

ERP – Enterprise Resource Planning: System Selection Process and Implementation Assessment

Sung-Wook Han[†]

Hi-Tech Consulting Center, LG CNS Co., Ltd.,
8F, Prime Tower, #10-1, Hoehyun-dong, 2-ga, Jung-gu, Seoul, 100-630, Korea
E-mail: sungwhan@lgcns.com

Abstract. Enterprise Resource Planning(ERP) systems offer pervasive business functionality – the applications encompass virtually all aspects of the business. Understanding and managing this pervasiveness will result in a successful and productive business application platform. Because of this pervasiveness, implementations have ranged from great successes to complete failures. This article has two distinctive parts. The first proposes and discusses a systematic process based on consulting experiences of LG CNS (leading information system company in Korea) for ERP selection. Also, the second provides the key factors that are critical to the successful implementation of ERP. The second part reports the results of a study carried out to assess a number of different ERP implementations in different organizations. A case study method of investigation was used, and the experiences of five Korean manufacturing companies were documented. The critical factors in the adoption of ERP are identified as: learning from the experiences of others, appointment of a process innovator, establishment of committees and project teams, training and technical support for the users, and appropriate changes to the organizational structure and managerial responsibilities.

Keywords: ERP, information system, success factor, competitive superiority

1. INTRODUCTION

Throughout the 1990s, most large industrial companies were installing enterprise resource planning (ERP) systems – that is, massive computer applications allowing a business to manage all of its operations (finance, requirements planning, human resources, and order fulfillment) on the basis of a single, integrated set of corporate data. ERP promised huge improvements in efficiency – for example, shorter intervals between order and payments, lower back-office staff requirements, reduced inventory, and improved customer service. Encouraged by these possibilities, businesses around the world invested some \$300 billion in ERP during the decade(Dorien and Malcolm, 2000).

What most attracted many a chief information officer (CIO) was the opportunity to replace a tangle of complex, disparate, and obsolescent applications with a single Y2K-compliant system from a reputable and stable vendor; one Korean major oil company, for example, managed to switch off 70 old systems when ERP went live. By entering customer and sales data in an ERP

system, a manufacturer can generate the next cycle's demand forecast, which in turn generates orders for raw materials, production schedules, timetables for shifts, and financial projections while keeping close track of inventory.

As the number of manufacturing firms adopting ERP has increased, so has the research by academics and researchers into all aspects of using these information technologies, covering planning, implementation, integration, management and exploitation(Lee and Lee, 2000; Parr and Shanks, 1999; Sumner, 1999). Some of examples of these studies include: a study of ERP in 20 British companies by Currie(1996); a study of 95 information systems by Jaikumar(1997) in North America; and a study of ERP and other information systems in the UK by Bessant and Haywood (1999).

Previous studies examining ERP implementations have found that expectations of ERP will not be brought to fruition unless a holistic approach is taken to planning, acquiring, implementation and exploitation. One of the critical issues to be considered in the decision-making process is that the link between the information system

and business strategy must relate to the competitive priorities and the positioning of the organization. The choice of information system, for which many options exist, must be driven by, and closely aligned with, the broader framework of competitive positioning decisions. The basic question: "How do we compete?" must be answered first before information system investment decisions are made. Therefore, this paper has two distinctive parts. The first describes ERP system selection process in implementation, the second addresses the key factors that are critical to the successful implementation of ERP. In the second part, the experiences of five Korean organizations, which have adopted ERP in recent years, are analyzed. A case study approach was used to explore the reasons for adopting the ERP, planning and implementation issues, benefits achieved and the limitations and difficulties associated with the ERP.

A field study design followed the one described by Gosse (1993) who says that "field study design reflects a research issue in transition, for which grounded theory or experience with relationships among well-defined variables have not yet emerged. Field studies are appropriate for such circumstances." The design of a field study should begin by developing a set of guidelines. Gosse developed his field study guidelines based on the suggestions of Stone (1978) and Yin (1984), and these were similarly developed for our study, covering: site selection, focus of inquiry, seeking richness in data and data gathering procedures.

