human resource information, supply chain information, and customer information. For managers who have struggled, at great expense and with great frustration, with incompatible information systems and inconsistent operating practices, the promise of a quasi “off-the-shelf” solution to the problem of business integration is enticing. Fig. 1 illustrates the scope of an enterprise system.

The list shows some of the many functions supported by an ERP System [3].

Financials

Accounts receivable and payable, Asset accounting, Cash management and forecasting, Cost-element and cost-center accounting, Executive information system, Financial consolidation, General ledger, Product – cost accounting, Profitability analysis, Profit-center accounting, Standard and period-related costing

Human Resources

Human-resource time accounting, Payroll, Personnel planning, Travel expenses.

Operations and Logistics

Inventory management, Materials management, Plant maintenance, Production planning, Project management, Purchasing, Quality management, Routing management, Shipping, Vendor evaluation.

Sales and Marketing

Order management, Pricing, Sales management, Sales planning.

Fig.1.: The scope of an enterprise system.

Why implementations fail

The top three reasons for the failure of IT-related projects, as cited by IT managers surveyed by Information Week, were poor planning or poor management (cited by 77%), change in business goals during the project (75%), and lack of business management support (73%). As a result, most IT-related projects fall far short of their potential payback, and 26% are canceled before completion. Moreover, in many of the completed projects, the technology is deployed in a vacuum and users resist it [8]. Langenwalter claims that the percentage of ERP implementations that can be classified as “failures” ranges from 40% to 60% or higher [14]. Ptak defines failure as an implementation that does not achieve the ROI identified in the project approval phase and finds that failure rates are in the range of 60–90% [23]. Based on the concepts presented in this paper, the reasons for failure can be placed into 10 categories [5,7,8,11,12-14,15]. These categories appear in Fig. 2.

The reasons why ERP implementations fail can be placed into ten categories.

1. Strategic goals are not clearly defined.
2. Top management is not committed to the system.
3. Implementation project management is poor.
4. The organization is not committed to change.
5. A great implementation team is not selected.
6. Inadequate education and training results in users that are unable to satisfactorily run the system.
7. Data accuracy is not ensured.
8. Performance measures are not adopted to ensure that the organization changes.
9. Multi-site issues are not properly resolved.

10. Technical difficulties can lead to implementation failures.

Fig. 2 . : Why ERP implementations fail.

III. Critical factors for successful ERP implementation

Implementing an ERP system is not an inexpensive or risk-free venture. In fact, 65% of executives believe that ERP systems have at least a moderate chance of hurting their businesses because of the potential for implementation problems [4]. It is therefore worthwhile to examine the factors that, to a great extent, determine whether the implementation will be successful. Numerous authors have identified a variety of factors that can be considered to be critical to the success of an ERP implementation. The most prominent of these are described below.

- 3.1. Clear understanding of strategic goals
- 3.2. Commitment by top management
- 3.3. Excellent project management
- 3.4. Organizational change management
- 3.5. A great implementation team
- 3.6. Data accuracy
- 3.7. Extensive education and training
- 3.8. Focused performance measures
- 3.9. Multi-site issues

Successful implementation of ERP requires the change in staff behavior, processes, departments and organizations: Seyed M.S. Hosseini (2012).

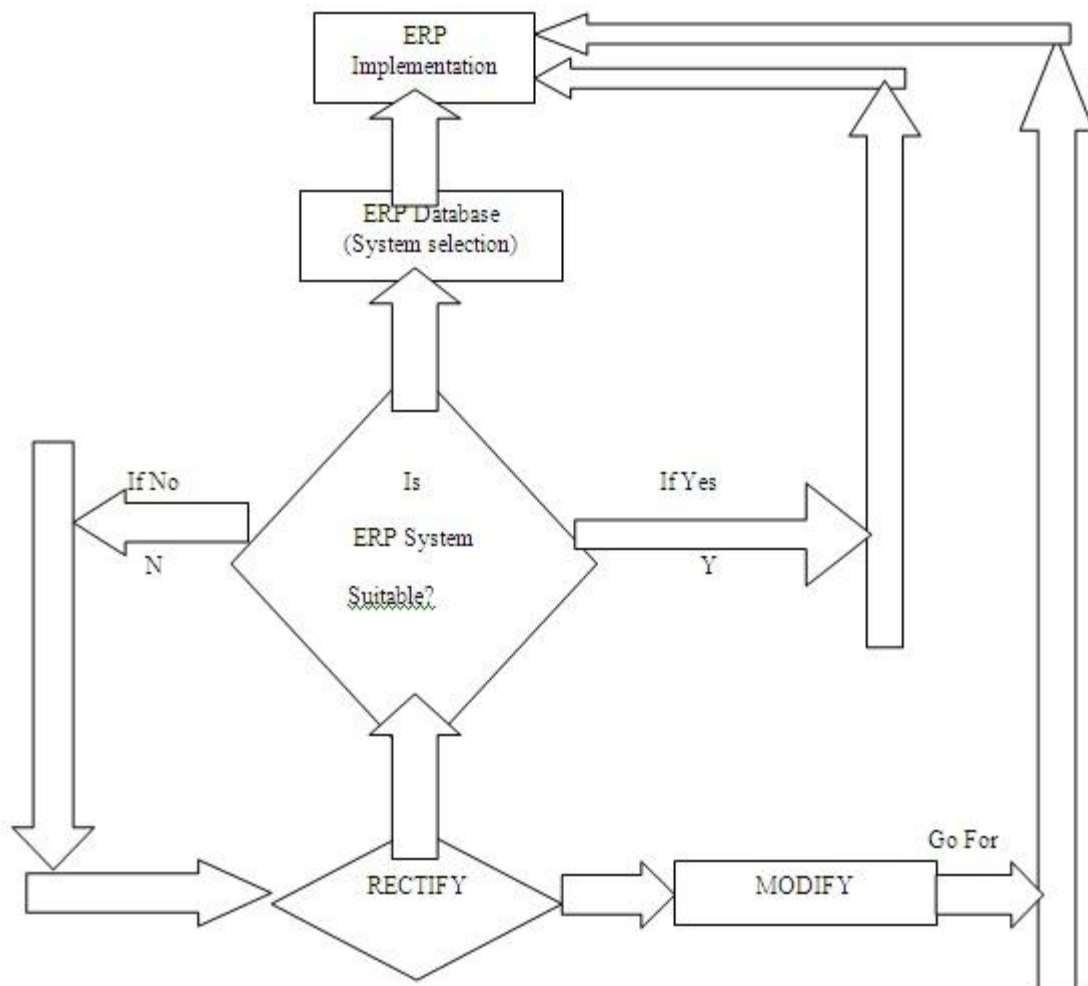


Fig. 3. Flowchart for an ERP system implementation process.

IV. Literature review :

While implementing ERP in an organization, there are following barriers which need to be addressed, are mentioned in the following Table-1.

Sr. No.	Category/Class	Name of barrier for ERP Implementation.	Name of author with year	Key research findings by this author	Methodology Used	Tool(s) used
1	Process	Lack of Perfection	Ike C. Ehie, Mogen Madsen, 2005	1) This study reports the results of an empirical research on the critical issues affecting successful ERP implementation. 2) Eight factors were identified that attempts to explain 86% of the variances that impact ERP implementation.	Empirical studies	Primary ERP software
2	Process	Lack of software acquisition process & Complexities.	1. Jacques Verville, 2. Alannah Halingten, 2003	1) Within this paper was presented a model of the ERP software acquisition process (MERPAP) that reflects the findings from the four cases examined in this study. 2) This high-level model depicts the principal processes that pertain to the acquisition of packaged software. 3) It is not generalizable to a larger population.	ERP Software Acquisition Process.	Six stage model of ERP
3	Process	Lack of the reactivity of the planning system.	Claire Berchet, Georges Habchi, 2005	1) A detailed model of the planning process is built. 2) Develop a control helping system based on performance indicators. 3) Outline the main results obtained at Alcatel in a general way, and describe the risks, the dysfunctions, and the reasons for them.	Five-stage deployment model	Integration and deployment of the planning process
4	Product	Lack of predetermined corporate goals	Elisabeth Umble ^a , Ronald R Haft, M. Michael Umble, 2003	1) This article identifies success factors, software selection steps, and implementation procedures critical to a successful implementation. 2) A case study of a largely successful ERP implementation is presented and discussed in terms of these key factors.	Case Study	Enterprise System Software.
5	Product	Lack of Structured GPM data.	Souleiman Naciri et al. 2011	1) This paper presents a methodology and a translator that allow management data to be included in a GPM data warehouse. 2) The proposed framework enables data management contained in flat Excel Files to be translated into structured GPM data.	GPM (Generic Product Model)	ERP data sharing framework
6	Product	Lack of organizational barriers.	1. Boonserm Kulvatunyou, 2. Richard A. Wysk 2000	1) Information models are necessary. 2) Product quality will be high and cost will be low. 3) The dynamics of the engineering process will be illustrated using these models.	Information Model.	Engineering Process Integration
7	Issues	Lack of Contextual issues.	Huigang Liang, Yajiong Xue, 2004	1) From an ERP vendor's perspective, this paper analyzes what can be done to address contextual issues relating to ERP implementation. 2) The case of UFSOFT, a Chinese ERP vendor, reveals three strategies that could be useful for achieving fit between ERP systems and adopting organizations.	Case research method-ERP Vendor, UFSOFT.	BPR

8	Management	Lack of management knowledge.	Ramin Vandaie 2008	<p>1) This paper identifies two major areas of concern regarding the management of ERP knowledge.</p> <p>2) The first area concerns the effects and implications of the tacitness of a great portion of ERP-specific knowledge.</p> <p>3) The second area examines the application of organizational memory in ERP knowledge management.</p>	Cross-functional and cross-divisional transfer of Knowledge.	Tacit Knowledge (KM)
9	Factors (risk)	Lack of risk assessment	Davide Aloini, Riccardo Dulmin, Valeria Mininno, 2012	<p>1) This work shows how colored PetriNets (CPNs) can be used to model risk factors in ERP projects in order to deal with the problem of interdependence in risk assessment.</p> <p>2) The technique is presented through an application to a real case study.</p> <p>3) Findings highlight the importance of interdependence and the indirect links for an effective ranking of risks.</p>	A PetriNet Approach.	Case study
10	Factors	Lack of data analysis.	AminAmid, Morteza Moalagh, Ahad Zare Ravasan, 2012	<p>1) 47 failure factors were identified.</p> <p>2) Robust Exploratory Factor Analysis (EFA) has been used for data analysis, which finally classified critical failure factors in seven groups named as vendor and consultant, human resources, managerial, project management, processes, organizational and technical.</p>	Data Analysis	Robust EFA Exploratory Factor Analysis
11	Factors	Lack of approach	Davide Aloini, Riccardo Dulmin, Valeria Mininno 2012	<p>1) The different approaches taken in the literature were compared from a risk management point of view to highlight the key risk factors and their impact on project success.</p> <p>2) Literature was further classified in order to address and analyze each risk factor and its relevance during the stages of the ERP project life cycle.</p>	Classification & Analyze.	Innovative Technique-Risk Analysis
12	Factors	Lack of Critical success factors.	Joseph Bradley 2008	<p>1) The findings suggest that choosing the right full time project manager, training of personnel, and the presence of a champion relate to project success.</p> <p>2) Integration of ERP planning with business planning, reporting level of the project manager, and active participation of the CEO beyond project approvals, resource allocation and occasional project review, are not found to be critical factors of success.</p> <p>3) All organizations implementing ERP, especially small and mid-sized enterprises with limited resources, will benefit from this knowledge.</p>	This study is a review of literature on ERP. (ABI Inform, Emerald, ScienceDirect and ACM Digital Library).	Framework of classical management Theory.
13	Industry	Lack of ERP systems benefits.	Daniel E. O'Leary University of Southern California 2005	<p>1) It is found that some benefits vary by industry.</p> <p>2) In particular, tangible benefits are largely industry dependent; with intangible benefits vary across industry.</p> <p>3) In addition, when compared to an earlier study by Deloitte Consulting, the results are statistically consistent with their findings, but find additional intangible benefits.</p>	ERP Database.	Statistical tool
14	Firm/ Industry	Lack of firm competences.	1. Yi-fen Su, 2. Chyan Yang, 2010	<p>1) The results provide empirical evidence that the beneficial impacts of ERP on the supply chain do lead to better overall SCM competence.</p> <p>2) Enhance firm competences of SCM in operational process integration, customer and relationship integration, and planning and control process integration.</p>	SEM	Conceptual Framework

