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AN EXPLORATORY STUDY OF VARIABLES INFLUENCING ENTERPRISE RESOURCE PLANNING (ERP) PERFORMANCE IN THE MANUFACTURING ENTERPRISES IN INDIA

M K Faseela[*1], N.Rajeev[2]
[*1] Department of Mechanical Engineering, NSS College of Engineering, Palakkad, Kerala 678008, India
[2] Department of Mechanical Engineering, NSS College of Engineering, Palakkad, Kerala 678008, India

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ABSTRACT
Enterprise Resource planning (ERP) is a software architecture that facilitates the flow of information among the different functions within an enterprise. ERP facilitates information sharing across organizational units and geographical locations. ERP implementation and its performance in enterprises are affected by many factors, known as critical success factors (CSF). These CSFs are identified from literature and they are classified into various categories such as technical, physical, economic, organizational, operational and contingency factors. Based on these a conceptual model for ERP performance is developed in this paper. The results provided details regarding the significant variables which influence the ERP performance of surveyed enterprises.

INTRODUCTION
ERP is a software package that attempts to integrate all departments and functions of a company onto a single computer system that can serve different department's needs. ERP began in the 1960s as material requirements planning (MRP) and, later, developed into a more advanced system called MRP II. Nowadays, the latest generation of ERP systems is more advanced and more effective in dealing with multiple business units including sales and operations planning, inventory/materials management, manufacturing, purchasing, order processing, accounting and finance, human resources, customer relationship management, and more. The failure rate of the ERP implementation will be increased if the factors affecting the ERP implementation are not taken into consideration. There are many factors that affect ERP implementation in an enterprise. These factors are known as Critical Success Factors. A number of empirical and non-empirical studies have addressed a variety of CSF for ERP implementation. Therefore this work focus on the study of the variables that affect the ERP performance of the manufacturing enterprises n India

The paper is organized into following sections. The paper is organized into following sections. Section 1 covers introduction followed by literature review in section 2.Section 3 covers objective scope and methodology of the work. Section 4 will cover the results and discussion and conclusions is mentioned in section 5. Finally references will be covered in section 6

LITERATURE REVIEW
This section presents review of available literature related to the CSFs for ERP implementation. The firms generally focused on managing CSFs to facilitate their implementation process in an attempt to achieve quicker benefits. Studies indicate that firms use CSFs to ensure success of their ERP system Implementations. Karakanian (1999), suggests that CSFs are an integral part of a firm's successful ERP systems deployment strategies. Bingi et al. (1999), emphasizes the importance of firms using a balanced mix of organizational and technical CSFs for ensuring successful ERP system implementations. The findings from their study suggests that firms focus on CSFs such as top management commitment, planning, alignment (reengineering firms' processes with those of the ERP system), consultants, skilled project team, implementation rollout strategy, employee buy-in, communication, cultural changes, data integrity, and training.

Sousa and Collado (2000), classify CSFs into four categories. The first one is organizational-strategic with CSFs like management support, organizational change management, project scope management, project team composition, business process engineering (BPR), user involvement, project champion, and trust between partners. The second category is organizational-tactical and comprises of CSFs such as dedicated staff and consultants, internal and external communication, formal project plan and schedules, training, preventive

maintenance, effective use of consultants, and empowered decision makers. The third one describes technological-strategic CSFs like implementation strategy, minimal customization, and relevant ERP version. The last category includes technological-tactical CSFs such as software configuration and legacy system knowledge.

After that Kyung-kwon hong & young–gul kim (2002), discussed critical success factors as an organizational fit perspective. In this they defined the concept of organizational fit of ERP and examined its impact on ERP implementation together with ERP implementation contingencies. The organizational fit of ERP include data fit, process fit and user fit and the contingency variables include ERP adaptation level, process adaptation level and organization resistance. The results from their study show that ERP implementation success depends on the organizational fit of ERP. Later Elisabeth J. Umble, et al. (2003), discussed ERP implementation procedures and critical success factors. In this CSF discussed are Clear understanding of strategic goals, Commitment by top management, Excellent project management, Organizational change management, a great implementation team, Data accuracy, Extensive education and training, focused performance measures and Multi-site issues. A case study of a largely successful ERP implementation is presented in this paper to discuss about the key factors.