2. ERP SYSTEM SELECTION PROCESS

Enterprise resource planning (ERP) systems offer pervasive business functionality. Because of this pervasiveness, implementations have ranged from great successes to complete failures. Therefore, advice is frequently sought in selecting systems. However, we have concluded that there is no system that is best for all companies, but rather there is a process you can go through to find the right system for your company. The process starts with assembling a competent cross-functional project team, composed of several full-time resources (including consultants, where appropriate). This team will document business needs, explore alternative scenarios, orchestrate vendor involvement, facilitate consensus and communicate progress and recommendations to senior management. The team must initially develop a vision that encompasses both the business processes and software application environment. Articulating this vision is a necessary step for gaining solid executive sponsorship for the project. The vendor selection phase consists of screening, analysis and scenario-based demonstrations to reach a consensus on the solution. Finally, the team must

transit the project expeditiously to an implementation mode. A thorough selection process will minimize risk and lay the foundation for a successful project (Han *et al.*, 2000).

2.1 The Initial Issues

Our road map defines an iterative process (see Figure 1). At each successive stage you will learn more about a previous decision. That is as it should be. However, with each iteration you are covering finer details.

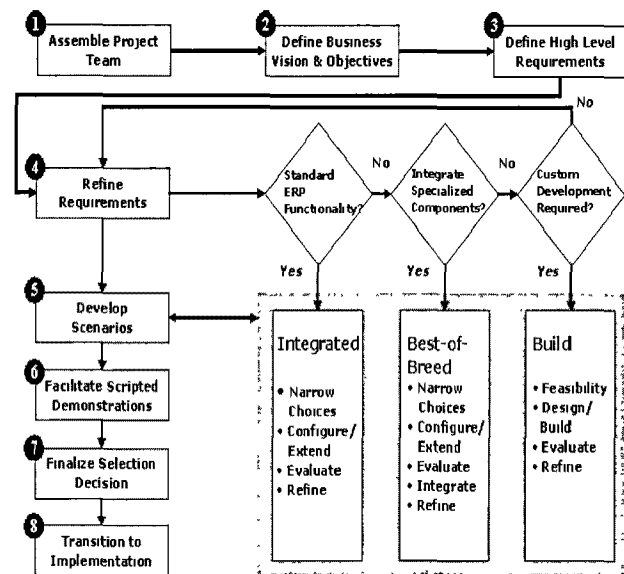


Figure 1. Selection process

2.1.1 Begin with the Business

The business rationale for acquiring the ERP system is of critical importance in the early stages of the project. The project team must be able to articulate a vision and set of objectives to build support and executive buy-in for the project, enabling funding and resource availability. The vision for the future ERP application environment should describe the business process enhancements and strategies that will generate value from the investment. Every ERP system should be rooted in the business, since it often pervades the business, encompassing and changing almost every area. To the extent that the system will deliver only incremental improvements in system integration and maintenance without fundamentally impacting the business, the project will lack the necessary business justification.

The step that is missed most often is defining the business reason for selecting the system (Miller, 1996). At the very least, a business must first look at itself and understand its substance, asking two very fundamental questions: "What are we?" and "What do we want to be?"

An ERP system will either help or hinder the outcome. For example, if the business wants to be process-driven, it should seek a highly integrated solution. If it wants to maintain a function orientation, a non-integrated solution may be in order.

To achieve maximum benefit from an ERP system, we should develop an enterprise system architecture that encompasses a system application environment (SAE) (Miller, 1996). The system application environment consists of two complementary models: (a) The Business model, (b) The Environment Model. Each captures an aspect of the system that should be as decoupled as possible from the others. This will aid in allowing changes to occur independently within each area (Miller, 1996). The business model is a composite picture of an organization along with measures to better its position through the application of information technology. The business model should encompass the current areas of business, anticipated areas of business, current competitors, and anticipated competitors. This model is the focus for business process reengineering. Each area of business should be examined to reveal the key competencies and competitive distinctions of the present and the future. Similar profiles should be developed for the competitors and the likely future competitors. Once completed, the model shows the total business environment and the key differentiators (Miller, 1996).

The environment model is the transitional layer between the business descriptions and the technology. The model contains the following four models: 1) the common application model is a model of the application including the business objects and workflow but stopping of topology and persistence issues; 2) the common user interface model gives the standards and criteria by which each type of interaction with the application environment takes place. It establishes a uniformity and approachability to the tasks at hand. It takes into account the various implementation options available; 3) the common database model establishes the criteria by which all persistence will occur. It provides for the mapping of various kinds of storage medium to the application model; 4) the distribution model establishes the application partitioning. It performs a mapping between the applications and the available technologies. It is fundamental to application and database distribution, and network and processor optimization (Miller, 1996).

