

A WEB-BASED DSS FOR THE EVALUATION OF AN ERP SYSTEM

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ABSTRACT:

The Enterprise Resource Planning System is a huge and complex information system that enables the whole organization to operate, collaborate and coordinate its activities through the use of a single data repository. It is expensive to procure and takes a long time to implement. As such, organizations are extremely cautious before making the decision on ERP implementation. Once ERP is implemented, organizations need to continuously monitor its performance and its alignment with the organizations strategic objectives. In this paper we describe our work on the development of a web-based Decision Support System (DSS) that can help organizations to evaluate the success of their ERP implementation and measure the benefits obtained. The challenge of developing the tool lies in determining the criteria for an ERP implementation to be successful, identifying measurements of ERP benefits and ascertaining productivity indicators. To acquire all these yardsticks and measures we had to conduct a survey, case studies and interviews. Finally, all the findings were incorporated in the web-based DSS tool and we called this web-based system, SEEBAS.

Index Terms: ERP implementation, evaluation, benefits, productivity

1. INTRODUCTION

ERP has been defined by Khalid in [1] as; "Enterprise Resource Planning (ERP) is an information system that manages, through integration, all aspects of a business including production planning, purchasing, manufacturing, sales, distribution and accounting". Whereas, Gable in [2] defined ERP as; "Comprehensive, packaged software solutions that seek to

integrate the complete range of a business processes and functions in order to present a holistic view of the business from a single information and IT architecture". Therefore, the key words in ERP definition are standard software, comprehensive software, highly integrated, shared information and data flows. Decision Support Systems (DSSs) are systems designed to assist in the decision making process by providing the necessary information to the analyst. Laudon and Laudon in [3] defined DSS as information systems at the management level of an organization that combine data and sophisticated analytical models or data analysis tools to support semi structured and unstructured decision making. A more comprehensive definition quoted by Turban in [4] who defined DSS as an interactive, flexible, and adaptable CBIS that utilizes decision rules, models, and model base coupled with a comprehensive database and the decision maker's own insights, leading to specific, implementable decisions in solving problems that would not be amenable to management science optimization models per se. Thus, a DSS support complex decision making and increase its effectiveness.

2. THE RESEARCH PROBLEM

ERP providers make many promises to their clients who adopt their ERP systems. Potential benefits include ease of use, integration of all functions in the organization, timely information, better communication, improved process times and reduced operating cost [5]. However, not all ERP projects implemented have been successful. As a result these companies are faced with all kinds of problems in their existing operations. ERP is considered a major project undertaken by any company. A huge amount of resources - manpower, money, time and so forth is needed to ensure

its success. All these resources will go to waste if it fails to benefit the company or even worse, fail in the implementing process. ERP is a highly integrated system and if it fails to function accordingly, the business operations would be severely crippled. About 90 percent of ERP implementations are late or over budget and ERP success rate is only about 33 percent [6]. Cissna in [7] revealed that 40% of all ERP installations only achieve partial implementation and 20% of attempted ERP adoptions are scrapped as total failure. Ptak and Schragenheim [8] reported that between 60% and 90% of ERP implementations do not achieve the return on investment identified in the project approval phase.

In China the success rate is extremely low at only 10 percent [9]. Further to this, Zhang et al in [7] proposed that the steep difference in ERP systems implementation success rates between Western countries and China call for a need for research to examine general and specific issues pertinent to China's critical success factor. Due to the differences in percentage of ERP success rates globally, there appears to be a need for research back home in Malaysia so that the potential companies in future can refer to it before embarking on this quite risky project. We believe that local scenario has its own characteristics that influence ERP success and most likely be different from prior studies in western countries or even in China. Since the usage of ERP amongst local manufacturers in Malaysia is still considered new, there is very little research that has been carried out.

The main concern of this research is the lack of proper guidelines or planning to assist old and new companies in implementing ERP systems correctly. Since the failure of ERP implementation is quite alarming as discussed in the literature, there is no guarantee that any ERP project, if undertaken, would be successful. As stressed by Sammon and Adam in [10], organizations are not well prepared when commencing their ERP projects and that this may explain why many instances of relative ERP failure have been reported. In view of the high investments in ERP systems, companies are immensely under pressure to ensure that their ERP implementation project successfully meets their company's expectations.