15	Man	Lack of data models.	Daniel E. O'Leary 2005	1) These compromises are based on the use of accounting artifacts and other, often, implementation-specific compromises. 2) In addition, there are emerging differences between the two.	REA (Resources–Events–Agents a theoretical accounting enterprise database model) And SAP.	A theoretical accounting enterprise database model
16	Analysiss	Foreign vendors have failed. (lack of good vendors)	Yajiong Xue ^a , Huigang Liang ^b , William R. Boulton ^c , Charles A. Snyder, 2005	1) From the social-cultural perspective, five cases in which foreign ERP vendors have failed in their work. 2) Chinese implementations are presented and analyzed. 3) Eight factors are identified which have contributed to ERP failure. 4) Implications of the findings for future ERP implementations in China are discussed.	Historical Perspective	ERP Vendor Software SAP / Oracle
17	Analysiss	Lack of augmentation	Vincent A. Mabert ¹ , Ashok Soni, M.A. Venkataramanan 2006. Model based	1) Using multiple modeling techniques can augment the findings from survey data and provide greater insight. 2) Each provides unique perspectives into The process and helps to develop a complete picture of the ERP landscape.	DEA	Mathematical & Computer Model (tool).
18	Analysiss	Lack of Critical factors.	1. Boo Young Chung 2. Mirosław J. Skibniewski 3. Henry C. Lucas Jr.; & 4. Young Hoon Kwak 2008	1) The main research findings here is that the new factor postulated from this study, function, was highly associated with perceived usefulness. 2) Subjective norm had a significant association with perceived usefulness.	Information system success model	Postulation of Factor(s).
19	Game	Lack of Passive learning	DESHPANDE, AMIT A. (deshpaaa@e-mail.uc.edu) Univ. of Cincinnati, ISBN , 2008 Length 188 pages	1) Constructivist learning by the use of simulation game. 2) Objectivist instructor led learning and collaborative learning through peer-to-peer interaction.	Motivation-based multi-source active learning methodology	Game based Learning–Simulation Game.
20	Control	Lack of Complementary control.	Severing V. Grabski ^a , Stewart A. Leech, 2007	1) Research has demonstrated that single modes of control are not sufficient, rather than a portfolio of control modes should be utilized. 2) The results provide support for the theory of complementary as applied to controls needed to achieve a successful ERP implementation.	ERP implementation on projects–Control modes.	SAP, BAAN, Oracle, QAD & Factor Analysis
21	Method	Lack of Multi-method analysis.	Craig Shepherd ¹ , Chris Clegg ² and Chris S tride ² 2009	1) Provided useful recommendations for practitioners which corroborate wider findings within the change management literature (e.g., importance of adequate training and communication of end users).	Discourse analysis of interviews and focus groups	Statistical Analysis
22	Method / Module.	Lack of conceptual framework.	Petri Hallikainen ^a , Hannu Kivijärvi ^b , Markku Tuominen ^b . 2009	1) Present first a general level conceptual framework to ERP module implementations. 2) It expands the model to a more detailed level in a case study. 3) The priorities for the implementation sequence of the ERP modules are determined in the case study.	Module/case Study.	ERP Model

23	Method / Process.	Lack of both imitative and logical evaluation forces.	Vincent S. Lai, Connie K.W. Liu, Fujun Lai, Jian Wang, 2010	1) ERP adoption time and extent have different effects on imitation and logical evaluation behaviors. 2) Imitative forces play a crucial role in the decision-making process. 3) It opens up a new avenue for research into technology adoption.	Integrated Model	Innovation & Imitation.
24	Test	Lack of Group cohesion.	Eric T.G. Wang, Ta-Chung Ying, James J. Jiang, Gary Klein 2006	1) Group cohesion is positively related to meeting management goals. 2) Group cohesion is likewise positively related to meeting management goals.	Survey and Data support	Empirical Relationship Tool
25	Test	Lack of Post-implementation success.	Yan Zhu, Yan Li, Weiquan Wang, Jian Chen 2010	1) Both ERP implementation quality and organizational readiness significantly affect post-implementation success, whereas external support does not. 2) The theoretical and practical implications of the findings are discussed.	Integrative model	Integrative model
26	Model	Lack of Decisive factors	Salvador Bueno, Jose L. Salmeron 2008	1) This research model has offered some evidence about main acceptance factors on ERP which help to set the users' behavior toward ERP.	Technology Acceptance Model (TAM)	Research Model
27	Policy	Lack of Engines of economic growth.	Helena Lenihan, 2011	1) Enterprise evaluation metrics are too narrow. 2) They focus almost exclusively on private firm impacts. 3) Illustrate how logic models could be expanded to account for these broader impacts.	'new' Enterprise policies.	Logic models
28	Project	Lack of Consulting fees	Malgorzata Plaza ¹ , 2008 Katrin Rohlf 2008	This research offers three major contributions: 1) a means of selecting a training strategy that minimizes project consulting costs, 2) an analytical method for accurately predicting a project completion date, and 3) a theoretical basis for empirical studies of learning and ERP (and other IT) implementations.	Analytical Modeling	Analytical tools
29	Project	Lack of hierarchical attribute structure.	1. Chun-Chin Wei, 2. Mao-Jiun J. Wang, 2004	1) A hierarchical attribute structure is proposed to evaluate ERP projects systematically. 2) An actual example in Taiwan demonstrates the feasibility of applying the proposed framework.	Fuzzy set theory	AHP
30	Enterprise	Lack of activities	V. Chapurlat, C. Braesch 2008	1) The first part introduces the concepts and definitions required 2) State of the art concerning the uses, best practices and main current research related to VVQC in the enterprise field. 3) Some orientations for future research to be prioritized in order to deal with crucial challenges in the enterprise.	Enterprise-modeling Domain.	VVQC
31	Data base	Lack of modeling language & ERP system's functionality.	1. Pnina Soffer, 2. Boaz Golany, 3. Dov Dori 2003	1) Capturing the entire scope of process variants supported by the ERP system. 2) Interdependencies among them. 3) Generic steps may be applied using a variety of modeling languages.	Object-Process modeling (OPM) Methodology.	Reverse engineering process
32	Case study	Lack of Business, technical and cultural issues.	1. Yahaya Yusuf, 2. A. Gunasegaram, 3. Mark S. Abthorpe 2004	1) The paper takes an in-depth look at the issues behind the process of ERP implementation via a case study methodology. 2) It focuses on business and technical as well as cultural issues at the heart of the Rolls-Royce implementation. 3) The case study also looks at the implementation time scales and assesses the benefits from the project both tangible and intangible.	ERP System-SAP R/3.	Advanced Business Application Programming (ABAP)

33	Data / System	Lack of cultural barriers	1. Mary C. Jones, 2. Melinda Cline, 3. Sherry Ryan, 2006	1.) A model is developed that demonstrates the link between the dimensions of culture and knowledge sharing during ERP implementation. 2) Possible research questions on which future research can be based are also identified.	Model.	Knowledge Sharing
34	S/w system	Lack of expert tool	M. Ghazanfari , M. Jafari , S. Rouhani, 2011	1) Enterprises can use this approach to evaluate, select, and buy software and systems. 2) It provides better decision support for their organizational environment, enabling them to achieve competitive advantage.	BI	DSS
35	System	Lack of Acceptance factors.	1. Adam R , 2. Kotzé, P. 3. Van der Merwe, A 2011	1.) This paper addresses the gap by considering the strategic, business, technical and human factors . 2) It influences the acceptance of ERP systems in small manufacturing enterprises in South Africa.	ERP System(s)	UTAUT Model
36	System	Lack of Theoretical bases & inter-organizational relationships.	Andreas I. Nicolaou, 2008	1) This research note utilizes recent research findings that bear on the effectiveness of the implementation and use of ERPS in business organizations and extends these findings in the inter-organizational context.	ERPS	The economic theory of complementarity and real options theory from finance.
37	System	Lack of Challenges.	Jim Odhiambo Otieno 2011	1) ERP implementation and upgrade is influenced by existing contextual factors - national and organizational. 2) The study provides practical guidelines to practitioners on ERP implementation and upgrade based on the experience of the case study organizations and the ERP consultants interviewed.	Empirical ERP Implementation Model (EEIM) and the Upgrade Decision Model (UDM)	BPR and Parr and Shank's model (PPM)
38	System	Lack of social factors.	1. Man-Kit Chang, 2. Waiman Cheung, 3. Chun-Hung Cheng and 4. Jeff H.Y. Yeung, 2008	1) Social factors are the most significant determinant affecting the ERP system usage. 2) Other factors such as compatibility and near-term consequences are also significant. 3) Propose some important managerial implications in connection to promoting the usage.	An empirical study	Conceptual Model (derived from Triandis framework) & regression analysis.
39	System	Lack of study findings for IS.	Princely Ifinedo, Birger Rapp, Airi Ifinedo, Klas Sundberg, 2010	1.) SEM results showed that five out of the six hypotheses have significant, positive associations. 2) The pertinence of the study's findings for IS success evaluation as well as its implications for practice and research are discussed.	SEM (Structural Equation Modeling)	Six hypotheses
40	System	Lack of decision-support benefits from an ERP system.	Clyde W. Holsapple, Mark P. Sena, 2005	1.) It provides insights into the decision-support benefits of ERP systems. 2) The study also examines relationships between the importances of various objectives in ERP planning. 3) The subsequent realization of decision-support benefits from an ERP system.	DSS	ERP System Adopters
41	System	Lack of technology implementation.	1. Kwasi Amoako-Gyampah, , 2. A.F. Salam , 2004	Empirical and theoretical support for the use of managerial interventions, such as training and communication, to influence the acceptance of technology.	Technology Acceptance Model (TAM).	□ Shared beliefs; □ Training & Communication

42	System	Lack of decision making approach.	E. Ertugrul Karsak, C. Okan Özogul 2009	1) The presented methodology appears as a sound investment decision making tool for ERP Systems as well as other information systems. 2) The potential use of the proposed decision framework is illustrated through an application.	QFD	Fuzzy linear regression and zero-one goal programming.
43	System	Lack of Adoption on firm.	1. Juha-Pekka Kallunki ^{2,1} , 2. Erkki K. Laitinen, 3 Hanna Silvola ² 2011	1) Formal types of management control systems act as intervening variables mediating the positive lagged effect between enterprise systems adoption and non-financial performance. 2) Find a significant relationship between non-financial and financial firm performance.	Survey data.	Empirical Analyses
44	System	Lack of ES(Enterprise-wide Systems) organizational issues.	John Ward, Christopher Hemingway, Elizabeth Danie. 2005	1) The findings from the case studies suggest that the framework can help understand how different approaches to managing ES implementations both address. 2) It influences the behaviours of key interest groups and hence the achievement of the benefits expected from the investment.	Framework.	CRM & ERP Software Packages.
45	System	Lack of usage & usefulness (of the system).	1 Kwasi Amoako-Gyampah, 2007	1) The results indicate that users perception of the perceived usefulness, ease of use of the technology, and the users' level of intrinsic involvement all affect their intention to use the technology.	Mail survey	Users' Perceptions
46	System	Lack of Organizational citizenship behaviors (OCBs).	Cheolho Yoon, 2009	1) It provides strategic insights for successfully managing ERP systems by identifying the effects of organizational citizenship behaviors in ERP context.	SEM	Research Model
47	System	Lack of Security and reporting issues.	Daniel E. O'Leary M. Lynne Markus, Bentley College, 2005	1) This paper investigates Microsoft's Enterprise Resource Planning (ERP) System implementation. 2) Risks and controls investigated include network exposures, data access, information disclosures, periodic lockouts and warnings and built-in controls.	SAP, Data Warehousing Tools	FinWeb & MAP99
48	System	Lack of sustained innovation.	Thongchai Srivardhana, Suzanne D. Pawlowski, 2007	1) The model highlights areas where active management has potential to enhance the capabilities of a firm 2) for sustained innovation of its business processes.	Theoretical framework	Model
49	System	Lack of Behavioral aspects of ERP systems adoption.	Yujong Hwang, Delvin Grant, 2011	1) The results indicate that low power distance and high uncertainty avoidance cultural orientation influence general CSE. 2) Uncertainty avoidance positively influences ease of use of ERP systems.	An online survey methodology	Research Model
50	System	Lack of System performance.	1.Wen-Hsien tsai, 2. Michael J. Shaw, 3. Yi-Wen Fan, 4. Jau-Yang Liu, 5. Kuen-Chang Lee, 6. Hui-Chiao Chen 2011	1) The results reveal a significant causal relationship between system providers, implementation consultants and project management, and project to system performance.	SERVQUAL Instrument.	SEM (Structural Equation Modeling)
51	System	Lack of Interdependency	Oana Velcu, 2010	1) Investigated the association between strategic alignment, management of ERP projects, business process changes, and the business performance of ERP systems. 2) The strategic alignment concept was found to have a central role in the Results Model. 3) Results showed that the more the ERP system strategy was aligned with the business strategy, the more likely that the ERP project was completed on budget and on time.	Structural Model	SEM Software Language

Table-1 : Barriers of ERP (identified through literature survey).