2.1.2 Build or Buy

Packaged applications will contain functions that will not be used by all companies because they were meant to cover the needs of many. On the other hand, they will also contain a rich set of best-practice functionality that will have been honed by multiple users. Duplicating the breadth and depth of functionality from

leading ERP vendors will be very difficult. You should consider building a custom system only when you have a wide set of unique needs as well as the resources to materialize the system.

2.1.3 Integrated vs. Best-of-Breed

Purchasing an integrated application package versus assembling a best-of-breed solution is really a question of degree. There are very few, if any, companies that run all aspects of their business on a single integrated application. However, there are a significant number that take an integrated package as their starting point and then supplement the system with niche applications for such areas as supply chain optimization, capacity-based planning, transportation planning, etc. (Barnett and Miller, 1996; Robey *et al.*, 2002).

A large number of companies adopting a single-solution approach to their packaged application needs are testament to the benefits of buying integration. Unified business and process models reduce training and maintenance costs, and also provide the highest level of integration of any approach available today. Integrated solution vendors, such as SAP, Oracle, and BAAN, seek to become “total solutions providers” and thus offer consulting services that are not offered by many of the smaller companies that sell discrete business applications.

Disadvantages associated with integrated solutions include the high overall cost of implementation and long project completion times. Large-scale implementations can take years given their scope and complexity. And, even when the initial roll-out is complete, users are often faced with the task of upgrading the packages, thus creating an ongoing cycle of systems implementation. Finally, applications from single-source providers may be incompatible with the user’s business process model. Some companies have adjusted their business models to fit the vendor’s. More and more, however, they feel that information technology should adapt to and serve the needs of business first.

The total best-of-breed approach is by far the minority approach to packaged application implementation (Barnett and Miller, 1996). In this option, developers choose packages from a number of vendors and build a custom integration framework to present them to the user and manage them internally.

A total best-of-breed approach means that packages are customized to the user’s business processes, with no vendor’s architecture or process imposed on the organization. Although this approach offers the highest degree of modularity, the lack of integration currently available between vendor applications means that information system must spend significant resources developing and maintaining interfaces between applications. Other pitfalls associated with a total best-of-breed

approach include increased training costs for multiple vendor’s products, increased product selection and evaluation efforts, and an overall decreased level of service and support from vendors relative to a centralized, single-source.

We would generally recommend selecting an integrated application. It is easier to install, configure, place into operation, and support than a best-of-breed solution. Because it will have more consistency in its user interface, it is easier to learn and use. No best-of-breed approach can provide a better overall solution than a complete integrated application suite. The time and effort it takes to integrate disparate packages far outweighs the benefits derived. Companies that adopt an application suite will benefit from the integrated data and process models, as well as consistent business processes across applications. If your situation demands a best-of-breed solution, make sure you look at vendors that are adopting strategies of integrating best-of-breed solutions as their own.

2.2 A Five-Step Selection Process

Barnett and Miller(1996) developed a process for ERP selection. The new structured selection process was developed based on what Barnett and Miller(1996) suggested, also on consulting experiences of LG CNS for ERP selection. The process has five distinctive steps.

2.2.1 Initial Vendor Screening

Limiting your choices is necessary almost from the start. There are four primary areas that you must take into account when narrowing the number of products to choose from: *Vendor, functionality, scalability, technology* (see Table 1).

2.2.2 Requirements and Selection Criteria

Selecting a product involves sorting out three levels of functionality: *Level 1, 2 and 3*. The level 1 is the basic functionality that a user assumes to be present – such as managing routine business transactions. The level 2 is the functionality that one wants – such as ability to support business processes in a manner that significantly enhances productivity. The level 3 is extra functionality that enables a best-practice process transformation– such as the ability to transact business with suppliers and customers in real time. Using these three levels of functionality will add depth and prioritization to the requirements document that will be used to evaluate the short-listed vendors.

We recommend that the requirements document be assembled from a business process view. An important aspect to this understands how the business processes should work in the future ERP environment, not how the processes currently operate. This business process orientation will enable the development of scripted scenarios that demonstrate how the software will support the way that the company intends to do business. The requirements document should also include a detailed list of technical criteria to ensure compatibility with the environment – flexibility, security, etc.