Since ERP is a system that keep evolving from time to time, the implementers are required to

update and enhance their ERP systems. In order to do this, the project manager needs to justify why the update is needed and also provide some points of current ERP performances. This is important for the companies to justify their huge investment in ERP. In the case of investment in IT/IS particularly the ERP, the future benefit is quite difficult to measure [11]. An organization must reap maximum benefits from ERP to justify their huge investment in it. Executives are often under immense pressure to find a way to measure the contribution of IS investments to the businesses' performances, as well as to find reliable ways to ensure that the business realizes the benefits from the investments [12].

We need a tool to assist organizations to evaluate the success of their ERP implementation and measure the benefits obtained. To develop a web-based tool that can help organizations evaluate their ERP system implementation, we need to establish a guideline of success factors, a measurement of ERP benefits and a list of productivity indicators. The research design is illustrated in Figure 1. We will name this DSS tool, *SELECTION, IMPLEMENTATION AND EVALUATION OF AN ERP BASED SYSTEM* or SEEBAS in short.

3. THE DESIGN AND DEVELOPMENT OF SEEBAS

The proposed SEEBAS system is designed to be very user friendly and can be used by non-technical end-users. The SEEBAS is uploaded on the internet so that potential users all over the world can access and utilize it. In order to ensure its user friendliness, SEEBAS was developed as a dialog-based application, much like a commonly used wizard programme. There are two major modules namely Selection and Evaluation. In this paper we will only focus on the evaluation of ERP performance.

3.1 The Survey

A total of 128 small and medium enterprises from the manufacturing sector of the state of Selangor, in Malaysia were chosen as respondents. They were chosen because of their strength and financial standing. All the respondents are located in the industrial estates such as the HICOM Industrial Estate, Bangi Industrial Estate, Klang Free Zone, Shah Alam and Petaling Jaya. The state of Selangor was chosen because it possesses modern

infrastructures liken that found in developed countries. The advanced facilities enable IT to be easily accessible at affordable cost. The SPSS package version 12 for Windows was used. In analyzing these data, the descriptive statistics were applied. Under descriptive statistics, three measurements of central tendency of mean, mode, median and dispersion measures of standard deviation and variance were considered.

3.2 The Case Study

Four case studies were conducted on manufacturing companies that have successfully implemented their ERP based systems. Two of

the case studies used the SAP software (the market leader of ERP systems) and the other two used the software Pronto (catering for relatively smaller to medium market segment). The case studies will reaffirm the findings from the survey carried out.

3.3 Interviews

Four interviews were conducted to verify the productivity indicators which were discovered during the case studies. The respondents are managers from the four SMEs that participated in the case studies.

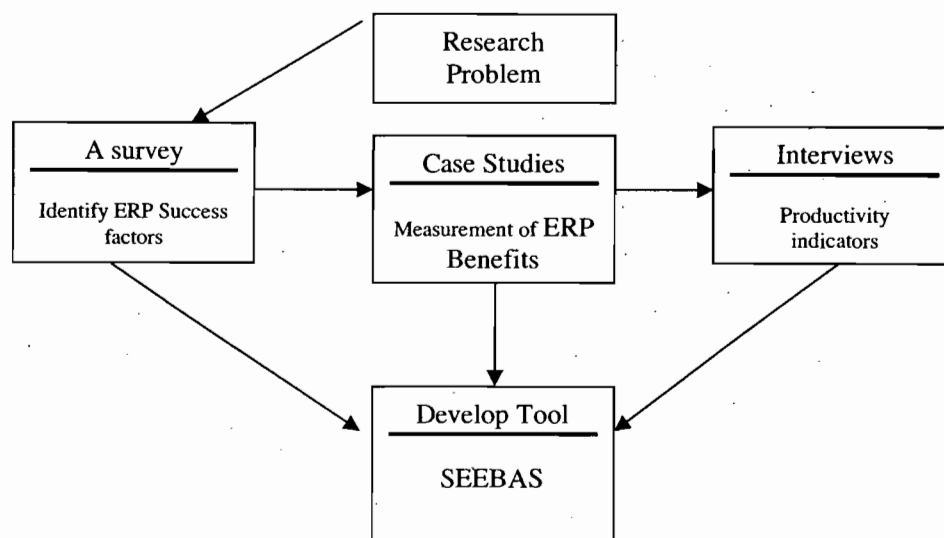


Figure 1: Research Design

Table 1: Framework For ERP Evaluation (ERP's Productivity)