Table 2 : ERP and AHP Barriers identified through literature review :

S. N	Category / Class	Barrier(s)	Name of author & year	Key research findings	Methodology used	Tool(s) used
1.	Risk	Lack of cooperation and commitment of ERP users and managers	J.L. Salmeron, C. Lopez 2010	1.The most critical stage in ERP maintenance is the first phase, which receives, identifies, classifies and ranks the software modification. 2.The findings of this study can also help the professional to achieve effective risk management in the whole ERP maintenance.	MCDM	AHP
2.	Applications (factors)/ Methods/ Materials	Lack of project management / Publishers.	N. Subramanian, R. Ramanathan, 2012	1. Significant research gap exists in the application of AHP in the areas of forecasting, layout of facilities and managing stocks. 2.Develops a framework for identifying the decision areas.	Observations Tables.	AHP
3.	Framework	Lack of feasibility	C.-C. Wei et al. 2005	1. Found out means and fundamental objectives for the framework of ERP system. 2. These objectives also indicate how outcomes should be measured and what key points should be considered in the decision process.	ERP System framework	AHP
4.	Factors/ system	Lack of consistency may arise in AHP	J.L. Salmeron, I. Herrero, 2005	1. Multiple choices were contemplated. 2. It provides a method for ranking critical success factors.	AHP	SAP R/3
5.	Software	Lack of generic methodology	A.S. Jadhav, R.M. Sonar, 2009	(1) analytic hierarchy process has been widely used for evaluation of the software packages, (2) there is lack of a common list of generic software evaluation criteria and its meaning, and (3) there is need to develop a framework comprising of software selection methodology, evaluation technique, evaluation criteria, and system to assist decision makers in software selection.	Selection of software framework, steps.	SimSelect
6.	Software	Lack of decision making	A.S. Jadhav, R.M. Sonar, 2011	This study provides conceptual understanding of all aspects related to the software selection such as (i) methodology describing factors and issues (ii) software evaluation criteria (iii) software evaluation techniques.	(i) generic methodology for software selection, (ii) software evaluation criteria	hybrid knowledge based system (HKBS) approach

7.	Model	Lack of inconsistent problems in AHP	Tsung-Han Changa, Shu-Chen Hsub,Tien-Chin Wangc, Chao-Yen Wud,2012	1) Improves the efficiency of pairwise comparison compared with the traditional AHP. 2) The possible occurrence ratings of success or failure outcome amongst decision makers.	MCDM with Incomplete Linguistic Preference Relations (InLinPreRa)	AHP
8.	Construction	Lack of activities/ Criteria	Mirian PicininiMe xas a,n, OsvaldoLuizG onc-alves a, Quelhas a, HelderGomes Costa 2012	1)The study showed that the financial, business and software criteria were most important for the respondents. 2) The importance of the sub criteria of each criteria group was also presented to assist decision makers when selecting ERP system.	ERP Systems Selection Criteria	AHP
9.	Review	Lack of rank reversal, some theoretical disputes.	A. Ishizaka, A. Labib, 2011	It is discussed odeling, pair-wise comparisons, judgement scales, derivation methods, consistency indices, incomplete matrix, synthesis of the weights, sensitivity analysis and group decisions. All have been important areas of research in AHP.	Modeling &other MCDM Methods.	AHP
10.	Evaluation	Lack of judgments	Lan Xu 2012	1) Presented ERP sandtable simulation evaluation to discuss how to make a decision using AHP. 2) Using this method can make enterprises consider factors influence operation of enterprise adequately, including feedback and dependence among the factors.	Sand table method	AHP
11.	Ranking	Lack of alternatives of the decision	T.L.Satty and G.Hu 1998	1) EM (Eigenvalue Method) is the only valid method for deriving the priority vector from a pair wise comparison matrix, particularly when the matrix is inconsistent.	Ranking by EM Vector Method.	AHP
12.	Review	Lack of results	A.I. Nicolaou 2004	1) Presents contributions for both the practice and research on ERP system implementation effectiveness.	A case study methodology	Post implementation review (PIR)
13.	Analysis	Lack of use of the 9-point scale.	C. Macharis et al. 2004	Recommendations are formulated to integrate into PROMETHEE a number of useful AHP features. 2) Suggests that future academic research should focus on comparative assessments of the relative strengths and weaknesses of alternative MCA approaches.	Preference Ranking Organisation MeTHod for Enrichment Evaluations (PROMETHEE) .	AHP
14.	Algorithm	Lack of decision making	S. Mahmoodzadeh, J. Shahrabi,	1) A simple approach to assess alternative projects and help decision maker to select the best	TOPSIS Technique/ Algorithm.	Fuzzy AHP

			M. Pariazar, and M. S. Zaeri 2007	one. 2) Reduce or eliminate assessment bias in pairwise comparison process. 3) To support project selection decisions.		
15	System	Lack of innovations	Injazz J.Chen 2001	1) Several critical planning issues are resolved. 2) Study also identifies new windows of opportunities and challenges facing companies .	Analysis	ERP System
16	Comparison	Lack of facts	P. KORHONEN AND H. TOPDAGI 2003	1) AHP is able to estimate the reasonable utility values for objects surprisingly well. 2) The origin separating utility and disutility scales was estimated as well.	Ratio-scale AHP Analysis	AHP
17	Selection / Evaluation	Lack of certain choices	ic, I ,Lalic, B. 2009	1) This tool helps us with simulating project importance based on changes in perception of the criteria. 2) AHP can dramatically improve the process of developing project proposals. 3) Its biggest strength is systematic approach in several steps.	MS EXCEL SOFTWARE & SIMULATION	AHP
18	Risk-based	Lack of risk attitude	Solomon Tesfamariam, Rehan Sadiq 2006	1) The traditional AHP is modified to fuzzy AHP using fuzzy arithmetic operations. 2) The methodology of the proposed technique is built on a hypothetical example.	MCDM	F-AHP
19	Performance	lack of performance measures.	Wen-Hsien Tsai*, Ping-Yu Hsu*, Yi-Wen Fan**, Jun-Der Leu* 2003	1) Presented an AHP approach to achieving the relative importance weights of ERP performance measures. 2) A company can select the specific dimensions and measures according to the goals of ERP systems and the context of the company.	Two-stage approach	AHP
20	Case study	Lack of objective functions & evaluation factors.	M. Marufuzzaman, K.B. Ahsan and K. Xing 2009	1) This selection process helps the manager to select a supplier from a dynamic environment. 2) Another important finding is that the proposed model is more reflecting the relation of how the selection criteria affect the selected suppliers and at the same time what is more important for the suppliers among the selection criteria.	MCDM	AHP
21	Case study	Lack of flexibility	Carlos Parra-López,	1) Results for this case study show a	AHP-extended	AHP

		y & previous specific data, hard data.	Javier Calatrava-Requena, Tomás de Haro-Giménez 2007	greater global performance of organic and integrated agriculture despite differences in the ideological tendencies of the experts. 2) Thus providing a scientific basis for endorsing institutional and social support for the promotion and implementation of these farming techniques. 3) Some conflictive issues, however, have been detected, especially in areas related to environmental performance. 4) Further research on the controversial topics is desirable for clarification.	methodology	
22	Note / Procedure.	Lack of problem with inconsistency. problem	H. Chao et al. 2004.	1) It is suggested that decision-makers still use the comparison matrix of Saaty. 2) Numerical examples are included to illustrate the findings. 3) As a result, it is concluded that the decision-makers should use the comparison matrix of Saaty.	Comparison matrix(Satty)	AHP
23	Review	Lack of degree of change.	John Gunson, Jean-Paul de Blasis 2003	1) The report findings highlight success factors(in order of importance) - user involvement, executive management support, clear statement of requirements ,proper planning, realistic expectations, smaller project milestones, competent staff, ownership, clear vision and objectives, hard-working focused staff, other. 2) Another finding was that project failures were on the increase in 1995 compared to 1990 or 1985.	ERP Solutions	Modules Enhanced ERP Web
24	Experiment	Lack of	James R. Langenbrunner et al. 2010	1) A method of information integration is illustrated. 2) (AHP) is used to determine weights for two models and two experimental data sets, by forming all possible pair-wise comparisons between model output and experimental data.	Modeling	AHP
25	Software / Perspectives	Lack of interrelated measures	Michael Rosemann, Jens Wiese 2000	1) Information concerning this perspective as well as concerning the other perspectives is mainly based on non-financial measures. 2) The final objective is to design a reference Balanced Scorecard. 3)As far as possible the Balanced Scorecard functionality within ERP software will be used to	BSC(Balanced Score Card) approach.	ERP Software

				realize an IT-based solution.		
26	Analysis	Lack of preparing the data for the analysis.	J. Jablonsky 2007	1) This paper discusses the possibility of using an AHP model with interval pairwise comparisons for the evaluation and classification of efficient units, and compares the results with super-efficiency DEA scores / models. 2) Several real-life economic applications will serve as background for numerical experiments. 3) The proposed approach is applied to assess the efficiency of pension funds in the Czech Republic.	data envelopment analysis (DEA) approach.	AHP - interval AHP Model
27	System	Lack of some aspects.	Manouchehr Behboudi Asl et al. 2012	1) Using Delphi method, the following factors: cost, software quality, vendor and software capability were identified as the main factors which should be considered by the organizations. 2) These criteria were, then, ranked using Shannon Entropy technique and the vendor was identified as the most important criterion.	Shannon Entropy Algorithm approach	Delphi method process
28	System	Lack of appropriate system	Ottar Bakås1, Anita Romsdal2 and Erlend Alfnes2 2007	1) The final output for the organisation is a choice of ERP system and vendor that ensures strategic fit and functional integration in the organisation. 2) The methodology was successfully developed and implemented in a Norwegian case company.	Conceptual framework, Process model and Guidelines.	ERP System
29	Method	Lack of relative measurement.	Thomas L. Saaty 1994	1) This paper provides a detailed discussion with references on the fundamentals of the Analytic Hierarchy Process and in particular of relative measurement. 2) It is shown that when there is synergy due to the number of elements the AHP can be used to both preserve rank when it is desired to preserve it and allow it to reverse when it should reverse.	EV(EigenVector) Method	AHP
30	Method	Lack of effectiveness	V.S.Lai et al. 2002	1) The experiment and survey findings indicated that the AHP is preferable to Delphi. 2) The AHP to be more conducive to consensus building in group decision settings.	TMulti-media authorising systems(MASSs)	AHP
31	Method	Lack of attributes	B.K. Mohanty, N. Singh	1) This model of AHP gives the solutions corresponding to the various combination operators of	Fuzzy methodology	AHP