The short-listed vendors should receive a copy of the prioritized requirements and be asked to respond in terms of their ability to meet these requirements. Responses will naturally be biased to the affirmative, but these responses will be further validated in the script demonstrations. The development of the detailed requirements document does not imply that the process must include a formal request for proposals(RFP). Our recommended process avoids the necessary delays of the traditional RFP process, while retaining the critical elements of the evaluation (Hamerman, 2000).

Table 1. The important initial Cut

Vendor	In some areas, you won’t be betting the business on a vendor, but with ERP you will. Be especially cautious when an ERP software vendor is trying to move between paradigms. Many of the ERP vendors that were successful in one technology simply have not been successful in the move to the next.
Functionality	Develop a function matrix that makes the major issues obvious. Start with the high level functional areas and continue to refine them. For example: Is HR needed? Is the manufacturing process discrete or process oriented?
Scalability	A piece of software is normally defined for a market space. That definition carries over into the architecture, which in turn limits the scalability. The architectural issues are also normally compounded by the choice of platform. This must be watched closely as some ERP architectures may actually favor an Intel or Sun box over an IBM mainframe, giving much better scalability on what is thought of as a low-end processor.
Technology (Platform)	Very often, the platform is chosen before the application is selected. This frequently causes a non-optimum solution to be chosen. We are not advocating purchasing a non-standard piece of hardware for the sake of an application. We are advocating a complementary decision where function and scale are at least equally weighted.

2.2.3 Developing Scripted Demonstration Scenarios

Scenarios are a very good way of communicating the complex, integrated functionality found in ERP systems. Scenarios are detailed stories that describe a business function, such as production planning, procurement and revenue realization. The scenarios can then be divided into a series of use cases that detail what is to happen for every contingency. The scenarios emphasize the most important aspects of the business and reflect the actual business processes that must be supported. These scenarios will guide the vendor's software demonstration, avoiding a standard demonstration of functionality that glosses over a vendor's weaknesses.

2.2.4 Conducting Scenario-Based Demonstrations

Due to the in-depth nature of the scripted demonstrations, it is critical to limit the short list of candidate vendors to three or less. Three to five days for each vendor is often required to gain a thorough assessment of each solution. The core project team is responsible for organizing and facilitating the demonstrations to play out the scenarios in a consistent manner. Vendors should be coached and monitored during the demonstrations to make sure they adhere to the scenario requirements. Participation of a wider audience of subject matter experts for specific elements of the program is highly recommended to support the final decision. Participant feedback should be collected at the end of each session via questionnaire and compiled. One or more core team members should validate the vendor's responses to the requirements as the demonstrations progress. Since the packages will likely meet the majority of the requirements, the team should make note of gaps in functionality and share this information in debriefings after each day of demonstrations.

2.2.5 Finalizing Selection Decision

A quantitative framework is recommended to score the outcome of the software demonstrations. Several key inputs to the decision process are required, including the following:

- Fit to documented requirements, weighed based on the prioritization scheme
- Compilation of participant feedback from demonstrations
- Gap analysis to assess the extent to which software customization may be necessary
- Cost analysis for the software and related services (e.g., maintenance, training)
- Customer referenceability

The final decision should also take into account qualitative factors such as ease of use, flexibility and

vendor support. A team limited to core team members and key stakeholders should make the final decision, with final approval by an executive steering committee.

3. THE KEY FACTORS FOR SUCCESSFUL ERP IMPLEMENTATION

3.1 Field Study Design and Site Selection

The five organizations involved in this study were chosen after preliminary discussion with the company contact concerning the aims and objectives of the research project. Potential companies for participation in the study were initially identified through various sources, i.e. suggestions by faculty staff members, existing on-going personal contacts with local companies/managers, new contacts made with company representatives participating in conferences and seminars and publicity of the company's newly acquired information system in the media.

Initial contacts were made by telephone with eight companies, primarily at the middle and senior management levels. In almost every case, the response was positive and immediate. In some cases, higher approval had to be sought by the company contact on behalf of the research team. After approval, a site visit was arranged to meet with senior management. In three companies, an initial interview was conducted with the managing director, who agreed to participate. However, after many unsuccessful telephone calls to proceed further, the companies were excluded from the research project.