No.	Indicator
1.	Indicator: Labour Cost Competitiveness (LCC) Formula : Added Value / RM of Labour Cost
2.	Indicator: Labour Cost per Employee (LCE) Formula : Labour Cost / Number of Employee
3.	Indicator: Unit Labour Cost (ULC) Formula : Labour Cost / Total Output
4.	Indicator: Labour Productivity (LP) Formula : Added Value / Number of Employees
5.	Indicator: Total Output per Employee Formula : Total Output / Number of Employees
6.	Indicator: Capital Productivity (CP) Formula : Added Value / Fixed Assets (IT related equipment)
7.	Indicator: Capital Turnover Formula : Total Output / Fixed Assets (IT related equipment)
8.	Indicator: Capital Intensity (CI) Formula : Fixed Assets (IT related equipment) / Number of Employees

3.3 Evaluation of ERP performance

This module is used to evaluate the performance of an ERP system. The ERP system needs to be evaluated because of factors such as:

- The huge investment. The outcome from its investment should be higher than the cost of implementing it.
- The system effectiveness in addressing all problems faced by the old system.
- Investment justification
- Future reference particularly when further investment need to be carried out as the ERP system evolve from time to time.

Through the result from this exercise, the management can take proper steps to further enhance the system or if the result is unsatisfactory, then the weaknesses can be rectified either through retraining or further collaboration with consultants, etc. In this module, there are three sub modules used to evaluate the ERP system. These three sub modules are:

- ERP's Implementation Success Factors
- ERP's Benefits
- ERP's Productivity Indicators