			1994	the fuzzy relations. 2) This leads to the ranking of the attributes (at each hierarchy level) in the AHP problem.		
32	Decision	Lack of moderate accurate results.	CC nnC	1) AHP methodology based on pairwise comparison element is a suitable tool to estimate criteria weighting which can get the results in quantitative manners. 2) It is suitable and flexible to express the judgement of experts in fuzzy numbers. 3) The approach presented in this paper is very useful.	AHP methodology under fuzzy environment	MHD M (Multiple Hierarchical Decision Making)
33	Supplier/ Vendor	Lack of selection of vendor with time axis	Saroj Koul, Rakesh Verma 2011	1) The research provides a mathematical system that captures the uncertainties associated with human cognitive processes in order to select the vendor. 2) The findings of this study provide meaningful and advanced knowledge to decision makers by demonstrating a simple, efficient method to enhance the ability to predict an appropriate vendor period wise.	fuzzy analytic hierarchy process (AHP) to propose the decision model	AHP
34	Supplier	Lack of current grey methodology	Davood Golmohammadi Mahour Mellat-Parast 2012	1) The findings suggest that the proposed model provides more consistent and reliable results which are in line with managers' ranking. 2) Implications of the study to the theory and practice and future research have been outlined.	An integrated, two-phase model is proposed which integrates the fuzzy pairwise comparison with a grey relational analysis.	Decision making model
35	Safety Mgmt/ Evaluation	Lack of	Metin Dağdeviren İhsan Yüksel 2008	1) In this study, a fuzzy AHP approach is proposed to determine the level of faulty behavior risk (FBR) in work systems. 2) As a result of the evaluation, FBR levels of work systems are determined and different studies are planned for work systems according to the FBR levels. 3) Work system safety is improved.	fuzzy AHP approach	AHP
36	Analysis	Lack of strategic investment decisions	Khalid Hafeez et al. 2002	1) The analysis may be viewed as a benchmarking exercise in order to find the competency gaps within the company. 2) The framework is generic in	Structured framework	AHP

				nature and is applicable to benchmark a public or service sector organization.		
37	Review	Lack of challenges	Faridun Ahmadi Jaafar Mahmoudi 2011	1) Presented the research results for determining ERP success factors in Iranian organizations. 2) Analyzed and defined Critical Success Factors (CSF) to implement successful ERP system in large governmental organizations.	Finding out the SFs(Success Factors) &analyze them.	ERP System
38	Materials	Lack of assessment	ZHANG Tian-yun ¹ et al. 2007	1) Reasonable and accurate. 2) Effective method to determine the weighing values for assessment index of engineering materials.	Analytic hierarchy procedure/M odel	AHP
39	Evaluation	Lack of decision	Pooria Assadi ¹ , Taraneh Sowlati ² 2009	1) An aggregated decision was derived considering the relative influence of decision makers in the decision-making process. 2) Sensitivity analysis was performed to evaluate the impact of changes in the influence of decision makers and changes in the importance of selection criteria on the final decision.	The recommended software package was acquired by the company and has been integrated into their system.	AHP
40	Technology	Lack of strategy	Seong Kon Lee et al. 2009	1) To prioritize the weights of energy technologies.2) Building technology is the most preferred technology in the sector of energy technologies against high oil prices. 3) coal technology and transportation technology follows and take the 2nd and 3rd place with the fuzzy AHP approach	Fuzzy technique/ MCDM Approach	AHP
41	Process	Lack of technical people	R. Gibney, J. Shang 2007	1) The results suggest that root cause of the differences was a variation in emphasis on certain criteria. 2) Discrepancies were analyzed and explained. 3) The AHP provides a convenient and effective tool for evaluating personnel.	Implementing AHP Model	AHP
42	Analysis	Lack of	Riddhi Dutta 2003	1) These decisions can be risky. 2) Estimation provides a value that is as close as possible to the actual (unknown) value. 3) In complex situations, structured approaches of decision analysis become crucial for businesses.	MCDM	Decision Analysis
43	Example	Lack of criterion	R. Whitaker 2007	1) There are numerous validation examples developed by many people using pairwise comparison matrices,hierarchies and networks for which the answers are already	Data from ahp and ANP Model	AHP

				known that show the accuracy and robustness of AHP/ANP and these have been shown in the paper on validation of the AHP by this same author in this journal.		
44	Process	Lack of selection	David Morera 2008	Presented how the DESMET methodology along with the AHP methodology can be combined in such a way that COTS selection would be easier and more accurate than before. COTS(Commercially Off-The Shelf) evaluation is always context dependent. It means that, an evaluation process must be carried out for a specific project and not for several different projects with distinct characteristics.	DESMET methodology	AHP
45	Method/procedure.	Lack of consensus.	Yucheng Dong et al. 2010	The geometric consistency index is suggested to measure the individual consistency of judgement matrices. Simulation experiments show that the proposed two consensus models can improve the consensus indexes of judgement matrices to help AHP decision makers reach consensus.	row geometric mean prioritization method (RGMM) / Simulation Experiment(s).	AHP
46	Analysis	Lack of appropriate levels of safety stock	Golam Kabir and Dr. M. Ahsan Akhtar Hasin 2011	<i>In this paper, a comparative analysis of AHP and FAHP for multi-criteria inventory classification model has been presented.</i> The FAHP approach proved to be a convenient method in tackling practical multi-criteria decision making problems. It demonstrated the advantage of being able to capture the vagueness of human thinking and to aid in solving the research problem through a structured manner and a simple process.	<i>Fuzzy Analytical Hierarchy Process (FAHP)</i>	AHP
47	Analysis	Lack of fuzzy MDS results.	Mei-Fang Chen et al. 2008M.-F. CHM.-F. ENG	This paper uses fuzzy analytic hierarchy process (FAHP) to determine the weighting of subjective judgments and to derive the performance values of each alternative. MDS analysis is conducted to identify similar groups from distances among alternatives based on fuzzy preferences as perceived by the evaluators to obtain a clear visual dimensional map of a multi-criteria decision-	fuzzy multi-criteria decision-making (FMCDM) environment & Multidimensional scaling (MDS) analysis.	FAHP

				making problem.		
48	Method / Analysis.	Lack of natural resource mgmt. situation s.	G.A. Mendoza ^a , H. Martins 2006	Provide a critical review of MCDA methods & new MCDA paradigms applied to forest and other natural resource management.	MCDA Method	AHP Model
49	Method	Lack of new ideas	KEUN TAE CHO 2003	First attempt to look at multicriteria decision making methods within a unified framework.	AHP Framework	AHP
50	Configuration	Lack of decision making.	F. Golbabaie et al. 2012	Evaluate each alternative layout with respect to each of the criterion and finally prioritized all the alternatives.	AHP Framework	AHP
51	Priorities	Lack of criterion	T. L. SAATY & M. OZDEMIR 2007	People lumped together positive and negative aspects of a problem.	AHP Framework	AHP
52	Ranking of alternatives	Lack of consistency	L.C. Leung ^a , D. Cao 2000	The alternatives are ranked on the basis of the global weights by application of a maximum–minimum set ranking method.	Fuzzy AHP	AHP
53	Rank	Lack of efforts	Hung-Yi Wu et al. 2012	Conducted evaluations, improved their performances and formed educational policies.	MCDM Model	Hybrid AHP
54	Judgement	lack of consistency	J. Benítez et al. 2011	This algorithm follows an iterative feedback process that achieves an acceptable level of consistency while complying to some degree with expert preferences. Finally, an application of the framework to a water management decision-making problem is presented.	DSS Algorithm	AHP
55	Transportation	Lack of emerging technology usage	T. Zayed et al. 2008	The R index model is developed using the analytic hierarchy process (AHP). Results show that political risk has the highest average weight of 0.5196; however, financial risk has the second highest average weight of 0.2336 in the macro level (company) areas. On the other hand, in the micro level (project), emerging technology and resource risks have the highest average weight of 0.2492 and .2098, respectively. The developed R model is tested, which prove its robustness in risk assessment (93%). It can also be used to sort highway construction projects based upon risk .	R index model	AHP
56	Approach	Lack of comparison	CHING-FU CHEN	<i>The findings indicate that the AHP approach is a useful tool to help</i>	(AHP) approach, a	AHP

		sons.	2006	<i>support a decision in convention site selection.</i>	<i>decision-making method</i>	
57	Issues	Lack of planning	Yang and Shi 2002	The result of this study shows that such an AHP application can assist managers to effectively evaluate firm's overall performance in their long-term strategic planning process even under complex economic and marketing conditions.	Fuzzy AHP	AHP
58	Policy	Lack of policy	Chun-hsu Lin 2010	The project was found to serve as a flexible and achievable application of AHP to the environmental policy-making process.	Decision-making tools	AHP
59	Analyze	Lack of certain risk factors.	Prasanta Kumar Dey 2012	The severity of failure is determined through consequence analysis. From this, the effect of a failure caused by each risk factor can be established in terms of cost, and the cumulative effect of failure is determined through probability analysis. The technique does not totally eliminate subjectivity, but it is an improvement over the existing inspection method.	a multiple-attribute decisionmaking technique,	AHP
60	Analysis	Lack of correctness/order.	Diederik J.D. Wijnmalen 2007	In this paper benefits–opportunities–costs–risks (BOCR) analysis using AHP/ANP methodology was addressed. The analysis in this paper suggests that it is crucial to express priorities on benefits, opportunities, costs and risks in commensurate terms.	AHP/ANP literature.	AHP
61	Analysis	Lack of shortage of traditional analytic hierarchy process	Gao-yang Yin et al. 2011	The simulation proved that the threat assessment result of anti-warship missiles to warship obtained through the threat assessment algorithm based on AHP and the principal components analysis was objective and reasonable.	Threat Assessment Algorithm	AHP
62	Numerical	Lack of feedback effects	Rachung Yu, Gwo-Hshiung Tzeng 2006	It incorporates the eigenvalue method, the fuzzy cognitive maps (FCM), and the weighting equation, to overcome the problem of preferential independent and the shortcomings of the ANP. In addition, two numerical examples are used to demonstrate the proposed method.	fuzzy cognitive maps & fuzzy decision maps (FDM)	(ANP/AHP)
63	Software	Lack of selection	Dr. Chi-Tai Lien	<i>It is found that out the 'business process reengineering (BPR) and</i>	<i>Enterprise</i>	

		<i>criteria</i>	Dr. Hsiao-Ling Chan 2006	<i>system tuning time' is significantly important of entire criteria in this ERP project. It is also found that 'recoverability' is the most important criteria among the software criteria of ERP software.</i>	<i>resource planning (ERP) software</i>	<i>(FAHP)</i>
64	Consultancy/Consultant.	Lack of decisions in a broad environment	Ozalp Vayvay et al. 2012	The experiments suggested that both AHP and fuzzy AHP led to the same results, but neither of these considered the interactions within decision elements during the selection process.	MCDM & Project Resource Planning method (PRP).	AHP & ANP.
65	Analysis	Lack of "defensive" factors.	Hsin-Pin Fu et al. 2006	The weights of "proactive" factors are found to be greater than those of "defensive" factors. Various factors are found to have different routes of influence in determining decision making in different industries. Risks involving the use of new technology did not constitute the major factor in influencing decision-making	A fuzzy analytic hierarchical process (AHP)	Adoption of electronic marketplace (EM) model.

Table 3 : ERP Components' Barriers identified through literature review :

<i>S.N</i>	<i>Component/Body/Driver.</i>	<i>Barrier(s)</i>	<i>Name of author & year</i>	<i>Key research findings</i>	<i>Methodology used</i>	<i>Tool(s) used</i>
1.	Issues	Lack of realization	N. Venkateswaran and V. Mahalakshmi 2012	Relative scores of issue importance are compared across the firms, roles (client versus implementation partner) and organizational levels. Study findings confirm the importance of this finer partitioning of the data and distinctions identified, reflecting the circumstances of ERP lifecycle implementation, management and support among the stakeholder groups.	ERP life cycle implementation	SAP financials
2.	Supplier	Lack of evaluation and selection	MOU Rui , 2004	System offers the interface of many kinds of data bases and has the characteristic of integration and extension. It introduces a computer decision system utilizing this model.	ERP System combined with SCM	AHP Algorithm
3.	Information Systems / <i>Core</i>	Lack of transformation and specific cultural and language	Liping Ge, Stefan Vo 2008	The first finding indicates that ERP systems dominate the area of information systems. One of the (not unexpected) findings is that not only analytical data concepts play an important role in successful ERP implementations in China but also	ERP software	Enterprise resource planning (ERP)