The companies involved in the research ranged in size from 124 employees to nearly 4500 employees, and manufactured different products using a variety of manufacturing processes. All companies had recently made a significant investment in ERP which was the focus of investigation by the research team. Each company had also acquired other information systems in the past. Table 2 summarizes the key characteristics of the five companies involved in this research project.

3.2 Field Interviews

Based on the author's previous research in ERP (Sohal *et al.*, 2000; Park and Han, 2002) and the literature, an interview questionnaire was developed and used in field interviews. The interview guide/questionnaire focuses the inquiry procedures, and ensures reasonably consistent inquiry procedures at all sites (Gosse, 1993). Several visits were made to each company.

Table 2. Key characteristics of the five companies

Company	Size (# of employees)	Products made	ERP Package
<i>A</i>	4500	TFT-LCD (Digital Display)	Oracle R11i
<i>B</i>	1022	Shadow Mask, Lead Frame, Tape Substrate	Oracle R11i
<i>C</i>	2987	PLC, Inverter	Oracle R11i
<i>D</i>	1300	Silicon Wafer	SAP R/3
<i>E</i>	124	PMMA (Polymethylmethacrylate)	SAP R/3

During the initial meeting with senior management (typically the managing director, general manager or plan manager), the aims and objectives of the research project were described and discussed in some detail. Discussion with senior management focused on issues such as: the overall strategy of the organization, the basis of competitive advantage, competition, the company's performance in relation to the dimensions of competitiveness, reasons for implementing the particular information system, their role in planning and implementation of the information system and the benefit of the information system to the organization.

Following the interviews with senior management, the focus of the interviews shifted to exploring issues concerning planning, implementation and management of the ERP implementation. At this stage, interviews were conducted with the two manufacturing managers, two marketing managers, two quality managers, the one company accountant, the two human resources managers and four supervisors and operators in each of participating companies. The interviews were conducted over several visits to the companies, and generally interviews with individuals lasted 1-2 hours.

With the permission of the interviewee, all interviews were recorded on tape. None of the interviewees objected to this. In all cases, each company provided supplementary documentation, for example, annual reports, the information system, organization charts and brochures on the company's product range (see Table 3).

3.3 Result and Summary

The taped interviews were transcribed and written up in the form of case studies. This process took a considerable amount of time as each case study went through a number of drafts, sometimes going back to the companies for further details or replaying the taped interviews. The case studies were then sent to the company contact for verification and permission for general use in publications.

The written case studies were then used to understand the following:

- Competitive priorities and company goals;
- Reasons for adopting the new information system;
- Planning and implementation procedures/issues;

Table 3. Sample companies

Company	Company Vision	Revenues	Project budget	ERP Modules implemented
<i>A</i>	World's No. 1 LCD Company	\$1.19 billion	\$15 million	Finance, sales, manufacturing, supply chain
<i>B</i>	Global Leader in Ultra-fine Components	\$164.4 million	\$2.5 million	Finance, sales, supply chain
<i>C</i>	Total Solution Leader in Electrics & Automation	\$404 million	\$1.5 million	Finance, sales, manufacturing
<i>D</i>	Best Wafer Company	\$144.8 million	\$3.5 million	Finance, sales, manufacturing, human resources
<i>E</i>	Best Leader in Polymethylmethacrylate	\$62.1 million	N/A	Finance, sales, supply chain

- Benefits achieved from the ERP investment; and
- The difficulties and limitations associated with adopting the ERP.

The results of this analysis are presented below under each of the above headings(see Table 4).

3.3.1 Competitive priorities and company goals

All companies had an external focus in terms of competitive priorities and goals. Providing high quality products, superior and reliable delivery performance and competitive costs were their main objectives. For example, Company A's goal is to be the low-cost producer of TFT-LCD in the global and to provide a high level of service. It aimed to increase the market share for existing products as well as to introduce new products into new markets.

Company B already had a reputation in the marketplace as an innovative manufacturer of high quality shadow mask, lead frame and tape substrate. Its major goal was to shorten delivery schedules. Company D, a manufacturer of silicon wafer products, identified "assuring technical quality and better control of processes" as its main goals. Company C, a manufacturer of electronics components, and Company E, a manufacturer of PMMA (Polymethyl-methacrylate) products, aimed for better work-in-process and stock control.