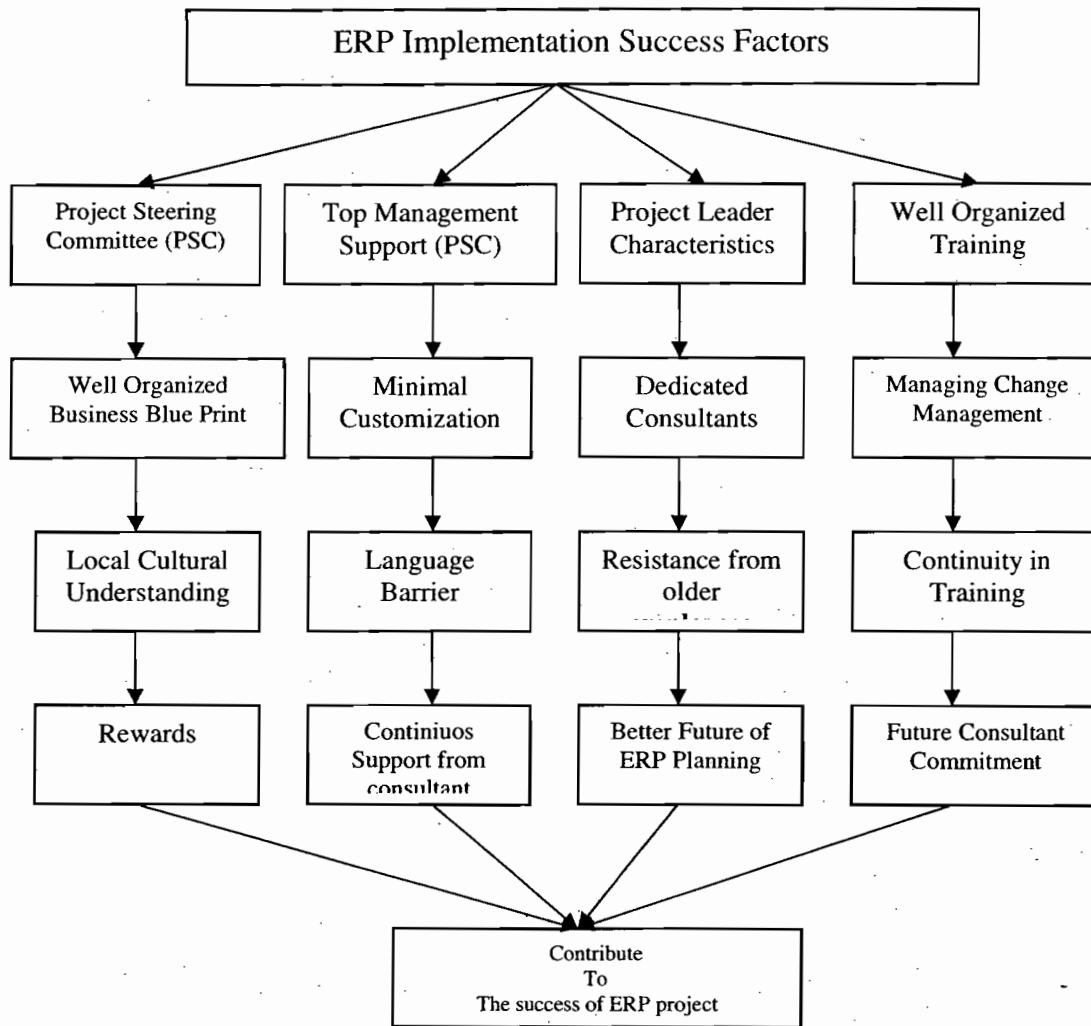


Figure 2: Framework for ERP's Evaluation - Implementation Success Factors

The framework of the **ERP implementation success factors** sub module is built from the results of the survey and this is depicted in Figure 2. The measurements of ERP benefits are derived from the case studies and are summarized in Figure 3. There are a few

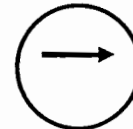
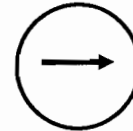
questions in this module and each question carries a certain weight that will be computed later. User can select to choose either 'No' or 'Yes' for each question asked. If 'Yes' then, the user is required to determine the impact of the ERP's application ranging from low to high.

Once done, the user can delete data if wrongly entered and rekeyed in and if the user is satisfied, the next button to choose is the submit button. From our case studies we discovered eight indicators are used as productivity indicators and this is highlighted in Table 1. Prior to using this module, the user is required to key in information such as year of ERP

implementation, number of staff in the organization, sales, staff cost, total asset of ERP related investment and value added. The system will allow a maximum of six years period for evaluation which is three years post ERP implementation and three years pre ERP implementation. Figure 4 to 7 are screen shots of the ERP evaluation module of SEEBAS

Code	Variables Asked
	Operational benefits:
OB01	Process cost reduction
OB02	Cycle time reduction
OB03	Productivity improvement
OB04	Quality improvement
OB05	Customer service improvement
	Managerial benefits:
MB01	Better resource management
MB02	Improved decision making and planning
MB03	Performance improvement
	Strategic benefits:
SB01	Supporting business growth
SB02	Support business alliance
SB03	Build business innovations
SB04	Building cost leadership
SB05	Assisting with product differentiation
SB06	Improved linkages with customers and suppliers
	Information Technology benefits:
TB01	Building business flexibility for current and future changes
TB02	Increased IT infrastructure capability
TB03	IT cost reduction
	Organizational benefits:
OB01	Supporting organizational change
OB02	Facilitating organizational learning
OB03	Empowerment of staff
OB04	Helping to build a common vision
	Communication benefits:
CB01	Speed up in preparing management report
CB02	Faster to prepare the end year Financial Statements
CB03	Increased real time information available
CB04	Better sharing information for business growth

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Figure 3: Framework for ERP Evaluation -ERP's Benefits