		e barriers		cultural and language aspects. Introducing information systems and especially ERP systems is closely related to organizational change.		systems
4.	Risk factors / Central	<i>Lack of ability to recruit and retain qualified ERP systems Developers. Lack of senior management support</i>	MARY SUMNER 2000	Findings included the challenge of re-engineering business processes to 'fit' the process which the ERP software supports, investment in recruiting and reskilling technology professionals, the challenge of using external consultants and integrating their application-specific knowledge and technical expertise with existing teams, the risk of technological bottlenecks through client-server implementation and the challenge of recruiting and retaining business analysts who combine technology and business skills.	commercial, off-the-shelf COTS software projects.	SAP, PeopleSoft and Oracle projects.
5.	Modular set of systems / Central	Lack of extended enterprise functionality.	H.A. Akkermans et al. 2003	1) Key SCM issues. 2) The second main finding is that the panel experts saw only a modest role for ERP in improving future supply chain effectiveness and a clear risk of ERP actually limiting progress in SCM. 3) Key limitations of current ERP systems .	A Delphi study research design.	Current ERP systems
6.	Corporate	<i>Lack of next-generation enterprise systems (ES).</i>	Charles Møller 2005	The paper proposes a conceptual framework for extended enterprise resource planning (ERP II). The aim of this model is to compile present ES concepts into a comprehensive outline of ERP II, thus composing a generic map and taxonomy for corporate-wide enterprise systems.	Model	Enterprise-wide System ES ERP II Framework
7.	Central	Lack of research & concept of change management.	Sherry Finney Martin Corbett 2005	The most significant finding is the lack of research that has focused on the identification of CSFs from the perspectives of key stakeholders. Additionally, there appears to be much variance with respect to what exactly is encompassed by change management.	Content analysis methodology and an inductive coding technique.	Literature review
8.	Central	Lack of conformity to the software processes	Dr. Ali E. Kashef et al. 2001	This paper offers an overview of Enterprise Resource Planning with regard to its vision, components, client expectations, system parameters, benefits, costs, as well as major steps	ERP System	Literature review

				towards the successful implementation of ERP.		
9.	Central & Corporate	Lack of ordinal variables	Augusto Pacheco-Comer et al. 2012	<p>The paper presents the first results from empirical study where it is found that there is a relation between size of the company and the amount of investment.</p> <p>The general results obtained from 152 complete surveys shows that 31.6% belongs to micro companies (1 to 10 employees), 23.7% to small (11 to 50 employees), 9.2% to medium (51 to 100 employees), 15.1% to large (101 to 250 employees) and 20.4% to big companies (more than 250 employees).</p>	Multi Agents Systems (MAS) architecture.	ERP System Survey
10.	Core	Lack of correctness	Chi-Tai Lien et al. 2005	<p>It is found out the 'cost' is significantly important of all factors in this ERP project.</p> <p>It is also found 'correctness' is the most important criteria among the software quality factor of ERP software.</p> <p>Among the distinctive performance factors, cooperative inclination, teacher's training and market share are the top three important criteria.</p>	Multi-criteria decision-making (MCDM), McCall software quality Model.	Enterprise resource planning (ERP) system & fuzzy analytic hierarchy processes (FAHP).
11.	Corporate	Lack of weights.	Chin-Tsai Lin et al. 2011	<p>ANP and TOPSIS are used to calculate the weight and give suppliers a ranking; LP effectively allocates order quantity to each vendor.</p> <p>As to the result, four PC board suppliers are given orders for 1200, 727, 1000 and 73 pieces.</p>	ERP model	ANP, TOPSIS, & LP.
12.	Central	Lack of functionality	P. Soffer et al. 2003	The generic process and detailed criteria developed, can serve for comprehensive ERP modeling, as well as for obtaining a model of other process-supportive off-the-shelf systems that are of generic and configurable nature.	Object-Process modeling (OPM) Methodology	generic ERP modeling
13.	Central	Lack of cultural barriers.	M.C. Jones et al. 2006	Developed a cultural configuration that shows the dimensions of culture that best facilitate knowledge sharing in ERP implementation.	Knowledge sharing	Literature review.

				The results also indicate ways that firms may overcome cultural barriers to knowledge sharing. Possible research questions on which future research can be based are also identified.		
14.	Central	Lack of erp architecture.	Edward E. Watson 1999	This paper identifies opportunities for incorporating the ERP body of knowledge into an IS program. This paper focuses on curriculum that is enriched through the hands-on experience gained by students working on a real ERP system. The paper also discusses related topics such as costs and critical success factors.	ERP Systems KnowDule (Knowledge Module).	SAP R/3 System
15.	Central	Lack of strong and committed leadership.	S. Sarker, A.S. Lee, 2003	In a longitudinal positivist case study, it is found that, while all three enablers may contribute to ERP implementation success, only strong and committed leadership can be empirically established as a necessary condition.	A critical embedded single-case design	ERP enablers
16.	Central	Lack of determinant factors.	Man-Kit Chang et al. 2008	Research results show that social factors are the most significant determinant affecting the ERP system usage. Other factors such as compatibility and near-term consequences are also significant. Based on findings, it is also proposed some important managerial implications in connection to promoting the usage.	conceptual model derived from the Triandis framework.	ERP system.
17.	Central	Lack of Organizational change	G. Buonanno et al. 2004	Companies seem to be disregarding ERP systems as an answer to their business complexity. SMEs disregard financial constraints as the main cause for ERP system non-adoption, suggesting structural and organizational reasons as major ones.	Questionnaire	Conceptual framework.
18.	Central	Lack of technical knowledge	Xin Chan et al. 2002	ERP solutions are an integral part of the emerging Digital Economy, not just as a precursor or back-office component, but as a foundation or trampoline for multinationals to avail themselves of new technologies (I.T. related or others). Recent studies and analysis suggest other avenues to explore in order to increase	I.T. software projects of ERP solutions.	Digital Economy

				implementation success rate.		
19.	Central and Corporate	Lack of national differences and cultural issues	C. Sheu et al. 2004	<p>The findings confirm that national differences affect multinational ERP implementation practices. The findings suggest that language, culture, politics, government regulations, management style, and labor skills impact various ERP implementation practices at different countries.</p> <p>Understanding such effects will enable companies to be more proactive in planning project budget and duration.</p>	Case study and secondary data research method .	Data analysis & Research validity tests.
20.	Core	Lack of project perspective	Michael Rosemann, Jens Wiese, 1999.	<p>The implementation process is evaluated.</p> <p>Balanced Scorecards are typically designed to monitor business processes.</p> <p>It focuses in most cases on only one process -implementation.</p> <p>As far as possible the Balanced Scorecard functionality within ERP software will be used to realize an IT-based solution.</p>	BSC (Balanced Scorecard) approach	ERP Software
21.	Core and Central	Lack of particular focus on resources.	Helmut Klaus et al. 2001	<p>The term ERP suggest the outcome of the historical development process; yet this process has some discontinuity, and it would be erroneous to assume that ERP literally means enterprise-wide planning of resources.</p> <p>Thus, Thomas Davenport (Davenport 2000) and Laudon and Laudon (Laudon and Laudon 2000) have argued strongly in favour of replacing the term ERP with Business Systems. This would also take into account that these systems are universal and not limited to manufacturing installations.</p>	Historical analysis and Meta Analysis.	IS literature & MIS of ERP
22.	Central	Lack of projects	Päivi Iskanius 2009	<p>This study presents experiences that are obtained in case studies in which three SME companies were drawn an ERP project risk analysis and characteristics analysis.</p> <p>The critical risks of the ERP projects have been identified and assessed.</p> <p>By using characteristics analysis method, the recommendations of how to divide the ERP projects into manageable sub projects have</p>	Characteristics analysis method	Case study

				been given.		
23.	Central	Lack of research in ERP area.	Majed Mashari Al-Mashari 2003	This paper has presented a survey of research relating to some major ERP issues. The paper has illustrated a taxonomy of ERP research that is believed to be covering the major issues in this important field.	Literature review	ERP Modules
24.	Collaborative	Lack of competitiveness.	Injazz J. Chen 2001	Study identifies new windows of opportunities as well as challenges facing companies today. Analyzes several critical planning issues and choosing a right ERP system.	Literature review	ERP System
25.	Central	Lack of information	S.-W. Chien, S.-M. Tsaur 2007	The results indicated that technological newness was the most important factor in determining the quality of the system. The pursuit of state-of-the art technology is a risky proposition. Proposed a success model & empirically tested the relationships between variables.	Data analysis	ERP System Model
26.	Central	Lack of repair & maintenance.	P. Mandal, A. Gunasekaran 2003	In summary, as part of the new ERP implementation process a review of the legacy systems were carried out. It was found that repair was not cost effective and replacement was the only option. system was tested, business rules promulgated, processes documented, data converted over, staff training organized and run, and it went live on time.	Case study	SAP-PS Module
27.	Central	Lack of SMEs.	D.L. Olson, B. Chae and C. Sheu 2005	Multinational ERP implementations radically change organizational information systems. Careful planning of how to implement ERP systems is needed in multinational environments in order to identify the best ERP design and the best redesign of business processes.	Case study	SCM & ERP System
28.	Central	Lack of risk management in ERP implementation.	Dr. Bernard Wong, David Tein 2003	The findings include a list of 23 unique Critical Success Factors identified throughout the literature, which we believe to be essential for Project Managers. Identifying the CSFs of an ERP implementation is paramount to ensure the success of the project.	Literature survey	ERP Project

29.	Central	Lack of distinction	Lars Brehm et al. 2000	ERP packages do not fit cleanly into the custom/off-the shelf distinction. Describes a portfolio of tailoring options between configuration and modification, with important implications for implementation risk and the difficulty of ERP system upgrades.	IS literature	ERP software
30.	Central	Lack of organizational culture impact	Z. Zhang et al. 2005	This study develops an ERP implementation success framework by adapting the Ives et al. information systems (ISs) research model and DeLone and McLean's IS success model to identify both critical success factors and success measures. Atlas/ti program is used to facilitate data analysis.	Literature review / Qualitative case study research methodology	DeLone and McLean's IS success model
31.	Central	Lack of misses /hits & errors.	Maarten A.S. Boksem et al. 2006	No correlations were found between BIS and Pe amplitude or between BAS and ERN/Ne amplitude. Results are discussed in terms of individual differences in reward and punishment sensitivity that are reflected in error related ERP components.	Behavioral Activation System/ Behavioral Inhibition System (BIS/BAS) scales.	error related negatively (ERN/Ne) factors. ERP analyses & Data Analysis.
32.	Central	Lack of study research	Mohamad Mohsen. Sedighi et al. 2012	This study tries to define a proper conceptual model for ERP-implementation in agile organizations. It is also endeavored to propose a method for prioritizing these phases and effectively assess agility during ERP lifecycle.	ERP lifecycle phases	Conceptual model
33.	Central	Lack of multidimensional variable	Guy Janssens et al. 2008	Logical clusters of ERP project activities can be used in further research to find variables for defining the size of an ERP implementation project.	Literature survey	ERP projects
34.	Central	Lack of training.	Valerie Botta-Genoulaz et al. 2005	A classification of company positions regarding their ERP use, based on both software maturity and strategic deployment directions, and an improvement process are proposed. Total 3 surveys and 5 stages have been found out while implementation of ERP.	The survey questionnaire	ERP Systems & projects.

35.	Central	Lack of selection criteria.	Wen-Hsien Tsai et al. 2012	Developed a conceptual framework for investigating how ERP selection criteria are linked to system quality and the service provided by suppliers and consultants, and thus how these influenced ERP implementation success. Study also suggested that enhanced system quality and service quality could increase user perspective and ERP success.	Cross-sectional survey	Conceptual framework
36.	Central	Lack of ES implementation	J. Ward et al. 2005	The findings from the case studies suggest that the framework can help understand how different approaches to managing ES implementations both address and influence the behaviors of key interest groups and hence the achievement of the benefits expected from the investment.	Case studies	Framework (ERP)
37.	Collaborative	Lack of engg. Integration & approach.	Boonserm K. et al. 2000	<i>This paper illustrates the requirements of information models.</i> Presents an integration approach.	Functional approach	ERP Integration
38.	Collaborative	Lack of MDBM concept	J.A. Gulla, T. Brasethvik 2002	Dynamic and adaptable business models constructed as part of the implementation project. Discussed how the linguistic part and the modeling part of MDBM mutually support each other.	model-driven business management (MDBM) approach	SAP R/3
39.	Central	Lack of efficient maintenance	O.B. Kwon et al. 2001	Proto type agent system is proposed. How the changes will affect an ERP performance.	Multi agent intelligent technology	ERP/ PN Database
40.	Central	Lack of maintenance	J.L. Salmeron, C. Lopez 2010	The maintenance of the ERP is necessary to correct and prevent systems failures as well as to enhance its performance and adapt continuously to the system. Risk factors identified and analyzed. The most important hazards in ERP maintenance are the cooperation and commitment of ERP users and managers.	analytic hierarchy process (AHP) methodology	(ERP) systems

Table 4 :
An Extended Literature : The reduced construct and barrier item of an ERP Construct:-