3.3.2 Reasons for adopting the new information system

Although all the companies had an external focus to better serve their customers, every one of them experienced difficulties in this respect. Company A had a

poor forecasting- and planning system and long cycle times. This resulted in poor delivery performance and high inventories. To overcome these problems, the company implemented ERP as well as a supply planning system using i2 package. These systems were developed packaged solution with considerable consultation and involvement of field workers.

Company B, a manufacturer of shadow mask and lead frame, was under pressure from its major customer to improve component identification throughout its processes. With the help of outside consultants, ERP and a parts traceability system were implemented and developed, which not only satisfied their major customer, but also provided many other benefits to the company.

Company C experienced rapidly-increasing product variety, and required flexibility in its manufacturing and assembly areas. ERP and a number of programmable technologies were implemented, which provided many tangible and intangible benefits.

Both Companies D and E had inefficient production processes and control systems. The result was excess obsolete and eroding customer service levels. The ERP and a distribution planning system were implemented, linking the warehouses around the country to the main manufacturing plant and head office in Seoul.

All of these companies had adopted appropriate ERP and the new information system to overcome a variety of internal and external problems, and were generally aware of their performance in relation to their main competitors. They had recognized the benefits which the ERP and new information system offered the organization, and had invested substantial amounts of funds and human resources.

Table 4. Summary of the contents in field interviews

Issues	Contents
Competitive priorities and company goals	All companies had an external focus in terms of competitive priorities and goals. Providing high quality products, superior and reliable delivery performance and competitive costs were their main objectives.
Reasons for adopting the new information system	All of these companies had adopted appropriate ERP and the new information system to overcome a variety of internal and external problems, and were generally aware of their performance in relation to their main competitors. They had recognized the benefits which the ERP and new information system offered the organization, and had invested substantial amounts of funds and human resources.
Planning and implementation	The five key common features of the planning and implementation stages are identified. These are: learning from others, appointment of a process innovator, committees and project teams, training and technical support, and changing the organizational structure and responsibilities.
Benefits achieved from the ERP	In all cases, the benefits were significant, in terms of improving the overall competitiveness of the companies. Table 6 shows the range of benefits achieved by the five companies.
Difficulties and limitations	On-going support of the information services departments was under-estimated; Problems with the outside package implementation consultants resulted in a delay in project completion; Training of user was under-estimated; Resources needed to maintain the system were under-estimated; Senior management support was delayed because they were initially not convinced; and the field workers were not convinced about a number of the changes required.

3.3.3 Planning and implementation

From the analysis of the five case studies, five key common features of the planning and implementation stages are identified. These are: learning from others, appointment of a process innovator, committees and project teams, training and technical support, and changing the organizational structure and responsibilities. These are discussed in Table 5.

3.3.4 Benefits achieved from the ERP

Generally the ERP delivered the benefits expected by the companies. In all cases, the benefits were significant, in terms of improving the overall competitiveness of the companies. Table 6 shows the range of benefits achieved by the five companies. Companies did not mention achieving benefits in all areas, and, in many cases, these were not directly measured. However, all the companies did achieve substantial

improvements in a number of different areas.

3.3.5 Difficulties and limitations

Although all the companies had carried out extensive planning and had used a variety of methods to learn from the experiences of others, they still faced a number of problems during implementation. These included:

- On-going support of the information services department was under-estimated;
- Problems with the outside package implementation consultants resulted in a delay in project completion;
- Training of user was under-estimated;
- Resources needed to maintain the system were under-estimated;
- Senior management support was delayed because they were initially not convinced; and
- The field workers were not convinced about a number of the changes required.