This was followed by Jaideep Motwani, et al. (2005), who analyzed Critical factors for successful ERP implementation from four case studies. They developed the factors such as Strategic Initiatives, learning capacity, cultural readiness, information technology, leveragability and knowledge-sharing capability, network relationships, change management practice, process management practice. They concluded that Understanding such effects will enable managers to be more proactive and better prepared for ERP implementation Understanding such effects will enable managers to be more proactive and better prepared for ERP implementation.

Later Shih-Wen Chien and Shu-Ming Tsaur (2007), investigated the success of ERP system by conducting case studies in three Taiwanese high-tech industries. The updated DeLone and McLean model was applied to collect data from the questionnaires. This study suggests that system quality, service quality, and information quality are most important successful factors. Man kit change, et al. (2008), discussed about understanding ERP system adoption from the user's perspective. In this they developed a model to analyze the factors affecting the ERP implementation. They concluded that social factors are more significant in ERP implementation other factors such as compatibility and near-term consequences are also significant. The main factors they developed from the model are perceived consequences, which include near-term consequences, and long-term consequences, affect, complexity, compatibility, facilitating conditions and social factors. These factors fall into three categories: individual, technological and organizational characteristics

Later E.W.T. Ngai, et al. (2008), examined the critical success factors in adoption of ERP. In this study 18 CSFs were identified, with more than 80 sub-factors, for the successful implementation of ERP. The findings to reveal that appropriate business and IT legacy systems, business plan/vision/goals/justification, business process reengineering, change management culture and programme, communication, ERP teamwork and composition, monitoring and evaluation of performance, project champion, project management, software/system development, testing and troubleshooting, top management support, data management, ERP strategy and implementation methodology, ERP vendor, organizational characteristics, fit between ERP and business/process, national culture and country-related functional requirement were the commonly extracted factors. In these 18 CSFs, top management support and training and education were the most frequently cited as the critical factors to the successful implementation of ERP systems

M. MunirAhmad & RubenPinedoCuenca (2013), identified the critical success factors for ERP implementation in SMEs. In this three basic research questions were addressed. First, what are the main critical success factors, second, how do these factors interact throughout the implementation process, third, which factors have their highest impact and in what stages? They classified the CSF into three main category ie, organizational factors, neutral factors and operational factors. Organizational factors include Formalized project plan/schedule, Project management, Cultural change/political issues, Cultural change/political issues, Business process reengineering(BPR), Experienced project manager-leadership, Project champion role, Interdepartmental communication, Project team composition/team skills, Management support and commitment, Monitoring and evaluation progress, Appropriate use of consultants, Reduced troubleshooting-project risk, Training on software, Formal methodology-ERP implementation strategy, Carefully defined information and system requirements, Adequate ERP software selection, Clear goals and objectives. Neutral factors include Interdepartmental

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cooperation and Software customization. The operational factors include Good project scope management, Management expectations, Steering committee, Adequate resources, Trust between partners, Empowered decision makers, Vendor's tool, Managing consultants, Software configuration, Education on new business processes, Vendor support, Data analysis and conversion. These 33 CSF is identified and the interrelationship between the top 10 CSF found out. These 10 CSF are again classified as basic, critical and dependent factors. The 10 CSF include Project team skills, Experienced project manager, Resources, Data analysis, Cultural change, Use of consultants, Management support, Cooperation, Evaluation progress, Communication.

Jiwat Ram,e tal. (2013), analyzed the implementation of CSF in ERP to determine whether they contribute to implementation success or post implementation performance in this factors. In this factors they considered to formulate the research hypothesis include Project management, Training and education, Business process re-engineering, System integration, Implementation success and organizational performance. They found that some CSFs were not critical to achieve success in ERP implementation but were critical to help an organizational achieve performance improvement from an ERP system. Additionally, they also found that achieving successful ERP system implementation mediates the degree to which a CSF affects output performance improvement.