Construct	Barrier(ERP)	Literature
Process „Jacques Verville et al. al.(2005).	Lack of perfection , lack of software acquisition process & complexities and lack of the reactivity of the planning system	Ike C. Ehie et al.(2005) (2003)and Claire Berchet et
Product al.(2003), „Richard A. Wysk et Souleiman Naciri et al.(2011)	Lack of predetermined corporate goals, lack of organizational information and Lack of Structured GPM data.	Elisabeth J Umble et al.(2000) and
Man O’Leary (2005)	Lack of data models	Daniel E.
Method al.(2009) and et al. (2009)	Lack of Multi-method analysis and lack of conceptual framework	Chris Clegg et Petri Hallikainen
Factors al.(2012), AminAmid Riccardo Dulmin et al. (2012)	Lack of risk assessment, lack of data analysis , lack of approach and lack of CSFs .	Davide Aloini et et al.2012), and Joseph
System al.(2005), Daniel E. O’Leary ,et al. al.(2011), Juha-Pekka K et al. (2011), Wen-H.Tsai et al. „Jones et al.(2006), Andreas I. Man-Kit Chang et al.(2008), al.(2010), Clyde W. Holsapple Amoako-Gyampaah et al.(2004), al.(2009), I. Kwasi A.G.(2007), Yoon T. Srivardhana et al.(2007), Y. al.(2011), Oana Velcu (2010).	Lack of Enterprise-wide organizational issues , Lack of Security and reporting issues, lack of acceptance factors, lack of adoption on firm, lack of challenges, lack of system performance, lack of cultural barriers, lack of theoretical bases and inter organizational relationships , lack of social factors, lack of study’s findings for IS, lack of decision support benefits for ERP system, technology implementation, lack of decision making approach, lack of usage & usefulness of the system, lack of OCBs, lack of sustained innovation, behavioral aspects of ERP systems adoption, lack of interdependency.	John Ward et (2005), Adam R et (2011), Jim O.Otieno (2011), Mary C Nicolaou (2008), Princely Ifinedo et et al.(2005), Kwasi E. Ertugrul K. et Cheolho (2009), Hwang et
Analysis al.(2005), Boo Young Chung et al.(2008), Mabertl et al.(2006) .	Lack of good vendors(foreign ERP vendors have failed), lack of critical factors, lack of augmentation .	Y. Xue et Vincent A.
Issues al.(2004).	Lack of contextual issues.	H. Liang et

Industry / O’Leary (2004), V. Chapurlat et al.(2008),	Lack of ERP systems benefits, lack of	Daniel E.
Enterprise/ Firm al.(2010).	activities, lack of firm competences.	Yi-fen Su et
Test al.(2010), Eric T.G. Wang et al. (2006).	Lack of post-implementation success,	Yan Zhu et
	Lack of group cohesion .	
Project (2008), Chun-Chin Wei et al.(2004)	Lack of consulting fees, lack of hierarchical attribute structure .	M. Plaza et al.

Table 5: Contributions – ERP Barriers

<i>Contributions</i>	<i>Author(s) with year</i>
Coping with ERP-related contextual issues in SMEs: a vendor’s perspective.	H. Liang, Y. Xue et al., 2004
Aligning ERP implementation with competitive priorities of manufacturing firms: An exploratory study.	H.R. Yen, C. Sheu, 2004
Enterprise systems, knowledge transfer and power users. An extension of the technology acceptance model in an ERP implementation environment.	O. Volkoff et al.,2004 K. Amoako-Gyampah, A.F. Salam, 2004
‘Best’ for whom? : the tension between ‘best practice’ ERP packages and diverse epistemic cultures in a university context.	E.L. Wagner, S. Newell, 2004
Aligning an ERP system with enterprise requirements : An object-process based approach.	P. Soffer et al., 2005
Going beyond ‘misfit’ as a reason for ERP package customization.	B. Light, 2005
Exploring knowledge sharing in ERP implementation: an organizational culture framework.	M.C. Jones et al., 2006
Information technology and systems justifications : A review for research and applications.	A. Gunasekaran et al., 2006
Effects of internal support and consultant quality on the consulting process and ERP system quality.	E.T.G. Wang, J.H.F. Chen, 2006
The impact of enterprise systems on corporate performance: A study of ERP, SCM, and CRM system implementations.	K.B. Hendricks et al., 2007
ERP systems as an enabler of sustained business process innovation : A knowledge- based view.	T. Srivardhana, S.D. Pawlowski, 2007
The role of readiness for change in ERP implementation: Theoretical bases and empirical validation.	K.-Y. Kwahk, J.-N. Lee, 2008
ERP II : The involvement, benefits and impediments of collaborative information sharing.	S.C.L. Koh et al., 2008
A practical model on controlling the ERP implementation risks.	A. Hakim, H. Hakim, 2010
An empirical investigation of the impacts of internal/external facilitators on the project success of ERP : A structural equation model .	W.-H. Tsai et al., 2011
Drivers, barriers, and critical success factors for ERP II implementation in supply chains : A critical analysis.	S.C.L. Koh et al., 2011
Analysis of information integration benefit drivers and implementation hindrances.	Y. Kang et al., 2012
Coding-error based defects in enterprise resource planning software: Prevention, discovery, elimination and mitigation.	I. Woungang et al., 2012
Identification and classification of ERP critical failure factors in Iranian industries.	A. Amid et al., 2012
Relationship bonding for a better knowledge transfer climate : An ERP implementation research.	W.-H. Hung et al., 2012

Table 6 : Details of Literature Review for above Table 5 :

Technique(s)	Proponent(s)	Methodology	Application(s)
Dialectic and cultural perspective	H. Liang, Y. Xue et al.	Case research method, UF Soft method .	1) It explores how vendor activities can improve ERP implementation success in the context of China's ERP market. 2) Use of ERP-U8 in Industry.
Direct observation and systematic interviews	H.R. Yen, C. Sheu .	Case research method	1) Used in data integration. 2) Application in ERP implementation cases.
KT (Knowledge Transfer) ES-Enterprise System KT	O. Volkoff et al.	Multiple case study approach & cross-case analysis	1) Power users –super users (employees). 2) Training and personnel transfer. 3) Helps (applied) in overcoming barriers.
Meta analysis of TAM(Technology Acceptance Model) research.	K. Amoako-Gyampah, A.F. Salam	Empirical and theoretical support .	1) Both training and project communication influence the shared beliefs. 2) Shared beliefs influence the perceived usefulness and ease of use of the technology.
Epistemic cultures	E.L. Wagner, S. Newell	Interpretive research; Longitudinal research.	ERP development alliance between Ivy and Vision resulted in a 'best practice' product which is being marketed on the vendor's international web site as their 'higher education industry solution' appropriate for universities across cultural and geographical contexts.
An iterative alignment process-Algorithm.	P. Soffer et al.	Object-Process Methodology (OPM)	1) The alignment algorithm has been tested in an experimental study. 2) Results demonstrate the ability of the approach to provide a satisfactory solution to the problem of aligning an ERP software package with an enterprise business model.
Customization	B. Light	<i>Case studies of the customization of ERP packages.</i>	1) Facilitate a smoother implementation. 2) Reduces the number of staff in that area – thus reducing costs. 3) Adds value to the ERP package.
Conceptual research	M.C. Jones et al.	Multisite case study	1) It indicates ways that

model			firms may overcome cultural barriers to knowledge sharing. 2) A model is developed.
Analytic approaches and the associated tools and techniques.	A. Gunasekaran et al.	A literature review	1) Assemble meaningful information for the development of a framework for IT/IS evaluation. 2) Better reflects the new business environment.
Conceptual background and the research model.	E.T.G. Wang, J.H.F. Chen	ERP consulting process	1) Measures 2) Data Analysis 3) Top Management & User Support.
Different enterprise systems (ES)	K.B. Hendricks et al.	Pre implementation & Post implementation period-ERP Systems.	1) Documents the effect of investments in ERP, SCM & CRP. 2) Application in SCM system.
A theoretical framework	T. Srivardhana, S.D. Pawlowski	Conceptual model	1) The model highlights areas where active management has potential to enhance the capabilities of a firm for sustained innovation of its business processes.
Structural equation analysis	K.-Y. Kwahk, J.-N. Lee	Research model & hypotheses	1) Analysis was conducted to assess the psychometric properties of the scales. 2) Model testing
Joint ventures, networks and Japanese-style 'purchasing partnership' & Sampling technique.	S.C.L. Koh et al.	Primary Data, Secondary Data & Literature Survey	1) Collaboration 2) Focus application deployment on the management of critical relationships and key performance metrics. 3) Deploy internal processes and enterprise systems 4) business intelligence framework
Proposed model & strategic modeling	A. Hakim, H. Hakim	Qualitative and interpretive case study	1) Beneficial for the organization. 2) ERP as the corporate strategic objective.
Statistics/ Statistical technique.	W.-H. Tsai et al.	Project Management & causal relationship of the SERVQUAL.	1) Integrated into the implementation and measured by the application of the service quality (SERVQUAL). 2) Facilitator.
ERP II, collaborative networks, and the extended enterprise.	S.C.L. Koh et al.	Grounded theory methodology	1) Combination of descriptive and exploratory study. 2) The results obtained are analyzed to identify the drivers and barriers

			for the ERP II implementation, critical success factors for ERP II implementation and future trends of ERP.
Information integration opportunity assessment tool (IOP tool).	Y. Kang et al.	Algorithm in the IOP Tool, RT 258	1) For locating Market/legal hindrances 2) Organizational and process hindrances
Coding /codification	I. Woungang et al.	The survey-based methodology	1) Testing, auditing and tracking. 2) In various experiments.
Robust Exploratory Factor Analysis (EFA)	A. Amid et al.	Conducting semi-structured interviews, instrument development, data collection and data analysis using robust EFA	1) Discovers patterns of multidimensional constructs. 2) Data interpretation and empirical results.
Transfer model	W.-H. Hung et al	Literature review and hypotheses	1) To integrate. 2) Bonding 3) Relationship bonding in ERP implementation.

Table 7 : Frequency of Barriers of ERP from various Journals :

Author(s)	Journal(s)	How many	
		1	2
Ike C. Ehie , Mogen Madsen, 2005	<i>Computers in Industry 56 (2005) 545–557</i>	✓	
Huigang Liang, Yajiong Xue, 2004	<i>International Journal of Production Economics, Volume 97, Issue 3, 2004 & The Journal of Strategic Information Systems, 2004 – Elsevier.</i>		✓
Elisabeth J Umble ^a , Ronald R Haft, M. Michael Umble, 2003	<i>European Journal of Operational Research 146 (2003) 241–257</i>	✓	
Ramin Vandaie 2008	<i>Knowledge-Based Systems 21 (2008) 920–926</i>	✓	
Davide Aloini , Riccardo Dulmin , Valeria Mininno, 2012	<i>European journal of operational research, 2012 and Business Process ... , 2012</i>		✓
Amin Amid, Morteza Moalagh, Ahad Zare Ravasan, 2011	<i>Information Systems, 2011 - Elsevier</i>	✓	
Yi-fen Su, Chyan Yang	<i>Expert Systems with Applications Volume 37, Issue 1, January 2010.</i>	✓	
Yajiong Xue ^a , Huigang Liang ^b , William R. Boulton ^c , Charles A. Snyder , 2005	<i>International Journal of Production Economics Volume 97, Issue 3, September 2005</i>	✓	

Vincent A. Mabert1, Ashok Soni, M.A. Venkataramanan 2006.	<u>Mathematical and Computer Modelling</u> Volume 44, Issues 1–2, July 2006	✓	
Salvador Bueno, Jose L. Salmeron 2008	Interacting with Computers, 2008 – Elsevier	✓	
Yan Zhu, Yan Li, Weiquan Wang, Jian Chen 2010	International Journal of Information ..., 2010 - Elsevier	✓	
Mary C. Jones, Melinda Cline, Sherry Ryan, 2006	Decision Support Systems, 2006 Volume 41, Issue 2.	✓	
Wen-Hsien Tsai et al. 2012	Decision Support Systems <u>archive</u> Volume 50 Issue 2, January, 2011	✓	
1. Boo Young Chung 2. Mirosław J. Skibniewski 3. Henry C. Lucas Jr.; & 4. Young Hoon Kwak 2008	JOURNAL OF COMPUTING IN CIVIL ENGINEERING © ASCE / NOVEMBER/DECEMBER 2008	✓	
S.C.L. Koh et al.	International Journal of Production ..., 2008 – Elsevier and <u>International Journal of Production Economics</u> Volume 113, Issue 1, May 2008, Pages 245–268		✓
A. Hakim, H. Hakim	Information Systems, 2010 – Elsevier.	✓	