Table 5. Five features of the planning and implementation stages

Learning from others	In the process of planning and implementation, each company took a number of steps to learn from the experience of others. They used the services of outside consultants, networked with sister companies in overseas, and employed technical support staff and engineers (Company A). For example, Company B was learned from the experience of its sister company, which had implemented a similar ERP. Companies C, D and E all used the services of local consultants to learn about modern management methods and to implement package solutions for their specific problems.
Appointment of a process innovator	Four of the five companies identified key individuals to act as process innovators of the ERP project. Typically manufacturing/sales managers, these individuals provided both technical expertise and managerial leadership throughout the planning and implementation stages. The process innovators also provided on-going communication between management and unions as well as between management and outside suppliers/consultants. They ensured that there was sufficient consultation with the field works, and provided regular feedback on developments.
Committees and project teams	All companies established committees and project teams to effectively plan and implement the ERP. Their main objective was to ensure that tasks were completed on time and within budget. For example, Company E set up both a cross-functional steering committee and a project team. Companies A, C and D set up an executive steering committee and an operational committee. Company B did not establish a committee; however, its senior management had several informal discussions with the field workers.
Training and technical support	All companies recognized the need for on-going training and technical support for the users of the ERP. In some companies, outside consultants were used for this purpose, while, in others, the suppliers of the ERP took on this task initially. For example, Company D's German supplier of the ERP provided considerable assistance during the planning and implementation stages. Companies A, B, C and E provided a considerable amount of training for its users and the ERP was demonstrated to the employees before implementation.
Changing the organizational structure and responsibilities	Changes to the organizational structure and responsibilities are absolutely necessary to optimize the ERP and achieve the promised benefit. Not every company made the changes necessary in this respect. With the implementation of its ERP system, Company A made a number of changes in responsibilities at headquarters, releasing staff at headquarters to focus on more strategic issues. A number of changes took place at Company C: purchasing staffs were relocated from the corporate office to the shop-floor and changes were made to supervisor responsibilities. Generally, employees and unions accepted the changes being introduced, and willingly participated in meetings to provide feedback and to review progress.

Regardless of the difficulties and limitations mentioned above, all the five companies regarded their ERP investment as successful. In each case, there were real benefits, in both strategic and operational terms. Further improvements to the ERP were planned, which, in turn, were expected to deliver additional benefits. Companies quickly learned to overcome the difficulties, providing additional resources where necessary.

4. LIMITATIONS OF THE STUDY

The findings and results are practical rather than theoretical because the participants of the survey are actually ERP users. In spite of the above strength, the study has weaknesses. Some limitations originated from the approach of our research. First, we had to rely on the consulting experiences of LG CNS and the retrospective experiences of the respondents. It may be argued that the experiences of LG CNS and the respondent views might be biased. Second, the experiences of ERP implementation are provided in user's manual type for detailed and easy information. Lastly, our samples are limited to Korea. Therefore, general conclusions must be made with caution. Additionally, the implementation of ERP in Korea has the barriers inherent in the process of technology transfer since ERP in Korea comes primarily from developed countries. The literature on the implementation of ERP has been written in the context of developed countries, primarily the United States and Europe. The findings of this study, together with other studies from developed countries, show that human and organizational factors play a central role in the ERP implementation. However, ERP is no longer restricted within countries because of globalization. Therefore, the findings of this study can be more than an indicator of other countries as well.

5. CONCLUSIONS/LESSON LEARNED

This study discusses an ERP system selection process. Before selecting an ERP system, a business must first look at itself and understand its substance, asking two very fundamental questions: "What are we?" and "What do you want to be?" The typical steps of ERP selection involve planning, analysis, vendor screening, in-depth evaluation and decision finalization. In contrast to other software selections, a comprehensive ERP selection is made more complex by the scope of application functionality, change impact, size and integration requirements. Most organizations struggle to commit a core team of full-time resources to the project. Our experience indicates that part-time resource commitments will fail to provide the continuity and level of effort necessary to meet the reasonable project deadlines. The project team must articulate a vision and set of objectives to build support and executive buy-in for the project, enabling funding and resource availability. The vision for the future ERP application environment should describe the business process enhancements and strategies that will generate value from the investment. To the extent that the system will deliver only incremental improvements in system integration and maintenance without fundamentally impacting the business, the project will lack the necessary business justification.