The factors contributing to ERP implementation were collected from the literature survey and they were classified into main categories. The analysis considering all contextual factors influencing economic performance is not carried out by any researcher, to the best of our knowledge. Therefore we explored the ERP related factors influencing the economic performance of surveyed enterprise

OBJECTIVES, SCOPE AND METHODODLOGY

OBJECTIVES

The objectives of this paper is

- To find out the variables influencing ERP performance and to classify them appropriately
- To develop a conceptual model featuring all the selected variables under each factor
- To explore the most influential variables under each category

SCOPE AND METHODOLOGY

The study explored the variables affecting the ERP performance in manufacturing enterprises in India. The data was collected from 28 ERP firms using semi structured questionnaire. Among this three firms were eliminated due to incomplete data. The data collected by the author itself between October 2014 and February 2015. Respondents were asked to provide data regarding the ERP based on the questionnaire provided. The data were collected using appropriate scale. Yes or no questions was represented by zero and one, five point likert scale was used to address some questions and remaining questions were of objective type. The analysis considering all contextual factors influencing economic performance is not carried out by any researcher, to the best of our knowledge. Therefore we explored the ERP related factors influencing the performance of surveyed enterprise a conceptual model was developed based on these available factors addressed in the literature.

Enterprises having ERP implementation is taken for the study. The data was collected using a semi structured questionnaire. The questionnaire has three parts, first part covers basic profile of the firms, second part covers data on economic indicators and the third part covers ERP related issues in the firms. The factors affecting ERP implementation is collected from the literature survey. These factors are classified into categories namely technical, physical economic, organizational, operational and contingency factors. Based on this a conceptual model is developed. Based on the conceptual model t-test was conducted using Minitab 17 to find out emerging variables under each factor.

RESULTS AND DISCUSSIONS

From the literature review the critical success factors affecting the ERP performance was found out and they were classified into suitable categories namely technical, economic, organizational, physical, operational and contingency factors. Based on this a conceptual model affecting the ERP performance was developed. Based on the conceptual model t-test was conducted to find out emerging variables under each factor.

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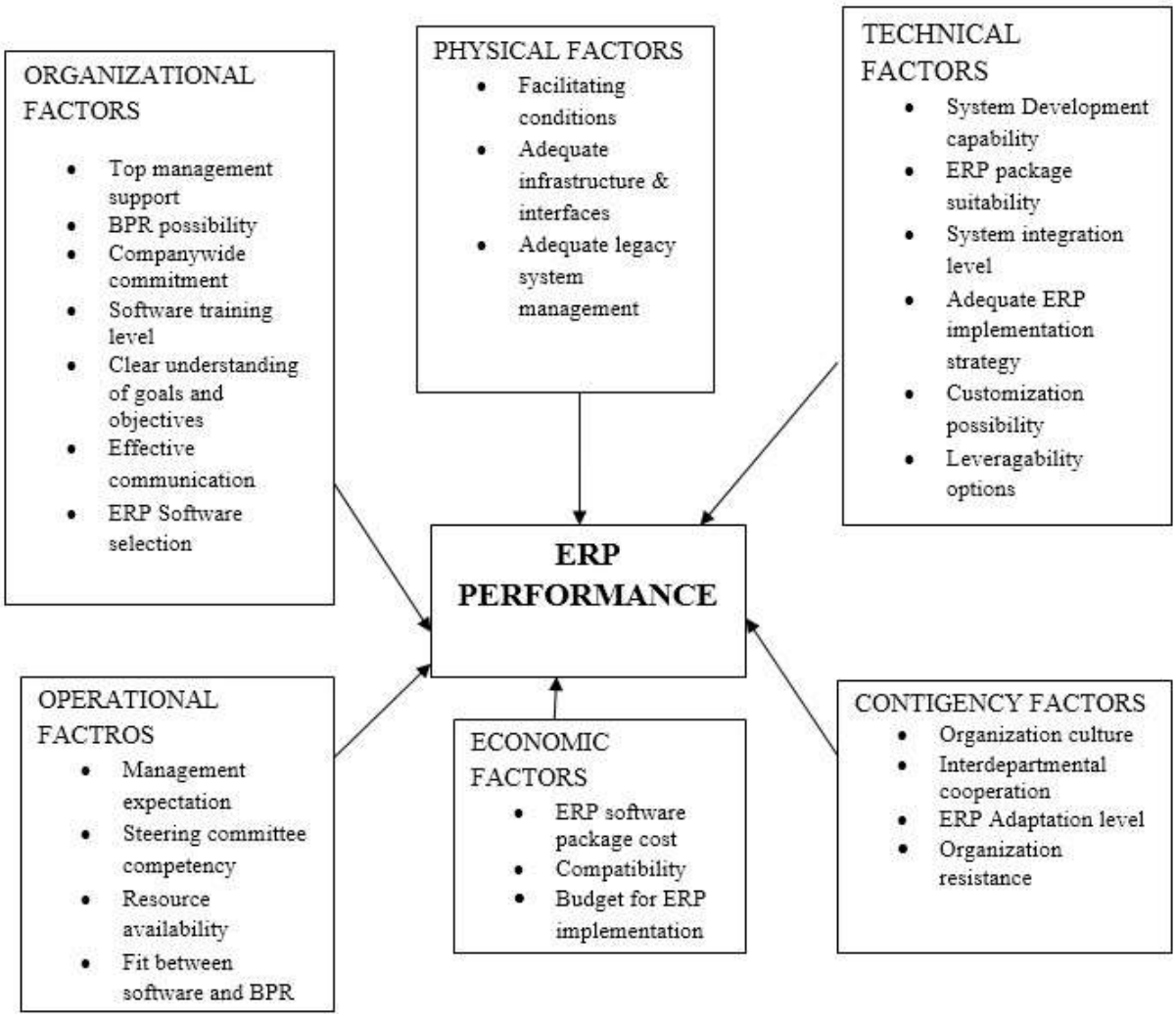