Table 8: Details of Literature Search :

Review Period	Time	Search Engines	Primary Keywords	Secondary Keywords	Secondary Keywords
				Keywords Group:1	Keywords Group:2
From 1992-1997		ScienceDirect	Enterprise Resource Planning	ERP Database	ERP Solution
From 1998-2002		ScienceDirect	Enterprise Resource Planning ERP systems, Organizational fit.	ERP, Business Modeling, Process model, Returned materials, Process adaptation.	SAP, Integration and performance, SAP R/3, Organznl. Resistance.
From 2003-2008		ScienceDirect & Googlescholar	Enterprise Resource Planning, ERP system, Information systems, TAM (Technology Acceptance Model), Manufacturing firms, ERP failure, ERP implementation,	ERP, BPR, Improvement, Implementation, ERP systems implementation, Linguistic modeling, Review, Operations strategy, Decision	Survey, Organizational issues, Case study, Critical success factors, Information processing, SME, Optimization, Case studies, Simulation Case research, AHP,

		Benefits, Organizational knowledge sharing, Organizational innovation, Survey data, Logistic models, Knowledge transfer, Perceived usefulness, Risk management, ERP benefit, Case study, Enterprise application integration, Supply chain management, Information system, Enterprise system implementation, Technology adoption, Enterprise modeling Verification.	analysis, Training, System integration Manufacturing, Success factors, Information systems, Operations management, Project mgmt., Survey methodology, Questionnaire survey, Risk mgmt. Historical perspective, Decision support, Critical success factors, Organizational culture, Balanced scorecard, IS/IT selection, Packaged software User participation, Logistic models, Regression analysis, Discriminate analysis, Users' absorptive capacity, Ease of use, Literature analysis, Segment, Supplier evaluation, Consistency, Lifecycle, Erp systems, Planning process, MRP activity, Orgnzl. Knowledge mgmt., Triandis model, Validation, Certification.	Information system , Communication, Healthcare, Rolls-Royce, Frameworks, Alignment, Implementation procedures, Logistic regression models, Swedish industry, Social-cultural perspective, Ensemble view, Impacts, Objectives, Literature review, ERP, Delphi method , Customization, Systems integration, Data envelopment analysis(DEA), Organizational support, Users' performance of ERP usage, Technology acceptance, User involvement, ERP life-cycle, Risk assessment, Rough set theory, Contract negotiation, Contractor, Infrastructure, Delphi study, Firm processes, Firm performance, Tacit knowledge, Survey Qualification.
From 2009-2012	ScienceDirect & Googlescholar	Enterprise Resource Planning, ERP system(s), Maintenance, SCM, Decision making, Coding defects, Generic product model (GPM), ERP system, Fuzzy AHP, ERP project, Information system, ERP, CSFs, Project preparedness, Risk factors inter-dependence, Technology adoption, Imitation.	ERP/II, ERP Barriers ERP systems, ERP suppliers, ERP consultants, MCDM, Risks taxonomy, Advanced resource planning, System performance, BI, Multi agent systems(MAS), Defect reduction, ERP market, ERP vendors, Management data Critical failure	Selection criteria, Supplier selection, AHP Hierarchy, SEM, Stochastic models, System vendor, Implementation consultant , Petri Nets(PN), Software selection Software testing, ERP selection model, Grounded theory, Information sharing, RFP(Request for proposal), Robust Exploratory factor

			factors(CFFs), Selection phase, Delphi, Customization, ERP, Petri Nets, Construction industry, Implementation problems , Measurement model, ERP post- implementation success, Risk Assessment, ERP.	analysis(REFA), Shannon Entropy, Maintenance and support, Software patches, MCDM, Analytical hierarchy process, Risk interdependencies Multi-criteria, Collective case study, ERP system success constructs Structural equation modeling, ISM Interpretive Structural Modeling, Diffusion of innovation theory.
--	--	--	--	---

Table 9 : Summary of the barriers for effective implementation of ERP :

Barrier Code	Description of Barrier	References	Total of References #
B1	Lack of perfection for effective implementation. Lack of software acquisition process and complexities. Lack of the reactivity of the planning system.	Ike C. Ehie ,Mogen Madsen, 2005 Jacques Verville, Alannah Halington ,2003 Claire Berchet,Georges Habchi , 2005	3
B2	Lack of the reactivity of the planning system . Lack of Structured GPM data. Lack of organizational barriers.	Elisabeth J Umble ^a , Ronald R Haft, M.Michael Umble,2003 Souleiman Naciri et al.,2011 Boonserm Kulvatunyou, Richard A. Wysk, 2000	3
B3	Lack of Contextual issues.	Huigang Liang, Yajiong Xue, 2004	1
B4	Lack of management of knowledge	Ramin Vandaie , 2008	1
B5	Lack of approach & risk assessment. Lack of Critical success factors. Lack of data analysis.	Davide Aloini, Riccardo Dulmin ,Valeria Mininno,2012. Joseph Bradley, 2008. AminAmid, Morteza Moalagh, Ahad Zare Ravasan,2012.	4
B6	Lack of ERP systems benefit . Lack of firm competences	Daniel E. O'Leary,2005 Yi-fen Su, Chyan Yang, 2010	2

B7	Lack of data models	Daniel E. O'Leary, 2005	1
B8	Foreign ERP vendors have failed (lack of good vendors) Lack of augmentation. Lack of critical factors	Yajiong Xue, Huigang Liang William R. Boulton ^c , Charles A. Snyder , 2005 Vincent A. Mabert ¹ , Ashok Soni, M.A. Venkataramanan 2006. Boo Young Chung , Miroslaw J. Skibniewski, Henry C. Lucas Jr.; & Young Hoon Kwak, 2008	3
B9	Lack of passive learning	DESHPANDE, AMIT A. ,2008	1
B10	Lack of complementary control	Severing V. Grabski ^a , Stewart A. Leech, 2007	1
B11	Lack of multi-method analysis. Lack of conceptual framework. Lack of both imitative and logical evaluation forces .	Craig Shepherd ¹ ,Chris Clegg ² and Chris S tride ²⁰⁰⁹ Petri Hallikainen , Hannu Kivijärvi , Markku Tuominen ^b 2009 Vincent S. Lai,Connie K.W. Liu, Fujun Lai, Jian Wang , 2010	3
B12	Lack of group cohesion Lack of post-implementation success.	Eric T.G. Wang, Ta-Chung Ying, James J. Jiang, Gary Klein,2006 Yan Zhu, Yan Li, Weiquan Wang, Jian Chen , 2010	2
B13	Lack of decisive factors	Salvador Bueno, Jose L. Salmeron 2008	1
B14	Lack of engines of economic growth.	Helena Lenihan , 2011	1
B15	Lack of consulting fees. Lack of hierarchical attribute structure.	Malgorzata Plaza ^s ,Katrin Rohlf 2008 Chun-Chin Wei, Mao-Jiun J. Wang , 2004	2
B16	Lack of activities	V. Chapurlat, C. Braesch 2008	1
B17	Lack of modeling & ERP's system functionality.	Pnina Soffer,.Boaz Golany, Dov Dori 2003	1
B18	Lack of business, cultural and technical issues.	Yahaya Yusuf, A Gunasekaran, Mark S Abthorpe 2004	1
B19	Lack of cultural barriers Lack of expert tool.	Mary C. Jones, Melinda Cline, Sherry Ryan, 2006 M. Ghazanfari ,M. Jafari ,S. Rouhani, 2011	2
	Lack of acceptance factors. Lack of theoretical bases and inter- organizational relationships. Lack of challenges. Lack of social factors.	Adam, R ,Van der Merwe, A 2011 Andreas I. Nicolaou , 2008 Jim Odhiambo Otieno, 2011 Man-Kit Chang, Waiman	

B20	<p>Lack of study findings for IS</p> <p>Lack of decision support benefits from an ERP system.</p> <p>Lack of technology implementation. Lack of decision making approach . Lack of adoption on firm.</p> <p>Lack of ES(Enterprise-wide Systems) organizational issues .</p> <p>Lack of usage and usefulness (of the system). Lack of OCBs(Organizational Citizenship Behaviors).</p> <p>Lack of security and reporting issues.</p> <p>Lack of sustained innovation.</p> <p>Lack of behavioral aspects of ERP systems adoption. Lack of system performance.</p> <p>Lack of interdependency.</p>	<p>Cheung, Chun-Hung Cheng and Jeff H.Y. Yeung ,2008 Princely Ifinedo, Birger Rapp, Airi Ifinedo, Klas Sundberg2010</p> <p>Clyde W. Holsapple, Mark P. Sena, 2005.</p> <p>Kwasi Amoako-Gyampah, , A.F. Salam , 2004 E. Ertugrul Karsak, C. Okan Özogul, 2009 Juha-Pekka Kallunki Erkki K. Laitinen', Hanna Silvola 2011</p> <p>John Ward, Christopher Hemingway, Elizabeth Danie, 2005</p> <p>Kwasi Amoako- Gyampah , 2007 Cheolho Yoon , 2009</p> <p>Daniel E. O'Leary, M. Lynne Markus,Bentley College, 2005</p> <p>Thongchai Srivardhana, Suzanne D. Pawlowski ,2007</p> <p>Yujong Hwang, Delvin Grant , 2011 Wen-Hsien Tsai,et al., 2011.</p> <p>Oana Velcu ,2010</p>	17
------------	--	---	-----------

Table 10 : Classification of Literature Review Research Paper :

S.N.	Author (Year)	Research Methodology	Samples	Industry	Country	Research Objective/ Focus	Main Findings/ CSFs
1.	Ike C. Ehie, Mogen Madse n, 2005	A five-stage ERP implementation process. (1) the retest method, (2) the alternative form method, (3) the splithalves method,	200 questionnaires. e.g. Unisource Worldwide, Inc. The Earthgrains Company . IBM, DaimlerBenz and Chrysler	200 ERP Softw are indust ries.	U.S.A.	The objective is to determine the extent to which the identified critical factors correlate with ERP implementation.	The study reveals that about 86.3% of the variances in ERP implementation were explained by the critical factors identified in the study.

		and (4) the internal consistency method [36].	Etc.				
2.	Jacques Verville, Alannah Halingten , 2003	ERP Software Acquisition Process.	It is not generalizable to a larger population .	50 China Industries.	China	To depict the principal processes that pertain to the acquisition of packaged software.	Presented a model of the ERP software acquisition process (MERPAP) that reflects the findings from the four cases examined in this study.
3.	Claire Berchet, Georges Habchi , 2005	Five-stage deployment model	System based on performance indicators.	Alcatel	France	To develop a control helping system based on performance indicators.	A detailed model of the planning process is built. Outline the main results obtained at Alcatel in a general way, and describe the risks, the dysfunctions , and the reasons for them.
4.	Elisabeth J Umble ^a , Ronald R Haft, M.Michael Umble , 2003	Case study	Multi-site issues.	Huck International , Inc.	U.S.A.	The objective is to see why and how Implementation of ERP fails?	This article identifies success factors, software selection steps, and implementation procedures critical to a successful implementation
5.	Souleyman Naciri et al. 2011	GPM(GenericProduct Model.	Two case studies	Hitachi Company	Switzerland.	To establish framework and to collect Structured GPM data.	The proposed framework enables data management contained in flat Excel Files to be translated into

							structured GPM data.
6.	Boonserm Kulvatanyou, Richard A. Wysk, 2000	Information Models.	Integrated Product and Process Data (IPPD)	Product and Processes Industry	U.S.A.	To present an integration approach between product and process.	Product quality will be high and cost will be low. The dynamics of the engineering process will be illustrated using these models.
7.	Huigan Liang, Yajiong Xue, 2004	Case research method-ERP Vendor, UF Soft.	Issues/ERP vendor.	China industries.	U.S.A.	To achieve the fit between ERP system and adopting organizations.	Analyzes Contextual Issues. Reveals 3 Strategies.
8.	Ramin Vandaele, 2008	Cross-functional and cross-divisional transfer of knowledge.	Knowledge-based view of ERP projects.	Enterprise system life cycle	Canada	To examine the application of organizational memory in ERP knowledge management.	This paper identifies two major areas of concern regarding the management of ERP knowledge.
9.	Davide Aloini, Riccardo Dulmin, Valeria Mininno, 2012	A PetriNet Approach.	Dependence impact class of risk factors.	Interdependence Industry	Italy	To show how Colored Petri Nets (CPNs) can be used to model risk factors in ERP projects.	This work shows how colored Petri Nets (CPNs) can be used to model risk factors in ERP projects.
10	Amin Amid, Morteza Moalagh, Ahad Zare Ravasani, 2012	Data analysis.	CFFs-47 Critical Failure Factors.	Iranian industries	Iran	The main purpose of this study is to identify such factors and classify them to help other industries, consultants and implementers to prevent failures in the	47 failure factors were identified. Robust Exploratory Factor Analysis (EFA) has been used for data analysis