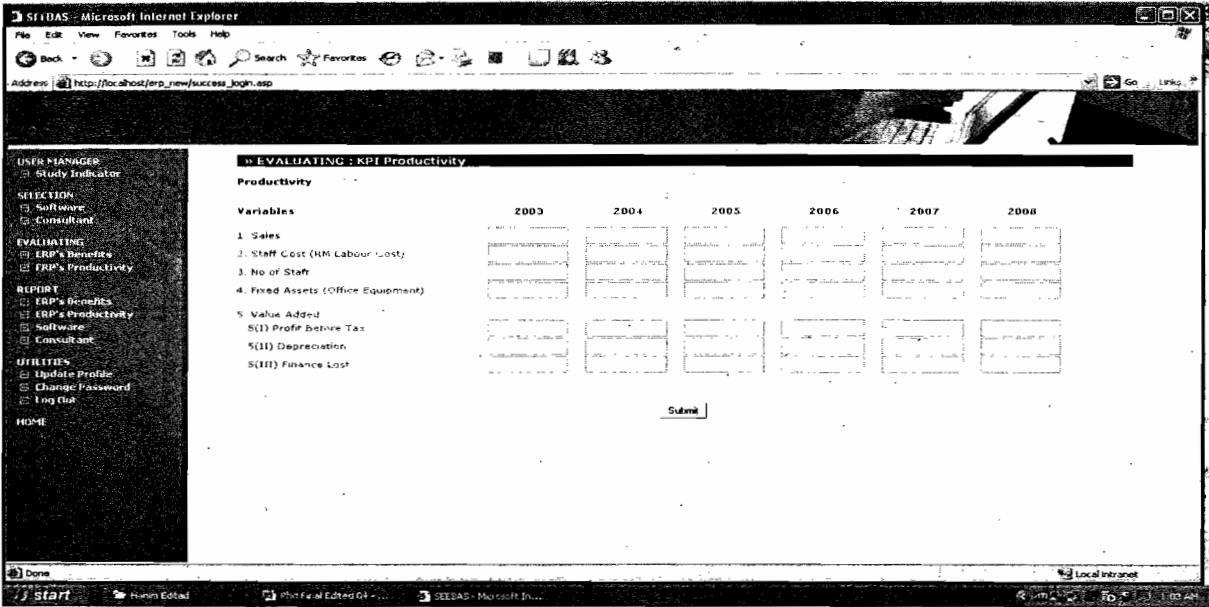


Figure 4: The sub module of ERP's Productivity

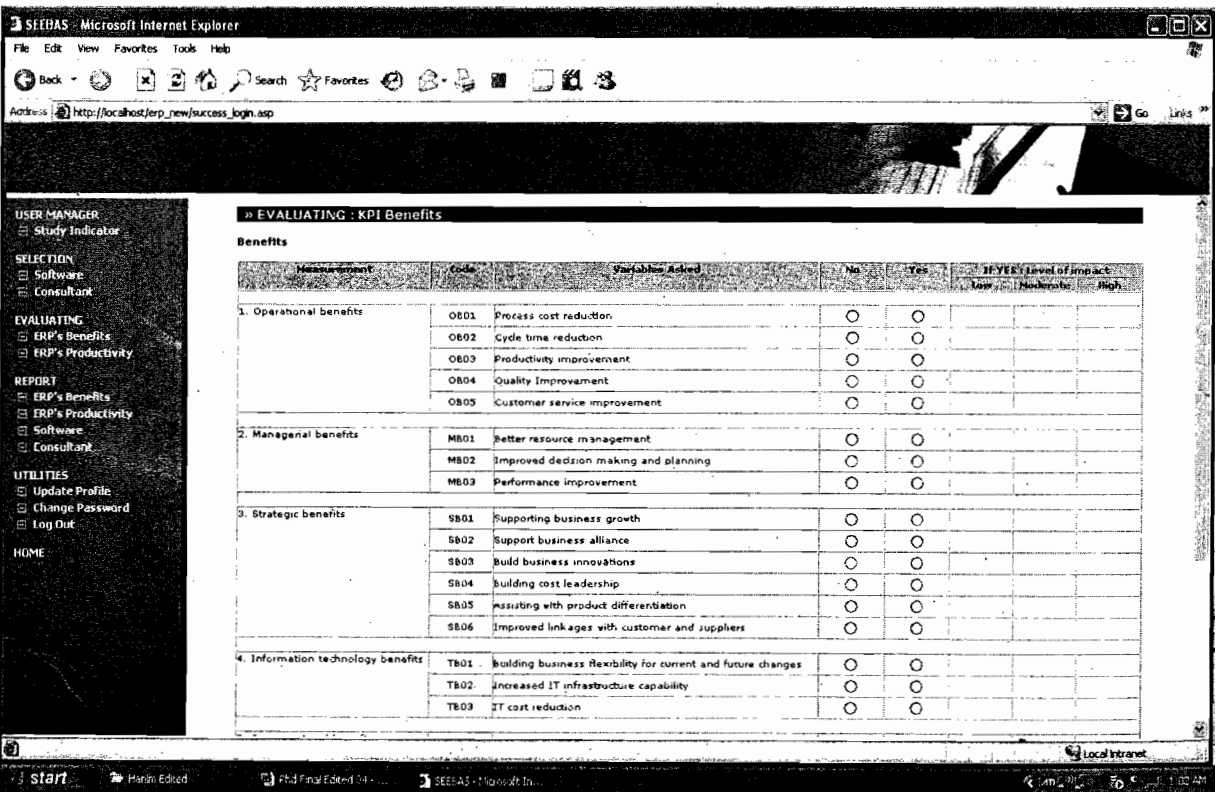


Figure 5: The Sub menu – ERP's Benefits

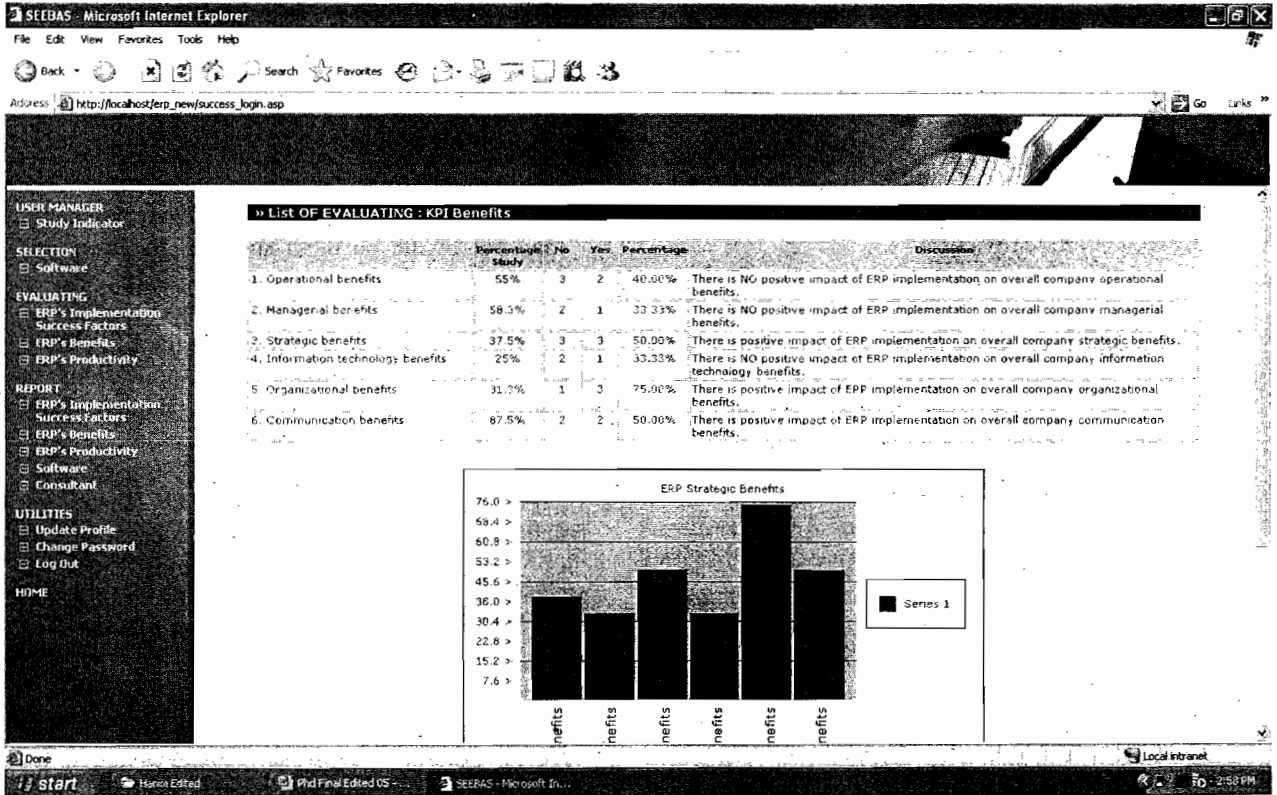


Figure 6: ERP's benefit-Result from example KPI-B-1

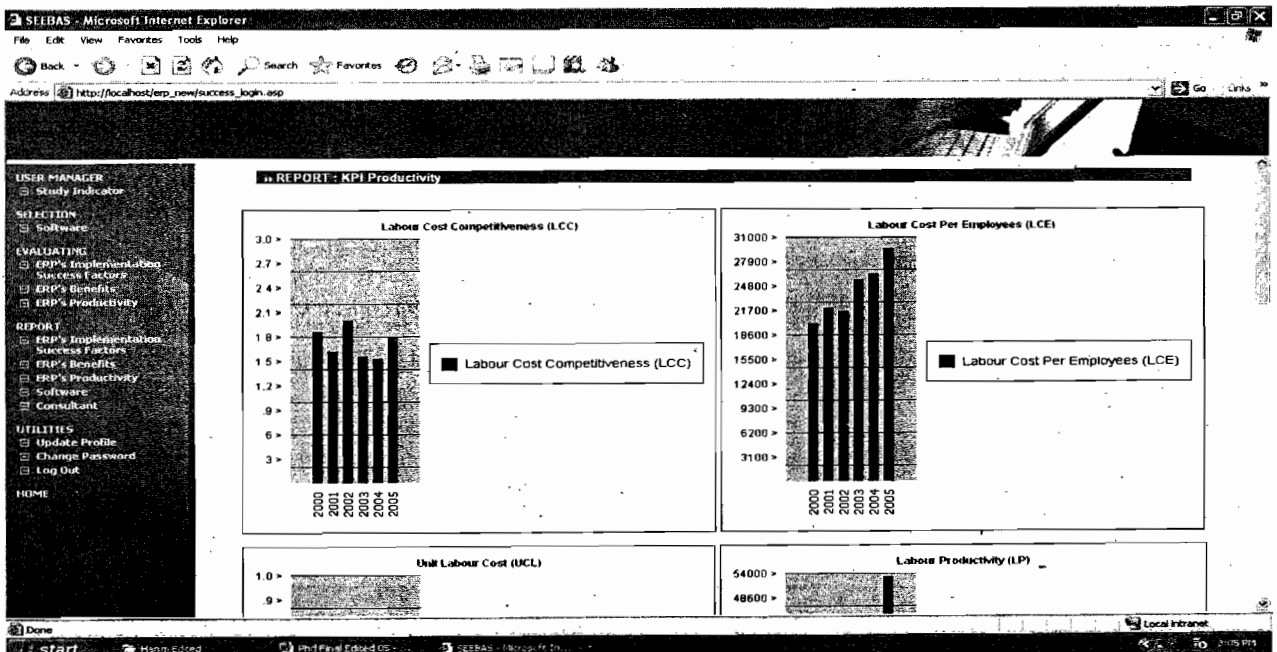


Figure 7: ERP's productivity indicators - Example: KPI-P-30 (graph)

4. DISCUSSION AND CONCLUSION

In this research project we conducted an extensive literature to develop our survey instrument which assisted us to identify the

critical success factors which are specific to Malaysian manufacturing SMEs. We then verified our findings through selected Case Studies on selected manufacturing SMEs. From the case studies we have identified the matrix of

ERP measurement benefits and from the interviews we determined the productivity indicators used to evaluate the success of an ERP implementation. With these findings, we incorporated it in the web-based to become the DSS which we have called SEEBAS. Finally, we invited five ERP users to evaluate the system and received positive reviews.

For future work, we would like to suggest the Delphi approach to be used to strengthen the criteria that we have used as ERP success factors, benefits measurements and productivity indicators.

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