Fig. 1. Conceptual model for ERP performance

Based on the conceptual model different variables are selected under each factor and a t test is conducted to find out the emerging variables under each factor and the results are shown below

Table.1 significance level of variables affecting ERP performance

SI.NO	VARIABLE NAME	P.VALUE SIGNIFICANCE
1	System Development Capability	0.011
2	ERP Package suitability	0.003(**)
3	System Integration Level	0.005(**)
4	Adequate ERP implementation strategy	0.000 (***)
5	Customization possibility	0.029
6	Leveragability options	0.001(***)
7	Facilitating condition	0.030
8	Adequate Infrastructure & Interfaces	0.000 (***)
9	Adequate Legacy System Management	0.009
10	ERP Software Package Cost	0.002(**)
11	Compatibility	0.009
12	Budget for ERP Implementation	0.004(**)
10	Top Management Support	0.559
11	BPR Possibility	0.029

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12	Company Wide Commitment	0.550
13	Software Training Level	0.224
14	Clear Understanding of Goals and Objectives	0.005(**)
15	Effective Communication	0.005(**)
16	ERP software selection	0.007
17	Management Expectation	0.327
18	Steering Committee Competency	0.000 (***)
19	Resource Availability	0.000 (***)
20	Fit Between Software and BPR	0.043
21	Organization Culture	0.013
22	Interdepartmental Corporation	0.000 (***)
23	ERP Adaptation Level	0.000 (***)
24	Organization Resistance	0.001 (***)

From conceptual model using t-test we analyzed the significance level of each variable under each factor and the results were generated. Under technical factor highly significant variable is adequate implementation strategy. The leveragability, ERP package suitability, and software integration level is also found to be significant, while the least significant variable under this section is system development capability and customization possibility. Under physical factors the highly significant variable is adequate infrastructure and interfaces. Adequate legacy system management is also found to be significant, while the least significant variable is facilitating condition.
Under economic factor the most significant variable is ERP package cost, budget for ERP is also found to be significant, while the least significant variable under this category is compatibility. Under organizational factor the variables that found to be significant are clear understanding of goals and objectives, effective communication and ERP software selection. BPR possibility was found to be least significant, while management support, companywide commitment, and software training level found to be insignificant.

Under operational factors steering committee competency and resource availability is found to be highly significant, fit between software and BPR is found to be least significant, while management expectation has no significance. Under contingency factors inter departmental cooperation and ERP adaptation level is found to be highly significant, organizational resistance is also found to be significant, while the least significance variable under this is organization culture.

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CONCLUSIONS

A conceptual model influencing the ERP performance was developed to study the variables affecting the ERP performance. A t-test was carried out to find out the emerging variables under each selected factor. The results obtained showed the highly significant variables influencing the ERP performance and hence the economic performance of the enterprises. The variables such as adequate ERP implementation strategy, leveragability, adequate infrastructure and interfaces, steering committee competency, resource availability, inter departmental corporation, ERP adaptation level and organizational resistance emerged as the most significant variables (a confidence level upto 0.001) . The factors such as ERP package selection, software integration level, ERP package cost, clear understanding of goals and objectives and effective communication was also found to be significant (a confidence level 0.001-0.005). The results obtained will help enterprises to focus on the emerging variables under each factor which may help them to achieve ERP performance and thereby improving their economic performance.

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