						implementati on of ERP projects.	
11	Davide Aloini, Riccardo Dulmin, Valeria Mininno, 2012	Classification & Analyze.	Innovative Technique - Risk Analysis	ERP Industry	Italy	To highlight the key risk factors and their impact on project success.	Literature was classified in order to address and analyze each risk factor and its relevance during the stages of the ERP project life cycle.
12	Joseph Bradley, 2008.	This study is a review of literature on ERP. (ABI Inform, Emerald, ScienceDirect and ACM Digital Library).	Based on the Classical Management Theory.	Case study companies	Moscow, ID, United States	To examine critical success factors for implementing Enterprise Resource Planning systems.	Project success. Integration of ERP planning with business planning.
13	Daniel E. O'Leary, 2005	ERP Database	Use of consultants	Deloitte Consulting	California, U.S.A.	To calculate the tangible and intangible benefits in case of industries.	Some benefits vary by industry. Statistically consistent. Tangible benefits are largely industry dependent.
14	Yi-fen Su, Chyan Yang, 2010	SEM (Structural Equation Modeling)	Model-process & hypotheses.	Taiwanese IT firms	Taiwan	To find out the Benefits derived from various integration process.	Beneficial impacts of ERP on the supply chain. Enhance firm competences of SCM.
15	Yajiong Xue, Huigan Liang, William R. Boulton ^c , 2005	Case study- • Historical perspective	Case studies from Chinese industry.	Chinese ERP Industry.	U.S.A.	To find the analysis of Factors for ERP implementation.	Chinese implementations are presented and analyzed. Eight factors are identified.

							Implications of the findings for future ERP implementations in China are discussed.
16	Vincent A. Mabert, Ashok Soni, M.A. Venkataraman 2006.	Field study Case studies & data collection	DEA & ERP Data Envelopment Analysis.	Of the 78 Responses, 77 had already implemented ERP Systems.	United States.	To analyze empirical data to verify hypotheses, calculate variances, and identify critical factors contributing to outcomes of interest.	Provide greater Insight. Each provides unique perspectives into the process and helps to develop a complete picture of the ERP landscape.
17	Boo Young Chung, Mirosław J. Skibniewski, Henry C. Lucas Jr.; & Young Hoon Kwak, 2008	DeLone and McLean DM IS success model	Success Factors-Research model	Construction Industry.	Korea & U.S.A.	The objective of this study was to identify and analyze critical factors that need to be considered to ensure successful ERP system implementation.	Perceived usefulness. 2) Subjective norm had a significant association with perceived usefulness.
18	DESH PAND E AMIT A., 2008	Motivation - based multi-source active learning methodology	Game based Learning – Simulation Game.	Learning.	U.S.A.	The objective is to led learning and collaborative learning through peer-to-peer interaction.	Constructivist learning by the use of simulation game.
19	Severing V. Grabski ^a , Stewart A. Leech, 2007	ERP implementation projects – Control modes	Projects & Survey.	ERP Software Industry.	Colorado USA.	To analyze & Control for the Implementation Of ERP.	A portfolio of control modes should be utilized. Complementary Controls.

20	Craig Shephard, Chris Clegg and Chris Stride, 2009	multi-method analysis	Statistical Analysis	ERP Software Industry & Consulting Industry.	UK	To provide useful recommendation for Practitioners in ERP industry.	Identified several constructs for inclusion in future studies of users' reactions to ERP systems.
----	--	-----------------------	----------------------	--	----	---	---

V. Research Method :-

The tool used for this research paper or the research methodology will be analytical hierarchy process (AHP). This methodology will be highly effective in finding out the barriers of ERP and finding their weights and finding out the consistency and determining the C.R. (Consistency Ratio).

Also AHP helps to resolve any ERP issue which may turn out to be a barrier if not attended. Thus AHP addresses this issue further and bring to the notice of ERP implementation team (expert). Basically AHP is a decision making process or one of the multi criteria decision making (MCDM) process which acts as the deterrent factor for this research work.

VI. Research Findings :

The findings of this literature review paper aims at providing the list of barriers of ERP while implementing it. Rigorous research has been done to do so. In all, total 200 papers have been referred and of the 200 papers, 51 papers were selected to carry out the research. The research shows that the barriers which are commonly observed are lack of many constructs, are mentioned in the given table 4. Analytic hierarchy process (AHP) has been used to calculate the pair wise combination of the barriers in and consistency ratio (CR) & consistency index (CI) can be calculated depending upon their constructs.

It is found that sometimes ERP implementation fails and sometimes it does not fail. There can be many more reasons for the failure of ERP implementation. These are the hindrances or barriers of ERP, so is the topic of research.

VII. Results and CONCLUSION :

The results show that the barriers which are common are internal factors and external factors in an enterprise and cannot be overlooked while implementing ERP. It shows that the barriers of ERP are mostly observed in large and in SMEs. The reasons for occurring the barriers while implementing ERP are because of many things which are cited in the Table 1- Barriers of ERP.

Thus conclusion is drawn that the barriers of ERP while implementing ERP can be avoided if and only if proper attention is taken. Various risk factors are involved in implementing it. These factors can be overcome by applying analytic hierarchical process which acts as the methodology for this literature review paper. Implementation of ERP is rigorous and costly process and it can be done at ease if these barriers are avoided.

VIII. Future scope (research) :

On this note, lot of research can be done as to why there have been barriers of ERP while implementing it? For the implementation of ERP, all types of industry is applicable-be it a software ,manufacturing or engineering or any other firm can be used.

As on today lot of research is done on implementing the ERP (or ERP implementation) but the research on the barriers of ERP is totally new and not much aware of. Hence there is a great scope for refining the research on this topic in future.

Acknowledgements:

I am always indebted to my research guide Dr.Santosh B. Rane who is a Professor in Sardar Patel College of Engineering (SPCE), Mechanical Engg.Dept. at Andheri (w), Mumbai. He has really guided throughout my research work and helped me frequently. I am always grateful to him. Secondly I am also thankful to my family since I was not sparing time for them. Also, I am very much thankful to referees for the favorable remarks given for this literature review paper. I thank all of them.

References

- [1] S. Shankarnarayanan, ERP systems—using IT to gain a competitive advantage, March 23, 2000.
- [2] C. Loizos, ERP: Is it the ultimate software solution, *Industry Week* 7 (1998)33.
- [3] C. Dillon, Stretching toward enterprise flexibility with ERP, *APICS—The Performance Advantage* (October)(1999)38–43.
- [4] S. Cliffe, ERP implementation, *Harvard Business Review* 77 (1) (1999)16–17.
- [5] T. Davenport, Putting the enterprise into the enterprise system, *Harvard Business Review* 76 (4)(1998)121–132 .
- [6] S. Langdoc, ERP reality check for scared CIOs, *PC Week* 15 (38)(1998)88.
- [7] G. Langenwalter, *Enterprise Resources Planning and Beyond Integrating Your Entire Organization*, St. Lucie Press, Boca Raton, FL, 2000.
- [8] C. Ptak, E. Schragenheim, *ERP: Tools, Techniques, and Applications for Integrating the Supply Chain*, St. Lucie Press, Boca Raton, FL, 2000.
- [9] C. Ptak, ERP implementation—surefire steps to success, *ERP World Proceedings*, August 1999.
- [10] J. Krupp, Transition to ERP implementation, *APICS - The Performance Advantage* (October)(1998) 4–7.
- [11] G. Langenwalter, *Enterprise Resources Planning and Beyond: Integrating Your Entire Organization*, St. Lucie Press, Boca Raton, FL, 2000.
- [12] D. McCaskey, M. Okrent, Catching the ERP second wave, *APICS—The Performance Advantage* (December)(1999) 34–38
- [13] T. Minahan, Enterprise resource planning, *Purchasing* 16 (1998)112–117 .
- [14] H. Oden, G. Langenwalter, R. Lucier, *Handbook of Material and Capacity Requirements Planning*, McGraw-hill, New York, 1993.
- [15] O. Volkoff, B. Sterling, P. Nelson, Getting your money_s worth from an enterprise system, *Ivey Business Journal* (1)(1999)54–57.
- [16] Ike C.Ehie, Mogens Madsen; Identifying critical issues in enterprise resource planning (ERP) implementation, *Computers in Industry*(2005)
- [17] Chun-Chin Wei et al. ; An AHP based approach to ERP system selection , *Int. J. of Prod.Economics* 96 (2005) 47-62
- [18] Elisabeth J.Umble, Ronald R.Haft, M. Michael Umble ; Enterprise resource planning :Implementation procedures and critical success factors , *European Journal of Operations Research* 146 (2003) 241-247.
- [19] Zhe Zhang, Matthew K.O.Lee, Pei Huang, Liang Zhang, X. Zhang; A framework of ERP systems implementation success in China : An empirical study, *Int. J. of Production Economics*, (2005).
- [20] O.S. Vaidya, S.Kumar ; Analytic Hierarchy Process : An Overview of Applications, *European J. of OR* 169 (2006) 1-29.
- [21] Y. Xue, H. Liang, W.R.Boulton, Charles A.Snyder ; ERP implementation failures in China : Case studies with implications for ERP vendors, *Int. J. of Production Economics* 97 (2005) 279-295.
- [22] T.-H. Chang et al. ; Measuring the success possibility of implementing ERP by utilizing the Incomplete Linguistic Preference Relations , *Applied Soft Computing* 12 (2012) .
- [23] C. Macharis et al.; PROMETHEE and AHP: The design of operational synergies in multi criteria analysis, *European J. of O.R.*(2004).
- [24] G. Noci, G. Toletti; Selecting quality- based programmes in small firms :A comparison between the fuzzy linguistic approach and the analytic hierarchy process, *Int. J. of Production Economics* 67 (2000) 113-133.
- [25] M. Bevilacqua, M. Braglio ; The analytic hierarchy process applied to maintenance strategy selection, *Reliability Engineering and System Safety* 70 (2000) 71-83.
- [26] M. J. Liberatore et al. ; The analytic hierarchy process in medical and health care decision making – A literature review, *European J. of OR* (2008) 194-207.
- [27] M.K.Chen, S.C.Wang ; The critical factors of success for information service industry in developing international market – Using AHP approach., *Expert Systems with Applications* 37 (2010) 694-704.
- [28] E.K.Delice, Z.G.; The usability analysis with heuristic evaluation and analytic hierarchy process. , *International J. of Industrial Ergonomics* 39 (2009) 934-939 .
- [29] Wen – Hsien Tsai et al. ; An empirical investigation of the impacts of internal/external facilitators on the project success of ERP : A structural equation model , *Decision Support Systems* 50 (2011) 480-490.
- [30] H.R.Yen , C.Sheu ; Aligning ERP implementation with competitive priorities of manufacturing firms : An exploratory study, *Int. J. of Prod. Economics* 92 (2004) 207-220.
- [31] S. Lee et al. ; Using AHP to determine intangible priority factors for technology transfer adoption , *Expert Systems with Applications* 39 (2012).
- [32] Amin Amid et al. ; Identification and classification of ERP critical failure factors in Iranian industries , *Information Systems* 37(2012).
- [33] D. O’Leary, *Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce, and Risk*, Cambridge University Press, 2000.
- [34] A. Hawari, R. Heeks, Explaining ERP failure in a developing country: a Jordanian case study, *Journal of Enterprise Information Management* 23 (2) (2010) 135–160.
- [35] O.G. Kayas, et al., The panoptic gaze: analyzing the interaction between enterprise resource planning technology and organizational culture, *International Journal of Information Management* 28 (6) (2008) 446–452.
- [36] J. Lattin, J.D. Carroll, P.E. Green, *Analyzing Multivariate Data*, Thomson Learning, Inc., Publishing, California, 2003.
- [37] C. Holland, B. Light, A stage maturity model for enterprise resource planning systems use, *The DATA BASE for Advances Information Systems* 32 (2) (2001).