Also, this paper has described the experiences of five companies which had recently adopted ERP. For most companies, the main aim of the ERP investment was to improve quality and provide a more superior and reliable delivery to their customers. All the companies achieved a range of benefits from their investments. Generally, employees and unions accepted the changes being introduced, and willingly co-operated with management in the planning and implementation of the new information system. This change of attitudes among

Table 6. Benefits achieved from the ERP implemented by the five companies

Company A	<ul style="list-style-type: none"> - Reduction of Consolidation Closing Time (within 2.5 days) - Real time Available to Promise - Reduction of Purchasing incidental costs
Company B	<ul style="list-style-type: none"> - Reduction of Consolidation Closing Time - Improvement Delivery Times assisting in Increased Sales - Accuracy Improvement of Cost Analysis
Company C	<ul style="list-style-type: none"> - Improvement of Product, Work-in-process and material Inventory Turnover - Improvement of Delivery performance (Han et al., 2000)
Company D	<ul style="list-style-type: none"> - Reduction of Consolidation Closing Time - Reduction of Order Fulfillment Time
Company E	<ul style="list-style-type: none"> - Reduction of Consolidation Closing Time - Reduction of Purchasing Cost - Reduction of Inventory Cost - Improvement of Delivery Performance

unions and employees had been the result of improved communication and involvement and the realization that the company must perform better in an environment where competition was increasing and local markets were no longer protected from foreign competition.

The common features/critical success factors in the adoption of ERP are identified as: learning from the experiences of others, appointment of a process innovator, establishment of committees and project teams, training and technical support for the users, and appropriate changes to the organizational structure and managerial responsibilities. These were visible in almost every company, and management realized that the absence of these critical success factors would have certainly led to the introduction of ERP which was inappropriate, or the implementation of the ERP was severely impacted and not realizing its full potential.

Most businesses are unique. Hence, when implementing the ERP, it is essential to have a detailed assessment of what is required of the business and what is available to satisfy those requirements. Long-term planning is absolutely necessary, and it is essential that as many people as possible become involved during the planning and implementation of the ERP. Maintaining a focus on the human factor issues, particularly during implementation, is critical. The most essential lesson learned is that the culture of the organization needs to be developed first. A minimum culture needs to be in place before the introduction of the ERP. This was very much the lesson for Company A, which ensured that the owner of the system was the end users. Management provided an on-going commitment, training, resources and appropriate documentation.

REFERENCES

- Barnett, L. and Miller, B. (1996) Best of Breed Versus Integrated Application Suites, *Giga Research*, PA, I-96-00042.
- Bessant, J. and Haywood, B. (1999) Experiences with ERP in the UK, *The Mckinsey Quarterly*, 4, 44-56.
- Currie, W. L. (1996) Investing ERP: a case of ad hoc decision making, *The Mckinsey Quarterly*, 1, 85-91.
- Dorien, J. and Malcolm, L.W. (2000) A Second wind for ERP, *The Mckinsey Quarterly*, 2, 100-107.
- Gosse, D. I. (1993) Cost accounting's role in computer-integrated manufacturing: An empirical field study, *Journal of Management Accounting Research*, 5, 159-179.
- Han, S. W. *et al.* (2000) KPI (Key Performance Indicator) Development for ERP Implementation, *LG Industrial Systems Project Report*.
- Hamerman, P. (2000) Tips for Streamlining the Software RFP Process, *Giga Research*, RIB-122000-00255.
- Jaikumar, R. (1997) The case for ERP system, *The Mckinsey Quarterly*, 4, 69-76.
- Lee, Z. and Lee, J. (2000) An ERP Implementation Case Study from A Knowledge Transfer Perspective, *Journal of Information Technology*, 15(4), 281-288.
- Miller, B. (1996) Ordering Chaos in the Application Environment, *Giga Research*, PA, T-96-00047.
- Park, K. S. and Han, S. W. (2002) Performance Obstacles in Cellular Manufacturing Implementation – Empirical Investigation, *Human Factors and Ergonomics in Manufacturing*, 12(1), 17-29.
- Parr, A. and Shanks, G. (2000) A Model of ERP Project Implementation, *Journal of Information Technology*, 15(4), 289-304.
- Robey, D., Ross, J. and Boudreau, M. (2002) Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change, *Journal of Management Information Systems*, 19(1), 17-46.
- Sohal, A., Samson, D. and Weill, P. (2000) Manufacturing and Information Technology Strategy: A survey of planning for ERP, *Sloan Management Review (Special Issue)*, 41(2), 71-79.
- Sumner, M. (2000) Risk Factors in Enterprise-Wide/ERP Projects, *Journal of Information Technology*, 15(4), 317-328.
- Stone, E. (1978) *Research Methods in Organizational Behavior*, Scott, Foresman and company, Glenview, IL.
- Yin, R.K. (1984) *Case study Research: Design and Methods*, Sage Publications, Beverly Hills, CA.